

11th MEETING OF THE SCIENTIFIC COMMITTEE

11 to 16 September 2023, Panama City, Panama

SC11 – Doc06

Intersessional Web Meetings of the Scientific Committee in 2023

Secretariat

Background

The SPRFMO Scientific Committee (SC) continued the practice of holding web meetings during 2023, in the lead up to the 11th Annual Meeting of the SC.

This document reproduces the reports from the following meetings (all dates are UTC):

Scientific Committee

1. Report of the 2023 SC Web Meeting, 31 August 2023 (to be added)

Habitat Monitoring Working Group

2. Report of the first 2023 HMWG meeting (2023 workplan), 16 March 2023
3. Report of the second 2023 HMWG meeting (assessment methods), 13 July 2023

Jack Mackerel Working Group

4. Report of the JMWG MSE Workshop, 11 February 2023
5. Report of the JMWG MSE Technical Session 1, 09 May 2023
6. Report of the JMWG MSE Technical Session 2, 14 June 2023
7. Report of the JMWG MSE Technical Session 3, 11 July 2023
8. Report of the JMWG meeting (SC preparations 1), 18 July 2023
9. Report of the JMWG MSE Technical Session 4, 01 August 2023
10. Report of the JMWG (MSE SC preparation), 21 August 2023 (to be added)
11. Report of the JMWG meeting (SC preparations 2), 29 August 2023 (to be added)

Squid Working Group

12. Report of the SQWG Workshop (Assessment Techniques), 21 June 2023
13. Report of the SQWG Workshop (Genetics and Connectivity), 19 July 2023
14. Report of the SQWG Workshop (Assessment Model and CMM development), 26 July 2023
15. Report of the SQWG meeting (SC preparations) 17 August 2023 (to be added)

Deepwater Working Group

16. Report of the DWG meeting (Exploratory Fisheries FOPs), 03 August 2023
17. Report of the DWG meeting (SC preparations), 22 August 2023 (to be added)
18. Report of the DWG meeting (SC preparations), 23 August 2023 (to be added)

Data Working Group

19. Report of the Data Working Group meeting (Inception meeting), 12 April 2023

2023 HABITAT MONITORING COORDINATION MEETING REPORT

17 March 2023 (NZDT)

1. Introductions

1. The HMWG Co-Chairperson (Dr Mariano Gutiérrez) welcomed all attendees. The meeting was attended by 11 participants. A list of participants is provided in Annex 1.
2. Agenda (Annex 2) and topics were agreed as below.

2. Workshop scheduling and coordination

3. The first workshop to be conducted by the HMWG will be focused on acoustic data. A group of specialists will meet to discuss acoustics-specific methodologies, modelling approaches (including geostatistics), and interpretation of these results. During this workshop the group will continue discussions on results introduced to the HMWG last year by Chile, Peru and the European Union. In addition, efforts will be made to compare acoustics from fishery-dependent activities to research survey transect data (data from Chile). Mariano Gutiérrez will coordinate this workshop. It is planned for early June with specific dates to be determined soon, and will be held in Lima, Peru with capabilities for virtual participation.
4. The second planned workshop will be focused on the organization and development of metadata for the classification of fishing fleets relative to acoustic capabilities. In addition, this subgroup will focus on exploring sonar capabilities, improving data collection from sonar, and evaluating how those data could inform quantitative research related to habitat and species dynamics within SPRFMO. Nicolas Alegria will coordinate this workshop with the aim of holding it in August. This workshop will be held in Talcahuano, Chile with capabilities for virtual participation.
5. The third scheduled workshop will explore the concept of habitat under an interdisciplinary ontogeny approach for jack mackerel and other species (e.g., chub mackerel). Habitat characteristics will be explored across different life history stages (with a focus on early life stages) and regions. Terms of reference are needed for this work and will be developed and circulated prior to the meeting. Aquiles Sepulveda will coordinate this meeting, which is scheduled for late July in Talcahuano, Chile with capabilities for virtual participation.
6. The WG expressed interest in a fourth meeting to be focused around data collection for jumbo flying squid in preparation for a workshop to be held in 2024. The HMWG has generally lacked participation from squid experts but will reach out to SPRFMO colleagues to identify a potential coordinator for these efforts. There is no meeting planned at this point.
7. The HMWG will also coordinate a report of workshops and activities at the national level. These efforts could be shared and discussed via the Teams platform and exchanged via email. Two such workshops were identified by the Peruvian delegation: the 11th National Workshop on Jack and Chub Mackerel (July 2023); 1st National Workshop on Jumbo Squid habitat (December 2023). Other delegations are invited to report on their activities to the HMWG.
8. Lastly, the Symposium was discussed. Aquiles Sepulveda reported on the organization of the symposium and noted that it is progressing well with many of the logistical details coming together. The organizers will have registration details to the Secretariat this week to open the website for registration, with additional details to follow. The meeting [link](#) is live; please have a look and share with interested colleagues.



Annex 1 – List of Participants

HMWG CHAIRPERSONS

Mariano Gutierrez
Aquiles Sepulveda

SC CHAIRPERSON

Jim Ianelli

CHILE

Nicolas Alegria
Victor Espejo

ECUADOR

Jose Luis Pacheco

PANAMA

Thelma Quintero

PERU

Daniel Isaias Grados Paredes
Miguel Angel Lleellish Juscamayta
Carlos Valdez Mego

SPRFMO SECRETARIAT

Tiffany Vidal



Annex 2 - Agenda

1. Opening of meeting by HMWG co-chair
2. Workshop virtually conducted during 2023 by the Subgroup of specialists to evaluate advantages and biases of analysis methods
3. Workshop virtually conducted during 2023 by the Subgroup of specialists to the classification of fishing fleets, to organize and develop the metadata for the datasets already provided by Chile and Peru
4. Workshop virtually conducted during 2023 to Explore the concept of habitat under an interdisciplinary ontogeny approach for jack mackerel and other species (by life history stages and regions)
5. To collect data regarding the jumbo squid data in preparation of a workshop to be conducted in 2024
6. Symposium on the State of Art of Habitat Monitoring, the web page already available: <http://www.symposiumonhabitatsprfmo.org/>

REPORT OF THE HABITAT MONITORING WORKING GROUP

ASSESSMENT METHODS

13/14 July 2023

1. Introductions and welcome from Co-Chairs

The Habitat Monitoring Working Group Co-Chairs, Drs Mariano Gutierrez and Aquiles Sepúlveda, welcomed all participants and invited everyone to introduce themselves. The workshop was attended by 12 participants. A list of attendees is included in Annex 1.

All presentations from this meeting have been made available through [Teams](#).

2. Presentation on the main results of the habitat workshop held in Lima

Dr Mariano Gutierrez gave a [presentation](#) on the results from the habitat workshop held in Lima, Peru from 26-30 June 2023. The presentation highlights the distribution of jack and chub mackerel across a range of environmental conditions including sea surface (ss) temperature, ss salinity, ss chlorophyll, and ss anomalies, between 2021 and 2023.

There was evidence that both species tend to be distributed along the edge of thermal, salinity, and chlorophyll fronts.

Mariano presented a suite of boxplots showing the distribution of the environmental variables observed from positive jack/chub mackerel sets (sets with some level of jack mackerel), showing some indication of habitat preference. With the recent switch to El Niño conditions, the distribution of jack mackerel has not changed substantially; however, with warmer waters to the north the distribution has shifted a bit to the south towards the edge of colder waters.

3. Presentation on acoustic methods used for estimating the abundance of jack mackerel and other species

Mariano gave a presentation on the acoustic methods that have been developed to estimate the abundance of jack mackerel and other species. He emphasized that these results are experimental, and not yet indicative of absolute abundance estimates.

He presented two acoustic methods to produce preliminary estimates of relative abundance for jack mackerel, chub mackerel and *Vinciguerria lucetia*, a mesopelagic species. The first method estimated biomass as a function of the average catch combined with average inertia and latitudinal component of the center of gravity from acoustic data, all by zone and week. The second approach used the acoustic data to estimate biomass (see [presentation](#) for details).

The two methods generally compared well, but in some time periods and for some species there were large discrepancies. Mariano suggested that these discrepancies may be due to human error in the processing/analysis of the acoustic data, as it is a complex process.

The target strength equation used for these analyses comes from an IMARPE study (Gutierrez & Herrera 1998).



Aquiles Sepulveda noted that normally mesopelagic fish are close to the backscatter, so how reliably can the abundance of these fish be estimated? Mariano agreed that this is one of the challenges of acoustic data; to be able to determine with certainty the species that are producing the different acoustic signals.

4. Comparing random and systematic survey of Chilean jack mackerel biomass estimates off south central Chile

Nicolás Alegría [presented](#) a study to evaluate whether abundance can be estimated from random surveys by fishing vessels. He compared acoustic biomass estimates from a systematic survey with estimates from fishing vessels (random).

He presented comparison results across several years. The distribution of the survey and fishing effort was variable and the two did not always align spatially and temporally in each year sampled. The disconnect in space and time is one of the main challenges with this comparison. When there was high overlap in the spatial and temporal distribution of the sampling, the estimates were reasonably comparable. However, when the two sampled different areas, there were large discrepancies in the estimates produced. Nicolás suggested that further work needs to be done to evaluate the accuracy and precision of these estimates.

Mariano suggests this work be summarised in a paper to SC11, if possible.

A discussion ensued about the possibility of the data collected by fishing vessels to inform the assessment for jack mackerel. Especially for years when the survey is unavailable, perhaps this fishery-dependent time series could provide an alternative source of information. Jim Ianelli agreed that the timing is right and good progress has been made on this topic, but exactly how it would be used would need to go through the SC process. If, as these preliminary results suggest, the two data sources are comparable, it would be natural to link these data to inform the assessment.

5. The role of Lagrangian coherent structure on the Chilean jack mackerel distribution

Kalle Michielsen gave a [presentation](#) on the key oceanographic structures driving jack mackerel distribution. The hypothesis behind these analyses is that predators (such as jack mackerel) require a certain level of food density, which is influenced by oceanic conditions. Locations that have conditions to support enrichment, concentration, and retention of food, created by convergent structures, should provide suitable habitat. In this talk he explored whether jack mackerel is associated with these Lagrangian Coherent Structures (LCS)?

He explored the use of finite-sized Lyapunov exponents (FLSEs) to address this question. Satellite data were used for a suite of variables including sea surface temperature, chlorophyll-a, mixed layer depth, sea level anomaly, and eddy kinetic energy. FLSEs were calculated at the same spatial and temporal scale as the acoustic data from 2009 and 2010. GALMSS models were used, with the estimated acoustic biomass of jack mackerel as the response variable.

There were strong correlations between FSLE and jack mackerel biomass indicating potential of FSLE as a predictor of jack mackerel biomass, in complement to other indicators. A relationship between jack mackerel and LCS was detected.

Kalle presented two potential uses of this type of information for industry and management:

- Use of FSLE for targeted searching in offshore fisheries; and
- Understanding population dynamics and assess if targeted fisheries are sustainable (e.g., tuna FAD fisheries).



Jim Ianelli asked about the link from the acoustic data to the estimates of jack mackerel density in the model, and how those values evolve over time (e.g., what is the time step?). Kalle indicated that a standard procedure to convert acoustics to NASC, which is a proxy for density, was used, and the acoustic data is collected in blocks of 1 nm and associated with the satellite data of the same day.

6. An empirical and deterministic model to know the variability of the potential habitat of jack mackerel

Carlos Valdez [presented](#) an update to a model to predict jack mackerel suitability in jurisdictional waters of Peru, that has been presented in previous years. This work is based on a previously published paper (Valdez et al. 2015), but with additional historical data.

The model uses 6 different input parameters to estimate the probability of suitable habitat for jack mackerel: distance to coast, bottom depth, sea surface temperature, thermal anomalies, sea surface salinity, and chlorophyll. Jack mackerel catch data were obtained from fishing sets and acoustic data (2011-2014, 2018-2023), to inform the model.

The results from the prediction of habitat suitability and the distribution of fishing sets from 2023, showed that fishing activity was taking place at the edge of the suitable habitat (at around probability of 0.5). These results were a bit unexpected, and Jorge Oliva suspects that perhaps the distance to the coast parameter may be biasing the results. He will revisit and explore distance from the continental shelf break and see how the results respond.

