

Report of the Second Meeting of the Southern Indian Ocean Fisheries Agreement (SIOFA)  
Scientific Committee Stock Assessment and Ecological Risk Assessment Working Group  
(SERAWG)

Held on 18, 23 and 25 June 2020 via videoconference using WebEx,  
as well as via email correspondence

*Items not addressed this year due to the reduced format and postponed to 2021 are in grey.*

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## **Agenda item 1 – Openings**

### **Agenda item 1.1 Opening statement from the Co-Chairs**

#### **Agenda item 1.2 Introduction of participants**

1. The meeting was co-chaired by Dr Tsutomu Nishida of Japan and Mr Lee Georgeson of Australia.
2. The lists of participants for each videoconference are attached (**Annex A**).

## **Agenda item 2 – Administrative arrangements**

### **Agenda item 2.1 Adoption of the Agenda**

3. The agenda was adopted (**Annex B**).

### **Agenda item 2.2 Confirmation of meeting documents**

4. The meeting documents (**Annex C**) were confirmed.

### **Agenda item 2.3 Appointment of rapporteurs**

5. Mr Alex Meyer (Urban Connections, Tokyo) was appointed as rapporteur with assistance from delegations.

### **Agenda item 2.4 Review of functions and terms of reference**

6. The Co-Chair (Japan) noted that there were no proposed changes to the functions and terms of reference (TOR) for the SERAWG.

## **Agenda item 3 – Alfonsino**

### **Agenda item 3.1 Update on the fishery**

### **Agenda item 3.2 Alfonsino workplan (SC4 Annex G and W)**

#### **Agenda item 3.3 Resource analyses by member countries**

7. The Co-Chair (Japan) provided a summary of the intersessional progress made so far towards conducting the splendid alfonsino stock assessment:
  - The SERAWG has decided to divide the stock into two management units: West and East, split along 80°E, until new scientific information on the stock structures becomes available.
  - The SERAWG has examined the use of acoustic data and CPUE data for the development of abundance indices. The SERAWG determined that the acoustic data generally have poor temporal-spatial coverage and that there are also concerns about the feasibility and cost of their use. Consequently, the SERAWG determined that, at the current time and until uncertainties with acoustics data can be further explored and/or resolved, the good temporal-spatial coverage for the CPUE data was much more appropriate for use as an index of abundance for an assessment. Although there are concerns about their usefulness due to issues such as fishery characteristics and the aggregating nature of alfonsino, the SERAWG agreed to evaluate the CPUE data and to use them for the stock assessment if feasible.

- SIOFA selected Marine Resource Assessment and Management Group (MARAM), University of Cape Town, as the consultant for the CPUE evaluation and stock assessment work.

#### Summary of paper (ageing)

8. The Co-Chair (Japan) and the consultant, Mr Kyne Krusic-Golub, Fish Ageing Services (FAS), presented SERAWG-02-INFO-05, which describes the progress on splendid alfonsino age determination work using otoliths from the SIOFA Contracting Parties that have participated in this fishery. The consultant provided an overview of the method, the image analysis system, the otolith margin classification, the readability score, and quality assurance and quality control. He explained that the age reading protocol used by Massey & Horn 1990 was selected for the work. The consultant explained that no zone count to age conversion has been conducted yet and suggested using a protocol following Santamaria et al. 2006 for future age readings. The consultant also recommended verifying the annual deposition of zones and determining the zone formation timing through marginal increment or edge type analysis, as well as verifying the longevity, perhaps by bomb radiocarbon dating.

#### SERAWG discussion

9. The SERAWG discussed the work presented, including the possibility of differences in the growth equations between the East and West management units and the potential existence of a gear-type effect on the otolith sampling resulting from the fact that young fish are typically pelagic, while older fish tend to be associated with bottom features.

#### Summary of paper (growth equation in the East)

10. Cook Islands presented SERAWG-02-07, which describes the estimation of the growth equation based on the age estimated by FAS using otoliths. Cook Islands provided an overview of the data inputs, and analysis of the readability and age/growth. Based on the study, the Cook Islands recommended:
  - using age estimated from otoliths with readability scores 1-3,
  - using sex combined length-at-age estimates,
  - undertaking additional sampling to get better estimates of female age and through the size range, and
  - assessing whether change in growth at around age 9 coincides with the onset of maturity or if it can be attributed to other factors.

#### SERAWG discussion

11. The SERAWG discussed the lack of data from female fish at higher ages. The SERAWG recognised that in other studies, male and female estimates are quite similar, so the missing data are unlikely to have a significant impact on the stock assessment. FAS explained that those data may exist but may have been removed in the data cleaning stage due to differences in measurement metrics (e.g. cm vs mm), and agreed to check this point before preparing their final report.
12. The SERAWG discussed the larger size-at-age for older ages and suggested that this could be the result of length-stratified sampling. The SERAWG recognised the importance of avoiding bias when estimating growth parameters with length-stratified age samples. In this case, the length-stratified sampling is likely to result in an overestimation of length-at-age since large fish are selectively oversampled

relative to their proportion in the fish population. Therefore, length-stratified sampling should be reflected in the model of fish growth (see e.g. Perreault et al. 2020, Canadian Journal of Fisheries and Aquatic Sciences, 2020, 77(3): 439-450).

Summary of paper (comparison among four growth equations)

13. The Co-Chair (Japan) presented SERAWG-02-INFO-01 (REV\_1), which provides comparisons among four studies on splendid alfonsino growth equations based on ages estimated from otoliths collected in the SIOFA Area. He noted that sex-combined growth equations can be used for stock assessment considering the fact that one of the studies suggests that there are no statistically significant differences in both equations between sexes, while the other three use sex-combined growth equations. Furthermore, he suggested that the equation in Brouwer et al (2020) (SERAWG-02-07) in the East is likely more plausible than others (West), as it covers a wider range and higher quantities of samples in three aspects, i.e., age (size), period (years) and depth.

#### **Agenda item 3.4 Report of CPUE evaluation and stock assessments by the Consultant**

14. The Co-Chair (Japan) summarised the main points of the TOR for the work to be done by a consultant to evaluate the catch-per-unit-effort data and conduct a stock assessment for splendid alfonsino. These are to evaluate if the CPUE data are useful for the stock assessment because of the large uncertainties around them, evaluate if there are useful abundance indices that can be used for the stock assessment, evaluate the current stock status relative to maximum sustainable yield (MSY) levels and project future stock status relative to MSY levels.

Summary of paper (CPUE evaluation and standardisation)

15. The consultant, MARAM, presented SERAWG-02-13, which provides a number of standardised CPUE series for the alfonsino resource in the SIOFA Area. The data are divided into two management unit areas: West and East, and three fleet series: S1 (trawl including both mid-water and bottom ones), S2 (mid-water trawl) and S3 (mid-water trawl). The basic analysis approach was to apply basic bifurcation depending on the proportion of zero catches and the covariate selection was determined using the Akaike Information Criterion (AIC). A number of sensitivity analyses were considered. Most did not show much of an effect, except for bycatch. S2 data for the East were excluded from the stock assessment as they are few and not informative. Fit diagnostics were checked and found to be reasonable. In general, sensitivities did not give results that differed greatly. Further approaches could have been explored, but this was not seen to be a high priority because the stock assessment analyses showed estimates of stock status and productivity to be insensitive to different CPUE standardisation approaches.

SERAWG discussion

16. The SERAWG discussed uncertainties around the use of CPUE data but recognised that, in the absence of other more suitable data sources, the standardised CPUE data was the best information that was currently available.
17. The SERAWG discussed the possibility of improving future CPUE standardisations by collecting hydro-acoustic data and using them to verify the plausibility of the CPUE data, as well as by collecting data on additional variables such as gear type and fishing ground type.
18. MARAM suggested that the CPUE standardisation work could be improved by collecting data at a higher resolution (ideally tow-by-tow rather than catch per day) and considering other definitions of effort such as swept area.

## Summary of paper (ASPM)

19. MARAM presented SERAWG-02-14, which provides the Age-Structured Production Model (ASPM) assessments of the alfonsino resource in the SIOFA Area.

- Data used: Total catch for each fleet, other member countries and non-member countries, with catches starting from 1977; relative abundance indices from the CPUE standardisation excluding the series for S2 (East); and length data for the S1 fleet in 2018.
- Key assessment model features: Assessments are carried out separately for West and East management units, a deterministic spawner-recruit relation by Beverton and Holt was used due to the limited data in the SIOFA database, and the same selectivity is assumed for all fleets and all years due to the limited length data.
- Model: The choice of model was limited by the paucity of size composition data and an ASPM was chosen to make allowance for time-lags arising from age-structure effects due to the relatively long-lived nature of alfonsino.
- Key assumptions: Beverton-Holt spawner-recruitment relation (deterministic), steepness ( $h$ ) of 0.75, natural mortality ( $M$ ) of 0.2, and age at maturity of 6 years.
- Sensitivities: A number of sensitivity analyses were considered for the East and West management units. The model was insensitive in most cases but was highly sensitive to  $M$  for both the East and West.

