Report of the
First Meeting of the Southern Indian Ocean Fisheries Agreement (SIOFA)
Scientific Committee Stock Assessment Working Group (SAWG)
15–18 March 2018, Saint-Denis, La Reunion, France

TABLE OF CONTENTS

Agenda item 1 – Opening

Agenda item 1.1 Opening statement from the Chair

1. The first meeting of the SIOFA SC Stock Assessment Working Group (SAWG) was opened by Dr Tsutomu Nishida, Chairperson of the SAWG at 9.03am on 15 March 2018. The Chair thanked the Secretariat for resolving the last minute cancellation of the planned meeting venue and for their efforts in preparing for the meeting.

2. The Chair welcomed participants from Contracting Parties, SIOFA Observers and External experts.

Agenda item 1.2 Introduction of participants

3. The Secretariat welcomed participants to Reunion and also welcomed Mr Pierre Peries to the role of SIOFA Data Manager.

4. Participants introduced themselves and noted their affiliations. A list of participants in attendance is included at Annex A.

Agenda item 2 – Administrative arrangements

5. The Chair noted that closed sessions may be required owing to the confidential and commercially sensitive nature of some of the data that may be presented during the meeting. Procedural details for dealing with closed sessions, should these be required, are included in the adopted agenda (Annex A). The Cook Islands advised the SAWG that the presentations of SAWG(2018)-01-INF09 and SAWG(2018)-01INF10 contained commercially sensitive acoustic data, and this could be interpreted as sufficient exceptional circumstances to warrant a closed session. Rather than request a closed session the presenter proposed that a copy of the visual aid to the presentation (a Powerpoint file) not be provided to participants and no photographs to be taken by SAWG participants of the echograms shown. The SAWG agreed to proceed with this approach.

6. The SAWG discussed that a process was required for summarising biological and other data from fishing by non-Contracting Parties and other entities that under normal circumstances would not be submitted to the Secretariat, and suggested that ideally, the Secretariat should act as the central repository for this information. It was noted that the recent appointment of the data manager will assist with this process.

7. The SAWG noted that the orange roughy assessments (SAWG(2018)-01-05-Rev-1 and SAWG(2018)-01-06-Rev-1), which were submitted to the SC meeting as information papers, should be formally presented to the SC meeting and should preferably be treated as working papers. This was in response to the concern that not all Contracting Parties were represented at the SAWG meeting and the role of the SC in reviewing the final assessments. The SAWG also noted that SAWG(2018)-01-INF01, SAWG(2018)-01-INF09 and SAWG(2018)-01-INF10 should also be treated as working papers for the SC meeting.

Agenda item 2.1 Adoption of the agenda

8. The agenda (Rev 3) was adopted (Annex B), noting changes to the structure during the meeting.

9. The following items were flagged for discussion under 'Other business':

- Discussion on the implications between outcomes from this working group and other working groups, particularly the ERAWG.

- A record of acknowledgements to recognise the contributions made to recent work by various parties.

- Discussion on database coding issues (e.g. between ORH/ORY).

Agenda item 2.2 Confirmation of meeting documents

10. The meeting documents (Annex C) were confirmed.

Agenda item 2.3 Appointment of rapporteurs

11. Mr Lee Georgeson will act as rapporteur, with assistance from participants.

Agenda item 2.4 Review of terms of reference

12. The SAWG Chair reminded the SAWG of its Terms of Reference. Paragraph 6a of CMM 2017/01 actions the SIOFA Scientific Committee to provide advice and recommendations to the Meeting of the Parties on the status of stocks of principal deep-sea fishery resources targeted, and, to the extent possible, taken as bycatch and caught incidentally in these deep-sea fisheries, including straddling fishery resources by 2019.

13. The SAWG Chair noted that the main priority for SAWG1 was orange roughy, with alfonsino and Patagonian toothfish to be discussed in more detail next year (2019). A review of progress against the SAWG Terms of Reference is included at Annex D.

14. The SAWG discussed that there are other fisheries in SIOFA (both historical and current) that are not considered within the current Terms of Reference. This was partly raised in relation to concerns that some fisheries may have been heavily exploited and depleted in a short timeframe. It was noted that Contracting Parties who had recently joined SIOFA (e.g. Thailand) are exploiting species that have not been considered to date by the SAWG. The SAWG **requests** that these issues are considered by the SC.

Agenda item 3 – SIOFA Tiered Management Framework

Summary of paper

15. Paper SAWG(2018)-01-INF06 describes a draft stock assessment and management framework for bottom fisheries within the SPRFMO Convention Area, which could provide a model for SIOFA. Such a framework may help to provide direction for future work of the SC/SAWG and may increase the efficiency of the SC/SAWG's considerations given the large number of species with which SIOFA fisheries interact. It was noted that the quantity, quality and suitability of data will vary among species over space and time and that this variability is likely to influence the parameters that can be estimated, and the associated uncertainties. To improve the efficiency of processes run by the SAWG, a tiered framework for prioritising stocks for status assessment was proposed based on the parameters that can be estimated given the data available. Such a tiered framework may eventually assist the SAWG and SC with developing transparent decision rules for advice on recommended biological catches and potential buffers (e.g. 'discount factors') that may be applied to account for assessment uncertainty. The recommended tiered levels consist of:

- Tier 1 Benchmark assessments that utilise 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.

- Tier 2 Data limited assessments that may utilise catch-only or simple indicators to track status (e.g. CPUE, size composition, Productivity-Susceptibility Analysis).

- Tier 3 No assessment necessary.

16. This tiered framework is not equivalent to those applied in some management approaches, where the tiers have been established to guide the application of harvest control rules and generate effort or quota outputs. Examples of these types of tiered frameworks were presented in papers SAWG(2018)-01-INF06, SAWG(2018)-01-INF07 and SAWG(2018)-01-INF11.

17. Categorisation into Tier 1 and Tier 2 of the framework should be based on the data available. Species/stocks with data suitable for estimation of current fishing mortality and depletion should be categorised to Tier 1. Species/stocks initially considered for Tier 1 may be subsequently classified for Tier 2 assessment if the Tier 1 assessment diagnostics fail to satisfy SAWG review. Prior to categorisation into Tier 1 or Tier 2 the SAWG may place some species into Tier 3 (No Assessment required) based on the presentation of sufficient evidence that the species rarely interact with the SIOFA fisheries. Species not placed into Tier 1 or Tier 3 categories by default are placed in Tier 2. For a species with multiple stocks in the SIOFA area, stocks may be classified into separate tiers if appropriate.

18. A Scoping Analysis for each SIOFA species should be undertaken to assist categorising each stock into Tier 1 or Tier 2. The Scoping Analyses should include, a description of the fishery, the entire catch history and other relevant data available (such as length frequency, ageing, surveys, stock structure information etc). The Scoping Analysis should also include documentation of management objectives (if defined), existing management measures (if any) and the risks associated with fishing. Much of this information is already contained with Parties' Bottom Fishery Impact Assessments and other papers to the Scientific Committee. Catch data, observer records, expert opinion, and/or species distribution maps should also be considered as part of the Scoping Analysis. Fishing-specific risks may include (but not limited to): capture and retained; capture and discarded, capture and live release; and direct impact without capture.

19. Species/stocks placed into Tier 2 should be subjected to semi-quantitative risk assessment methods such as Productivity-Susceptibility-Analyses (PSA) and/or Sustainability Assessment for Fishing Effects (SAFE). These methods rank species/stocks into priority from high to low relative risk, with SAFE also being capable of generating proxy estimates of fishing mortality. This step should identify to the SAWG the Tier 2 species/stocks requiring immediate attention (if any). It may be determined by the SAWG that stocks assessed to this level may not require further assessment if the risks from fishing are assessed to be low, or if adequate management measures are in place to mitigate moderate or high risks. Tier 2 and 3 species may require the application of annual reporting on indicators that are designed to identify when the fishery has changed sufficiently to warrant new or further assessment.

20. SAWG participants were encouraged to read SC paper SC-03-07(01) (Proposed framework for low-information ERA), which provides an example of potential responses for various assessment outputs derived from the application of methods such as ecological risk assessment.

SAWG discussion

21. In relation to CMM 2017/01 and the SAWG's Terms of Reference, it was noted that there could be 5-10 key target stocks and around 100 other stocks with which SIOFA fisheries interact. The capacity to assess status and/or formulate catch limits

for many retained bycatch species might be difficult, impractical or impossible given the data availability. A number of retained species that may fall into these categories were mentioned and included oreo dories, bluenose (*Hyperoglyphe antarctica*) and cardinalfish.

22. The SAWG supported the application of appropriate risk mitigation in decision making that reflects the level of uncertainty or error present in the methods being used to make assessment and management decisions. The SAWG noted that the level of confidence in the assessment outputs and the data availability are not necessarily related. The tiered framework would provide a means for prioritising assessment and investment.

23. The SAWG discussed how decisions classifying stocks into tier three would be made (i.e. circumstances where catch was so low that assessment was not required). In response, it was noted that the proposed scoping analyses could resolve this.

24. The SAWG noted the following implications for its workplan:

    • Scoping Analysis – this should provide direction to future assessment work on fisheries. The SAWG may wish to consider this as a living document that is updated annually (or as required) as new information becomes available. It could act as a list of data holdings for SIOFA species.

    • Tier 2 risk analyses should be included in the SAWG and ERAWG workplans.

25. In relation to the tiered assessment framework, the SAWG recommends that the SC:

    • **Adopts** the proposed assessment framework for SIOFA fisheries to provide direction for future assessment work and speed the SAWGs processes in developing analyses for the Scientific Committee.

    • **Requests** Parties cooperate in the development of a Scoping Analysis for the species caught by their SIOFA fisheries.

    • **Amends** the SAWG's work plan to include the activities described above.

    • **Considers the** activities described above as part of the ERAWG's work plan.

    • **Requests** the SIOFA data manager to support these activities.

Summary of additional papers under agenda item 3

26. SIODFA presented SAWG(2018)-01-INF11, which details Australian Tiered Management Protocols for Alfonsino (from Shotton 2016). In this method, alfonsino stocks with lower information availability (i.e. higher uncertainty) are managed with a greater level of precaution. This tiered method also took into account economic yield in the management of stocks. SIODFA noted that it was important to acknowledge as these were commercially important fisheries and economics needed to be considered in the management of stocks.

SAWG discussion

27. It was noted that the tiered structure applied as part of the harvest strategy from which this tiered framework was derived is a methods-based approach (i.e. it was based around the stock assessment methods that were available and are being used). The Australian framework is currently being revised to include a greater focus on the level of certainty around the parameters that can be estimated and how this relates to the formulation of biological catch limits.

28. In relation to economic considerations, it was noted that Australia classifies stocks in this fishery, where alfonsino is one of the species caught, into key commercial,

secondary commercial and byproduct and non-retained bycatch. The normal default for key commercial stocks is to use an integrated age-structured model (generally with a target of MSY with a x1.2 buffer added (used as a proxy for MEY)). SIODFA noted that alfonsino should be regarded as a key commercial fishery in SIOFA.

29. It was discussed that consideration of economic aspects required a different (and sometimes confidential) suite of data and that it was often difficult to include economic analyses in stock assessment to derive MEY targets.

30. The SAWG Chair noted that IOTC is considering applying a similar tiered approach to the one described in SAWG(2018)-01-INF11.

Summary of paper

31. SAWG(2018)-01-INF03 is the report of a stock assessment workshop for North Pacific Armourhead, held in Japan in 2012. The report details a 6-tiered approach.

Agenda item 3.1 Data rich situations: Stock assessments based advice

32. No papers were provided for this agenda item. The SAWG Chair noted that in data rich situations, a number of approaches and/or information can be used for providing robust management advice.

Agenda item 3.2 Data limited situations: Indicators based advices using Harvest Control Rules (HCR)

Summary of paper

33. SAWG(2018)-01-INF07 details empirical harvest rules for management advice in use by SEAFO. The tiered approach described was developed by ICES and uses a six-tier system. SEAFO now applies ICES data poor (catch only) HCR (the 5th tier of the ICES tier approach) for Alfonsino and Southern boarfish and NAFO HCR (Greenland Halibut) for Patagonian toothfish and deep sea red crab. This is because in SEAFO, only short time series of data are available, hence robust stock assessments for these species are not possible to conduct.

Agenda item 3.3 No data situation: Parameters based advice by Ecological Risk Assessment (ERA)

34. No papers were provided for this item (noting that ERA methods were discussed elsewhere in the agenda). The SAWG Chair gave a brief overview of potential methods for use in these situations.

Agenda item 4 – Stock assessments: Orange roughy

Summary of paper

35. Paper SAWG (2018)-01-03 summarises preparations for assessment of orange roughy (*Hoplostethus atlanticus*) stocks in the SIOFA Area. The paper describes various stock assessment models in use for orange roughy and their data requirements. The CASAL and SPM-SS stock assessment models had been considered but there had been no consensus intersessionally on the application of surplus production models due to most orange roughy fishing in SIOFA occurring on spawning aggregations. Surplus production models are generally not suitable in this circumstance as the generated CPUEs are not considered a reliable index of abundance. The orange roughy assessment preparation identified that it should be possible to apply the CASAL model for the assessment of orange roughy in the Walter's Shoal region (WSR) and this was agreed intersessionally by the SAWG. This assessment is described in SAWG(2018)-01-05.

Agenda Item 4.1 Basic issues

(1) Fisheries and catch

Summary of paper

36. SAWG(2018)-01-08 provides a summary of catch data used in the assessments. China and Norway have recently provided data to the Secretariat, but the location of some Chinese catches was unclear.

SAWG discussion

37. In reconstructing the historical catch data for orange roughy the SAWG noted the following issues:

    - The probability of missing catches for vessels flagged to non-Contracting Parties. For example, it was reported that a number of nations that included Belize, Cambodia, St Vincent and Grenadines, Cyprus and Panama had vessels operating in the fishery, but their data are not currently available.

    - Double-counting of catch was identified as a potential risk and it was noted that it was important to look at the history of individual vessels as they may have operated under flags of more than one state.

    - Potential coding errors with data. Australia had found a number of issues with its data up to 2002 (for example, a non FAO code ORH had been entered (whitespotted bambooshark) rather than the FAO code ORY (orange roughy)). Australia had subsequently provided an update of these data to the Secretariat, and these had been used for the orange roughy stock assessments. In relation to Australia's data, Graham Patchell noted that he had checked with the skipper of the vessel during the period in question and they corroborated that the catch coded as ORH was orange roughy.

38. The SAWG agreed that documenting the process for reconstructing the catch history was an important exercise and should be reviewed by the SAWG to ensure the reconstruction is transparent. Cook Islands, SIODFA, Innovative Solutions Ltd. (ISL) and the SIOFA Data Manager worked together during the SAWG workshop to provide a summary of this information, which was presented to the SAWG. The summary demonstrated where orange roughy catch histories for each sub-region or feature are based on various official and unofficial records, some of which needed to be corroborated (including by fishing industry and non-Contracting Party representatives). The summary also indicated where conversion factors were used where records may have been for processed catches. This summary will be held by the Secretariat in accordance with relevant confidentiality requirements described in CMM 2016/03. It was suggested that a narrative to accompany the catch history summary be provided to the Secretariat (and for future use by the SAWG).