7. Update on the organization of the Symposium of State of Art of Habitat Monitoring

Aquiles Sepúlveda gave the workshop and update on the symposium. He noted that the presentations during this session would be great candidates for working papers to present at the symposium.

Registration for the symposium is open and the venue has been secured. They are looking into having a workshop on the use of sonars, and perhaps other courses. They are working with local companies to provide financial support for students and international colleagues wishing to attend. Abstract submissions are starting to be received.

8. Next session

The next HMWG intersessional session to discuss acoustic data has not been scheduled yet. An invite will be sent as soon as it is.



ANNEX 1. List of Participants

Habitat Monitoring Working Group Co-Chairs

Mariano Gutierrez

Aquiles Sepulveda

SC Chairperson

Jim Ianelli

AUSTRALIA

Lara Ainley

CHILE

Nicolas Alegría

Sebastian Vasquez

Sergio Nunez

Jorge Oliva

PERU

Carlos Valdez

Daniel Grados

Invited Participant

Kalle Michielson

SPRFMO SECRETARIAT

Tiffany Vidal



Jack Mackerel MSE Workshop – REPORT

11 February 2023

1. Introductions and Agenda

The SC Chairperson (Dr Jim Ianelli) welcomed all participants and explained the objectives of workshop. He then invited Dr Ana Parma, an external expert in MSE, and Dr Niels Hintzen, the SC vice-Chair, to introduce themselves, followed by participants of the workshop. Jim Ianelli introduced the agenda and schedule for the day (Annex 1).

2. Introduction and Management Strategy Evaluation

Jim Ianelli gave a presentation about the Management Strategy Evaluation (MSE) process, Management Procedures (MPs), and important definitions to ensure clarity for the ensuing discussions. All presentations were made available on the Teams platform.

Ana Parma gave a presentation on the objectives of MSE, the concept of tuning, including examples from Southern bluefin tuna, Atlantic bluefin tuna, and bigeye tuna from the Indian Ocean. A general discussion around objectives and time frames to complete an MSE process followed. Dr Parma presented a suite of example objectives, including, for example, the technical guidelines for the Marine Stewardship Council (MSC) certification include an MSE (with 5-years to implement it) as part of the certification requirements.

Participants inquired about the process to develop the operating models (OMs). For example, there was concern that Members may seek to evaluate the technical models independently. It was clarified that OMs are always chosen jointly by a Committee, and that if several teams are conducting MSE trials, they are all working off the same OM code. Participation in this process was welcomed.

Several Members inquired about the ability to include environmental variables/processes in the MSE, either in the OM or the MPs. It was explained that this is rare because while possible to include environmental variables in the model, it is difficult to predict (with certainty) future environmental conditions. Uncertainty in environmental condition is more commonly treated as a type of process error, sometimes with temporal correlation. Also, plausible future shifts in stock productivity (driven by unspecified variables and processes) are included as robustness tests in the MSE.

One Member asked how the decision about whether to use an absolute amount or a percentage change in limit catch changes between management periods is decided upon and what the potential implications are of one over the other, with respect to the MP. In other fisheries, these decisions have been taken by stakeholder and managers, and can be tested within the MSE framework.

An MSE was compared to operating on autopilot. The management procedure is followed, but under supervision to ensure the process track. One Member asked how you decide when such intervention is required. It was explained that these decisions are detailed in what is referred to as meta-rules. In this case, meta-rules would check whether exceptional circumstances are occurring, with respect to indicators developed, and ensure that the performance of the fishery is within the uncertainty bands simulated during the MSE.

There was a discussion about how the life histories of different species are considered as part of this process. The longevity of the TAC is one way in which this is accomplished. For example, for a long-lived species, the TAC may be set for a longer period; however, for short-lived species, that time frame may need to be reduced.



3. Introduction to the Jack Mackerel Operating Models

Niels Hintzen gave a presentation to describe the general technical components of an MSE process, the role of OMs, and then explored the details of the jack mackerel OM. It was noted that a distinction needs to be made between management stock units and biological stock units during this process.

The possibility of evaluating a spatial model with mixing rates, to account for different population structures, was raised. This approach is possible, and spatial models of jack mackerel (SEAPODYM) have been tested in the past; however, mixing rates are often non-stationary. Therefore, assuming stationary rates may introduce bias, and estimating time-varying mixing rates may be challenging and uncertain as well.

With respect to the steps involved in the MSE process, the first step is to update the model from the benchmark assessment and prepare projection code able to generate simulated data. At that point, technical testing will be done to ensure that under the model specification the uncertainty can be properly quantified (e.g., using a Bayesian approach). This work would be best carried out with guidance from a small technical working group; a request to the COMM to task the SC with this work is suggested.

One of the long-standing questions and uncertainties with the jack mackerel assessment and management is around the stock structure, and specifically whether there are multiple stocks or a single stock. The idea would be to build an OM that allows testing the robustness of candidate MPs to these different, potential realities.

4. Breakout Groups and Feedback

Participants were split into two break outgroups to work towards identifying objectives for the jack mackerel fishery. The results were then generally grouped into four main categories of objectives: stock status, stability, yield, and safety (Table 1).

5. Next Steps

The group noted that a working group will need to be formed with initial goals to:

- Schedule an action plan to progress the activities of the working group (terms of reference)
- Coordinate with the contractor on the status of updating the revisions to the OM that are needed to be consistent with the Benchmark data and model changes
- Compile a prioritized list of technical features required for the OM including data generation



Table 1. Summary of the broad objectives identified by the managers and stakeholders during the breakout sessions.

Stock Status	<p>Achieve MSY, being tracked with associated target reference points</p> <p>Remaining in the green quadrant of a Kobe plot with high certainty</p> <p>Satisfy conditions for MSC certification</p> <p>Ensure underfishing as well as overfishing doesn't occur</p>
Stability	<p>Reduced interannual variability</p> <p>Food security</p> <p>Allow for TAC rollover; consider adjusting TAC every year or every 2-3 years except when extreme environmental conditions occur</p> <p>Market/supply concerns relative to prices and profitability</p> <p>Relax constraints to increase TAC when market conditions or fish availability are favourable</p>
Yield	<p>Allocation of sufficient quota to have a viable fishery</p> <p>Establish limitations on small size classes (e.g., X% of catch cannot be below certain size); recognizing potential implications for bycatch and unintended discarding</p> <p>Assess opportunities for fishery expansion</p>
Safety	<p>Incorporate Blim or similar precautionary reference point/indicator that satisfy MSC certification requirements with regards avoiding the point of recruitment impairment.</p> <p>Strengthen management measures if the stock is below Btarg (and even more so if stock drops below Blim)</p> <p>Ensure management procedure is responsive enough to low recruitment</p> <p>Develop reference points relative to observed minimum stock depletion (e.g., 8% that is currently used)</p> <p>Account for recoverability of the stock if the stock falls below limit reference points</p>
Other	<p>Reduce ecosystem impacts from the jack mackerel fishery</p>



Annex 1 – Agenda

Morning Tea at ~ 10:30

Lunch at ~ 13:00

Afternoon Tea at ~ 15:30

1. Opening of workshop
 - a. Introductions
 - b. Agenda and workshop objectives
2. Introduction of Management Strategy Evaluation
 - a. Generic presentation on MSE, MPs, definitions and applications
 - b. Presentation on MSE objectives, concept of tuning, including examples from other fisheries, presentation on Performance Metrics
3. Introduction to the Jack Mackerel Operating Models
 - a. Current jack mackerel assessment model—data and indications
 - b. Presentation of the updated OM (following the benchmark) and stock structure treatment, implementation error, and other sources of uncertainty
4. Identify MSE Objectives
 - a. Goal of the break-out groups, what to achieve
 - b. Break out groups
 - c. Feedback from break out groups to plenary
5. Identify MSE Performance Metrics
 - a. Goal of the break-out groups, what to achieve
 - b. Break out groups
 - c. Feedback from break out groups to plenary
6. Wrap Up and Next Steps

REPORT OF THE FIRST MSE TECHNICAL WORKSHOP IN 2023

10 May 2023

1. Introductions and Overview of MSE Process

The Jack Mackerel Working Group Chairperson, Dr Niels Hintzen, welcomed all participants and invited everyone to introduce themselves. The workshop was attended by 17 participants. A list of attendees is included in Annex 1.

2. Current state of MSE development

An overview of the current state of MSE development was provided by the Chair, with a brief summary of key points included below.

The aim of the Management Strategy Evaluation (MSE) process is to develop a way to provide management advice that is robust to uncertainties in the system including the different stock structure hypotheses. Over the past year there has been a strong focus on the MSE development using the [FLR](#) package. Substantial testing has been done to merge the stock assessment with the *FLR* package to create a closed-loop MSE process. We have a working example of the jack mackerel operating model (OM); however, it has not been fully updated and tested based on the most recent benchmark assessment.

Development of harvest control rules (HCRs) was paused until the benchmark was completed. In June 2022, the benchmark was carried out. The updated model incorporated new growth information, which had a notable impact on the assessment. Now, we can continue with the conditioning of the operating models, based on the benchmark assessment.

The [MSE workshop](#) held in Manta in February 2023, has helped to guide the next phase of development, based on stakeholder input.

Following the benchmark, the MSE code has been updated (by Iago Mosqueira) to reflect the new assessment model. It can currently handle all inputs, create a new data set, and run the model. It is capable of replicating the stock assessment runs. The next step is to make sure these iterations can happen inside the MSE framework with the simulated data sets. Work is ongoing to fine tune the code, but good progress is being made.

The [Github site](#) is active and will be updated once the new, updated code is available and fully tested. Iago Mosqueira will update Github with the new code so that participants can access it and begin using it. If you do not have access and would like it, please email the Data Manager, Tiffany Vidal (tvidal@sprfmo.int), for access.

The SC Chair, Dr Jim Ianelli, offered to contribute to the process of including uncertainty in the MSE process. Decisions around using an MCMC approach or considering structural differences in the model will be assessed. At the benchmark, uncertainty in the model was explored and converged MCMC results were obtained, which was positive. The advantage of the MCMC is that we can condition the OM with priors, which may simplify things. Exploring uncertainty in a similar way in the OM would be advantageous. The first step is to get the point estimate into the model and then we can discuss the dimensions of structural uncertainty – e.g., recruitment.



3. Participation and Work Plan

Conditioning of the OM is one of the first tasks (e.g., including weight-at-age, maturity, etc.). Jim, Niels, and Ignacio Paya (CHL) will work with Iago on this. There is interest in soliciting greater participation from other delegations with technical expertise. Niels will reach out directly to individuals to discuss further.

Consideration also needs to be given to the types of Management Procedures (MPs) that should be tested. The idea behind the MPs is to have a simpler approach to provide management advice, on an annual basis, than running a full stock assessment. The reason for this is that an MP is often simpler, less data and computationally intensive, and can be understood and communicated to broader audiences more easily. This does not diminish the role of the full stock assessment, but it provides a pathway to providing robust management advice in a more timely and efficient manner, in between the full stock assessment evaluations. Consideration must also be given to the data streams that will go into the MPs. Some examples include CPUE and acoustic surveys.

It was suggested that perhaps another MSE capacity building workshop would be valuable to help get participants up to speed to enable more effective participation.

4. Action items

The following tasks were identified to focus on before the next technical workshop on 14 June. (See the [SC Meeting Planner](#) on Teams for a list of all upcoming meetings.)

- a. All Members that contribute data (other than catch information) prepare a short description of those data streams, what their expectations are with respect to when those data will become available, what is the time interval of the availability of those data, and how do you envision the continuation of those data streams over the next 10 years, in order to evaluate different scenarios in the MSE.
- b. Participants to prepare working documents for the next meeting to discuss ideas around the technical implementation of operating models (OMs).
- c. Participants to prepare ideas on how to develop alternative approaches that wouldn't require a complex assessment model for management advice (i.e., MPs). What types of approaches would participants suggest/support?

