

**Report of the Working Group
on Statistics, Assessments and Modelling**
(Bremerhaven, Germany, 24 to 28 June 2013)

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INTRODUCTION

Opening of the meeting

1.1 The 2013 meeting of WG-SAM was held at the Alfred Wegener Institute (AWI), Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany, from 24 to 28 June 2013. The meeting was convened by Dr S. Hanchet (New Zealand) and local arrangements were coordinated by Dr S. Hain (AWI) with support from the German Federal Ministry of Food, Agriculture and Consumer Protection.

1.2 Drs Hain and Hanchet welcomed participants (Appendix A) and Dr Hanchet outlined the work ahead. WG-SAM is a technical working group which advises on quantitative issues relevant to the work of the Scientific Committee and its other working groups (SC-CAMLR-XXV, paragraphs 13.4 to 13.8).

Adoption of the agenda and organisation of the meeting

1.3 The Working Group referred the papers on toothfish biology (WG-SAM-13/19, 13/26 and 13/27), submitted to subitem 4.2, to WG-FSA for consideration. The agenda was adopted (Appendix B).

1.4 Documents submitted to the meeting are listed in Appendix C. While the report has few references to the contributions of individuals and co-authors, the Working Group thanked all the authors of papers for their valuable contributions to the work presented to the meeting.

1.5 In this report, paragraphs that provide advice to the Scientific Committee and its other working groups have been highlighted. A list of these paragraphs is provided in Item 6.

1.6 The report was prepared by Drs M. Belchier (Convener WG-FSA), C. Darby (UK), D. Ramm, K. Reid (Secretariat), Mr R. Scott (UK), Drs B. Sharp (New Zealand), D. Welsford and P. Ziegler (Australia).

RESEARCH IN DATA-POOR EXPLORATORY FISHERIES

2.1 The Working Group recalled the procedure that it adopted last year when reviewing research proposals, and agreed to structure this section of the report such that general points that apply to all toothfish research plans are presented, as well as commentary and recommendations specific to research plans provided by Members.

General points applicable to research in data-poor areas

2.2 The Working Group noted that the research plans for fishing in data-poor exploratory fisheries are included as a part of the notification process required under Conservation Measure (CM) 21-02 (and CM 24-01 in respect of research in other fisheries). These plans were then extracted by the Secretariat and submitted to the Working Group by the Secretariat on behalf of the notifying Member. In some cases the notifying Members had also provided papers, and gave presentations at the Working Group that provided additional information.

2.3 The Working Group agreed that in order to clarify the process, and avoid potential confusion, Members should submit their research plans as stand-alone papers directly to the Working Group rather than for these to be extracted from the notifications by the Secretariat. The Working Group requested that the mechanism by which changes in research plans associated with notifications are recorded be reviewed, especially as the research plan is often revised prior to the meetings of WG-FSA and the Scientific Committee, such that the final research plan may not be the same as in the initial notification.

2.4 The Working Group noted that estimates of fishable area used in the early stages of developing stock assessments rely on bathymetry datasets which may be at low resolution in areas of the Southern Ocean. It encouraged Members to collate bathymetry data from their fishing and research vessels to assist with producing more accurate estimates of fishable area in data-poor areas, and also to use the most up-to-date bathymetric datasets available (e.g. GEBCO-08 which includes updated bathymetry for the Southern Ocean: www.gebco.net). It was further noted that seabed area could be estimated as either the planimetric area or the surface area of the seafloor in three dimensions, and that analyses should be clear as to which area is used in any calculations.

Road map for developing and reviewing research plans

2.5 The Working Group noted that the recent focus by the Scientific Committee and its working groups had led to relatively rapid development of a framework for developing research plans to collect data and develop stock assessments in data-poor areas. It was noted that WG-SAM-13/37 collated and summarised this advice, particularly for developing tag-based toothfish assessments. The Working Group agreed that such a summary was useful and should be further developed.

2.6 The Working Group requested that an annotated flowchart be developed by Members showing the different stages of research leading to a stock assessment and that this be presented to WG-FSA, noting that this could also provide an efficient framework for summarising and reviewing progress of research plans.

2.7 The Working Group agreed that the following points are useful to guide the development and implementation of research plans:

- (i) In subareas or small-scale research units (SSRUs) for which no data are available, the objective of research in the 'prospecting phase' is to map the area for fish abundance in order to locate appropriate research blocks for the next phase of the research focused on recapturing tagged fish. In the prospecting phase research should be effort limited, not catch limited; however, catch limits

in tonnes should also be calculated by applying a high CPUE from an analogous area, on the assumption this catch limit will not be reached and the full number of sets will be completed unless the CPUE is considerably higher than expected.

- (ii) Once CPUE has been characterised in an area, research blocks should be defined in which subsequent effort will be constrained during the tag-recapture phase. The delineation of research blocks should prioritise spatially contiguous areas where CPUE is high and (if possible) where tag releases have already occurred.
- (iii) A mechanism should be proposed to ensure that fishing effort is spatially distributed across fishable depths within the research block. Appropriate mechanisms could include grid-based designs, minimum separation rules, assigning sets within multiple pre-defined strata, or other mechanisms.
- (iv) Not all cohorts of tagged fish can be assumed to be equally available for recapture, especially from years in which the tag-overlap statistic was low. One appropriate mechanism for deciding which tags are used in the estimation of local biomass would be to use only tags from those vessels from which at least one tagged fish has been recaptured, in the year of that tagged fish's release and in subsequent years.
- (v) Proponents should estimate the number of expected tag recaptures per year for a given research design as a function of research catch, tagging rate and the preliminary biomass estimate. Research catch limits should be designed to produce sufficient tag recaptures to obtain a stock assessment in a reasonable time period (e.g. 3 to 5 years).
- (vi) There is no simple formula to estimate the number of tag recaptures required to attempt a stock assessment. Previous experience and modelling approaches have suggested that a minimum of 10 (WG-FSA-12/18) or 15–20 (WG-SAM-13/37) cumulative tag returns are likely to be required in a reasonable time period.
- (vii) Precautionary exploitation rates should be evaluated at the level of the stock, but where a stock hypothesis is unknown, then estimating exploitation rate at the scale of the SSRU is appropriate.
- (viii) Combined catch limits for all research blocks or SSRUs should be evaluated to ensure that the combined catch is lower than a precautionary exploitation rate. The Working Group recognised that exploitation rates of 3–4% of B_{current} (at the scale of the stock or SSRU) are appropriate for stocks with current status ranging from 20% to 100% B_0 , consistent with previously utilised methods (SC-CAMLR-XXX, Annex 7, paragraphs 5.22 and 5.34) to ensure that research catches do not delay recovery for depleted stocks (Welsford, 2011).
- (ix) Because stock- or SSRU-scale biomass estimates are unavailable for data-poor fisheries, estimated exploitation rates at this scale will be highly uncertain. Research plans should include an estimation of local exploitation rates (i.e. within research blocks) and also report the proportion of the fishable depth

in the areas of the stock or SSRU that is contained within research blocks, to inform evaluation of to what extent the proposed research catch limits are appropriately precautionary.

- (x) Noting that many of the data-poor areas are very large, developing multi-vessel and multi-Member plans provides benefits, including allowing standardisation between vessels.

2.8 Dr A. Petrov (Russia) made the following statement:

‘In my opinion, the introduction of research blocks in areas with insufficient data limits the ability to conduct research in those areas where research is being conducted for the first time (Weddell Sea). Therefore, I consider not suitable for this approach, which does not meet the recommendations of the Scientific Committee (SC-CAMLR-XXX, Annex 5, paragraphs 2.26 to 2.29 and 2.35).’

Specific advice on research proposals

Subarea 48.6

2.9 WG-SAM-13/05, 13/09, 13/11, 13/22 and 13/29 were considered under this section.

2.10 WG-SAM-13/05, 13/09 and 13/11 described research conducted by one South African and one Japanese vessel in 2012/13 in this subarea as proposed in 2012. Fishing focused in the four research blocks identified last year as being likely to have highest tag densities, as described in WG-FSA-12/60 Rev. 1. It was noted that fishing in 2012/13 may still continue in the north of Subarea 48.6 as the catch limit had not yet been taken, however, the southern area was now inaccessible due to sea-ice.

