



Australian Government

Australian Fisheries Management Authority



Sixty-eighth meeting of the Sub-Antarctic Resource Assessment Group (SARAG)

FINAL MINUTES

SARAG 68

2-3 MAY 2023

SUB- ANTARCTIC RESOURCE ASSESSMENT GROUP (SARAG)

CHAIR: Mr Bruce Wallner

Date: 2-3 May 2023

Venue: Lenna of Hobart, Tasmania

Attendance

Members

Dr Philippe Ziegler, AAD
Dr Cara Masere, AAD
Dr Rich Hillary, CSIRO
Dr Tim Ward, IMAS
Brad Milic, Industry
Rhys Arangio, Industry
Danait Ghebregabhier, AFMA
Claire Wallis, Executive Officer, AFMA

Invited Participants & Observers

Dr Heather Patterson, ABARES
Dr Pia Bessell-Browne, CSIRO
Malcolm McNeil, Industry
Martijn Johnson, Industry
Selina Stoute, AFMA
Dale Maschette, IMAS
Alice McDonald, AFMA
Heather Johnston, DAFF

Introduction

Agenda item 1 - Preliminaries

1.1 Welcome and Apologies

The sixty-eighth meeting of the Sub-Antarctic Resource Assessment Group (SARAG 68) was opened at 1:00pm on 2 May 2023 by the Chair, Mr Bruce Wallner. The Chair welcomed members and observers to the meeting and acknowledged the Muwinina people as the traditional owners and custodians of the land SARAG 68 met on, including their ongoing connections to land and sea country and paid respects to elders past, present and emerging.

Dr Rachel Baird and Malcolm McNeil were noted as apologies for the meeting.

Members noted that the meeting was being recorded for the purpose of developing the meeting record.

1.2 Declarations of interest

SARAG noted a declaration of interests from Heather Johnston, from the Department of Agriculture, Forestry and Fisheries (DAFF), which was incorporated into the standing declaration of interests, which can be found at **Attachment A**.

The Chair noted that industry has a strong interest in stock assessment items, but as the items in the meeting focused on technical inputs only, all members would be included in the discussions.

On the matter of the 2023/24 CCAMLR New and Exploratory Fisheries application (Agenda Item 8.1) SARAG agreed that Mr Arangio would leave the room for the discussion due to the commercial in confidence nature of the item.

Members noted that industry also holds an interest in the seabird arrangements (agenda item 9.4) and agreed that should the discussion progress to recommendations, industry would be asked to leave the room.

1.3 Adoption of agenda

SARAG added an item under Other Business to include a presentation from Dr Masere on recent University of Tasmania (UTAS) postgraduate student projects related to HIMI and adopted the amended agenda.

The agenda can be found at **Attachment B.**

Agenda item 2 – Actions Arising

Actions arising from SARAG 66, SARAG 67 and a Joint Meeting of SARAG and SouthMAC (February 2023) are summarized at **Attachment C.**

SARAG noted an update from the AFMA member on the status of actions arising from previous SARAG meetings.

SARAG 68 noted that AFMA has clarified with the AFMA observer program that the cameras available are suitable to meet the requirements of the current observer workplan. On the issue of updates to the observer workplan and potential flow on changes to camera performance requirements, SARAG members noted that the observer data collection program guidelines should be reviewed regularly, with the next review required prior to the 2023/24 season start.

SARAG heard that pictures supporting species ID in the CCAMLR New & Exploratory (N&E) fisheries were not reliably of sufficient quality, and that a question also existed as to whether cameras should be retained by vessels rather than individual observers to ensure their availability. The group discussed whether data needs were being met by current data collection protocols and requested that this be determined, including as part of reviewing the observer data collection workplan if appropriate.

SARAG discussed the role of electronic monitoring (EM) and how emerging and available technology might be considered in the context of reviewing data needs and updated observer protocols, with some members recalling prior AFMA work around EM and meeting management needs. Members noted that as AFMA projects provide recommendations, SARAG might consider this under future reviews of the observer data collection requirements. SARAG also noted that some data collection requests have come through in an ad-hoc manner, such as genetic sampling, and noted the importance of both using defined pathways to request data collection, in addition to regular review of data needs.

Members discussed whether data collection requirements were described in the fishery data and monitoring strategy and recommended reviewing this document to clarify. Members recommended that Action Arising 2 be streamlined, and that the AAD should review the data needs of the New and Exploratory fisheries, MITF and HIMI fisheries, including those related to image collection, followed by a meeting between AFMA and the AAD to review the observer instructions and handbook for the 2023/24 seasons, with thought also given to supplementary instructions. Members noted that following this, SARAG may be approached for a recommendation on any additional data collection methods, including suitable cameras.

The group heard an update from the AFMA member on the observer seabird abundance data collection protocols in both HIMI and MITF and noted that AFMA was still investigating the availability and extent of seabird abundance data. The group noted that the task is partially complete and that AFMA recommended that an external expert should be engaged to complete a retrospective data analysis exploring the suitability of available data and data collection protocols to answer questions informing management risk assessments and subsequent decisions and making recommendations to address any gaps identified.

The group noted that this initial analysis would then support further interrogation of the data to identify temporal trends in presence/absence and abundance data (possibly by species) with the goal to illustrate changing risk throughout the season.

SARAG heard an update from the AAD on recommended upgrades to the CCAMLR Mixture Model (CMIX), a model used to distinguish age classes in toothfish, and relevant funding investigations. Members noted that the CMIX model was developed by the AAD in 1994, and the AAD was seeking to update the model and develop an open-source platform in R or C. The AAD considered that providing the funding was necessary for the benefit of the Australian and CCAMLR communities, and as a result the updated open source CMIX is nearing completion with a paper to be presented to WG-SAM at either the 2023 or 2024 meeting.

The AFMA member provided an update on the status of the Electronic Monitoring (EM) Working Group including a history of EM-WG activity and noted the ongoing importance of revisiting activation of the group. SARAG was asked to consider whether EM discussions should be incorporated by a broader Commonwealth Fisheries EM group or carried by a separate subgroup going forward and noted the significant differences in data needs in the Sub Antarctic and CCAMLR fisheries.

The group discussed whether EM could be considered as augmentation or a replacement for some observer tasks, and what the CCAMLR approval process for this might be. A Scientific member indicated that any EM functions would need to show equivalence with observer protocols, with production of evidence through structured work. The group noted that testing EM in the HIMI or MITF fisheries might eventually provide baseline performance data to inform these discussions.

SARAG heard that AFMA hosted a meeting focused on HIMI specific potential uses of EM in supplementing elements of observer tasks and following this meeting AFMA announced broader funding in its data transformation strategy across Commonwealth fisheries. Industry members clarified that the broader AFMA EM-WG following this announcement was for all Commonwealth fisheries, not solely focused on the sub-Antarctic fisheries. SARAG noted that EM is not a regulatory tool in the Sub Antarctic Fisheries and is not currently implemented on all active vessels, and industry expressed support for discussions that focused on data collection rather than regulation at this time.

Members noted the previous discussion of data collection review processes and how this might eventually incorporate use of EM data to meet data needs and discussed whether a standing data needs agenda item should be introduced at the start of each season. SARAG reflected that while a standing agenda item is appropriate, additional actions in this area are needed in the interim including reconvening a focused EM discussion group. The group would be tasked with considering potential roles EM and other emerging related technology might have in the fishery, including AI species identification, length-weight data collection, and emerging climate data collection needs. Members noted that future work on EM in the Sub Antarctic fisheries should seek to link to AFMA funding in a structured way to support dedicated time to progress these discussions.

SARAG agreed another meeting should be scheduled to consider potential roles of EM might have in the fishery, beginning with a planning process including determining which fisheries might be best suited for initial trials.

Dr Hillary gave an update on the close-kin mark-recapture (CKMR) sampling program. SARAG heard that the initial questions the pilot study sought to address was whether it would be possible to get sufficient useable samples while avoiding things like cross contamination. Dr Hillary outlined several sampling approaches that were trialled, acknowledged the challenges of sampling toothfish and confirmed that a tuna sampling tool is currently the best available option. SARAG heard that the assessment of the most recent samples provided indicates the sample quality is good, with sufficient DNA volume and low cross contamination and a 10% drop out rate. Dr Hillary expressed that sample quality could be further improved, and that next steps are to improve the drop-out rates (linked to the amount of each sample provided) which will in turn allow fishers to more easily provide the number of viable samples to support the study.

Industry asked whether the vessel that provided the higher quality batch of samples could be identified and noted that the key message is further tightening of clean, sufficient sample collection on the vessels. SARAG noted that resumption of sample collection and further progression of the project would be informed by the data collection cost-benefit analysis discussion under Agenda Item 7.

SARAG heard that the AAD had completed development of a data logsheet for mag-by-mag recording of sea lice data, and that this was distributed to industry in January 2023.

SARAG noted Action Arising 8 where industry had requested that a list of biological samples collected during a trip be provided to the vessel to ensure everything is unloaded correctly. SARAG recommended that AFMA should contact Tim Lamb at the AAD to get a full understanding of the history of this issue, and to revisit the discussion at SARAG 69. The group noted that the issue may have stemmed from macrourid samples being accidentally mixed with toothfish during an unload, which the AAD has sought to address by providing yellow biosecurity bags for whole fish samples for differentiation from toothfish going forward. The SARAG heard that there may be emerging challenges with importing biological samples into Australia as vessels are showing greater preferences to unload in Mauritius, and that thought might need to be given to processes around this going forward.