Additional context:

- MPs could be based on a surplus production model or something simpler, but that wouldn't eliminate the use of the full assessment model. Every 5 years or so (perhaps 3) the assessment is still run to check where the stock is and to ensure the OM conditioning is still appropriate. Annual management advice may no longer rely on an annual update of the full assessment model.
- A full stock assessment is not part of the MP, but it is used to test the MP to ensure performance is within the bounds of exceptional circumstances.
- An MP typically tracks recruitment and spawning biomass in a straightforward way, so there is clear understanding of the process that can be communicated among scientists and managers.
- Inclusion of uncertainty in the process of simulating data into the future needs to be considered.



All working documents to address these action items should be shared on the Teams platform in the SC Jack Mackerel Working Group [MSE channel](#). A folder called [Tech WorkingDocs](#) has been created for these working documents. Inside this folder are two additional folders, one for OM-related working documents and one for MP-related working documents. You can also use the **Posts** section of the MSE channel to have discussion and seek feedback from other participants. This feature has not been used much in the past, so this will be a bit of an experiment.

Please reach out to Niels, the Chair of the WG (nhintzen@pelagicfish.eu), if you have questions about the content of these working documents of the MSE process and to the Secretariat (tvidal@sprfmo.int) if you have any questions about the use of or access to the Teams platform for this purpose.

5. Potentially Useful Information

The [HarvestStrategies.org](https://www.harveststrategies.org) website has a lot of useful information for understanding the MSE process. In particular, there is a page dedicated to an [overview of the MSE process](#) which is quite informative. In addition, on the [openMSE](#) software platform site there is some overview information that may be helpful in collecting thoughts for the development of the working documents on OMs and MPs. There is also a page with an [OM library](#) with links to OM details for different species, which may also be helpful as a reference for this work. Lastly, as a reminder, the currently proposed [harvest control rule](#) for SPRFMO is available on the website for reference.

ANNEX 1. List of Participants

Jack Mackerel Working Group Chair

Niels Hintzen

SC Chairperson

Jim Ianelli

Invited Experts

Iago Mosqueira

BELIZE

Charles Coc
Robert Robinson
Ernie Howe

CHILE

Ignacio Paya
Victor Espejo
Jose Zenteno

EUROPEAN UNION

Jasper Bleijenberg

KOREA

Eunjung Kim
Ilkang Na

PERU

Antonino Moreno
Pablo Marin
Josymar Torrejón-Magallanes
Miguel Llellish

SPRFMO SECRETARIAT

Tiffany Vidal

REPORT OF THE SECOND MSE TECHNICAL WORKSHOP IN 2023

14/15 June 2023

1. Introductions and Overview of MSE Process

The Jack Mackerel Working Group Chairperson, Dr Niels Hintzen, welcomed all participants and invited everyone to introduce themselves. The workshop was attended by 17 participants. A list of attendees is included in Annex 1.

The purpose of the meeting was to evaluate the current status and development progress of the MSE work, to discuss the working documents that have been received so far that may motivate discussions, and to make plans for the upcoming weeks.

The Chair motivated the group to contribute to a tangible product prepared for the Scientific Committee meeting in Panama in September, to demonstrate progress and preliminary results..

2. Update on the technical development of MSE software

An update of the MSE development was provided by Dr Iago Mosqueira. He indicated that the technical framework is able to pick up the latest (SC10) assessment results. With assistance of the SC chair, an MCMC approach to estimate uncertainty was incorporated through the *adnuts* R package (no U turn sampler).

The model is now up and running. This approach has been taken for two preliminary base case runs (i.e., SC10 models h1_1.00 and h2_1.00. *these will be upgraded to 1.02 in line with SC10 final models*), noting this can be done for any of the stock assessment runs if using alternative formulations of the models they contain. This information is also used to set the OEM (observation error model).

The OMs are now based on the MCMC runs, with future dynamics being taken as averages over the last three years for natural mortality, maturity and weights. For the moment, it is suggested to keep those values unchanged as well as for the future of the fleet dynamics in terms of selectivity, weights-at-age in the catch (when those are different from those considered from the stock), and the catchability. The group was invited to prepare alternative OMs (i.e. sensitivity scenarios)

Future recruitment deviations from the stock-recruitment relationship are currently modelled by following a lognormal distributed set of deviances with some autocorrelation. Both the level of autocorrelation and the error in the lognormal deviances is computed from the estimate from the stock assessment models.

Further detail on derivation of fishing effort for forward projection and some preliminary results were provided by Iago. He showed stock status relative to SSB over SSB_{MSY} , F over F_{MSY} , and spawning biomass over virgin spawning biomass (SSB/SSB_0), where the reference points are simply those estimated by the stock assessment. Therefore, the result is just a direct computation result from the stock assessment and the level of uncertainty in relative stock status that this particular OM is showing.

For the 2-stock OM (h2_1.00), estimation of uncertainty and parameterization took the same approach and stock status is estimated and available.

Jim suggested that, for reporting purposes, MCMC output could be compared with the base case estimates, which should overlay those coming from the displayed OM. He also pointed out that decisions on what to present to the commission, also in relation to reference points, requires some further discussion with the group.



Iago gave an overview of mechanics involved in the OM grid and the possible next steps for any desired alternative scenario outputs. He asked that experts in stock assessment start coming up with reasonable scenarios for low recruitment such as with La Niña.

An estimation method needs to be defined for the MSE, which could be the same stock assessment model that is currently used for TAC advice. Iago indicated that running the full MP is a costly exercise so requested that agreement is reached on conditioning and OEM configuration prior to starting the simulations.

Chile asked about the buffer that the MP has for the quota, which considers 15% increases, while this year the Commission increased it by 20% and that didn't seem to have been included in the model. Niels clarified Management Procedure would be discussed later (possibly in a future session).

The Chair asked whether there are any other proposals to set up the historical part of the operating models, apart from MCMC, to address uncertainty in the simulation; he suggested that if no alternative proposals are on the table, then to continue using MCMC for the simulation. Nobody objected to this, so **the decision was made to consider using MCMC** as a key source of parametric uncertainty in the OM.

The chair asked the group to consider the structural uncertainty in the OMs (i.e. stock structure). Iago confirmed three structurally different OMs are the ones considered for future projections (i.e. one stock, two stock and a metapopulation).

The SC chair brought up the issue of catch proportions by fleet and how to simulate that into the future, minimizing the number of options of scenarios. He suggested to take a scenario closest to the actual catch proportion as the sensitivity to what Iago actually did (computing the average of the last few years); although the latter may present a problem in that, i.e., Chile's actual catches has changed significantly over the last 20 years.

The chair invited participant Members (developers) to write a working paper on this matter, particularly Chile and Peru, to come up with a proposal on how to best simulate this issue. Jim invited constructive collaboration on the sensitivity of catches and entitlements, as well as roll overs, quota leasing, and transfers, among others.

Chile asked for clarification as to whether past practice is going to be followed, i.e., using a grid to approach uncertainty with about 12 different OMs, or if the base model scenario that came out from the last stock assessment will be used and then apply different scenarios for projections.

Jim enquired about the base case model with MCMC for projection purposes, which gives a good look at the range of uncertainty on the model conditioning; alternatively, we could look at the grid, then if the MSE group can come up with the grid of 12 (or some appropriate number) of scenarios and running those just as MLE or the regular kind of condition model.

- Chile agreed to contribute to a paper with options for OMs with different uncertainties because they had different parameters, as well as coming up with a recommendation for this task group so a decision can be made. Chile also mentioned a concern with how availability may vary among fisheries and regions.

Peru expressed some concern about the confusing terminology and recommended that if a document is going to be written where MCMC is chosen as the method to quantify uncertainty, then the terminology is also standardised and agreed, just to make sure everybody is on the same page.

- The group asked that the Microsoft Teams MSE environment structure be tidied up and agreed that the old MSE Team should be removed as it is confusing and outdated.

The Chair suggested to put a working document together documenting the technical implementation and decisions made in development of the MSE. A decision on the OM will be made in the next session of the group.



3. Planning for session to refresh users of MSE software

Iago is available to run a refresher session as soon as the outstanding decisions are made and Jim volunteered to take on one-on-one sessions with delegations/scientists (Chile).

4. Planning for the next session

The meeting ran out of time to discuss all the agenda items. The following items were deferred until the next session:

- Review of the working document on the OM development
- North Stock (Josymar)
- South Stock (Juan-Carlos)
- Connectivity (Niels)
- Discussion on the next steps in OM development
- Discussion on the proposed MP

ANNEX 1. List of Participants

Jack Mackerel Working Group Chair
Niels Hintzen

SPRFMO SECRETARIAT
Susana Delgado

SC Chairperson
Jim Ianelli

Invited Experts
Iago Mosqueira

BELIZE
Charles Coc

CHILE
Ignacio Paya
Aquiles Sepuveda
Victor Espejo
Nicole Mermound
Sebastian Vasquez

FAROE ISLANDS
Jan Arge

KOREA
Eunjung Kim

PERU
Antonino Moreno
Ana Alegre
Criscely Lujan
Josymar Torrejón-Magallanes
Erich Diaz

REPORT OF THE THIRD MSE TECHNICAL WORKSHOP IN 2023

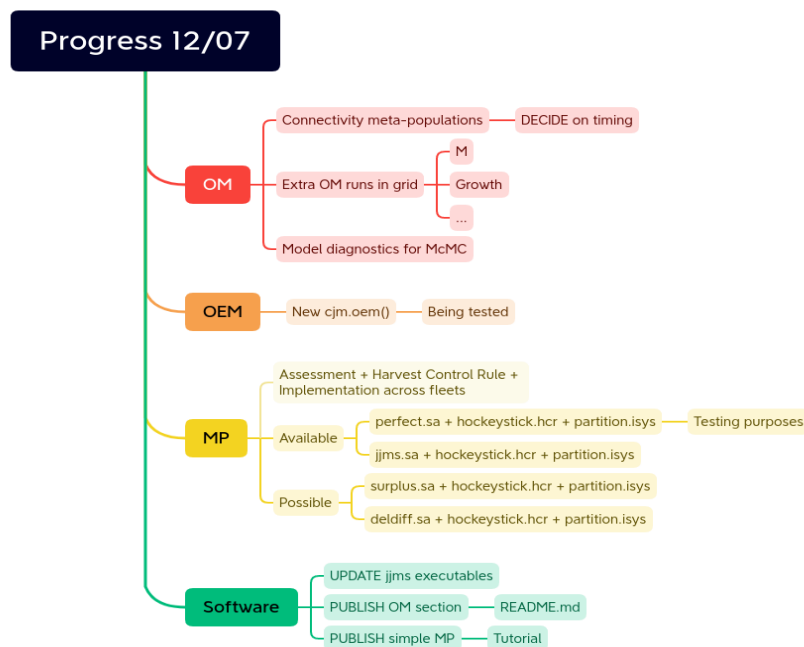
11/12 JULY 2023

1. Introductions and Overview of MSE Process

The Jack Mackerel Working Group Chairperson, Dr Niels Hintzen, welcomed all participants and invited everyone to introduce themselves. The workshop was attended by 21 participants. A list of attendees is included in Annex 1.

2. Update on technical development of MSE software

Iago Mosqueira presented a schematic (see below) detailing the progress made on the technical development. He has been updating the OM to include connectivity, conducting extra OM runs in the grid (including natural mortality (M), growth), and finalized a set of MCMC model diagnostics. There is a new observation error model (OEM) function for testing. The OEM testing will lead to updates in the software and the JJM executables will be updated and published. Participants will be notified when this happens with the hope that individuals will explore and test the updates. After further testing, these updates will be made public along with the initial code version for running the management procedures (MPs). Iago has the first 2 MPs up and running (out of 6 that have been tentatively proposed). He has been primarily polishing and testing the code and waiting on the discussions during this meeting around the conditioning and robustness OMs.



Niels will liaise with Iago to determine the decisions that are still required from this group. There is also interest in hosting a 1.5 hour training session to help participants get up to speed with the software. Niels and Iago will coordinate to identify an appropriate time for this training session.



Participants of the group were requested to prepare proposals for alternative MPs in detailed working documents (WDs), including equations and decision rules, etc.

