REPORT OF THE SPRFMO DEEP WATER WORKING GROUP WORKSHOP

Hobart, Australia, 23-25 May 2017

1. Welcome & Introductions

The Chair (Mauricio Galvez) welcomed delegations to the third Scientific Committee workshop (Deep Water Working Group). The Chair opened proceedings at 08:30 am on 23 May 2017, and participants introduced themselves. A list of participants is provided in Appendix 7.1.

a. Workshop arrangements

The Chair outlined procedural matters including the workshop schedule, administrative arrangements, appointment of rapporteurs, and asked the workshop to endorse the following theme conveners:

- Plenary - Mauricio Galvez
- Stock Assessment - Martin Cryer
- VME - Simon Nicol

b. Adoption of Agenda

Agenda (Appendix 7.2) was adopted without amendments.

c. Reporting arrangements

The workshop agreed that a Summary Report would be adopted intersessionally with an Executive Summary. Rapporteurs were appointed to assist with drafting the summary report. Support rapporteurs were appointed to assist with documenting the meeting. Meeting recommendations were adopted at the workshop.

2. Stock Assessment Theme

The Chair outlined that the objectives of the stock assessment theme were to respond to the request of SPRFMO to draft a tiered assessment framework for demersal species based on estimable parameters and available information for potential Total Allowable Catch (TAC) guidance in a Conservation and Management Measure (CMM). To develop this draft framework the Chair outlined that several documents and presentations would be presented to the meeting. These included:

- an introductory paper;
- three papers describing existing reference points and harvest strategies;
- two papers on the collection of acoustic and biological data for the assessment of Orange Roughy;
- three papers on the application of standardised CPUE in demersal fishery stock assessments;
- three papers on the application of catch and effort data-only stock assessments methods;
- two papers on integrated statistical catch at age models.

To facilitate this discussion the papers and presentations were presented under the following agenda items:

- 2a Draft Assessment Framework;
- 2b Use of Acoustic Data in Stock Assessments of Aggregating Demersal Fish Stocks;
- 2c Application of CPUE time - series in Stock Assessments of Aggregating Demersal Fish Stocks;
- 2d Review of Recent Orange Roughy Stock Assessments in New Zealand, Australia, and SPRFMO;
- 2e Assessment Framework.

a. Consistency with member national policies

The workshop noted that both Australia and New Zealand have applied tiered-based assessment and harvest frameworks for commercial fisheries in their national jurisdiction. Development of a tiered assessment framework for the demersal fisheries in the western sector of SPRFMO would benefit from drawing upon these frameworks and the Management Strategy Evaluation (MSE)-tested harvest strategies that both members have developed for demersal species. Decision support tools such as FISHPATH (SCW3-Doc05), which assist with matching assessment methods in circumstances of limited available data, were also noted by the meeting. The **workshop agreed** that an ideal tiered assessment framework should generate incentives for continued and improved data collection.

b. Influence of data quality and availability and species life-history on choice of stock assessment method
The **workshop noted** that for many species caught by SPRFMO fisheries the data quality and quantity varies through time and by species. This variation in data will impact the choice of assessment method and highlights the need for a tiered assessment framework that (1) allows the Scientific Committee to prioritise and schedule assessments; (2) encourage improved data collection; and (3) monitor stocks against reference points and triggers that are compatible with the available data.

The workshop also discussed that the appropriate assessment methods will be influenced by species' life histories. This will influence the level of confidence that can be given to the assessment results. For example, the uncertainty in Orange Roughy assessments in New Zealand and Australia may be reduced when the recruitment dynamics are explicitly described.

c. Data and Assessment uncertainties and sensitivities
The three presentations on the use of standardised CPUE methods highlighted the uncertainties associated with their application to demersal fisheries in the SPRFMO Area. The workshop noted that bias could be introduced in a variety of ways, and before using catch and effort data, these data need to be fully characterised and criteria applied for data selection or complete rejection. Data selection criteria should include an assessment of the data is distribution, whether rounding has affected the distribution, are there apparent differences due to the units applied (eg. between kg/hr, kg/record), what is the spatial and temporal pattern of catch and effort data, what changes in fisheries management have taken place, is there variation in catch due to fish behaviour (ie. spawning aggregations versus dispersed periods). The workshop agreed that comprehensive documentation and fishery characterisation was important to increase the defensibility of the use of catch and effort data in status determination. The workshop also noted that it was important to distinguish between 'bias' and 'variance'. It was commented that if CPUE data is used as an input into a population dynamics model that variance tends to get overridden in the model, as process error tends to be bigger. The **workshop agreed** that a "best practice" for using CPUE time series was the application of multiple indices, generated from alternative assumptions, to explore potential stock size and stock status in conjunction with suitable models (and alternative parameter values within each model, e.g., growth, recruitment patterns). This approach describes the bias in the data and analyses, which would allow for scientific advice to be generated that is explicit about uncertainties.

The **workshop noted** that for some Orange Roughy stocks where spawning aggregations are targeted and spatial management is in place, catch and CPUE alone are unlikely to be adequate for reliable stock assessments. However, the workshop noted that they are useful for exploration of trends in the data.

