



International Consultations on the Establishment of the
South Pacific Regional Fisheries Management Organisation

REPORT OF THE CHILEAN JACK MACKEREL ASSESSMENT METHODS WORKSHOP

4 – 8 May 2009
Lima, Peru

Introduction

The interim measures adopted for pelagic fisheries in the area of the proposed South Pacific Regional Fisheries Management Organisation (SPRFMO) require the SWG to provide advice, in 2009, on the status of pelagic stocks in the SPRFMO area, the most important of which is the Chilean jack mackerel. One of the first steps towards the assessment of the stock abundance and the sustainable yield of the Chilean jack mackerel (*Trachurus murphyi*) in the South Pacific Ocean was the development of working population structure hypotheses upon which to base such assessments, and the identification and characterization of the biological, catch and effort data available to use in stock assessments.

Accordingly, at its third meeting (held in Reñaca, Chile, in April 2007), the Science Working Group (SWG) of the South Pacific Regional Fisheries Management Organization (SPRFMO) recommended that a specific Jack Mackerel Stock Structure and Assessment Workshop be convened to specifically discuss and develop agreed working hypotheses on jack mackerel stock structure, and to consider joint fish stock assessment requirements and inputs under such stock structure hypotheses. This Jack Mackerel Stock Structure and Assessment Workshop was held in Santiago, Chile in 2008. The results of this workshop contributed important scientific information for the assessment, and for the provision of the advice requested on the status of Chilean jack mackerel.

The workshop identified four working stock structure hypotheses for Chilean jack mackerel. These comprise alternate hypotheses about the relationship between the stocks off Peru and Chile, and alternate hypotheses about the relationship between stocks off Chile and the adjacent areas of the high seas. The 2008 workshop also provided a number of conclusions and recommendations about data needs, future assessment processes and assessment models.

The Jack Mackerel Assessment Methods Workshop (reported here) was then held to further progress the development of a joint assessment of the status of Chilean jack mackerel.

Opening Ceremony

The Chilean Jack Mackerel Stock Assessment Methods Workshop was held in Lima, Peru from 4 – 8 May 2009. The meeting was attended by 29 participants from Australia, Chile, China, European Union, Peru, Russian Federation, and the SPRFMO Interim Secretariat.

The opening ceremony was opened by Rear Admiral Hector Soldi Soldi, President of the Board of Directors of the Marine Research Institute of Peru (IMARPE).

In the opening ceremony, Dr. Alfonso Miranda Eyzaguirre, Vice Minister of Fisheries for Peru, highlighted both the importance of high seas fisheries and the need for international cooperation to ensure they are not overexploited. He reported that an assessment by the University of British Columbia had ranked Peru as being among the leading countries for seven

fishing indicators for applying conservation and management measures for living resource, protection of biodiversity and fisheries sustainability.

Mr. Sandy Morison, Chair of the workshop, thanked Peru for hosting the workshop and for the excellent facilities provided. He commented on the impressive amount and quality of the scientific work that has been undertaken on Chilean jack mackerel and on the level of collaboration there has been in past meetings. He highlighted the importance of continued collaboration and expressed his confidence that the workshop would meet its objectives.

The full list of participants to the Workshop is attached in Annex SA-01.

Confirmation of Chairperson

Mr. Sandy Morison was confirmed as Chair of the Workshop.

Nomination of Rapporteurs

Scientists from Chile and Russia offered to act as rapporteurs for the workshop.

Agenda, Workshop Objectives and meeting arrangements

The draft agenda was discussed and was revised after agreement that options for modelling were not considered separately for each of the stock structure hypotheses as it was considered that each assessment model could assess status under a range of hypotheses.

The Chair and others provided an outline of the unsuccessful attempts that had been made to secure an independent stock assessment expert for this workshop.

The revised agenda (SP-07-SWG-JM-SA-01) was adopted and is attached as Annex SA-02.

