ANNEX 5

REPORT OF THE WORKING GROUP ON FISH STOCK ASSESSMENT

(Hobart, Australia, 12 to 23 October 2009)

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[1] Appendices E to S have been published only in electronic format. For these reports, please refer to www.ccamlr.org/pu/e/e_pubs/fr/drt.htm.

REPORT OF THE WORKING GROUP ON FISH STOCK ASSESSMENT

(Hobart, Australia, 12 to 23 October 2009)

OPENING OF THE MEETING

1.1 The meeting of WG-FSA was held in Hobart, Australia, from 12 to 23 October 2009. The Convener, Dr C. Jones (USA), opened the meeting and welcomed participants (Appendix A).

1.2 Dr D. Miller (Executive Secretary) joined in welcoming participants to the CCAMLR Headquarters. He reflected on the history of WG-FSA and wished the meeting success in its current round of deliberations.

1.3 The Convener noted that the following meetings and workshop in 2008/09 had provided information and advice to WG-FSA:

- meeting of SG-ASAM (Annex 8)
- meeting WG-SAM (Annex 6)
- meeting of ad hoc TASO (Annex 9)
- meeting of WG-EMM including FEMA2 (Annex 4)
- Workshop on VMEs (Annex 10)
- meeting of WG-IMAF (Annex 7; see Item 7).

ORGANISATION OF THE MEETING AND ADOPTION OF THE AGENDA

2.1 The agenda of the meeting was discussed and it was agreed to modify the agenda as follows:

- consider the research plan for *Dissostichus* spp. at Ob and Lena Banks (Division 58.4.4) under subitem 5.1 (new and exploratory fisheries);

- restructure subitem 10.1 (bottom fishing activities and VMEs) to include risk assessments (10.1.1), review of fishery- and research-based notifications submitted in 2008/09 (10.1.2), review of conservation measures (10.1.3) and advice to the Scientific Committee (10.1.4).

The revised Agenda was adopted (Appendix B).

2.2 The Working Group agreed to follow WG-SAM's initiative and highlight sections of the report dealing with advice to the Scientific Committee and its working groups, and list the relevant references to paragraphs in advice to the Scientific Committee (Item 14). The Working Group also agreed to make every effort to reduce the overall size of its report and subsequent translation. The report captured essential background, discussion and advice, and made full use of CCAMLR's archive of publications and meeting documents.

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

2.4 The report was prepared by Drs D. Agnew (UK), M. Belchier (UK) and A. Constable (Australia), Messrs A. Dunn (New Zealand) and N. Gasco (France), Drs S. Hanchet (New Zealand), R. Holt (USA), K.-H. Kock (Germany) and R. Leslie (South Africa), Mr J. McKinlay (Australia), Drs R. Mitchell (UK) and S. Parker (New Zealand), Mr T. Peatman (UK), Dr D. Ramm (Data Manager), Mss K. Rivera (WG-IMAF Co-convener) and N. Slicer (Compliance Officer), Mr N. Walker (WG-IMAF Co-convener) and Dr D. Welsford (Australia).

2.5 Selected components of WG-FSA's work were developed intersessionally and during the meeting by the following subgroups:

- Subgroup on Assessments (coordinator: Dr Agnew)
- Subgroup on New and Exploratory Fisheries (coordinators: Drs Belchier and Hanchet)
- Subgroup on By-catch (coordinators: Drs Belchier and Mitchell)
- Subgroup on Biology and Ecology (coordinator: Dr Kock)
- Subgroup on Tagging (coordinator: Dr Welsford)
- Subgroup on the Scientific Observer Program (coordinator: Dr Leslie)
- Subgroup on VMEs and Ecosystem Management (coordinator: Dr Constable)
- Subgroup on IUU Fishing (coordinator: Dr Holt).

2.6 The information used in developing the assessments is provided in the Fishery Reports (Appendices E to S). These reports will be published on the CCAMLR website (www.ccamlr.org – go to 'Publications', see 'Fishery Reports').

REVIEW OF AVAILABLE INFORMATION

Data requirements specified in 2008

Development of the CCAMLR database

3.1 The Data Manager, Dr Ramm, provided an update on recent developments in managing the CCAMLR database and associated work. During the intersessional period, the Secretariat had further developed procedures, databases and data forms at the request of the Commission and the Scientific Committee and its working groups. Work relevant to WG-FSA was highlighted (WG-FSA-09/4).

3.2 In November 2008, the Secretariat revised the longline data form for fine-scale catch and effort data (C2) in order to capture variability in trotline configuration (SC-CAMLR-XXVII, paragraph 13.5). Revisions were also made to the scientific observer logbook (SC-CAMLR-XXVII, paragraph 5.28). Consequential changes were made to the CCAMLR database and the revised data forms were posted on the CCAMLR website for use in 2008/09.

3.3 The Working Group noted that the volume and complexity of the CCAMLR database continues to expand rapidly (e.g. the volume of fishery data has increased at an average rate of 25–30% per annum and 40-fold since 1993; CCAMLR-XXVIII/BG/12). It also noted that the increasing volume of data and requirements for detailed, accurate real-time/continuously updated data are placing greater demands on the Secretariat's resources, some of which have reached full capacity. The Working Group recognised the large amount of work involved in the preparation of data for its assessments, and thanked the Secretariat for its professionalism and timeliness in processing data and managing the CCAMLR database.

3.4 The Working Group recognised that part of the Secretariat's work involved the validations of preliminary assessments submitted to WG-FSA (WG-FSA-06/6, paragraphs 6.1 and 6.2). This work is an essential step in the development of the assessments and further, more quantitative, validations and analyses are anticipated (see sections 12 and 13). The Working Group recommended that the Scientific Committee explore the potential of placing an assessment scientist on the Secretariat staff to assist with this work (paragraphs 15.2 to 15.8).

3.5 The Working Group agreed that updated information on the operation, development and documentation of the CCAMLR database (CCAMLR-XXVIII/BG/12, including Appendix 1) should continue to be provided at its annual meetings. The Working Group advised the Scientific Committee of the need for a regular review of the data requirements and the Secretariat's resources in order to ensure that adequate resources were always available to fully support the operation and development of the CCAMLR database (see also sections 12 and 13).

3.6 The Working Group recognised the important role of fishing crews, scientific observers and Members in collecting and processing CCAMLR data, and the essential role of the Secretariat in managing these data, including the development of quality assurance for data used in stock assessments.

3.7 In considering the workflow associated with fine-scale data and scientific observer data, from collection on board the vessels to input to stock assessments (Figure 1), the Working Group recognised various pressure points associated with data submission deadlines, data processing and validation by the Secretariat, and the preparation of preliminary assessments for the Working Group. Further, in developing the preliminary assessments, researchers took account of advice provided by WG-SAM, as well as new developments and implications which may arise from the addition of data from the current season. The Working Group sought advice from the Scientific Committee on ways to alleviate pressure points in future assessments (see also sections 12 and 13).

Data processing

3.8 The Secretariat had processed fishery and observer data from 2008/09 which had been submitted up to approximately one week prior to the start of the meeting. In addition, the Secretariat had processed available fishery and observer data from the fishery at Prince Edward and Marion Islands (South African EEZ in Subareas 58.6 and 58.7 and Area 51), the fishery at Kerguelen Islands (French EEZ in Division 58.5.1) and the fishery at Crozet Islands

(French EEZ in Subarea 58.6). Data from 2008/09 had undergone preliminary validation prior to the meeting, and further validation will be conducted in the forthcoming intersessional period.

Fishery Plans

3.9 The Secretariat has maintained the Fishery Plans and has added data from 2008/09 to the time series.

Fisheries information

Catch, effort, length and age data reported to CCAMLR

3.10 In accordance with conservation measures in force in 2008/09, Members' fishing vessels operated in the following fisheries (Table 1, see also CCAMLR-XXVIII/BG/6):

- fisheries for icefish (*Champsocephalus gunnari*) in Division 58.5.2 and Subarea 48.3;
- fisheries for toothfish (*Dissostichus eleginoides* and/or *Dissostichus mawsoni*) in Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b and 58.5.2 and Subareas 48.3, 48.4, 48.6, 88.1 and 88.2;
- fishery for krill (*Euphausia superba*) in Subareas 48.1, 48.2 and 48.3.

3.11 Three other fisheries targeting toothfish were conducted in the Convention Area in 2008/09:

- fishery at Prince Edward and Marion Islands (South African EEZ[2] in Subareas 58.6 and 58.7);
- fishery at Kerguelen Islands (French EEZ in Division 58.5.1);
- fishery at Crozet Islands (French EEZ in Subarea 58.6).

3.12 The Working Group noted that in 2008/09 the Secretariat had monitored 154 catch limits for species groups (target and by-catch species) in SSRUs, SSRU groups, management areas, divisions and subareas (CCAMLR-XXVIII/BG/6). This work included forecasting fishery closures once the catch of a managed species exceeded 50% of its catch limit. So far in 2008/09, 21 fishing areas and five fisheries have been closed on the advice of the Secretariat (CCAMLR-XXVIII/BG/6, Table 2). The closures were generally triggered by catches of *Dissostichus* spp. approaching their respective catch limits. Some closures required the consequential closure of other areas, and one closure was triggered by the catch of *Macrourus* spp. approaching its limit in the Northern Area of Subarea 48.4.