### Basic results:

- There is spawning biomass depletion for the West and East for both the base (reference) case and sensitivities.
- A comparison was conducted of the spawning biomass depletion for the West and East for the base case and two retrospective analyses. Hardly any change was shown in the East. In the West, with more data and time, the situation seems to be slightly better than in the past, which warrants monitoring.
- Spawning biomass depletion projections were conducted for the base case for the West and East at the current catch level (2018) and  $\pm 10\%$ , 20%, 30% and 40%. For the West, the spawning biomass is projected to remain above MSY if fishing occurs at the 2018 level. For the East, however, if fishing occurs at the 2018 level, the spawning biomass is projected to decline slightly.
- One concerning sensitivity case is if  $M$  is reduced to 0.15. In that case, in the West, if the catch level is increased by 40%, spawning biomass will drop below MSY level within 10 years, while in the East, even at the current catch level, spawning biomass will drop below MSY level within 10 years.
- Average fishing proportion ( $F^*$ ) projections were conducted. In the West,  $F^*$  will remain the same if the catch level remains the same. In the East, under the current catch level,  $F^*$  will increase slightly and if the catch level is increased,  $F^*$  will increase rapidly.

### Key outcomes:

- The assessment model results indicate that the stocks are at about 60% of their pre-exploitation spawning biomasses in West and East. Neither stock is overfished, where overfished is defined as  $SSB < SSB_{msy}$  nor is overfishing, where overfishing is defined as  $F > F_{msy}$  taking place. The low  $M$  ( $M=0.15$ )

sensitivity has the most influence on assessment results. The selection of catch levels (i.e. 2018 catches or the last 5-year average) has a marked influence on projections of depletion (more so for the West than for the East).

**Recommendations for future work:**

- Add available size data from CCPs to the SIOFA database.
- Develop data catalogues or characterisations for future assessments so that CCPs can ensure all data are being used.
- Estimates of abundance in absolute terms, for example by using acoustic data, would help reduce uncertainties associated with the value of  $M$ .

SERAWG discussion

20. The SERAWG asked MARAM to provide additional analyses, the results of which are as follows:

- Uncertainties around the estimates of  $SSB/SSB_0$ : With only one year of length distribution data used in this assessment, there is no basis to estimate variations about the spawner-recruitment relationship that exist in reality. Furthermore, the constraint of a deterministic model restricts the range of alternative possible inferences. Therefore, a realistic estimation of the statistical precision and variance of quantities such as current spawning biomass depletion is not possible.
- Projection of catches using the last 5-year (2014-2018) average catch level: In the East, the 5-year average catch amount is 706 tonnes, which is within the results of the catch scenarios used in the stock assessment projections. In the West, the 5-year average catch amount is 3,436 tonnes, which is above the level projected at the 2018 catch level +40%.
- Kobe plots of a base case where  $M=0.15$ : In the West, the model indicates that the stock is not overfished (using the definition  $SSB < SSB_{msy}$ ) and overfishing (using the definition  $F > F_{msy}$ ) is not taking place. In the East, the model indicates that the stock is not overfished (using the definition  $SSB > SSB_{msy}$ ) but the level of fishing is very close to  $F_{msy}$ .
- Spawning biomass depletion for the West and East with a Santamaria growth equation: The spawning biomass depletion is around 80% for both West and East, up from around 60% under the original growth curve, suggesting that the model is sensitive to the growth curve.

21. The SERAWG considered the results of the stock assessment and determined that in the base case with  $M=0.2$ , the ASPM results indicate that there is little concern about stock status in 2018 because depletion levels of  $SSB$  (spawning stock biomass) and  $F$  can secure  $MSY$  levels. The ASPM indicates that results are slightly less optimistic for the East management unit than the West. Projections are sensitive to the use of the 2018 or 5-year average catch, showing more rapid depletion under the latter scenario. The  $M=0.15$  sensitivity in combination with the 5-year average catch scenario provides the least optimistic scenarios for both management units, while securing  $MSY$  levels.

22. However, caution is needed for these interpretations due to uncertainties caused by the limited data available for the ASPM (i.e., it is a simple model).

23. The SERAWG discussed the paucity of available data and the fact that when the alfonsino stock assessment work began, SIOFA's data cataloguing work was still at an early stage. Progress has been made since then and more data should be

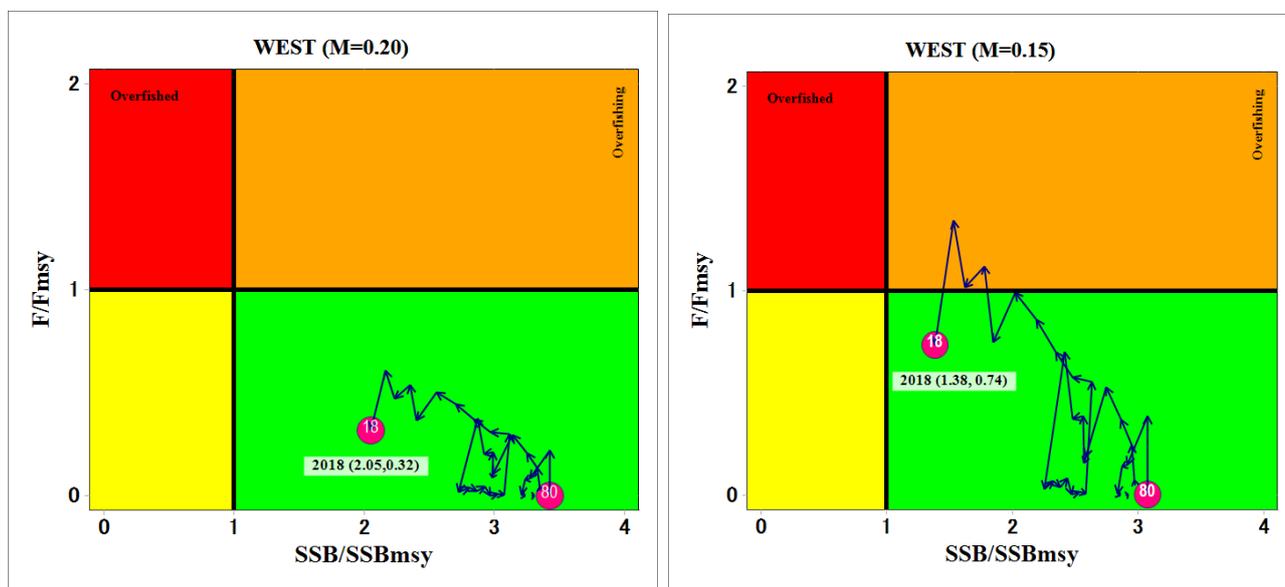
available for the next stock assessment. This work should be continued, and the catalogue should include a wide range of variables and attributes. Such a catalogue would enable a quick understanding of what kinds of information are available and be essential for the development of concrete time/cost effective approaches for stock assessment, as well as other scientific work.

24. The SERAWG discussed the need to collect more biological information, while recognising that the collection of more data should be introduced gradually to avoid placing an additional burden on fishing vessels and observers and risking a consequent reduction in the quality of the data collected.
25. MARAM highlighted the fact that having more length-frequency data would be particularly useful for improving the stock assessment. Having the length-frequency data for each fleet would help remove the bias of assuming the selectivity for each fleet is the same. Furthermore, having multiple years of length-frequency data would enable a shift away from a deterministic stock-recruitment relationship, making more realistic measures of precision possible.
26. The SC Chairperson noticed discrepancies between the catch data in MARAM's report and the catch data from the draft overview of SIOFA fisheries reports. The SERAWG also discussed uncertainties with the Cook Islands data that had been used (i.e. whether it was based on processed weight or whole weight). Upon further investigation, the Secretariat confirmed that 1) data from Japan had been accounted for twice in the draft overview of SIOFA fisheries, which explained the discrepancy, 2) that the Cook Islands data used in the assessment were the whole weight data, and not the processed weight data that had previously been submitted to the Secretariat (but have since been resubmitted).
27. There was discussion about creating a small working group to review data sheets and identify means to collect more complicated data. The current data standards outlined in CMM 2019/02 were noted.
28. The SERAWG discussed the possibility of using acoustic data for stock assessments as an abundance index. It recognised that such data are complex and have many potential issues, and a feasibility study should therefore be conducted.
29. The Southern Indian Ocean Deepsea Fishers Association (SIODFA) pointed out that uncertainties around the behaviour of alfonsino and various characteristics of the fishery may influence the usefulness of acoustic surveys.
30. SIODFA commented that the nature of the spawner-recruitment relationship for alfonsino is very uncertain and that genetic experiments may be useful for seeing if there is any evidence to support the idea that recruitment is from a single spawning population.
31. MARAM agreed that genetic experiments would be the most effective means of acquiring such information, specifically close-kin genetics, which enables identification of population connections. However, it cautioned that such experiments can be very expensive if there are large population numbers.