The workshop discussed the benefits of using spatially disaggregated CPUE indices. This method accounts for non-random temporal changes in spatial distribution of fishing effort and consequently may reduce bias from fleet dynamics in time and space. The example provided for Orange Roughy potentially minimized bias association with differing population structures and aggregation effects by defining the subarea strata by fishing features. The example estimated average annual abundance, and factored in spatial and temporal variability in the underlying population, on the assumption that movements are consistent among years, which allowed measurement across years. The workshop noted that this approach introduces uncertainty associated with subarea strata and weighting. The determination of area strata need to be as systematic as possible so any bias is equally spread across all 'subareas' and results are consistent. Biases associated with the weightings in the example were less evident because trends could differ among areas. A second example applied a spatial mesh to account for non-random changes in fleet dynamics. The workshop noted that the simulation work completed was encouraging and this approach should be effective at minimizing bias due to spatial effects. The workshop noted that the method is computationally intensive.

The **workshop noted** that describing uncertainties and model sensitivities is equally important in the formulation of scientific advice from integrated statistical catch at age models as it is for more data limited approaches such as those discussed in this section. The workshop agreed that identifying key sensitivity analyses should be included in the draft tiered assessment framework for this suite of methods.

d. Biological data and use of independent estimates of biomass

Collection of otoliths for age frequency and tissue samples for genetic analyses to aid the discrimination of stock boundaries was noted as an important priority to expand the assessment options available. The workshop provided recommendations for the Scientific Committee's work plan to encourage collection of these biological samples. The workshop agreed that collection of biological data needs to follow a protocol that ensures the data can be used to inform the stock assessment.

The workshop noted that a potential available biomass for a new location could be predicted using physical features and oceanography. The workshop noted that these estimates could be used to inform priors in subsequent analyses of these locations.

Design and timing of acoustic surveys needs to take into account the natural variation between sites and changes in fish behaviour over time. The impact of this variation has implications for interpretation of one-off surveys of biomass and time series of acoustic surveys. The potential impact of this bias is more easily detected in time-series data than one-off surveys. The workshop noted that the current spatial management arrangements (ie. no access areas for surveys by industry) limit the capacity to undertake acoustic surveys, and if aggregations straddle spatial boundaries or move over time this may result in some of the biomass remaining cryptic. The results from acoustic studies in both New Zealand and Australia for Orange Roughy have detected these effects. The workshop discussed that acoustics can be collected by AOS and boat mounted systems. The workshop noted that although AOS is the preferred method, it is slower because it is attached to net and for large features its application becomes more difficult (better in calm and flat seas). In this context, the choice of sampling method needs to be flexible to the *in situ* conditions.

The meeting commented that as a "*general rule of thumb*" a time-series of acoustic data was more informative when applied in integrated statistical stock assessments. However, one-off surveys that allow the biomass to be fixed for the year of survey are likely to be very useful for tuning data-limited method to more precisely estimate key parameters.

The meeting agreed that the application of acoustics is evolving with time and is not static. Current best practice includes using a range of frequencies to assist with species discrimination, *in situ* calibration of equipment, improved knowledge on target strength and improved understanding of the behaviour of species. The advances in acoustic measurement are seen in existing time series where the error associated with biomass estimates is smaller in more recent periods in comparison to historical periods.

The meeting noted that acoustic data should be carefully assessed to ensure that any bias and error are understood before its application within a stock assessment model.

e. Interpretation and advice that can be drawn from different tiers of analyses

The workshop agreed that regardless of the assessment tier (data limited or full benchmark assessment), model interpretation and the formulation of scientific advice needs to explicitly include uncertainties and sensitivities associated with the estimate of stock status. The tiered framework should allow appropriate reference points to be associated with each assessment level which should assist the Scientific Committee with generation of its advice.

The workshop noted that for new methods and or novel applications there is an onus to demonstrate that the analyses are equivalent to existing best practice (given data) or an improvement and that any technical deficiencies are made explicit.

f. Reference points, harvest control rules, and harvest strategies

The workshop discussed the importance of applying MSE tested harvest strategies to SPRFMO stocks. The New Zealand Orange Roughy Harvest Strategy was considered a useful starting point. The workshop noted that if the biology of Orange Roughy in SPRFMO is the same as that described in the New Zealand Orange Roughy Harvest Strategy then it may also be suitable for SPRFMO Orange Roughy stocks. .