[2] The EEZ also extends to Area 51 outside the Convention Area.

3.13 Catch limit overruns (i.e. the catch exceeded the catch limit) occurred for *D. eleginoides* in Subarea 48.3 (Management Area B: overrun of 7 tonnes, total catch was 101% of the limit) and *Dissostichus* spp. in Division 58.4.1 (SSRU C: 8 tonnes, 108% of the limit; SSRU E: 4 tonnes, 108% of the limit; whole fishery: 12 tonnes, 106% of the limit), Division 58.4.3 (SSRU E: 21 tonnes, 153 % of the limit), Division 58.4.3b (SSRU D, 1 tonne; 102 % of the limit; SSRU E: 15 tonnes, 148% of the limit) and Subarea 88.1 (SSRUs B, C, G: 58 tonnes, 116% of the limit). In addition, the fishery in Subarea 88.1 closed 266 tonnes below the catch limit (90% of the limit) due to bad weather, extensive sea-ice and vessels exiting the fishery within 2–3 days of notification of the closure.

3.14 The Working Group noted that the minimum monitoring period is five days (Conservation Measure 23-01) and the current catch and effort reporting system is not well suited to the monitoring of small catch limits (e.g. below approximately 100 tonnes in longline fisheries for *Dissostichus* spp.). In recent seasons, SSRUs with small catch limits in exploratory fisheries have been combined to ensure that the minimum catch limit for *Dissostichus* spp. was approximately 100 tonnes (CCAMLR-XXVIII/BG/6, Figure 1). However, in 2008/09, there were 12 catch limits for *Dissostichus* spp. below 100 tonnes and the smallest limit was 30 tonnes (5 occurrences). These catch limits were set for fishing areas and fisheries in Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b, and four catch limit overruns occurred.

3.15 The Working Group advised the Scientific Committee that additional data on catches and gear deployed, provided daily by fishing vessels, would likely improve the Secretariat's ability to forecast closures, in situations where the catch limits were small or as catches approach the limit. The Working Group recognised that daily reporting of catch and effort, if implemented, would place considerable additional demands on vessels and the Secretariat, and would have budget implications for the Secretariat.

3.16 The Working Group noted the Secretariat's implementation of the new procedure for allocating the starting positions of research hauls in the exploratory fisheries in Subareas 48.6 and 58.4, and the level to which this allocation had been implemented by vessels in 2008/09 (WG-SAM-09/6). The implementation of this procedure is discussed under Item 5.1.

3.17 Fishery and scientific observer information, including tables and figures, in WG-FSA's Fishery Reports were updated by the Secretariat immediately prior to the 2009 meeting. Fishery Reports are discussed under Item 5.

Estimates of catch and effort from IUU fishing

3.18 WG-FSA reviewed estimates of IUU catches in the Convention Area prepared by the Secretariat based on information submitted by 30 September 2009 (Table 2, see also WG-FSA-09/5 Rev. 1). As in previous years, the agreed deterministic method used by the Secretariat to estimate IUU fishing effort was based solely on reports submitted by Members of sightings by surveillance operations and legal fishing vessels. No reports of undocumented landings were received during the current season. Additional information on catch rates was derived from CCAMLR data on licensed vessels. The estimated catch history of *Dissostichus* spp. taken by IUU longlining and gillnetting activities in the Convention Area is summarised in Table 3.

3.19 During 2008/09 there were six sighting reports of five identified IUU vessels and one unidentified vessel in the Convention Area. Additionally, one gillnet from an unknown IUU vessel was hauled by Australia. It has been assumed that at least six of the vessels were fishing with gillnets (WG-FSA-09/5 Rev. 1, Table 1).

3.20 A limited amount of new information had been submitted by inspectors in respect of gillnet vessels in Division 58.4.3b (one report from Australia and three reports from France). This information indicated the recovered gillnets may have achieved catch rates of up to 5 tonnes per day, with an unweighted mean catch rate of 1.85 tonnes per day. By comparison, the mean daily catch rate for licensed longline vessels in that division in 2008/09 was 1.89 tonnes per day. Consequently, the Secretariat used a mean daily catch rate of 1.9 tonnes per day in the estimation of IUU catches in Division 58.4.3b. Mean daily catch rates from licensed longline fishing vessels were applied to the other divisions where IUU fishing was detected (Divisions 58.4.1 and 58.4.2).

3.21 The Working Group reiterated its concern about IUU fishing and the use of gillnets in the Convention Area. Further, gillnets are less selective than longlines and may result in greater catches of by-catch, and continue to fish if abandoned or lost (see also Item 8).

3.22 The Working Group endorsed the Secretariat's estimates of IUU catches for use in stock assessment and by WG-IMAF, noting that catches from gillnets may be underestimated (see Items 5, 7 and 8). The Working Group noted the reduction in the number of IUU fishing vessels sighted in recent seasons (Table 3). Such reduction may be as a result of several factors, including those potentially related to economic factors, the impact of IUU fishing on stocks, increased fishery surveillance and the effect of CCAMLR measures to deter IUU fishing.

3.23 The Working Group agreed that it would be useful, where possible, for the Secretariat to provide an estimate of the catch allocation between *D. eleginoides* and *D. mawsoni* based on the known location of sightings of IUU activities.

3.24 The evaluation of the threats arising from IUU fishing activities was discussed under Item 8.

Catch and effort data for toothfish fisheries in waters adjacent to the Convention Area

3.25 Catches of *D. eleginoides* from fisheries outside the Convention Area and reported in the CDS in 2007/08 and 2008/09 are summarised in Table 4. The total CDS-reported catch from outside the Convention Area for 2008/09 to October 2009 was 10 065 tonnes.

3.26 The Working Group noted that most of the catch of *D. eleginoides* taken outside the Convention Area was from Areas 41 and 87. The Working Group also noted that the CDS records only processed weights and that the figures provided by the Secretariat were converted to estimated green weight using a standard set of conversion factors.

Scientific observer information

3.27 Scientific observers appointed under the CCAMLR Scheme of International Scientific Observation were deployed on all vessels targeting finfish in the Convention Area, and some vessels targeting krill in 2008/09 (WG-IMAF-09/4, 09/5 and 09/7). Scientific observations were discussed under Items 7 and 11.

Inputs for stock assessment

3.28 The Working Group agreed that a short summary of specific input data to be used for stock assessments will be considered under this agenda item, and that the stock assessments themselves will be considered under Item 4.2.

Catch-at-length/age from fisheries

3.29 WG-FSA-09/20 and 09/21 presented input data for the update of the integrated assessment for Division 58.5.2, and WG-FSA-09/22 Rev. 1 investigated general issues of applying ALKs in assessments. The Working Group noted the inclusion of new age data in the assessment for Division 58.5.2, development of a two-stage model for accounting for reader error when incorporating age data into the assessment, and methods for optimising sample sizes of fish selected for measurement for age and length.

3.30 Since 2007, substantial ageing work of *Dissostichus* spp. (~7 400 specimens) has been undertaken in the HIMI fisheries, including ageing of recaptured tagged fish. The Working Group noted that this work was based on discussion in WG-SAM (Annex 6, paragraph 3.12; WG-SAM-09/9), and incorporated recommendations requested by that group.

3.31 The Working Group noted that one result from the work presented in WG-FSA-09/21 suggested a propensity for a greater degree of negative reader errors in fish below 10 years, with positive error more likely for fish aged 12–22 years, and queried how possible ageing biases affecting the accuracy of ALKs would be incorporated and propagated into an assessment.

3.32 The Working Group noted the results of WG-FSA-09/22 Rev. 1 on the different sampling methods for optimising the number of fish selected for measurement, that the length-bin random sampling (LBRS) methodology improved precision of older age classes but with loss of precision for younger age classes, however that this may be a desirable improvement due to the relatively low frequency of larger fish in catches. The Working Group noted that the relative merit of these approaches would depend on practical issues relating to the collection of samples at sea, the relative costs and tradeoffs of alternative biological sampling strategies, and the performance of assessment models that use data with different levels of precision in the catch-at-age proportions (i.e. using management strategy evaluations and simulation experiments).

3.33 WG-FSA-09/36 provided an update of the catch-at-age frequencies for the Subarea 88.1 and 88.2 fisheries. On average, about 800 *D. mawsoni* otoliths collected by observers were selected for ageing each year and used to construct annual area and

sex-specific ALKs. Age data were available for the 1998/99 to 2007/08 seasons, but were not yet available for the 2008/09 season. In the Ross Sea, sex-specific ALKs were applied to the shelf/slope fisheries, and the north fishery. The ALKs were applied to the catch-weighted length-frequency distributions for each year to produce catch-at-age distributions (WG-FSA-09/36). However, in SSRU 882E, otoliths were only available from the New Zealand fleet which did not fish that SSRU in every year. Therefore, for SSRU 882E, a single sex-specific ALK from otoliths from all available years from New Zealand vessels was used to construct annual age frequencies (WG-FSA-09/36).