The draft workshop objectives were discussed. It was agreed that the emphasis of the workshop was to be on methods for the assessment of Chilean jack mackerel, to identify the data needed for these assessments, and to agree on the parameters for such assessments. The final workshop objectives adopted were:

1. To agree on standard datasets for use in all stock assessment models under different stock structure hypotheses, and a process for creation and exchange of these data sets.
2. To specify and agree on model specifications, assumptions, values for life history parameters to be used in the stock assessments (M, Sexual maturity, etc.), data (including the level of spatial and temporal data aggregation), and other inputs to the assessments to be undertaken in the 2009.
3. To identify useful target biological reference points and limit reference points to facilitate the diagnosis of stock status.
4. To conduct a preliminary evaluation of jack mackerel stock assessment models used to date.
5. To agree on stock assessment modelling approaches to take forward in the 2009 and future Chilean jack mackerel assessments.
6. To document a stock assessment working protocol covering all the aspects defined above.

Other aspects of the Draft Workshop Programme (SP-07-SWG-JM-SA-02) were not reviewed or revised.

Review of results of 2008 workshop.

The Chair presented a brief overview of the results of the 2008 Jack Mackerel Stock Structure and Assessment Workshop that were relevant to the current workshop including

the main issues for stock assessments that were raised and the desirable characteristics of stock assessment models that were identified.

Overview of recent assessment results

Chile noted that it did not have an updated assessment available. Instead, a presentation (SP-07-SWG-JM-SA-INF-07) was given on the development of its stock assessment methods for Chilean jack mackerel, describing the progression towards the current integrated assessment.

There was a presentation on the monitoring and assessment of Peru's main fisheries (SP-07-SWG-JM-SA-07) including for jack mackerel. This provided an overview of its acoustic surveys on Chilean jack mackerel including the time series of biomass estimates and the changes in the distribution of Chilean jack mackerel out to 100 nm.

Development of Standard datasets

The importance of both the quality and quantity of data available and the need to agree on how data are to be used in assessment models was reiterated. It was noted that this would be important for reducing the number of assumptions needed in assessment models and avoiding fundamental inconsistencies among them. It was agreed that data requirements would be also be determined by the types of assessment models that were agreed to be used.

A desire was expressed for models to be as simple as possible to allow non-modellers to understand and work with them. However, it was also pointed out that there are many complexities to the biology of the fish and the development of the fishery that need to be reflected in any assessment model.

It was noted that the 2008 workshop held in Santiago had already produced an inventory of the available data which was useful for determining the types of models that could be applied to the assessment of Chilean jack mackerel.

The possibility of comparing models with simulated data was raised and supported. This option was agreed because it was recognised that all the data that would be needed to run assessment models was not going to be available in the short term. Some participants expressed concern at the unavailability of data from all countries.

The Chair commented that the development and use of simulated data could be useful for the investigation of the performance of assessment models. But it is was important to realise that it would not allow the jack mackerel sub-group to provide any additional advice to the Science Working Group on the current status of Chilean jack mackerel in 2009.

Further discussion on this agenda item was deferred until after detail of assessment models were discussed.

The development and use of the simulated data set is described below under the heading of the evaluation of assessment models.

It was agreed that further discussion of standard datasets and the process for their exchange be deferred to a future meeting and should await the development of agreed assessment models.

Model Inputs

There was a presentation on the review paper on some biological aspects of Chilean jack mackerel (SP-07-SWG-JM-SA-05) that covered age estimation and growth, size and age at sexual maturity, and natural mortality.

There was also a presentation (SP-07-SWG-JM-SA-INF-08) on the estimates made by Peruvian scientists of age and growth, reproductive parameters, natural mortality, diets, and on work on tagging techniques.

These presentations highlighted the extent of the variation in the reported values for these parameters and the need for agreement on the values to use in assessments. It was agreed that rather than select specific values at this stage it was important to agree on the range of values to be used as possible sensitivities in assessments.

Age and growth

The information presented indicated substantial differences between the estimated growth rates of Chilean jack mackerel from Peru and Chile. Some of the variation in growth curves was attributed to non-representative sampling and some to methodological differences in the interpretation of otoliths, but it was acknowledged that there may also be regional variation in growth rates. All laboratories read otoliths whole under reflected light so there are no differences in methods of preparation that may contribute to the differences in age estimation.

It was agreed that it was very important that these differences be resolved as quickly as possible.