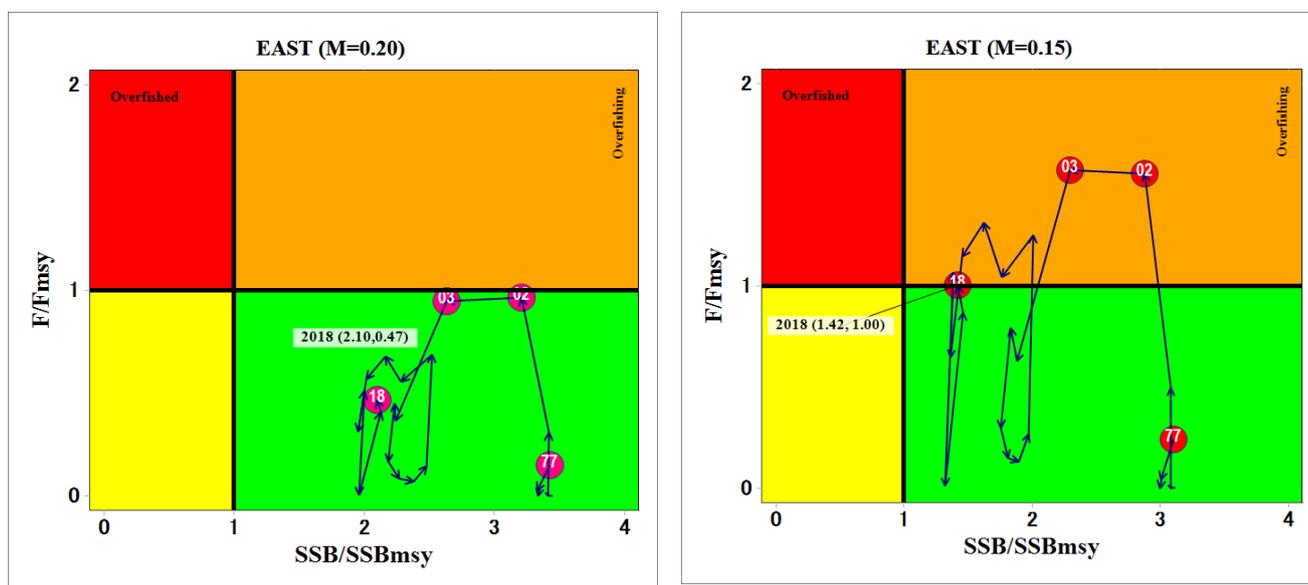
## Results

Stock status (2018) (Kobe plot) by management unit and M

### WEST (1980-2018)



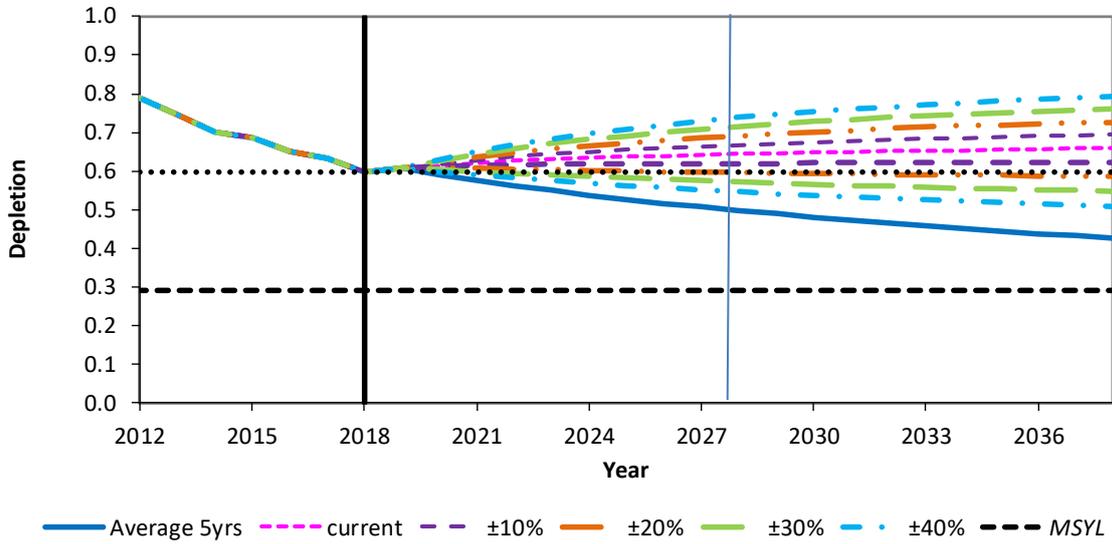
### EAST (1977-2018)



Projections (SSB depletion) (WEST)

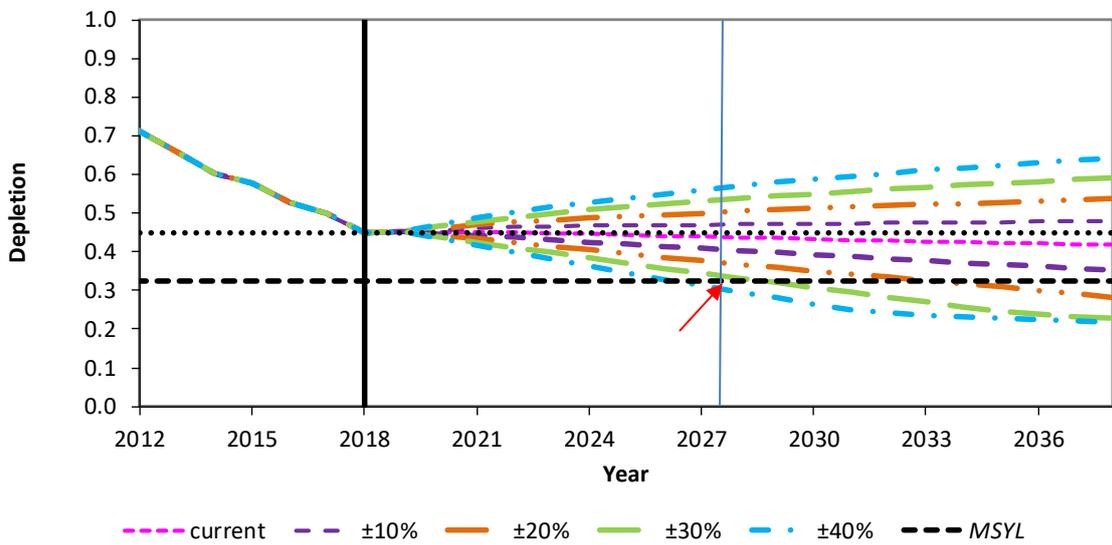
M=0.20

Base case (West)



M=0.15

M = 0.15 (West)



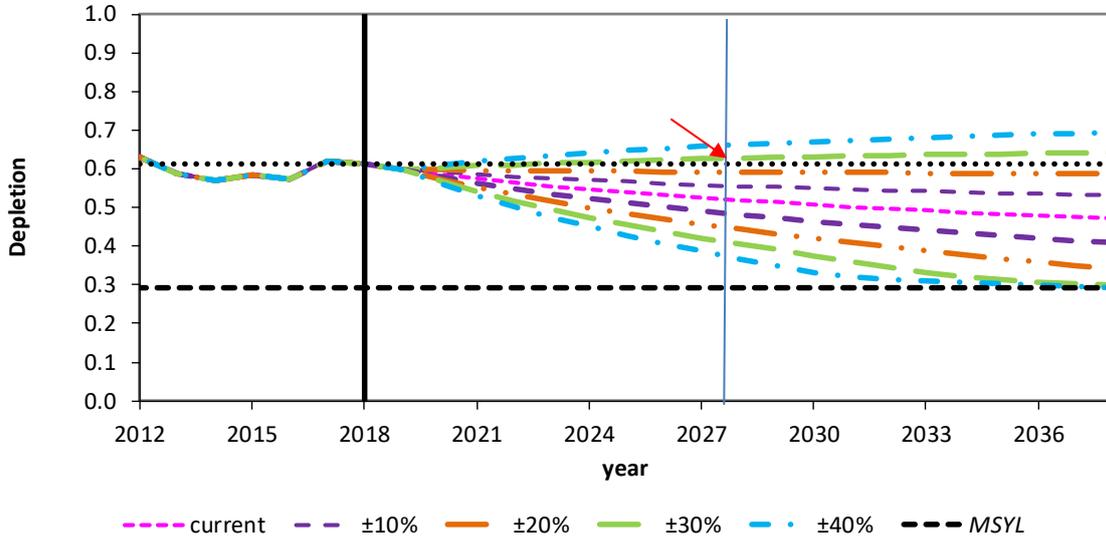
(Note)

The projection using 5-years catch average (3,436 tons) is close to the one with the +40% of the current (2018) catch (2,157 ton) because the gap of two catch is +37%. This implies that in 10 years later (2028), the depletion rate is about the MSY level (red arrow).