2.11 The Working Group recalled that within-season recaptures of tagged fish were exceptionally high in 2011/12; 32 of a total of 34 recaptures were fish released in that year. In 2012/13, 3 of the 13 recaptures were from fish released within season. While it was noted that within-season recaptures may have limited value in estimating stock biomass due to limited time for mixing, it was agreed that, due to the extensive coverage of much of the northern SSRUs in 2012/13, further investigation of the within-season recaptures from 2011/12 and 2012/13 should be conducted to ensure the maximum information on behaviour of toothfish after tagging and abundance of toothfish can be extracted. The Working Group requested that the Secretariat provide an analysis of within-season recaptures, including sex, species and size distribution, apparent growth, time and movement between release and recapture for consideration by WG-FSA.

2.12 The proponents of this research requested consideration of the following modifications to the research plan in Subarea 48.6:

- (i) a relaxation of the requirement to set lines with a separation of 3 n miles to enable greater operational flexibility

- (ii) a change to the distribution of proposed species-specific toothfish catch limits to reduce the risk that catches of Patagonian toothfish (*Dissostichus eleginoides*) prevent achievement of the Antarctic toothfish catch limit agreed between the proponents
- (iii) changing the catch limits to achieve an objective of 25 tag returns per annum by 2016
- (iv) inclusion of an additional research block (48.6e), where tagged fish have also been released in the past
- (v) a change to the application of the *Macrourus* by-catch move-on rule, to reduce the risk of by-catch preventing achieving the research objectives.

2.13 The Working Group noted that bias can arise from tag-based estimates of abundance where tags are not distributed proportional to the underlying abundance of the fish (WG-SAM-12/23). The requirement for 3 n mile spacing of lines was one means of ensuring that fishing did not concentrate in just areas of high abundance, allowing an unbiased evaluation of abundance within a research block. It also noted that other mechanisms, such as fishing across a grid, or assigning sets to strata defined geographically as well as by depth, could achieve the same goal. Therefore, the Working Group agreed that research proponents could propose an alternative method of ensuring spatial coverage of the research block in their revised proposal to WG-FSA.

2.14 The Working Group noted that species-specific catch limits in this subarea were established as part of a collaborative research implementation plan between South Africa and Japan, based on the results of analyses presented in WG-FSA-12/60 Rev. 1. The proponents agreed to revise the design of the research blocks and/or propose an alternate catch-limit split between the two species of toothfish prior to review in WG-FSA-13, noting the need to avoid overexploitation of either species of toothfish while attempting to maximise coverage of research blocks where tagged fish had been released in previous years.

2.15 The Working Group recalled its previous discussions that the nature of tag-recapture programs made it difficult to prescribe a target number of recaptures of tagged fish, as the number of recaptured tagged fish is a function of the vulnerable biomass, tagged fish released and fish recaptured, which are all likely to vary spatially. It further noted that tag overlap also influenced the relationship between tagged fish recaptures and biomass estimates. It therefore recommended that research proponents provide a rationale for an appropriate number of expected tag returns, drawing on the advice provided in previous reports such as WG-SAM-11 (SC-CAMLR-XXX, Annex 5) and papers such as WG-FSA-12/18.

2.16 The Working Group noted that the research blocks used in Subarea 48.6 in 2012/13 were designated based on the numbers of tagged fish released in previous years, and noted that WG-SAM-13/09 identified another potential research block (48.6e) where over 300 tagged fish were estimated to be available for recapture in 2013/14. It was noted that very few tagged fish recaptures had occurred from fish released in the southern SSRUs of Subarea 48.6 (such as research block 48.6d on Gunnerus Ridge) and that a possible hypothesis for this may be that toothfish move out of areas where tagged fish have been released. It was noted that while toothfish can move large distances over their lifetime, it was unlikely that many fish had moved from research block 48.6d to 48.6e, and therefore

expanding the boundaries of research block 48.6d may be more likely to detect tagged fish that have moved off Gunnerus Ridge to the continental slope. Therefore, it was suggested that the proponents consider expanding research block 48.6d to include contiguous areas of the slope and continental shelf.

2.17 The Working Group noted that paragraph 6 of CM 33-03, which regulates by-catch in new and exploratory fisheries, was intended for multi-vessel fisheries to prevent individual vessels from catching the full catch limit for by-catch species and thereby triggering a fishery-wide closure for other vessels. For this reason, application of this paragraph may be inappropriate or unnecessary in the context of research plans involving only a few vessels. It noted that paragraph 8 of CM 41-03 was changed to address this issue in Subarea 48.4 (SC-CAMLR-XXVIII, Annex 5, paragraphs 6.28 to 6.31). It therefore agreed that information on by-catch in Subarea 48.6 be collated to enable an appropriate threshold for the by-catch limit to be determined, and that a paragraph similar to paragraph 8 of CM 41-03 be developed for Subarea 48.6.

2.18 The Working Group noted that WG-SAM-13/09 included point estimates of biomass exploitation rates and expected tagged fish recaptures in the research blocks in Subarea 48.6. However, many of the input parameters would have associated uncertainty, which would propagate through to the estimates of biomass, exploitation rates and expected tag recoveries. The Working Group therefore:

- (i) recommended that such uncertainties be presented in future to assist in interpreting the results of such calculations
- (ii) noted that fishable depths calculations in WG-SAM-13/09 be revised to include habitat between 600 and 1 800 m, rather than between 550 and 2 200 m
- (iii) noted that the inverse variance weighted biomass estimates presented in the paper did not account for the lack of independence between the estimates, and requested the authors consider including these data in an integrated assessment framework to avoid this issue
- (iv) noted that the use of a tagging mortality rate estimate of 0.2 (rather than the usual 0.1) was initially recommended for trotlines in 2011 following concerns about potentially higher tagging mortality for fish released from trotlines (SC-CAMLR-XXX, Annex 7, paragraph 5.20). However, since that time Japan has undertaken and submitted considerable further work demonstrating that the fishing gear utilised in these experiments captures an adequate number of single-hooked fish in a state suitable for tagging
- (v) recommended that the proponents reconsider applying the standard tagging mortality rate estimate of 0.1 rather than 0.2.

2.19 The Working Group discussed the changes to research catch limits proposed by Japan based on the criterion of achieving an estimated 25 annual tag returns by the 2016 season. It supported the practice of setting research catch limits to achieve a target number of tagged fish recaptures necessary for a stock assessment, but agreed that 25 recaptures in a single year was higher than what has been required to achieve stock assessments in the past.

2.20 The Working Group noted that there had been no ageing of any toothfish from this subarea. It recalled that catch-at-age data are a key input into stock assessments, along with tag-recapture data, and requested that research proponents provide detail as to how such data will be acquired.

2.21 The Working Group congratulated Japan and South Africa for working together to deliver the research plan for this area. It noted the benefit of achieving agreements between proponents that avoid the race to fish during research, and encouraged such collaboration between proponents in other areas where research is planned.

2.22 The Working Group reviewed a research notification submitted by Ukraine to fish in Subarea 48.6 (WG-SAM-13/13 Rev. 1), with reference to the research plan evaluation table used by WG-FSA to evaluate new research plans in the same area in 2012 (SC-CAMLR-XXXI, Annex 7, Table 10). The Working Group noted that some of the necessary information to fully evaluate the proposed research was not provided. Ukrainian scientists said that they would provide a more fully developed plan to WG-FSA-13. The Working Group encouraged Ukraine to coordinate their efforts with ongoing research by Japan and South Africa in this area.

2.23 A Bayesian biomass model using catch and standardised CPUE was developed for toothfish in Subarea 48.6 (WG-SAM-13/29). The results were strongly influenced by priors, indicating that very little useful information on stock dynamics was contained in the available data. It was noted that this reinforced the need for an absolute index of abundance for assessing toothfish, such as from a tag-recapture program.

2.24 The Working Group noted that the catch-rate standardisations shown in WG-SAM-13/09 and 13/29 produced different results and requested that reasons as to why such differences may have arisen, such as differences in input data or analysis method, be investigated further. It was further noted that recording of lost hooks, and distinguishing between longline methods, had changed over the period analysed and that this needs to be considered in such standardisations.