SARAG heard an update from the AFMA Member that actions arising from February discussions on the Random Stratified Trawl Survey (RSTS) had been completed, including confirmation from SouthMAC to approve an amendment to the RSTS start date to 13 March 2023.

Agenda item 3 – Correspondence

SARAG noted the correspondence which had been received out-of-session since the SARAG 66 meeting in August 2022, a summary of which is at **Attachment D**.

Agenda item 4 – Member Updates

4.1 Industry Member Updates

Mr Arangio reported that Austral started the HIMI fishing season targeting icefish in January and February. SARAG heard that the icefish TAC is very high this year, and Austral reported catching approximately 1000t in 2022. Ongoing challenges with market access made selling the catch more difficult last year, and as a result Austral decided not to pursue the full quota in 2023. Catch rates in

January started off very poor before improving, with a retained catch of ~300t this season. Following this, the Random Stratified Trawl Survey took place in March and April, with the survey starting five days earlier than previous years and taking just over three weeks to complete. SARAG heard that Patagonian toothfish catches at Evitas were quite high while icefish was relatively low.

Austral has sold a vessel, with two remaining HIMI vessels, to increase efficiencies following reductions in the HIMI TAC. Mr Arangio reflected that as a result of the sale, Austral carries increased financial risk if catch rates are low or the seabird interaction limits during the season extension at HIMI are activated. Austral currently has a vessel fishing with longlines since the last fortnight, while the other vessel had been longlining since the start of April. Catch rates started off well and both vessels are experiencing whale and sea lice issues at present, and that an interaction with a grey petrel had occurred in the April extension period.

Mr Milic gave an update on behalf of Australian Longline Pty Ltd. SARAG heard that at the start of the year one vessel was in East Antarctica (58.4.2) and fished research blocks 58.4.2_1 and 58.4.2_2, and that the TACs in East Antarctica are shared with France under the research plan. Catch rates in research block 58.4.2_1 were good and the catch limit was reached. High grenadier catches that may have reflected a spawning event were reported when the vessel started fishing in block 58.4.2_2, and the group heard that the vessel had to pause fishing strategically to manage 10-day bycatch trigger limits. The vessel completed fishing on 20 March after triggering the macrourid 10-day bycatch limits and returned to Mauritius, then departed to fish at HIMI in mid-April.

The second vessel was active in the Ross Sea over the summer period starting in 88.2_A until the area north of 70°S was closed by CCAMLR and then moved east. The trip was interrupted by a medical evacuation to New Zealand, and the vessel then returned to the western parts of the Ross Sea. The macrourid move on rule was triggered once in 88.2_H, at which point the vessel moved to 88.2_G and spent the rest of the season there, with good Antarctic toothfish catches reported. The vessel returned to New Zealand following this trip and has been fishing the Macquarie Island Toothfish Fishery (MITF) since the season opened on 15 April.

4.2 AFMA Update

SARAG noted the following written updates provided to the members as read.

2022 season deployments

Between 1 December 2021 and 30 November 2022 AFMA deployed an observer on sixteen voyages, achieving 898 fishing days spread across HIMI, MITF and CCAMLR exploratory fisheries

- 12 HIMI voyages, (710 fishing days)
- 2 MITF voyages, (128 fishing days); and
- 2 CCAMLR exploratory fisheries (1 Ross Sea and 1 East Antarctic) voyages (60 fishing days).

Tagging update for 2022 season

Since the commencement of the fishing season there have been a total of 6,764 Toothfish tagged (1,642 recaptured) and 1,345 skates tagged (43 recaptured) spread across HIMI, MITF and CCAMLR exploratory fisheries

- 5,345 toothfish were tagged at HIMI (1642 recaptured).

- 1,320 skates were tagged at HIMI (42 recaptured).
- 927 toothfish were tagged at Macquarie Island (208 recaptured).
- No skates were tagged or recaptured at MITF.
- 492 toothfish were tagged in Exploratory fisheries (24 recaptured).
- 25 skates were tagged in Exploratory fisheries (1 recaptured).

Members noted an update from the AFMA member on the ongoing review of MAC and RAG consultative arrangements, conducted externally by Sententia. Members heard that while the comment period closed in March, the reviewers are still accepting comments while finalising the report.

Agenda item 5 – Climate Change

The Senior Manager of the AFMA Climate Change Program gave a brief update on the outcomes from the preceding HIMI Climate Change Workshop, which met on 1-2 May 2023. SARAG heard that a workshop report was being prepared and would be provided to SARAG as it became available. SARAG noted that the workshop report would also be made publicly available on the AFMA website.

SARAG heard that AFMA would undertake an internal session looking to explore the workshop outcomes and develop an adaptation plan for the HIMI fishery. SARAG supported undertaking a similar workshop for the MITF, building on outcomes from the HIMI work however, a timeframe was not clarified. SARAG noted that CCAMLR will be holding a workshop on climate change in September 2023. The workshop will take a three-pronged approach and will seek to explore:

- 1) identification of relevant scientific information available,
- 2) potential means of integrating the information with management and CCAMLR decisions: and
- 3) data collection and management issues.

SARAG considered whether the HIMI climate change workshop outcomes might be fed into the CCAMLR process, perhaps by submission of a paper, noting that it is going to be focused not just on fisheries but also broader conservation issues, where discussions around application of the Harvest Control Rules may be relevant.

SARAG noted that the HIMI fishery was one of the first to progress under AFMA's Climate Change Program, and that moving forward the AFMA Commission expects to see that TAC setting advice has explicitly considered climate change impacts and how these inform any recommendations generated through the RAG and the MAC. Members heard that AFMA is working to develop guidance on how to undertake this and how to meet the AFMA Commission's expectations and noted that advice did not have to be quantitative; rather, identifying areas of uncertainty or clarifying where climate impacts have been captured in the stock assessment. The group discussed the potential to retroactively explore historical management decisions regarding TAC setting or fishery rules as indicators of responses to climate change.

The SESSF was identified as having already undertaken a process during TAC setting in February 2023, which included species summaries tables incorporating a traffic light approach to climate impacts for each species, in addition to identification of best available information used to create

the table. SARAG requested that this example be provided to the group for information (**Action Item 1**).

Action Item 1 - AFMA to provide example of SESSF approach to considering climate change in TAC setting at SARAG 69

Agenda item 6 – Stock Assessment Updates

6.1 Heard Island & McDonald Islands Patagonian Toothfish Stock Assessment

Dr Masere presented a paper on a draft HIMI Patagonian Toothfish Stock Assessment and described the range of data sources that inform the model including; catch data from 1997 to present, commercial catch-at-age data from 1997 to the end of 2022, estimates of IUU and catches in adjacent areas, gear loss considerations, the RSTS biomass estimates and ageing data to the end of 2022, and tag-recapture data to the end of 2022. The RSTS and commercial tagging are key data sources for the model. The group noted that location and spread of fishing effort and associated tagging activity have varied over time, with 2012 to 2022 showing an increase in fishing footprint.

Dr Masere drew SARAG's attention to tagging data, highlighting an increase in tag releases in 2015 following a rule change implementing a higher tagging rate. A reduction in longline tag releases in 2020 was noted due to the logistic difficulties on the observer program during Covid. Members heard that the age-length curve re-estimation was based on a substantial otolith collection managed by the AAD. Dr Masere clarified that the model was run with the assumption that the domestic TAC in 2023 was fully utilized.

The process of developing the model was presented to the group, starting with the stepwise addition of data during a bridging analysis. Model 1 involved updating the 2021 model with new catch, survey, commercial catch-at-age, and tag-recapture data, while Model 2 built on Model 1 by incorporating the updated growth parameters.

SARAG noted that the biomass and catchability estimates were comparable for Models with updated catch, survey, commercial catch-at-age, but that the addition of tag-recapture data produced both a substantial decrease in biomass and increase in survey catchability q . SARAG heard that the model is strongly driven by tagging data, with only a weak prior on the estimate of survey q .

Previous discussion of the 2021 assessment had flagged that the q estimate of 1.13 in the accepted model for 2021 seemed unrealistically high and that q was typically expected to be below 1. In Model 2 presented here, q further increased to 1.31, and SARAG considered that this issue requires further investigation before other aspects of the stock assessment can be addressed.

The group noted a mismatch between observed and predicted tag recaptures, with much increasing variance in recaptures seen from 2017. Members noted that in addition to the tagging data discrepancies, biomass estimates from Model 2 were well below the RSTS biomass estimates between 2018-2021 and estimates of year class strength are relatively low from 1996 onwards, with some substantial variation in the estimates around 2012. A review of expected age class abundance also indicated fewer than expected young fish were being reported, with this pattern appearing again when explored via predicted median age boxplots by gear type. SARAG considered the issue of young fish coming through into the targeted stock, and how this progression is captured under the RSTS is important to consider in the context of the B_0 trajectory over time.

The group noted that a tension appears to exist between the RSTS data and the tag return data, and the question remains how to rationalize and balance or weight these two sources of conflicting information. SARAG also recalled a previous paper that explored varying weightings of RSTS and longline data in informing the model, which clearly identified the conflict between the two data sources.