Projections (SSB depletion) (EAST)

M=0.20

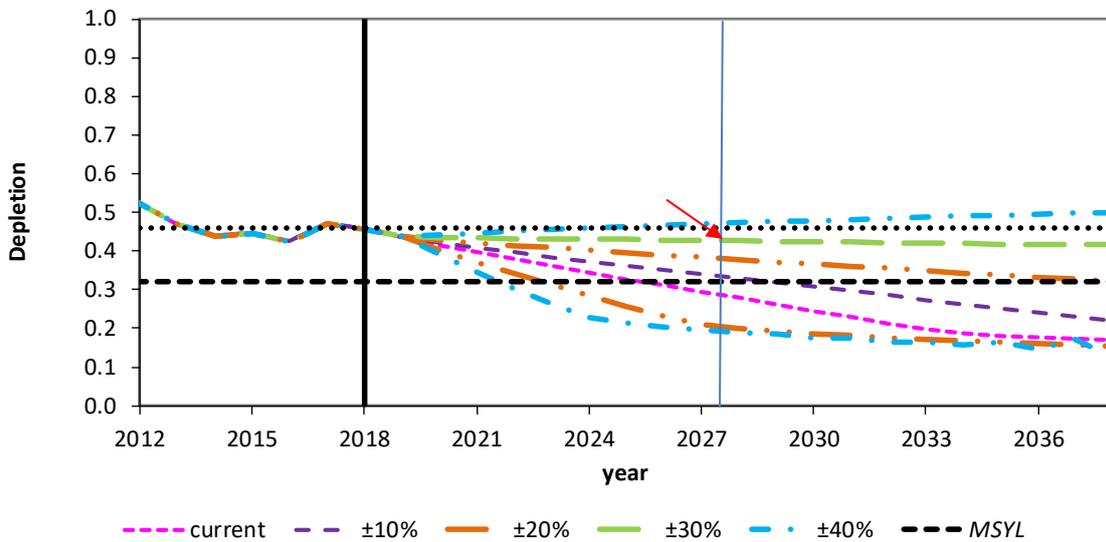
Base case (East)



(Note)

The projection using 5-years catch average (706 tons) is close to the one with the -30% of the current (2018) catch (992 ton) because the gap of two catch is -29%.  
The red arrow indicated its position in 10 years later (2028)

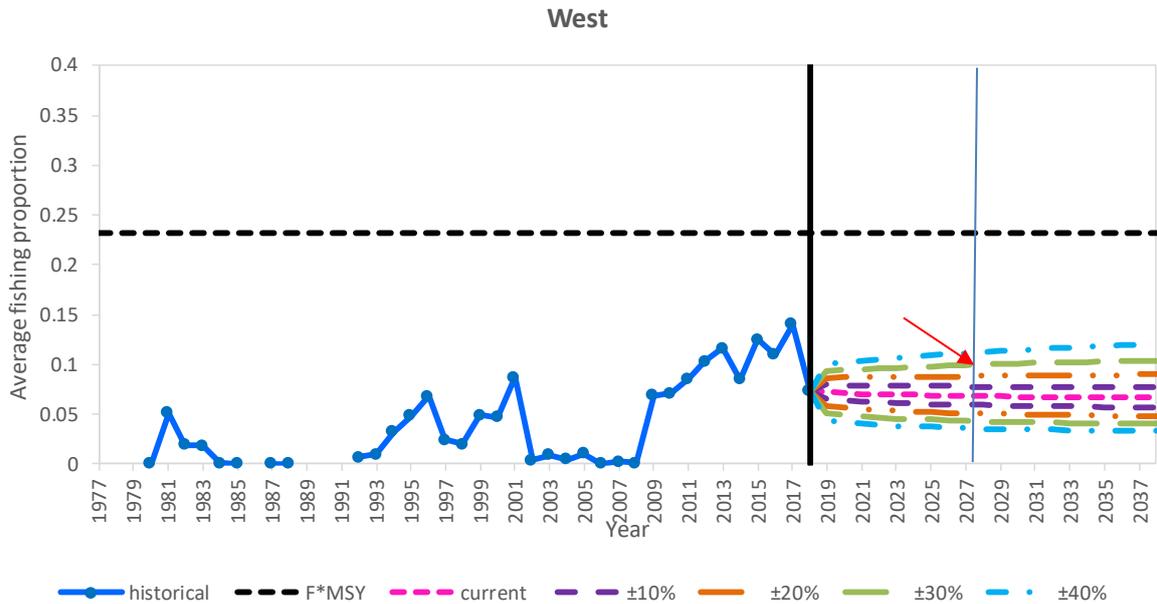
M = 0.15 (East)



(Note)

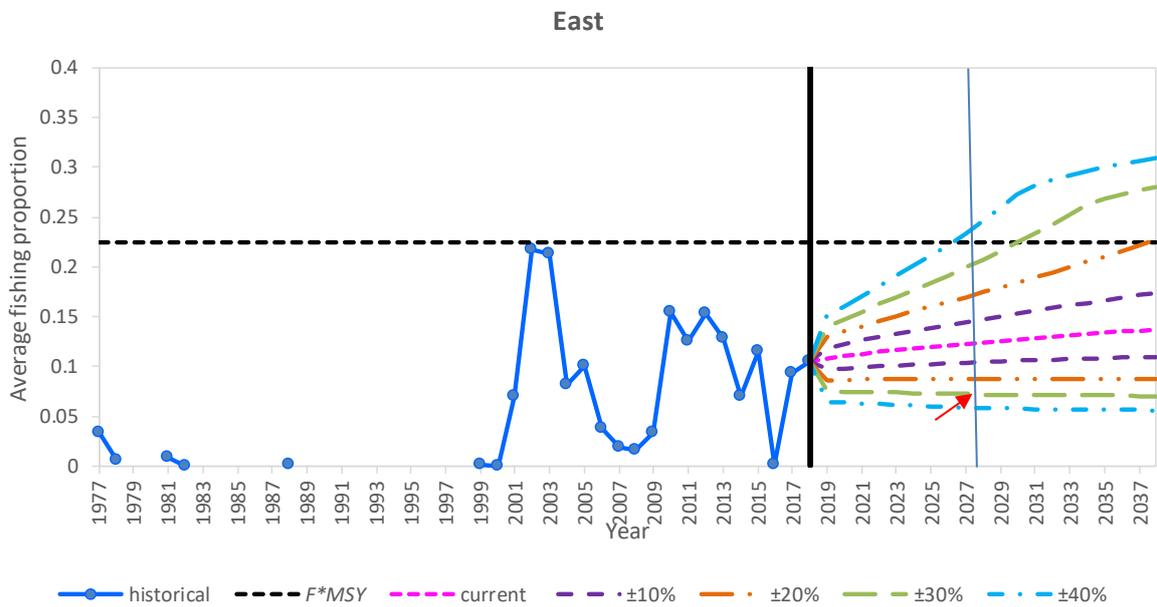
The projection using 5-years catch average (706 tons) is close to the one with the -30% of the current (2018) catch (992 ton) because the gap of two catch is -29%.  
The red arrow indicated its point in 10 years later (2028)

Projection (F\*) Base case (M=0.20)



(Note)

The projection using 5-years catch average (3,436 tons) is close to the one with the +40% of the current (2018) catch (2,157 ton) because the gap of two catch is about +37%. The red arrow indicated its point in 10 years later (2028)

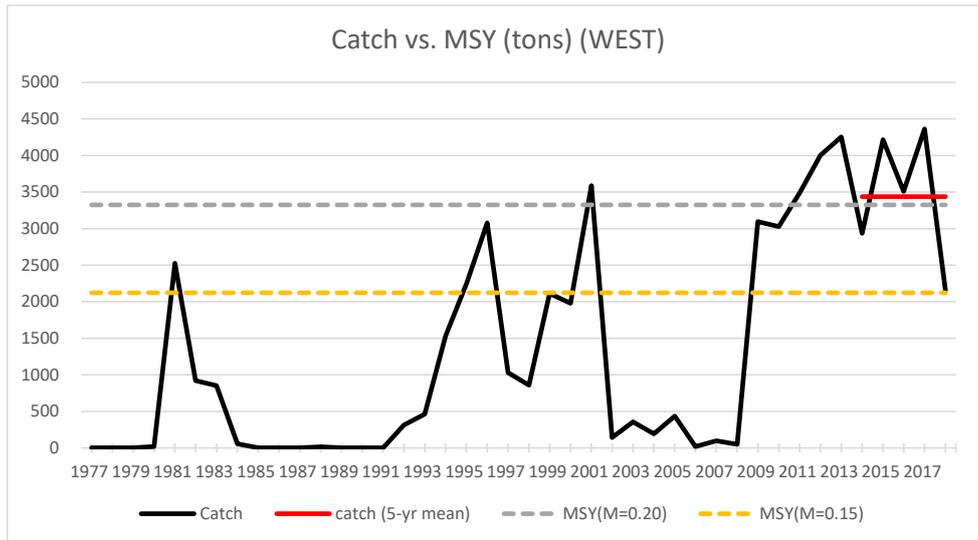


(Note)