39. The SIOFA Data Manager **requested** that detailed information on historical catches, particularly assumptions around the spatial aspects (e.g. data on latitudes and longitudes), should ideally be provided with data submissions. The SAWG noted that all data should be submitted as closely as possible in accordance with CMM 2017/02.

Summary of paper

40. Mr Evgeny Romanov (External expert) gave a presentation of USSR historical research and fisheries operations on underwater ridges of the Southern Indian Ocean (SAWG(2018)-01-INF08). Much of the data and research outputs from this work were not published, but some are available.

SAWG discussion

41. It was clarified that the Russian and Ukrainian fleets had not been active in the southern Indian Ocean since the early 2000s. Much of the current Russian effort is directed at Atlantic and Pacific Antarctic zones.

42. The SAWG noted that some historical fishing and research information, specifically including that of Japan, would be critical for future assessments for other species, including boarfish and alfonsino. However, not all the data is available electronically and collation of the information would be a substantial task.

43. It was suggested that the use of some historical research fishing data (including catches of orange roughy taken as bycatch) might be used as proxies to enable estimation of the mortality of some target and bycatch species that may be otherwise unaccounted for.

44. The Secretariat was asked to confirm if any Korean research fishing had been done in the area.

45. Evgeny Romanov noted that an FAO report detailed *Surveys of historical data sets of past fisheries research and exploratory fisheries cruises in the SWIOFP region*, which may be of use to the SAWG.

46. The SAWG **requests** the Secretariat to investigate opportunities to recover historical commercial fishing data from Crimea at the ABNJ Deep-Seas Program Project Steering Committee meeting in April 2018.

(2) Abundance indices (acoustic data)

Summary of papers

47. SAWG(2018)-01-INF01 provides a summary of the FAO Acoustics workshop to review the performance of acoustics data in the assessment of orange roughy in the Southern Indian Ocean.

48. Reviews of acoustic datasets for use in orange roughy assessments are detailed in SAWG(2018)-INF09 and SAWG(2018)-INF10. Paper SAWG(2018)-INF09 describes Orange roughy biomass estimation in SIOFA: Review of the use of acoustics from industry vessels. Paper SAWG(2018)-INF10 provides an evaluation of some of the existing industry data (2005 and 2009 Sleeping Beauty acoustic surveys) against the adopted framework and how these data may be used within single stock assessments for orange roughy. It included consideration of uncertainty in species identification, rate of sound absorption, dead zone correction, data quality, acoustic calibration and survey strategy.

Presenter's summary

49. The Cook Islands presented SAWG(2018)-INF09 (Orange roughy biomass estimation in SIOFA: Review of the use of acoustics from industry vessels) and SAWG(2018)-INF10 (Review of SIOFA OR acoustic data).

50. The presenter noted that the FAO 1020 protocols for data collection and acoustic surveys, as updated in 2012, are formal requirements for all Cook Island vessels to follow, and for SIODFA members. The extensive data available to the SIOFA SAWG are a result of these formal requirements on vessels to undertake acoustic surveys.

51. The work plan for the 2017 Acoustic review was presented:

- Build on FAO/ABNJ Rome workshop by describing and quantifying sources of uncertainty in estimates of orange roughy biomass.

- Review the protocols for collection of acoustic data, refine and test existing and new survey protocols to facilitate this data collection.

- Analyse 2005 and 2009 'Sleeping Beauty' surveys and the Sealord net attached Acoustic Optical System (S-AOS) data, with appropriate reporting for use in a stock assessment.

52. In relation to the reviews of acoustic data (SAWG(2018)-INF09 and SAWG(2018)-INF10), the following conclusions were noted by the presenter:

- Data quality was high and methods used were consistent with standard practice for the acoustic datasets reviewed for 'Sleeping Beauty' for 2005 and 2009.

- Standardised reporting should be adopted and acoustic data workshop/reviews should be held prior to biomass estimates being used in a stock assessment.

- Errors in inference area calculation and fish movement within surveys can lead to biomass differences up to ±3 times.

- Selected biomass estimates other than those from 'Sleeping Beauty' were recalculated for the Walters Shoal Region (WSR) stock assessment.

- For the 2009 SB standard grid survey the recommended EDSU estimate was 1.6 times the geostatistical mean estimate across all surveys.

- There was evidence that the 2005 survey data were collected with reduced system sensitivity, and the 2005 estimates are biased low.

- With the depth of orange roughy aggregations in SIOFA, absorption correction has large uncertainty as there are no validated measurements in deep water worldwide.

- Use of one or other of the two most commonly used absorption functions changed the biomass estimate by 30%, and for this review the most conservative set (Doonan as opposed to Francois and Garrison) was used. Measurements should be made to resolve this major source of potential error acoustic estimates in the SIOFA region.

53. The presenter noted the following conclusions in relation to Target Strength (TS):

- Net attached acoustic optical survey (S-AOS) was used successfully in the high seas by fishers to collected critical target strength and species ID information that contributed to reducing error in biomass estimates.

- Prior to the workshop, the TS of 45cm orange roughy was very uncertain as previous measurements were on smaller 35cm fish. TS measurements on 45cm fish at SB were 2-3dB higher than predicted by the recommended formula, and if correct would reduce the biomass by 63.1 to 50.1%.

- Accurate TS measurements on 40-60cm orange roughy are critical for other stocks in SIOFA and on 25-35cm fish in other regions.

54. The presenter noted the following conclusions in relation to species identification:

- Species identification may be a major source of error in deepwater acoustic surveys and requires multiple lines of investigation.

- The AOS species ID using 38kHz and 120kHz frequencies demonstrated a difference for 45cm orange roughy was about 4dB, and is similar to that observed for 35 cm fish in Australia and New Zealand.

55. Paper SAWG(2018)-INF09 also included the following recommendations that were not explicitly highlighted by the presenter:

- That key metadata and data storage methods are developed and adopted so that results can be replicated.

- That further investigations are made to resolve the analytical difference in the geostatistical and transect mean and variance estimates that could affect all surveys.

- Subject to the outcome of the previous recommendation, that for closely spaced parallel grid based surveys the EDSU mean and geostatistical variance is adopted as used in current Australian and New Zealand stock assessments.

- That the net attached AOS is used in areas of complex species mixing and or steep slopes to reduce biomass estimation bias and uncertainty.

- To resolve the potential target strength bias of a factor of 2 more visually verified target strength measurements are obtained ideally with the industries net attached AOS on selected grounds.

- Follow recommendations in section 3 [of the report] and previous documents for industry data collection (FAO, 2012; FAO, 2017).

SAWG discussion

56. The SAWG discussed various uncertainties with the use of acoustic data as inputs for stock assessment necessitates verification of these datasets. Uncertainties include species identification and mixing, cryptic biomass, survey design, target strength (TS), absorption of the sound pulse, calibration and data quality. These uncertainties were explored by the FAO Acoustic workshop (SAWG(2018)-02-INF01).

57. The SAWG clarified that most of the fishing for orange roughy in the southern Indian Ocean sub-regions used in the assessments had occurred on spawning aggregations, which is an important assumption for the use of acoustic data as an index of abundance. It was noted that aggregations do form outside spawning season and that their size and age composition might be different to those during spawning season. During the early years of the fishery (1999-2000), more catch was reportedly taken outside spawning season (i.e. during October, November, December). The SAWG discussed the influence this may have on the stock assessments. It was noted that the further back in time the uncertainty of the catch history the less important it was given the availability of recent acoustic biomass estimates.

58. The group discussed that there can be considerable variability (over relatively short time periods of 2-4 weeks) in the size of aggregations as they build towards the peak of spawning (the example of observations from the eastern zone orange roughy stock in Australia was noted). It was noted that acoustic estimates are not used in the assessment as an estimate for absolute biomass and the acoustic estimate is normally used as a minimum for aggregation size. The SAWG noted that a long time series is not required to estimate abundance and that acoustic information over a relatively short timeframe (e.g. 3-5 years) can still provide useful information about trends. The SAWG agreed that the average of multiple acoustic surveys on a feature over a year generally provides more reliable information when used in a time series of annual estimates of abundance.

59. The Cook Islands and ISL provided a summary table of the acoustic surveys with respect to whether they had been processed (assessed), reviewed (i.e. in SAWG(2018)-INF10) and used in the assessments for either the Walter Shoal Region (WSR) or MPD-based assessments. It was noted that no 2016 surveys were included in the summary due to a faulty transducer. The summary table is included

at Annex E. A confidential version of this table has been provided to the Secretariat for future use by the SAWG and SC.

60. The SAWG agreed that additional work would be useful in exploring the selection of methods used to calculate absorption.

61. The SAWG **recommended** to the SC that a letter be sent to the NORAD/FAO R.TV Dr Fridtjof Nansen program to encourage that research on sound in sea water be done to better determine absorption rates at depths >300m using various frequencies (and in particular 38 kHz), as research on this topic may be in the remit of this program, and that such work is relevant for acoustic assessment of deepwater fish stocks in SIOFA.

62. In relation to the acoustic review, the SAWG **recommended** that the SC consider the advice provided:

    - Standardised reporting should be adopted and acoustic data workshop/reviews should be held prior to biomass estimates being used in a stock assessment.

    - Key metadata and data storage methods should be developed and adopted so that results can be replicated.

    - Further investigations should be made to resolve the analytical difference in the geostatistical and transect mean and variance estimates that could affect all surveys.

    - Subject to the outcome of the previous recommendation, that for closely spaced parallel grid based surveys the EDSU mean and geostatistical variance should be adopted as used in current Australian and New Zealand stock assessments (the SAWG identified that New Zealand does not routinely use this approach).

    - The net attached AOS should be used in areas of complex species mixing and or steep slopes to reduce biomass estimation bias and uncertainty.

    - To resolve the potential target strength bias of a factor of 2 more visually verified target strength measurements should be obtained ideally with a net attached AOS on selected grounds.

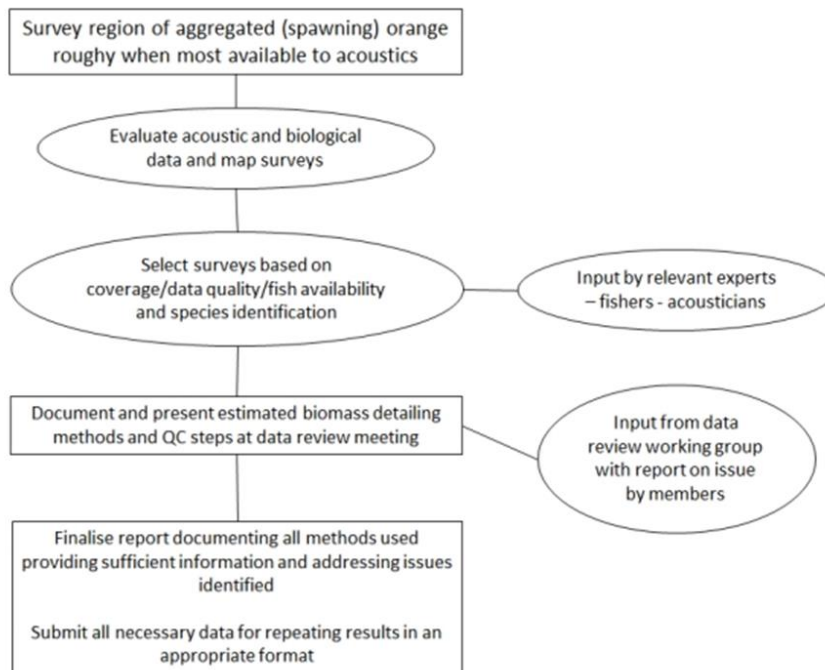   - The recommendations in section 3 [of the report] and previous documents for industry data collection (FAO, 2012; FAO, 2017) should be adopted.

63. The SAWG **recommended** that the SC consider the review protocol for acoustic surveys in SIOFA.

Proposed review mechanism for acoustic surveys for stock assessments in SIOFA

(3) Biological information

Paper summary

60. Paper SAWG(2018)-01-04 describes age composition of Sleeping Beauty spawning aggregation orange roughy in 2017, collected by F.V. *Will Watch* crew and observers. Otoliths of orange roughy were prepared and aged from the SB feature. Otoliths were prepared and read by one reader following the accepted ageing protocol. The objective was to develop an age composition for use in an assessment of this stock. A sample of 400 otoliths collected in 2017 was analysed. The age sample had a broad range from 21 to 140 years, with a mode from around 32 to 45 years. The results indicated post-transition zone growth was faster than for New Zealand orange roughy, and the sample indicated a higher proportion of older (>90 year old) fish than that in New Zealand stocks. Further, the fish were generally larger than those seen elsewhere. Results indicate that age at 50% maturity is at 37 years old, and as such it may be inferred from the surveys that there are likely to be fish that have not recruited to the aggregations.

SAWG discussion

61. Large variations in growth and size that were being seen in age composition and growth across multiple sub-regional areas may indicate complex stock structuring, highlighting the need for better information on stock structure. Further, these biological differences necessitate careful interpretation of various inputs, including those derived from the use of different otolith sampling protocols. Differences in the growth rates of certain populations may be a useful proxy for sub-regional stock differentiation. The SAWG noted that it is unclear if this indicates the existence of different stocks, or whether there might be the result of other factors (e.g. food availability, environmental conditions). Site fidelity also needs to be considered as orange roughy tend to return to the same home grounds to spawn. The evidence that maturity ogives are similar for these stocks and other stocks (e.g. NZ stocks)

coupled with the different growth rates observed may indicate that there are complexities in the biology of orange roughy in this region that have not been considered.

62. Sampling protocols for otolith collection for orange roughy in relation to the incidence of damaged samples were discussed (Cook Islands noted recent changes to the FAO 1020 protocol). The SAWG **recommended** that the SC consider the value of standard protocols for biological data collection.

(4) Stock structure and management units

63. The SAWG agreed that the term 'sub-regions' instead of 'management units' was more appropriate when referring to the orange roughy assessments.

Summary of papers

64. Paper SAWG(2018)-01-03 described the stock structure and management unit assumptions for orange roughy in the SIOFA Area. The paper noted that there is little information available to delineate stock structure in the SIOFA Area but that the available data and expert knowledge could be used to delineate plausible management units that may correlate with biological stock structure, at least at coarse scales. For stock assessments purposes, the SAWG suggested one potential sub-region, the Walter's Shoal Region in the southern part of SIOFA Area 2 (Madagascar Ridges), which includes 6 banks and knolls, where fisheries independent abundance indices (acoustic data) are available for 14 years (2004-2017) and catch is about 50% of the total in the SIOFA Area, and about 30% of the historical catch. The SAWG suggested (intersessionally) that stock assessments should be conducted there using acoustic data and assuming the area with the assumption that the 5-6 banks and knolls is a homogenous stock. The paper suggests that further stock structure research should be done to confirm the homogenous stock assumption in the Walter's Shoal area.