When asked how to approach weighting of data sources, the group identified that both the RSTS and tagging data could be reviewed for improvements; the RSTS may benefit from a review of locations or sampling stations and strata and of the relative weight of the Evtas stratum given relative to the broader area. Tagging data could be heavily driven by concentration of fishing effort and variability between years, which leads to very noisy observed recapture data and the current results appear to highlight a spatial issue. Ageing data is reasonable but may also have areas for improvement. In addition, a key focus should be identifying where assumptions have been violated.

Members noted that ideally a cohort should be identified in the RSTS and then a few years later appear in the commercial longline data, but it appears that the RSTS small fish are not making the transition as expected. Dr Hillary suggested testing what change in estimated natural mortality (M) might be needed to result in an increased survivorship of 25% at age 10, and members heard that an adjustment from 0.155 to 0.153 can affect estimates independent of age specific M .

Scientific members raised the question of spatial overlap in data collection between years, and whether longline data at this stage gives a reasonable density estimate for the entire fishery area. SARAG noted that further exploration of tag release and recapture patterns related to fishing effort between years was warranted, as was a review of tag movement patterns.

Some scientific members noted that it would be difficult to accept an analysis that included both RSTS and tag data sources at this stage due to the lack of model fit to these data without further investigations. SARAG suggested several sensitivity analyses to explore, including (a) using tag data to determine a prior for survey q before the RSTS data are introduced; (b) fully weighting one of the data sources at the expense of the other, and (c) excluding RSTS or tagging data.

The group noted that it would be worth exploring any signals of RSTS tagged fish in longline recaptures, noting that low returns are expected due to the decade between RSTS tagging and first availability in the longline fishery and intervening mortality and tag loss rates. The group noted time at liberty in the CASAL model is capped at 6 years due to a relatively simple implementation of tag-loss in the model, but that Casal2 will allow assessment of longer time-at-liberty periods and that it can properly represent tag loss of double-tagged fish. A suggestion was made to increase the mixing period to 2 years (as opposed to the current 1 year) to allow for the assumption of mixing to be better met. Recapture rates of tags released in 2018 - 2021 were discussed, with members noting they would have expected to see more of a decline across years, which strengthens the likelihood of a spatial issue in the data.

The group noted the high RSTS biomass estimates over the last 6 years. To evaluate whether this reflects a true recruitment pulse, Members suggested exploration of RSTS age structure and numbers of individuals in those years, noting that the mean age in the timeseries from 2018 onward was low and may reflect higher abundance of young fish. The impact of sample size between years, and whether a sub sampling approach to years with higher sample sizes might reduce variability in the time series was discussed. Review of the cohort-transformed plot of age distribution suggested recruitment rather than a catchability effect in the RSTS.

Scientific members noted that resolution of the spatial aspects of tagging data would assist in setting a direction for next steps with the model, with consideration of adding a spatial component to the

model going forward discussed. The ability for year class strength to be captured with confidence and increased understanding of age specific movement was also highlighted as key issues going forward. SARAG further discussed approaches to mixing models including discussion of spatially explicit models, which would add significant complexity. The group agreed that the AAD should continue with the development of the stock assessment taking into account suggestions raised during the discussion (**Action Item 2**) and that depending on the results of the analysis, an OOS meeting of SARAG may be necessary for further guidance prior to August.

Action Item 2 – AAD to further explore contrasting RSTS and longline tagging data results and impact on q by exploring:

- In-depth exploration of RSTS biomass patterns since 2016
- RSTS aging subsampling
- Spatial and temporal aspects of tag release and recapture overlap and impacts on recapture likelihood
- Tag movement patterns
- Years allowed between tag release and recapture
- Choice of years used for YCS estimates and use in assessment
- RSTS and tag data weighting (bridging analysis and sensitivity analysis)
- Combining RSTS and LL tagging data to explore RSTS tag returns

6.2 Macquarie Island Patagonian Toothfish Stock Assessment

Dr Bessell-Browne gave a presentation on updates to parameters used in the Macquarie Island Patagonian toothfish stock assessment, and preliminary outputs. SARAG heard that growth inputs had been updated using age at length data up to 2021, with separate growth curves developed for males and females. Maturity parameters for both sexes were updated up to 2021, but only the female maturity relationship was used in the model. Schnute parameterisation of the von Bertalanffy growth curve was used to determine the mean length-at-age, which uses reference ages at two specified points and is less reliant on direct sampling of smaller fish. SARAG heard that the updated growth parameters were almost identical to the 2021 estimates and the model fits were good for males and females.

Updated maturity estimates changed slightly since the 2021 assessment. SARAG heard that males mature faster than females; the current analysis found that for females the size at 50% maturity was 90.5cm and for males it was 78.3cm, with both values approximately 9% smaller than previous estimates. Members heard that change was driven by a slight increase in the number of mature animals in the 50–70cm range for both sexes and a better fit to the peak in the data (80–100cm range) with a reduction in fit to the observed data in the 110cm and above range. SARAG noted the challenges of differentiating between stage 2 and stage 6 maturity stages through visual gonad staging methods as histology indicates that many fish classified macroscopically as stage 2 are actually at stage 6. This mainly influences the fit to large fish over 1m in length. Dr Hillary advised that CSIRO is currently working on a proportional estimation of stage 2 to stage 6 fish. AAD advised that it is also currently undertaking histology to estimate maturity at age for toothfish at HIMI.

Dr Bessell-Browne presented the updated stock assessment, noting that the approach was consistent with previous years and it is an age-based assessment with males and females modelled separately, and a two-area migratory population model. The data used spanned from 1985-2022 and included catch-by-fleet, length-frequency and age-at-length (both by fleet), and spatial and size structure mark-recapture data. The fleets include the Aurora trawl (ATT), Northern Valley

trawl (NVT), Aurora Trough longline (ATL), Northern Macquarie Ridge longline (NMRL) and Southern Macquarie Ridge longline (SMRL).

Data weighting is included in the model rather than post-hoc, and other parameters include recruitment deviations and year class strength, spatial proportion and movement. North-south and south-north migration is included in the model as an age-independent input. Stock recruitment steepness was fixed at 0.75, while M was set at 0.13.

SARAG noted overall good fits for observed vs predicted length data in the trawl fisheries (ATT and NVT), though NVT has lower data availability, with greater variability in fit seen as a result. Similarly, the model fit reasonably well to observed peaks in the ATL length data, while NMRL and SMRL had more variable fits across the years, with low levels of catch data provided in some years linked to this. Age-at-length data was also described, with members noting that the observed data points substantially fell within the 95th percentiles given by the model outputs for each fishery.

Tagging data from 1995 was presented, and SARAG noted the fits for observed and predicted tag recaptures following year of release, with clear patterns of decline in recapture over time and good fits shown. The group heard that previous assessments showed greater diversion in fit in more recent years due to overpredictions in the north and under predictions in the south which has been remedied with additional data in the current model. Recaptures by region results were described and an improvement in residuals was noted. Dr Bessell-Browne summarized that the ATT, ATL and SMRL data overall shows reasonable fit, while the NVT and NMRL data fit is not as good, which while possibly linked to lower data availability could be subject to further exploration of temporal effects or selectivity patterns if recommended.

SARAG heard that the parameter dispersion analysis results did not raise any cause for concern, and the outputs from the MCMC runs were also within expected bounds. The spawning stock biomass (SSB) estimates, while slightly lower than previous years remained above the fishery target reference point, and the RAG heard that in the preceding years the MITF has seen either average or above average recruitment. Regional analysis consistently shows greater female SSB in the northern parts of the fishery, though the disparity between regions has reduced in the current assessment. The spatial abundance in the North is the most uncertain due to lower recaptures compared to the South. Low movement rates between regions results in the high abundance in the North also contributing high variation in absolute abundance estimates, though as recaptures in the North increase the abundance estimate will become more accurate. An overall decrease in abundance and mature biomass since 2021 is primarily driven to the reduced abundance estimate for the North, with the 9% decrease in size at maturity also having an effect.

Four post-hoc sensitivity tests were run, with the first using estimates of tag shedding rates instead of assuming zero tag loss over time. The stock recruitment steepness (h) was also tested at 0.6 and 0.9, and M was increased to reflect the HIMI M estimate

The CCAMLR decision rule is used in MITF TAC setting, which informed testing of spatial scenarios with a fixed catch proportion in the Aurora trough and the remainder shared between the North and South. The group discussed proposed TACs against scenarios with different spatial splits of fishing effort. The recommended TACs ranged from 451 to 499 t. The average of 472 t was an approximate decrease of 27% from the 644 t average from 2021, which was due to the lower, but more robust, Northern stock status estimates in the current assessment. The group noted that increased effort in the North part of the fishery would further refine this estimate, which has substantially lower tags returned than the South. Industry noted that there are fewer safe fishing grounds in the North, and balancing model needs may be challenging.

SARAG reflected that the model projections did not drill down into varying spatial splits of effort, and that future assessments may benefit from aligning differences in SSB decline projections associated with different TAC scenarios. The group also noted that the model projections show continued decline of SSB over the next 35 years, and while this meets the CCAMLR decision rule, it is likely to result in increasingly variable TACs in the future if the trend is followed. SARAG noted that there is greater flexibility in the MITF to test alternate decision rules that may be more appropriate to address this variability despite the overall status of the stock not changing significantly across assessments. SARAG heard that while SSB in the key fishing grounds is declining, the assessment data is still being bedded down, and that the outputs are then filtered through a rule that does not consider economic factors or future TAC management approaches. The group heard that the South Georgia toothfish fishery had undertaken an MEY assessment in recent years, and set a target of B55 as a result, and that something similar may be of benefit in the MITF. Industry reflected that a TAC of less than 400t would not be ideal, so determining an approach that would see TACs maintained above a limit would be of interest.