3. Review WD on OM development

3.1. Connectivity (Niels)

Niels presented the details of his working document on jack mackerel connectivity. There are currently 3 hypotheses: 1 stock, 2 stock, and a metapopulation. He has reverted to the work done by Dragon et al. 2018. In that paper, they used SEAPODYM in a spatial model to estimate migration rates. There were donor and recipient regions. Niels summarised their results and applied a linear interpolation of migration rates by age, aggregated across the SPRFMO stock areas. There are clear uncertainties and limitations with this approach; however, it may represent the best available science at this point in time, and offer a path forward for application in the OM.

There was extensive discussion around the idea of migration rates, versus distribution and availability associated with environmental conditions, and in particular El Niño. The environmental conditions can be highly variable, and yet SEAPODYM doesn't account for that temporal variability. It was also noted that the SEAPODYM study was from a limited time period in the past (prior to 2011), and that the fishery has since been distributed in a different way.

There was also concern that the proposed migration rates seemed quite low, relative to general understanding. Niels pointed out that although the rates appear relatively low, rates of migration around 13%, as proposed, are quite substantial in absolute terms.

The Chilean delegation noted they are working on this topic, and that the Connectivity Task Group is also focused on these questions; however, that work has not yet been presented. It will be possible to update these assumptions when better information is presented, but for now, this is the best available.

There was also a brief discussion about the possibility of weighting different alternatives. It was reiterated, however, that the point here is not to find an optimal scenario but to test whether the MP is robust against all potential stock structure hypotheses.

The working group accepted proposal in WD as the base case.

3.2. Natural mortality

Josymar Torrejón-Magallanes presented his WD on sensitivity analyses using the JJM model with different values of M , both fixed and age-specific. The age-specific values produced important changes in the earlier time period in biomass and recruitment (R), but those differences were less pronounced for the more recent years. The age-specific M produced substantial changes in the biological reference points, and in general, the model seemed sensitive to the changes in M .

The group expressed interest in the likelihood fits from the different assumptions of M to better evaluate the reliability of these different models, and questioned whether age-specific M would be a valid model configuration. Josymar will review and come back to the group.

Iago offered that it would be possible to consider alternative model runs in the conditioning by introducing M into the grid. He also questioned whether there may be some confusion about the initial age in the WD as the scale for M at age-1 was more comparable to what is usually seen for age-0. The range of M values could certainly be evaluated. we would just have to run the model and apply the standard diagnostics.

Ignacio Payá did not support including sensitivity runs with respect to growth affecting the southern stock, and referred to their SC10 paper on jack mackerel growth ([SC10-JM07](#)).

The group agreed that different M configurations are on the table for a sensitivity in the grid, but not part of the base case.



3.3. Catch proportions

Niels briefly presented his WD on catch proportions and noted that this issue relates to fish availability. The aim of this work is to address how the catch proportion by fleet is going to change in the projected period. There has been a lot of variability in the catch proportion for some of the fleets, e.g., the south Chile fleet. This approach effectively aims to detrend the catch proportions by retain some of the temporal variability.

There were questions raised by the group about how the allocation and distribution of fish would influence these proportions. The catch proportions are designed to reflect the materialization of the allocation scheme; however, there remains a need to limit changes in effort to ensure that introducing this error doesn't enable a fleet to increase dramatically. Jim Ianelli proposed using an auto-regressive (AR) or moving average process to allow for gradual changes. It was noted that care needs to be taken to avoid confounding the specific allocations and transfers, and that the resulting error in catch is likely one-sided. It would be unusual for a member to harvest less than their allocation, but they could harvest more than their allocation. The allocation could serve as a boundary of sorts.

More work is needed to include effort limits and a lower bound associated with allocation as well as autocorrelation in the timeseries of catch proportions. The current scenario could be used for preliminary analyses.

3.4. Technical creep

Niels discussed technological creep as detailed in Annex 3 of the [JJM MSE documentation](#) paper. Different effort creep scenarios were run with all of the available the abundance indices, but the results didn't show a large change in SSB across the 3 levels of creep. The assessment is not very sensitive to alternate scenarios of effort creep. Assuming no creep would be more optimistic, perhaps overly so, and therefore, perhaps a reasonable approach is to retain the creep scenarios as a sensitivity test.

Ignacio noted that there were two main variables that changed during the benchmark: i) more flexibility in selectivity and ii) 2 periods of catchability (q). Currently, it's hard to understand why these changes in creep didn't impact the trends/status. This raises a question, why doesn't the inclusion of additional creep impact the assessment, especially considering that these abundance indices are some of the key inputs to the model. There should be additional focus on this matter to understand whether some of these other changes could be absorbing the influence of the abundance indices.

Iago added that the scale of effort creep compared to some of the uncertainty in other inputs means it shouldn't be too surprising that the effect isn't marked.

The group agrees that there is no need to further assess effort creep assumptions. No alternative sensitivities with effort creep are suggested, and effort creep will remain as it is in the current assessment. There is no interest at this point in trying to simulate technical creep into the future.

3.5. CPUE and abundance indices

Ignacio Payá's proposed to consider a change in CPUE time-series for the Chilean fleet as part of a sensitivity analyses. The catch per unit effort (CPUE) for the Chilean fleet is currently based on days out of port, which has decreased in recent years (due to the distribution closer to shore). Therefore, the CPUE index is really representative of availability to shore and not necessarily increased abundance. He will evaluate an index based on catch per set as opposed to catch per days out of port, to compare.



Ignacio revisited concerns over the inclusion of an effort creep correction factor of 1% per year. He suggested that effort creep may in fact be better represented by time blocks (perhaps 5 years), during which creep is relatively stable (non-existent) potentially punctuated by events that increase efficiency (e.g., vessel technologies or perhaps El Niño phase to account for availability). He is preparing a WD on this topic.

Jim asked whether the suggested 5-year blocks reflect what we've seen in terms of alternating between the two regimes.

The table in the [WD](#) associated with coastal/high seas phase during the different time blocks could be considered in a robustness test. The El Niño phase should largely govern availability or distribution. Niels questioned what would change in the simulated and projected period, as we currently aggregate by fleet. Catchability associated with the CPUE changes, but otherwise it's hard to understand how the data changes and how this would be implemented. Iago suggested that this is an issue of q in the survey and the fleet data, and it may be possible that when one goes up the other goes down, or something like that.

One of the main challenges associated with incorporating the influence of El Niño conditions is that we don't have the ability to predict in the future; thus, limiting the utility for projections.

Niels urged the group to be mindful of the time constraints, and the desire to be presenting some draft advice to SC11. Decisions need to be expedited on some of these issues.

Ignacio volunteered to further evaluate these concerns and will prepare a WD with a practical proposal to simulate changes in spatial distribution for the fleet and survey, which could be changes in q , a step change, or perhaps a smoother approach. He will prepare the paper for and discuss this work at next session. This WD will be prepared ahead of the next session and posted on Teams at around the 28th of July.

3.6. Weight-at-age

Jim Ianelli presented material on assuming alternative body mass-at-age data (details in [WD](#)). This modelling approach is intended to smooth through the data on weight-at-age. The smoothing is more apparent for the Northern Chile data, which is a bit more variable, same with the south central. This approach takes into account an assumed observation error as well as year and cohort effects.

Although the WD details fishery data, this same type of approach could also be used with the survey data. The average weight data were compared to the modelled results, and although the results produced smoothed effects (e.g., F), there was a rather minor impact on the overall results. There was not a lot of support for pursuing this further, as this is probably not an overly important axis of uncertainty, but Jim welcomed comments.

Ignacio noted that it is hard to interpret the change in F because weight-at-age changes would also impact the estimate of number of fish caught. Jim replied that the general scales were the same, but the original data was more variable (e.g., for individual F).

With respect to the implementation, there was a question of whether we would apply this to predict mean weight in the future, following the cohort. That would be a possibility, and could be built into the OM, but it's probably not worth it as we don't have great estimates.

There was also discussion around propagating trends in weight-at-age into the future, but that was not generally supported given concerns over cohort effects, environmental variability, and potential aging error or changes in aging protocols. Without knowledge of the mechanism driving these changes, it would be challenging to predict any trend.

At the moment, the OM code is using an average of weight-at-age from the last 3-5 years (ICES style). If we were resampling, these issues of variability would be more of a concern, but with the averaging there is a bit of a buffer against this variability.



The group agreed not to include this smoothing approach in the OM, and to stick to 5-year average and use that for future projections, as the base case. There is still consideration as to how best to deal with the projections under varying environmental conditions. This WD will be prepared ahead of the next session and posted on Teams at around the 28th of July.

Participants advocated for addressing changes in productivity when considering weight-at-age, as this can impact the body condition of jack mackerel. Chile has been including some environmental variables (e.g., chlorophyll) in their CPUE standardization and to explain changes in distribution. Although the group considered this topic important, it was not possible to carry out the necessary work within the next 2 weeks. However, Ignacio agreed to produce mean weights based on El Niño conditions (i.e., cold/warm periods). This information on productivity could be included as a sensitivity (when testing the MPs), not in the base case. Ignacio will prepare a WD for the next meeting.

4. Discussion on next steps in OM development

Iago will take the decision points from today's discussion to progress the OM and will liaise with Niels on further input needed from the group at this stage.

5. Discussion on proposed MP

Iago briefly discussed the two estimators in the MP that he has included as part of the testing. He highlighted two other potential estimator options, as examples of those that have been used for other species/regions. The group has been requested to prepare alternative estimators and harvest control rules for consideration. If no other estimators are proposed, we will forge ahead with the JJM.

6. Concluding & planning next session

The group agreed that additional sessions will be necessary. The plan is to schedule another session in 3 weeks' time to discuss WDs and Ignacio's work, and maybe another meeting in 5 weeks to discuss management procedures. Meeting invites, and agendas to the extent possible, will be distributed soon for these upcoming meetings.

ANNEX 1. List of Participants

Jack Mackerel Working Group Chair

Niels Hintzen

SC Chairperson

Jim Ianelli

Invited Expert

Iago Mosqueira

BELIZE

Charles Coc

CHILE

Ignacio Payá
Aguiles Sepúlveda
Victor Espejo
Nicole Mermound
Jose Zenteno
Sebastian Vasquez

ECUADOR

Jose Luis Pacheco

FAROE ISLANDS

Jan Arge

KOREA

Jeongseok Park

PERU

Criscely Lujan
Josymar Torrejón-Magallanes
Ana Alegre
Giovanna Sotil
Elmer Quisipe

RUSSIAN FEDERATION

Maxim Dubischuk



JM Connectivity Chair
Fabrice Stephenson

SPRFMO SECRETARIAT
Tiffany Vidal

REPORT OF THE FOURTH MSE TECHNICAL WORKSHOP IN 2023

1/2 August 2023

1. Introductions and Overview of MSE Process

The Secretariat Data Manager, Tiffany Vidal, welcomed all participants and invited everyone to introduce themselves. The workshop was attended by 15 participants. A list of attendees is included in Annex 1.

The items flagged for follow up during the last meeting were revisited to provide context for this meeting. Specifically:

- **CPUE abundance indices:** Ignacio volunteered to further evaluate concerns raised by the WG and prepare a working document (WD) complete with a practical proposal to simulate changes in spatial distribution for the fleet and survey, which could include changes in q , e.g., a step change or perhaps a smoother approach. This WD will be prepared ahead of the next session and posted on Teams at around the 28th of July.
- **Weight-at-age:** Evaluating how best to deal with the projections under varying environmental conditions. This WD will be prepared ahead of the next session and posted on Teams at around the 28th of July. Ignacio agreed to produce mean weights-at-age based on El Niño conditions (i.e., cold/warm periods). This information on productivity could be included as a sensitivity (when testing the MPs) but will not be considered in the base case. Ignacio to provide a presentation during this meeting.
- **OM development:** Iago will take the decision points from today's discussion to progress the OM and will liaise with Niels on further input needed from the group at this stage.
- **Management procedures:** The group has been requested to prepare alternative estimators and harvest control rules for consideration. Participants of the group were requested to prepare proposals for alternative MPs in detailed working documents (WDs), including equations and decision rules, etc.

Jim Ianelli, SC Chair, asked if there were any questions with the process outlined before continuing with the meeting presentations. There were none.

2. Growth, mean weight-at-age, and the environment

Ignacio Payá (CHL) presented an analysis of mean weight-at-age by years and cohorts and evaluated correlations between mean weight-at-age and environmental conditions. The presentation is available on [Teams](#).