65. Seven other sub-regions were assumed as 'stocks', with assessment methods applied to six of these that had adequate data (SAWG(2018)-01-06).

SAWG discussion

66. The SAWG agreed that documenting the basis for the assumptions around the proposed stock structure was important so that it was transparent and could be reviewed. The Cook Islands provided a document summarising the information that had been used to identify preliminary sub-regions (stock structure) for use in the assessment, which is provided at Annex F. A confidential version with more detailed information was also provided to the Secretariat for future use by the SAWG and SC. Information on the geomorphological features, presence and timing of spawning aggregations and length frequency of the catches were used.

67. The SAWG discussed the uncertainties associated the process of identifying the preliminary stock structure, including larval dispersal and the influence of environmental factors on length frequency. Stock structure research requirements were considered further under agenda item 5.2.

Agenda item 4.2 Walter's Shoal Region (Area 2)

(1) Results by CASAL (Consultant)

Paper summary

68. SAWG(2018)-01-05 details the stock assessment of orange roughy undertaken for the Walter's Shoal region (WSR) (defined to be the region enclosed by the rectangle 33 50' to 34 41' S, 44 00' to 46 00' E). Biological data were used in conjunction with a stock hypothesis, a catch history, and acoustic biomass estimates to perform a

Bayesian stock assessment using NIWA's stock assessment package CASAL. The absolute scale of the WSR stock is very uncertain because the true scale of the acoustic biomass estimates is poorly known. Virgin biomass (B_0) is very likely to be in the range of 25 000 – 90 000 t. However, it is certain (given the stock hypothesis) that 2017 stock status is above 50% B_0 (the upper bound of the biomass target range for New Zealand orange roughy stocks).

69. Patrick Cordue thanked the Cook Islands for their nomination of ISL to do this work and the SIOFA Secretariat for their help formulating a contract. Graham Patchell was thanked for his dedication to and involvement in the work. NIWA was thanked for the use of their stock assessment package CASAL.

Methods

70. The method used is a single sex model with the following biological parameters:

   - Growth (von Bertalanffy was used)
      i. Fixed T_0 allows estimates of K and l_{inf}
   - Length-weight parameters
      i. A large amount of sexed length weight were available for WSR
      ii. LW relationship from SB was used
   - Natural mortality (*M*)
   - Stock-recruitment relationship (Beverton-Holt, steepness *h=0.75*)
   - Maturation parameters (normally estimated within the model)

71. ISL noted that selection of different steepness values and some growth parameters does not have a large influence on the assessment outputs due to depletion of the stock not being to levels that impact recruitment.

72. It was noted that the presence of fish 140 years old indicates that the stock should be in a relatively healthy state unless M is very low.

73. Late data from China and Norway may include some catch in the WSR region but these have not yet been included.

74. Due to the expectation of missing catches in the early 2000s, 2000 t of additional catch was added in 2000 and 750 t in 2001. Sensitivity runs were undertaken at half and double the parameter estimates.

75. The use of acoustic estimates was described. Eight acoustic survey biomass estimates were available that have been reviewed and refined; these were from five different features collected from 2007 to 2015 during peak spawning. A much larger set of acoustic estimates were available but had not be reviewed and refined; these were used in a sensitivity run. Potential biases arise from three factors: target strength, error in the absorption coefficient that was used and the analysis method. Double counting and species mix was not an issue for the reviewed surveys.

76. Three different treatments were used for the acoustic estimates:

   - Low: used factors that reduced the biomass estimates the most (Doonan absorption; geostatistical analysis): 63% of the original (base) biomass estimates
   - Base/middle: two adjustments that cancel out so that the original values were used (higher TS but design based instead of geostatistical estimate

- High: uses the option for each factor that increases the biomass estimates the most (ignore new TS data; design based analysis, Francois and Garrison absorption value: 165% of the original (base) biomass estimates.

77. Target strength assumptions for length were described and a method that did not consider tilt adjustment was used. A fixed slope of 16.15 for the TS = length function was derived from the literature and used for this relationship, but other slopes (e.g. 20) were considered.

78. Low, middle and high biomass estimates from the 8 acoustic surveys were described. All surveys retained for use in the assessment had relatively low CVs (11 to 43%); surveys with CVs greater than ~60% were not used. Variance in the survey biomass estimates is calculated from the geostatistical estimates.

79. Model structure was described.

- Single sex, with fish categorised by age (1+ to 120+) and whether immature or mature

- Seven areas: 'Home', 'Other', and five numbered features

- The 'Home' area was taken to have only immature fish, that migrate as soon as they mature using different constant migration proportions to the other areas)

- Fishing mortality was estimated at the end of the year on 'Other' and the numbered features and only mature fish, equally vulnerable by age). It is assumed that M occurs over the year and F is instantaneous at the end of the year. This assumption was made as almost all of the catch is made during the spawning season but does not make any difference to assessment outputs).

- Model is initialised at B_0 with an equilibrium age structure and constant recruitment (R_0)

- *M* is constant across ages

- Model starts in 1885 so that all year class strengths (YCS) can be estimated.

80. Free parameters in the model were described:

- B_0

- YCS (1887–1992)

- *M* with an informed prior

- Maturation: determined by the two parameters of a logistic curve (a_{50} to a_{95})

- Five migration parameters

- The acoustic *q*: the proportionality constant for the acoustic estimates; *q* scales the real spawning biomass to the acoustic estimate.

81. Bayesian estimation was described. Estimated parameters are treated as random variables and conditional probability is used to update their probability distribution (using Bayes' theorem). Ancillary information is used in prior distributions for the free parameters. The joint posterior distribution of the free parameters updates the prior distributions given the data that were observed (the updated belief about each parameter is described by its marginal posterior distribution).

82. There are two steps: 1) find the mode of the joint posterior distribution (MPD) and 2) Obtain samples from the joint posterior distribution using a Markov chain Monte Carlo (MCMC) process.

83. Informed priors were described:

- For q, if all fish were pluming at the same time and TS was correct then q=1. However, not all fish would have been surveyed and the TS is unlikely to be correct. The prior on the acoustic q accounts for potential bias in the estimates. The prior used was log-normal (mean=0.8, CV=25%). The largest potential biases in the assessment was captured through the three different treatments of the acoustic estimates (low, base/middle, high).

- Information on M was available from two lightly fished NZ orange roughy stocks (M=0.045). A sensitivity was run at 0.036 (20% lower). It was noted that this prior should be sensible given there is no indication the WSR stock has been heavily fished.

- The migration proportion to Other was assumed to be 20% based on the proportion covered in the six un-numbered features.

- The a_{50} maturity parameter was based on NZ orange roughy, and a weakly informed (large CV) prior was put on a_{to95}.

84. There were eight sensitivity runs performed:

- Low: This has the low treatment of the acoustic biomass estimates with only 10% of mature fish instead of 20% assumed to migrate to 'Other'.

- High: This has the high treatment of the acoustic biomass estimates with 30% of mature fish assumed to migrate to 'Other'.

- Uniform: This has a uniform prior on both maturation parameters.

- AF80: This has double the effective sample size on the age frequency (80 instead of 40).

- Low catch: The amount of catch added on to reported catch for 2000 and 2001 is half that assumed in the base model.

- High catch: The amount of catch added on to reported catch for 2000 and 2001 is double that assumed in the base model.

- Low, low M: The low treatment of the acoustic data and a fixed $M = 0.036$ (20% less than the mean of the prior in the base model).

- More acoustics: This uses a more extensive set of acoustic biomass estimates (that have not been revised/refined).

Results

85. Projections were run to explore whether current catches could deplete the stock to an undesirable state (see Figures 5 and 6).

86. MCMC chain diagnostics were presented, which included checks for drift. ISL noted that chain diagnostics suggested that the joint posterior distribution had been sampled adequately. Convergence for B_0 is adequate. There was variation in the estimate for current status, but it was noted that this was small and of little consequence for the development of advice on stock status.

87. ISL presented the base model MCMC results, covering MPD fits to the data, and MCMC fits to the acoustic biomass indices. All diagnostics indicated that results were adequate.

Base model results

88. The base model MCMC biomass and status estimates (median) and 95% credibility intervals were presented (Table 1). The point estimates are the median of the marginal posterior distribution and 95% CIs are given around these point estimates.

89. It was noted that the estimated YCS are consistent with deterministic recruitment.

90. The spawning stock biomass (SSB) trajectory was presented (Figure 1) and it was noted that the stock has not depleted substantially relative to the base case estimates of SSB (43,000 t).

91. Annual exploitation rates suggested that only one year (2000) had exceeded the HCR_{max} derived from the NZ HCR (Figure 3).

92. The Kobe/phase plot was presented showing the exploitation rate in relation to the HCR_{max} and $U50\%B_0$ and $U30\%B_0$ reference points (Figure 4).

Sensitivity analyses

93. For all sensitivity runs, current spawning biomass was estimated to be above $50\%B_0$ (Table 2).

94. The feature by feature analysis was presented to investigate potential for local depletion. One feature 'Other' (the combination of the six unnumbered features) showed some potential for depletion (noting that this only occurred in the low and low-low sensitivity runs).

Base model projections

95. Stochastic projections at current catch levels showed no issues of concern for the sub-region as a whole. For individual features 1 and 4, projected spawning stock biomass may go below $50\%B_0$ in the next 5 years (Figure 6).

96. The 'Low' sensitivity indicated there could be potential for localised depletion on some features.

97. Base model projections were based on the exploitation rate of u=5.625%. For these exploitation rates to be met, catches would need to be much higher (but would decrease year on year).

Conclusions

98. Absolute scale of the WSR stock is very uncertain because the true scale of the acoustic biomass estimates is very uncertain. It is very probable that B_0 is in the range of 25,000-90,000 t. Stock status is estimated to be above 50%. Local depletion may be an issue for some un-numbered features within 'Other' if they were heavily fished in 2000-2001 and have not yet recovered. Current catches with the current spatial distribution are not considered unsustainable (except perhaps for feature 4). The challenge is to devise a practical management regime that maintains the stock at sustainable levels and avoids local depletion of any of the sub-stocks.

Table 1: Base model: MCMC estimates of virgin spawning biomass (B_0), current spawning biomass (B_{17}), current stock status (B_{17}/B_0), and the probability of current biomass being above 30% B_0 or 50% B_0. The median and 95% CI are given for each parameter. The second row gives the local depletion estimates for spawning biomass at each numbered feature and collectively the un-numbered features (Other). Local depletion is the current biomass at the feature divided by the virgin biomass at the feature (expressed as a percentage).

B_0 (000 t)	B_{17} (000 t)	ss_{17} (% B_0)	P(B_{17} > 30% B_0) (%)	P(B_{17} > 50% B_0) (%)
43 29-64	32 19-53	76 63-87	100	100