Industry members reflected that effort is lower generally in the north due to lower catches and increased risk of gear loss. The group noted the reports of lower catch despite SSB indicating higher fish presence in the Northern region. Industry shared their views on expected fishing effort distribution, and based on this SARAG requested that CSIRO undertake additional analysis to explore additional TAC scenarios (**Action Item 3**) for presentation intersessionally:

1. Setting Aurora Trough at 200, 250 and 300t with a 50:50 split between NMRL and SMRL
2. Setting Aurora Trough at 200, 250 and 300t with a 25:75 split between NMRL and SMRL
3. Setting Aurora Trough at 200, 250 and 300t with a split reflective of the average percentage of catch between 2020-2022 (3 years) between NMRL and SMRL

The group discussed timing of data availability each season and how this feeds into the assessment, and reflected that the 2022 season aging data became available when the assessment work was already underway. Members noted that the MITF assessment has historically been run without the most recent season's age data, with each update adding the intervening 2 years of information. Members noted that the fit of the models is quite good, and that addition of 2022 age data is not anticipated to make a significant difference to the outputs. Alternatively, the MITF assessment could be undertaken in August depending on the availability of CSIRO staff. The group also flagged that HIMI and MITF toothfish stock assessments might take place in alternate years and requested that CSIRO provide advice on the feasibility of conducting an MITF stock assessment update in 2024, to create an offset between HIMI and MITF toothfish stock assessments (**Action Item 4**).

Action Item 3 – CSIRO to present additional TAC scenarios prior to SARAG 69

1. Aurora Trough (200, 250, 300), 50:50 split between NMRL and SMRL
2. Aurora Trough (200, 250, 300), 25:75 split between NMRL and SMRL
3. Aurora Trough (200, 250, 300), μ 3yr catch (2020-2022) split between NMRL and SMRL

Action Item 4 – CSIRO to provide advice to SARAG 69 on options to stagger stock assessment timing, including feasibility of undertaking an MITF stock assessment process in 2024, rather than 2025

6.3 Macquarie Island Patagonian Toothfish Management Strategy Evaluation

Dr Hillary gave a presentation on potential options for the development of a Management Strategy for the Macquarie Island Toothfish Fishery. SARAG heard that the CCAMLR Harvest Control Rule (HCR) is starting to run into challenges in both HIMI and the MITF. Of particular concern, the variability in TACs between runs and resultant scale of variability in the management advice generated from the CCAMLR HCR are significant, and in other forums the range of variability has been capped under a Management Procedure (MP). Members noted that the MITF, while currently managed in alignment with CCAMLR rules, is not in the CCAMLR Convention Area and may provide an opportunity to explore alternate management approaches. SARAG noted that in the past they have been managed this way due to the way the fisheries were developed, and that separation may provide opportunities to test approaches not feasible to explore in HIMI in the near term. SARAG was asked to consider alternatives to the CCAMLR HCR, including consideration of developing a separate stock assessment-based HCR, or exploring a higher-level approach such as developing a Harvest Strategy (HS) and Management Procedure (MP) to provide management advice. The presentation provided by Dr Hillary is at **Attachment C**.

Dr Hillary proposed taking an initial high-level approach to developing an MSE for toothfish species with first steps exploring initial conditions and catch/effort histories. The option to explore spatial population configurations was raised, whereby meta-population or sub-population approaches to stock management questions could be investigated. The working environment of the fishery and operational constraints, such as TAC frequency/variability and trade-offs that industry could consider. The selection of available and potentially available data inputs to inform assessments was flagged, as was the development of a new HCR.

The group noted that if an MP is developed, the stock assessment would no longer be the sole piece of information used to set management advice, rather management could move to a meta-monitoring approach designed to provide indicators of whether the Management Strategy is working. In this case, SARAG could consider extending the timing and frequency of the stock assessment, keeping in mind that while it should occur the year prior to running the Management Strategy the overall workload could be reduced.

SARAG noted that the sensitivity of the current CCAMLR HCR to stock assessments has resulted in substantial inter-annual TAC variability, and in its current configuration is not able to be subjected to MSE testing. If there were appetite to move away from the CCAMLR HCR, challenges to be considered include the alignment of HIMI and MITF assessment approaches and how this may be viewed in CCAMLR, and domestically, the agreement on objectives, practicalities, and demonstration of consistency with the intent of the Commonwealth Harvest Strategy Policy. Dr Hillary summarised the currently available data, noting that while tagging and size/age data is available from the MITF, independent survey data streams are restricted to HIMI; however, a high-level assessment of data inputs into an MP would need to consider use of survey data in its development.

The group heard that economic data could be included in an MP but that seeking detailed information at this step may fall in the realm of commercial-in-confidence. The group heard that economic performance may be better incorporated by performance statistics and review. Industry reflected that the economic profile of the MITF is likely quite different to other Commonwealth fisheries, so determining what MEY looks like may diverge from previous examples.

Dr Hillary advised that inter-annual variability in TAC setting could be reduced by adjusting TACs within a certain range based on a tag-based estimate of fishing mortality (F) time series. The group heard that this approach is applied in the Eastern Tuna and Billfish Fishery (ETBF) and the Southern Bluefin Tuna fishery (SBTF), and that thought could be given to a constant or dynamic F

strategy. Industry sought clarification whether a tag-driven MP would be subject to the challenges seen in recent HIMI stock assessments and heard that the focus of the approach is tracking changes in F over time. In this case, determination of F does not have to be unbiased, and if bias is consistent the MP could be tuned to accommodate it. SARAG noted that F approaches are different to the biomass estimates undertaken during stock assessments.

SARAG heard that size and age composition MPs are another potential approach, where a catch curve of total mortality can be generated from size and age composition data. The methods to estimate the split between natural and fishing mortality in support of this approach may be a source of bias, and the model is less robust to dynamic systems. Trends in mean length-at-age are more informative in short lived species, so this may be less relevant to toothfish. This approach is generally used in data poor fisheries and not as well regarded as reliable in some areas; the group heard that this type of information may be a useful addition to another core MP approach but not sufficiently informative on its own.

Survey data-based MP are likely the most common types implemented in other fisheries, including the previously mentioned ETBF and SBTF. The primary input is either relative or absolute abundance indices over time using fishery-dependent data, and adjustment is made within bounds to the estimated abundance and a new TAC is generated. This approach may benefit from size and age data, but the key focus is use of the abundance indices generated from the surveys. The group heard that a survey-based MP would also seek to identify multi-year trends or moving averages based on time-series data.

Dr Hillary proposed a tag-based MP for the MITF as the most suitable option, and that thought could be given to the value-add potential of size and age composition data streams. For HIMI it was suggested that both tag and/or survey-based MPs are plausible, and an integrated MP would be worth exploring. The group heard that the SBTF uses an integrated approach, including juvenile gene-tagging data, a CPUE index, and Close Kin Mark Recapture (CKMR) data. The group also heard that highly complex approaches do not necessarily mean high performance, and that the ability to be able to clearly interpret MP outputs should be valued.

The RAG was asked to consider constraints of interest to guide next steps on this issue, including consideration of changing TAC setting frequency from 2 to 3-year cycles, and the implementation of symmetrical or asymmetrical boundaries for maximum and minimum TAC changes. The group heard that most operational MPs are constrained in some way with a 20% cap being a common choice and noted that any reduction in TAC variability is also usually linked to some reduction in catch.

Members noted that development of an MP is not meant to replace a stock assessment process, but the role of the stock assessment would adjust to monitoring the performance of the MP. As this transition occurred over time, the frequency and timing of the stock assessment could be adjusted to ensure it occurred the year prior to running the MP, or in alternate years in the case of the MP running every two years. SARAG noted that running a stock assessment and an MP on a 2-year cycle would result in doubling the workload and funding required, and thought should be given to extending timelines to mitigate this effect.

The group noted that in the SESSF, 3-year TACs are set using a hockey-stick HCR, and that those fisheries are investigating adding a buffer to the rule to account for low-data periods. Members heard that in the Torres Strait Tropical Rock Lobster fishery the development of an empirical HCR allowed the fishery to transition from annual to triennial assessments. An AFMA participant advised that CSIRO had developed an online dashboard that allowed stakeholders to explore and implement the HCR themselves.

The group heard that in developing an MP or HCR, thought should be given to also developing a consensus-based process plan on how to respond when the stock assessment or data inputs give results outside the bounds tested in the MSE, otherwise referred to as break out rules. A question was raised on timelines between assessment procedures and ability to respond, noting prior conversations about timing of data availability and how this can interact with management advice needs. In considering the example of the SESSF, members noted that most assessment years multiple species are flagged for review due to one or more break out rule being triggered, and to members' knowledge, these reviews had not resulted in changes to management advice. Scientific members reflected that the response would depend on the type of data that had fallen outside the tested bounds.

SARAG agreed that CSIRO present a paper on proposed options for a toothfish species MP for more detailed RAG feedback in early 2024 (**Action Item 5**). Following this, CSIRO intends to undertake subsequent work on developing a plan and preliminary MITF MP for presentation to SARAG in 2025.

The group heard a question on how CKMR data could be incorporated into a tagging-based MP as it became more available in the future. Advice was given that in the case of the SBTF, the pre-existing framework was maintained while the procedure was updated to also consider the genetics information under the MP. Following these steps, CKMR data was formally embedded in the management procedure.