Divisions 58.4.1 and 58.4.2

2.25 Japan, the Republic of Korea and Spain had all conducted research in Division 58.4.1 in 2012/13 as reported in WG-SAM-13/09, 13/10, 13/12, 13/28 and 13/30. All vessels encountered significant difficulties in conducting research due to sea-ice conditions and the *Shinsei Maru No. 3* was also unable to complete research in Division 58.4.2 due to low CPUE, attributed to potential localised depletion arising from activities by an IUU vessel.

2.26 Regarding the Japanese research plan in WG-SAM-13/09, the Working Group recalled that the spatial design and research plan methodology is largely unchanged from WG-FSA-12/60 Rev. 1, which was the basis for the Scientific Committee's advice in these areas in 2012, and that very little new data was available to inform revisions to this design. Examination of variable ice patterns to evaluate the likely accessibility of potential research blocks between years (as in WG-SAM-13/07) would be useful to inform evaluation of future plans.

2.27 The Working Group noted that its advice for Subarea 48.6 (above) – i.e. regarding spatial separation of sets, by-catch move-on rules, tagging mortality estimates for trotline-caught fish, research catch limits based on expected tag returns, and fishable depths ranges to be used in area-based estimates of abundance – applies also to the plans in Divisions 58.4.1 and 58.4.2.

2.28 Regarding the research report and plan by the Republic of Korea in WG-SAM-13/10 and 13/28, the Working Group expressed appreciation for the dedication of the Korean vessel attempting to complete the planned research despite considerable operational difficulty arising from unfavourable ice, and for providing a considerable amount of biological and other data available from the small numbers of fish that were caught. It encouraged Korea to continue its research and to progress toothfish ageing from otoliths collected in these areas. It encouraged Korea to submit a revised research plan outlining methods to be used to evaluate hooking injuries and suitability for tagging from fish captured from this particular trotline configuration (as in WG-FSA-11/13 Rev. 1 and WG-FSA-12/56), and to ensure that their gear is described in the CCAMLR gear library.

2.29 Regarding the Spanish depletion experiment and ongoing research plan in WG-SAM-13/12 and 13/30, the Working Group noted that this research design combines aspects of both the prospecting phase and also the tag-recapture phase, requiring that the vessel return to the locations that they fished in 2013. The Working Group encouraged Spain to continue its research, including developing a framework for which the data collected can be developed into a stock assessment. It noted that the highest priority for the at-sea research should be returning to those locations, to evaluate CPUE variability between years and to recapture tagged fish, enabling comparisons between depletion-based and tag-based estimates of abundance, but that further prospecting sets are also valuable. The Working Group recommended that prospecting sets be conducted across a range of depths to inform improved area-based estimation of biomass within fishable depths at the SSRU scale.

2.30 The Working Group noted that local biomass estimates were obtained in both locations at which depletions were conducted, and that these estimates were different despite similar initial CPUEs because the slope of the depletion was steeper in SSRU 5841G relative to SSRU 5841H. The Working Group requested that the resubmission of the research plan to WG-FSA provide more detailed diagrams of set sequence and location within the area of the depletion experiment to evaluate to what extent observed CPUE declines are likely to represent actual depletion in a single location or that the vessel has moved away from the location of highest abundance.

2.31 The Working Group noted that there were no within-season recaptures of toothfish during either of the depletion experiments despite the numbers of tagged fish released and the observed decline in CPUE.

2.32 The Working Group noted that more than one research plan is proposed and that these may occur in the same SSRUs in these divisions, such that subsequent evaluations should consider research catches combined for all research plans in the area, relative to precautionary exploitation rates at the SSRU scale.

2.33 The Working Group noted that a standardised catch rate time series in WG-SAM-13/09 showed declining catch rates in SSRU 5841G since 2005. It recalled that CPUE is a generally poor index of changing abundance over time and that the level of volatility apparent

in the observed catch rates could not be expected to track an actual abundance trajectory. Nonetheless it agreed that these observations warranted further consideration in future discussions regarding stock status and trends in this area, and the likelihood that proposed research catch limits could be achieved in this SSRU.

Division 58.4.3a

2.34 The Working Group noted that France and Japan had proposed research in this Division in 2012/13, and the *Shinsei Maru No. 3* conducted sets that caught a total of 9 tonnes of toothfish. It further noted that France and Japan proposed to continue research in this division as described in WG-SAM-13/08 (France) and 13/09 (Japan).

2.35 The Working Group noted that the management advice for Division 58.4.3a was in some respects more advanced than in other data-poor areas – for example the research catch limit has been set based on an analysis that incorporates the intent of the CCAMLR decision rules. It therefore encouraged the continued development of an integrated assessment for this area, and noted that inclusion of data from fish aged by France and Japan was a priority.

2.36 The Working Group noted that no French scientists attended the Working Group and recalled that this situation was the same at WG-SAM-12. It also noted that this research proposal did not contain sufficient detail so that it could not be evaluated without reference to other documents such as working group reports or previous research plans, and recalled that the previous research proposal to which WG-SAM-13/08 makes repeated cross-reference (WG-FSA-12/29) was itself judged by WG-FSA to require considerable changes and additional information (SC-CAMLR-XXXI, Annex 7, Table 12).

2.37 WG-SAM-13/41 provided a characterisation of catch and effort in Divisions 58.4.3a, 58.4.3b, 58.4.4a and 58.4.4b. The Working Group noted that some of the patterns in catch and effort in the region analysed overlapped a period of known IUU fishing as well as changes in management measures, and that these need to be considered when interpreting patterns in catch and effort. The Working Group noted the high standard of graphics presented in the paper and requested that the Secretariat work with the authors to learn some of the data visualisation methods used in WG-SAM-13/41 for inclusion in Fishery Reports.

REVIEW OF SCIENTIFIC RESEARCH PROPOSALS FOR OTHER AREAS (E.G. CLOSED AREAS, AREAS WITH ZERO CATCH LIMITS, SUBAREAS 88.1 AND 88.2)

Subarea 48.5

3.1 The results of the first year of a multi-year research survey of Antarctic toothfish (*D. mawsoni*) carried out by Russia in Subarea 48.5 (Weddell Sea) were presented in WG-SAM-13/23. Due to the prevailing ice conditions experienced in late February/March, the survey was restricted to one region in the east of the Weddell Sea and therefore followed option 1 of the research plan. A total catch of 59.5 tonnes (from a survey catch limit of

60.6 tonnes) was taken on eight longline sets. A high CPUE meant that it was not possible to achieve the planned number of research sets (50) as the catch limit was reached very quickly, which therefore constrained the spatial coverage of the survey.

3.2 A tagging rate of 5 tags per tonne was achieved with 314 *D. mawsoni* released with a tag-overlap statistic of 64%. Information on fish maturity, diet and size composition of target species was presented with additional details on by-catch and VME. It was noted that otoliths had been collected for subsequent ageing studies. Further details of the survey will be presented to WG-FSA.

3.3 The Working Group thanked Russia for the report and noted the considerable amount of information presented.

3.4 Recalling WG-FSA-12/18, the Working Group noted that, whilst the minimum 60% tag overlap required in CM 41-01 had been achieved, it would be desirable to increase the overlap to ensure that large fish were tagged in proportion to their abundance in the catch. It was also noted that there was an apparent decrease in mean length with depth, which differs from the situation observed in most other fisheries where fish tend to be larger at greater depths.

3.5 A proposal for the second year of the survey series during the 2013/14 season was presented (WG-SAM-13/07). The proposal was essentially the same as that presented to WG-SAM and WG-FSA in 2012 and again provided three options to cover different regions of the Weddell Sea depending on accessibility due to ice conditions. The major difference between the proposals was the increase in catch for the 2013/14 survey for all three of the research proposal options. The increase in catch was proposed in order that the survey would not be truncated (in terms of number of proposed sets) based on the experience of 2012/13 when the existing catch limits were achieved in considerably fewer line sets due to the high CPUEs achieved during the survey.

3.6 The Working Group noted that any proposed increase in catch in 2014 should be spatially constrained to the area surveyed last year in which tagged fish were released. The application of catches based on the high CPUE data outside the area surveyed in 2012/13 may not be appropriate. Calculation of a catch to be taken from within the area (box) surveyed during 2012/13 could be undertaken using the approach outlined in the roadmap for developing research plans in data-poor fisheries (paragraphs 2.5 and 2.6) based on the application of 'ChartMaster' to generate a preliminary local biomass estimate inside the research block and applying an appropriate precautionary exploitation rate.