The workshop noted that other harvest strategies have been MSE tested in Australia and New Zealand for other species that are also caught in the SPRFMO jurisdiction, including several that are data limited. These should be examined to see if they may also be suitable for application within SPRFMO.

g. Assessment Framework

The workshop noted that SPRFMO Scientific Committee is requested to provide scientific advice on stock status for over 30 demersal species. Although catch and effort data are likely to be available for most taxa/groups of taxa (spp), the quantity and quality of these data (and complementary biology and fishery-independent data) is likely to be variable over time. The available data may support the assessment and monitoring of some stocks using reliable CPUE indicators within existing management areas. In addition, assumptions around species distribution and life history parameters for many of these species will need to be made. Therefore, taking into account the variability in the quantity and quality of data, the parameters that can be estimated given the data available, and the precision of parameter estimates, the workshop recommended a tiered approach for assessing demersal stocks in the SPRFMO Area, considering the following steps:

1. To prioritise species for stock assessment the SC should undertake a Scoping Analysis for each SPRFMO demersal fisheries.
   Noting that the Scoping Analyses should include, where possible, the entire catch history for each species. This would describe the data available for each species and allow for expert judgement (informed by catch histories) to initially evaluate if a stock should progress to a higher-level assessment, or whether simple triggers or other mechanisms are adequate and can be applied to monitor the fishery.

2. Species identified in the Scoping Analysis that have limited catch histories, that are low in volume, or have otherwise inconsistent and spatio-temporally diffuse data, **should have triggers** defined that identify to the Scientific Committee when the fishery has changed (in terms of greater vulnerability) so as to re-evaluate if more in-depth analyses on stock status is warranted.

3. A SAFE (Sustainability Assessment for Fishing Effects) or other data limited method should be applied to those species identified in the Scoping Analysis with sufficient data for analyses under the data limited assessment level but with insufficient data for a full stock assessment.
   These analyses should identify those data limited species that are at higher risk to the impacts of fishing and require more specific indicators and triggers (eg. changes in trend of standardized CPUE, change in median size, etc.) and monitoring of the fishery to identify to the Scientific Committee when risk may have changed.

4. The species (management units) identified by the Scoping Analysis to be target species with sufficient data should have full benchmark assessments undertaken.
   Considerations for Orange Roughy: The life history of Orange Roughy and the nature of the fisheries targeting this species typically requires that biological as well as independent estimates of biomass are integrated in a statistical catch at age model to estimate fishing mortalities and stock depletion with a low to intermediate level of uncertainty. The precision of estimates are likely to be poorer when this data is not available.

5. Where sufficient information is available, statistical catch at age models are the priority method for assessment. This should include advice on the impact on stock status of alternative catch volumes. The advice must be explicit on the assessment uncertainties and sensitivities.

6. Where this information is unavailable the Scientific Committee should advise SPRFMO that collection of this information is a priority.

Industry collaboration and industry self-sampling are two potential options for the collection of this information.

7. Where full benchmark assessments are not possible, data limited assessments or benchmark assessments with high uncertainty should be applied to provide indicative and preliminary advice to SPRFMO on stock status. This should include advice on the impact on stock status if current catch is maintained versus alternative catch levels and include uncertainty estimates.
8. Comparison of different approaches and methods to assist interpretation (for many species) noting we need to be ensure whether the different methods test different potential biases (also consider with broader meta analyses from literature).
9. **Consider the New Zealand Orange Roughy Harvest Strategy as provisional approach.** This would include the limit reference point of B20, target biomass range of B30 to B50 and its HCR and scaling down rule. This would assume biological attributes are equivalent.
   The Scientific Committee should recommend an MSE tested harvest strategy for orange roughy to SPRFMO. The New Zealand Orange Roughy Harvest Strategy (which has been MSE tested) is a useful starting point and the Scientific Committee should consider the merits of adopting the harvest control rule as an interim measure to ensure sustainability of stocks.
10. Note rebuilding strategy (timebound, etc).
   The Scientific Committee should evaluate other harvest strategies that have been MSE tested for its other species (include those that are data limited). The harvest strategies applied to Commonwealth Fisheries in Australia and those that have been developed for demersal fisheries in New Zealand would be a useful starting point (that have been MSE tested).
   Prepare a review paper for the Scientific Committee to develop a program of MSE tested Harvest Strategies for each of its fisheries

Based on the steps detailed above, the workshop recommended the Assessment Framework follow the following tiers:

1. Full Benchmark Assessment that utilises catch data from fishery monitoring, ideally in combination with stock abundance from independent surveys, catch rates and biological data with the purpose of estimating depletion levels and fishing mortality rates;
2. Data Limited Assessment that may utilise catch only or simple indicators to track status (e.g. CPUE, size composition, Productivity-Susceptibility Analysis);
3. No assessment necessary.

Two subsets, may apply after initial classification of stocks into Tier 1 Tier 2 or Tier 3.

i. Research Assessment where new methods or data types are applied which may require substantive review of the methods by the Scientific Committee; and
ii. Update Assessment where previous accepted assessments are updated with new data.

In addition, the workshop provided different options for stock assessments (Appendix 7.5), identifying for each of them the fishery and research data needs, the assumptions, uncertainties, considerations, and specifying the type of possible scientific advice that can result.