Other	Feature 1	Feature 2	Feature 3	Feature 4	Feature 5
75 60-87	66 51-79	99 90-107	89 80-98	66 49-80	71 57-83
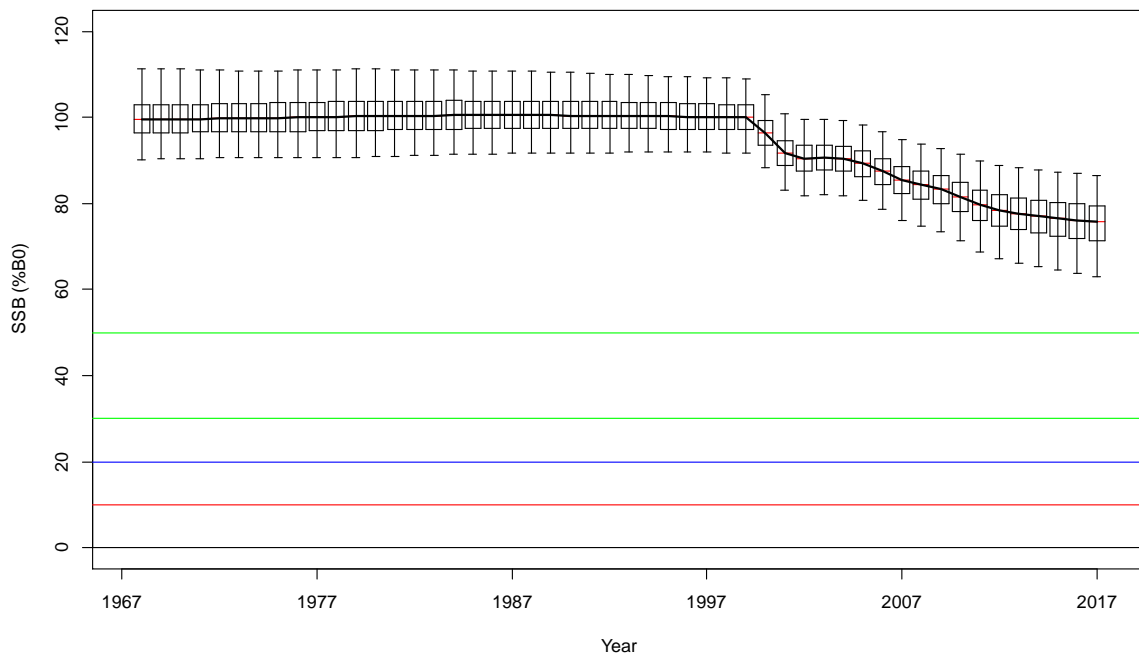
Figure 1: Base model MCMC: box and whiskers plot of the spawning biomass trajectory for the whole stock (% B_0). Each box covers the middle 50% of the distribution and the whiskers extend to a 95% CI.
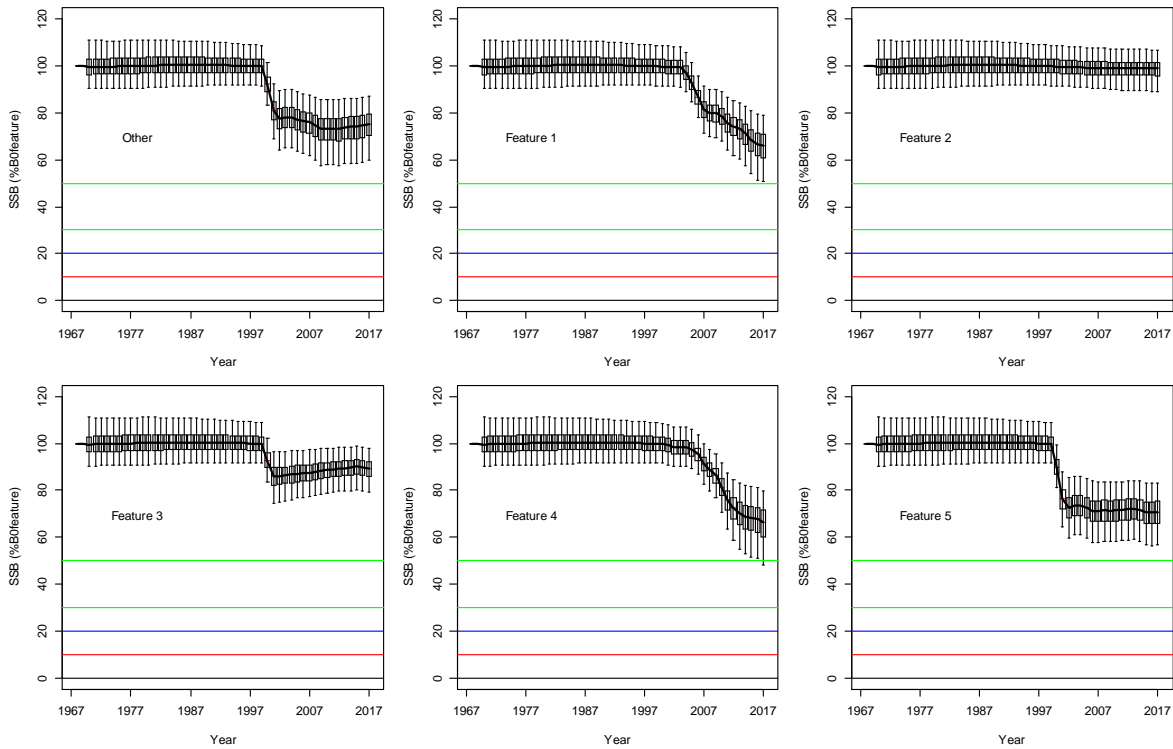
Figure 2: Base model MCMC: box and whiskers plot of the spawning biomass trajectory for Other and each numbered feature (% of virgin biomass at the feature). Each box covers the middle 50% of the distribution and the whiskers extend to a 95% CI.
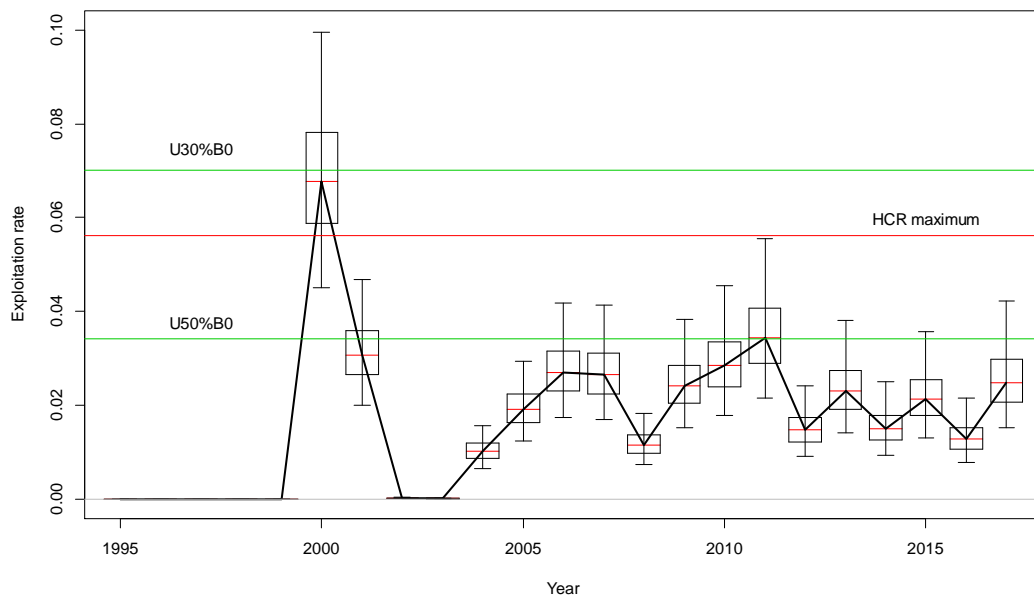
Figure 3: Base model MCMC: box and whiskers plot of the exploitation rate trajectory for the whole stock. Each box covers the middle 50% of the distribution and the whiskers extend to a 95% CI. The New Zealand HCR has a target biomass range of 30–50% B_0. The associated target exploitation rate range of $U_{30\%B0}$–$U_{50\%B0}$ is plotted (where $U_{x\%B0}$ is the exploitation rate that delivers a deterministic equilibrium spawning biomass of x% B_0). However, the maximum exploitation rate allowed in the HCR is less than $U_{30\%B0}$ and is marked by a red line.
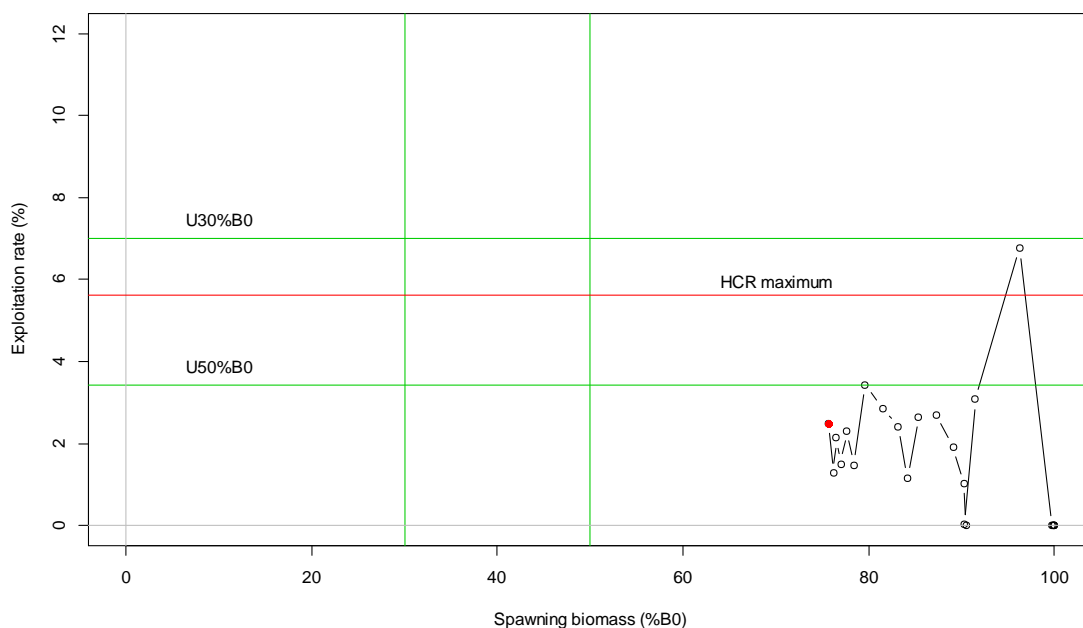
Figure 4: Base model MCMC: snail trail showing stock status and exploitation rate trajectories (medians) (current stock status and exploitation rate marked as the solid red point). The New Zealand HCR has a target biomass range of 30–50% B_0. The associated target exploitation rate range of $U_{30\%B0}$–$U_{50\%B0}$ is plotted (where $U_{x\%B0}$ is the exploitation rate that delivers a deterministic equilibrium spawning biomass of x% B_0). However, the maximum exploitation rate allowed in the HCR is less than $U_{30\%B0}$ and is marked by a red line.

Table 2: MCMC estimates: medians and 95% CIs for virgin spawning biomass (B_0), current spawning biomass (B_{17}), and current stock status ($ss_{17} = B_{17}/B_0$) for the base model and sensitivities (see the text for the description of each run). The estimated probability (%) of current spawning biomass being above 30% B_0 or 50% B_0 is also given.

	B_0 (000 t)		B_{17} (000 t)		ss_{17} (%B_0)		P(B_{17} > 30%B_0)	P(B_{17} > 50%B_0)
Base	43	29-64	32	19-53	76	63-87	100	100
Low	29	22-42	19	12-31	65	53-77	100	100
High	71	46-97	61	37-86	85	76-94	100	100
Uniform	42	29-64	32	19-53	75	63-86	100	100
AF80	43	30-67	32	19-55	74	62-85	100	100
Low catch	42	28-65	32	18-55	77	65-88	100	100
High catch	43	29-66	32	18-53	73	60-84	100	100
Low and low *M*	29	23-42	19	12-31	63	53-75	100	99
More acoustics	44	30-69	34	20-58	76	64-87	100	100
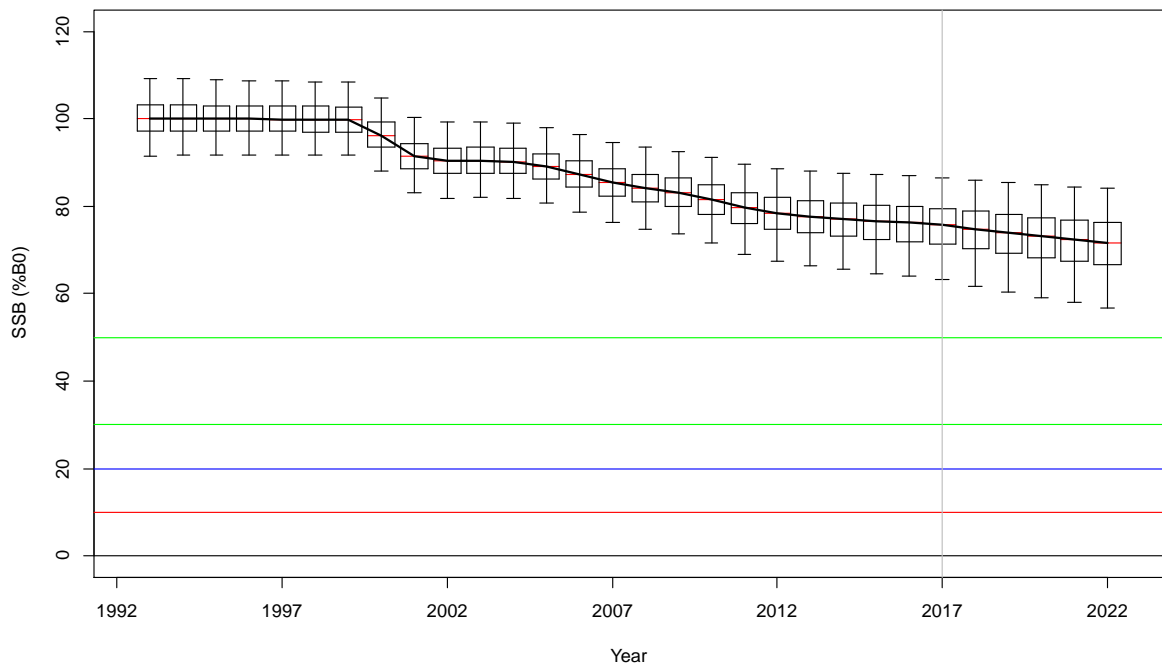
Figure 5: Base model MCMC: constant catch projection at current levels: box and whiskers plot of the spawning biomass trajectory for the whole stock. Each box covers the middle 50% of the distribution and the whiskers extend to a 95% CI.
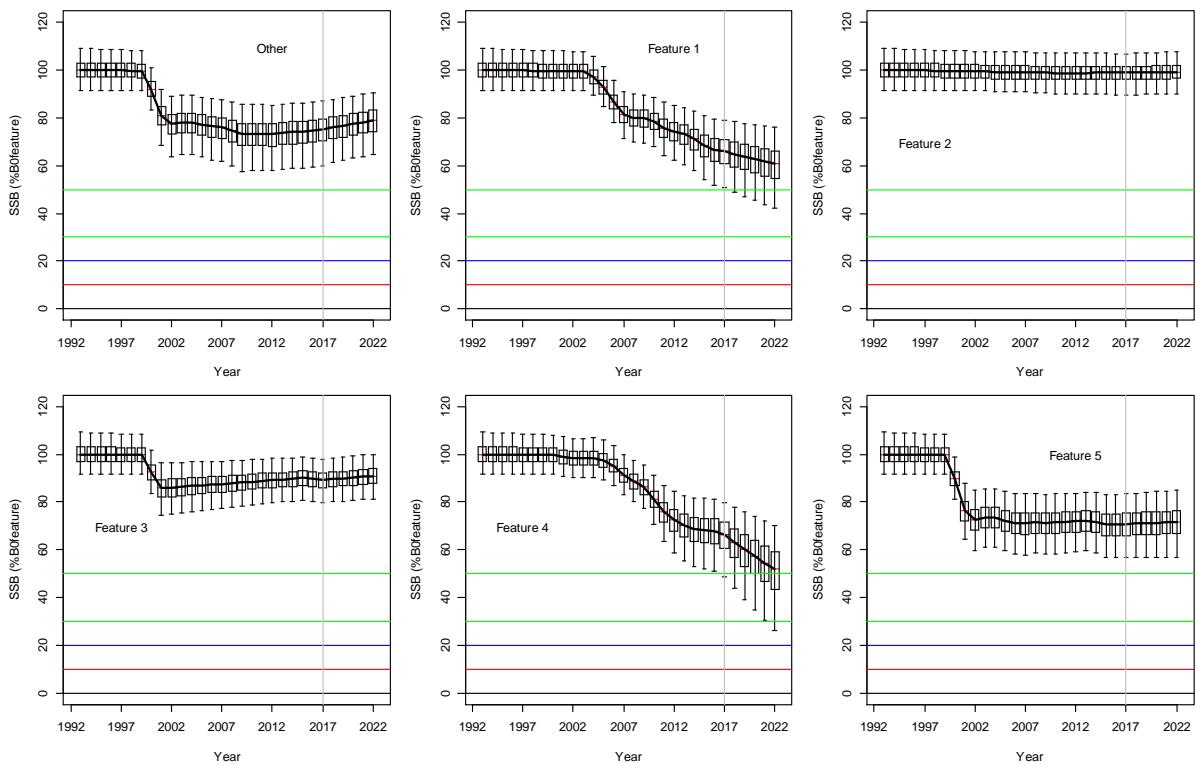
Figure 6: Base model MCMC: constant catch projection at current levels: box and whiskers plot of the spawning biomass trajectory for each numbered feature and collectively each un-numbered feature (Other). Each box covers the middle 50% of the distribution and the whiskers extend to a 95% CI.

SAWG discussion

99. The SAWG discussed whether feature 4, where biomass may be expected to decline (see Figure 6), would be influenced by the use of all of the (i.e. additional) acoustic estimates. It was queried whether processing all the additional acoustic data would provide a better estimate of biomass. It was agreed the sensitivity run that used additional acoustic estimate for feature 4 and that working up the additional acoustic estimates would provide a better estimate for this feature. However, ISL noted that the inclusion of additional acoustic data would not change the estimate of B_0 by a large amount, unless the acoustic estimates that were not used were substantially different to those that were.

100. The SAWG discussed whether the 5 year projection was relevant to the current management of the sub-region given the longevity of the species. It was noted that projections could be run for different timeframes but that given the assumptions on management (i.e. constant catch) it was not necessarily realistic to project this for a longer time period. It is noted that 5 years projections are requested in the SAWG ToR.