3.7 Outside the previously surveyed block, the research was still in the prospecting phase as limited catch data were available and due to the high level of uncertainty associated with extrapolating outside the surveyed area, the Working Group considered that this would not be appropriate for areas outside the surveyed area. Outside the surveyed area, a greater spatial spread of sets is desirable in order to obtain spatial CPUE information and consequently, in order to increase spatial coverage, it was suggested that shorter longlines be deployed in the forthcoming survey, or that the distance between sets in the research areas be increased, as this would provide increased spatial and depth information on the distribution of *D. mawsoni* in the Weddell Sea whilst balancing the potential impact on the stock in un-surveyed areas for which no data are available.

3.8 Dr Petrov expressed concern that the deployment of shorter lines was operationally difficult and that, in order to deploy the required 50 lines, the proposed increased catch limits would be necessary. He undertook to consider the suggestions made by the Working Group and resubmit the proposal to WG-FSA.

3.9 Dr Petrov made the following statement:

‘In my opinion the calculations provided for the required resource potential for research in the 2013/14 year, for that would do a completely research program (set 50 scientific research lines by option 1 (WG-SAM-13/07)), calculated according to the recommendations of the Scientific Committee (SC-CAMLR-XXX, Annex 5, paragraph 2.40(ii)) and meets all the requirements of CM 24-01, including a research agenda item (rationale that proposed catch limits are consistent with Article II of the Convention). Also, I would like to remind the Working Group that we obtained data on CPUE for option 1 in Subarea 48.5 is currently the best for CCAMLR and used by us to calculate the required yield for achieving the goals recommended by the Scientific Committee (SC-CAMLR-XXX, Annex 5, paragraphs 2.25 to 2.29 and 2.35).

We do not support the proposal of the Working Group to the limit research to the square (WG-SAM-13/37) where they were carried out (eight sets) last year. We believe that this proposal restricts our research and does not give the possibility to obtain new data on the distribution of fish in the study area, and the proposed Working Group setting of short lines are not feasible from a technical point of view. But we have informed the Working Group that in WG-SAM-13/07 plan is detailed and station positions (with coordinates) research lines, including water area, is taken into account, where the fish were tagged in 2013 and we plan to catch us previously marked fish from this area. But we also plan to expand our research and new data on the spatial distribution of the target species and the study of all by-catch species, and we believe that our proposed resource potential for research in option 1 is required for the full implementation of the given program.’

Additional information

3.10 The Working Group noted that a new international standard GEBCO bathymetric dataset is available for the Weddell Sea region and this could assist with refinement of the calculation of fishable area in future research proposals in the region.

3.11 Details of a proposed scientific survey of the eastern Weddell Sea, scheduled for December 2013–March 2014 using the vessel *Polarstern*, was presented to the Working Group by Germany. The multidisciplinary survey will include biological, geological and hydrographic studies of the region close to the location of the proposed Russian survey. It was noted that this is a known biological hotspot with large numbers of higher predators observed during summer. Germany has also deployed three acoustic moorings in the region and was requested to provide the location of the moorings to the Secretariat following the example in SC CIRC 13/22.

Subareas 48.1 and 48.2

3.12 The Working Group considered a proposal by Chile to conduct research on finfish distribution and abundance in Subareas 48.1 and 48.2 (WG-SAM-13/14). It noted a number of inconsistencies and omissions from the proposal that made it difficult to provide a thorough appraisal. The Working Group recommended that further details be provided to WG-FSA so that the proposal can be evaluated.

- (i) It was not clear whether a pelagic survey was intended (as suggested by the gear/net selection) or a demersal survey (as suggested in the accompanying text). Greater detail on the proposed analysis of acoustic data was requested. The proposed use of a non-scientific echosounder may make the acoustic data difficult to analyse quantitatively and it was not clear how this was to be achieved.
- (ii) The Working Group could not clearly determine the aims of the survey and how this was to be achieved using the survey design which only examined the area to the north of the South Orkney Islands chain. The USA and Germany have conducted a considerable number of demersal research surveys in the region and it was not clear what information the new survey would add. Consequently, reference to previous studies is encouraged, especially as these could be used to guide the proposed survey stratification.
- (iii) It was recommended that the proponents of the research should also consider the likelihood of the survey taking place close to, or within, areas of high VME abundance as notified by CCAMLR (www.ccamlr.org/node/78917) and that, if the fishing gear used was likely to come into contact with the seafloor, then this should be addressed in the revised submission.

3.13 The Working Group recommended that the proponents of this proposal consider the advice that had been provided and submit a revised proposal to WG-FSA.

Subarea 48.2

3.14 A proposal submitted by Ukraine (WG-SAM-13/38) for research starting in 2013/14 on *Dissostichus* spp. using bottom-set trotlines at depths between 600 and 2 000 m in Subarea 48.2 was reviewed by the Working Group.

3.15 The Working Group noted that the proposed research was for the austral summer period and recalled that a risk assessment had been carried out for the region by WG-IMAF (SC-CAMLR-XXVIII, Annex 7, Tables 13 and 14, Figure 2) and that, due to the risk of incidental mortality to seabirds by demersal longlines, the mitigation measures relating to longline fishing in the region should be followed and addressed in the proposal.

3.16 Previous research on toothfish distribution and abundance in Subarea 48.2 had been carried out by Chile in 1998 (Arana and Vega, 1999) and reported low catch rates of Patagonian toothfish (*D. eleginoides*) (and no *D. mawsoni*) from seven hauls in the region. This information could be useful in refining the spatial extent of the survey.

3.17 The large spatial extent of the survey area was noted and it was suggested that it would be difficult for one vessel to effectively cover all of the proposed research area. It was recommended that smaller spatial units could be sampled more effectively.

3.18 The Working Group recommended that a stock hypothesis for *Dissostichus* spp. within the proposed area should be developed. It is currently uncertain what the relationship is between toothfish found within Subareas 48.1 and 48.2 and those in neighbouring subareas.

3.19 The Working Group also noted that the proposal includes two sets within the boundaries of the South Orkney Islands southern shelf MPA (CM 91-03).

3.20 It was recommended that the proponents of the research should also consider the likelihood of the survey taking place close to, or within, VMEs as notified by CCAMLR (www.ccamlr.org/node/78917) and address this in the revised submission by illustrating the proximity to the areas at risk.

3.21 The Working Group recommended that the proponents of this proposal consider the advice that had been provided and submit a revised proposal to WG-FSA.

Subarea 88.1

Sub-adult survey

3.22 The Working Group considered WG-SAM-13/32 and 13/33 describing the results of the second longline survey of sub-adult *D. mawsoni* in the southern Ross Sea in 2013 and a proposal to continue the time series of research in 2014. The results were broadly similar to those of the 2012 survey, with a total retained catch of 30.7 tonnes of toothfish taken from 65 longline sets, a slightly lower total than obtained in 2012, with a comparable CV.

3.23 Catch rates during the survey were comparable to those obtained by commercial vessels operating in the same area prior to the survey, except in a localised area near the ice shelf of stratum A, where the survey CPUE was much lower than in the commercial fishery. In particular, a large contrast was apparent from a single vessel for which catch rates were substantially higher than reported by other vessels or in previous seasons.

3.24 In reviewing the proposal for a survey in 2014, the Working Group noted that the survey design and number of sets for the three core strata are unchanged from the 2013 survey. Fifteen sets exploring new strata in 2013 failed to locate areas containing substantial numbers of the target size range of fish. The proposal suggests a new exploration stratum for those 15 sets in the southern part of SSRU 881M, which was selected as it was considered a likely habitat for sub-adult *D. mawsoni* and could provide tagged fish which had moved west from the survey area. Survey timing and methods will remain the same as in previous years, although the number of sets is proposed to be reduced by five sets to a total of 60 with a catch limit of 50 tonnes.

3.25 In light of the apparent localised reduction in survey CPUE following commercial fishing activity, the Working Group discussed whether it may be better to conduct research prior to the start of the fishery. However, whilst this may be desirable, it was likely to be

operationally impractical given the ice conditions in the region. The Working Group supported the proposed survey design and effort limitations by strata for the 2014 season and agreed that they required no further modification.