Jim Ianelli noted that there may be a problem with sample sizes, especially when there is poor recruitment in some years and as a result, you may not get sufficient sample sizes of those older ages. He noted that the modelling has been done on mean weight-at-age as opposed to the raw values, and therefore, asked for some additional information about the raw data available for this work. It is difficult to assess the variability when using aggregate statistics, e.g., you probably couldn't get good CVs from curves, especially using aggregated data.

Jim noted that it may be possible to model length at age. He suggested for Ignacio to prepare a summary of what is in the database. For example, if you pick a single year, can you go back to the raw data and detail how many fish were aged and how many have associated weight measurements.



The WG has previously identified a few options regarding projecting mean weight-at-age forward. The first is to use a recent average for the OM going forward. The problem in a MSE setting, is that we should be including the data collection side of things, but here the details regarding the data collection process that resulted in the estimates on screen are not clear. It is not reasonable at this point to simulate observers sampling in unbalanced ways, so the proposed approach is a compromise. This is OK for a start, but in a full blown MSE, we would take in account the data generating process.

When asked about providing alternative approaches for mean weight-at-age, Ignacio suggested that an average in recent years could be possible, but that perhaps that average should be cold/warm period specific. He noted that the patterns observed for younger fish are not so clear.

Ignacio agreed to produce a summary table to include the number of observations by age and year, along with CVs. However, he noted that CVs could be problematic because of the averaging and the allometric growth equation used.

Jim shared his screen to demonstrate an approach taken for Alaska pollock. It is a data driven approach to illustrate mean and variability at age and year, which visually highlights the cohort effects. CVs are computed with the raw data and then predictions of mean weight-at-age are based on CVs, using inverse-weighting based on sample size (Fig. 1). The random-effects modelling allowed for density dependence and annual growth increment changes.

For projections, the WG was generally in support of using a recent mean to get started. Ignacio indicated that there is interest in testing different scenarios within the OM.

There was a brief discussion about robustness tests, noting that these tests, the OM is affected. For example, if we have a couple management procedures (MPs), a robustness test is something that is less plausible, but specified in the OM as slightly outside the plausible range. We need to first understand what the MP will be, and what kind of data collection systems will be in place. At this point it is difficult to think about how to switch between environmental regimes as part of this process.

Sebastian Vasquez (CHL) suggested that instead of cold/warm phase of El Nino, perhaps we can consider differences between coastal and offshore distribution. We have some onshore distribution in very productive areas as well as some offshore samples. Distance to shore was suggested as a possible variable to consider when evaluating changes in growth and mean weight-at-age. Sebastian also noted that assessing environmental conditions at appropriate lags will be important.

3. Review of OM development

Iago Mosqueira gave a brief update on the development of the MSE. He is working on finalizing MPs testing on both OMs and has implemented the movement between the two sub-stocks, as discussed at the last meeting. There is one task remaining: trying to run the one stock assessment when we have a two stock OM. There are also questions around the CPUE index to use as current diagnostics are not great.

The Chilean delegation presented a genetic analysis that suggested that migration rates may be higher than those proposed at the last meeting from the SEAPODYM model. They indicated that there may be more connectivity than what has been proposed. Jim noted that although these are important discussions, it is probably too late to change stock structure hypotheses and movement rates in the MSE. These discussions will certainly be useful but for the next generation of discussions around stock structure hypotheses.



Sebastian Vasquez and Cristian Canales (CHL) presented a table on bidirectional relative migration rates based on genetic analysis from 16 different areas, spanning from Peru to New Zealand. Most of the migration rates are higher than what is currently being used in the OM. The WG noted that migration rates are usually on generational time scales, so questioned how we are generating annual migration rates. This question remains, but Sebastian added that this work is focused on a source-sink hypothesis, as in their view, the metapopulation hypothesis has less support.

Giovanna Sotil (PER) expressed concerns about the spatial and temporal sampling design, for the samples used in the analysis. Cristian noted that the samples came from 2007 and 2010 and 2021/2022, during a short period during the summer. Giovanna added that the Peruvian samples were only from 2007, and when you talk about connectivity you are assuming there is contraction and expansion, and you are therefore looking for the boundaries. When you only have samples from Peru from 1 year, how can you estimate these migration rates?

The WG agreed that addressing the sampling design is important and will require some additional work.

Iago pointed out that the migration rates from SEAPODYM range from about 4-10% movement. The WG noted that the max migration rate from SEAPODYM is about 25% whereas the Chilean study suggested max migration rates around 80%. They don't have age-specific migration rates; these values form a population point of view. Jim again expressed concern about how to scale these values to an annual rate, as perhaps they should be weighted by abundance at age. It is not trivial.

Iago suggested that it may be possible to elaborate on the testing, even without an MP, to evaluate the effect of an alternative movement matrix. For example, we could simply multiply current values by 2 or 4. We can explore the scale and whether those values change in different patterns in different directions, and at different ages.

4. Concluding & planning next session

The next SC preparatory session is scheduled for 21 August 13:00 (UTC). Participants are encouraged to upload all working documents and presentation to Teams before the next meeting so that members have time to review them and identify discussion points.



Figures

Spawning biomass body-weight-at-age

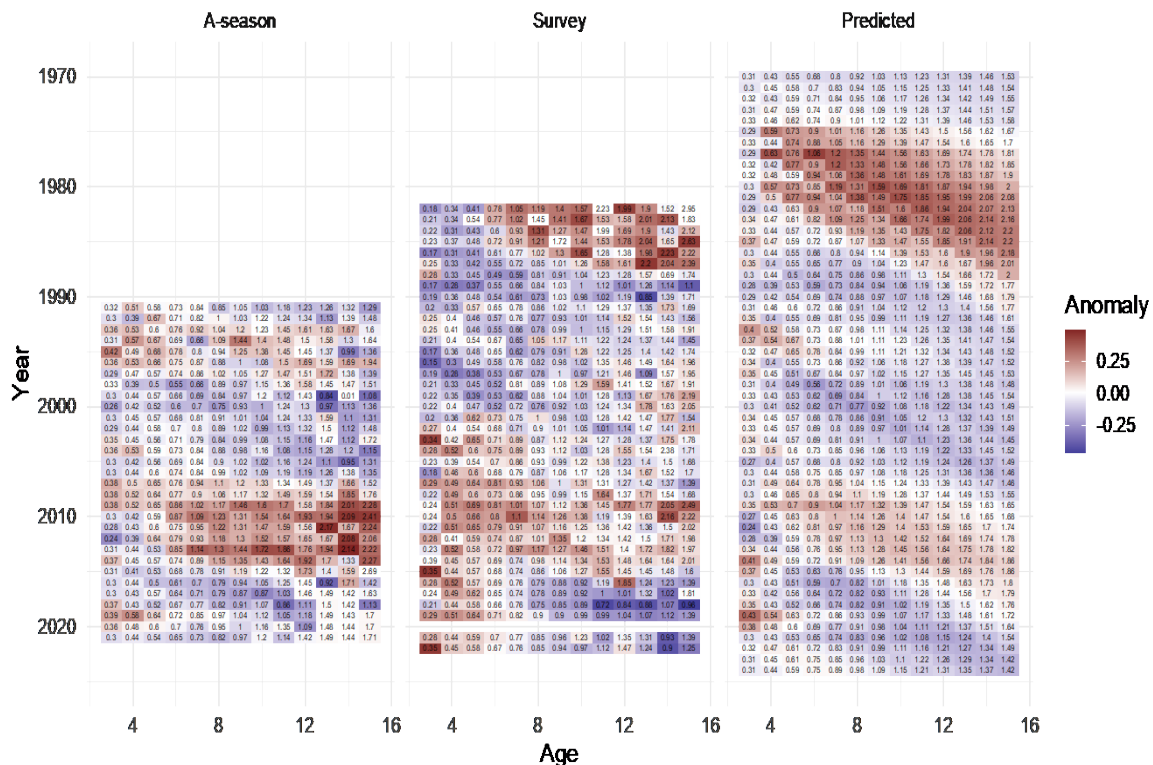


Figure 1. Example of combining different weight-at-age data (weighted by the inverse variance—not shown) on left and middle panels to estimate predicted stock weights for Eastern Bering Sea Alaska pollock. Note this approach is essentially derived from empirical means and variances with cohort and year effects treated as random effects.

ANNEX 1. List of Participants

SC Chairperson

Jim Ianelli

Invited Expert

Iago Mosqueira

CHILE

Aurora Guerrero

Ignacio Payá

Aquiles Sepúlveda

Victor Espejo

Criscely Lujan

Sebastian Vasquez

Cristian Canales

Sandra Ferrada

PERU

Criscely Lujan

Ana Alegre

Giovanna Sotil

Josymar Torrejón-Magallanes

SPRFMO SECRETARIAT

Tiffany Vidal

REPORT OF THE SQUID WORKING GROUP

21/22 June 2023

1. Introductions and Overview of MSE Process

The Squid Working Group Chairperson, Dr Gang Li, welcomed all participants and invited everyone to introduce themselves. The Chair noted that this was the 1st of 3 planned SQ Teams meetings. The group agreed that considering those upcoming meetings there will not be any need to hold a pre-SC meeting on Squid topics. The workshop was attended by 16 participants. A list of attendees is included in Annex 1.

All presentations from this meeting are stored in the SPRFMO [Teams repository](#).

2. CALAMASUR assessment model

Dr. Rodrigo Wiff, on behalf of CALAMASUR, gave a presentation of their modelling results titled “Regional assessment of the jumbo squid with multi-annual and multi-fleet generalized depletion models”. This was a model with data from members, by month, and was applied in a fleet-specific way.

There was a question about stock structure and genetic structure, which was considered an alternative hypothesis about the fishery structure.

Fishing power among fleets is kept separate, a catchability, hyper-stability parameter, and a suitability logistics.

The Peruvian Fleet combines industrial and artisanal vessels, and Asian fleets are combined across different member countries. Combining fleets for Chile was considered apples-to-apples (additive to hauls) and the group noted it was a simplification.

Mean body weight was unavailable from the different Asian fleets, so they were combined. Also, they had the same units of effort. The combining of Asian fleets was considered reasonable.

Estimation of natural mortality was questioned. The analysts responded that it was set as a free parameter.

In response to a question, the analyst confirmed that the model type had previously been tested using simulated data.

Recommendations:

CALAMASUR scientists provide their assessment code (and data) in a manner to be available to SPRFMO SC members.

If time permits, consider fixing natural mortality at some alternative values.

3. SPiCT model

Dr Ignacio Payá, gave a presentation of the model Chile had developed. He reviewed the results achieved last year. This year the objective was to assess the stock using SPiCT with different priors. Model used nominal CPUE (ton/fishing day) extracted from annual reports for Asian fleets plus GLMM (Chile) and an abundance index for Perú. An annual global abundance index was created for 2000-2021. His analysis considered 5 different cases and resulted in a more pessimistic view of the stock.



A question was raised on the R prior and whether the model had been tested to use different values especially regarding the base Peruvian data which had a different intrinsic rate. The possibility that this difference was related to phenotypical differences was raised by Chile.

Recent regime changes were acknowledged and the SPiCT has an option for introducing environmental changes, but this has not been explored yet.

Recommendations

R values estimates were identified as possibly needing more investigation. It was suggested that gaps in the nominal CPUE for the Asian fleets due to months where there is nil or very low fishing may introduce bias.

Suggestions for R for squid were discussed and it was suggested that the life history theory used for fish and mammals should be indicative for squid also.

4. Bayesian state-space production model

Dr Gang Li gave a presentation of the model China developed using monthly catches. The CPUEs of the Chinese squid-jigging fishery were standardized and used as relative abundance indices. Bayesian state-space surplus production models were employed, taking into account annual and monthly data, as well as environmental conditions (El Niño and La Niña). The annual model utilized squid catch data from 2012 to 2021, while the monthly model covered January 2017 to December 2021, assuming that catch in the Peruvian EEZ was proportional to that in the high seas. Key model parameters, carry capacity (K) and intrinsic rate of increase (r), followed a uniform distribution with consistent boundaries across models (monthly r equals to 1/12 annual r).