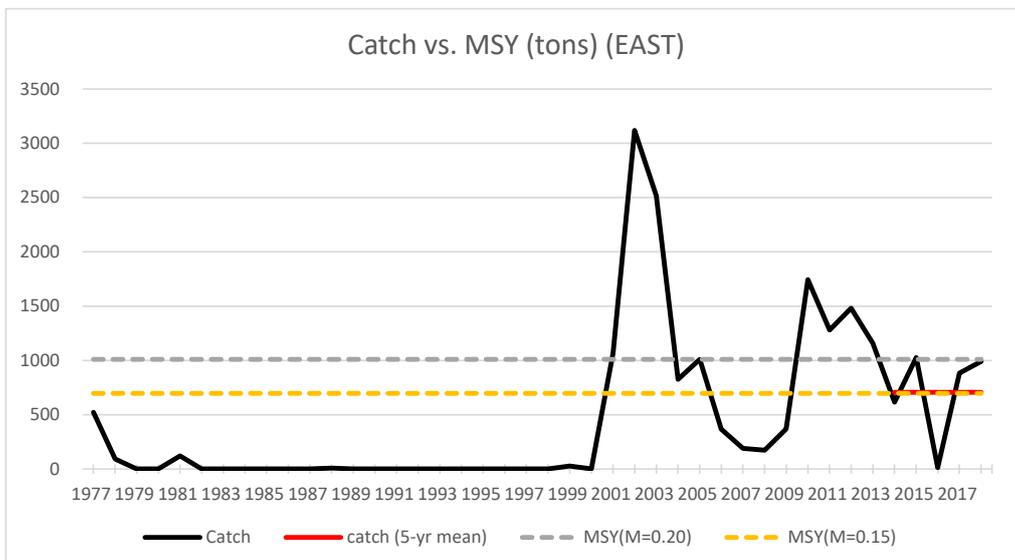
The projection using 5-years catch average (706 tons) is close to the one with the -30% of the current (2018) catch (992 ton) because the gap of two catch is -29%. The red arrow indicated its point in 10 years later (2028)

### Catch vs. MSY

| WEST |       |       |       |                            |
|------|-------|-------|-------|----------------------------|
| MSY  |       |       | Catch |                            |
| M    | 0.15  | 0.20  | 2018  | 5-year average (2014-2018) |
| tons | 2,123 | 3,325 | 2,157 | 3,436                      |



| EAST |       |      |           |                            |
|------|-------|------|-----------|----------------------------|
| MSY  |       |      | Catch     |                            |
| M    | 0.15  | 0.20 | 2018      | 5-year average (2014-2018) |
| tons | 1,010 | 696  | 992 (300) | 706 (131)                  |



### **Agenda item 3.5 Review of progress against CMM 2019-15 (Demersal stocks)**

32. Progress has been made as described in this report.

### **Agenda item 3.6 Future work plan**

33. Annex D describes the future work plan.

### **Agenda item 3.7 Other matters (storage and property of otoliths and relevant data)**

### **Agenda item 3.8 Advice to the SC**

#### **34. The SERAWG's summary of advice to the SC is:**

- to use two provisional management units for assessment purposes: West and East, split along 80°E, until new scientific information on stock structure becomes available.
- for the age estimation in the EAST by FAS:
  - i. to use age with readability scores 1-3 (reliable ranges).
  - ii. to estimate sex combined growth equations.
  - iii. to assess whether change in growth at around age 9 coincides with the onset of maturity or if it can be attributed to other factors.
  - iv. to improve ageing and growth functions, including applying the Santamaria method, verifying longevity with bomb radiocarbon, increasing the accuracy of ageing for all ages especially female alfonsino (> 50cm).
  - v. to verify the annual deposition of zones and determine the zone formation timing through marginal increment or edge type analysis, as well as verify the longevity by bomb radiocarbon.
- to develop growth equations for the West using the age newly estimated by FAS.
- that in the base case with  $M=0.2$ , the ASPM results indicate that there is little concern about stock status in 2018 because depletion levels of SSB (spawning stock biomass) and F secure their MSY levels. The ASPM indicates that results are slightly less optimistic for the East management unit than the West. Projections are sensitive to the use of the 2018 or 5-year average catch, showing more rapid depletion under the latter scenario. The  $M=0.15$  sensitivity in combination with the 5-year average catch scenario provides the least optimistic scenarios for both management units, although SSB and F remain above and below the levels that provide MSY, respectively. However, caution is needed for these interpretations due to uncertainties caused by the limited data available for the ASPM (simple model).
- to conduct other stock assessments in the future using methods that do not use CPUE (such as the catch only method, length cohort analyses, Yield/Recruit analyses, etc.) to compare results with ASPM. This is because there are still uncertainties around the use of CPUE as the abundance index, so if the results of the ASPM and other models are similar, the stock status will become more certain.
- For more plausible CPUE standardisation and stock assessments in the future, create a small working group to review data sheets, develop minimum data standards, and identify means to collect more complicated data, with a

view to moving towards a common data sheet in the future for both log books and observer programs.

- to collect more biological information such as sex, size, weight, gonad, genetic tissue, and otoliths through observer programs to estimate SIOFA-specific length-weight relationship, maturity at age, M, etc., by management area, for more reliable stock assessments. The collection of more data should be introduced gradually to avoid placing an additional burden on fishing vessels and observers and risking a consequent reduction in the quality of the data collected.
- to conduct a feasibility study into whether acoustic data are useful for stock assessments as an abundance index because they are complex and have many issues. Specifically, the following points need to be clarified: target strength, vessel calibration, inter-vessel comparison, temporospatial coverage, etc.

## **Agenda item 4 – Patagonian toothfish**

### **Agenda item 4.1 Update on the fishery**

### **Agenda item 4.2 Patagonian toothfish workplan (SC4 Annex G and W)**

### **Agenda item 4.3 Resource analyses by member countries**

Summary of paper (Del Cano Rise)

35. The EU presented a preliminary analysis of Patagonian toothfish fishing data from the Del Cano Rise in the SIOFA Area (SERAWG-02-11), based on fishing data from vessels flagged to Spain, France, Japan, and Korea. The study was conducted to provide a better understanding of the impact of these fisheries and two events of higher fishing effort identified on the Del Cano Rise Patagonian toothfish stock, and involved developing preliminary proxies of fish biomass based on depletion analysis and exploring temporal trends of fish biomass based on CPUE standardisation and data poor modelling approaches using the Catch-MSY approach of Stock Reduction Analysis and Just Another Bayesian Biomass Assessment (JABBA), a state-space surplus production model. The time series data are from the past 17 years at different levels of information detail and aggregation (improved in recent years with the development of standardised data collection templates). More data are needed to estimate sustainable catch limits.
36. Based on the study, the EU recommended that, in order to be able to provide sound recommendations on biologically appropriate catch limits and assess the local toothfish stock and its relation to adjacent areas:
  - the efficiency of the data request process and data release detail for purposes of the work of the SC and its WGs should be evaluated;
  - the update of the longline observer data template should include a record sheet for tag releases/recaptures on toothfish, to develop a tagging protocol for observers/vessels and to coordinate, likely with the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), about tagging supplies; and
  - a longer-term fisher-based research plan should be developed for the Del Cano Rise area.

37. Furthermore, the EU suggested that fishing effort should be spread spatially and stratified across depth over as large a range as possible for the Del Cano Rise region to obtain the information necessary to determine the potential for this fishery, over-concentration of catch and effort should be avoided, and representative toothfish biological data for biomass estimation and population characteristics should be attained.

#### SERAWG discussion

38. The SERAWG discussed the importance of collecting information from broader fishing grounds, while recognising potential feasibility issues due to the limited fishing grounds in the area.
39. The CCAMLR Secretariat expressed support for collaborating with the SIOFA Secretariat to provide tagging supplies and data infrastructure.

#### Summary of paper (whale interaction)

40. France (Territories) presented SERAWG-02-12, which provides a study of whale interactions with fishing activities targeting Patagonian toothfish. Such whale depredation results in decreased fishing yields for vessels and also uncertainty around the depredated part of the catch, which can affect the accuracy of stock assessments of the Patagonian toothfish population and the management of stocks. The study showed that, from 2009-2019, the interaction rate was 28% and 43.8% for killer whales and sperm whales, respectively. The mean depredation rate over the same period was estimated to be 7.5%. Some of the whales observed in Del Cano rise were also observed interacting with fishing activities in Crozet/Kerguelen.
41. Based on the study, France (Territories) recommended that the SC:
- acknowledges the existence of depredation in the SIOFA Area and the impact that depredation can have on toothfish catches in the SIOFA Area;
  - adopts a mandatory protocol for documenting marine mammal interactions with all fishing vessels operating in its Area that is compatible with that of CCAMLR (see Gasco et al 2013); and
  - adopts the following actions for longline fishing vessels subject to killer whale interactions in order to reduce the risk of spreading depredation behaviour:
    - i. stop hauling and buoy off the line when killer whales are sighted,
    - ii. steam away at least 30 nautical miles,
    - iii. not haul any line within a radius of 30 nautical miles around the initial observation point, and
    - iv. restart hauling of the buoyed-off line once killer whales are absent.

#### SERAWG discussion

42. The SERAWG agreed that the estimated rate of depredation of 7.5% is a significant problem, but recognised that the proposed measures are management measures and are therefore outside the scope of the SERAWG.