The following process was agreed to address the issue of potential differences in age estimation protocols with the timetable to be finalised after consultation with key staff in each country:

- Each laboratory contributing a sample covering the full range of fish sizes to form a combined reference set
- There would then be an exchange of otoliths so that all otoliths in this reference set would be read by experienced readers in each of the collaborating laboratories.
- All readers should be provided with the data normally made available to them at the time of reading, but this should not include any information on the ages assigned by other readers.
- A comparison of the ages determined for this common reference set would provide data on the extent of any differences in interpretation among readers and laboratories.
- If significant differences in interpretation were confirmed a workshop of key technical staff would then be needed to help clarify the basis for any disagreements and work towards an agreed protocol for age estimation.
- This work should be concluded and the results reported back to the JMSG by the next meeting if not sooner.

A common 'birthday' of 1 January was agreed to be used for Chilean jack mackerel.

Laboratories from Chile, Peru and the EC agreed to be involved in these activities with invitations also extended to New Zealand and other interested parties. The EC reported that they are currently training a staff member in age estimation to follow the methods employed by scientists in Chile.

The Chair advised that comparisons of the ages estimated can be effectively represented using age-bias plots as described in Campana *et al.* (1995)¹.

The Chair also suggested that if a workshop on age estimation was needed that an independent expert would be useful and that the EC was a likely source of such a person with both experience with *Trachurus* sp., and knowledge of the process of inter-laboratory calibration, because of the similar work that the European Fish Ageing Network has previously undertaken.

¹ Campana, S.E., Annand, M.C., and McMillan, J.I. (1995). Graphical and statistical methods for determining the consistency of age determinations. Transactions of the American Fisheries Society 124, 131-138.

Some work done in Chile on sectioned otoliths indicated that this mode of preparation produced estimates of age that were older in some fish. The differences were not considered to be important because they mostly occurred in older fish. Fish of 12 years and older were also rare in the catches and combined in a plus-group in their assessment model.

Counts of daily growth increments have been used to validate the location of the first and second annual increments, but it was reported that this method cannot be used for older ages because the daily growth increments become too closely spaced.

Length and age at maturity

There were some differences in terminology regarding length or age at maturity between fish from Chile and Peru with some uses meaning the smallest or youngest mature fish that have been observed and others referring the length or age at which 50% of fish were mature.

It was agreed that maturity is best represented by a vector showing the proportion mature at each length or age so that a maturity ogive can be calculated.

The maturity scales used by Chile and Peru differed in the number of categories but this was not considered to contribute to any differences in interpretation of maturity.

Peru had recorded fish maturing at younger lengths than Chile by several centimetres. This difference was not attributable to differences in methods or terminology. Off Peru the mean length at first maturity was 21.3 cm TL compared to about 25 cm FL (approximately 27 cm TL) for Chile.

This is also reflected in differences in age at maturity but these differences are affected by the differences in age and growth mentioned above.

These differences were thought to be due to the high biological production off Peru and because of environmental conditions the Chilean jack mackerel could grow faster and reach maturity at smaller lengths.

Natural mortality

Values for natural mortality reported in SP-07-SWG-JM-SA-05, based on the methods of Pauly, Hoenig, and Alverson-Carney, ranged between 0.22 yr^{-1} and 0.27 yr^{-1} . However, a subsequent estimate for fish from Peru, also based on Pauly's method, produced an estimate of 0.33 yr^{-1} .

This difference reflected a combination of the differences in water temperature and estimated growth rates in the two regions.

The differences cannot be resolved until the differences in age estimates and growth are resolved.

The need for assessment models to investigate sensitivity to a range of natural mortality values was reiterated.

Acoustic indices

There was a presentation on the potential use of industry vessels to gather additional acoustic data to that provided by standard scientific surveys (SP-07-JM-SA-08). These data could provide information at times between surveys and in more detail for the times and locations when fishing was occurring. It could also provide information not only on jack mackerel but also on their predators and prey, other species and environmental conditions.

There was general support for this proposed use of industry vessels in this way and it was suggested that a more specific proposal be developed for submission to the SWG for its consideration.

There was also acknowledgement that this proposal, while useful in the future, would not assist with the immediate task of providing advice on the status of jack mackerel this year.

CPUE as an index of abundance

The issues with CPUE as an index of abundance at the 2008 jack mackerel workshop were reviewed and discussed.