3. Vulnerable Marine Ecosystems Theme

The chair of the VMEs theme, provided an overview of the three topics to be discussed: predictive models for mapping the distribution of benthic habitats and VMEs; assessment of the size and impact of the fishing footprint; and the use of spatial decision-support tools to evaluate trade-offs in the design of spatial management proposals.

a. Habitat and VME mapping

The workshop agreed that, although the models would benefit from addition data on the distribution of key taxa, there was sufficient information to make useful models to predict the occurrence of VME indicator taxa, including uncertainty, at the scale of likely management (kilometres to tens of kilometres). The finerscale maps predicting the distribution of actual VMEs (as opposed to indicator taxa) using the criteria from New Zealand's Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 ("EEZ Act") merited further work because the criteria were contentious and had not had wide review. The workshop agreed that progressing to models designed to predict abundance would be helpful, but currently available data did not allow that outside the five features where detailed multi-beam and seabed video data were available.

> The workshop did note, however, that additional bathymetric data could be available from the fishing industry, and other sources of information on the distribution of benthic invertebrates could be explored. Together these may enable the development of abundance models or more fine-scale models of individual features in the future.

b. Spatial decision support tools

The workshop agreed that use of spatial decision-support tools made decision making processes more flexible, targeted, and transparent. The types of information that could be included in ZONATION models were discussed and it was noted that "point data" (e.g., individual seamounts) and layers denoting other broader areas like Ecologically or Biologically Significant Areas (EBSAs) could be included if these assisted evaluating obligations or trade-offs that were considered important. The workshop noted that the analyses tabled demonstrated that a well-designed new spatial management regime was likely to provide better protection for VMEs and better access for fisheries than the existing regime, and agreed that this was a worthwhile goal.

c. Bottom Fishing Impact Assessment Standard

The workshop agreed that impact assessment using this approach was very useful and urged New Zealand to extend the analysis to include all bottom trawl data in the western SPRFMO Area. The workshop also agreed that the analysis should be done at the finest scale commensurate with the spatial precision of the available data, probably 1x1 km cells. Such an analysis would provide a useful input to the ZONATION modelling as an indicator of existing impact and, potentially, "naturalness" of given areas of seabed habitat within the fishing footprints.

d. General discussion of VME theme

The Chair reminded the workshop that there was a strong expectation that the next meeting of the Scientific Committee would put forward proposals to update the bottom fishing measure CMM 03-2017. To assist with development, New Zealand would be hosting a series of three stakeholder workshops in July and August 2017. The workshop had a detailed discussion of the purpose of such stakeholder workshops and agreed to the general approach described in the skeletal agendas shown in Appendix 7.3. It was agreed that it would be very useful if Australian stakeholders and officials could attend at least the first of the workshops, likely to be held in Wellington, New Zealand.

The workshop noted that it was very important that stakeholders were explicit about their objectives when using spatial decision-support tools, and that stakeholders and officials had to operate within the requirements and obligations of the SPRFMO Convention and UNGA resolutions when designing proposals for spatial management. The workshop also noted that a revised bottom fishing measure was likely to include other settings and measures as well as the spatial management framework, including catch limits, move on rules, encounter thresholds, and responses to new information. New Zealand provided information paper SCW3-INF01 (word version) that described many of the issues that they considered important to be considered in the development of a revised bottom fishing measure and indicated that they would welcome workshop members' thoughts. The workshop heard from policy officials who indicated that SPRFMO would appreciate scientific advice on the pros and cons of each of these options within a revised bottom fishing measure, including looking at what other RFMOs were doing.

4. Future research and Workplan

The future research and the 2018 Workplan Plan for the Deep Water Working Group (DW WG) was discussed in plenary. Participants were briefly introduced to the 2013 Scientific Committee (SC) Research Programme, highlighting the general topics included into it, which are: Target Species (Biology, Dynamics and Stock Assessment); Vulnerable Marine Ecosystems (predictive habitat models and move-on rules); and, Ecosystem Approach (Ecological Risk Assessment, Bycatch, among others).

In alignment with the 2013 Scientific Committee Research Programme, the DW WG were informed on the content and advances of the 2017 DW Workplan. Then, taking into account the advances made so far, participants were asked to identify research needs in accordance with the issues discussed in the Stock Assessment and VME Themes. The result of this consultation is shown in Appendix 7.4.

Participants recognised that a tiered assessment framework identified during the workshop is a good approach to assist the SC in recommending conservation and management measures to the Commission, but is also a good approach to organise the analyses and researches that have to be done in the future. Nevertheless, the emphasis of activities identified by participants for 2018 and the coming years was on the need of collecting new data and organizing the existing ones. In addition, with the purpose of making better use of existing data, it was suggested by the workshop to conduct meta data analyses and/or assemble agreed combined data set for analyses.

5. Recommendations

a. Stock Assessment Theme Recommendations

The workshop recommended a tiered approach for assessing demersal stocks in the SPRFMO as noted in section 2.g above.

b. VME recommendations

The workshop recommended to:

1. Prepare a review paper for consideration by the Scientific Committee on the application of spatial management, VME indicator taxa and thresholds, and move-on rules to inform SPRFMO on the options that may best satisfy its requirements to protect VME's.

2. Continue to develop spatially explicit impact assessments and predictive habitat mapping at a range of scales to identify areas of high risk to VMEs from fishing.