In the annual traditional model, disregarding El Niño/La Niña effects, the mean estimated values for MSY, Bmsy, and Fmsy were 2427 thousand tonnes, 5254 thousand tonnes, and 0.556, respectively. In the annual environment-dependent model, MSY differed under El Niño and La Niña conditions, with values of 2620 and 3181 thousand tonnes, respectively. Bmsy showed similar variability (5728 and 5335 thousand tonnes), while Fmsy exhibited values of 0.472 and 0.644 for El Niño and La Niña, respectively. The stock was not overfished, and overfishing did not occur according to the annual models. In El Niño or La Niña years, K, MSY, and Bmsy increased, while the intrinsic rate of increase (r) decreased during El Niño conditions but increased during La Niña years.

In the monthly traditional model, MSY, Bmsy, and Fmsy were estimated at 607 thousand tonnes, 7839 thousand tonnes, and 0.078, respectively. Stock biomass exceeded 0.5 Bmsy but fell below Bmsy in some months, indicating no overfishing. When El Niño and La Niña effects were considered, MSY and related reference points changed. In El Niño conditions, MSY and Fmsy decreased while Bmsy increased compared to the traditional monthly model, whereas the opposite trend was observed in La Niña months. Fishing mortality remained much lower than Fmsy regardless of environmental impacts. The stock biomass remained above 0.5 Bmsy, except in certain months (mostly March, April, and May during 2017-2019). The month-based model provided a more detailed reflection of population dynamics, and the assessment could be more accurate with monthly catch and CPUE data from all participants.

Recommendations

It was noted that the values of R estimated by the China model are similar to those estimated by Chile's model. This was considered worthy of further consideration regarding the differences in phenotype lifetimes.

CPUE was standardized with a lot of covariates – perhaps some of them should be removed. It's unlikely to change the results, but it would reflect standard practice.



A question was raised that the El Nino/La Nina R as results seemed to suggest the opposite from what was expected. This was considered related to K value variation, and was considered a characteristic of the relationship between R and K. Further checks on this aspect were recommended.

It was requested that CPUE be separated not just by area, but rather the maturity size, as has been previously discussed.

There was a suggestion to consider monthly lat/long as a surface within the model to better reflect the movement ability of the jumbo flying squid.

Further restriction of the R values was also suggested.

An exercise to generate data and then re-run the model to test to see if the expected result is obtained was suggested as a method to verify the model reference outputs.

Modelling using numbers might also be a way of accounting for any phenotype/fleet co-variation.

Overview of pros and limitations of the three models evaluated in the squid working group
(Original Table 2 from SC10-Report has been updated).

Model(s)	Pros	Limitations	Recent updates
Bayesian state-space production model (CHN): Annual (2012-2021) Monthly (2017-2021)	Incorporation of process error on biomass and observation error on abundance index; Exploration of environment-dependent parameters; The prior distribution of the parameters adjusted with the time step of the model; Reflect the population dynamics in more detail within a year	Only based on the standardized CPUE indices for China. Short time series for the monthly model; Assumption existed for monthly catch data in the Peruvian EEZ;	Pros/limitations have been updated.
SPiCT (CHL) 2000-2021	Incorporates process errors on biomass and fishing effort and observation errors (catch and abundance index) Longest abundance index (2001-2020) with contrast. Global abundance index Flexible time scales (annual model presented)	Production specified as Schaefer model Prior distribution intrinsic growth (r) Nominal CPUE indices for China, Chinese Taipei and Korea. Peruvian data from ANJ report figures (digitised)	5 different priors were examined



<p>Regional depletion model combined with time varying parameters Pella-Tomlinson surplus production model (CALAMASUR) 2012-2020</p>	<p>Monthly time scale;</p> <p>All parameters estimated by the model-data combination, no parameter fixed by the analyst.</p> <p>Regional-wide assessment covering >99% of landings.</p> <p>Takes into account environmental cycles (Niño-Niña).</p> <p>Fully reproducible, open-source code.</p> <p>Software (R package CatDyn) ranked as 'Supported and Recommended' by the Australian FRDC toolbox (https://toolbox.frdc.com.au/toolbox/#page-content)</p>	<p>High estimated r; potentially overly optimistic</p> <p>Poor fits to Chinese catch data</p> <p>Peruvian data from ANJ report figures (digitised 2012-2020)</p> <p>Natural mortality estimates are too low for a life history with max 2 years longevity.</p>	<p>Depletion model fitted to real biological data from Asian fleets now providing good fits to Asian fleets catches.</p> <p>Depletion model fitted to complete Peruvian data now provided by official sources.</p> <p>Natural mortality estimate (1.85 per year, CV=7.3%) now fully consistent with squid life history.</p> <p>Pending the fit of the Pella-Tomlinson model using annual biomass estimates from the depletion model.</p>
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ANNEX 1. List of Participants

Squid Working Group Chair
Gang Li

SC Chairperson
Jim Ianelli

CHILE
Ignacio Payá
Marcos Troncoso Valenzuela

CHINA
Dongming Li
Yangming Cao

ECUADOR
Jose Luis Pacheco

PERU
Josymar Torrejón-Magallanes
Juan Torres
Elizabeth Roncal
Jimena Mendoza

CHINESE TAIPEI
Chih-Shen Chen
Han-Ching Chuang

CALAMASUR
Rodrigo Wiff
Ruben Roa-Ureta

SPRFMO SECRETARIAT
Craig Loveridge

SQUID WORKING GROUP ON GENETICS - MEETING REPORT

19/20 July 2023

1. Introductions and Overview of MSE Process

The Squid Working Group Co-Chairperson, Dr Gang Li, welcomed all participants and invited everyone to introduce themselves. The agenda, as detailed in Annex 1 was adopted. The workshop was attended by 18 participants. A list of attendees is included in Annex 2.

2. Update on the genetics studies based on mtDNA analyses and genetic diversity

2.1 Population genetic studies of jumbo flying squid collected in Peruvian jurisdictional waters (Giovanna Sotil)

Giovanna Sotil (PER) briefly presented the progress on mtDNA analyses from Peruvian waters; her [presentation](#) is available on Teams. Analyses were performed by grouping the data by phenotype-sizes, latitudinal and longitudinal distribution of the samples. She noted they are lacking samples of the large phenotype from the north of Peru, which is a current limitation for a complete comparison.

This work has focused on the ND2 gene with several different statistical analyses performed: pairwise F_{st} distance, AMOVA, and SAMOVA. The analyses were in general agreement that there is significant differentiation between the oceanic and coastal organisms sampled; and when phenotype was included in the analysis, the large oceanic organisms showed significant differentiation from the other groups.

They are still waiting on additional samples (92) to be sequenced for ddRAD-seq analysis and expect to have those results in about 2 months. There is ongoing sampling to obtain additional samples from the northern areas of Peru.

Ignacio Payá (SQWG Co-Chair) asked how these results should be interpreted given the limited spatial range of the samples. Questioning whether these results suggest the existence of population units or population subunits. Giovanna noted that the geographic distribution of squid is related to their size, and this may be related to environmental conditions, food availability, etc., but we don't fully understand the mechanisms yet. It is clear, however, that there are genetic differences between the oceanic and coastal organisms. The connectivity between the southern and central regions is not clear yet, but hopefully the new SNPs analyses will shed more light on this.

Christian Ibáñez (CHL) referenced a paper by Sanchez et al. (2016), noting that they found genetic variation, but it was not related to geographic structure, and there were no differences identified between the phenotypes. Giovanna was familiar with the paper and suggested that some of the differences in results could be due to the sampling design.

Christian questioned whether there could be squid migrating from equatorial waters into Peruvian waters. He also noted that we need to exercise caution when interpreting the effect of environmental variation on genetic diversity, as some of this variability could be from mutations occurring over thousands of years, and maybe not a reflection on the environment. He suggested comparing the Peruvian samples with samples from a broader geographic range.

Congcong Wang (CHN) asked for clarification around the distribution of the large phenotypes. Giovanna noted that samples of the large organisms were only obtained from the oceanic and coastal waters in the south and central areas of Peruvian waters, but not in the north.



Ignacio asked for clarifications as whether the genetic variation observed suggests that there are different species of squid, because we have generally considered phenotypic variation, which suggests different expressions of the same genes. Giovanna indicated that there is no evidence for different species; these results have highlighted genetic variation which is different from gene expression.

2.2 Genetic population structure and genetic diversity of *Dosidicus gigas* along the Pacific Ocean

Christian Ibáñez gave a brief presentation on work in progress on the genetic population structure of squid through its distribution (Canada to Chile); his presentation is on Teams. The work presented largely focused on the mtDNA marker COI, as opposed to Giovanna who focused on ND2. The preliminary results show evidence of high connectivity between all locations; however, the northeast Pacific differentiates from the southeast Pacific. The data suggests single genetic unit in the South Pacific.

Giovanna highlighted another paper that conducted a similar study but did not find genetic differences between the North and South Pacific (Staaf et al., 2010). Christian pointed out that this study used ND2 markers and not COI. Giovanna pointed out that this analysis should be interpreted with caution because: COI is a paralogous gene (not suitable for these studies) and also has a low mutation rate (is more conserved).

Eunjung Kim (KOR) asked whether Christian has analysed his samples at smaller spatial scale, such as the scale used by the Peruvian colleagues, to compare results. Christian noted that they not, however, they have analysed different markers (ND2 vs. COI). He recognized the need for more samples from the northern hemisphere to better estimate the genetic discontinuity. Giovanna added that last year Peru presented results obtained with COI gene.

3. Sample collection and exchange

Concong Wang (CHN) gave a presentation on sample collection and exchange, which is available on [Teams](#). She noted that due to the pandemic, sample exchange has been halted. In addition, processing of the samples is very expensive, which can cause delays. They are expecting to receive more results in about 2 months.

Christian noted that Chile will update their sequences in GenBank before SC11 in Panama, later this year. He encouraged Peru and other colleagues to upload their sequences to GenBank, if possible, so that they can more easily compare results and explore methodologies.

Giovanna raised concerns about provisioning additional sample data along with the sequences in GenBank. In 2021, Peru prepared a template to consider information that should be included when registering the sequences – data like the date and location of the sample collection and the animal size or phenotype.

Tiffany Vidal (Sec) suggested the possible use of the SPRFMO [GitHub account](#) for code sharing related to these analyses, as appropriate. If this is of interest, and you would like access to this account, please email the Secretariat (data@sprfmo.int).

Gang added that for China, this is the first time using an international cargo agency for biological samples such as this, and they are facing some challenges with transport of samples (e.g., to Chile or Korea). He agreed that GenBank is a good platform to share the sequence data, even if samples can't be shared directly.

4. Update agreement on consistent approaches to genetic analyses

The Working Group agreed that not only should samples and/or sequences be shared, but it will also be important to agree on the most appropriate methodologies for analysing this information, for consistency and easy of comparison.

Giovanna, Congcong, and Christian will work on a document to describe techniques and analytical approaches used. Giovanna also suggested the possibility of having an independent lab analyse samples from all members, once the NGS methodology has been agreed upon. Thus far the working group has focused on mtDNA, and specifically ND2 and COI markers, but other approaches could be considered.



5. Register DNA sequences in public DNA databases (GenBank)

The Working Group agreed that GenBank should be used to share mtDNA sequences, and that in addition, the template to be agreed upon, will be used to provide additional metadata about the samples that will be valuable for the analyses and interpretation of results.

The sample [template](#), developed in 2021, is available on Teams for members to review, comment on, and eventually use to accompany the sequences.

6. Other issues

Gang brought attention to a couple of recent papers (2022) describing mRNA editing in cephalopods; both have been added to the Teams folder for this meeting. He encouraged members to read them and review for discussion.