SARAG reflected on the integration of climate change considerations in fisheries management and TAC setting, and how an MITF MP could pick this up. AFMA is looking at the broader influence of integrating climate impacts on decision making, whether through a qualitative overlap or integration into stock assessments and harvest strategies, and SARAG heard there may be greater clarity on this later in 2023. The use of an MP to model climate related changes in mortality, and how this can inform TAC advice in the testing stages was noted. The group heard that a tag-based MP might find integration of climate change impacts challenging to incorporate, but integrated stock assessment approaches could likely pick up on relevant indicators. SARAG noted that incorporation of these parameters via an integration approach would allow implicit consideration of this issue during TAC setting based on MP advice.

Dr Ward asked whether CSIRO could explore assessments of varying control rules in comparison to the CCAMLR HCR, and suggested that, pending advice from industry on preferences for stability vs yield a paper could be developed that looks at creation of rules based on uncertain biomass estimates, proceeds to describe potential model outputs and clarifies what sort of management decisions would lead to an unwanted and potentially rapid decline in biomass. Dr Hillary sought clarification on whether Dr Ward was asking for a full MSE of all the current assessment. Dr Ward clarified that he was asking about testing the CCMLAR HCR, possibly against a hockey stick or staircase HCR, and based on the outputs of the model what it might look like to meet industry's interests in terms of stability or yield.

Dr Hillary clarified that the CCAMLR HCR cannot be meaningfully tested, though a static version could be for the sake of comparison which may or may not provide useful information. If looking at testing, it takes months to set up and there are thousands to undertake every three years. The variability in the CCAMLR HCR makes this approach highly complicated and labour intensive, which the RAG should consider when considering new pathways. The group heard that the approach raised by Dr Ward would likely be more palatable to CCAMLR, and that it would be useful to see this work undertaken in addition to work proposing a departure from the stock assessment-based decision making, as it may provide a valuable steppingstone. Scientific

members concluded that a conversation on what an HCR based on the model outputs could look like would be useful, to fully explore what might be realistic moving forward.

Action Item 5 – CSIRO to present an updated MSE options paper with further refined options for discussion at SARAG 70
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Agenda item 7 – HIMI Data Collection Cost/Benefit Analysis

Dr Ziegler gave a presentation on the status of the HIMI Data Collection Cost/Benefit Analysis (CBA). SARAG heard that the cost aspect of the analysis needs some further work including consultation with an economist and noted that the detail of this aspect could be recommended by SARAG. The CBA was first raised at SARAG 66 where the stock assessment data discrepancies were discussed alongside a paper on a proposed Random Longline Survey, and initial reports on the CKMR trial. Given the issues of data divergence between the current data sources in the stock assessment (see above) and parallel emergence of new potential data streams, a CBA was requested comparing these to inform development of a data collection package.

The group noted the detail provided by the supporting paper on historical data sources and how these have been used to provide management advice over time, and the benefits and shortcomings of both the existing and proposed data sources and related analyses. The paper focused on existing data sources including the scientific observer program, logbook data, the aging program, the RSTS and the tagging programs, with less attention given to CTD tags, benthos video footage and the sea lice trap program. The paper moved on to describe the data needs as prescribed under the management plan and fisheries assessment plan. The paper concludes that there are three target areas for management supported by these data collection approaches, including TAC setting for each target species, ensuring the sustainability of non-target and bycatch species, and ensuring the sustainability of the marine environment.

A summary of the proposed RLS and how it might supplement data gaps with the tag recapture time series was noted, as was the potential for CKMR work. Members noted that the RLS could be conducted with existing data collection methods, though it would require additional stations to meet random sampling requirements. In contrast, a CKMR program would require specific sample collection (and subsequent sample analysis) but could be conducted during commercial fishing operations. The use of these emerging data streams would result in amendments to the stock assessment, and they are proposed to remedy perceived bias in the commercial tagging data.

SARAG noted a summary of the contributions each of the data collection programs make towards monitoring objectives, and a table describing potential risks or consequences of reducing, ceasing or provision of unexpected results from various programs.

SARAG was asked to advise on whether a cost assessment should be produced and heard that in the development of this information would be required to set parameters that influence costs, such target biomass estimates that could be used to test costs for data collection through the respective programs. The group heard that it was unlikely any one data collection program would fully replace another, rather a package of alternate approaches would be likely. Both RLS and CKMR would start new time-series. While the RLS would provide a data time series that could be readily incorporated into the current stock assessment, data from the CKMR would require some thought on how to incorporate into the existing stock assessment model (e.g. via a new Casal2 module or a bespoke stock assessment model) and how to bring CCAMLR up to speed with the new methodology.

The RAG thanked Dr Ziegler for presenting the comprehensive summaries of the data collection programs and agreed that it would be useful for the costing component of the programs to be further developed. Industry expressed a strong and continued interest in gaining cost efficiencies regarding the frequency of the RSTS, noting the cost of vessel time reaching approximately \$1 million each season, and the impact of small toothfish catches as an opportunity cost. Industry reaffirmed their view that moving the RSTS to a biennial arrangement is their preferred approach. Interest in exploring the costs and benefits of the proposed RLS and CKMR programs was also expressed, though some concern was noted on the number of shots that might be required under an RLS. Members heard that as industry fleets have reduced in size, if a sampling program created a risk that quota would go uncaught then it would not be viewed favourably. Industry expressed that if the RLS had to occur entirely within season and catch rates on some RLS shots are expected to be lower, then that may be cause for concern, and recalled that previous conversations had indicated the sampling regime would require a month of effort from each available vessel.

Scientific members reflected that the discussion is an opportunity to explore how to leverage the varying data sources against each other for maximum benefit, and that it should not be expected that any source of data would be entirely retired. It takes a while for time-series to develop, which is part of the consideration of costs when exploring how long one data collection program should continue while another is established in parallel prior to being superseded, to avoid gaps and take testing to ensure objectives continue to be met.

AAD members acknowledged that sampling effort and related cost of an RLS are an important factor, and that sampling design could seek synchronicity as much as possible, though some shots would need to be outside of preferred fishing areas. SARAG recommended that to better clarify these concerns, the AAD should produce a paper with further detail on RLS design including the number of shots required, spread of line placement across the fishing grounds and estimated catch opportunity cost (**Action Item 6**).

The group noted that an RLS paper had been previously discussed which had considered tentative shot numbers against historical TAC. Tag return data was raised as needing consideration in future discussions of RLS design, as well as greater thought regarding spatial coverage aspects and whether sub-sampling could be explored. The group suggested that previous catch and effort data could be used to identify regions that are unlikely to provide data, which could be excluded from sampling design, though the group noted that spatial catch patterns can vary between vessels.

Dr Hillary provided additional information on the type of data CKMR could provide, including identification of which age classes were reproducing (reducing effort on maturity at age modelling), as well as information on adult mortality. The group discussed dealing with Kerguelen influences in the CKMR data and how juvenile migration in or out of the sampling area would be managed, noting that genetic insight into movement patterns could inform approaches to tag return results. SARAG heard that in terms of costs, CKMR approaches tend to be expensive in the initial stages due to sample collection and processing costs to develop an appropriate ongoing sampling design, with sample sizes able to eventually reduce over future years. The discussion returned to access to juveniles for sampling through the RSTS, and the role of the observer program and crew in sample collection. Members also noted advice from CSIRO that promising epigenetic aging techniques are being developed, which may allow de-linking genetic sampling from length data collection and allow sampling of frozen product in the future.

Noting that the initial CKMR project has been focused on proof of concept, SARAG recommended that CSIRO develop a sampling design and costing information to allow comparison of CKMR and

RLS methods for a fulsome discussion around their inclusion in the stock assessment model to the AAD (**Action Item 7**).

The group noted that a discussion of the RSTS periodicity resulting in a decision would need to occur prior to the following data collection season. The group noted again that transitioning the RSTS to every second year would result in a decrease in icefish TAC for the second year of projections due to the life history of the species. The RSTS was also highlighted as the only data source for bycatch species monitoring, with two of four species managed from the data provided showed high variability between years. In terms of the toothfish stock assessment the RSTS is currently the only means of observing non-commercial biomass, and supports an assessment approach whereby a cohort needs to be observed in the RSTS three times before a YCS estimate is generated for that cohort. An annual survey allows calculation of a recruitment estimate from approximately 6 years prior, while shifting to a biennial survey would halve the number of observations and extend the recruitment observation to approximately 9 years and reduce confidence in more recent recruitment.

Industry reported a willingness to accept reductions in icefish TACs every second year and considered that the historical dataset for bycatch management is sufficient to build on going forward. On YCS estimates, Industry acknowledged that potential misinterpretation of trends and reduced TACs was a risk, but that it was also difficult to justify annual surveys when recruitment pulses were not apparently being realised at this time.

The group noted a previous request from SARAG that the AAD produce a paper exploring TAC impacts through reduced sampling designs, including reduced sampling in strata with lower biomass. SARAG recommended that the AAD progress this paper, including discussion of RSTS periodicity and intensity options (biennial full survey; alternating full and partial surveys, streamlined strata approaches) with reference to toothfish, icefish and bycatch management, for decision at SARAG 69 (**Action Item 8**).