There was support for the continued use of CPUE, if it was appropriately standardised, for a number of reasons including that it was easy to obtain, covered a long time period and covered some early years of the fishery when no other index was available.

The issue of hyper-stability was discussed and there was some concern expressed that it was not possible to assess its importance without some independent estimate of biomass. But it was reported that it was possible to statistically account for this potential problem.

Peru reported that it was developing new ways to measure effort using observers and was also investigating the use of search time as a better measure of effort. There was support for the use of search time as a better measure of effort but it was acknowledged that data on this measure was not always easy to collect and, while it may help in the future, any new measure of effort could not be used with historical data sets.

It was agreed that it was not desirable to try and establish a single agreed unit for measuring effort but that the methods should be selected to suit the characteristics of individual fleets.

The value of obtaining CPUE indices from the distant water fleets was also mentioned, particularly from the Russian fleet but also from more recent fishing activities.

Stock-Recruitment Relationships

The different uses of a stock-recruitment relationship in the assessment process were noted, such as during model fitting and for future projections. It was indicated that a Beverton-Holt relationship was now considered by Chilean assessment scientists to be more suitable for stocks of Chilean jack mackerel than the Ricker model that was previously used.

Attempts by scientists from both Chile and Peru to get indices of recruitment were mentioned. It was noted that there was information on recruitment contained in the catch-at-age matrix that was used in assessments.

Identification of target and limit reference points

There was a presentation on the paper which provided a review of biological reference points and management for Chilean jack mackerel (SP-07-SWG-JM-SA-06). This paper also contained a table that summarised the limit, threshold and target reference points as they were defined and used by the U.S.A. and several international fisheries management organisations.

The dynamic nature of populations of Chilean jack mackerel was noted and that they responded to changes in oceanographic conditions. Chile has therefore adopted a dynamic reference point based on the current spawning biomass relative to that which would have been present in the absence of fishing. This recognises that there will be changes in the biomass even in the absence of fishing and avoids the concept of a static unfished reference biomass.

There have been regime shifts noted in the past for Chilean jack mackerel that have changed their abundance, recruitment and distribution patterns. Any reference points set would need to take into account the potential for such changes to occur again in the future.

The linkage between assessment models and reference points was noted, as was the benefits of using Management Strategy Evaluation to test models together with particular reference points.

It was noted that the estimates of the biological reference points would depend on the values adopted for life history parameters which also adds uncertainty to the process for their estimation.

Other options for suitable reference points were discussed but no particular set of candidate reference points was proposed.

Evaluation of Current Assessment Models

There have been no updated assessment models presented since the workshop in Santiago in 2008.

There was a presentation on the paper (SP-07-SWG-JM-SA-04) which proposed an integrated assessment model that could be used to assess the status of Chilean jack mackerel. The paper suggested that this proposed approach would allow assessment under the different stock structure hypotheses with an objective statistical comparison of the models.

There was support from some participants for the proposed approach.

There was general support for using a simulated dataset. It was agreed that a simulated data set would be generated that would represent a simulated stock of Chilean jack mackerel. This would be used to allow the development, testing and comparison of models.

A presentation was made by the Russian Federation on a similar process that had been conducted for herring stocks by ICES (SP-07-SWG-JM-SA-INF-09).

A task team of specialists (the Assessment Simulation Task Team) was nominated to decide on the detailed characteristics of this dataset, following the ICES example. This task team was to comprise specialists from Chile, Peru, the Russian Federation and the EC. This task team developed a process for the development of the simulated dataset and testing of the models, including criteria for the evaluation of model performance (Annex SA-05).

It was agreed that the assistance of an independent stock assessment expert again be sought to guide this process, generate the simulated dataset, assist with the analysis of the results, and attend the next meeting where the results would be reported.

The Chair offered to initiate contact with suitable candidates for the role of independent expert. He contacted Dr Jim Ianelli who indicated that he would be willing to assist with the simulation exercise.

Candidate assessment models that were identified for this exercise were an integrated assessment model developed by Chile, an Integrated Catch Analysis to be undertaken by the EC and a TISVPA model developed by the Russian Federation. Peru was also to consider developing an assessment model that would use this simulated dataset.