3. Apply spatial planning decision-support tools to provide scientific advice on the location of areas open and closed to demersal fishing to achieve the objectives[1] of the SPRFMO Convention.

6. Meeting closed

The meeting was closed by the Chair at 15:00 hr on Thursday 25th.

[1] The objective of the Convention is, through the application of the precautionary approach and an ecosystem approach to fisheries management, to ensure the long-term conservation and sustainable use of fishery resources and, in so doing, to safeguard the marine ecosystems in which these resources occur.

7. Appendices

7.1. List of Participants

SPRFMO 3rd Workshop: **Deep Water Working Group**
Hobart, Australia, 23-25 May 2017

DEEPWATER WORKING GROUP CHAIRPERSON
NAME: Mauricio GALVEZ
POSITION TITLE: Head of Fishery Reseach Division
AFFILIATION: Fishery Development Insititute (IFOP)
EMAIL: mauricio.galvez@ifop.cl

Stock Assessment Theme Convenor
NAME: Martin CRYER
POSITION TITLE: Science Manager
AFFILIATION: Ministry for Primary Industries
EMAIL: martin.cryer@mpi.govt.nz

VME Theme Convenor
NAME: Simon NICOL
POSITION TITLE: Senior Scientist
AFFILIATION: Australian Bureau of Agricultural and Resource Economics and Sciences
EMAIL: simon.nicol@agriculture.gov.au

Workshop participants
Australia
NAME: Kerrie ROBERTSON
POSITION TITLE: Assistant Director, Governance And High Seas Fisheries
AFFILIATION: Department of Agriculture and Water Resources
EMAIL: kerrie.robertson@agriculture.gov.au

NAME: Daniel BEARD
POSITION TITLE: Policy Officer
AFFILIATION: Department of Agriculture and Water Resources
EMAIL: daniel.beard@agriculture.gov.au
NAME: Rocio NOREIGA
POSITION TITLE: Scientist
AFFILIATION: Australian Bureau of Agricultural and Resource Economics and Sciences
EMAIL: rocio.noreiga@agriculture.gov.au

NAME: Brodie MACDONALD
POSITION TITLE: Manager High Seas
AFFILIATION: Australian Fisheries Management Authority
EMAIL: brodie.macdonald@afma.gov.au

NAME: Dale MASCHETTE
POSITION TITLE: Fisheries Research Assistant
AFFILIATION: Australian Antarctic Division
EMAIL: dale.maschette@aad.gov.au

NAME: Danait GHEBREZGABHIER
POSITION TITLE: AFMA-SETFIA Liaison Officer
AFFILIATION: Australian Fisheries Management Authority
EMAIL: danait@afma.gov.au

NAME: Ryan KEIGHTLEY
POSITION TITLE: Management Officer - High Seas Fishery
AFFILIATION: Australian Fisheries Management Authority
EMAIL: ryan.keightley@afma.gov.au

NAME: Dirk WELSFORD
POSITION TITLE: Antarctic Conservation and Management Program Leader
AFFILIATION: Australian Antarctic Division
EMAIL: dirk.welsford@aad.gov.au

NAME: Judy UPSTON
POSITION TITLE: Principal Research Scientist
AFFILIATION: CSIRO
EMAIL: judy.upston@csiro.au

NAME: Malcolm HADDON
POSITION TITLE: Principal Research Scientist
AFFILIATION: CSIRO
EMAIL: malcolm.haddon@csiro.au

NAME: Rudy KLOSER
POSITION TITLE: Principal Research Scientist
AFFILIATION: CSIRO
EMAIL: rudy.kloser@csiro.au

NAME: Shijie ZHOU
POSITION TITLE: Principal Research Scientist
AFFILIATION: CSIRO
EMAIL: shijie.zhou@csiro.au

NAME: Malcolm McNEIL
POSITION TITLE: Managing Director
AFFILIATION: Australian Longline
EMAIL: mm@australianlongline.com.au

NAME: Lyn GOLDSWORTHY
POSITION TITLE: Executive Director
AFFILIATION: Frank Fenner Foundation
EMAIL: director@fennerfoundation.org.au

Chile
NAME: Renzo TASCHERI
POSITION TITLE: Scientist
AFFILIATION: Fishery Development Insititute (IFOP)
EMAIL: renzo.tascheri@ifop.cl

NAME: Aquiles SEPULVEDA
POSITION TITLE: Director
AFFILIATION: Fishery Research Institute
EMAIL: asepulveda@inpesca.cl

China
NAME: Jianfeng TONG
POSITION TITLE: Postdoc Researcher
AFFILIATION: Shanghai Ocean University
EMAIL: jftong@shou.edu.cn

European Union
NAME: Lius Jose LOPEZ ABELLAN
POSITION TITLE: Directorate
AFFILIATION: Spanish Institute of Oceanography
EMAIL: luis.lopez@ca.ieo.es

New Zealand
NAME: Tiffany BOCK
POSITION TITLE: Team Manager Deepwater Fisheries
AFFILIATION: Ministry for Primary Industries
EMAIL: tiffany.bock@mpi.govt.nz