Action Item 6 – AAD to provide a paper on RLS design, including number of lines, potential shot placements, and opportunity cost at SARAG 70
Action Item 7 – CSIRO to provide preliminary sampling design and costings to SARAG 69, and advice to industry on whether to continue sampling
Action Item 8 – AAD to provide a paper on RSTS periodicity and intensity options (biennial full survey; alternating full and partial surveys, streamlined strata approaches) for decision at SARAG 69

Agenda item 8 – CCAMLR New and Exploratory Fisheries

8.1 CCAMLR New & Exploratory Fisheries application

Due to commercial in confidence discussions, Mr Arangio left the room for the discussion of Agenda Item 8.1.

Mr Milic provided an update to participants on fishing conditions in the New and Exploratory Fisheries in the 2022/23 season, and regarding an application for the 2023/24 season of CCAMLR New and Exploratory Fisheries. SARAG noted that the application had been discussed in April by the CCAMLR Interdepartmental Committee (IDC) and CCAMLR Consultative Forum (CCF) and

accepted with no amendments, and that the AAD would submit the application on behalf of Australia to the CCAMLR Secretariat by the June 1 2023 deadline. SARAG noted the supporting Research Plan was developed in 2022/23.

8.2 & 8.3 Papers to WG-SAM, WG-EMM, WG-FSA, WG-IMAF, SC & Commission

SARAG noted an update on papers to be taken to working groups from the AAD member which was taken as read. Members heard that key priorities included relevant research plans, milestone reporting, RSTS results and the icefish and toothfish assessments for the current year. The group noted that WG-IMAF met in 2022 and was set to meet again in 2023.

Agenda item 9 – Environmental Interactions & Bycatch

9.1 Skate and ray post-release mortality

SARAG heard that Dr Jaimie Cleeland and a PhD student were at sea on the *FV Cape Arkona* tagging skates to explore post-release mortality in the 90-day post capture period. Members heard that skate blood samples to explore stress signals were also being collected. The scientists were anticipated to return in June, with a report expected to be available at SARAG 69 in August 2023.

9.2 Trawl gear modification trial

SARAG heard an update on trials of new demersal trawl gear to target ice fish with the goal of reducing skate bycatch while increasing target catch. Members heard that three years of fishing with the new gear under a scientific permit have now occurred. The current trawl gear requirements are contained in the HIMI Regulations, necessitating a scientific permit to use trial gear types each season. Members heard that the first two years of data were encouraging, and that in 2022 side by side tows facilitated near direct comparison of the old trawl net against the trial net. Mr Arangio clarified that this season's data presented in the update was compared against data collected in the first year of the trial only, as Dr Cleeland provided data in the second year of the trial. SARAG heard that icefish is highly variable between years. Comparison of skate bycatch between periods representing good or poor icefish catch rates was described, with monthly icefish catch compared between 2021 and 2023. In January 2023, when icefish catch was poor, skates were caught at a comparably lower proportion than in 2021 with higher icefish catch. Members noted that in February 2022, good icefish catches were reported, with a 10-day average catch of 11t of icefish against 400kg of skates, resulting in a 3.5% skate proportion of the total catch. Similar catch rates were reported over 8 days in February 2023, and during that period there was a 5.5% skate proportion. While higher than 2022, it was lower compared to the old gear performance which had lower icefish catches and a skate bycatch proportion of 7%. Noting the discussions at SARAG 65 requiring completion of 40 tows, SARAG did not make any additional requests for data at this time and noted that at the conclusion of the trial the results should be passed to the MAC.

The group discussed that the next steps to remove the requirement for a scientific permit would require AFMA to undertake amendments to the legislation where the gear regulations are held. AFMA advised that while aware of the need, internal steps to start the process could not begin until the 23/24 financial year and that the process is likely to take at least 18 months, including reviewing the work done leading into this process and seeking advice and recommendation from SouthMAC.

9.3 TEP interactions & gear loss

The AFMA member gave an update on gear loss and fishery interactions with Threatened, Endangered and Protected (TEP) species. The paper was taken as read, and the group noted an

increase in elephant seal interactions had been raised at SouthMAC for further investigation. SARAG heard that the AAD has completed some preliminary mapping, and members recommended that a discussion paper be developed for SARAG 69 to discuss further data or analysis needs which could guide SARAG and SouthMAC discussions (**Action Item 9**). The RAG requested that this paper consider population trends in the adjacent southern elephant seal populations, and noted advice that this information may be difficult to obtain due to challenges in getting estimates around Kerguelen.

Members heard that the gear loss reports are developed from reports provided by industry, and that in HIMI and the N&E fisheries a reduction was seen in lost gear volumes compared to the previous season. In contrast, increased gear loss had been reported in the MITF which industry reflected was due to more challenging oceanographic and weather conditions in the 2022 season. SARAG heard that night setting requirements in the MITF limit fishers' ability to set with the tide, which increases the risk of gear loss when setting conditions are suboptimal. Industry also reported that due to lower catches in the north, recent efforts to set gear in the south included trickier or previously unfished areas which increased risk of loss. The group heard that industry members were working with broader COLTO resources to improve gear retrieval approaches, and about gear monitoring approaches from Norway that can use sensors to monitor gear wear over time. The group requested that future gear loss reports seek a way to indicate numbers of lines lost, to give context to the high numbers of floats reported lost in the N&E fisheries.

AFMA was asked whether anything was produced regarding HIMI seal interactions as part of Australia's negotiations under the application of the United States Marine Mammal Rule. Members noted that the Department of Agriculture, Fisheries and Forestry leads on engagement in this area, and AFMA agree to provide an update on this issue at SARAG 69 (**Action Item 10**).

The group discussed marine mammal predation on lines more broadly, noting that sperm and killer whale predation on toothfish is an emerging issue particularly in Kerguelen. Industry reported only seeing killer whales twice so far, and that sperm whales are more seasonal during migrations at the start of the season with an increasing trend over the last decade. As the season has extended and whales have increased in abundance, fishing line predation behaviour has also increased. Acoustic deterrents don't appear to work on sperm whales and killer whales are also able to habituate, but usage of these acoustic deterrents have not been coupled with a proper experimental process. The AAD reflected that observer reports of cetacean sightings can also be incorporated into stock assessments to reflect varying levels of predation or catch loss.

Action Item 9 - AFMA to provide a discussion paper for SARAG 69 to explore data or investigation/analysis needs regarding elephant seal interactions

Action Item 10 – AFMA to provide an update to SARAG 69 on the US MMR and any specific response regarding requirements around HIMI and marine mammal interactions

9.4 Seabird Management Arrangements

SARAG recalled the joint meeting with SouthMAC in February 2023 to discuss MITF seabird bycatch mitigation measures and noted an updated summary of requests by industry for a trial to increase fishing flexibility by easing some of those measures. The group took the supporting paper as read and noted the two proposals industry sought consideration from SARAG on: the trial of a daylight setting period during the annual periods of lowest seabird abundance; and a trial season

extension of up to an additional 14 days (to 21 September). The proposed season extension trial is modelled on a HIMI proposal that was progressed through CCAMLR, and SARAG noted that the trial was considered ready for analysis after 500,000 hooks had been set during the periods under consideration. Industry proposed that as the MITF has a smaller footprint and lower effort, the hooks required for the trial be reduced to 300,000 which may take 3-4 years to meet. The AAD recalled that the 500,000-hook minimum was based on the TAP rate of 0.01 birds/1000 hooks and the ability to extrapolate sufficient data to detect whether this rate had been exceeded under the trial conditions.

Members recalled that an analysis of seabird abundance data was recommended to identify periods of lowest risk where a daylight setting trial may be considered. The group also heard that industry was seeking guidance on what a daylight setting trial might look like, and whether this might mean additional fishing time around nautical dawn and dusk, or substantially within daylight hours. It was also noted that an Action Item from the joint meeting was that industry should provide an estimate of financial benefit from a daytime setting trial. SARAG heard this estimate was difficult to develop, as opportunity cost against tide conditions is not recorded.

In reviewing the action items from the joint meeting, SARAG recalled that once data availability was confirmed AFMA would review observer seabird abundance data to explore winter low risk periods. The AFMA member proposed that the next step could be to get an external expert's opinion summarising all lines of evidence to assess any risk of seabird bycatch as a result of changing current management conditions. The expert would be tasked to explore alterations to night setting scenarios, as well as changing risk over the course of a season extension of up to two weeks. SARAG also noted that any change to management arrangements in the MITF would require Commission advice.

Members recalled that a framework already exists which provided a one-week extension and were reminded that SouthMAC 38 required SARAG to undertake a review of the outcomes of the MITF season extension trial the first time industry made use of it. Members heard that the first use of the season extension period was September 2022.

AFMA advised that there is additional work required to facilitate SARAG to undertake this assessment before discussions of a further extension could be progressed. Noting these review requirements, AFMA agreed to provide a paper outlining the process to follow for review of the prior extension (including taking the results to the AFMA Commission), the steps to progress a new trial (including SouthMAC and Commission processes) and providing an update on 2022 September data for SARAG to review (**Action Item 11**).

SARAG noted that there was likely greater data availability to inform a mid-season daylight setting trial, with only a single season of seabird observations potentially available for the first week of September and no seabird abundance data further into September. Some members took the view that this lack of data made an extension potentially higher risk of the two proposed approaches. The group noted that data collection may be necessary, but also that any proxy information for seabird activity should be used to make an informed decision due to the impacts of an interaction with the listed bird species.