#### **Agenda item 4.4 Relevant information from CCAMLR**

#### **Agenda item 4.5 Review of progress against CMM 2019-15 (Demersal stocks)**

43. The SERAWG **noted** that, in accordance with CMM 2019/01 para 6, SC 2020 shall develop and provide advice and recommendations to the MoP on the status of

stocks of principal deep-sea fishery resources targeted. Progress has been made as described in this report.

#### **Agenda item 4.6 Future work plan**

44. Annex D describes the future work plan.

#### **Agenda item 4.7 Advice to the SC**

45. **The SERAWG's summary of advice to the SC is::**

- To consider including in the longline observer data template a record sheet for tag releases/recaptures, to develop a tagging protocol for observers/vessels and to coordinate, likely with CCAMLR, about tagging supplies.
- that a longer-term fisher-based research plan should be developed for the Del Cano Rise.
- to understand the existence of depredation in the SIOFA Area and the impact that depredation can have on toothfish catches in the SIOFA Area.

### **Agenda item 5 – Orange roughy**

#### **Agenda item 5.1 Update on the fishery**

#### **Agenda item 5.2 Orange roughy workplan (SC4 Annex G and W)**

#### **Agenda item 5.3 Resource analyses by member countries**

46. No papers were presented.

#### **Agenda item 5.4 Review of progress against CMM 2019-15 (Demersal stocks)**

47. No discussion was made due to lack of time in the video meeting.

#### **Agenda item 5.5 Future work plan**

48. None.

#### **Agenda item 5.6 Advice to the SC**

49. None.

### **Agenda item 6 – Other fisheries/species**

#### **Agenda item 6.1 Deepwater chondrichthyans**

Summary of paper

50. Australia presented SERAWG-02-09, which provides the final SIOFA deepwater chondrichthyans ecological risk assessment (ERA). This work has since been published in the ICES Journal of Marine Science (Georgeson et al. 2020). The main conclusions are that several species that are reported to have been commercially targeted in SIOFA were assessed as being at high or extreme risk to fishing, based on which SC4/SERAWG1 developed a list of 'species of concern'; better catch, effort and biological information is needed to inform assessment and management; and if there is targeted shark fishing in the Southern Indian Ocean, improved assessments and estimates of sustainable yields are urgently required to mitigate risk of overexploitation.

51. Based on the paper, Australia proposed that the SERAWG recommend that the SC:

- Notes that the work represents a positive and successful collaborative effort between SIOFA CPs, the Secretariat and various other institutions, and on behalf of all co-authors and contributors, accepts Australia's expression of gratitude for the outcomes achieved.
- Notes that there is considerable uncertainty around the characteristics of SIOFA deepwater chondrichthyan fisheries and that resolving these uncertainties would greatly assist future scientific research and management of these fisheries, and requests that SIOFA CPs catching the largest volumes of deepwater chondrichthyans (whether defined as 'targeted' or 'bycatch') collaborate to provide a paper to SC6 on the characteristics of these fisheries.
- Notes the key findings of this assessment, specifically that:
  - i. Uncertainties in ERA analyses and the input data should not prevent a precautionary approach being taken by SIOFA to prioritise species for further research, data collection and/or stock assessment to estimate sustainable yields;
  - ii. Information on the identification, distribution, stock structure, biology and life history of many deepwater chondrichthyans is lacking and needs to be improved;
  - iii. At-sea identification protocols need to be improved and efforts should be made to collect information on deepwater chondrichthyans at a species level in logbook and observer records, with these data being recorded at the best possible resolution in the SIOFA databases;
  - iv. Research on species' post-capture mortality and selectivity would be useful to reduce uncertainties in this assessment, as well as to inform mitigation strategies to minimise vulnerability associated with susceptibility; and
  - v. More quantitative assessments are urgently required for deepwater shark species which are reported to be commercially targeted or retained in relatively high volumes in the Southern Indian Ocean to minimise the risk of overexploitation that has occurred in other fisheries globally.
- Notes the measures implemented in SIOFA partly in response to this work, including the implementation of CMM 2019/12 (Sharks) and the recommendation for SIOFA vessels to carry and use the relevant FAO guides to the Deep-sea Cartilaginous Fishes of the Indian Ocean (Volumes 1 and 2).
- Recommends that the ERA for SIOFA deepwater chondrichthyans be updated every five to ten years, or whenever there is a substantial change in the fishery (e.g. large changes in catch and/or effort), and that these periodic updates be reflected in the SIOFA SC workplan.

#### SERAWG discussion

52. The Food and Agriculture Organization (FAO) suggested that the use of risk analyses provides a first estimate to identify what species are at risk, which can be applied to many situations. There is surprisingly little information available on the distribution of the fisheries by gear and on the species at risk. Spatial information on fisheries, stocks and bycatch species is important and needed, not only for their

risk assessments, but for sustainable fisheries, biodiversity impacts and marine spatial planning. The SERAWG agreed that better and more accessible information, particularly on species distribution, is highly desirable.

53. Regarding reviewing progress against CMM 2019-12 (Sharks), the Co-Chair (Australia) reminded the participants that the SC has been tasked with advising the Meeting of the Parties (MoP) on the need to adopt bycatch limits for deepwater sharks in SIOFA.
54. The SERAWG discussed the large removals of low-productivity and potentially highly vulnerable species and agreed that precautionary bycatch limits are necessary if the removals continue. The Co-Chair (Australia) noted that the majority of catches of deepwater sharks in SIOFA are being taken by one CP using longline gears.
55. The SC Chair reminded the participants that, after the SERAWG1 discussions, SC4 advised the MoP to urgently consider measures to mitigate the overexploitation of the key species of concern. Based on that advice, the MoP developed the current CMM (Sharks). It would help the SC if the SERAWG could provide or identify data for setting bycatch limits, as the SC has already advised the MoP that the setting of such limits is needed.
56. The SERAWG discussed that there were no attempts being made to identify SIOFA-specific bycatch limits for deepwater sharks at the current time. Consequently, in the absence of any other attempts or methods to inform the setting of bycatch limits, the SERAWG suggested that the deepwater chondrichthyan bycatch and move-on rules used by CCAMLR would be a sensible way to mitigate bycatch of deepwater sharks in SIOFA.

#### **Agenda item 6.1.1 Implementation of FAO shark guides (CMM 2019-02, para. 8) and other efforts to improve data collection**

#### **Agenda item 6.1.2 Review of progress against CMM 2019-12 (Sharks), including development of precautionary bycatch limits (para. 4)**

57. Progress has been made as described in this report.

#### **Agenda item 6.1.3 Future work plan**

58. Annex D describes the future work plan.

#### **Agenda item 6.2 Resource analyses by member countries**

#### **Agenda item 6.3 Future work plan**

59. Annex D describes the future work plan.

#### **Agenda item 6.4 Advice to the SC**

60. **The SERAWG's summary of advice to the SC is to:**
  - note that the work represents a positive and successful collaborative effort between SIOFA CPs, the Secretariat and various other institutions, and on behalf of all co-authors and contributors, accept Australia's expression of gratitude for the outcomes achieved.
  - note that there is considerable uncertainty around the characteristics of SIOFA deepwater chondrichthyan fisheries and that resolving these uncertainties would greatly assist future scientific research and management of these fisheries, and request that SIOFA CPs catching the largest volumes of deepwater

chondrichthyans (whether defined as ‘targeted’ or ‘bycatch’) collaborate to provide a paper to SC6 on the characteristics of these fisheries.

- note the key findings of the ERA, specifically that:
    - i. uncertainties in ERA analyses and the input data should not prevent a precautionary approach being taken by SIOFA to prioritise species for further research, data collection and/or stock assessment to estimate sustainable yields;
    - ii. information on the identification, distribution, stock structure, biology and life history of many deepwater chondrichthyans is lacking and needs to be improved;
    - iii. at-sea identification protocols need to be improved and efforts should be made to collect information on deepwater chondrichthyans at a species level in logbook and observer records, with these data being recorded at the best possible resolution in the SIOFA databases;
    - iv. research on species’ post-capture mortality and selectivity would be useful to reduce uncertainties in this assessment, as well as to inform mitigation strategies to minimise vulnerability associated with susceptibility; and
    - v. more quantitative assessments are urgently required for deepwater shark species which are reported to be commercially targeted or retained in relatively high volumes in the Southern Indian Ocean to minimise the risk of overexploitation that has occurred in other fisheries globally.
  - note the measures implemented in SIOFA partly in response to the ERA, including the implementation of CMM 2019/12 (Sharks) and the recommendation for SIOFA vessels to carry and use the relevant FAO guides to the Deep-sea Cartilaginous Fishes of the Indian Ocean (Volumes 1 and 2).
  - update the ERA for SIOFA deepwater chondrichthyans every five to ten years, or whenever there is a substantial change in the fishery (e.g. large changes in catch and/or effort), and reflect these periodic updates in the SIOFA SC workplan.
61. Regarding CMM 2019-12 (Sharks), the SERAWG **recommended** that, in the absence of any other attempts or methods to inform the setting of SIOFA-specific bycatch limits, the deepwater chondrichthyan bycatch and move-on rules used by CCAMLR would be a sensible way to mitigate bycatch of deepwater sharks in SIOFA.