3.26 The Working Group discussed potential mechanisms by which a catch limit should be applied to the survey, which will include SSRU M (which has a catch limit of 0 tonnes). The Working Group requested that this matter be considered by the Scientific Committee and the Commission.

Divisions 58.4.4a and 58.4.4b (Ob and Lena)

3.27 WG-SAM-13/20 reported the results of a research survey for *D. eleginoides* conducted by Japan in SSRUs C and D within Divisions 58.4.4a and 58.4.4b during the 2012/13 season. A total catch of 31.1 tonnes was reported from 64 longline sets. A total of 233 fish were tagged and released (achieving a tag-overlap statistic of 81%) with three recaptures of tagged fish from releases in SSRU C (in 2007/08 and 2010/11). In addition to the target species, new information on the distribution and abundance of by-catch species was provided in the study.

3.28 The Working Group reviewed the proposal by Japan (WG-FSA-13/21) to continue research in SSRUs C and D in 2013/14 with a proposed catch of 50 tonnes. The survey design would remain the same as that used in 2012/13. Noting the continued development of integrated stock assessments for SSRUs C and D, the Working Group supported the proposal and agreed that it required no further modification and thanked Japan for the effort that had been undertaken to progress this work. The Working Group further noted that the effort limit could be removed from the survey design as this research is in the catch-limited phase. Specific advice provided by the Working Group relating to the development of the model is provided in paragraphs 4.15 and 4.16.

METHODS FOR ASSESSING FINFISH STOCKS IN ESTABLISHED FISHERIES, NOTABLY *DISSOSTICHUS* SPP.

Toothfish assessment

4.1 WG-SAM-13/18 reported on a new method using length-frequency data to inform how to allocate hauls to fisheries for a stock assessment. The model uses length-frequency distributions which are simplified to length quantiles at a range of cumulative probabilities, applying a generalised additive mixed model (GAMM) to fit cubic smoothing splines to these length quantiles, and a flexible combination of the covariates such as gear type, depth strata, fishing region or the sex of the sampled fish. The Working Group noted the value of performing sensitivity analyses with different fishery structures in any stock assessment, and noted that this method provided a tool for informing such analyses. The Working Group also noted the main limitation of this method is the need for arbitrary splits in the data that can subsequently be tested. It further recommended that any suggested split be tested in sensitivity analyses.

4.2 WG-SAM-13/24 presented a revised stock assessment of Patagonian toothfish in Subarea 48.4. The revised assessment retained much of the structure of previous assessments, but was revised to include data for Subarea 48.4 South, employed a revised maturity ogive and different assumptions about the functional form of the selection pattern.

4.3 The Working Group noted the strong dependence of the assessment on the 2009 age composition data that gave rise to the very large recruitment event estimated early in the time series. It recommended that the weighting of age-composition data be reinvestigated along with a comparison of alternative assumptions for incorporating uncertainty in recruitment into the projections of future stock status (using e.g. bootstrapping or resampling methods).

4.4 The Working Group welcomed the intention to age more fish otoliths and re-age some of the 2009 otoliths for the assessment which will be presented at WG-FSA-13. It also referred to the recommendation from the Ageing Workshop during WG-FSA-12 on inter-laboratory exchange of otoliths.

4.5 WG-SAM-13/34 reported on further developments of a tag-detection performance index and its application to the stock assessment of toothfish in the Ross Sea fishery. Following on from work last year (WG-FSA-12/47 Rev. 1 and SC-CAMLR-XXXI, paragraph 3.167), the paper included simulations to evaluate the power of performance indices for tag-induced mortality and tag detection. Although the two methods resulted in a similar performance ranking of vessels, the former was found to have only low power and was therefore not further developed.

4.6 In reviewing the paper, the Working Group noted that the proposed application of the method in a stock assessment assumes a relationship between the performance of a vessel in releasing tagged fish with its performance in detecting tagged fish, since all tagging data, including released tagged fish, are excluded from a stock assessment for vessels with a low tag-detection index. It also noted that, because the vessel selection imposes a binary distinction (inclusion or exclusion of the vessel data) based on a continuous index, the particular choice of the selection criteria is arbitrary. The Working Group recommended further development of the method that would allow a selection or weighting of vessel data which is based completely on a statistical procedure as well as estimating the relationship between the tagging and detection of tagged fish for an individual vessel.

4.7 Most Members agreed that the method proposed in WG-SAM-13/34, instead of the method used in the 2011 assessment, should be used to select vessels for the 2013 toothfish stock assessment in the Ross Sea.

4.8 Dr S. Goncharov (Russia) made the following statement to WG-SAM:

‘Some Members have stated doubt about the necessity of the use of the presented method for a stock assessment in 2013, because of a small representativeness of the data. I suggest to continue work on the presented method on more statistical material.’

4.9 The Working Group noted that a poor tag-detection rate of a vessel could simply arise from vessels that do not scan all fish for the presence of tags, whereas the scanning and detection rate of tagged fish in a CASAL stock assessment is assumed to be constant across all vessels and years of a fishery.

4.10 The Working Group recommended that the results from the analysis presented in WG-SAM-13/24 should be used to improve the overall performance of the tagging program, through the investigation of potential operating procedures that may lead to low tag-detection rates for those vessels with a low tag-detection index, and subsequent evaluation of ways for improvement. It noted that the introduction of the tag size-overlap requirement had led to an increase in the number of fish being measured and may have improved the tag-scanning and tag-detection rates. This indicates that specific management measures can have further-reaching effects than anticipated. The Working Group noted that it would be useful if this method was used in other areas of CCAMLR, as it could inform on the performance of vessels that fish mainly in other areas.

4.11 Some Members suggested that opening closed SSRUs would also help with this method. However, the authors explained that the method is independent of fish movement or location of fishing as it accounts only for the tagged fish available in a location. Opening closed SSRUs would only provide useful information for this method if fishing effort was highly concentrated in these SSRUs, since the case-control method works only when multiple vessels fish in close proximity to each other.

4.12 WG-SAM-13/35 and 13/36 reported on further developments of a spatially explicit population dynamics operating model for Antarctic toothfish in the Ross Sea region and, using this operating model, an investigation of potential biases in the assessment of Antarctic toothfish in the Ross Sea fishery. The Working Group noted that, whilst results are still preliminary, the modelled toothfish distributions and movements are consistent with available data. Simulations of the effect of these movements on the single-area stock assessment point towards a conservative stock assessment and are broadly consistent with WG-FSA-12/45.

4.13 The Working Group noted uncertainty arising from the use of data from only fished areas to inform assumed distributions and movements in the entire Ross Sea region, and the uncertainty in the choice of the shape of assumed movement parameter functions. The Working Group noted that further data collection would be beneficial to the parameterisation of movement functions in the model, particularly making collection of gonad weight measurements routine, and recommended WG-FSA consider how best this might be undertaken. The Working Group noted that surveying likely spawning grounds during winter, and obtaining data from areas not fished to date, would also be beneficial.

4.14 The Working Group noted that for a given fish movement scenario, the model can simulate the likely effects on the stock assessment of different spatial management options affecting the distribution of fishing effort, data collection and/or tagged fish releases. The Working Group encouraged the submission of papers describing alternative movement hypotheses in order to evaluate the robustness of different spatial management options against a range of movement hypotheses.

4.15 WG-SAM-13/21 reported further progress on the CASAL stock assessment of Ob and Lena Banks (Division 58.4.4a). The Working Group noted that there were issues with data weighting and recommended that further investigations be carried out. While some initial runs were carried out during the meeting, the Working Group recommended the model be investigated further, including increasing the weighting of tag data in order to improve fits. The Working Group noted that although the fits to the 2012 tag data were problematic, these data should be included in the model if at all possible, as the tagging vessel has had tagged

fish recovered in previous years in this area. It also noted that although IUU catches are not calculated by the Secretariat anymore, estimates for recent years were required for inclusion in sensitivity runs.

4.16 The Working Group recommended a stand-alone paper be presented at WG-FSA on this stock assessment showing all the fits and diagnostics and sensitivities to data weighting. It also welcomed any expert review by other Members to help progress this stock assessment.