Documentation of a stock assessment working protocol

It was agreed that the development of a working protocol for stock assessment was premature at this stage and that this should wait until the assessment model or models have been developed and agreed.

Review and Adoption of Workshop Report

The report was adopted after all agreed amendments.

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AGENDA

The background and objectives for the Jack Mackerel Stock Assessment Methods Workshop are outlined in the Workshop Programme

1. Welcome & Introductions

- 1.1 Opening of the Workshop.
- 1.2 Workshop arrangements.
- 1.3 Nomination of rapporteurs.
- 1.4 Review and approval of the workshop objectives and agenda.
- 1.5 Review of results of 2008 workshop.

2. Overview of recent assessment results

- 2.1 Updates on fishery characterizations and results of recent assessments from major catching countries.

3. Development of standard datasets

- 3.1 Development of agreed standard datasets and process for data sharing.

4. Model inputs

- 4.1 Review of common input parameters to assessment models: natural mortality, size and age at maturity, growth etc.

5. Identification of target and limit reference points

- 5.1 Identification of potential target and limit reference points and appropriate indicators

6. Evaluation of current assessment models

Consideration of issues of data availability, model structure, alternative scenarios, and future modelling approaches.

7. Documentation of a stock assessment working protocol

- 7.1 Identification of important elements of a stock assessment protocol
- 7.2 Document a draft protocol for the assessment of Chilean jack mackerel.

8. Review of progress

- 8.1 Review of progress and agreement on the use of remaining time.

9. Review and Adoption of Workshop Report

9.1 Presentation of the Draft Report of the Workshop

9.2 Review and Adoption of the Workshop Report.

9.3 Closing of the Workshop

Workshop Programme

Background

The interim measures adopted for pelagic fisheries in the SPRFMO area, require the SWG to provide advice, in 2009, on the status of pelagic stocks in the SPRFMO area, the most important of which is the Chilean jack mackerel. One of the first steps towards the assessment of the stock abundance and the sustainable yield of the Chilean jack mackerel (*Trachurus murphyi*) in the South Pacific Ocean was the development of working population structure hypotheses upon which to base such assessments, and the identification and characterization of the biological, catch and effort data available to use in stock assessments.

Accordingly, at its third meeting (held in Reñaca, Chile, in April 2007), the Science Working Group (SWG) of the South Pacific Regional Fisheries Management Organization (SPRFMO) recommended that a specific Jack Mackerel Stock Structure and Assessment Workshop be convened to specifically discuss and develop agreed working hypotheses on jack mackerel stock structure, and to consider joint fish stock assessment requirements and inputs under such stock structure hypotheses. This Jack Mackerel Stock Structure and Assessment Workshop was held in Santiago, Chile in 2008. The results of this workshop contributed important scientific information for the assessment, and for the provision of the advice requested on the status of Chilean jack mackerel.

The workshop identified four working stock structure hypotheses for Chilean jack mackerel. These comprise alternate hypotheses about the relationship between the stocks off Peru and Chile (hypotheses 1 and 2), and alternate hypotheses about the relationship between stocks off Chile and the adjacent areas of the high seas (hypotheses 3 and 4).

Hypothesis 1: Jack mackerel caught off the coasts of Peru and Chile each constitute separate stocks which straddle the high seas.

This is the current hypothesis expressed in the Jack Mackerel Species Profile and used in past stock assessments. There is a fairly substantial amount of historic and current evidence supporting this hypothesis. However, there are some indications of shifts in distribution, and perhaps of possible mixing, in the southern Peru / northern Chile area related to oceanographic changes, and additional work is required to determine the most likely boundary between separate Peruvian and Chilean stocks. For the purposes of jack mackerel assessments to be conducted in the immediate future, separation at the Peruvian / Chilean border would be a reasonable and convenient assumption to use under this stock hypothesis, until further information becomes available to improve the definition of stock boundaries.

Hypothesis 2: Jack mackerel caught off the coasts of Peru and Chile constitute a single shared stock which straddles the high seas.

Some new information on similarities in biological and population structure trends observed off southern Peru and off Chile was presented at this workshop in support of this alternate hypothesis.