<p>Action Item 11 – AFMA to provide a paper for review at SARAG 69 outlining; the process to follow for season extension review, progression of the next trial, and giving an update on 2022 September abundance data</p>
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Agenda item 10 – Research Priorities & Process

The AFMA member introduced the paper and noted that while the Research Priorities and Annual Plans will be further discussed at SARAG 69, AFMA was seeking members' preliminary views to inform development of the documents. The group was asked to consider what research might be suitable for funding under the ARC in the 2024-25 financial year. SARAG heard a description of ARC timelines, including the assessment process, scope development, ARC consideration and decision making. The group also noted that updated Strategic Research Plans and Annual Research Statements are due in late August 2023, which may be adjacent to the next meeting date. The AFMA member drew the group's attention to the MITF Stock Assessment contract being in its last year, and proposed it may be suitable to seek ARC funding in the coming round.

Industry reflected that with the FRDC IPA in place, any research considered R&D would go through the IPA pathway to leverage that funding. Core function research, such as the MTIF stock assessment, would be suitable for the ARC process, so when considering proposals to go through the AFMA process, R&D type projects should be reserved. The group noted that this pathway does not go through COMRAC, and due to its independent structure, the process is undertaken through direct consultation between industry and FRDC with a higher likelihood of funding success.

An industry member raised that there has been an ongoing challenge with identifying historic PIT-tags in toothfish, particularly older tagged fish which have shed their external tags. Where PIT-tags have not been identified and removed, there is a risk of PIT-tags being included in sold product. SARAG heard that there were approximately 15,000 PIT-tags remaining from releases in HIMI before the program ceased in 2016, and that while the chance of retrieving a PIT-tag with both external tags lost is low, not identifying these individuals is cause for concern. Industry members advised that as HGT processing has moved from straight to a V-cut approach, the risk of the PIT tag being retained in commercial product has changed, and industry is exploring technological means of improving PIT-tag identification to ensure they are removed. Metal detector systems are being explored for on-vessel use and a future conversation on how this could be progressed through the IPA was noted.

The group recalled the previous discussions of the RLS and CKMR and noted that CKMR is more likely to go through the IPA rather than ARC, with further progression of this topic reliant on previously discussed milestones. The question was raised whether CKMR stages could be set up as multiple discrete projects for funding requests over time. CSIRO indicated that at this stage it's easier to absorb the cost to get through the pilot. While this does not preclude revisiting funding conversations, CSIRO noted that internal processes favour large complex packages or work, rather than smaller sequential pieces. Industry members requested that CSIRO explore the current samples for any temporal or vessel-based trends in sample quality and provide advice (refer **Action Item 7**). The group also noted potential work on genome development which may be occurring in parallel.

SARAG recommended that the MITF stock assessment & MSE development package is identified as a research priority for ARC funding. SARAG noted that other research priorities for sub-Antarctic Fisheries would be pursued through the IPA process, including the development of a Randomised Longline Survey, PIT-tag retrieval, and operationalisation of the outcomes of CSIRO 2019-169 which explored use of oceanographic variables to predict toothfish catchability. The group also discussed emerging research streams exploring the use of Electronic Monitoring, Artificial Intelligence and other data flows and recalled that Geoff Tuck has an interest in further work in this area.

Agenda item 11 – Other Business

Dr Masere provided an update to SARAG on outcomes from recent supervised graduate student projects. Members heard that Dr Masere is co-supervising two Masters students; one student project is exploring grenadier species differentiation from otolith morphology, an approach based on papers from New Zealand presented at CCAMLR WG-FSA in 2022. The group noted that reviewing historical HIMI otoliths that may improve taxonomic understanding of grenadiers, with potential benefits to development of management advice for these species. This project is co-supervised with Dr A Marshall and Dr P Coulson.

The second student project is co-supervised with Dr N Hill and Dr J Williams. The student is updating and expanding a statistical regional common profile (RCP) analysis approach to explore HIMI demersal fish communities and correlations of species' occurrence with respect to environmental and geographic data. This updated RCP for HIMI will incorporate count and abundance data for numerous species along with age class and sex where available. SARAG noted that RSTS data would be used by this project.

Agenda item 12 – Next Meeting

Members agreed that SARAG 69 would be held on Tuesday 22 and Wednesday 23 August 2023, in Hobart. AFMA agreed to communicate with members closer to SARAG 69 to confirm details.

The Chair thanked members for their contributions and closed the meeting at 4:20pm on Wednesday 3 May 2023.

Attachment A

Member, invited participant and observer's declarations of interest as advised to date.

Name	Membership	Declared interests
Bruce Wallner	Chair	No pecuniary or other potential interests in sub-Antarctic fisheries.
Dr Philippe Ziegler	Scientific member	Employed by AAD and is the Fishery scientist responsible for Heard Island and McDonald Islands Fishery (HIMIF) work, including the HIMI stock assessments. Dr Ziegler has no pecuniary interest in the sub-Antarctic and his salary is not connected to any research grants noting that he is a principle and co-investigator on current FRDC projects. Dr Ziegler is also the scientific member of SouthMAC, and the Scientific Representative for Australia to CCAMLR.
Dr Cara Masere	Scientific member	Member of the Fisheries team within the Southern Ocean Ecosystems Program at the AAD and has no pecuniary or other interests in the sub-Antarctic fisheries.
Dr Rich Hillary	Scientific member	Employed by CSIRO and is the Principal Investigator of the Macquarie Island Toothfish Fishery (MITF) stock assessment. He is a member of AFMA's Southern Bluefin Tuna Management Advisory Committee (SBTMAC) and Tropical Tuna RAG. Dr Hillary advised that he has no pecuniary interests in the sub-Antarctic fisheries.
Dr Tim Ward	Scientific member	Institute Marine and Antarctic Studies, University of Tasmania, Associate Professor, Fisheries Scientist AFMA Small Pelagic Fishery Resource Assessment Group, Scientific Member AFMA Research Projects (SPF Monitoring, Blue Mackerel Spawning Fraction), Principal Investigator Natural Environment and Resources, Tasmania (Developmental Tasmanian Sardine Fishery), Scientific Advisor, Principal Investigator South Australian Marine Scalefish Fishery Management Advisory Committee, Independent Conservation Scientist, Member Pelamis Pty Ltd (Environmental Consulting Company), Director
Brad Milic	Industry member	General Manager, Operations, at ALFPL which holds various fishing rights in, and operates vessels in, the sub-Antarctic fisheries and New and Exploratory fisheries under the jurisdiction of CCAMLR.

Name	Membership	Declared interests
Rhys Arangio	Industry member	Employed by Austral Fisheries P/L (Austral Fisheries) as the General Manager of Science and Policy. Austral Fisheries owns Statutory Fishing Rights (SFRs) in the Australian sub-Antarctic fisheries, which include waters under the jurisdiction of CCAMLR. Noting no changes since the last meeting, Mr Arangio is the Executive Officer of COLTO, as well as being a member of SouthMAC. He was not aware of any investigation or prosecution action by AFMA against his Company, nor of any legal action taken by his Company against AFMA, and has an interest in all agenda items.
Danait Ghebrezgabhier	AFMA member	AFMA employee, no interests pecuniary or otherwise.
Claire Wallis	Executive officer	AFMA employee, no interests pecuniary or otherwise.
Selina Stoute*	AFMA observer	AFMA employee, no interests pecuniary or otherwise.
Alice McDonald	AFMA observer	AFMA employee, no interests pecuniary or otherwise
Dr Heather Patterson	Invited Participant	Employed by the Department of Agriculture, Fisheries and Forestry and is the Editor of the Australian Bureau of Agricultural Resource Economics and Sciences (ABARES) Fishery Status Reports. Dr Patterson noted that she has no pecuniary interest in the sub-Antarctic fisheries.
Dr Pia Bessell-Browne	Invited Participant	Employed by CSIRO as an assessment scientist. Dr Bessell-Brown advised they are the principal investigator on the FRDC project 'Developing a harvest control rule to use in situations where depletion can no longer be calculated relative to unfished levels.' Dr Bessell-Brown noted they have no pecuniary interests in the sub-Antarctic fisheries.
Martijn Johnson	Industry Observer	An employee of Australian Longline Fishing Pty Ltd (ALFPL). Mr Johnson is the Sustainability and Operations Coordinator of ALFPL which holds various fishing rights in, and operates vessels in, the sub-Antarctic fisheries and New and Exploratory fisheries under the jurisdiction of CCAMLR. Mr Johnson is not aware of any investigation or prosecution action by AFMA against ALFPL or any litigation entered in to by ALFPL.
Dale Maschette	Invited Participant	Mr Maschette is employed by IMAS and is a fishery scientist responsible for HIMI work including the HIMI icefish stock assessments. He holds no pecuniary interest in the subantarctic fisheries. His salary is connected to two FRDC research grants related to Southern Ocean fisheries, one that he is the primary investigator on, another that he is a co-investigator on. He is also one of the alternative Scientific Committee representatives to CCAMLR.

Name	Membership	Declared interests
Heather Johnston	Observer	Employed by the Department of Agriculture, Fisheries and Forestry. No interests pecuniary or otherwise.