3.34 WG-FSA-09/17 provided a description of the distribution of catch, effort, proportions of fish-at-length and catch-at-age frequencies for the period 2005–2009 in Subarea 48.4 and concluded that the fishery appeared to be dominated by a single cohort of older fish, spawned in 1992. The Working Group thanked the authors for the considerable work that had gone into developing the paper and noted that the descriptive analyses provided a comprehensive overview of the fishery.

3.35 WG-FSA-09/28 provided an update of the catch-at-age and CPUE indices for *D. eleginoides* in Subarea 48.3. The CPUE indices rose in 2000 in response to the strong 1990 year class entering the fishery, but the paper also noted that the indices had declined in recent years. The Working Group noted that, in this fishery, CPUE indices appeared to reflect changes in abundance, and that this was due, in part, to the presence of the same vessels in the fleet in the fishery since 1998.

3.36 The Working Group discussed the issue of how necessary age–length data from processing otoliths can be acquired without relying on the current small number of Members that have access to otolith ageing facilities and are actively engaged in producing assessments. The Working Group noted that this was an important input into stock assessments because it can reduce uncertainty in toothfish assessments. The Working Group noted that Australia has developed a standardised manual for ageing *D. eleginoides*, which would be made available on request. The Working Group noted the importance of optimisation of sampling programs for determining fish ages, and the necessity to increase the capability (either through capacity or resources) of Members to have otoliths efficiently sampled and read. The latter issue was addressed further under Item 9.3.

Research surveys

3.37 WG-FSA-09/9 presented a report on the results of a UK groundfish survey at South Georgia in January 2009. Biomass estimates and CIs for *C. gunnari* were presented for all survey years since 2000. The mean estimate of biomass was the second lowest since 2000. The Working Group noted that the observed low biomass coincided with a strong ecosystem anomaly at South Georgia in early 2009 (see WG-EMM-09/23). Elevated sea-surface temperatures and associated reduction in krill abundance is likely to have led to a reduction in *C. gunnari* biomass and associated changes in their spatial distribution in Subarea 48.3. The survey indicated that icefish were less aggregated than typically observed in the austral summer, leading to a reduction in the variance of *C. gunnari* catch weight in hauls. This, coupled with an increase in haul numbers, led to a more precise estimate of mean icefish biomass than obtained in surveys since 2000.

3.38 The Working Group noted that the survey showed no further evidence of recruitment of juvenile *D. eleginoides* on the shelf areas within Subarea 48.3. The strong cohort of toothfish juveniles observed in the survey data since 2003 was not evident during the 2009 survey. It is likely that these fish have moved into deeper water and were unavailable to the trawl survey. There was evidence that some of these fish had started to recruit to the longline fishery (WG-FSA-09/28).

3.39 The Working Group noted that the considerable interannual variability in krill abundance at South Georgia, and subsequent impacts on *C. gunnari* abundance and behaviour, were known to be linked to large-scale climatic variability. The Working Group encouraged that further research be undertaken to better assess the relationships that exist between environmental variability and *C. gunnari* abundance.

3.40 WG-FSA-09/19 provided a report of the results of a demersal finfish survey of the South Orkney Islands undertaken in 2009; the first survey in the area for 10 years. The Working Group concluded that the survey estimates of standing stock biomass of demersal finfish indicated that biomass of several species remains extremely depressed, at only a fraction of the level available during the years that the commercial fishery operated in the South Orkney Islands.

3.41 The Working Group noted that the survey may have some limitations for determining biomass of *C. gunnari*, as it assumes a catchability equal to 1, which may, in practice, result in conservative estimates of biomass. The Working Group agreed that collection of acoustic data for all bottom trawl surveys of *C. gunnari*, along with further investigation of target strength of this species, may assist in adjusting for biases in survey estimates due to catchability assumptions. The Working Group concluded that the survey followed typical CCAMLR protocols for estimating fish biomass using swept areas, and that the design has been kept constant between survey times. Given that consistency, the Working Group considered it reasonable to conclude that there is insufficient biomass for the stock to be considered as recovered (see also paragraphs 5.180 and 5.181).

3.42 WG-FSA-09/34 provided results from stratified random trawl surveys using consistent methodology examining the distribution and abundance of toothfish in Division 58.5.2. The Working Group noted that the low abundance of toothfish and icefish in 2008, which was difficult to attribute to stock status, may have been due to unusual oceanographic conditions and very poor weather in the area. Information from fishers in the area suggested that catch rates in commercial hauls were also low around the time of the survey in 2008.

3.43 The Working Group noted that CVs were not reported along with biomass estimates and that they should be included in future reports detailing survey results.

Catch and effort data

3.44 The Working Group noted that WG-FSA-09/14 used CPUE data in age-structured and production models to estimate stock biomass and population parameters for toothfish in Division 58.4.1, but that the estimates of CPUE used in the paper were not tabulated or described, and urged the authors to submit both the CPUE data and analyses so that these could be evaluated by WG-FSA.

3.45 WG-FSA-09/36 provided a characterisation of the Subarea 88.1 and 88.2 toothfish fisheries from 1997 to 2009.

3.46 The Working Group noted that, in the Ross Sea fishery, half of the vessels had fished for only one year, and only eight vessels have had a presence for more than three years. The Working Group noted that the inconsistent presence of vessels in the fishery over time precluded WG-FSA from developing consistent time series and hindered the interpretation of catch and effort data.

3.47 The Working Group noted that 2009 was the first time that fishing effort had been concentrated on the slope of Subarea 88.2, resulting in landings of small fish, and perhaps indicating a need to reflect the fishery structure in the assessment for this area.

Tagging studies

3.48 The Working Group considered that the descriptive analysis of the tagging program in Subareas 88.1 and 88.2 in WG-FSA-09/39 represented a useful assessment of the available data and agreed that these estimates should be used in the updated assessment of the stock assessments for the Ross Sea and SSRU 882E.

3.49 WG-FSA-09/35 presented an analysis of data metrics for selecting high-quality tagging data for inclusion in stock assessments. The method first selected an initial informative dataset comprising trips with (i) high (above median) rates of recovery of tagged fish, and (ii) where tags released on the trip were subsequently recaptured at a high rate. The method then used these trips to define data-quality metrics that were informative with respect to tagging data. Other trips with data-quality metric values within these ranges were then added to the initial informative dataset. The Working Group endorsed the methodology as suitable for providing an objective way of determining high-quality data for inclusion in stock assessment models.

3.50 The Working Group noted that both tails of distributions of metrics of interest were used as the basis for excluding data. That is, when selecting data for inclusion in assessments, records with data quality values that were 'too high' were excluded equally with values that were 'too low'. The Working Group suggested considering only using one-tailed tests for exclusion might be appropriate in future refinements of the method.

3.51 The Working Group noted that, although this had not been formally examined, there did appear to be agreement in quality between the accuracy of observer- and vessel-derived data and that this could be useful for further refinement of the data-quality metrics used in future developments of the method.

3.52 WG-FSA-09/P1 described observations on migration of *D. mawsoni* obtained during tagging of fish arising from the longline fishery in the D'Urville Sea in 2008/09. The main observation concerned the recovery of a tagged small toothfish inside the gut of a larger individual recovered at some distance (~200 km) from the tagging position of the small fish.

3.53 The Working Group noted that there were no records of a tagged fish detected within the stomach contents of a larger toothfish in the Ross Sea toothfish fishery, although small toothfish were sometimes observed in stomach contents of larger fish. The Working Group noted that tag loss by this mechanism was likely to be a rare event.

3.54 The Working Group also noted that the paper indicated that only smaller toothfish (<100 cm) were tagged in this tagging program, since these could be landed without being gaffed. The Working Group emphasised that this practice is at variance with the conservation measure and previous recommendations by the Scientific Committee and its working groups, which require that fish be tagged by length in proportion to their size distribution in the catch. While the Working Group recognised there may be a reluctance of commercial fishers to tag and release large fish, it stressed the importance of tagging the full size range of fish, and that it is a requirement under the conditions of access to the fishery (paragraphs 5.12 to 5.17).

Biological parameters

3.55 WG-FSA-09/37 examined the length- and age-at-spawning of *D. mawsoni* in the Ross Sea. The paper summarised the method for determining age-at-spawning by hindcasting from the presence of post-ovulatory follicles in the ovaries or forecasting from the assessment of oocyte developmental stage. The hindcasting and forecasting methods gave similar results. The Working Group noted that the estimates were based on samples from the slope, which included mature fish that were not spawning.

3.56 The Working Group adopted the revised estimates of the length and age of maturity for male and female *D. mawsoni* presented in WG-FSA-09/37, but noted that if the estimates had included fish from the northern part of the fishery, then the resulting ogives might have a lower age and length at 50% spawning. Revised estimates for the mean age and length at 50% spawning for females on the Ross Sea slope region were 16.6 years and 133.2 cm and for the mean age and length at 50% maturity for males were 12.8 years and 120.4 cm.

3.57 The Working Group agreed that these estimates should be used in *D. mawso ni* assessments for Subareas 88.1 and 88.2, and the sampling of reproductive parameters during winter months (when toothfish are spawning) may assist with understanding age/size-at-maturity and spawning dynamics, and hence help reduce the uncertainty in estimates of SSB in assessments.