Albertin, C.B., Medina-Ruiz, S., Mitros, T. et al. Genome and transcriptome mechanisms driving cephalopod evolution. *Nat Commun* 13, 2427 (2022). <https://doi.org/10.1038/s41467-022-29748-w>

Schmidbaur, H., Kawaguchi, A., Clarence, T. et al. Emergence of novel cephalopod gene regulation and expression through large-scale genome reorganization. *Nat Commun* 13, 2172 (2022). <https://doi.org/10.1038/s41467-022-29694-7>





ANNEX 1. Meeting Agenda

- Update on the genetics studies based on mtDNA analyses and the genetic diversity
- Sample collection and exchange
- Update agreement on consistent approaches to genetic analyses
- Register DNA sequences in public DNA databases (GenBank)
- Other issues

ANNEX 2. List of Participants

Squid Working Group Co-Chairs

Gang Li

Ignacio Payá

SC Chairperson

Jim Ianelli

CHILE

Marcos Troncoso Valenzuela

Christian Ibáñez

Ignacio Payá

CHINA

Congcong Wang

Dongming Lin

KOREA

Eunjung Kim

Jeongseok Park

PERU

Ana Alegre

Juan Argüelles

Rocío Roncal

Giovanna Sotil

CHINESE TAIPEI

Chih-Shin Chen

Han-Ching Chuang

SPRFMO SECRETARIAT

Tiffany Vidal

Susana Delgado

SQUID WORKING GROUP ON ASSESSMENT MODEL REVIEW AND CMM DEVELOPMENT

MEETING REPORT

26/27 July 2023

1. Introductions and Purpose of the meeting

The Squid Working Group Co-Chairperson, Dr Gang Li, welcomed all participants and invited everyone to introduce themselves. The draft agenda was amended; the adopted agenda is available in Annex 1. The workshop was attended by 23 participants. A list of attendees is included in Annex 2.

There was some confusion about the agenda, so the group reviewed the SC workplan. Chile wished to discuss the biology of jumbo flying squid as it relates to the potential migration patterns and how area closures might be considered. Peru noted that they have a presentation on this as a scheduled agenda item.

From the SC workplan the group noted that it contained an element expressing the need to: *“Revise data template to sufficient detail and create scripts to allow current assessment methods to be used and also future higher resolution approaches (e.g., depletion estimator by phenotype).”* The group agreed that this item covered too much for this meeting and it was dropped from the agenda. There was also some uncertainty as to whether this had already been completed given the work presented by CALAMASUR.

All presentations shared during this meeting are available on [Teams](#).

2. Model comparison

Ignacio Payá (CHL) [presented](#) updated results using the SPICT model. The update included new prior distributions for r , based on similar squid species, and the change in the initial year from 2000 to 2001. In all the alternative scenarios he examined, the results suggested an overfished stock status. He noted that the abundance indices need to be improved. However, he also mentioned that in the case of the Chinese fleet, standardized CPUE and nominal CPUE have a similar trend. The WG suggested that prior to concluding results from any production model simulations are required to ensure that the results can be validated. Participants asked what information is needed to inform the model regarding phenotype, as this information hasn't been included thus far. Ignacio noted that we need the size structure and maturity stages of the squid from different areas. In Chilean waters, there is only the large phenotype, but in other areas, information about phenotype would be important to include, and to have phenotype-specific CPUE indices.



CALAMASUR's [presentation](#) was presented earlier but they provided additional details for discussion. In contrast to the Chilean model results, these models indicated that fishing mortality rates were very low relative to natural mortality. WG asked about the correlations between parameters estimated by depletion models as natural mortality, fishing mortality, and catchability coefficient. R. Wiff clarified that fishing mortality is not a parameter to be estimated by the model, but it is calculated using the model results, therefore, the model does not estimate correlation with fishing mortality, however, recognized that fishing mortality is related to the natural mortality through the catch equation. The correlation between natural mortality and catchability coefficient has not been analysed yet, but it will be done. Having access to data that is currently scarce (particularly Chinese, Chinese Taipei, and Korean data) was identified as having the potential to improve the depletion and surplus production models results. Some of the Ecuadorian data has gaps to which should be filled in to fit a four-fleet depletion model at stage 1. CALAMASUR also suggested that the WG should agree on better definitions of the periods of the environmental cycle (ENSO index, Peruvian Oscillation index [decadal changes]); they also suggested that consideration should be given to developing multi-annual, multi-fleet generalised depletion models that take into account the environmental cycle by allowing natural mortality to change according to the cycle. Finally, CALAMASUR's results of the depletion models and surplus production model show that the stock is not overfished nor undergoing over-fishing.

Yangming Cao (CHN) [presented](#) on updated CPUE standardisation and stock assessment modelling of jumbo flying squid in the South Pacific. The presentation was split into two parts: i) standardised CPUE –adjusting spatial resolution, inclusion of temporal-spatial interaction terms and delineating different fishing regions, and ii) assessment model –obtaining reliable monthly catches and CPUE data from three fleets (namely, Chile, Peru, and China). There was some discussion about the different results obtained using GLMs and GAMs, as well as how to incorporate this information into the assessment. The new models showed that standardized and nominal CPUE had a similar trend through the years. Participants questioned whether zeros were included in the standardisation (e.g., in a delta-lognormal model). Further follow-up was identified as needed prior to considering including this information within the assessment.

The risk table and harvest control rule sections of the agenda were covered to some degree within the presentations.

3. Possibility of fishery closure in areas close to spawning grounds in the SPRFMO Area

Jimena Mendoza (PER) [presented](#) research on spawning areas for jumbo flying squid. The distribution areas according to mantle length were identified as: small sizes located close to equatorial zones (low latitudes), medium sizes were found almost throughout the whole distribution range (except for high latitudes), and the large sizes were found in the far north and also along the northern/central Peruvian coast.

According to Peru's presentation, spawning of squid seems to occur over the continental slope of Peru and adjacent oceanic waters off Peru and near surface water layers and, temporally, it takes place year-round with a main period in spring-summer, with peak spawning between October-January. In Chile, there are some records of maturing stages for both males and females, but no spawning stages nor spawning grounds have been confirmed. In Peru, however, even though egg masses have not been found, it is inferred that spawning is occurring due to the presence of spawning adults, larvae, and juveniles.

Peru noted that there is not enough information to propose delimitation of spawning areas in space and time. And any such proposals will require further research. Peru also clarified that more historical data may be available but have yet to be included. Peru also stated that migration patterns are poorly understood (as well as growth rates) and that the duration of spawning period within Peruvian waters is unknown.



The Chinese delegation inquired about the percentage of spawning adults in the given area, since no egg masses were recorded in Peruvian waters. Peru indicated that they don't yet have that information, but spawning areas are inferred from the presence of paralarvae and juveniles in the same area.

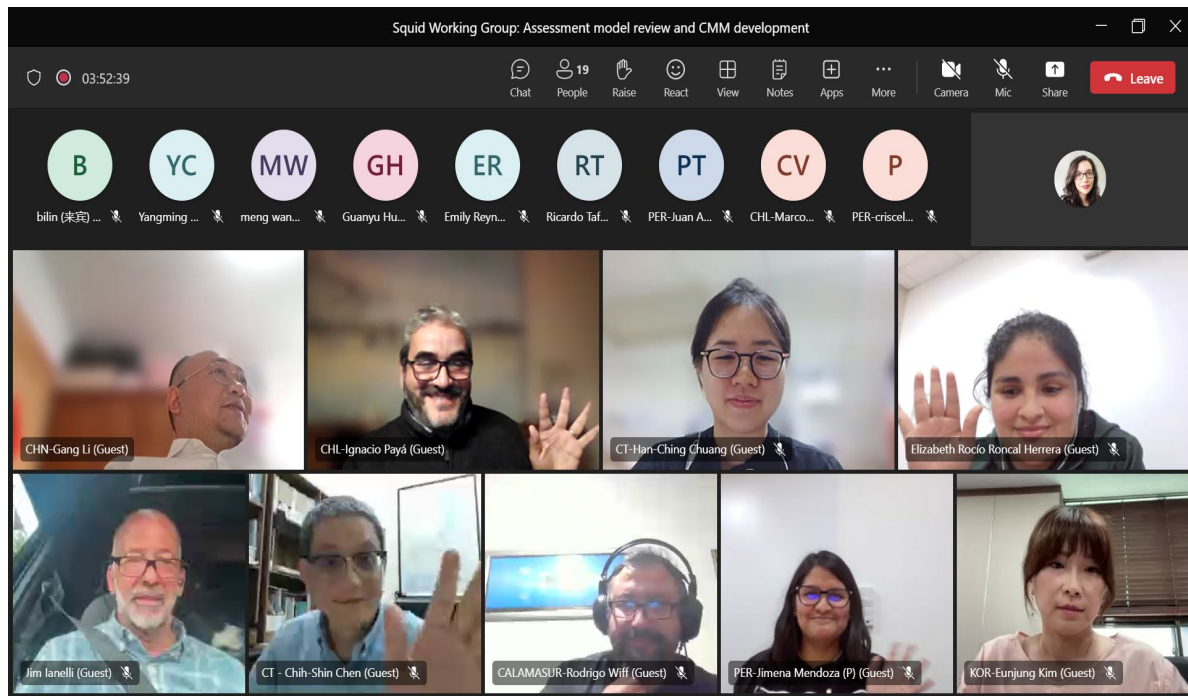
During the group discussion it was noted that information from recent years on juvenile squid was lacking; furthermore, that more research applying stock assessment methods, including tests on robustness of conclusions using known but simulated data, was needed.

4. Recommendations and Next Meeting

The WG Chair proposed a 4th Working Group session to deal with issues on stock assessment before the SC meeting. The date of the next meeting was agreed for 16/17 August and the times per location are as follow:

Proposed Time and Date for next SQWG session

Location	Local date	Local time
Rarotonga, Cook Islands	Thu 17 Aug 2023	3:00 hrs
Seattle, United States	Thu 17 Aug 2023	6:00 hrs
Belmopan, Belize	Thu 17 Aug 2023	7:00 hrs
Havana, Cuba	Thu 17 Aug 2023	9:00 hrs
Quito, Ecuador	Thu 17 Aug 2023	8:00 hrs
Panama City, Panama	Thu 17 Aug 2023	8:00 hrs
Lima, Peru	Thu 17 Aug 2023	8:00 hrs
Washington DC, United States	Thu 17 Aug 2023	9:00 hrs
Santiago, Chile	Thu 17 Aug 2023	9:00 hrs
Torshavn, Faroe Islands	Thu 17 Aug 2023	14:00 hrs
Brussels, Belgium, European Union	Thu 17 Aug 2023	15:00 hrs
Moscow, Russia	Thu 17 Aug 2023	16:00 hrs
Beijing, China	Thu 17 Aug 2023	21:00 hrs
Taipei, Chinese Taipei	Thu 17 Aug 2023	21:00 hrs
Seoul, South Korea	Thu 17 Aug 2023	22:00 hrs
Canberra, Australia	Thu 17 Aug 2023	23:00 hrs
Port Vila, Vanuatu	Fri 18 Aug 2023	0:00 hrs
Wellington, New Zealand	Fri 18 Aug 2023	1:00 hrs
UTC	Thu 17 Aug 2023	13:00 hrs



ANNEX 1. Meeting Agenda

1. Opening and Introductions
2. Model comparison
 - Harvest control rule (HCR) and total allowable catch (TAC)
 - Projections
 - Risk analyses
3. Possibility of fishery closure in areas close to spawning grounds in the SPRFMO Area



ANNEX 2. List of Participants

Squid Working Group Co-Chairs

Gang Li

Ignacio Payá

SC Chairperson

Jim Ianelli

CHILE

Marcos Troncoso Valenzuela

CHINA

Bilin Liu

Ce Liu

Meng Wang

Hao Xu

Yangming Cao

Guanyu Hu

KOREA

Eunjung Kim

PERU

Criscely Lujan

Jimena Mendoza

Juan Torres

Josymar Torrejon

Elizabeth Roncal

Ricardo Tafur

CHINESE TAIPEI

Chih-Shin Chen

Han-Ching Chuang

UNITED STATES

Emily Reynolds

CALAMASUR

Rodrigo Wiff

SPRFMO SECRETARIAT

Susana Delgado

DEEPWATER WORKING GROUP MEETING REPORT

Fishery Operations Plans

2/3 August 2023

1. Introductions and Overview of MSE Process

The Deepwater Working Group Chairperson, Dr John Syslo, welcomed all participants and invited everyone to introduce themselves. The workshop was attended by 20 participants. A list of attendees is included in Annex 1.

This meeting focused on discussions around the exploratory fishery proposals and associated fishery operations plans (FOPs) that have been submitted to the SC. There will be 3 additional meetings to discuss the remaining deepwater papers that have been prepared for the SC.