*Participated in Agenda Items 1-7

Sixty-eighth Meeting of the Sub-Antarctic Resource Assessment Group (SARAG)

Meeting 68 – 2-3 May 2023

Draft Agenda

Time (AEDT): 2 May 1:00pm – 5:00pm, 3 May 9:00am – 5:00pm

Location: Lenna of Hobart, 20 Runnymede St, Battery Point, Hobart

Chair Name: Bruce Wallner

Approximate time	Item	Purpose	Lead Presenter	
SARAG 68 - Day 1 - 2 May 2023				
13:00 (1hr)	1. Preliminaries			
	1.1 Welcome and apologies	For noting	Chair	
	1.2 Declaration of interests	For decision	Chair	
	1.3 Adoption of agenda	For decision	Chair	
	2. Actions Arising		For noting	AFMA
	3. Correspondence		For noting	AFMA
	4. Member updates			
	4.1 Industry and scientific member update	For noting	All	
	4.2 AFMA update	For noting	All	
	5. HIMI Climate Change workshop recap		For noting	AFMA
14:00 (1 hr)	6. Stock assessment updates			
	6.1 HIMI Patagonian Toothfish stock assessment	For discussion	AAD	
15:00 (15 min)	Afternoon Tea			
15:15 (1.75hr)	6.1 HIMI Patagonian Toothfish stock assessment (cont.)	For discussion	AAD	
17:00 - Close of Day 1				

SARAG 68 - Day 2 - 3 May 2023

9:00 (1.5hr)	6. Stock assessment updates (<i>continued</i>)		
	6.2 MITF Patagonian Toothfish stock assessment	For discussion	CSIRO
10:30 (15min)	Morning tea		
10:45 (1hr)	6.3 MITF Management Strategy Evaluation	For discussion	CSIRO*
11:45 (45min)	7. Costs and benefits of implementing various data collection methods in the HIMI Fishery	For discussion and advice	AAD
12:30 (45 min)	Lunch		
13:15 (2hrs)	7. Costs and benefits of implementing various data collection methods in the HIMI Fishery (cont.)	For discussion and advice	AAD
15:15 (15 min)	Afternoon Tea		
15:30 (30 min)	8. CCAMLR New & Exploratory Fisheries		
	8.1 CCAMLR New & Exploratory Fisheries application	For noting	AFMA
	8.2 Papers to WG-SAM & EMM	For noting	AAD
	8.3 Papers to WG-FSA, SC & Commission	For noting	AAD
16:00 (15min)	9. Bycatch updates		
	9.1 Skate and ray post-release mortality	For noting	AAD*
	9.2 Trawl gear modification trial	For noting	Austral
	9.3 TEP interactions & gear loss	For discussion	AFMA
	9.4 Seabird Management Arrangements	For discussion	Australian Longline
16:15 (45min)	10. Research priorities and process	For noting	AFMA
	11. Other Business	For discussion	Chair*
	11.1 UTAS postgraduate research projects update	For noting	AAD*
	12. Next Meeting	For decision	Chair*

* Verbal update, no agenda paper provided

Item	Action arising	Status
1	<p>Longline survey – AAD to keep SARAG up-to-date regarding a longline survey in the HIMIF (SARAG 62 Agenda Item 7), and to develop a paper with 3 RLS options and cost/benefits for each approach for discussion (SARAG 65 Agenda Item 11).</p> <p>AAD to integrate survey design scenarios, sample size stations and predict some inputs to progress the recommendations of the RLS paper. AAD will incorporate this work into the overarching research priorities document to determine operational components of the RLS. (SARAG 66 Agenda Item 5.5)</p>	<p>Ongoing. To be discussed further under Agenda Item 7.</p>
2	<p>Observer Data Collection - AFMA to clarify with observer program whether current cameras are adequate for Southern Ocean work, and if change needed AFMA, AAD and Industry to explore and cost options where required.</p> <p>AFMA to consult on observer task lists with relevant SARAG members to review and provide comments (out of session) and update the observer manual for the coming season.</p>	<p>Complete.</p> <p>The observer program has advised that the cameras that are issued to observers are suitable for the program's current needs. A further update on this action item is provided in Agenda Item 4.</p> <p>Ongoing.</p> <p>AAD to review data needs of the CCAMLR New and Exploratory, HIMI and MITF fisheries, and to subsequently meet with AFMA to review and update the observer instructions and handbook for the 2023/24 seasons; including seabird data collection requirements and with regard to the Fisheries Data & Monitoring Strategy</p>

Item	Action arising	Status
	AFMA to advise on the nature and extent of historical observer seabird abundance and consider the resumption of seabird abundance counts by observers (Joint SARAG & SouthMAC Meeting Feb 23).	<p>Partially completed.</p> <p>Observers are asked to determine abundance of seabirds within the vicinity of vessel during fishing operations and when the vessel is not actively fishing for both the HIMI and MIT fisheries. This constitutes one daily observation (abundance count) each day during daylight hours, when the vessel is NOT fishing; one abundance count conducted during each set and one for each haul.</p>
3	AAD Data Analysis - SARAG recommended upgrading the CMIX program, with AAD to explore funding options and report back to SARAG (SARAG 66 Agenda Item 5.1).	Complete
4	<p>HIMI Data Collection Approaches - AAD to provide an analysis update for the May 2023 meeting on the effectiveness of changing RSTS surveying method. Analysis to include potential of scaling back particular strata identified by Industry (SARAG 66, Agenda Item 5.3)</p> <p>AAD to work with CSIRO, industry and AFMA to provide a paper to the next SARAG meeting outlining the broad scientific and resource costs and benefits associated with the implementation of different surveys and research proposals: Random Stratified Trawl Survey (RSTS, including variations to the periodicity), Random Longline Survey (RLS) & Close Kin Mark Recapture (CKMR) (SARAG 66, Agenda Item 5.4)</p>	In progress. To be discussed further under Agenda Item 7.
5	<p>Electronic Monitoring - AFMA to review EM WG membership and reconvene the group (SARAG 66, Agenda Item 6).</p> <p>AFMA to schedule an OOS meeting of SARAG to progress planning process for a Sub-Antarctic EM data collection trial (SARAG 68, Agenda Item 2)</p>	Ongoing. The CSIRO/AAD/AFMA/Industry EM working group will reconvene following a review of the membership and terms of reference of the working group.

Item	Action arising	Status
6	<p>Close Kin Sampling - Dr Hillary to get Close Kin sample quality information from the lab and provide this information to the members of the RAG.</p> <p>Dr Hillary to work with industry to ensure that the tissue sampling technique is uniform before continuing collection of tissue samples for CKMR (SARAG 66, Agenda Item 7.2)</p>	Complete
7	<p>Sea Lice Sampling - AAD, in consultation with AFMA and Industry, to develop marked up data log sheet for mag-by-mag recording. AAD to provide Industry with the Sea lice analysis for discussion before January 2023 decision of sea lice sampling to the entire HIMI fleet (SARAG 66, Agenda Item 7.3)</p>	Complete
8	<p>Observer Samples – A list of samples collected during trips to be provided to industry to ensure all observer samples are unloaded. AAD and AFMA to develop a procedure to provide this list (SARAG 66, Agenda Item 9.1).</p> <p>AFMA to contact T Lamb and to clarify history of the issue and report back at SARAG 69 (SARAG 68, Agenda Item 2).</p>	Ongoing
9	<p>Random Stratified Trawl Survey - AFMA to undertake consultation process with SouthMAC to amend the HIMI FAP to allow RSTS start date of 13 March 2023 (SARAG 67 Agenda Item 2)</p> <p>AAD and Austral to meet to discuss potential to undertake complementary night-time sampling during the 2023 RSTS period (SARAG 67 Agenda Item 2).</p>	<p>Complete</p> <p>Complete</p>

Attachment D

Date	Correspondence Item
2 September 2022	AFMA emailed SARAG providing details of the MAC and RAG Consultative Review, including the Terms of Reference and AusTender details.
6 September 2022	AFMA emailed SARAG announcing the AFMA ARC 2023/24 call for proposals, and a request for members to distribute this information to their networks
14 October 2022	AFMA emailed SARAG seeking comments on the SARAG 66 Meeting Record
18 October 2022	AFMA emailed SARAG providing the Milestone 3 update report for the Southern Ocean IPA project on <i>Environmental and ecosystem drivers of catch efficiency within Australia's subantarctic Patagonian Toothfish fisheries</i> (FRDC 2019-169)
6 December 2022	AFMA emailed SARAG seeking comment on an industry discussion paper on management arrangements in the Macquarie Island Toothfish Fishery, and a following email on the same matter on 27 January 2023
7 February 2023	AFMA emailed SARAG seeking member availability for a special Out Of Session meeting (SARAG 67) to discuss the format of the icefish components of the Random Stratified Trawl Survey
13 February 2023	AFMA emailed SARAG providing a discussion paper on Macquarie Island Toothfish Fishery management arrangements for consideration and decision at a special combined meeting of SARAG and SouthMAC on February 17.
22 February 2023	AFMA emailed SARAG providing a discussion paper for consideration and decision at the special Out of Session meeting of SARAG (SARAG 67).
1 March 2023	AFMA emailed SARAG seeking comments on the SARAG 67 Meeting Record
1 March 2023	AFMA emailed SARAG seeking comments on the Joint SARAG SouthMAC Meeting Record
3 March 2023	AFMA emailed SARAG seeking availability to attend a Climate Change Adaptation workshop
21 April 2023	AFMA emailed SARAG providing the final meeting record of the Joint SARAG SouthMAC Meeting, papers on seabird distribution around Macquarie Island, and on the HIMI season extension
28 April 2023	AFMA emailed SARAG providing the final meeting record of SARAG 67