NAME: Alistair DUNN
POSITION TITLE: Manager Stock Assessment Science
AFFILIATION: Ministry for Primary Industries
EMAIL: alistair.dunn@mpi.govt.nz

NAME: Ben SHARP
POSITION TITLE: Principal Scientist
AFFILIATION: Ministry for Primary Industries
EMAIL: ben.sharp@mpi.govt.nz

NAME: Kirstie KNOWLES
POSITION TITLE: Senior International Advisors
AFFILIATION: Department of Conservation
EMAIL: kknowles@doc.govt.nz

NAME: Ashley ROWDEN
POSITION TITLE: Principal Scientist
AFFILIATION: NIWA
EMAIL: ashley.rowden@niwa.co.nz

NAME: Malcolm CLARK
POSITION TITLE: Principal Scientist
AFFILIATION: NIWA
EMAIL: malcolm.clark@niwa.co.nz

NAME: Marie-Julie ROUX
POSITION TITLE: Principal Scientist
AFFILIATION: NIWA
EMAIL: marie-julie.roux@niwa.co.nz

CCAMLR
NAME: Keith REID
POSITION TITLE: Science Manager
AFFILIATION: Commission for the Conservation of Antarctic Marine Living Resources
EMAIL: keith.reid@ccamlr.org

SIOFA
NAME: Graham PATCHELL
POSITION TITLE: Scientific Committee representative
AFFILIATION: Southern Indian Ocean Fisheries Agreement
EMAIL: gjp@sealord.co.nz

DSCC
NAME: Duncan CURRIE
POSITION TITLE: Adviser
AFFILIATION: Deep Sea Conservation Coalition
EMAIL: duncanc@globelaw.com

NAME: Barry WEEBER
POSITION TITLE: Adviser
AFFILIATION: Deep Sea Conservation Coalition
EMAIL: baz.weeber@gmail.com

NZ High Seas Fisheries Group
NAME: Andy SMITH
POSITION TITLE: Operations Manager
AFFILIATION: NZ High Seas Group
EMAIL: andy.smith@talleys.co.nz

NAME: Patrick CORDUE
POSITION TITLE: Scientist
AFFILIATION: NZ High Seas Group
EMAIL: patrick.cordue@isl-solutions.co.nz

Other Officials
NAME: James IANELLI (remote participation)
POSITION TITLE: SC Chairperson
AFFILIATION: NOAA Fisheries, Alaska Fisheries Science Center
EMAIL: jim.ianelli@noaa.gov

SPRFMO SECRETARIAT
NAME: Craig LOVERIDGE
POSITION TITLE: Data Manager
AFFILIATION: SPRFMO
EMAIL: cloveridge@sprfmo.int

NAME: Guillaume CARRUEL
POSITION TITLE: Intern
AFFILIATION: SPRFMO
EMAIL: guillaume.carruel@agro-bordeaux.fr

7.2. Provisional Annotated Agenda (revised)

SPRFMO 3rd Workshop

Deep Water Working Group
Hobart, Australia, 23-25 May 2017

SCW3 - Doc01-rev1

Provisional Annotated Agenda (revised)

1. OPENING OF WORKSHOP
    a. Welcome address
    b. Workshop arrangements
    c. Adoption of agenda
    d. Reporting arrangements
2. STOCK ASSESSMENT THEME
    a. Draft Assessment Framework
    b. Use of Acoustic Data in Stock Assessments of Aggregating Demersal Fish Stocks
    c. Application of CPUE time-series in Stock Assessments of Aggregating Demersal Fish Stocks
    d. Review of Recent Orange Roughy Stock Assessments in New Zealand, Australia, and SPRFMO
    e. Assessment Framework
3. VULNERABLE MARINE ECOSYSTEMS THEME
    a. VME Mapping
    b. Using Spatial Mapping/Zonation
    c. Bottom Fishing Impact Assessment Standard
4. DEEPWATER RESEARCH PROGRAMME AND WORKPLAN
5. ADOPTION OF THE WORKSHOP REPORT
6. CLOSE OF THE WORKSHOP

7.3. Draft of skeletal agendas for the stakeholder workshops

In order to advance the work towards a revised bottom fishing measure, including spatial impact assessment and spatial management planning, the following draft of skeletal agendas for three stakeholder workshops are envisaged.

Workshop 1: mid-July 2017 (1 or 2 days)

1. Agree on scope.
2. Introduction to spatial management planning and use of decision-support tools
3. Example use of the ZONATION decision-support tool for Vulnerable Marine Ecosystems (VME) in the NZ region as previously presented to SPRFMO's SC
4. Agree on objectives for the analysis (i.e., written statement of what stakeholders want to achieve within the constraints of the SPRFMO Convention and UNGA requirements, including questions in the A3 table)
5. Determine data input types (e.g., VME indicator taxa or VME thresholds, fishing 'cost', impact, naturalness etc) and identify suitable input data and data layers
6. Identify area (e.g. SW Pacific), any stratification and bio-regionalisation, connectivity issues (including with adjacent EEZs), and the nature and spatial scales of candidate management approaches (grids, individual seamounts, etc)
7. Identify appropriate modifiers to guide the analysis (e.g., weightings, boundary length etc). This may include presentation and discussion of some examples showing the different results under different ZONATION settings.
8. Identify next steps