Stock structure and management areas

3.58 WG-FSA-09/38 presented an assessment of methods for deriving the best available bathymetry data for fisheries management of the Ross Sea. This work has arisen through a need to standardise and make transparent the data and algorithms used for deriving seabed areas and bathymetry, which are increasingly being incorporated into management rules (e.g. for assessing bottom fishing impacts). The Working Group agreed that it would be desirable to develop standardised methods and data sources for deriving bathymetric information for the Convention Area.

3.59 The Working Group encouraged the development of a common repository and for other data providers to contribute suitable bathymetric data to such a facility. Dr Welsford proposed the Australian Antarctic Data Centre may provide an appropriate centre for storage and administration of such data.

Depredation

3.60 WG-FSA-09/16 presented a study on cetacean depredation of toothfish around South Georgia and implications for toothfish stock assessments. Results indicated amounts of catch lost to depredation are relatively small, typically in the order of 3% per year with interannual variation in the range 2–6%. Differential rates of depredation were apparent between killer whales (3–5% of lines affected) and sperm whales (in excess of 10% of lines). Interaction rates with lines were noted to be similar to those over the 2003–2009 study period.

3.61 The Working Group suggested monitoring cetacean presence by hydrophones to measure an index of relative abundance as a possible means of determining night-time rates of depredation.

3.62 The Working Group noted that depredation was variable from area to area, and that while depredation on an individual line may be high, taking the fishery as a whole shows only a small amount of total depredation on catch (~3%). The Working Group noted that differences in methods used by vessels to mitigate depredation would have to be accounted for in any such assessment of regional variation.

PREPARATION FOR ASSESSMENTS AND ASSESSMENT TIMETABLE

Report of SG-ASAM

4.1 SG-ASAM met in 2009, primarily considering issues related to the estimation of krill target strength and biomass (Annex 8).

4.2 In response to the request from WG-FSA to consider the application of the adjustment factor for trawl headline height used in icefish bottom trawl surveys (SC-CAMLR-XXVII, Annex 5, paragraphs 3.26 and 13.20), SG-ASAM considered one paper (SG-ASAM-09/7) which indicated that due to icefish occurring above the headline of a bottom trawl, the difference between a 6 m and 8 m headline height could lead to a 1.8-fold difference in biomass estimates, although this adjustment factor varied greatly over space and time scales.

4.3 No further advice on icefish surveys was provided by SG-ASAM. However, two other papers were considered by SG-ASAM (SG-ASAM-09/5 and 09/6) that WG-FSA agreed would have a bearing on discussions under Item 10.

Report from WG-SAM

4.4 Dr Constable (WG-SAM Convener) presented the report of its meeting in 2009 (Annex 6). The Working Group had considered a number of issues associated with stock assessment models for toothfish (in Subarea 48.3, Division 58.5.2 and Subarea 88.1/88.2 (Ross Sea)) and icefish. WG-SAM provided advice to WG-FSA on the use of age–length keys, tagging data, estimation of stock size in new and exploratory fisheries, longline research surveys, age- and length-based assessments, and spatially structured models (Annex 6, paragraph 7.2).

Review of preliminary stock assessment papers

4.5 The Working Group discussed a number of preliminary stock assessment papers, in preparation for the final stock assessments conducted at the meeting and reported under Item 5.3

Toothfish

4.6 WG-FSA-09/28 presented an updated assessment of *D. eleginoides* in Subarea 48.3. The major changes to the model from the previous 2007 assessment were that survey data for 1999–2008 were included, and that the catch-at-length proportions were replaced by catch-at-age proportions derived from direct random sampling of fish from the fishery. WG-FSA noted that WG-SAM had considered an earlier version of this model (WG-SAM-09/13) and results of the additional work that had been requested by WG-FSA in 2007 (SC-CAMLR-XXVI, Annex 5, paragraph 5.115 and Appendix J, paragraph 43).

4.7 In the updated assessment, fits to the tag, CPUE and catch-at-age data were good, with the exception of the 2009 catch-at-age data. The model, which included statistically optimal multinomial weighting for the catch-at-age and survey data, did not adequately predict the large proportion of young (age 7) fish caught this year. Two alternative explanations for the lack of fit to the 2009 catch-at-age data were offered by the paper; either recruitment (to the 2001 cohort) has been exceptionally high, or the behaviour of the fishery has changed. Regarding the latter, Dr Agnew reported that several features of the Subarea 48.3 fishery had been different in 2009, including the lack of krill (see WG-EMM-09/23), reported large numbers of small fish and a change in the market value of small and large fish. The Working Group agreed that distinguishing between these two hypotheses was difficult at the moment but will become clearer when the 2001 cohort has fully recruited to the fishery in one or two years' time.

4.8 WG-FSA-09/17 presented a new CASAL assessment of the northern Subarea 48.4 stock of *D. eleginoides* following the conclusion of the comprehensive tag-based research program in the northern part of Subarea 48.4. Catch-at-length data indicate the vulnerable biomass may be composed of one cohort, with biometric data suggesting that growth parameters for *D. eleginoides* in Subarea 48.4 are similar to those in Subarea 48.3. Evidence of gonad development in *D. eleginoides* suggests that spawning may occur in the north of Subarea 48.4. The CASAL model fits to data were good.

4.9 The Working Group commended the success of the four-year experiment in Subarea 48.4, in particular development of the CASAL-based model presented in the preliminary assessment. The Working Group also noted the current stock structure for the population, with vulnerable biomass seemingly dominated by a few, or even one, cohort.

4.10 WG-FSA-09/20 presented an updated CASAL assessment of *D. e leginoides* in Division 58.5.2. Following discussions at WG-SAM, the catch-at-length proportions used in the 2007 assessment were replaced by catch-at-age proportions derived applying ALKs to sub-fishery and year-specific length-frequency data.

4.11 Compared to the assessment that did not incorporate catch-at-age or abundance-at-age data, the aged-based assessment dramatically lowered the CV for the recruitment series, from around 1.8 down to approximately 0.6. The Working Group noted that this latter recruitment CV is consistent with that used for the Ross Sea and Subarea 48.3 assessments. It also noted that the fits to the survey abundance-at-length and abundance-at-age data, and catch-at-age data were good, but the fits to the CPUE series were not; where the CPUE series indicates a declining trend, the model prediction is for a steady or rising CPUE in recent years. Dr Welsford commented that although there was a discrepancy between these trends, the predicted CPUE lay for the most part within the 95% confidence intervals of observed CPUE. The Working Group further noted that this model was very complex, involving 10 sub-fisheries, and that reducing this complexity may improve the model structure. Age data were unavailable for the most recent year, and the incorporation of length-based catches in an otherwise age-based model may increase uncertainty in parameter estimates.

4.12 WG-FSA-09/40 and 09/41 presented updated assessments of toothfish in the Ross Sea and SSRU 882E respectively. The major developments in these assessments since 2007 (Ross Sea) and 2006 (SSRU 882E), were the inclusion of tag-recapture data from a wider range of trips than before, selected on overall data quality metrics using the methodology of WG-SAM-09/19, and the revision of the maturity ogive (WG-FSA-09/37), based on a reanalysis of data from the fishery and separated by sex.

4.13 The Working Group noted that model fits to the data were adequate. Although the estimate of B_0 has declined slightly from the 2007 assessment, the perception of current status remains at about 85% of B_0. The impact of the new maturity ogive was to reduce estimates of spawning biomass, and of the larger tag dataset from selected trips was to increase estimates of spawning biomass in the Ross Sea and reduce estimates of spawning biomass in SSRU 882E.

4.14 Assessments of the Ross Sea and SSRU 882E are currently undertaken independently for convenience, and because they are separated considerably in space by closed SSRUs. The Working Group recognised the need to combine these assessments in future, on the basis of tag movements between areas and circulation in this region indicating links between these areas.

4.15 WG-FSA-09/14 Rev. 1 presented an assessment of *D. mawsoni* in Division 58.4.1 using an age-structured TISVPA model and a dynamic Schaefer-production model. The analysis suggested that current biomass in the division was about 12 000 tonnes and initial stock biomass was 19 000 tonnes. The paper used these results to calculate yield, based on a proportion of 3.75% of initial biomass, as being 724 tonnes.

4.16 The Working Group welcomed this further look at the data from Division 58.4.1, recalling that the preliminary assessment that it carried out last year identified several inconsistencies in the data from this division which required further investigation (SC-CAMLR-XXVII, Annex 5, paragraphs 5.21 to 5.29). However, the Working Group recalled that neither it nor WG-SAM has yet been able to validate the use of TISVPA as an assessment method for CCAMLR (SC-CAMLR-XXVII, Annex 7, paragraph 3.21). Further, from the information presented in the report of WG-SAM, WG-FSA was unable to determine how key inputs to the assessment, such as CPUE and catches-at-age, had been calculated and whether the fits to CPUE data and other assumptions of the model justified the conclusions of the report. Of particular concern was the apparent generation by the model of a population age structure that did not appear to agree with biological information from the fishery.