2. European Union Patagonian and Antarctic toothfish fishery

Joost Pompert (EU) gave a [presentation](#) on the EU's fishery operations plan. This and all presentations from this meeting are available on [Teams](#).

It was clarified that the proposed total allowable catch (TAC) is in greenweight, although not specified in the proposal. Joost added that there is an effort and quota limit for the proposed fishery and the fishery will cease whenever one of those limits is reached.

Jan Geert Hiddink (EU) asked how the size distribution of fish selected for tagging was determined. Joost noted that 5 fish per harvested tonne are tagged and the size distribution of these fish must overlap the size distribution of the catch, as recorded by the observer, by at least 60%. In practice this overlap is usually at least 70%. These details will be added to a revision of the FOP.

Trent Timmis (AUS) noted Australia's support for this proposed fishery and that Australia would be keen to exchange genetic samples with the EU, especially for fish caught around Macquarie Island. Australia is currently looking into close-kin mark-recapture to estimate the population size for toothfish. The EU reciprocated this interest.

John Syslo noted that the preliminary stock assessment focused on CPUE by area, and that there is a mismatch between the depth range of the reference area in CCAMLR and the area in SPRFMO. This mismatch could result in artificially inflated estimates of the population size, and John questioned whether this was viewed as potentially problematic. Joost noted that the assessment work was contracted out, but that he will inquire with the consultant that did this work.

Jim Ianelli (SC Chair) raised questions about the Chapman method used to generate preliminary estimates of stock size. The method is focused on changes in CPUE over time, but what are the implications of fishing the same place over time? Trent explained that when talking about spatial distribution of effort, the implication was that effort is to be dispersed within a single season, and that it is reasonable (and likely beneficial) to go back to the same fishing grounds season after season, especially with tagging efforts. Repeat sampling of the same areas will help to inform the population assessments.



3. Australia Toothfish fishery on the Macquarie Ridge

Trent Timmis (AUS) gave a [presentation](#) on Australia's proposal for an exploratory toothfish fishery for an area that has not yet been targeted for fishing activities. At this point, they are unsure which species of toothfish will be present, and therefore have proposed fishing for both species. They have completed a risk assessment and noted that the potential for seabird interaction is the highest identified risk. To address this, they have planned the timing of the fishing activities during a period expected to minimize those risks. Catches of elasmobranchs are expected to be low in that area, and nylon traces will be used to mitigate shark bycatch. All elasmobranchs brought to the surface will be released alive, to the extent possible.

Jan Geert questioned the spatial distribution and constraints of where the lines are shot. Trent noted that a specific distance constraint between fishing events has yet to be defined, as the area is relatively small, and including these constraints may be problematic without further investigation of the bathymetry. Australia is looking to replicate provisions in CCAMLR, but the skipper of the vessel wanted to have a look at the bathymetry before committing to those specifications. Jan Geert followed up by expressing concerns that the risk of encountering good catch rates in one location could motivate a vessel to continue fishing in that same area and potentially take the full TAC from that one area, which would not be in the spirit of an exploratory fishery. Trent agreed that without additional detail in the proposal that would appear possible, however, that is not the intent of these activities. He agreed to further investigate this issue and work towards developing some additional provisions for the SC.

Jasper Bleijenberg (EU) noted that the line sink rate in the proposal was 0.24 m/s but the minimum requirements in CMM 09 is 0.3 m/s. Trent reiterated that they are using integrated weighted lines, so the sink rate should be well above that, and he will double check that value.

Jasper also questioned the potential risk of interactions with elephant seals, as this is not well covered by the risk assessment. Trent explained that although there are interactions with them in a fishery to the west, but there hasn't been an interaction on the Macquarie Ridge, but he will investigate this in more detail for a revision.

John Syslo asked for some additional justification for considering the proposed TAC precautionary, as the proposal text mentions extraction rates from comparable fisheries of around 0.4 kg/km², but the rate in this proposal is around 0.7 kg/km². Trent noted that the proposed extraction rate is about ½ the rate of the Macquarie Island fishery, and that the reference rates in the proposal come from the EU and NZ exploratory fisheries. The Macquarie Island fishery has been sustainably fished for about 15 years and has double the TAC proposed here, lending some justification to the precautionary nature of the proposed TAC.

4. Cook Islands Dropline and Jigging for Hapuka

Steve Brouwer [presented](#) on the Cook Islands' proposal for a new exploratory dropline and jigging fishery targeting hapuka (*Polyprion spp.*). This is an area that has not experienced this type of fishery, and therefore the anticipated catch rates of hapuka and associated bycatch are largely unknown. At this point they are not able to set target and limit reference points, but they are hopeful they will be able to do so with additional data collection.

Tiffany Vidal (Sec) asked about the data collection process envisaged, and whether these activities would be submitted on different data templates (i.e., dahn line and jigging), as disparate data collection could lead to confusion down the line when analyzing these data, from a SPRFMO database perspective. Steve noted that the intention is to submit all data using the dahn line templates as the minimum data collection standards but will further investigate whether it will be important to include additional data fields to those templates.



Jan Geert asked how the proposed TAC of 1000 t/year was derived, as it seems quite large. Steve noted that it is based on a similar fishery in New Zealand, but the TAC is half of the NZ TAC (although the fishable area in the proposal is smaller). Jan Geert expressed concern that it is hard to judge whether this amount is reasonable based on the justification provided and this level of extraction could potentially lead to overexploitation. Steve agreed to add some more detail on the fishable area, but noted there are many more seamounts that have not been fished yet. The information to provide justification and support is quite limited at this point.

Jan Geert also expressed concern about the 5% by weight VME limit to trigger a move on requirement. He noted that the selectivity of the gear is probably quite low for VMEs, and given the heavy weights used to drop the lines, significant damage to VMEs would likely be incurred before the 5% by weight limit was reached. He suggested that the number be reduced.

Jan Geert requested additional information (e.g., specific species) regarding anticipated mammal and bird interactions, with some evidence to underpin these expectations. Steve agreed to expand on these details in a revision to this document and added that the sink rates are fast and the line remains close to the vessel, so the expectation is that bycatch, especially birds will be very low, but perhaps not impossible.

Jasper (EU) raised some confusion about this proposal being in response to lobster fishery, as it appears to be a bottom fishery. He suggested conducting a risk assessment like those done for other bottom fisheries. Steve noted that because there hasn't been a similar fishery in this area before, they don't really know what will be encountered. He added that all elasmobranchs will be returned to the sea alive, to the extent possible (a requirement for Cook Islands vessels). Steve concurred that it is a unique proposal as it will occur during another fishery; however, the two are very different. He also clarified that the proposed fishery would cease when either the TAC or the bycatch limit (20% of the TAC) is reached.

John Syslo noted that the US had similar concerns as those raised by the EU.

5. Other matters

None noted.



ANNEX 1. List of Participants

Deepwater Working Group Chair

John Syslo

SC Chairperson

Jim Ianelli

AUSTRALIA

Trent Timmis
Brooke D'Alberto
Lara Ainley

CHILE

Aurora Guerrero
Lorenzo Flores

COOK ISLANDS

Steve Brouwer

EUROPEAN UNION

Jasper Bleijenberg
Joost Pompert
Jan Geert Hiddink
Rob Banning

KOREA

Jeongseok Park
Eunjung Kim

PERU

Maritza Saldarriaga

NEW ZEALAND

Duncan McDonald

UNITED STATES

Emily Reynolds

HIGH SEAS FISHING GROUP

Jack Fenaughty
Andy Smith

SPRFMO SECRETARIAT

Tiffany Vidal

2023 DATA WORKING GROUP INCEPTION MEETING REPORT

13 April 2023 (NZDT)

1. Introductions

1. The Secretariat's Data Manager (Dr Tiffany Vidal) welcomed all attendees and asked Members to briefly introduce themselves and describe any aims they may have for this new group. The meeting was attended by 38 participants. A list of participants is provided in Annex 1.
2. Agenda (Annex 2) and topics were agreed as below.

2. Aims of the working group

3. Background on the motivation to initiate this working group was provided, including inconsistent data within the database, labour intensive and potentially error data submission processes, and impediments to data usability by Members.
4. The initial aims of the group include addressing data collection, submission, and reporting needs as well as supporting the SC with data analyses. These objectives are still under discussion, however, as over the next month Members will have an opportunity to discuss via Teams the Terms of Reference (ToRs) and scope of this group.

3. Develop Terms of Reference and Nominate Chair

5. The draft Terms of Reference were discussed. Participants were not prepared to adopt the ToRs but instead agreed to take the next month to review and revise them via a shared document on Teams.
6. A Chair of the group was not identified during this meeting, as participants preferred to establish the ToRs before nominating a Chair. In the interim, the Secretariat will continue to coordinate the efforts of this group. We will solicit nominations once the ToRs have been adopted.
7. There was some concern and confusion raised about this new group might overlap with other working groups. The group largely agreed that the Data Working Group could support additional analyses for the SC (e.g., special requests) but would not replace or assume the analyses that are ongoing. It would also not assume or replace the analyses done by Members. Instead, it could offer complementary support.
8. The discussion around scientific analyses was an important one and raised valuable considerations for the ToRs and also the nature of the group itself.

4. Tasking

9. One potential focus for the group, raised by participants, was improvements in the transshipment notification reporting. This is an important issue that was raised during the Commission meeting and one that has important implications for compliance as well as science.
10. Participants also expressed interest in improving data submission processes by developing web-based tools.
11. The group agreed that tasking (and prioritisation) for this group should generally come from the SC or Commission, depending upon the adopted ToRs.
12. The Data Manager presented a document (available on [Teams](#)) that outlined a proposed task to standardize some of the data fields in the database and update existing data to improve usability and consistency of the data holdings. The suggested changes would retain the data integrity but make



modifications to ensure a consistent and accurate format. The Secretariat is asking for Member feedback on the proposed lists which will serve to validate input data, and to provide guidance on any values that do not have a clear link to the proposed reference lists.

13. There was one recommendation to review gaps or inadequacies in the data standards as a first tasking.

5. Next Steps

14. The action items requested of Members included:
 - a. Help form the Terms of Reference to define the scope of this group (deadline of 14 May 2023).
 - b. Consider nominees to chair this group.
 - c. Review the [data standardization document](#) available on Teams for input into the lists themselves or the mapping of current values to a consistent and standardized list of values for the different data fields. Comments and suggestions can be sent to tvidal@sprfmo.int.
 - d. Distribute the data service provider Request for Proposals (RFP) broadly to ensure best qualified candidate pool. See [link](#) to the RFP.



Annex 1 – List of Participants

SC CHAIRPERSON

Jim Ianelli

AUSTRALIA

Kathryn Benning
Adam Camilleri
Lara Ainley

CHILE

Aurora Guerrero
Ignacio Paya
Victor Espejo
Aquiles Sepuveda
Carlos Montenegro

CHINA

Gang Li
Ce Liu
Meng Wang

COOK ISLANDS

Tiare Nicholas

ECUADOR

Jose Luis Pacheco
Manuel Peralta

EUROPEAN UNION

Niels Hintzen

KOREA

Eunjung Kim

PERU

Ana Alegre Norza
Criscely Lujan
Daniel Isaias Grados Paredes
Marissela Pozada Herrera
Pablo Marin
Giovanna Sotil
Jimena Mercedes Mendoza Samame
Miguel Angel Perez Huaripata
Elizabeth Rocío Roncal Herrera
Erich Diaz Acuña
Antonino Edmundo Moreno Macedo
Jorge Mostacero Koc
Carlos Valdez Mego

NEW ZEALAND

John Moriarty

CHINESE TAIPEI

Han-Ching Chuang
Shih-Chin Chou

UNKNOWN DELEGATION

Josymar Torrejón-Magallanes
Javier Guiovanni Garcia Parada
Luis U.

SPRFMO SECRETARIAT

Tiffany Vidal
Randy Jenkins
Susana Delgado

Annex 2 - Agenda

1. Welcome and introductions
2. Overview of and discussion around the aims of this WG
3. Review/develop the Terms of Reference
4. Nominate a Chair
5. Develop a workplan leading up to the 2023 SC