101. The SAWG discussed whether recruitment that takes historical depletion into account could be incorporated into the model. It was noted that due to low levels of depletion, and assumed steepness, this would not influence the projections of depletion. It was noted that there was always the possibility of poor recruitment due to environmental factors.

102. The SAWG discussed the possible merit in using reproductive potential instead of a maturity ogive, and whether this may address questions raised in relation to how reproductive contribution might change with the size of fish in the population.

103. It was discussed whether runs of low steepness of the stock recruitment relationship would be useful for exploring potential outcomes of current exploitation, given potential for localised depletion of feature 4 and 'Other'. However, it was noted that this was probably not very important given the current depletion estimate for the total sub-region. It was noted that exploration of lower steepness values would be more important if the stock was at a lower level. It was discussed whether changes to projection trajectories would be slower under lower steepness values, and noted that lower steepness would result in a slower rebuild. The SAWG agreed that at the current levels of depletion this would not make much difference to the generation of stock status advice. It was noted that if a feature represents a stock and was fished down in the early years of the fishery, then poor recruitment would not be expected until 20 years from now. This highlighted a limitation of the model in that one stock is assumed across the sub-region.

104. The SAWG queried whether selectivity is fixed in the model; in response it was noted that the model assumed equal vulnerability of selection across ages.

105. The SAWG queried if aging error was included in the model and noted that the CASAL model incorporates a 10% ageing error.

106. In relation to the use or discarding of certain acoustic data sets, it was noted that effort would be better directed at sorting out some of the uncertainties around the acoustic estimates (e.g. TS and absorption) as opposed to processing additional acoustic data for WSR.

(2) Management advice

107. The SAWG discussed the requirement to provide advice on the status of stocks and advice on appropriate reference points. The SC has not been explicitly tasked to provide management advice in the form of proposed catch limits. Consolidated advice for Agenda item 4 orange roughy is provided at the end of this section.

Agenda item 4.3 Harvest Control Rules (SIOFA Statistical Area 1, 2, 3a and 3b) (Consultant)

Paper summary

108. Paper SAWG(2018)-01-06 details assessments and application of New Zealand's harvest control rule to several orange roughy sub-regions within SIOFA statistical areas 1, 2, 3a and 3b (using catch histories available as at 23 February 2018 for the catch-history only methods). For six sub-regions a catch-history based assessment is performed. For three of those sub-regions a simple model-based (MPD) assessment is also done using acoustic biomass estimates (and some inputs from the WSR assessment).

Methods

109. ISL noted that the assessments were done on what were believed to be the most appropriate sub-regional 'stock' boundaries (Figure 7), but that assessments could be combined for each of the SIOFA statistical areas (or other boundaries) if this was desired.
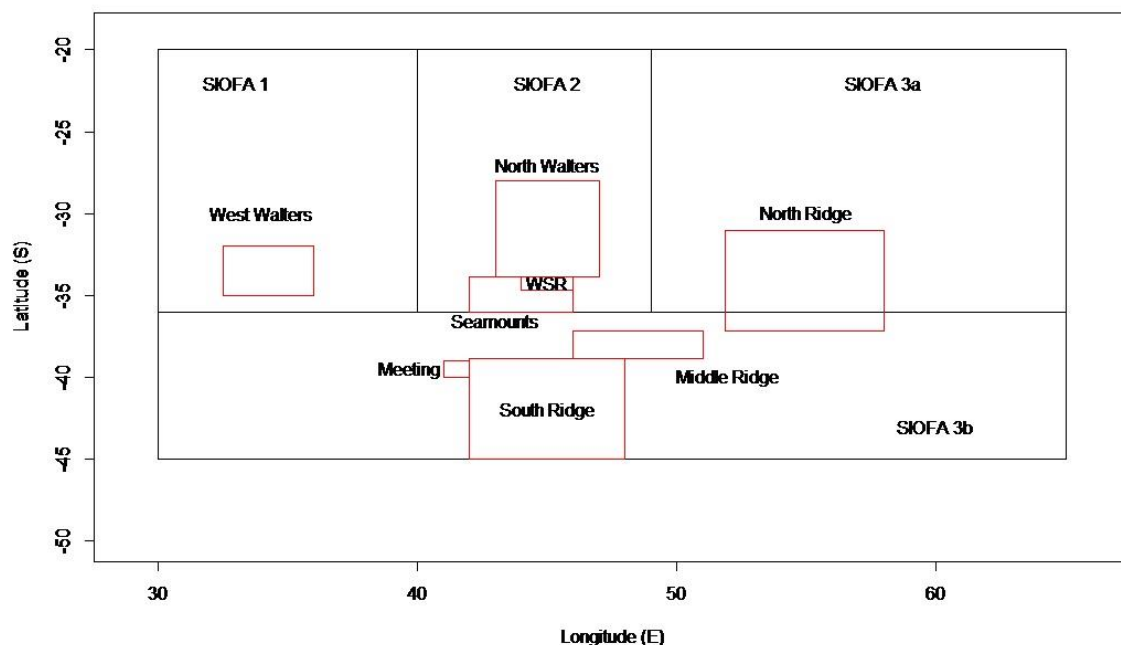
Figure 7: SIOFA statistical regions (1, 2, 3a, and 3b) and the stock boundaries defined for the purposes of these stock assessments. WSR = Walter's Shoal Region which was assessed separately (see agenda item 4.2).

110. Construction of catch histories used for these assessments was presented and it was noted that these may change for some sub-regions based on unaccounted mortalities. It was highlighted that not all data used had been verified and provided through government agencies, and that some data were based on corroboration by the fishing industry. Consequently, it was suggested that the updated data on fishing mortality that had recently become available should be used. Revised results incorporating updated catch histories were presented to the SAWG and are reflected in this report (SAWG(2018)-01-06-Rev-1).

111. ISL noted that none of the acoustic estimates that were used had been reviewed or refined. Surveys with large CVs (>60%) were not used. Only surveys noted to be at peak spawning were used. Low, middle and high treatments were applied to the acoustic estimates.

112. Most of the model biological parameters were the same as for the WSR assessment. Three different maximum exploitation rates were considered in the initial assessment: 50%, 20% and 10%. The key question in relation to exploitation rates is what proportion of the stock could have been taken during the peak fishing period (2000 and 2001).

113. It was noted that once this maximum exploitation rate is assumed, B_0 can be calculated.

114. The acoustic q posteriors from WSR were used as informed priors for the Bayesian MPD estimates.

115. ISL described the application of the NZ orange roughy harvest control rule (HCR) and associated reference points.

(1) Results

116. Results were provided for each maximum exploitation rate (Table 3) and for each treatment of the acoustic estimates for the three stocks for which these were used (Table 4). As expected, higher maximum exploitation rates result in much lower potential catch limits, as the stocks are assumed to be much smaller. Results were provided for the catch-only estimates and indicated that at U_{max} of 50% the three stocks would only be lightly depleted. It was noted that the key question was what is plausible in terms of a maximum exploitation rate for the whole 'stock'.

117. The MCMC (WSR) results for biomass and status were compared to the MPD (using acoustic) and catch-history only methods, showing generally consistent results.

118. It was noted that there is some concern about potential mixed species composition in some of the acoustic estimates for a small number of features and this may make the estimates from certain features unreliable.

119. ISL recommended that:

- Appropriate U_{max} values should be considered for each sub-region

- The reliability of the acoustic estimates on features that may have mixed species needs to be considered

- In general, the MPD estimate based on acoustic estimates are to be preferred to the catch-history based estimates.

SAWG discussion

120. The SAWG noted that in the early years of the fishery (1999–2003), a substantial part of the catch was taken by non-Contracting Parties.

121. The SAWG clarified that its main task was to provide an indication of stock status for the sub-regions assessed.

122. The SAWG discussed the maximum exploitation rates assumed for the initial assessments (50%, 20% and 10%) and noted that 50% was too high. The WSR sub-region had an exploitation rate of less than 10%. It was reported that the proportion of spawning habitat on a feature that is fishable could be as low as 1-2%, which may mean the use of a low U_{max} is suitable. The SAWG discussed that it may not have time to explore exploitation rates for individual sub-regions in detail, and that this would only be necessary if there is any concern around the status of any of the sub-regions. In relation to exploitation rates, the SAWG agreed that the use of 5% and 40% for U_{max} values was more appropriate than the 10%, 20% and 50% values run for the initial assessment. These results are reflected below.

123. For the catch history-only method, the revised catch histories (SAWG(2018)-01-06-Rev1) only resulted in minor changes to estimates of status for most sub-regions (SAWG(2018)-01-06), but it was noted that the addition of catch history data would provide more accurate results.

124. It was noted that U_{max} values of 40%, if plausible, may indicate some concern for the Seamounts sub-region, but that these exploitation rates were still at the very high end of plausible rates. The MPD estimate indicated that there was no concern.

125. For the MPD-based method, the revised assessment using updated catch data (which only resulted in revision for Middle Ridge) did not result in any substantial changes.

Tables

Table 3: The calculated values of virgin biomass (B_0), current biomass (B_{17}), and current stock status (ss_{17}) for each assessed stock and the two levels of historical maximum exploitation rate.

		B_0 (000 t)	B_{17} (000 t)	ss_{17} (%B_0)
Meeting	U_{max} = 40%	4.2	3.2	77
	U_{max} = 5%	34	33	97
N. Walters	U_{max} = 40%	2.7	1.5	57
	U_{max} = 5%	20	19	94
Seamounts	U_{max} = 40%	9.1	2.0	22
	U_{max} = 5%	43	36	84
N. Ridge	U_{max} = 40%	15.5	7.8	50
	U_{max} = 5%	104	96	93
M. Ridge	U_{max} = 40%	22	13	59
	U_{max} = 5%	160	151	94
S. Ridge	U_{max} = 40%	8.7	3.7	43
	U_{max} = 5%	65	60	92

Table 4: The MPD estimates of virgin biomass (B_0), current biomass (B_{17}), and current stock status (ss_{17}) for each assessed stock and each of the three different treatments of the acoustic biomass estimates (see paragraph 111).

		B_0 (000 t)	B_{17} (000 t)	ss_{17} (%B_0)
N. Walters	Low	9.7	8.5	88
	Middle	13	12	91
	High	19	17	94
Seamounts	Low	24	17	70
	Middle	31	24	77
	High	45	38	84
M. Ridge	Low	55	46	84
	Middle	75	66	88
	High	108	99	92

(2) Management advice

126. **In relation to the biological information used for the orange roughy stock assessments, the SAWG recommends that the following advice be noted by the SC:**

  - There is uncertainty in the biological parameters that underpin all assessments

  - The results of the ageing work carried out under agreed protocols are valid inputs to the orange roughy assessments

  - The age composition data are valid inputs to assessment of biological parameters for the assessment of orange roughy Stocks in SIOFA (noting that these inputs were subsequently stratified by sex in the stock assessment).

127. **In relation to stock structure assumptions, the SAWG recommends that the following advice be noted by the SC:**

  - The sub-regions assumed for the assessments are preliminary and based on the available information and expert judgement.

128. **In relation to the assessment approaches for orange roughy in the SIOFA Area, the SAWG recommends that the following advice be noted by the SC:**

  - The three assessment approaches can be regarded as data rich (1 sub-region (WSR) using acoustic indices and age-frequency data), data moderate (three sub-regions using only the MPD-based model incorporating acoustic indices and no age-frequency data) and data poor (three sub-regions using the catch-history only method).

  - The three assessment approaches are suitable for providing advice on the current stock status for the seven sub-regions assessed.

129. **In relation to the assessment outputs, the SAWG recommends that following advice be noted by the SC:**

  - Assuming an interim limit reference point of 20%B_0, all three assessment approaches indicated that there were no concerns about the current level of depletion for the 7 sub-regions assessed.

  - Projections for the WSR sub-region (assuming the base-case current SSB estimate of 67–87%) indicate that the stock in this sub-region is unlikely to be depleted to levels below the interim limit reference point in the next 5 years if future catches in these years do not exceed those reported in 2017.

  - Noting that the provision of advice on stock status requires a reference point(s) it would be prudent for the SC to be proactive developing advice on appropriate determination of reference points.

  - For transparency in advice related to rates of fishing mortality and catch limits it would also be prudent for the SC to consider possible harvest strategies (with associated harvest control rules) that could be applied to SIOFA orange roughy stocks

  - A total catch limit could be applied for the entire WSR sub-region

  - An interim limit reference point of 20%B_0 and an interim target reference point of >30%B_0 was agreed to be appropriate for orange roughy, should the

SC wish to develop advice on specific catch limits using the application of harvest control rules.

Agenda item 5 – Future work

Agenda item 5.1 Stock assessments

130.   Dr Anne-Elise Nieblas (External expert) presented paper SAWG(2018)-01-INFO12, which describes a Virtual Research Environment (VRE) to run stock assessment models. Stock assessment software are complex and advanced technical skills are required to develop the models. Producing output becomes time-intensive and even more complex as thousands of simulations must be run on super-computers in order to include the multiple sources of uncertainty in assessment results. As few stock assessment participants have the specific technical skills required to reproduce these outputs, our aim has been to develop a VRE that enables any user to easily parameterize, execute and edit online various steps of the stock assessment work flow, with standardized data outputs. A collaborative environment such as the VRE uses simple tools to enable the storage and access of the data and source codes necessary to replicate past results or to try new parameterizations of the model. Here, we illustrate the stock assessment work flow through the VRE using SS3 (a widely-used statistical catch-at-age model), as an example. Theoretically, this type of environment can be adapted for any species or stock assessment model, including CASAL.

131.   A number of scenarios were highlighted where the VRE could be used by a group such as the SAWG to run stock assessments and sensitivities in near-real time (limited to the run-time of the model). It allows participants of meetings, as well as experts, to use the VRE to interrogate stock assessments presented during meetings. Model outputs can be browsed and visualised. Model outputs can be stored for future reference, and reports can be partially automated.

132.   A demonstration of the online VRE tool was given. Key elements of the online tool include interrogation of metadata, R code (to automate SS3 runs), data and processing services (which allow model parameters to be interrogated), the automation of reports and R Shiny. The R Shiny graphical interface allows interactive interrogation of model outputs (which for SS3 are MPDs), including diagnostic plots.

SAWG discussion

133.   The SAWG noted that MCMC outputs (e.g. from the CASAL package) could not be parallelized in the form that was described in the paper and presentation as the MCMC require sequential processing.

134.   The SAWG noted that because of the small scale nature of fisheries such as the SIOFA orange roughy fishery in which a small number of vessels may be operating, there may be confidentiality issues that may not need to be considered in some of the bigger fisheries in which the VRE has been applied (as data are able to be aggregated). Dr Nieblas noted that it is possible to provide secure access to those who are authorised to access the data.

135.   In response to questions about how the VRE might be used by other RFMOs, it was clarified that the BlueBridge project is looking for other interested parties with which to engage.