## Agenda item 7 – Technical work to inform reference points and harvest strategy development

### Agenda item 7.1. Review and progress against the work plan (SC4 Annex X)

### Agenda item 7.2. Future work plan

### Agenda item 7.3. Advice to the SC

## Agenda item 8 – Ecological risk assessment

### Agenda item 8.1 Teleosts and others

62. Australia presented SERAWG-02-10 (update to SC4-27), which provides an update on the ERA for the effects of bottom fishing gears on SIOFA teleosts.

- Update: There have been no major changes to the results. However, the species list is still incomplete as a number of species codes in the SIOFA database correspond to species that do not occur in SIOFA. There are also issues with resolution in the database relating to group codes and catches by gear. A number of red flags were identified, such as an F estimate for alfonsino of 0 for midwater trawl gears, indicating a problem with the distribution and/or effort data.
- Response to the issues raised at SC: The presenter (Australia) decided against constraining the species list for each gear type until distribution data issues are resolved. It has also concluded that there would be limited benefit in exploring biological/life history data gaps as the objective of the ERA is to prioritise species requiring more attention.
- Future work: Suggested future work includes reviewing effort data quality, coverage and currency; reviewing and refining the species list; looking at database coding and gear type issues; running sensitivities on the distribution data or looking for alternative sources; and reviewing and refining selectivity assumptions for certain gears. Australia noted that it can continue this work.

63. Based on this, Australia proposed that the SERAWG recommend that the SC:

- Notes that ERA can be a useful method for prioritising species that may require further data collection, assessment and/or management actions, particularly when results are considered against relevant conservation and management measures and in the context of information on catches, fishing effort and species biology;
- Notes that these ERA tools could be extended to cover other taxa in SIOFA, including marine mammals, marine reptiles, seabirds and other species of concern;
- Notes the methodological update made to this assessment;
- Notes the actions described and proposed in response to discussions during SERAWG1 and SC4;
- Notes that the uncertainties around the results indicate the need for additional work on the species list, species distribution, fishing effort data and selectivity assumptions;
- Notes that until these uncertainties are reduced, results should be viewed with caution;

- Requests the Secretariat to work collaboratively with each CP to resolve species coding and database issues (particularly whether catch data for 'unspecified trawl' gears can be disaggregated into specific trawl gear types) before SC6 in 2021;
- Requests Australia to continue to lead this work in collaboration with the Secretariat and SIOFA CPs; and
- Reflect an update to this work to resolve the aforementioned uncertainties in SIOFA SC's and SERAWG's workplans.

**Agenda item 8.1.1 Relevance to implementation of the SIOFA stock assessment framework and refinement of SIOFA species list**

**Agenda item 8.1.2 Priority species for further assessment**

**Agenda item 8.2. Report of Ecosystem Approach to Fisheries - Dr Fridtjof Nansen cruise (2018) (Seychelles and Thailand)**

**Agenda item 8.3. Future work plan**

64. Annex D describes the future work plan.

**Agenda item 8.4. Advice to the SC**

65. The SERAWG's **summary of advice to the SC is to:**

- note that ERA can be a useful method for prioritising species that may require further data collection, assessment and/or management actions, particularly when results are considered against relevant conservation and management measures and in the context of information on catches, fishing effort and species biology.
- note that the tools used in the ERA for teleosts (SERAWG-02-10) could be extended to cover other taxa in SIOFA, including marine mammals, marine reptiles, seabirds and other species of concern.
- note the methodological update made to the ERA for the effects of bottom fishing gears on SIOFA teleosts.
- note the actions described and proposed in response to discussions during SERAWG1 and SC4.
- note that the uncertainties around the ERA results indicate the need for additional work on the species list, species distribution, fishing effort data and selectivity assumptions and that, until these uncertainties are reduced, results should be viewed with caution.
- request the Secretariat to work collaboratively with each CP to resolve species coding and database issues (particularly whether catch data for 'unspecified trawl' gears can be disaggregated into specific trawl gear types) before SC6 in 2021.
- request Australia to continue to lead the ERA work for teleosts in collaboration with the Secretariat and SIOFA CPs.
- reflect an update to this work to resolve the aforementioned uncertainties in SIOFA SC's and SERAWG's workplans.

## **Agenda item 9 – SIOFA stock assessment framework – implementation, including species categorisation and data characterisation, including refining SIOFA species list**

### **Agenda item 9.1. Review and discussion**

#### **Agenda item 9.2. Advice to the SC**

66. The SERAWG **advised** that the SC support the establishment of a data catalogue be established for the SIOFA database, as normally available in other RFMOs, including observer data, to be able to quickly understand what kinds of information are available. The catalogue should include variables such as catch, effort, size, weight, maturity, etc., and attributes such as sex, gear, fleet, temporospatial resolutions, period, etc. Such a catalogue will be essential for the development of concrete time/cost effective approaches for many aspects such as CPUE standardisation, stock assessment, MPA, ecological risk assessment, bottom fishing impact assessment, footprint development, VME mapping, etc.

## **Agenda item 10 – Future meeting arrangements**

## **Agenda item 11 – Other business**

## **Agenda item 12 – Adoption of the meeting report**

67. The report of the 2nd meeting of the SIOFA SERAWG was adopted via e-mail on July 15, 2020.

## **Agenda item 13 – Close of meeting**

68. The meeting was closed on July 15, 2020 when the report was adopted.

## ANNEX A – List of participants of the 2nd SERAWG of SIOFA

| co-chairs                                     | Name             | Email                            |
|---|------------------|----------------------------------|
|   | Tom NISHIDA      | tom.nishida.9691@gmail.com       |
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### Observers

|                 |                 |                               |
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| CCAMLR          | Keith REID      | keith.reid@ccamlr.org         |
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## Consultants

|                                     |                   |   |
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## SIOFA Secretariat

|                |                   |                             |
|----------------|-------------------|-----------------------------|
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## Rapporteur

|            |                           |
|------------|---------------------------|
| Alex MEYER | Meyer@urbanconnections.jp |
|------------|---------------------------|

## **ANNEX B – Agenda**

### **Second Meeting of the SIOFA Stock and Ecological Risk Assessment Working Group (SERA-WG2)**

Co-Chairs: Dr Tom Nishida (Stock Assessment) and Mr Lee Georgeson (Ecological Risk Assessment)

Items which will not be addressed this year due to the reduced format and postponed to 2021 are in grey text.

Note: The SIOFA SERAWG is a formal sub-group of the SIOFA Scientific Committee and is subject to the same Rules of Procedure as other SIOFA bodies. In accordance with the SERAWG's Terms of Reference, all 'rules' of the SERAWG will be consistent with the SC Terms of Reference.

#### **1. Openings**

- 1.2 Opening statement from the Co-Chairs
- 1.2 Introduction of participants

#### **2. Administrative arrangements**

- 2.1. Adoption of the agenda
- 2.2. Confirmation of meeting documents
- 2.3. Appointment of rapporteurs
- 2.4. Review of functions and terms of reference

*These agenda items are administrative requirements as guided by the SIOFA Rules of Procedure.*

#### **3. Alfonsino**

*In accordance with CMM 2019/01 para 6, SC 2020 shall develop and provide advice and recommendations to the MoP 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.*

*In accordance with CMM 2019/15 para 3, SC shall provide annual reports on the status of demersal fisheries resources targeted, relative to available and/or relevant reference points. The reports shall include, where possible, projections of stock status over a period no less than 20 years, with 5 years steps, relative to a range of fishing mortality. In addition to the annual report on stock status, SC will provide management advice relative to available and/or relevant reference points. Additionally, MoP5, para 51, requests SC provide advice on the status of stocks in relation to MSY until specific reference points are adopted (MoP5 Report, para 51).*

##### **3.1. Update on the fishery**

*The update on the fishery will provide input to the requirement in CMM 2019-15 (Demersal stocks) para 3.*

##### **3.2. Alfonsino workplan (SC4 Annex G and W)**

*SERAWG to review workplan. SC4, para 135 and Annex V outline the work plan for the alfonsino assessment under the SERAWG.*

##### **3.3. Resource analyses by Contracting parties, participating non contracting parties and participating fishing entities (CCPs)**

##### **3.4. Report of CPUE evaluation and stock assessments by the Consultant**

##### **3.5. Review of progress against CMM 2019-15 (Demersal stocks)**

*In addition to the directions noted above in CMM 2019/01 para 6 and CMM 2019/15 para 3, in accordance with CMM 2019/15 para 54-55, the SC 2020 shall assess the Beryx splendens stocks and provide advice on assessment time frames. The SC shall provide advice and guidance on any necessary changes to data collection to reduce future assessment uncertainty.*

### **3.6. Future work plan**

*SERAWG to formulate future workplan.*

3.7. Other matters (storage and property of otoliths and relevant data)

### **3.8. Advice to the SC**

*SERAWG to formulate advice to the Scientific Committee on the stock assessment, stock status and work plan.*

## **4. Patagonian toothfish**

*In accordance with CMM 2019/01 para 6, SC 2020 shall, develop and provide advice and recommendations to the MoP 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.*