Additional work is required to further investigate a wider range of data which might support or reject this hypothesis, as proposed under the multi-disciplinary Stock Structure Research Programme.

Hypothesis 3: Jack mackerel caught off the Chilean area constitute a single straddling stock extending from the coast out to about 120°W.

This is one of the current hypotheses expressed in the Jack Mackerel Species Profile, and is the hypotheses currently used in Chilean stock assessments. There is a fairly substantial amount of evidence supporting this hypothesis. However, there is little information upon which to base a reliable definition of the westward boundary of such a stock, and additional work is required to determine the most likely westward boundary of a straddling Chilean stock. For the purposes of jack mackerel assessments to be conducted in the immediate future, the westward boundary of this stock could be assumed to be about 120°W, to cover all areas currently fished in the southeast Pacific Ocean, until further information becomes available to improve the definition of this boundary.

Hypothesis 4: Jack mackerel caught off the Chilean area constitute separate straddling and high seas stocks.

Little information is available upon which to base a reliable definition of the boundary between such stocks. Additional work is required to determine to most likely position of such a boundary.

The 2008 workshop also provided a number of conclusions and recommendations about data needs, future assessment processes and assessment models. Participants are asked to review this report and implement these where appropriate.

Participants are also reminded that the Plenary meeting in October 2008 approved the request from the SWG for the release of non public domain data to the Jack Mackerel Subgroup for the purposes of stock assessment,

This important measure followed one of the recommendations of the 2008 workshop in recognition of the need for data at a finer resolution than 5°x5° square for the conduct of effective stock assessments for jack mackerel.

Because of the unavailability of an independent stock assessment expert for this workshop, it is particularly important that participants arrange for participation of their own experts with skills in stock assessment for the workshop. It is expected that such participants will contribute to the evaluation of the strengths of different assessment methods in a scientifically objective and impartial manner.

Objectives

The following objectives are proposed for the workshop:

1. To agree on standard datasets for use in all stock assessment models under different stock structure hypotheses, and a process for creation and exchange of these data sets.
2. To specify and agree on model specifications, assumptions, values for life history parameters to be used in the stock assessments (M, Sexual maturity, etc.), data (including the level of spatial and temporal data aggregation), and other inputs to the assessments to be undertaken in the 2009.

3. To identify the types of biological reference points that would be calculable and useful for the diagnosis of stock status for Chilean jack mackerel stocks.
4. To conduct a preliminary evaluation of jack mackerel stock assessment models used to date.
5. To agree on stock assessment modelling approaches to take forward in the 2009 and future JM assessments.
6. To document a stock assessment working protocol covering all the aspects defined above.

A specific workshop agenda to address these objectives will be finalised and agreed at the start of the workshop.

It is expected that, as an outcome of its analyses and discussions, the Workshop will produce a technical report with its findings, conclusions and recommendations on the above matters. Such a report should be comprehensive and clear enough to provide guidance to participants in the inter-sessional preparation of jack mackerel stock assessments under the various stock structure hypotheses, for review at the next Jack Mackerel Sub-Group stock assessment meeting, towards the end of 2009.

Venue and Dates

The workshop will be held from 4 to 8 May 2009 in Lima, Peru at Foresta Hotel and Suites:
Avenida Libertadores N° 490, San Isidro, Lima

<http://www.southpacificfmo.org/7th-international-meeting-Information-for-Delegates/>

Inputs to the Workshop

In order to meet the proposed objectives and produce the desired results, participants are expected to provide the Interim Secretariat with the data required under the agreed Data Standards, and are also requested to provide the types of data identified in the 2008 Workshop Report², and listed in the Annex attached to this draft workshop programme. These data should either be submitted to the Interim Secretariat prior to the start of the workshop, or alternatively should be brought along to the workshop itself.

This workshop should be less formal than the 2008 workshop, with fewer papers and presentations, and more emphasis on technical discussions around suitable stock assessment methods and data inputs. An update from each of the major catching countries on their latest assessment results would be useful if these have been updated since last year's workshop. Prospective participants should provide titles and short abstracts (maximum half a page) of any proposed papers in electronic form by email addressed **to the Interim Secretariat (interim.secretariat@southpacificfmo.org)** as soon as possible, and preferably **by Friday 24 April 2009**, to facilitate planning of the various workshop sessions. The actual technical documents and other written contributions to be reviewed and used during the Workshop should be provided in advance so that contributions can be compiled and circulated to other participants in advance of the workshop.