Inter-workshop

Obtain and format data layers and run ZONATION scenarios based on decisions from Workshop 1

Workshop 2: late July 2017

1. Present results of ZONATION runs
2. Discuss results of ZONATION runs
3. Identify any new data/modifications
4. Re-run ZONATION runs if possible using new data/modifications and discuss
5. Identify next steps

Inter-workshop

Obtain and format data layers and run ZONATION scenarios based on decisions from Workshop 2

Workshop 3: mid-August 2017

1. Present results of ZONATION runs
2. Discuss results of ZONATION runs
3. Identify any new data/modifications
4. Re-run Zonation runs if possible using new data/modifications and discuss / finalise
5. Identify next steps – re report for SC (starting 24 September 2017), any work between SC and Commission (January 2018), and a work programme for future development

7.4. 2017 Scientific Committee workplan on Deep Water fisheries and proposed Deep Water Working Group Research workplan for 2018.

	-------------------- 2017 (January) SC WORKPLAN --------------------	-------------------- 2018 DW-WG RESEARCH WORKPLAN ------------
TARGET SPCIES	• Consider the recent global review report of ORH biology, stock assessment, and approaches to management. **(no yet)** • Develop data collection proposals for increasing information available for different areas/stocks **(in progress)** • Draft a tiered assessment framework for demersal species based on estimable parameters and available information for potential TAC guidance in a CMM. **(in progress)** • Work towards developing limit and target reference points not inconsistent with the variety of domestic policies and international guidelines / best practices. **(in progress, into the assessment framework)** • Ensure that catch series are updated to include all catch for orange roughy from study areas and finalise estimates of initial biomass, productivity, and stock status for relevant orange roughy sub-stocks. **(done)**	• Consider the recent global review report of ORH biology, stock assessment, and approaches to management. • Make an inventory of orange roughy otoliths and use it to identify future research needs (a catalogue could be held by the secretariat with data being populated by members) • Consider a meta-analysis of key life history parameters for orange roughy • Assemble agreed combined data set for analyses and/or comparing methods on single data set • Develop data collection methods and proposals for incorporating multiple biological samples from individual fish
VME	• Report on relevant data and model developments to predict VME indicator taxa **(in progress)** • Update data available and evaluate the impact of fishing activities on VMEs and EBSAs in the convention area and evaluate spatial management options, including using stakeholder workshops. **(mostly done)**	• Identify possible steps to move toward abundance models for VME taxa and VMEs • Extend impact models to include all bottom fishing data and the sensitivity and recovery of key VME or structuring taxa. • Develop a process to regularly update benthic models and impact assessments using new data or methods.

	2017 (January) SC WORKPLAN	2018 DW-WG RESEARCH WORKPLAN
		• Update data available and evaluate the impact of fishing activities on VMEs and EBSAs in the convention area and evaluate spatial management options, including using stakeholder workshops and considering cumulative impacts.
ECOSYSTEM	• Draft risk assessment of the impact of deep water fishing on deep water sharks **(mostly done. Draft in review)** • Include fishing mortality or Productivity Susceptibility Analysis **(in progress. Data requested)** • Refer to the SPRFMO list of species of concern and proposed provisional additions to help rank species for ID and sampling purposes. **(done. Now in cross-checking)** • Review and recommend modifications, if necessary, to CMM 3-2017, the bottom fishing measure based on results of stock assessments, VME modelling and spatial management options. **(no yet)**	• Identify the most urgent information to improve estimates of risk for the shark species at highest risk • Review and recommend modifications, if necessary, to CMM 3-2017, the bottom fishing measure based on results of stock assessments, VME modelling and spatial management options.

7.5. Stock assessment options and its considerations to be taken into account in the Assessment Framework

Assessment options	Fishery & Research Data needs	Assumptions/ Uncertainties / Considerations	Type of possible Scientific Advice
Statistical catch-at-age integrated models.	Catch Effort. Length composition. Maturity ogive. Age composition Fisheries - independent series indices (acoustic, research survey, tagging, egg survey).	Acoustics - Species ID critical. Target strength needs to be validated if different length and species surveyed. "Dead zone" can be important on steep-sided hill features. Combined trawl and acoustic survey approaches can work well in mixed habitat/density situations. Interpretation of time series need to be cognoscente of variation which can be influenced by time of survey (wrong time) and natural cycles. A Multi frequency approach is preferred. Surveys with high confidence species composition and target strength estimates give a snapshot biomass estimate with Intermediate uncertainty.	Advice in relation to estimation of F and B