136. In summary, Dr Nieblas noted that VRE can enhance participation, understanding and collaboration; it enables traceability and replicability of results; and facilitates standardisation of stock assessment outputs and metadata.

137. Dr Nieblas thanked collaborators and contributors to the project.

(1) Alfonsino

138. The SAWG Chair noted that stock assessment of alfonsino part of the workplan for 2019 and will require the development of a data inventory. Work on this inventory was started during the meeting. It was noted that there are many different sources of data for alfonsino. The SAWG suggested that the inventory should be informed by the *Global review of alfonsino* report (SAWG(2018)-01-INF011). A review of the SIOFA data holdings relevant to alfonsino is an important part of this work.

139. The SAWG discussed a stepped approach to the requirement to provide advice on the status of alfonsino in SIOFA, and proposed some indicative timeframes for intersessional progress:

Time line of Alfonsino stock assessments (SA) (SIOFA SAWG)													
Activities	Responsibility	2018									2019		
		4	5	6	7	8	9	10	11	12	1	2	3
Data Inventory + Scoping analyses	SAWG Chair with Parties + Data manager	▓	▓	▓	▓								
Decision on assessment approach	SAWG Chair with Parties + Consultant (if required)					▓							
Data submission	Parties and Secretariat	▓	▓	▓	▓	▓	▓	▓	▓				
Database	Secretariat	▓	▓	▓	▓	▓	▓	▓	▓				
Appointment of consultant/s	SAWG Chair + Secretariat				▓				▓				
Assessment analyses	Consultant and/or SAWG members										▓	▓	▓
SAWG02													▓

140. It was noted that the inventory will help to inform what sort of assessments could be undertaken. The SAWG discussed that some types of models (e.g. surplus production/biomass dynamic models) may not be suitable for species such as alfonsino. CASAL, SS3, or delay-difference models may be more appropriate, assuming adequate data are available.

141. The SAWG noted that there are many unresolved uncertainties (particularly around acoustic surveys and stock structure) and that stock assessment for alfonsino in 2019 may be premature. Regarding acoustic surveys, it was noted that there remains a high level of uncertainty around target strength estimates for alfonsino. The Cook Islands noted that some alfonsino TS measurements had been gathered with the S-AOS, but not processed. The SAWG noted the substantial funds invested in the recent TS estimation procedure noted in SAWG-01-INFO 10. It was noted that this was also the case for the current orange roughy assessments, and the value might be in the availability of relative indices of abundance as opposed to absolute estimates. However, this would require a time series of acoustic surveys for each stock unit. The SAWG noted the substantial additional investment in the recent orange roughy acoustic review, and this could give guidance to understanding the costs of establishing a time series of alfonsino acoustic surveys. This highlighted the

value of engaging experts (e.g. stock assessment scientists) in the early scoping stage to better understand what can be done given the data available.

(2) Patagonian toothfish

142.   The SAWG noted the agreement to collaborate with CCAMLR on Patagonian toothfish assessment and that SIOFA could consider the results of CCAMLR assessment results in its deliberations on the status of Patagonian toothfish.

143.   It was noted that the main known fishing grounds of toothfish relevant to SIOFA are on the Del Cano Ridge, which is adjacent to Crozet and Kerguelen islands (France (Territories) EEZ) and Prince Edward and Marion islands (South African EEZ). It is likely that these are part of the same stock.

144.   A number of different methods are used in CCAMLR to assess stocks based on the availability of data (e.g. CASAL, CPUE-by-seabed methods). It was described that the assessments for the Heard Island and McDonald Islands (HIMI) stock are conducted using CASAL, and it is assumed that CPUE relationships to stock status from the HIMI area can be adapted to the other toothfish stocks in data poor areas.

145.   It was considered that an adaptation of the CCAMLR method for data poor areas could be applied to stocks within, or straddling, the SIOFA Area.

146.   It was noted that tag recaptures indicated that toothfish were likely moving across large areas and that collaboration with CCAMLR (and potentially other entities) was useful. It was noted that similarly to alfonsino, a characterisation of catches and potential assessment options was required.

147.   The SAWG recalled that SC2 tasked the SC Chair and France (Territories) with maintaining collaboration with CCAMLR in relation to the use of data in CCAMLR assessments, including in relation to the provision tag of recaptures collected by vessels from SIOFA Contracting Parties to CCAMLR. This collaboration should extend to South Africa and Australia and the SAWG **requests** Contracting Parties to assist in these discussions.

148.   It was noted that intersessional work will continue on the provision of advice on the status of Patagonian toothfish in the SIOFA Area, as per the following indicative timeline:

Time line of Patagonian toothfish stock assessments (SA) (SIOFA SAWG)													
Activities	**Responsibility**	**2018**									**2019**		
		4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
Data Inventory	**SAWG Chair with Parties + Data manager**	▓	▓	▓	▓								
Discussion on collaborative approach with CCAMLR, relevant states	**SAWG Chair/Nominated Parties (TBC)**	▓	▓	▓	▓	▓	▓	▓	▓				
Decision on assessment approach	**SAWG Chair with Parties + collaborators**					▓							
Database	**Secretariat**	▓	▓	▓	▓	▓	▓	▓					
Assessment analysis	**SAWG members + collaborators**									▓	▓	▓	▓
SAWG02													▓

(3) Other species

149.   The SAWG discussed the process for considering other species. It was agreed that the SC or the SAWG can propose other species for consideration as part of its

workplan. It was acknowledged that there are other species and fisheries that may warrant further consideration by the SAWG. The fishery on the Saya de Malha bank (being fished or has previously been fished by Thailand, France (Territories), Seychelles, Mauritius and potentially some non-Contracting Parties) was highlighted as an area that may warrant further investigation. Thailand noted that it would be grateful for advice on SIOFA's priorities regarding investigation of species with which its fisheries interact.

150.   In relation to paper SAWG(2018)-01-INF03, it was noted that Peter Coulson from Murdoch University had started sampling boarfish (armourhead) otoliths with early indications that fish from the southern Indian Ocean are living much longer than previously assumed.

151.   It was also noted that substantial boarfish catches in the southern Indian Ocean had been taken in some years (particularly during 1999, 2000 and 2001).

152.   The SAWG **requests** the SC's advice on the prioritisation of other species for which advice on status may be required.

Agenda item 5.2 Stock structure studies

(1*) Orange roughy*

153.   It was noted that programs to collect genetic samples for single-nucleotide polymorphism (SNP) analysis were investigated during 2017 and 2018. SNP analyses provide a greater number of genetic markers to make inferences about stock structure and consequently the sampling power of SNPs is far higher than that of microsatellite analysis or mitochondrial DNA. It was noted that the new approach may provide information on differences that may not have otherwise been detected using other approaches.

154.   A research group from the University of Victoria in Wellington, NZ and collaborators affiliated with the University of Canberra have been approached regarding analyses to address stock structure questions in SIOFA. Research could be done through postgraduate research studies, with a realistic timeframe of 2-3 years for definitive results for orange roughy. This may feed into the next iteration of orange roughy assessments. It was noted that sampling in 2018 would be limited to only a few locations if sampling was to coincide with collection of otoliths on spawning aggregations. The group was informed that sampling spawning aggregations was the preferred design methodology for analyses proficiency and use in stock assessment. It was noted that temporal partitioning of samples (ie across years) would not prevent this type of analysis being extended to the entire fished area to get a better overall picture of stock structuring if sampling within other stocks was to occur when they are fished (as spawning aggregations) in future years.

155.   It was noted that the research group does not have experience with alfonsino, but that the experience of the group may enable this species to be included. The collection of samples in SIOFA fisheries is the leverage for SIOFA to be involved in this work. It was noted that sampling could be flexible (i.e. spatially and temporally opportunistic), so should not be a large burden on crew and/or observers. In terms of costs, some sampling equipment may be required, but it was thought that these costs may be relatively low.

156.   The Cook Islands noted three stocks where there were plans to collect age composition data in 2018, and that their vessels would be able to take genetic samples at the same time. The SAWG recommended a number of orange roughy stocks where genetic sampling could lead to improved understanding of stock structure: Walters South (age composition available but genetics would be useful),

Walters Seamounts, Middle Ridge and South Ridge. It was noted that sampling should be done during the spawning season.

157. The SAWG noted that this work represents an opportunity for SIOFA to demonstrate its commitment to scientific collaboration and the development and application of cutting-edge science.

(2) Alfonsino

158. The potential uncertainty regarding alfonsino stock structure were highlighted and it was suggested that it may be important to define 'areas of interest' because of the species' broad geographical distribution (a focus on the southern Indian Ocean was suggested as a possible way to constrain any research in this regard).

159. It was noted that work on alfonsino genetics has been done in New Caledonia and is noted as part of the *Global review of alfonsino* (SAWG(2018)-01-INF011). It was suggested that the global review could be used to start to define a stock structure hypotheses for alfonsino.

(3) Patagonian toothfish

160. Collaboration on tag recaptures was cited as the main contribution to work in this regard.

Agenda item 5.3 Budgets and timeline

161. The Secretariat noted that an SC activities budget of 30,000 EUR was available to be split between the SAWG and the ERAWG for 2018 and that previous unspent funds from 2017 were being used to finance the ISL consultancy (Orange Roughy Stock Assessment and Harvest Control Rule) owing to delays in starting this work.

162. A successful application was submitted for EU grant aid to support the ISL consultancy. The result of this application means that up to 80% of this cost can be claimed back.

163. The EU is making available up to 60,000 EUR of support funding for SIOFA science and compliance activities each year through an annual programme to assist international fisheries organisations. It was noted that access to these funds requires a 'non-guaranteed' funding application process and that advanced notice was needed in order to process funding applications and facilitate acceptance. Activities should be formally approved prior to an application being submitted. The maximum intervention rate is 80% thus requiring a 20% contribution from the SIOFA budget.

164. The Secretariat made it clear that the possibility to apply for EU grant aid must not be used as a reason for Contracting Parties to reduce financial contributions for scientific work. The EU grant can only be available for agreed activities/work that cannot be undertaken by SIOFA SC members themselves and for which there is insufficient SIOFA budget. The secretariat also noted that other avenues of funding are being explored.

165. It was noted there are two emerging areas of key research needs: alfonsino and the fisheries on the Saya de Malha bank. It was noted that it is often unclear whether member states have resources to invest in the assessment of these fisheries.

166. The following priority activities were noted:

- Establishment of a Target Strength and length relationship for alfonsino (data collection has already been done) (cost uncertain)

- Otolith preparation and reading for ageing for alfonsino, orange roughy or other species (estimated for 1 age composition of 400 otoliths, approx. 8,000 EUR)

- Genetics work to provide equipment for SNP analyses to postgraduate students (estimated 5,000 EUR)

- Stock assessment consultant for alfonsino work

- Investigation of 'new' fisheries (e.g. characterisation of Thai fisheries on Saya de Malha, identification of key knowledge gaps).

167.   The SAWG noted that research priorities and costs of activities will be discussed in more detail during the SC meeting.

Agenda item 6 – Other business

Relationships with other SIOFA working groups

168.   Relationships between the work of the SAWG and the ERAWG were discussed and it was noted that the ToR for the ERAWG align very closely with the outputs of the SAWG assessment (for tier 2 and 3 species). It was suggested that the two working groups could be combined for efficiencies, particularly given the overlap in the membership of the two groups. The proposals for an additional Ecosystem Working Group and the yet-to-be-formally established Protected Areas Working Group were also noted as possible reasons to consider the combination of the SAWG and ERAWG.

169.   The SAWG **requests** the SC to consider the possible merger of the Stock Assessment Working Group and the Ecological Risk Assessment Working Group.

Acknowledgements

170.   Graham Patchell, as well as Sealord, were thanked for the exceptional contributions made to the assessment of orange roughy stocks in the SIOFA Area, in particular the contributions made to constructing the orange roughy catch history and the characterisation of biological and acoustic data for use in the assessment. It was acknowledged that this work was based on many years of dedication and experience.

Coding issues

171.   It was discussed that various codes are used for different purposes, for example for marketing and export/import. The SIOFA Data Manager noted that scientific names should be submitted next to codes as much as possible so that codes can be checked. It was noted that the data standards CMM 2017/01 specifies that FAO codes should be used.

172.   It was noted that there are potentially several species for which coding errors or confusion may exist. It was suggested that a letter could be sent to FAO to ask for codes to be changed for iconic species over which there is a level of confusion.

173.   Before a letter can be sent to FAO, it will be necessary to analyse the codes and identify where errors or confusion may exist.

174.   The SAWG **requests** the SC to request that the SIOFA Chairperson send a letter to FAO regarding coding issues for SIOFA species.

Agenda item 7 – Dates and place for SAWG2 (2019)

175. It was proposed that the SAWG occur immediately before SC4. The issue of having a break day was raised and whether or not it was appropriate in terms of the costs and the time. It was noted that meeting duration should depend on the agenda and what needs to be covered.

176. Venue and dates would be determined by the SC meeting.

Agenda item 8 – Advice to SC3

177. The SAWG discussed that there are other fisheries in SIOFA (both historical and current) that are not considered within the current Terms of Reference. This was partly raised in relation to concerns that some fisheries may have been heavily exploited and depleted in a short timeframe. It was noted that Contracting Parties who had recently joined SIOFA (e.g. Thailand) are exploiting species that have not been considered to date by the SAWG. The SAWG **requests** that these issues are considered by the SC.

178. In relation to the tiered assessment framework, the SAWG **recommends** that the SC:

- **Adopts** the proposed assessment framework for SIOFA fisheries to provide direction for future assessment work and speed the SAWGs processes in developing analyses for the Scientific Committee.

- **Requests** Parties cooperate in the development of a Scoping Analysis for the species caught by their SIOFA fisheries.

- **Amends** the SAWG's work plan to include the activities described above.

- **Considers** the activities described above as part of the ERAWG's work plan.

- **Requests** the SIOFA data manager to support these activities.

179. The SAWG **recommended** to the SC that a letter be sent to the NORAD/FAO R.TV Dr Fridtjof Nansen program to encourage that research on sound in sea water be done to better determine absorption rates at depths >300m using various frequencies (and in particular 38 kHz), as research on this topic may be in the remit of this program, and that such work is relevant for acoustic assessment of deepwater fish stocks in SIOFA.

180. In relation to the acoustic review, the SAWG **recommended** that the SC consider the advice provided:

- Standardised reporting should be adopted and acoustic data workshop/reviews should be held prior to biomass estimates being used in a stock assessment.

- Key metadata and data storage methods should be developed and adopted so that results can be replicated.

- Further investigations should be made to resolve the analytical difference in the geostatistical and transect mean and variance estimates that could affect all surveys.

- Subject to the outcome of the previous recommendation, that for closely spaced parallel grid based surveys the EDSU mean and geostatistical

variance should be adopted as used in current Australian and New Zealand stock assessments (the SAWG identified that New Zealand does not routinely use this approach).