Appropriate stock assessment modelling approaches for jack mackerel will be developed after careful consideration by the workshop of what data will be available for use in such assessments, including consideration of data coverage (by area or time) and representivity (whether data have been adequately stratified across known stock distribution ranges and size / age classes). Adequate data will specifically be required to assess stocks under any of the agreed stock structure hypotheses.

The revised draft of the Chilean jack mackerel profile that is available on the SPRFMO web pages³ reflects the current knowledge of the species biology and main fisheries including the information provided to the 2008 workshop. Any documents to be provided should not repeat such information. Relevant information not contained in the current profile could be made available to allow an updated version to be prepared during the workshop.

²<http://www.southpacificfmo.org/chilean-jack-mackerel-workshop/>

³ <http://www.southpacificfmo.org/science-working-group/swg-profiles/species-profiles>

Document list

Meeting Documents

SP-07-SWG-JM-SA-01	Agenda
SP-07-SWG-JM-SA-02	Workshop Programme
SP-07-SWG-JM-SA-03	Workshop Document List
SP-07-SWG-JM-SA-04	Approach to the implementation of hypotheses
SP-07-SWG-JM-SA-05	Short review of some biological aspects of the Chilean jack mackerel
SP-07-SWG-JM-SA-06	Review of biological reference points
SP-07-SWG-JM-SA-07	Hydro-acoustic assessment jurel IMARPE
SP-07-SWG-JM-SA-08	Abstract Peru proposal about using fishing vessels

Information papers

SP-07-SWG-JM-SA-INF-01	Commonwealth fisheries harvest strategy: Policy and Guidelines
SP-07-SWG-JM-SA-INF-02	FAO Fisheries Technical Paper No. 347: Reference points for fisheries management
SP-07-SWG-JM-SA-INF-03	Harvest strategy standard for New Zealand fisheries

Presentations

SP-07-SW-JM-SA-INF-04	Jack mackerel fishery - Peru
SP-07-SW-JM-SA-INF-05	Acoustic evaluation of jack mackerel by IMARPE (6 MB)
SP-07-SW-JM-SA-INF-06	Biological Reference Points – Chile
SP-07-SW-JM-SA-INF-07	Development of the Chilean stock assessment approach
SP-07-SW-JM-SA-INF-08	Estimates of age, growth, size and age at maturity and natural mortality - Peru
SP-07-SW-JM-SA-INF-09	ICES simulated data sets

Report of the Assessment Simulation Task Team

The Assessment Simulation Task Team have developed the following proposal to provide simulated data to the stock assessment modelers and to explore the performance of different assessment models that have been proposed to be applied to Chilean jack mackerel.

The task team agreed that there was a need for an independent expert to generate and provide a simulated data set that will be used as input for the final proposed modeling frameworks.

The task team proposed to hold a workshop to facilitate agreement on the assumptions needed for the development of the models. Otherwise differences in the assumptions used for different models could produce differences in the model outputs.

The workshop should be held as soon as possible depending on the availability of the key participants.

The task team agreed that it was desirable to simulate data for a stock that was fished by three different fleets (two with the known characteristics of purse seine fleets and one with the known characteristics of a mid water trawl fleet).

The dataset should consider the available information presented at the Chilean Jack Mackerel Stock Structure and Assessment Workshop held in Santiago in 2008 and summarized in the table on page 14 of the report of that workshop.

A simulated dataset has been produced for the use in the evaluation of models used in the assessment of the Norwegian Herring stock. Although there are some similarities between this fishery and the Chilean jack mackerel fishery, the task team regarded it only as an example of how simulated datasets can be produced.

The simulated stock of Chilean jack mackerel should live for up to 20 years old and produce a catch-at-age matrix for the simulated fishery that includes fish from age 2 up to 12+. The dataset should cover a time period of 30 years.