4.17 Dr K. Shust (Russia) noted that the TISVPA model had been described in WG-FSA-06/50 and had been submitted to WG-SAM in 2007 and 2008 (WG-SAM-07/9 and 08/8). He further noted that age–length data used in WG-FSA-09/14 Rev. 1 had been provided and considered by WG-FSA as requested during the meeting. Therefore, Dr Shust considered that the results in WG-FSA-09/14 Rev. 1 could be recommended to the Scientific Committee for setting precautionary catch limits in Division 58.4.1. He also recalled that the B_0 and catch limits estimated last year in Divisions 58.4.1 and 58.4.2 used data from the Ross Sea (Subareas 88.1 and 88.2) which are not applicable for these divisions.

4.18 Dr Shust further noted the comments by WG-SAM and WG-FSA on the TISVPA assessment for Division 58.4.1 and undertook to encourage the authors of WG-FSA-09/14 Rev. 1 to present an updated copy of the TISVPA manual, model examples and simulations to allow WG-SAM to validate the package at a future meeting.

4.19 The Working Group reiterated its advice (e.g. SC-CAMLR-XXVI, Annex 5, paragraph 4.27; SC-CAMLR-XXVII, Annex 7, paragraph 3.21) about the detail that is required for it to interpret the results of assessments that are presented to it, particularly when they use new or unvalidated methods, specifically:

(i) the need to provide a full model description;

(ii) the need to present all source data used in the model, and to describe how these were derived from data available either to the authors or, preferably, available in the CCAMLR databases;

(iii) the need to provide software, manuals and input files to CCAMLR;

(iv) the need to present a full suite of diagnostics in the results, including particularly the goodness of fit, and plots, of observed and fitted parameters as well as confidence intervals bounding results, including stock trajectories;

(v) the need to present assessments that structurally differ from previous assessments, or are based on new assessment methods, to WG-SAM for validation prior to their submission at WG-FSA.

4.20 The Working Group noted that the use of an assumed harvest rate based on the experience from fully assessed fisheries was only useful if the assumptions in its derivation were stated explicitly, if the current state of the stock was taken into consideration, and that it

was used only as a very preliminary indication of likely yield. The Working Group agreed that the CCAMLR decision rules should be used explicitly with the assessment results to determine yields, rather than relying on harvest rate proxies. It was noted that harvest rates consistent with the CCAMLR decision rule would be dependent on stock dynamics and the state of the stock.

4.21 Since many CASAL assessments are now using catch-at-age data and are capable of estimating year-class strength more accurately, the Working Group recommended that all future assessments include presentation of bubble plots of catch-at-age proportions, which will assist with identification of strong and weak cohorts. The Working Group also recommended that likelihood profiles should be included in all assessment results.

Icefish

4.22 WG-FSA-09/33 presented an assessment of *C. gunnari* in Division 58.5.2 based on the 2009 survey results. The strong year class detected in the last two surveys (the current 3+ cohort) now dominates the population. Two scenarios were considered when calculating yields for the following two seasons: a two-year projection, based on the assumption that the 3+ cohort will survive into 2010/11; and a single-year projection, based on the assumption that the 3+ cohort will disappear at the end of 2009/10.

4.23 The Working Group recognised that the 3+ cohort currently dominating the population is unlikely to survive until 2010/11 as 5+ fish have rarely been present in significant numbers in previous surveys of the division.

4.24 The CCAMLR assessment method for *C. gunnari* uses CMIX to disaggregate length-density data into age density before applying CCAMLR decision rules in GYM. An alternative methodology which works entirely on length data and utilises a growth transition matrix was presented in WG-FSA-09/27, and applied to Subarea 48.3. The method was tested on 2006, 2007, 2008 and 2009 data, and gave similar yields to the traditional assessment method.

4.25 The Working Group recognised the importance of the transition matrix, and its determination, for the correct application of the method. The Working Group also recognised that growth rates in the CMIX/GYM model are not well estimated.

4.26 The Subarea 48.3 assessment model currently recognises the possibility of variable natural mortality and accounts for this uncertainty by using a high natural mortality rate. Ideally, external information, such as availability of krill or evidence of ecosystem anomalies (see WG-EMM-09/23), could be used to modify *M* in the model. The Working Group noted that there have been repeated efforts to do this with limited success. However, the issue of ensuring sufficient icefish escapement for predators under conditions of variable natural mortality and ecosystem productivity warrants further consideration.

Assessments to be carried out and assessment timetable

4.27 Assessment approaches taken for the assessed fisheries were based on the preliminary assessment submission, issues identified during the course of WG-FSA, as well as subgroup discussions. The Working Group agreed to undertake updated assessments for the following fisheries:

- *D. eleginoides* in Subarea 48.3
- *D. eleginoides* in Subarea 48.4
- *D. eleginoides* in Division 58.5.2
- *D. mawsoni* in Subarea 88.1 and SSRUs 882A–B (Ross Sea management area)
- *D. mawsoni* in Subarea 88.2, SSRU E
- *C. gunnari* in Subarea 48.3
- *C. gunnari* in Division 58.5.2.

4.28 The Working Group agreed that all assessments for *Dissostichus* spp. will use the CASAL framework, and *C. gunnari* will use the short-term projection approach. Specific information on input data and assessment methodologies for each assessed fishery are provided in Item 5.

4.29 The Working Group did not have new information with which to update assessments for *D. eleginoides* fisheries in Division 58.5.1, Subarea 58.6 (Crozet) and Subareas 58.6/58.7 (Prince Edward Island).

4.30 All assessment work was undertaken by primary authors of preliminary assessments, and reviewed independently. Tasks of independent reviewers are listed in WG-FSA-06/6, paragraph 6.3. The outcomes of the assessments were reported in the Fishery Reports (Appendices E to S).

ASSESSMENT AND MANAGEMENT ADVICE

New and exploratory fisheries in 2008/09 and notifications for 2009/10

5.1 In 2008 the Commission agreed to seven exploratory longline fisheries for *Dissostichus* spp. in the 2008/09 season (Conservation Measures 41-04, 41-05, 41-06, 41-07, 41-09, 41-10 and 41-11), an exploratory trawl fishery for *E. superba* in Subarea 48.6 (Conservation Measure 51-05), and exploratory fisheries for crab in Subareas 48.2 and 48.4 (Conservation Measures 52-02 and 52-03). Activities in the exploratory fisheries are outlined below and summarised in Table 5.

5.2 Notifications for new and exploratory fisheries in 2009/10 are summarised in Table 6. Ten Members submitted paid notifications for exploratory longline fisheries for *Dissostichus* spp. in Subareas 48.6, 88.1 and 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b, an exploratory trawl fishery for *E. superba* in Subarea 48.6, and for exploratory pot fisheries for crab in Subareas 48.2 and 48.4.

5.3 In addition, one Member notified its intention to fish for crabs in Subarea 48.3 in 2009/10 in accordance with Conservation Measure 52-01.

5.4 The notifications for crabs are dealt with further under Item 5.4.3 (paragraphs 5.182 and 5.183).

5.5 The Working Group agreed, as in previous years, that it would not attempt to determine whether the notifications for exploratory fisheries satisfied the requirements of the notification procedure (Conservation Measure 21-02); this, it believed, should be done by SCIC. It did, however, note that many of the notifications provided very little information on the research to be undertaken as part of the exploratory fishery and the assessment of impacts of the fishing activities on VMEs. These issues are considered further under Items 5.2 and 10 respectively (paragraphs 5.112 to 5.120 and 10.1 to 10.51).

5.6 The Working Group noted that Argentina had notified to fish using both pots and longlines in Subarea 88.1. It also noted that this would be the first time that pots had been used in this fishery and that this would provide a number of potential issues for analysis of data from the fishery. Firstly, the fishing selectivity of the pots was unknown and therefore a large number of fish would need to be measured per line so that the selectivity of the pot could be reliably estimated. The Working Group agreed that as many toothfish as possible should be measured from each pot with a minimum of at least 100 fish randomly sampled and measured per line. The Working Group noted that potting toothfish may introduce uncertainty and/or biases into the tagging program because parameters such as tag shedding and initial mortality may differ between longline- and pot-caught fish. Although CPUE is not currently used in the Subarea 88.1 and 88.2 assessments, the Working Group was also concerned that the CPUE characteristics of the potting system for toothfish and by-catch species was poorly understood.

5.7 Unstandardised CPUE data for *Dissostichus* spp. caught in exploratory longline fisheries between 1996/97 and 2008/09 are summarised in Table 7.

5.8 Under Conservation Measure 41-01, each longline vessel fishing in exploratory fisheries for *Dissostichus* spp. in 2008/09 was required to tag and release *Dissostichus* spp. at the rate of one toothfish per tonne of green weight caught throughout the season in Subareas 88.1 and 88.2, and three fish per tonne in Subarea 48.6 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b (Table 8). All vessels achieved the required tagging rate except for the *Isla Eden*[3] in Subareas 88.1 and 88.2. In 2008/09, 6 326 *Dissostichus* spp. were reported to have been tagged and released in the exploratory longline fisheries (Table 9), and 172 tags were recovered (Table 10).