Results of the Korean workshop on anomalous CPUE

4.17 Arising from the discussion of anomalously high CPUEs reported from some Korean vessels in data-poor exploratory fisheries (SC-CAMLR-XXXI, paragraph 3.117), the Republic of Korea held a workshop in May 2013.

4.18 The Working Group thanked Korea for holding this workshop and also thanked Dr I. Yeon (Republic of Korea) for her very detailed presentation of the report of the workshop (WG-SAM-13/39). In endorsing the key points and recommendations for future work in WG-SAM-13/39, the Working Group noted in particular the following:

- (i) recognition that a high CPUE by itself is not a problem but the anomalous pattern of high CPUEs requires an explanation
- (ii) during the fishing trips concerned (*Insung No. 22* in 2009, *Insung No. 2* in 2010 and *Insung No. 7* in 2011), the gear configuration (including the bait) did not change during the trips, although there were differences between vessels and trips
- (iii) different measures of effort (number of hooks, length of line, hauling time) showed a consistent pattern within trips. The catch in tonnes showed a similar pattern of variation to the CPUE
- (iv) a description of the fishing patterns from an *Insung* captain indicated that fishing occurred in SSRU 5841G until ice conditions allowed the vessel to move to preferred fishing areas
- (v) it is apparent that the experience and skill of the captain and crew is very important in understanding the differences in CPUE between vessels and years, however, this is very difficult to quantify and was unlikely to change within a single fishing trip
- (vi) data analysis and information presented to the workshop provided a greater understanding of the available data and allowed the analysis to move from data exploration to the identification and testing of hypotheses of how the anomalous CPUE might have arisen
- (vii) further work should be undertaken to:
 - (a) test the hypotheses developed at the workshop as well as additional hypotheses that can be produced

- (b) identify and quantify additional factors that might help interpret and standardise CPUE data, including the skill of the captain and crew, improved fishing gear, bait, sea-ice pattern, seabed and the density of toothfish.

4.19 Following an undertaking given at the workshop, Dr Petrov presented WG-SAM-13/16, which had previously been presented in Russian at the Korean workshop. The authors highlighted the difficulties in interpreting non-standardised CPUE and that, in their opinion, this meant that further analysis to determine the reasons for the high CPUE from the Korean vessels was not appropriate. The Working Group thanked Dr Petrov for presenting the paper.

4.20 Dr Yeon pointed out that an analysis of the CPUE variation of all vessels in exploratory fisheries also indicated some cases of unusually high CPUEs by some vessels that were even higher than the highest CPUEs recorded in Divisions 58.4.1 and 58.4.2 and Subarea 48.6. She also said the captains and crews who had more experience would be more likely to achieve higher CPUEs, and most of the high CPUEs appeared with the relatively lower fishing efforts even though the catch was low. She also emphasised that it would be very useful to focus on developments in the approaches to the use of CPUEs collected from different fishing gears, areas, skills of captains and crews, ice conditions, seabed etc.

4.21 The Working Group agreed that work on standardisation of CPUE between vessels with different characteristics should continue and also that all uncharacteristically high CPUEs recorded in CCAMLR fisheries should be investigated.

4.22 Dr Petrov also noted that the Scientific Committee made a recommendation that on Korean vessels in Divisions 58.4.1 and 58.4.2 and Subarea 48.6 there were anomalously high CPUEs but that the Scientific Committee had not provided criteria for ‘anomalously high’ CPUEs and questioned what should be considered as an anomalously high CPUE. He also noted that WG-SAM-13/16 presented results of analysis of different gear, analysis of soak of gear, which clarify that operation factors should be taken into account, but they were not taken into account in WG-FSA-12/07 on which all accounts are based.

4.23 The Working Group recognised that there has been considerable discussion of the complexities surrounding the choice of metrics of CPUE and how such metrics can be compared between vessels and fisheries. In the case of the data from the three Korean vessels, there was also a recognition that, while it was the occurrence of high CPUEs that had stimulated the detailed analysis presented in WG-SAM-13/39, attention could now also focus on the pattern of CPUE throughout the trips made by the three vessels.

4.24 The Working Group encouraged interested Members to engage appropriate experts in the construction and testing of hypotheses to examine factors that might produce the observed patterns of CPUE, including analyses of data from all fishing vessels in CCAMLR exploratory fisheries, and to present these results to WG-FSA.

Other

Spatial data and analyses

4.25 WG-SAM-13/04 gave an introduction to the ChartMaster GIS software, including examples of its application for mapping the spatial distribution of commercial species, three-dimensional analysis and visualisation of the seafloor topography and methods for the estimation of total biomass from research fishing and survey abundance indices.

4.26 The Working Group agreed that the software was a useful tool for data visualisation and spatial analysis and noted that the facility to consider the three-dimensional topography of the seafloor when interpolating CPUE, rather than using the sea-surface area (in the horizontal plane) that covers the study area, was particularly useful. Several methods of interpolation are facilitated by the software. The Working Group noted that the results obtained from ChartMaster have been validated by comparison with other spatial analysis software (SURFER). It welcomed the detailed description of the algorithms employed by ChartMaster and supporting references but requested some further information on the methods of interpolation used by the ChartMaster software. Dr Goncharov directed the Working Group to the English references in WG-SAM-13/04.

4.27 The Working Group considered that the software could be used to provide a preliminary estimate of stock biomass, based on CPUE and seabed area, but that such estimates should not be based on extrapolations beyond the spatial bounds of the sample data. It further noted that the software had applications for the estimation of krill biomass and acoustic-based analyses and could be of interest to WG-EMM and encouraged the authors of WG-SAM-13/04 to submit it to WG-EMM and SG-ASAM.

Methods for forecasting the closure of fisheries

4.28 WG-SAM-13/06 outlined a work in progress to refine the method currently used by the Secretariat to forecast the closure dates of fisheries. The forecast model was developed in 1991 based on a linear regression of cumulative catches against reporting period (CCAMLR-X/BG/09; subsequently published as Agnew, 1992). The method uses a linear projection of catches derived from the mean daily catch rate of vessels for the three most recent reporting periods and assumes that the fishery will operate in the future in the same way that it did in the period from which data are used to make the projection. As a consequence, overruns of the catch quota in some instances are inevitable.

4.29 The Working Group noted that both over- and under-catches are normal operational outcomes of the method by which CCAMLR manages fishery closures. It considered that the current method for predicting the closure of a fishery was generally effective. It noted that the potential for an overrun of the catch quota is more likely when catch limits are small and when many vessels participate in the fishery, and that it is particularly difficult to predict the closure of a fishery when there are insufficient data to determine a linear relationship for recent catch rates. The Working Group suggested that other modelling approaches, such as GAMMs and quantile regression, could be explored but noted that the problem is likely to

persist in situations where data are sparse. It noted that in the case of very small quotas no such prediction method would be effective as the quota could be taken before sufficient data is available to run modelling methods.

Skate tagging

4.30 WG-SAM-13/25 Rev. 1 provided an overview of global tagging studies in skates, a review of tag loss and tag shedding in elasmobranch fishes, a summary of tag data from studies conducted in European waters to inform on typical return rates in those studies and some initial observations on some of the tagging work undertaken under the auspices of CCAMLR. The report made a number of recommendations regarding the recording of data on tagged skates. These included taking multiple length measurements (e.g. total length and wing spread) to allow for data validation as well as improved species identification and data checking prior to submission to the Secretariat. The report further recommended that tagging studies in which individuals are tagged with multiple tags of different types be developed to investigate tag shedding in skates.

4.31 The Working Group considered the paper to be a very useful overview of tagging practices both within and outside of the CAMLR Convention Area. It supported the recommendations on the collection and validation of data on tagged skates and recommended that the paper be forwarded to WG-FSA for further consideration along with the Secretariat review of skate data requested last year (SC-CAMLR-XXXI, Annex 7, paragraph 8.18).

Icefish assessment in Subarea 48.3

4.32 WG-SAM-13/31 Rev. 1 described a retrospective analysis and sensitivity evaluation of the performance of the CCAMLR harvest control rule (HCR) for the mackerel icefish (*Champscephalus gunnari*) in Subarea 48.3. The retrospective analysis showed the harvest control rule generates levels of exploitation that are considered precautionary. The sensitivity analyses demonstrate that the application of fixed von Bertalanffy growth and length-to-weight relationship parameters does not introduce significant bias or noise to the potential catch estimates.