*In accordance with CMM 2019/15 para 3, SC shall provide annual reports on the status of demersal fisheries resources targeted, relative to available and/or relevant reference points. The reports shall include, where possible, projections of stock status over a period no less than 20 years, with 5 years steps, relative to a range of fishing mortality. In addition to the annual report on stock status, SC will provide management advice relative to available and/or relevant reference points. Additionally, MoP5, para 51, requests SC provide advice on the status of stocks in relation to MSY until specific reference points are adopted (MoP5 Report, para 51).*

### **4.1. Update on the fishery**

*The update on the fishery will provide input to the requirement in CMM 2019-15 (Demersal stocks) para 3.*

### **4.2. Patagonian toothfish workplan (SC4 Annex G and W)**

*SERAWG to review workplan.*

### **4.3. Resource analyses by CCPs**

4.4. Relevant information from CCAMLR

### **4.5. Review of progress against CMM 2019-15 (Demersal stocks)**

*In addition to the directions noted above in CMM 2019/01 para 6 and CMM 2019/15 para 3, in accordance with CMM 2019/15 para 28-30, SC 2020, for the Del Cano Area, the SC shall make recommendations to build an area wide habitat model, a spatial and temporal CPUE analysis, an estimate and map of local abundancies and a local population assessment. It shall advise on any necessary improvements to data collection to reduce future assessment uncertainty. The SC shall address the issues related to depredation and advise on appropriate limits for relevant species caught as bycatch in Dissostichus spp. fisheries.*

### **4.6. Future work plan**

*SERAWG to formulate future workplan*

### **4.7. Advice to the SC**

*SERAWG to formulate advice to the Scientific Committee on the technical elements above and work plan.*

## 5. Orange roughy

*In accordance with CMM 2019/01 para 6, SC 2020 shall, develop and provide advice and recommendations to the MoP 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.*

*In accordance with CMM 2019/15 para 3, SC shall provide annual reports on the status of demersal fisheries resources targeted, relative to available and/or relevant reference points. The reports shall include, where possible, projections of stock status over a period no less than 20 years, with 5 years steps, relative to a range of fishing mortality. In addition to the annual report on stock status, SC will provide management advice relative to available and/or relevant reference points. Additionally, MoP5, para 51, requests SC provide advice on the status of stocks in relation to MSY until specific reference points are adopted (MoP5 Report, para 51).*

### 5.1. Update on the fishery

*The update on the fishery will provide input to the requirement in CMM 2019-15 (Demersal stocks) para 3.*

### 5.2. Orange roughy workplan (SC4 Annex G and W)

*SERAWG to review workplan.*

### 5.3. Resource analyses by CCPs

### 5.4. Review of progress against CMM 2019-15 (Demersal stocks)

*SERAWG to review progress against CMM 2019-15 paragraphs 4-6. Specifically, in accordance with para. 5, the orange roughy stocks shall be the subject of a full stock assessment to be assessed every three to five years. In the interim period available information on ORY stocks shall be presented annually [also relevant to agenda item 5.1]. In accordance with para. 6, the SC shall provide a summary of future data needs to improve assessment accuracy, as well as provide a summary to MoP-7 on progress against the ORY work plan.*

### 5.5. Future work plan

*SERAWG to formulate future work plan.*

### 5.6. Advice to the SC

*SERAWG to formulate advice to the Scientific Committee on the technical elements above and work plan.*

## 6. Other fisheries/species

*In accordance with CMM 2019/01 para 6, SC 2020 shall, develop and provide advice and recommendations to the MoP 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.*

### 6.1. Deepwater chondrichthyans

6.1.1. Implementation of FAO shark guides (CMM 2019-02, para. 8) and other efforts to improve data collection

6.1.2. Review of progress against CMM 2019-12 (Sharks), including development of precautionary bycatch limits (para. 4)

*SERAWG to review progress against CMM 2019-02 paras 1–7. Specifically, in accordance with paragraph 4, by 2020 the SC shall advise the Meeting of the Parties on the need to adopt any appropriate by-catch limits for relevant SIOFA deep sea shark species and fleets, including on scientific and data needs for underpinning the elaboration of such advice.*

### 6.1.3. Future work plan

*SERAWG to formulate future workplan.*

- 6.2. Resource analyses by CCPs including the MRAG report (Saya de Malha bank) (Mauritius)
- 6.3. Future work plan

### 6.4. Advice to the SC

*SERAWG to formulate advice to the Scientific Committee on the technical elements above and work plan.*

## 7. Technical work to inform reference points and harvest strategy development

*MoP5 para 52-53 requested the SC provide advice on candidate target and limit reference points for orange roughy, alfonsino and toothfish and develop a framework and workplan for the establishment of harvest strategies for key SIOFA stocks. SC4 para 174-175 and Annex X outline the work plan to progress this work.*

- 7.1. Review and progress against the work plan (SC4 Annex X)
- 7.2. Future work plan  
*SERAWG to formulate future workplan.*
- 7.3. Advice to the SC  
*SERAWG to formulate advice to the Scientific Committee on the technical elements above and work plan.*

## 8. Ecological risk assessment

*In accordance with CMM 2019/01 para 6, SC 2020 shall, develop and provide advice and recommendations to the MoP 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.*

### 8.1. Teleosts and others

- 8.1.1. Relevance to implementation of the SIOFA stock assessment framework and refinement of SIOFA species list
- 8.1.2. Priority species for further assessment
- 8.2. Report of Ecosystem Approach to Fisheries - Dr Fridtjof Nansen cruise (2018) (Seychelles and Thailand)

### 8.3. Future work plan

*SERAWG to formulate advice to the Scientific Committee on the technical elements above and work plan.*

### 8.4. Advice to the SC

*SERAWG to formulate advice to the Scientific Committee on the technical elements above and work plan.*

## 9. SIOFA stock assessment framework – implementation, including species categorisation and data characterisation, including refining SIOFA species list

- 9.1. Review and discussion
- 9.2. Advice to the SC

## 10. Future meeting arrangements

## 11. Other business

## 12. Adoption of the meeting report

Close of meeting

## **ANNEX C – List of SERAWG Meeting Documents**

SERAWG-02-01 Terms of Reference for SERAWG.pdf  
SERAWG-02-02 Template for Papers to SERAWG2.docx  
SERAWG-02-03 Provisional Agenda rev 8.pdf

SERAWG-02-07 Alfonsino Age and Growth rev1.pdf  
SERAWG-02-08 Preliminary estimation of alfonsino growth equation in SW IO.pdf  
SERAWG-02-09 SIOFA chondrichthyans risk assessment.pdf  
SERAWG-02-10 Update teleosts risk assessment.pdf  
SERAWG-02-11 RESTRICTED Preliminary analysis of the Patagonian toothfish data of Del Cano Rise.pdf  
SERAWG-02-12 No boundaries for whales interacting with fishing activities targeting Patagonian toothfish.pdf  
SERAWG-02-13 RESTRICTED Alfonsino CPUE standardisation (Final 20-03).pdf  
SERAWG-02-14 Age-Structured Production Model assessments of the Alfonsino.pdf

SERAWG-02-INFO-01 Rev1 Comparison of 4 alfonsino growth equations.pdf  
SERAWG-02-INFO-02 Alfonsino management units.pdf  
SERAWG-02-INFO-03 Alfonsino abundance index (acoustic vs CPUE) .pdf  
SERAWG-02-INFO-04 ToR CPUE evaluation and stock assessments of splendid alfonsino.pdf  
SERAWG-02-INFO-05 Alfonsino age determinaton.pdf  
SERAWG-02-INFO-06 RESTRICTED Alfonsino CPUE standardisation (Draft 14-02).pdf  
SERAWG-02-INFO-07 RESTRICTED Comments & reply on STD\_CPUE (ref INFO-06).docx  
SERAWG-02-INFO-08 RESTRICTED ASPM comments (Cook Islands) word version.docx  
SERAWG-02-INFO-09 RESTRICTED Consultant's reply (for Qs by SC + Additional work) rev1.pdf

## **ANNEX D – Future Work Plan**

(1) Patagonian toothfish: Stock assessment: 25,000 Euros (Consultant) (2020)

This work is required in accordance with CMM 2019/01 Para 6 and CMM 2019/15 Para 3.

(2) Reference points and harvest strategies: 20,000 Euros (2020) (Consultant)

The SC (2019) requested SERAWG to provide advice on candidate target and limit reference points for orange roughy, alfonsino and toothfish and develop a framework according to MoP5 (2019) report para 52-53 and SC4 report para 174-175. SC specifically requested the following three points: (a) to develop a generic approach for determining reference points for current and future stocks, (b) candidate reference points should take into account the level of data uncertainty in stocks, noting the data-limited nature of some fisheries/stocks and (c) for straddling stocks, consistent reference points should be applied across the stock. In conducting this work, a consultation will be maintained among the three parties of scientists, fishery managers and stakeholders. This plan was initially scheduled to be implemented over two years, but due to the delay by one year (no activities). Thus its duration will be shorted by one year (2020) and work will be conducted intensively.