The simulated data should include:

- Catch-at-age and catch-at-length data for each fleet.
- One of the purse seine fleets should mainly catch larger adults and the other purse seine fleet should catch smaller adults. The mid water trawl fleet should catch all adults.
- Matrixes of mean weight-at-age by year and at the beginning of each year.
- Weight-at-length relationships by year.
- Growth functions for growth in length and weight.
- Maturity ogive.
- Natural mortality.
- Total catch in weight for each fleet for each of 30 years.
- Fishery independent indices of abundance including
 - A CPUE for each of the different fleets
 - Acoustic biomass estimates (structured by age)
 - Spawning biomass (from the DEPM) estimates (structured by age).

Other considerations:

Some gaps should be produced in the fishery independent indices of abundance (short series and/or in the middle of the series)

The dataset should include variation in abundance levels reflecting variation in recruitment.

Selectivity of each fleet should not be stable but have atypical selection in some years

The catch-at-age and catch-at-size time series should also be affected by both random noise and noise from a trend over some periods. This should produce outliers for some years.

The variation in stock abundance should influence the catch matrices for each fleet.

The catch-at-age dataset may vary for the three different fleets.

There should be periods of high and low fishing pressure on the population.

One purse seine fleet should produce half the catch of the other one.

The model of recruitment should allow for non-systematic changes and for autocorrelation between years because environmental changes could generate periods with different levels of productivity.

Performance of the models:

The performance of the models will be assessed by comparing the true simulated population and the results obtained by the models. Statistical indices like the Akaike Information Index or a comparison of the differences in residuals may be used for these comparisons. Other options to assess the performance of the different models could be discussed in the proposed workshop.

Region	Peru	N-C Chile	C-S Chile	W of EEZ Chilean	W of EEZ	W of 120 Russ. Fed.	NZ (EEZ only)
Fishery							
Catch	1950-2007, monthly, 1995-2007, daily	1975-2007	1975-2007	1981-2007	1979-91 ^R 2000-07 ^C 2003-07 ^K	1980-83, 1989-91	1985 - 2007
Effort	1980 - 2007, by fleet, trip	1975-2007	1981-2007	1992-2007	1979-91 ^R 2003-07 ^K	1980-83, 1989-91	1985 - 2007
Standardization	Vessel, area, month	-	Yes	Yes/No	1979-91 ^R	1980-83, 1989-91	Vessel, area, month
Fishery Age	-	1975-2007	1975-2007	1992-2007	1979-91 ^R 2006 ^C	1980-83, 1989-91	1990 - 2007, otolith sections
Fishery length frequency	1990 - 2007	1975-2007	1975-2007	1981-2007	1979-91 ^R	1980-83, 1989-91	1986 - 2007
Surveys							
Acoustic	1983 - 2007	1981-1995, 2006-2007	1997-2007	2003-2007	1986-88, 2002-03 ^R 2003 ^K	1980-83, 1989-91	No
Spawning Eggs and larvae		No 1982-2007	1999-2006 1999-2006	1999-2006 1999-2006	2003 ^K		No
CPUE	1996 - 2007, Std by haul, trip-length	No	No	No	1986-88, 2002-03 ^R 2000-07 ^C 2003 ^K	1980-83, 1989-91	1991 - 2007, standardised MWT
Survey age		No	1997-2007	2003-2007	1986-88, 2002-03 ^R	1980-83, 1989-91	No
Survey size	1983-2007	No	1997-2007	2003-2007	1986-88, 2002-03 ^R	1980-83, 1989-91	No
Biological data							
Growth	Oto: 1980, 2005; Scales: 1983	Yes	Yes	Yes	1979-91, 2002-03 ^R 2000-07 ^C 2003 ^K	1980-83, 1989-91	Yes, from otoliths
Maturity (age/size)	Yes, surveys and fisheries	Yes	Age and size	Yes	Yes ^R 20006 ^C	1980-83, 1989-91	Yes, obs. and landings
Natural mortality	Yes		Yes				Possibly
Environmental indices							
	SST, Salinity, 1960-2007	SST, salinity, 1964-2007	SST, salinity, 1964-2007		Temperature and salinity profiles 1979-1991, 2002-03 ^R , SST, salinity 2003 ^K	Temperature and salinity profiles 1980-1983, 1989-1991 ^R	Possibly SST

^C = China, ^R = Russian Federation, ^K = Republic of Korea