5.9 The Working Group noted that there had been a total of 45 tag recaptures (including 33 which had been at liberty for at least one year) in the exploratory fisheries in Subareas 48.6 and 58.4. The Working Group also noted that over 7 000 tags have been released in these fisheries, and reviewed possible reasons for the low recapture rate including time at liberty, distance moved, location of tagging and subsequent fishing effort, and size distribution of fish tagged. Ten fish had been at liberty for at least two years with one fish being recaptured after four years, suggesting good retention of the tags and survival of at least some of the tagged fish. There was concern from some members that tagged fish may move into adjacent closed SSRUs. However, the majority of tagged toothfish were recaptured less than 50 km from

[3] The tagging rates for the *Isla Eden* were incorrectly reported at the meeting. The *Isla Eden* achieved the required tagging rates in Subareas 88.1 and 88.2. See Table 8 corrigendum.

their release position, both in these subareas as well as in Subareas 88.1 and 88.2 (WG-FSA-09/39), suggesting that movement to adjacent closed SSRUs was unlikely to be the main reason for the low recapture rates.

5.10 Tagging rate per vessel was plotted against time to check whether tagging was carried out throughout the fishing period (in accordance with Conservation Measure 42-01). The results suggested an improvement on the 2007/08 season with most vessels now tagging at the correct rate throughout fishing. However, the Working Group noted one vessel which initially tagged at a very high rate (including 100 fish tagged in one set) but then ceased tagging altogether (Figure 2). Although the vessel exceeded the overall required tagging rate, the Working Group was concerned that such a high tagging rate over a short period of time may be detrimental to those fish that were tagged, and was not consistent with the intention to spread tagged fish throughout the area as fishing proceeds.

5.11 To determine whether the spatial mismatch between tags and subsequent fishing effort was a possible reason for the lack of tag recaptures in Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b, the Working Group reviewed the annual distribution of tags and subsequent fishing effort in these areas. The results suggested reasonably good overlap of where the tags were released and where the effort was subsequently carried out, suggesting that spatial overlap was not the primary problem.

5.12 The length-frequency distribution of the tagged fish was compared to the length-frequency distribution of the fish caught to check whether the full size range of fish was being tagged in accordance with Conservation Measure 41-01. The results show that for every vessel * statistical area * species combination, the size of fish being tagged was not representative of the length-frequency distribution of the fish caught (Figure 3). Indeed, for *Insung No. 22* in Subarea 48.6, the two distributions did not even overlap, with every fish less than 100 cm being tagged and released and every fish over 100 cm being retained.

5.13 To evaluate the degree of mismatch between the length-frequency distribution of the tagged fish and that of the fish caught, the Working Group developed a metric based on the overlap between the two distributions. The metric (θ) was

$$\theta = \left(1 - \frac{\sum_{i=1}^{n} \left| P_t - P_c \right|}{2} \right) \times 100$$

where P_t was the proportion of all fished tagged in length bin i, P_c was the proportion of all fish caught (i.e. the sum of all the fish caught and either landed or tagged and released), for 20 cm length bins. θ is therefore one minus half the sum of the absolute differences in the proportions-at-length in 20 cm length bins, over the range of the data, expressed as a percentage. A value of 0% represents no overlap, and 100% represents perfect agreement between the two distributions. The metric was then converted to a descriptive rating based on the degree of overlap: High (≥60% overlap), Medium (≥30 to <60% overlap) and Low (<30% overlap). Examples of the degree of overlap and the corresponding descriptive rating are shown in Figure 3.

5.14 The results were highly variable between vessels depending on species and areas (Table 11). However, several vessels (*Isla Eden, Insung No. 1, Insung No. 22, Jung Woo No. 2, Jung Woo No. 3* and *Tronio*) showed low overlap between the two distributions in all statistical areas fished. Other vessels (*Shinsei Maru No. 3, Antarctic Chieftain, Janas, San Aotea II, San Aspiring* and *Ross Star*) achieved high overlap in at least one statistical area. The Working Group noted that this was a method by which consistency with Conservation Measure 41-01 can be assessed and referred this to SCIC for further consideration.

5.15 The Working Group agreed that one of the main reasons for the lack of recaptures in these subareas was likely to be the small size of the fish tagged compared to the size distribution of the fished population.

5.16 The Working Group agreed that tagging large numbers of small fish in these exploratory fisheries, whilst potentially providing useful information on growth and movement in the medium to long term, would have very limited use for the estimation of abundance. This is because small fish are not commonly caught in these longline fisheries (i.e. have very low selectivity), and it would be many years before they are fully selected in the fishery. (For example, in the example mentioned in paragraph 5.12 it may take 15–20 years for the tagged fish to be fully selected by the longline gear.) During this time period the tags could be shed, grown over, or covered by fouling organisms, and many of the tagged fish (over 80%) would be estimated to die due to natural mortality.

5.17 The Working Group recalled that a paper had been submitted to WG-FSA in 2007 which outlined methods by which large toothfish could be tagged in good condition (WG-FSA-07/36). The Working Group noted that it would be useful for the methods described in this paper to be considered by ad hoc TASO. The Working Group agreed that some vessels showed a very low level of commitment to the tagging program and that this was having a serious impact on the efficacy of the tagging program. The Working Group recommended that the Scientific Committee once again strongly urge Members to request their vessels to fully comply with all aspects of Conservation Measure 41-01, in particular with respect to the size of toothfish being tagged.

5.18 Under Conservation Measure 41-01, each longline vessel fishing in exploratory fisheries for *Dissostichus* spp. in Subareas 48.6 and 58.4 in 2008/09 was required to complete 10 research hauls (each comprising 3 500–5 000 hooks and separated by a distance of at least 5 n miles) on entering an SSRU in an exploratory fishery. For the 2008/09 season, each SSRU was divided into two strata (fished and non-fished/lightly fished) and vessels were required to carry out their research hauls at pre-determined randomly allocated positions. If it was not possible to complete the research hauls in the allocated positions, then the vessels were requested to complete the hauls within the appropriate strata. The implementation of the research hauls by fishing vessels was summarised in WG-SAM-09/6 and CCAMLR-XXVIII/BG/6.

5.19 The Working Group noted that the degree of consistency between the allocated and actual research haul locations varied considerably between vessels and statistical areas (WG-SAM-09/6). Most hauls were separated by the required minimum distance of 5 n miles, although three vessels had set lines closer together than the minimum required distance (Table 12). Whilst most vessels set lines on or close to the allocated location, the *Banzare* consistently sets its research hauls at a mean distance of more than 25 n miles from the allocated positions (Table 12). An example of the allocated hauls and actual hauls for the

Banzare is shown in SSRU 5843bE (Table 12 and Figure 4). Although not all research hauls were always set at the allocated location, some research hauls were not even completed in the required stratum (Table 12). Several reasons were given by vessels for being unable to reach the allocated positions, including the presence of sea-ice, other vessels having set lines in those allocated positions and fishery closure.

5.20 The Working Group also compared mean catch rates (catch per 1 000 hooks) from the research hauls with mean catch rates from subsequent commercial hauls made by the same vessel in that division or subarea and concluded that there was no substantial reduction in overall catch rates from completing the 10 research hauls.

5.21 The Working Group noted that the use and implementation of research hauls had been reviewed by WG-SAM (Annex 6, paragraphs 2.56 to 2.61) and that it had provided the following comments and recommendations that:

(i) the research set allocation approach developed for use for the exploratory fisheries in 2008/09 be retained for the 2009/10 season with the implementation outlined in Annex 6, paragraph 2.58;

(ii) the number of research hauls required to achieve a target CV for this monitoring tool should be evaluated by WG-FSA and, if appropriate, the proportion of research hauls in the non-fished/lightly fished strata could be altered accordingly;

(iii) WG-FSA be more specific over how this may lead to, or improve, an assessment.

5.22 The Working Group endorsed this advice and noted that this is considered further under Item 5.2.

Open and closed SSRUs

5.23 Some members expressed the opinion that the closed SSRUs in the new and exploratory fisheries throughout the Convention Area should be reopened to fishing. They considered that there was a paucity of data on the distribution and size composition of toothfish and on the rate of by-catch (catch composition) in those SSRUs. They also noted the inability to recapture tagged fish which had moved to closed SSRUs, and the inability to tag fish in closed SSRUs. They considered that this may result in underestimation of toothfish biomass and catch limits in the new and exploratory fisheries. Taking all this into account, they suggested that the Scientific Committee consider the possibility of reopening some of the closed SSRUs in order to distribute the exploratory effort across more of the Convention Area and provide better estimates of the toothfish stock in those subareas.

5.24 Other members considered that the network of open and closed SSRUs should be retained because they considered that progress in stock assessments had been assisted by the concentration of effort within the open SSRUs. They agreed that it was important to have a good understanding of the distribution and abundance of *Dissostichus* spp. throughout the Convention Area, but noted that this had to be balanced against developing assessments for the fisheries which was best achieved by concentrating effort on a subset of areas within the

Convention Area. They noted the success that had been achieved in this regard in Subareas 48.4, 88.1 and 88.2 where a staged approach to data collection and fishery developments had been adopted and regularly evaluated. They considered that it was premature to consider reopening the closed SSRUs until the simulation work that was requested in 2008 by the Scientific Committee (SC-CAMLR-XXVII, paragraph 4.158) had been completed.