4.33 The Working Group noted that the retrospective analysis showed biomass projections using the CCAMLR HCR algorithm for the Subarea 48.3 icefish (which do not include recruitment) fall below the subsequent year's survey estimates with a high probability, indicating that the projections upon which the catch advice is based are consistent with the objectives of the CCAMLR HCR. It further noted that the timing of survey series should, as far as possible, be kept consistent, as the distribution of icefish differed at different times of the year, and would impact on the results.

4.34 The Working Group further noted that icefish length-distribution data were available from studies on the diets of higher predators in Subarea 48.3 and that these data could be compared to survey length distributions to investigate the potential development of a recruitment index for the stock.

Algorithms for checking the quality of observer data

4.35 WG-SAM-13/40 presented ongoing work by the Secretariat to develop an algorithm for checking the quality of observer data submitted by Members. The algorithm is able to detect and report invalid data formats, as well as value inconsistencies, through a limited set of logical tests. For each logbook inspected, a text report and set of figures are produced indicating the occurrence of faulty entries. The Working Group agreed that the approach presented was useful and encouraged the Secretariat in further developing algorithms for automated data checking.

4.36 The Working Group recognised that the timing of making changes to the observer logbooks and instructions following the Commission meeting meant that the information was not available in all languages before the beginning of the fishing season. The Secretariat agreed that this was an unfortunate process issue and encouraged everyone who had experienced such difficulties to respond to the recently released CCAMLR Scheme of International Scientific Observation (SISO) review survey which was an integral part of the review of the observer scheme (SC-CAMLR-XXXI, paragraphs 7.3 to 7.6).

OTHER BUSINESS

Discussion of Joint WG-SAM–WG-EMM Focus Symposium on Spatial Modelling in 2014

5.1 The Working Group considered the proposal to hold a spatial-modelling symposium in 2014 (SC-CAMLR-XXXI, paragraph 15.2) and agreed that, while such a workshop would be of interest scientifically, it may not be a priority given current workloads and priorities. The conveners of WG-SAM and WG-EMM both reflected on the range of science programs (e.g. ICED) that were working on models of the Southern Ocean and encouraged Members to engage in these programs to ensure that CCAMLR benefits from the scientific synergies available.

Accessibility and availability of CCAMLR science to a wider audience

5.2 The Working Group discussed a proposal for making the science undertaken in CCAMLR more widely available within the public domain (WG-SAM-13/17) and specifically how working group papers might be made available, via the search facility of the CCAMLR website, to a wider audience.

5.3 Proposals for delaying the release of the paper on the CCAMLR website (publication embargo) until at least after the meeting of the Scientific Committee were considered. Such an embargo may be applied for varying time periods, depending on the content of the paper and, at the discretion of the Scientific Committee representative, may be subject to further extension, where necessary, in order to protect sensitive information.

5.4 The Working Group recognised that the papers must be considered in the context of the discussions as recorded in the working group report to which the papers had been submitted and discussed. It was further noted that disclaimers could be appended to working group papers including, inter alia:

- (i) the paper should not be cited without the prior permission of the author
- (ii) the working group report should be consulted prior to citing the paper to ensure the correct context
- (iii) the content of the paper reflects a contribution to scientific discussions that are ongoing, and does not necessarily reflect the ongoing views of the Member submitting it, or of CCAMLR.

5.5 The Working Group agreed that for each paper a tick-box system could allow the submitter to choose the type of embargo to be applied to the paper, which could be revisited at the appropriate working group if another Member disagrees with the proposed embargo.

5.6 The need for clarity on the application of the CCAMLR data access rules as applied to working group papers and those in the public domain was noted, as well as a requirement for guidance on how the working group papers should be cited.

Editorial procedures of *CCAMLR Science*

5.7 The Working Group discussed a proposal for revising the editorial procedures for papers submitted to *CCAMLR Science*. The proposal included a recommendation that papers that are to be considered for publication in *CCAMLR Science* should be submitted in the format required for the journal to the working group meeting or within one month of the working group meeting. The Working Group considered that this deadline may prove difficult for those participants in WG-FSA who were also engaged in Scientific Committee and Commission meetings, and also that the contents requirements of a scientific paper and a working group paper are different, which might result in insufficient information presented at CCAMLR working groups where the paper is intended for submission.

5.8 The Working Group considered that Microsoft Word templates and EndNote reference styles would be useful tools to assist authors when submitting manuscripts. Similarly, LaTeX style files and templates were also requested.

5.9 The Working Group noted that the official language of *CCAMLR Science* was English and this was considered to be a problem by some Members who stated this to be the reason that few Russian papers had been published in the journal in recent years.

CCAMLR web-based GIS

5.10 The Secretariat presented a prototype of the CCAMLR web-based GIS which is being developed jointly with the British Antarctic Survey (BAS) to provide state-of-the-art capacity

for displaying geo-referenced data relevant to CCAMLR (WG-EMM-12/70). This development will include capacity building at the Secretariat and a phased handover of the system to the Secretariat.

5.11 The development of the GIS will be implemented in two stages, with stage 1 nearing completion and stage 2 being implemented in 2014. The prototype is currently located at gis.ccamlr.org and contains basic data layers (e.g. management areas, bathymetry, sea-ice). An option to download data is available to users authenticated on the CCAMLR website. The Secretariat encouraged users to provide feedback.

5.12 The Working Group agreed that this web-based GIS will be a valuable tool and congratulated BAS and the Secretariat on progress to date.

ADVICE TO THE SCIENTIFIC COMMITTEE

6.1 The Working Group's advice to the Scientific Committee and its working groups is summarised below; the body of the report leading to these paragraphs should also be considered:

- (i) Research plans for exploratory fisheries in Subareas 48.6 and 58.4 in 2013/14 –
 - (a) submission of research plans (paragraph 2.3).
- (ii) Scientific research proposals for other areas –
 - (a) research in Subarea 88.1 (paragraphs 3.25 and 3.26)
 - (b) research in Divisions 58.4.4a and 58.4.4b (paragraph 3.28).
- (iii) Methods for assessing finfish stocks in established fisheries –
 - (a) routine collection of gonad weights (paragraph 4.13).
- (iv) Other matters –
 - (a) papers on toothfish biology referred to WG-FSA for consideration (paragraph 1.3).

ADOPTION OF THE REPORT AND CLOSE OF THE MEETING

7.1 The report of the meeting of WG-SAM was adopted.

7.2 In closing the meeting, Dr Hanchet thanked the participants for their contributions to the meeting and their work during the intersessional period, the subgroup coordinators for motivating in-depth discussions, the rapporteurs for preparing the report, and the Secretariat for its support. Dr Hanchet also thanked AWI and the German Federal Ministry of Food, Agriculture and Consumer Protection for hosting the meeting and Dr Hain and colleagues for their kind hospitality and assistance during the meeting.

7.3 Dr T. Ichii (Japan), on behalf of the Working Group, thanked Dr Hanchet for facilitating discussions in a convivial atmosphere which had resulted in a successful meeting.

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AGENDA

Working Group on Statistics, Assessments and Modelling
(Bremerhaven, Germany, 24 to 28 June 2013)

1. Introduction
 - 1.1 Opening of the meeting
 - 1.2 Adoption of the agenda and organisation of the meeting
2. Evaluation of research plans from Members notifying to fish in new and exploratory fisheries in Subareas 48.6 and 58.4
3. Review of scientific research proposals for other areas (e.g. closed areas, areas with zero catch limits, Subareas 88.1 and 88.2)
4. Methods for assessing finfish stocks in established fisheries, notably *Dissostichus* spp.
 - 4.1 Toothfish assessments
 - 4.2 Toothfish biology
 - 4.3 Anomalous CPUE workshop
 - 4.4 Other
5. Other business
 - 5.1 Discussion of joint WG-SAM–WG-EMM focus symposium on spatial modelling in 2014
6. Advice to the Scientific Committee
 - 6.1 WG-FSA
 - 6.2 General
7. Adoption of report and close of meeting.