- The net attached AOS should be used in areas of complex species mixing and or steep slopes to reduce biomass estimation bias and uncertainty.

- To resolve the potential target strength bias of a factor of 2 more visually verified target strength measurements should be obtained ideally with a net attached AOS on selected grounds.

- The recommendations in section 3 [of the report] and previous documents for industry data collection (FAO, 2012; FAO, 2017) should be adopted.

181. The SAWG **recommended** that the SC consider the review protocol for acoustic surveys in SIOFA.

182. Sampling protocols for otolith collection for orange roughy in relation to the incidence of damaged samples were discussed (Cook Islands noted recent changes to the FAO 1020 protocol). The SAWG **recommended** that the SC consider the value of standard protocols for biological data collection.

183. **In relation to the biological information used for the orange roughy stock assessments, the SAWG recommends that the following advice be noted by the SC**:

- There is uncertainty in the biological parameters that underpin all assessments

- The results of the ageing work carried out under agreed protocols are valid inputs to the orange roughy assessments

- The age composition data are valid inputs to assessment of biological parameters for the assessment of orange roughy Stocks in SIOFA (noting that these inputs were subsequently stratified by sex in the stock assessment).

184. **In relation to stock structure assumptions, the SAWG recommends that the following advice be noted by the SC:**

- The sub-regions assumed for the assessments are preliminary and based on the available information and expert judgement.

185. **In relation to the assessment approaches for orange roughy in the SIOFA Area, the SAWG recommends that the following advice be noted by the SC:**

- The three assessment approaches can be regarded as data rich (1 sub-region (WSR) using acoustic indices and age-frequency data), data moderate (three sub-regions using only the MPD-based model incorporating acoustic indices and no age-frequency data) and data poor (three sub-regions using the catch-history only method).

- The three assessment approaches are suitable for providing advice on the current stock status for the seven sub-regions assessed.

186. **In relation to the assessment outputs, the SAWG recommends that following advice be noted by the SC:**

- Assuming an interim limit reference point of 20%B_0, all three assessment approaches indicated that there were no concerns about the current level of depletion for the 7 sub-regions assessed.

- Projections for the WSR sub-region (assuming the base-case current SSB estimate of 67–87%) indicate that the stock in this sub-region is unlikely to be depleted to levels below the interim limit reference point in the next 5 years if future catches in these years do not exceed those reported in 2017.

- Noting that the provision of advice on stock status requires a reference point(s) it would be prudent for the SC to be proactive developing advice on appropriate determination of reference points.

- For transparency in advice related to rates of fishing mortality and catch limits it would also be prudent for the SC to consider possible harvest strategies (with associated harvest control rules) that could be applied to SIOFA orange roughy stocks

- A total catch limit could be applied for the entire WSR sub-region

- An interim limit reference point of $20\%B_0$ and an interim target reference point of $>30\%B_0$ was agreed to be appropriate for orange roughy, should the SC wish to develop advice on specific catch limits using the application of harvest control rules.

187. The SAWG recalled that SC2 tasked the SC Chair and France (Territories) with maintaining collaboration with CCAMLR in relation to the use of data in CCAMLR assessments, including in relation to the provision tag of recaptures collected by vessels from SIOFA Contracting Parties to CCAMLR. This collaboration should extend to South Africa and Australia and the SAWG **requests** Contracting Parties to assist in these discussions.

188. The SAWG **requests** the SC's advice on the prioritisation of other species for which advice on status may be required.

189. The SAWG **requests** the SC to consider the possible merger of the Stock Assessment Working Group and the Ecological Risk Assessment Working Group.

190. The SAWG **requests** the SC to request that the SIOFA Chairperson send a letter to FAO regarding coding issues for SIOFA species.

Agenda item 9 – Adoption of the meeting report

191. The meeting report was adopted at 5.24pm on 18 March, 2018.

Agenda item 10 – Meeting close

192. The meeting was closed at 5.24pm 18 March, 2018.

The Southern Indian Ocean Fisheries Agreement (SIOFA)

1st Meeting of the Stock Assessment Working Group (SAWG), Saint-Denis 15-18 March 2018

LIST OF PARTICIPANTS

(as at 12/03/2018)

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AGENDA

1st Meeting of the SIOFA SAWG (Stock Assessments Working Group)

15-18 March 2018, Hôtel Mercure Créolia, 14 rue du Stade Montgaillard, Saint Denis, La Réunion

Meeting Room – SALON DISKOUR

Chair SAWG: Japan

This agenda for the 1st meeting of the SIOFA SAWG was developed to focus on the areas of work identified in its ToR agreed in SC02 (2017) (SC02 report: Annex K). Registration will be open from 08:00 and the meeting hour will be 9 am-5 pm daily.

NOTE1: After this meeting, SC03 will convene 20-24 March in the same venue

NOTE2: There may be at least one closed session where non-contracting parties and observers will be asked to leave the room (For details, see page 3)

NOTE3: Group photo will take place at an appropriate time.

Agenda	Related documents
1. Openings 　　1.1 Opening statement (Chair MoP: Japan) 　　1.2 Introduction of participant	
2. Administrative arrangements 　　2.1　Adoption of the Agenda 　　2.2　Confirmation of meeting documents 　　2.3　Appointment of rapporteur 　　2.4　Review of terms of reference	
3. SIOFA Management framework by tier approach 　　3.1　Data rich situation: Stock assessments based advices 　　　　(1)　MSY and B0 based approach 　　　　(2)　Target and limit reference points 　　　　(3)　Retrospective analyses 　　　　(4)　Stock trajectories plots 　　　　(5)　Risk assessments 　　3.2　Data limit situation: Indicators based advices using Harvest Control Rules (HCR) 　　3.3　No data situation: Parameters based advices by Ecological Risk Assessment (ERA)	● **INF#05** Deepwater WS-Report (2017) (SPRFMO) ● **INF#06** Tiered-assessment WS report (2017) (SPRFMO) ● **INF#12** Australian Management Protocols for Alfonsino: The Tier Management Method (2016) (Shotton) ● **INF#03** Report Pacific armorhead WS (2012)**INF#02** Data Limit Stock Guidance Report (2012) (ICES) ● **INF#07** Empirical Harvest Rules (2015) (SEAFO)

4. Stock assessments: Orange Roughy
 	
    4.1 Basic issues
       (1) Fisheries and Catch
	● **#03** Preparation for orange roughy SA+HCR (2018) (SIOFA-SAWG)
	
	● **INF#08** (Part 1-3) SOVIET AND UKRAINIAN information (2003) (Romanov)
	● #08 Summary of historical orange roughy catch (2018) (SAWG Chair + Secretariat)

(2) Abundance indices (acoustic data)	● **INF#01** FAO acoustic WS (2017) (FAO) ● **INF#09** OR biomass estimation in SIOFA - acoustic data (2017) (CSIRO) ● **INF#10** Review of SIOFA OR acoustic data. (2017) (CSIRO)

(3) Biological information
 	
       (4) Stock structure and management units
 	
  4.2 Walters Shoal Region (Area 2)
       (1) Results by CASAL (consultant)
       (2) Management advices
 	
  4.3 Harvest Control Rules (SIOFA statistical area 1,2,3a and 3b) *(consultant)*
       (1) Results
 	
       (2) Management advices
	● **#04** Orange Roughy Age Readings from Sleeping Beauty (2017) (Patchell)
	● **#05** Stock assessment of orange roughy Walter's Shoal (2017) Cordue)
	● **#09** PowerPoint for #05 (2018) (Cordue)
	● **INF#04** Orange Roughy Stock Assessments (2014) (Cordue)
	● **#06** Assessment of orange roughy stocks SIOFA Areas 1, 2, 3a and 3b (2018) (Cordue)
	● **#07** PowerPoint for #06 (2018) (Cordue)

5. Future works
  5.1 Stock assessments
    (1) Alfonsino
    (2) Patagonian toothfish (*)
    (3) Other species
  5.2 Stock structure studies
    (1) Orange Roughy
    (2) Alfonsino
    (3) Patagonian toothfish
  5.3 Budgets *(Secretariat)* **and timeline**
	● **INF#11** Global Review of Alfonsino, pages 121-123 (2016) (Shotton)
	● **INF#12** A virtual research environment to easily run stock assessment models with reproducible results
	● **INF#13** Alfonsino data inventory

6. Other business **7. Dates and place for SAWG02 (2019)** **8. Advice to SC03** **9. Adoption of the meeting report** **10. Closings**	

(*) Participants are requested to report on data inventories to prepare Alfonsino and Patagonian toothfish stock assessments next year. Available historical catch and CPUE, as well as biological and other relevant information need to be reported as information paper)

Information on "closed session"

As previously notified on the SIOFA website http://www.siofa.org/node/68 there may be at least one closed session where non-contracting parties and observers will be asked to leave the room, owing to the confidential and commercially sensitive nature of some data that is intended to be presented.

In accordance with SIOFA Rule of Procedure 20 (see below), the SAWG may decide that exceptional circumstances require that part of this meeting be held in closed session. In consultation with both SC and SAWG Chairpersons and to assure adherence to the SIOFA Rules of Procedure the process will be as follows;

1. On adopting the agenda, some MoP (hereafter MoP A) will make a request providing explanation and justification which agenda item, or portion of an agenda item, should be closed for exceptional reasons.

2. Based on the explanation provided, the SAWG will decide whether it is justifiable to close the identified session/presentation for exceptional reasons. In the event that SAWG do not agree, MoP A may decide whether or not to present their data.

3. Upon reaching an agenda item SAWG have agreed to close, any observers and non-CPs present will be instructed to leave the meeting room.

Upon registering participation for SAWG1, observers and Non-CPs will be informed that there may be closed sessions at this meeting.

SIOFA Rules of Procedure
Part XII – Transparency
Rule 20 – Open and Closed meetings

1. Consistent with Article 14 of the Agreement, ordinary and extraordinary Meetings of the Parties and its subsidiary bodies shall be open to observers unless the Meeting of the Parties or the subsidiary body concerned decides that exceptional circumstances require that a meeting, or part thereof, be held in closed session.

2. Notwithstanding paragraph 1 of this Rule, meetings of any subsidiary body established to consider financial matters shall be restricted to budget contributors and discussions concerning the selection and appointment of the Executive Secretary shall ordinarily be conducted in a closed meeting.

3. The outcomes of a closed ordinary or extraordinary Meeting of the Parties or part thereof shall be announced at the next opportunity - either at the next open session or at the next open Meeting of the Parties as appropriate. At the end of a closed meeting of a subsidiary body, the Chairperson of the subsidiary body may issue a communiqué through the Executive Secretary outlining any recommendations made at that closed meeting

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SAWG1 List of meeting documents

Paper	Title	Relevant agenda items
SAWG(2018)-01-01	Meeting Notice	N/A
SAWG(2018)-01-01 A	Observers list	N/A
SAWG(2018)-01-01 B	Participants Registration Form	N/A
SAWG(2018)-01-01 C (Rev_1)	Template for Submission of Papers	N/A
SAWG(2018)-01-01 D	List of Hotels	N/A
SAWG(2018)-01-01 E	List of meeting documents	N/A
SAWG(2018)-01-01 F	List of Participants	N/A
SAWG(2018)-01-02	Provisional Agenda	N/A
SAWG(2018)-01-02 (Rev_1)	Provisional Agenda (Rev 1)	2
SAWG(2018)-01-02 (Rev_2)	Provisional Agenda (Rev 2)	2
SAWG(2018)-01-02 (Rev_3)	Provisional Agenda (Rev 3)	2
SAWG (2018)-01-03	Preparation for orange roughy SA+HCR (final 13.02.2018)	4
SAWG(2018)-01-04	Orange Roughy Age Readings from Sleeping Beauty	4
SAWG(2018)-01-05	Stock assessment of orange roughy Walter's Shoal. Cordue, 2018	4
SAWG(2018)-01-05 (Rev 1)	Stock assessment of orange roughy Walter's Shoal. Cordue, 2018 (Rev 1)	4
SAWG(2018)-01-06	Assessment of orange roughy stocks SIOFA Areas 1, 2, 3a and 3b. Cordue, 2018	4
SAWG(2018)-01-06 (Rev 1)	Assessment of orange roughy stocks SIOFA Areas 1, 2, 3a and 3b. Cordue, 2018 (Rev 1)	4
SAWG(2018)-01-INF01	FAO acoustic WS 2017	4
SAWG(2018)-01-INF02	ICES Data Limit Stock Guidance Report 2012	3
SAWG(2018)-01-INF03	Report Pacific armorhead WS (2012)	5
SAWG(2018)-01-INF04	Orange Roughy Stock Assessments (2014)	4
SAWG(2018)-01-INF05	Deepwater WS-Report (SPRFMO 2017)	4
SAWG(2018)-01-INF06	Tiered-assessment WS report (SPRFMO 2017)	3

[SAWG(2018)-01-INF07](#)	SEAFO_Empirical HarvestRules	3,4,5
[SAWG(2018)-01-INF08](#)	Romanov, 2003_Part1	3,4,5
[SAWG(2018)-01-INF08](#)	Romanov, 2003_Part2	3,4,5
[SAWG(2018)-01-INF08](#)	Romanov, 2003_Part3	3,4,5
[SAWG(2018)-01-INF09](#)	OR biomass estimation in SIOFA - acoustic data. CSIRO, 2018	4
[SAWG(2018)-01-INFO10](#)	Review of SIOFA OR acoustic data. CSIRO, 2018	4
[SAWG(2018)-01-INF011](#)	Global Review of Alfonsino, pages 121-123. Shotton,R. 2016	5
[SAWG(2018)-01-INFO12](#)	A virtual research environment to run stock assessment models	5
[SAWG(2018)-01-INF013](#)	Alfonsino data inventory	5

Progress of Terms of Reference for SAWG (March 17, 2018) (draft)

ToR	Progress
1. The SAWG will be tasked with developing a research and review plan for implementation of stock assessments and related processes for progressing the objectives of the SIOFA SC and Meeting of the Parties. In the short-term, the SAWG will:	
a. Assist with the timely provision of data to support the implementation of the SAWG for orange roughy and alfonsino.	*Orange roughy: major parts are completed* *Alfonsino: started and to be completed by SC04 (2019)*
b. Assist with review of methods and outputs used for stock assessments and provide advice to the SC on a harvest strategy and fisheries reference points for SIOFA fisheries.	*Orange roughy: Completed as the interim basis* *Alfonsino: to be developed by SC04 (2019)*
In the medium to long-term, the SAWG will:	
2. To facilitate timely development of stock assessments, and in the absence of an established and populated SIOFA Fisheries Database, Parties agree to provide the necessary and available data to the working group within two months of a request, noting that appropriate data confidentiality protocols (as per CMM 2016/03 and domestic data and privacy policies) will apply.	*Orange roughy: Completed except one Contracting Party and some non-Contracting Party fleets* *Alfonsino: to be completed by January 2019*
3. The requesting party will need to confer with the data custodian to ensure the appropriate data confidentiality agreements and other relevant processes are followed.	
Interim dates and other issues for stock assessment • Within the close of SIOFA SC2 and 1 month prior to SIOFA SC3, participants agree to: **Alfonsino**	
o Undertake analyses of any CPUE time series and length frequency data for the SIOFA **alfonsino stocks.** These analyses need to demonstrate that the CPUE and length frequency series satisfies the assumption that any trend is indexing the abundance of the stock and not changes in fisheries behaviour or data bias.	*Just started and to be completed by SC04 (2019)*
o Provide a summary of available biological information to SC3.	*Just started and to be completed by SC04 (2019)*
o Prepare and submit a paper to SIOFA SC3 on the outcomes of the above **alfonsino** CPUE analyses)	
o Consider availability of other abundance indices, relative or absolute, that could provide input to alfonsino stock assessments and other methods to evaluate the status of **alfonsino** stocks.	
o Consult the FAO global alfonsino report and other relevant information to assist with stock assessments and other methods to evaluate the status of **alfonsino** stocks.	
Interim dates and other issues for stock assessment • Within the close of SIOFA SC2 and 1 month prior to SIOFA SC3, participants agree to: **Orange roughy**	

o Provide a summary of orange roughy stock structure information and propose a delineation of management stocks. Identify a priority orange roughy stock for assessment and provide a summary of the data available for that stock	*Completed as the interim basis*
o Agree on an assessment model and undertake a preliminary assessment to estimate current fishing mortality (and if feasible current biomass and biomass prior to fishing). If feasible (given the method) project biomass trends for the next 5 years given current fishing mortalities.	
o Propose biomass and fishing mortality reference points for these stocks for consideration by SC3.	
o Prepare and submit a paper to SIOFA SC3 on the outcomes of the above orange roughy stock assessments	
General stock assessments	
o Provide advice to the SIOFA secretariat on the design needs of SIOFA data bases for the purposes of stock assessment.	***Orange roughy****: completed as the interim basis* ***Alfonsino****: to be completed by SC04 (2019)*

Annex E Summary table of available acoustic datasets for orange roughy

Note that a confidential version of the summary table has been provided to the Secretariat for future use by the SAWG and SC.