5.25 The Working Group was unable to provide consensus advice on the issue of maintaining the network of open and closed SSRUs in these subareas.

5.26 The Working Group agreed that a well-designed research experiment in accordance with the guidelines developed at SC-CAMLR-XXVII (SC-CAMLR-XXVII, paragraphs 8.9 to 8.11) and endorsed by the Commission in paragraph 4.66 of CCAMLR-XXVII, with catch limits consistent with the objectives of the experiment, could provide information on the distribution and abundance of *Dissostichus* spp. within a closed SSRU over a 2–3 year time period.

5.27 The Working Group agreed that it was important to use simulations and MSE frameworks to address the potential bias in assessments arising from open/closed SSRUs and that there were several possible approaches to this. For example, potential biases in Divisions 58.4.1 and 58.4.2 were evaluated by comparing observed and expected tag-recapture rates under different tag-movement assumptions in WG-FSA-08/63, which indicated that movement of fish into closed SSRUs did not explain the current low levels of tag-recapture rates. The Working Group also recalled that New Zealand has been developing an SPM over the past two years which could be used to assess potential issues of bias in the tagging program (WG-SAM-08/14, 09/17, 09/18). The SPM was endorsed by WG-SAM for this purpose at the 2009 meeting (Annex 6, paragraphs 4.1 to 4.5). New Zealand welcomed the cooperation of other Members to further develop this work.

5.28 The Working Group reiterated its recommendation from last year that the relative merits of the different views on harvest strategies for toothfish in new and exploratory fisheries be evaluated using simulations. It recommended that such work be submitted to WG-SAM for review of the simulation methodologies before submitting the outcomes to WG-FSA for consideration.

Progress towards assessments of exploratory fisheries

Development of advice on catch limits for *Dissostichus* spp.

Dissostichus spp. Subarea 48.6

5.29 In 2008/09, the exploratory fishery for *Dissostichus* spp. in Subarea 48.6 was limited to Japanese and Korean flagged vessels using longlines only, and no more than one vessel per country was permitted to fish at any one time. The precautionary catch limit for *Dissostichus* spp. was 200 tonnes north of 60°S (SSRUs A and G) and 200 tonnes south of 60°S (SSRUs B–F). Information on this fishery is summarised in Appendix E.

5.30 Licensed longline vessels have fished the exploratory fishery for *Dissostichus* spp. in Subarea 48.6 since 2003/04, and the main species caught has been *D. eleginoides*, except in

2008/09 when the dominant species in the catches was *D. mawsoni*. In 2008/09, two vessels fished in SSRUs E and G. SSRU E was closed on 12 March 2009 (catch limit for *Dissostichus* spp.: 200 tonnes; final reported catch: 189 tonnes), with a consequential closure of all other SSRUs south of 60°S.

5.31 There was no evidence of IUU fishing in 2008/09.

5.32 Vessels were required to tag and release *Dissostichus* spp. at a rate of one fish per tonne of green weight caught, and a limit of 500 fish tagged per vessel applied until the end of 2006/07. The tagging rate was increased to three tags per tonne in 2008/09 and both vessels achieved the new target rate. A total of 401 *D. eleginoides* and 906 *D. mawsoni* (total 1 307 fish) have now been tagged and released, and five *D. eleginoides* and two *D. mawsoni* have been recaptured in that subarea (Tables 9 and 10).

5.33 Three Members (Japan, Republic of Korea and South Africa) and a total of five vessels notified their intention to fish for toothfish in Subarea 48.6 in 2009/10.

5.34 The Working Group recommended the existing conservation measures for Subarea 48.6 be retained for the 2009/10 fishing year.

Dissostichus spp. Division 58.4.1

5.35 Two Members (Republic of Korea and Uruguay) and three vessels fished in the exploratory fishery in Division 58.4.1 in 2008/09. The precautionary catch limit for toothfish was 210 tonnes, of which no more than 100 tonnes could be taken in SSRU C, 50 tonnes in SSRU E and 60 tonnes in SSRU G. The five other SSRUs (A, B, D, F and H) were closed. Fishing was prohibited in depths less than 550 m in order to protect benthic communities. Information on this fishery is summarised in Appendix F.

5.36 SSRU G was closed on 2 February 2009 (catch limit for *Dissostichus* spp.: 60 tonnes; final reported catch: 60 tonnes). SSRU E was closed on 27 February 2009 (catch limit for *Dissostichus* spp.: 50 tonnes; final reported catch: 54 tonnes). SSRU C, and consequently the fishery, was closed on 12 March 2009 (SSRU C catch limit for *Dissostichus* spp.: 100 tonnes; final reported catch: 108 tonnes). The catch limit for the whole *Dissostichus* spp. fishery was 210 tonnes and the final reported catch was 222 tonnes. Information on IUU activities indicated that 152 tonnes of toothfish were taken in 2008/09.

5.37 A total of 1 127 toothfish were tagged and released in the 2008/09 season, and seven tagged toothfish were recaptured during that season (Tables 8 and 10).

5.38 Five Members (Japan, Republic of Korea, New Zealand, Spain and Uruguay) and a total of 11 vessels notified their intention to fish for toothfish in Division 58.4.1 in 2009/10.

5.39 The Working Group noted that Russia had begun research on *Dissostichus* spp. in this division (WG-FSA-09/14 Rev. 1). The Working Group encouraged the continuation of the work during the intersessional period and for the otolith readings to be verified by CON (paragraphs 9.4 to 9.8) and for the results to be evaluated by WG-SAM (Annex 6, paragraph 3.18).

5.40 The Working Group recommended that the existing catch limits and other aspects of the conservation measures for Division 58.4.1 be retained for the 2009/10 season. It noted that several SSRUs in this division have catch limits of 30 tonnes which posed problems with predicting fishery closures (paragraphs 3.13 to 3.15) considering the large number of vessels notified for this division.

Dissostichus spp. Division 58.4.2

5.41 Two Members (Japan and Republic of Korea) and two vessels fished in the exploratory fishery in Division 58.4.2 in 2008/09 and the reported catch was 66 tonnes. SSRU E was closed on 17 February 2009 (catch limit for *Dissostichus* spp.: 40 tonnes; final reported catch: 61 tonnes), and the fishery was closed on 23 February 2009 (catch limit for *Dissostichus* spp.: 70 tonnes; final reported catch: 66 tonnes). The other SSRUs (B, C and D) were closed to fishing. Fishing was prohibited in depths less than 550 m in order to protect benthic communities. Information on this fishery is summarised in Appendix G.

5.42 The fishery targeted *D. mawsoni* and operated in SSRUs A and E in 2008/09. It was estimated that 176 tonnes of *D. mawsoni* were taken by IUU fishing in 2008/09.

5.43 A total of 277 toothfish were tagged and released in 2008/09 and one tagged toothfish was recaptured (Tables 9 and 10).

5.44 Five Members (Japan, Republic of Korea, New Zealand, Spain and Uruguay) and a total of nine vessels notified their intention to fish for toothfish in Division 58.4.2 in 2009/10.

5.45 The Working Group recommended the existing conservation measures for Division 58.4.2 be retained for the 2009/10 season. It noted that several SSRUs in this division have catch limits of 30 tonnes which posed problems with predicting fishery closures (paragraphs 3.13 to 3.15) considering the large number of vessels notified for this division.

Dissostichus spp. Division 58.4.3a

5.46 One Member (Japan) and one vessel fished in the exploratory fishery in Division 58.4.3a in 2008/09. The precautionary catch limit for toothfish was 86 tonnes and the reported catch was 31 tonnes. Information on this fishery is summarised in Appendix H.

5.47 There was no evidence of IUU fishing in 2008/09.

5.48 A total of 113 toothfish were tagged and released in 2008/09 and two tagged toothfish were recaptured during that season.

5.49 Two Members (Japan and Uruguay) and three vessels notified their intention to fish for toothfish in Division 58.4.3a in 2009/10.

5.50 The Working Group agreed that, in the absence of a new assessment, the catch limit should remain at 86 tonnes in this division.

Dissostichus spp. Division 58.4.3b

5.51 Two Members (Japan and Uruguay) and two vessels fished in the exploratory fishery in Division 58.4.3b in 2008/09. In November 2007, the division was divided into two SSRUs: A north of 60°S and B south of 60°S. In November 2008, the area north of 60°S was further subdivided into four SSRUs (A, C, D and E). The precautionary catch limit for *Dissostichus* spp. in the fishery was 30 tonnes in each of SSRUs A, C, D and E, and SSRU B remained closed to fishing. Information on this fishery is summarised in Appendix I.