LIST OF DOCUMENTS

Working Group on Statistics, Assessments and Modelling
(Bremerhaven, Germany, 24 to 28 June 2013)

WG-SAM-13/01	Provisional Agenda for the 2013 Meeting of the Working Group on Statistics, Assessments and Modelling (WG-SAM)
WG-SAM-13/02	List of participants
WG-SAM-13/03	List of documents
WG-SAM-13/04	GIS ‘ChartMaster’ for aquatic living resources research in Antarctic V.A. Bizikov, S.M. Goncharov, A.V. Polyakov, S.B. Popov and A.F. Petrov (Russia)
WG-SAM-13/05	Progress report on the research longline fishery of <i>Dissostichus</i> spp. in Subarea 48.6 being jointly undertaken by Japan and South Africa: 2012/13 R. Leslie (South Africa), K. Taki, T. Ichii (Japan) and S. Somhlaba (South Africa)
WG-SAM-13/06	Review of fishery monitoring and forecast procedures Secretariat
WG-SAM-13/07	Notification for multi-year research in Subarea 48.5 Delegation of Russia
WG-SAM-13/08	Research plan for the exploratory fishery for <i>Dissostichus</i> spp. in Division 58.4.3a in 2013/14 Submitted by the Secretariat on behalf of France
WG-SAM-13/09	Research plan for the exploratory fisheries for <i>Dissostichus</i> spp. in Subarea 48.6 and Divisions 58.4.1, 58.4.2 and 58.4.3a in 2013/14 Submitted by the Secretariat on behalf of Japan
WG-SAM-13/10	Research plan for the exploratory fishery for <i>Dissostichus</i> spp. in Division 58.4.1 in 2013/14 Submitted by the Secretariat on behalf of the Republic of Korea
WG-SAM-13/11	Research plan for the exploratory fishery for <i>Dissostichus</i> spp. in Subarea 48.6 in 2013/14 Submitted by the Secretariat on behalf of South Africa

WG-SAM-13/12	Research plan for the exploratory fisheries for <i>Dissostichus</i> spp. in Divisions 58.4.1 and 58.4.2 in 2013/14 Submitted by the Secretariat on behalf of Spain
WG-SAM-13/13 Rev. 1	Research plan for the exploratory fisheries for <i>Dissostichus</i> spp. in Subarea 48.6 and Division 58.4.1 in 2013/14 Submitted by the Secretariat on behalf of Ukraine
WG-SAM-13/14	Research plan to investigate finfish distribution and abundance in Subareas 48.1 and 48.2 Submitted by the Secretariat on behalf of Chile
WG-SAM-13/15	Research plan to assess the stock status of <i>Dissostichus</i> spp. in Subarea 48.2 Submitted by the Secretariat on behalf of Ukraine
WG-SAM-13/16	Assessment of the analysis of anomalous CPUE data from data-poor exploratory fisheries V.A. Tatarnikov, A.F. Petrov and I.I. Gordeev (Russia)
WG-SAM-13/17	CCAMLR Papers: accessibility, availability and publication – options for the future Secretariat
WG-SAM-13/18	A distribution-free model of length-frequency distribution to inform fishery stratification for integrated assessments S. Candy, P. Ziegler and D. Welsford (Australia)
WG-SAM-13/19	Results of reading tests of TOP otolith sections and time schedule of reading for <i>Dissostichus</i> otoliths caught in regions of data-poor fisheries K. Taki and T. Ichii (Japan)
WG-SAM-13/20	Reports on abundance and biological information of toothfish in Division 58.4.4a & b by <i>Shinsei Maru No. 3</i> in 2012/13 season K. Taki, T. Ichii, T. Iwami and M. Kiyota (Japan)
WG-SAM-13/21	Research plan for toothfish in Division 58.4.4a & b by <i>Shinsei Maru No. 3</i> in 2013/14 Delegation of Japan
WG-SAM-13/22	Operational difficulties in exploratory fisheries N. Miyagawa, J. Okamoto, N. Akimoto and K. Hirose (Japan)
WG-SAM-13/23	Results of research program of the Russian Federation in Subarea 48.5 (Weddell Sea) in season 2012/13 A.F. Petrov, I.I. Gordeev and E.F. Uryupova (Russia)

- WG-SAM-13/24 A revised assessment of Patagonian toothfish in Subarea 48.4
R. Scott (United Kingdom)
- WG-SAM-13/25 Rev. 1 An overview of tagging skates (Rajiformes) and CCAMLR skate tagging data
S.R. McCully, D. Goldsmith, G. Burt, R. Scott and J.R. Ellis (United Kingdom)
- WG-SAM-13/26 Diet composition and feeding strategy of Antarctic toothfish, *Dissostichus mawsoni* in SSRU 5841C-a for the exploratory longline fishery in 2012/13 of Korea
I. Yeon, Y.J. Kwon, S.G. Choi, K.J. Seok, D.W. Lee, J.M. Jeong, S.J. Ye, H.J. Kim and G.W. Baeck (Republic of Korea)
- WG-SAM-13/27 Reproductive analysis of *Dissostichus mawsoni* in SSRU 5841C-a for the exploratory longline fishery in 2012/13 of Korea
I.J. Yeon, J.S. Lee, Y.J. Kwon, M.A. Jeon, S.K. Choi, K.J. Seok, D.W. Lee, K.Y. Ku and H.J. Kim (Republic of Korea)
- WG-SAM-13/28 Results of the research for the exploratory longline fishery for *Dissostichus* spp. in SSRUs C and E in Division 58.4.1 in 2012/13 of Korea
I.J. Yeon, Y.J. Kwon, D.W. Lee, S.G. Choi and K.J. Seok (Republic of Korea)
- WG-SAM-13/29 A preliminary stock assessment in SSRUS 486A, G: A Bayesian and CPUE based biomass dynamic model
R. Wiff, J.C. Quiroz (Chile) and R. Scott (United Kingdom)
- WG-SAM-13/30 Research plan for the Spanish exploratory longline fishery for *Dissostichus* spp. in Divisions 58.4.1 and 58.4.2: preliminary results of stage 1 (2012/13 season)
R. Sarralde, L.J. López Abellán and S. Barreiro (Spain)
- WG-SAM-13/31 Rev. 1 An evaluation of the performance of the CCAMLR mackerel icefish (*Champsocephalus gunnari*) harvest control rule as applied within CCAMLR Subarea 48.3
C. Darby, T. Earl and H. Peat (United Kingdom)
- WG-SAM-13/32 Results of a CCAMLR sponsored research survey to monitor abundance of subadult Antarctic toothfish in the southern Ross Sea, February 2013
S.J. Parker, S.M. Hanchet, S. Mormede, A. Dunn (New Zealand) and R. Sarralde (Spain)

- WG-SAM-13/33 Proposal to continue the time series of CCAMLR-sponsored research surveys to monitor abundance of subadult Antarctic toothfish in the southern Ross Sea in 2014
S.J. Parker, S.M. Hanchet, S. Mormede and A. Dunn (New Zealand)
- WG-SAM-13/34 Further development of pairwise tag detection performance index and its application to the stock assessment of toothfish in the Ross Sea fishery
S. Mormede (New Zealand)
- WG-SAM-13/35 Further development of a spatially explicit population dynamics operating model for Antarctic toothfish in the Ross Sea region
S. Mormede, A. Dunn, S. Parker and S. Hanchet (New Zealand)
- WG-SAM-13/36 Investigation of potential biases in the assessment of Antarctic toothfish in the Ross Sea fishery using outputs from a spatially explicit operating model
S. Mormede and A. Dunn (New Zealand)
- WG-SAM-13/37 Considerations for research plan design and implementation in data-poor fisheries
S.J. Parker, B. Sharp, A. Dunn (New Zealand) and K. Taki (Japan)
- WG-SAM-13/38 Plan of research program of the Ukraine in Subarea 48.2 in 2014
Delegation of Ukraine
- WG-SAM-13/39 Report of the Workshop for the Analysis on the Anomalously High CPUE by Korean Vessels in the CCAMLR Area
Delegation of the Republic of Korea
- WG-SAM-13/40 Development of an algorithm designed to assess observer data quality and performance
Secretariat
- WG-SAM-13/41 Characterising catch and effort from data-poor toothfish fisheries in CCAMLR Divisions 58.4.3 – 58.4.4
J.C. Quiroz, R. Wiff (Chile) and P. Martinez (Argentina)