Year	Feature	Survey	System	Status	Timing	Survey area	Biomass (t)	CV	WSR sensitivity	MPD assessment	Reviewed?	Base model?	Biomass (t)	CV (%)	Comment
2004	WSR	1	Hull Mounted	Assessed	Spawning Peak	13	7459	0.51	Yes						
2004	WSR	2	Hull Mounted	Assessed	Spawning Peak	5	6114	0.44	Yes						
2004	WSR	3	Hull Mounted	Assessed	Spawning Peak	19	8923	0.37	Yes						
2004	WSR	6	Hull Mounted	Assessed	Spawning Peak	23	9308	0.25	Yes						
2004	WSR	1	Hull Mounted	Assessed	Spawning Peak	7	1817	0.74			Yes	No			Very high CV
2004	WSR	3	Hull Mounted	Assessed	Spawning Peak	12	13232	0.81							
2004	Northern Ridge	1	Hull Mounted	Assessed	Spawning Peak	4	11291	0.73							
2004	Middle Ridge	1	Hull Mounted	Assessed	Spawning Peak	10	8463	0.58		Yes					
2004	Middle Ridge	1	Hull Mounted	Assessed	Spawning Peak	8	7050	0.66		Yes					
2004	Middle Ridge	2	Hull Mounted	Assessed	Spawning Peak	6	5843	0.46		Yes					
2004	Middle Ridge	3	Hull Mounted	Assessed	Spawning Peak	7	7616	0.69		Yes					
2004	Middle Ridge	4	Hull Mounted	Assessed	Spawning Peak	8	6274	0.59		Yes					
2004	Middle Ridge	5	Hull Mounted	Assessed	Spawning Peak	6	7676	0.45		Yes					
2004	Middle Ridge	4	Hull Mounted	Assessed	Spawning Peak	13	9311	0.57		Yes					
2005	Northern Walters	12	Hull Mounted	Assessed	Spawning Peak	25	802	15.50							
2005	Northern Walters	14	Hull Mounted	Assessed	Spawning Peak	15	3461	0.51							
2005	Northern Walters	18	Hull Mounted	Assessed	Spawning Peak	9.7	2310	0.30							
2005	Northern Walters	19	Hull Mounted	Assessed	Spawning Peak	10	605	0.42							
2005	Northern Walters	21	Hull Mounted	Assessed	Spawning Peak	16	5310	0.37							

2005	WSR	14	Hull Mounted	Assessed	Spawning Peak	16	7884	0.27							
2005	WSR	15	Hull Mounted	Assessed	Spawning Peak	13	6108	0.48							
2005	WSR	14.1	Hull Mounted	Assessed	Spawning Peak	7	1093	0.49							
2005	WSR	14.2	Hull Mounted	Assessed	Spawning Peak	8	1838	0.38							
2005	WSR	11	Hull Mounted	Assessed	Spawning Peak	7	864	0.53			Yes	No			2005
2005	WSR	11	Hull Mounted	Assessed	Spawning Peak	25	7040	0.26							
2005	WSR	12.1	Hull Mounted	Assessed	Spawning Peak	13	18911	0.28							
2005	WSR	12.2	Hull Mounted	Assessed	Spawning Peak	23	23090	0.23							
2005	WSR	12.3	Hull Mounted	Assessed	Spawning Peak	42	20511	0.24							
2005	WSR	14.1	Hull Mounted	Assessed	Spawning Peak	17	13806	0.34			Yes	No			2005
2005	WSR	14.2	Hull Mounted	Assessed	Spawning Peak	28	3279	0.33							
2005	WSR	19	Hull Mounted	Assessed	Spawning Peak	45	22000	0.23							
2005	WSR	21	Hull Mounted	Assessed	Spawning Peak	56	29085	0.22							
2005	WSR	10	Hull Mounted	Assessed	Spawning Peak	14	1665	0.29			Yes	No			2005
2005	South Ridge	1	Hull Mounted	Assessed	Pre-spawn	5	2075	0.64							
2005	Middle Ridge	1	Hull Mounted	Assessed	Spawning Peak	33	13030	0.41							
2007	WSR	5	Hull Mounted	Assessed							Yes	Yes	7923	10	
2007	WSR	1	Hull Mounted	Assessed	Spawning Peak	23.56	2902	0.11	Yes		Yes	Yes	2902	11	
2008	South Ridge	1	Hull Mounted	Assessed	Spawning Peak	3.7	2004	0.67							
2008	Middle Ridge	1	Hull Mounted	Assessed	Spawning Peak	4.9	2451	0.37		Yes					
2008	North Ridge	1	Hull Mounted	Assessed	Spawning Peak	2.4	945	0.46							
2008	WSR	1	Hull Mounted	Assessed	Spawning Peak	0.7	85	0.96							
2008	Middle Ridge	1	Hull Mounted	Assessed	Spawning Peak	6.7	3179	0.25		Yes					
2008	Walter's Seamounts	1	Hull Mounted	Assessed	Spawning Peak	0.6	187	0.85							
2008	Middle Ridge	1	Hull Mounted	Assessed		14.8	8324	0.92							
2008	Middle Ridge	1	Hull Mounted	Assessed	Spawning Peak	1.1	463	0.56							

2008	Middle Ridge	1	Hull Mounted	Assessed	Post-spawn	2.1	412	0.51							
2008	WSR	1	Hull Mounted	Assessed	Spawning Peak	4.8	1549	0.39							
2009	WSR	14	Hull Mounted	Assessed	Spawning Peak	6.6	3327	0.34	Yes						
2009	Northern Walters	21	Hull Mounted	Assessed	Spawning Peak	5.8	3163	0.30		Yes					
2009	Walter's Seamounts	19	Hull Mounted	Assessed	Spawning Peak	3.6	381	0.55		Yes					
2009	Middle Ridge	24	Hull Mounted	Assessed	Spawning Peak	4.1	1173	0.51							
2009	Middle Ridge	17	Hull Mounted	Assessed	Spawning Peak	5.8	7321	0.47		Yes					
2009	Middle Ridge	16	Hull Mounted	Assessed	Spawning Peak	4.2	6528	0.34		Yes					
2009	North Walter's	17	Hull Mounted	Assessed	Spawning Peak	7.7	4841	0.36		Yes					
2009	WSR	12	Hull Mounted	Assessed	Spawning Peak	4.6	1249	0.59							
2009	WSR	1	Hull Mounted	Assessed	Spawning Peak	8.3	5752	0.30	Yes						
2009	WSR	13	Hull Mounted	Assessed	Spawning Peak	5.4	17289	0.36	Yes						
2009	WSR	14	Hull Mounted	Assessed	Spawning Peak	4.9	9108	0.33	Yes						
2009	WSR	12.1	Hull Mounted	Assessed	Spawning Peak	5.9	9137	0.29	Yes		Yes	Yes	10618	30	
2009	WSR	12.2	Hull Mounted	Assessed	Spawning Peak	9.3	9562	0.40	Yes						
2009	WSR	8	Hull Mounted	Assessed	Pre-spawn	5.4	1417	0.51			Yes	Yes	860	19	Just pre-spawn
2009	WSR	14	Hull Mounted	Assessed	Spawning Peak	8.1	2501	0.34	Yes		Yes	Yes	2752	27	
2009	Walter's Seamounts	5	Hull Mounted	Assessed	Spawning Peak	5.3	10012	0.31		Yes					
2009	Walter's Seamounts	60	Hull Mounted	Assessed	Spawning Peak	13.4	10522	0.27		Yes					
2009	Walter's Seamounts	68	Hull Mounted	Assessed	Spawning Peak	13.5	8371	0.23		Yes					
2010	WSR	23.1	Hull Mounted	Assessed	Pre-spawn	1.91	895	0.25			Yes	No			Pre-spawning
2010	WSR	7.1	Hull Mounted	Assessed	Spawning Peak	12.3	4542	0.32	Yes						
2010	WSR	30.1	Hull Mounted	Assessed	Pre-spawn	12.3	6447	0.22							
2010	WSR	23.1	Hull Mounted	Assessed	Pre-spawn	1.3	611	0.22							
2010	Walter's Seamounts	14.1	Hull Mounted	Assessed	Spawning Peak	11.3	1345	0.35		Yes					

2010	Walter's Seamounts	12.1	Hull Mounted	Assessed	Spawning Peak	8.9	3331	0.18		Yes					
2010	WSR	7.1	Hull Mounted	Assessed	Spawning Peak	13.24	13542	0.26	Yes						
2010	WSR	7.2	Hull Mounted	Assessed	Spawning Peak	5.92	8240	0.23	Yes						
2010	WSR	30.1	Hull Mounted	Assessed	Pre-spawn	1.5	367	0.72							
2010	Walter's Seamounts	27.11	Hull Mounted	Assessed	Pre-spawn	33.4	12728	0.16							
2010	Walter's Seamounts	27.12	Hull Mounted	Assessed	Pre-spawn	33.4	16044	0.21							
2010	Walter's Seamounts	28.1	Hull Mounted	Assessed	Pre-spawn	33.4	29546	0.18							
2010	Walter's Seamounts	28.11	Hull Mounted	Assessed	Pre-spawn	33.4	38532	0.12							
2011	WSR	1	Hull Mounted	Assessed	Spawning Peak	0.87	1737	0.43	Yes			Yes	Yes	1737	43
2011	Middle Ridge	1	Hull Mounted	Assessed	Spawning Peak	3.32	15635	0.34		Yes					
2011	WSR	1	Hull Mounted	Not Assessed	Spawning Peak										
2012	WSR	1	Hull Mounted	Not Assessed	Spawning Peak										
2012	Walter's Seamounts	1	Hull Mounted	Not Assessed	Pre-spawn										
2012	WSR	1	Hull Mounted	Not Assessed	Pre-spawn										
2013	WSR	1	Hull Mounted	Not Assessed	Pre-spawn										
2013	WSR	2	Hull Mounted	Not Assessed	Spawning Peak										
2013	WSR	1	Hull Mounted	Not Assessed	Pre-spawn										
2013	WSR	2	Hull Mounted	Not Assessed	Spawning Peak										
2014	WSR	1	AOS-ID		Spawning Peak										
2014	WSR	2	AOS	Partial Assessment	Spawning Peak										
2014	WSR	3	AOS	Partial Assessment	Spawning Peak										
2014	WSR	1	AOS	Partial Assessment	Spawning Peak										
2014	South Ridge	1	AOS	Not Assessed	Spawning Peak										

2014	North Ridge	1	AOS-ID		Post-spawn										
2014	North Ridge	1	AOS-ID		Pre-spawn										
2014	North Ridge	1	AOS	Not Assessed	Pre-spawn										
2014	North Ridge	1	AOS-ID		Pre-spawn										
2014	North Ridge	1	AOS-ID		Pre-spawn										
2014	North Ridge	1	AOS-ID		Pre-spawn										
2014	North Ridge	1		Not Assessed	Pre-spawn										
2014	North Ridge	1	AOS	Not Assessed	Post-spawn										
2014	Walter's Seamounts	1	AOS-ID		Pre-spawn										
2015	WSR	1	Hull Mounted	Assessed	Spawning Peak				Yes		Yes	Yes	3788	32	
2015	WSR	2	Hull Mounted	Assessed	Pre-spawn	4.1	3419	0.56							
2015	WSR	1	Hull Mounted	Assessed	Spawning Peak	4.6	4043	0.21	Yes		Yes	Yes	3164	12	
2015	WSR	1	Hull Mounted	Assessed	Spawning Peak	10.9	5648	0.27	Yes		Yes	Yes	3779	20	
2015	WSR	1	Hull Mounted	Assessed	Spawning Peak	7	5269	0.30	Yes						
2015	Walter's Seamounts	1	Hull Mounted	Assessed	Pre-spawn	27.3	21335	0.23							
2017	Walter's Seamounts	42179	Hull Mounted	Not Assessed	Pre-spawn										
2017	Walter's Seamounts	42911	Hull Mounted	Not Assessed	Pre-spawn										
2017	WSR	42917	Hull Mounted	Not Assessed	Spawning Peak										
2017	WSR	42921	Hull Mounted	Not Assessed	Spawning Peak										
2017	WSR	42908	Hull Mounted	Not Assessed	Pre-spawn										
2017	WSR	42909	Hull Mounted	Not Assessed	Pre-spawn										
2017	WSR	42914	Hull Mounted	Not Assessed	Pre-spawn										
2017	WSR	42917	Hull Mounted	Not Assessed	Spawning Peak										

Annex F Information used to support orange roughy stock structure assumptions

Note that a confidential version of the summary table has been provided to the Secretariat for future use by the SAWG and SC.

A publicly accessible version has been provided on the SAWG1 meeting part of the SIOFA website www.siofa.org/node/68