Assessment options	Fishery & Research Data needs	Assumptions/ Uncertainties / Considerations	Type of possible Scientific Advice
Biomass Dynamics Model. Length based catch at age.	Catch Effort. Life history data for individual stocks. Fisheries-independent indices of stock abundance.	Need to evaluate if the BDM is adequately describing life history. High to intermediate uncertainty. Allowance should be made for the impact of a proportion of each stock closed to fishing. A BDM (with no recruitment lag) will be perfectly acceptable for many species. However, the suitability for species which are known to first mature at 20-25 years of age or older would need to be justified. Catchability estimate (potentially useful for quantitative and spatially-explicit risk assessments). Best used in a scenario-based approach to characterise the influence of model assumptions on model outcomes. Best practice would be to use hierarchical BDM by modelling multiple stocks simultaneously. This will borrow strength and reducing uncertainty.	Status relative to B0 or BMSY, with uncertainty (posterior distributions).
Length-based spawning-biomass-per-recruit (SPR)	Catch Effort Length composition Maturity ogive Age composition		Advice in relation to estimation of F
Size relative to size-at-maturity	Catch Effort. Length composition. Maturity ogive over time.	For ORH assume transition zone in otolith represents maturity (reasonable evidence for this). Sampling needs to be representative of catch or stock.	Advice in relation to Harm/no harm proxies

Assessment options	Fishery & Research Data needs	Assumptions/ Uncertainties / Considerations	Type of possible Scientific Advice
Std CPUE by size indicators. Changes in mean length/weight/size percentiles Modal analysis to estimate growth rates.	Catch Effort. Length composition.	Sampling representative of catch or stock.	Trends to warn if possible management action required. Advice in relation to Harm/no harm proxies
Spatial change	Catch Effort Stock structure information.	Consistent measures of distribution (constant fishing effort over space)	Advice would be in relation to triggers
Sustainability Assessment of Fishing Effects (SAFE). Optimized catch only method. Depletion analysis. Depletion-corrected Average Catch (DCAC). Depletion-based Stock Reduction Analysis (DB-SRA).	Catch Effort. Age data. Fisheries-independent presence/absence.	Need to evaluate the assumptions of the underlying surplus production models. Outcomes will be strongly influenced by initial depletion level assumptions. High uncertainty. SAFE: Assumes that species distribution is known and relies on catchability thresholds. High to intermediate uncertainty. Best used in a scenario-based approach to characterise the influence of model assumptions on model outcomes. Avoid using DCAC and DB-SRA unless you modify the methods.	Relative reference points including F proxy and B proxy

Assessment options	Fishery & Research Data needs	Assumptions/ Uncertainties / Considerations	Type of possible Scientific Advice
Std CPUE. CUSUM.	Catch Effort only.	Bias and variance uncertainties should be considered. Before using catch and effort data it needs to be fully characterised leading to data selection criteria or complete rejection: (1) is it homogenous (this assumption is relaxed when using a spatially disaggregated approach); (2) how has rounding affected the distribution; (3) spatial structure of catch and effort data – taken care of using a spatially disaggregated approach. GMFR approach – can be used to check assumptions about mixing affect outcomes (High uncertainty). Multiple indices, generated from alternative assumptions, are useful to explore potential stock size and stock status in conjunction with suitable models (and alternative parameter values within each model, e.g., growth, recruitment patterns). This is an exploratory approach and not definitive. For some species catch and CPUE are unlikely to be adequate for reliable stock assessments (base model and sensitivities). Reference points are limited to triggers.	Potentially useful information on trends. Best practice would be the development and monitoring of a set of CPUE indicators (to ensure that trends are consistent under a range of assumptions).

Assessment options	Fishery & Research Data needs	Assumptions/ Uncertainties / Considerations	Type of possible Scientific Advice
Regression Habitat Model.	Large catch >Xt/yr. Seamount residency data (Age structure, age-at-maturity genetics).	Cumulative catch can be problematic. There are conceptual problems where each seamount is not a stock and in some stocks where catch is not taken predominantly from seamounts, but the fish may still associate with seamounts. You'd be missing the catch that is taken out of that stock but not from the seamount. Could be useful as priors for quantitative Stock Assessment if there are no other options. Need to use only SPRMFO relevant data.	Potential application to seamount habitats in new fisheries. Can only estimate B min.
Qualitative Risk Assessment. Comprehensive assessment of risk to ecosystems. Productivity Susceptibility Analysis. SICA.	Small Catch <Xt/yr. Age data.	Relative. High uncertainty. PSA has some fundamental drawbacks and SAFE should be used if data allows. A SICA will quantify the spatial overlap and frequency of events, and so could be the best way to go in the ERA space.	Prioritisation (i.e., identification of high risk bycatch species and associated information needs). Reference points will be limited to Harm/ no Harm proxies
Catch only.	Large catch >Xt/yr only.	High uncertainty. May provide information for setting priors in more complex models.	Would provide a F proxy reference point.

Assessment options	Fishery & Research Data needs	Assumptions/ Uncertainties / Considerations	Type of possible Scientific Advice
Species ratios. Changes in gear.	Small Catch <Xt/yr only.	Highly uncertain. Potential bias caused by changes in spatial distribution of effort over time and management measures. Assumes same fishing practices, depth ranges, topographic features, localities.	Annual Monitoring of indicators.