5.52 In 2008/09, the fishery operated in SSRUs A, C, D and E. SSRU D was closed on 27 January 2009 (catch limit for *Dissostichus* spp.: 30 tonnes; final reported catch: 31 tonnes). SSRU A was closed on 2 February 2009 (catch limit for *Dissostichus* spp.: 30 tonnes; final reported catch: 28 tonnes). SSRU E was closed on 7 February 2009 (catch limit for *Dissostichus* spp.: 30 tonnes; final reported catch: 45 tonnes). The entire fishery was closed on 9 February 2009 with a reported total catch of 104 tonnes of *Dissostichus* spp. (87% of the precautionary catch limit for the fishery).

5.53 Information on IUU activities indicated that 610 tonnes of toothfish were taken in 2008/09.

5.54 A total of 431 toothfish were tagged and released in 2008/09, including 75 *D. eleginoides* and 356 *D. mawsoni* . One tagged toothfish was recaptured during the 2008/09 season.

5.55 Four Members (Japan, Republic of Korea, South Africa and Uruguay) and six vessels notified their intention to fish for toothfish in Division 58.4.3b in 2009/10.

5.56 Dr Welsford presented WG-FSA-09/44, including revised analyses of the catch and effort data for BANZARE Bank. The authors noted evidence of depletions in areas where fishing has concentrated, and the lack of large numbers of fish outside these areas, as shown in the surveys conducted by Australia in 1999 and 2008, indicate that the stock of *D. mawsoni* is depleted and the fishery should be closed. For a range of scenarios of initial biomass, and fishery and IUU catches in this division, the GYM was then used to assess foregone yields and to estimate (i) the probability of being depleted below 0.2 B_0 and (ii) the time to recovery to 0.5 B_0. The authors of WG-FSA-09/44 noted that these scenarios also confirmed that this stock is likely to be depleted, and in the absence of fishing it is likely that it will be at least five years before it is sufficiently low risk to survey this stock to determine if recovery is occurring. They propose a recovery strategy, with a survey to be undertaken in five years' time to determine comparative catch rates and age structure and establish a mark-recapture program. The stock should then be surveyed two years later to determine the rate of recovery and a full recovery strategy to help the stock recover to target levels, at which time the fishery could be reopened. The authors further noted that this strategy could be used to develop a recovery strategy for *D. eleginoides* on Ob and Lena Banks and other depleted stocks.

5.57 The Working Group considered three possible scenarios for the *D. mawsoni* stock on BANZARE Bank, based on existing knowledge:

(i) Scenario 1: spawning fish have a high turnover in Division 58.4.3b, moving freely within this division between SSRUs and areas outside each year.

(ii) Scenario 2: spawning fish move sporadically to Division 58.4.3b, and then remain in the area, moving little across the area between years.

(iii) Scenario 3: there is large turnover of large fish in Division 58.4.3b, but they represent only a fraction of the spawning stock that sustains the population in East Antarctica.

5.58 It further noted that due to their proximity, the fish on BANZARE Bank are likely to originate from the coastal areas of Antarctica in the Southern Indian Ocean. The Working Group noted that other plausible scenarios could be envisioned, however, it saw that the three scenarios captured useful alternative hypotheses for this division (Figure 5).

5.59 The Working Group recalled that it had agreed last year (SC-CAMLR-XXVII, Annex 5, paragraph 5.57) that:

(i) Based on fishing information until 2006/07, the fisheries across BANZARE Bank show that the preferred fishing grounds were depleted in the Southern Area (adopted by WG-FSA-07, resulted in the closure of the Southern Area).

(ii) Based on the survey and fisheries across BANZARE Bank, there are very few fish apart from in the preferred fishing grounds.

(iii) The fish found in the preferred fishing grounds are large and likely spawning, there are no small fish and fish are male dominated (79%).

(iv) In the survey, the fish are large and mostly male.

(v) Spawning fish in East Antarctica have only been found on BANZARE Bank (WG-FSA-07/44 and paragraph 5.56).

5.60 The Working Group then considered the data and analyses on CPUE, size distribution and tagging data from Division 58.4.3b (WG-FSA-09/44). The Working Group agreed that CPUE data indicated that:

(i) depletion had occurred during fishing in Patch B in 2007/08 and Patch C in the 2008/09 season, but the results of the depletion analyses were ambiguous for Patch A and for Ground C (see Figure 6 for location of grounds and patches);

(ii) unstandardised CPUE for the whole of Division 58.4.3b has increased between 2003/04 and 2008/09 (Figure 7);

(iii) CPUE is affected by factors such as gear and bait type, vessel, season, depth fished, species and area fished, and these have serious consequences for interpreting unstandardised CPUE (SC-CAMLR-X, Annex 6, paragraphs 7.107 to 7.121; SC-CAMLR-XI, Annex 5, paragraphs 6.143 to 6.166).

5.61 The Working Group also agreed that tagging data indicated that:

(i) of 10 tags recaptured in Division 58.4.3b, nine were released in Division 58.4.3b and one was released in Division 58.4.1 (Figure 8);

(ii) large movements of fish have been observed for fish at liberty for two years or more, and tend to be from the east to the west in coastal Antarctica, or from the coast to BANZARE Bank;

(iii) stocks of *D. mawsoni* are likely to be distinct at the scale of ocean basins (see also Smith and Gaffney, 2005).

5.62 The Working Group further agreed that size distribution data and maturity data indicated that:

(i) there is no evidence of recruitment of small (<60 cm) *D. ma wsoni* in Divisions 58.4.1, 58.4.2 and 58.4.3b (Figure 9);

(ii) *D. mawsoni* are likely to move throughout Divisions 58.4.1, 58.4.2 and 58.4.3b;

(iii) smaller fish are found in the western area of Division 58.4.2 and in waters shallower than 1 000 m, and larger fish in waters deeper than 1 000 m.

5.63 The Working Group noted that the observed size distribution and location of tag recaptures of *D. ma wsoni* from Subarea 58.4 suggested a life-history pattern that was analogous to that proposed for *D. mawsoni* in the Ross Sea by Hanchet et al. (2008). Hence the size distribution of *D. mawsoni* on BANZARE Bank would be expected to be similar to that in the north of the Ross Sea (Figure 10).

5.64 The Working Group noted that the development of this hypothetical lifecycle for the Ross Sea had been useful in understanding population dynamics in this region. The Working Group encouraged Members to develop a similar detailed review of data to develop a hypothetical lifecycle for *D. mawsoni* in the Indian Ocean sector of the Convention Area for Subarea 58.4, including consideration of oceanographic features in the area.

5.65 The Working Group noted that analysis of otoliths would assist in understanding population dynamics of *D. mawsoni* in this area.

5.66 The Working Group was unable to provide management advice on catch limits in this division, but recommended that all other aspects of Conservation Measure 41-01 be carried forward if a catch limit is set in 2009/10. It noted that several SSRUs in this division have catch limits of 30 tonnes which posed problems with predicting fishery closures (paragraphs 3.13 to 3.15) considering the large number of vessels notified for this division.

Dissostichus spp. Subareas 88.1 and 88.2

5.67 In 2008/09, six Members (Chile, Republic of Korea, New Zealand, Spain, UK and Uruguay) and 13 vessels fished in the exploratory fishery in Subarea 88.1. The fishery was closed on 25 January 2009 and the total reported catch of *Dissostichus* spp. (excluding research fishing) was 2 434 tonnes (90% of the limit) (Appendix J, Table 3). The following SSRUs were closed during the course of fishing:

- SSRUs B, C and G closed on 22 December 2008, triggered by the catch of *Dissostichus* spp. (total catch 410 tonnes; 116% of the catch limit);

- SSRUs H, I and K closed on 22 January 2009, triggered by the catch of *Dissostichus* spp. (total catch 1 957 tonnes; 98% of the catch limit).

The IUU catch for the 2008/09 season was estimated to be 0 tonnes.

5.68 Seven Members (Argentina, Republic of Korea, New Zealand, Russia, Spain, UK and Uruguay) and a total of 18 vessels notified their intention to fish for *Dissostichus* spp. in Subarea 88.1 in 2009/10.

5.69 Seven Members (Chile, Republic of Korea, New Zealand, South Africa, Spain, UK and Uruguay) and seven vessels fished in the exploratory fishery in Subarea 88.2. The fishery closed on 31 August 2009 and the total reported catch of *Dissostichus* spp. was 484 tonnes (85% of the limit) (Appendix J). SSRU E was closed on 8 February 2009, triggered by the catch of *Dissostichus* spp. (total catch 316 tonnes; 89% of the catch limit). The IUU catch for the 2008/09 season was estimated to be 0 tonnes.

5.70 Seven Members (Argentina, Republic of Korea, New Zealand, Russia, Spain, UK and Uruguay) and a total of 18 vessels notified their intention to fish for *Dissostichus* spp. in Subarea 88.2 in 2009/10.

5.71 The Fishery Report for *Dissostichus* spp. in Subareas 88.1 and 88.2 is in Appendix J. In 2005 the Working Group recommended that Subareas 88.1 and 88.2 be split into two areas for stock assessment purposes: (i) the Ross Sea (Subarea 88.1 and SSRUs 882A–B), and (ii) SSRU 882E.

5.72 The catch limits for Subarea 88.1 and 88.2 SSRUs in the Ross Sea were changed as part of a three-year experiment (SC-CAMLR-XXIV, paragraphs 4.163 to 4.166). To assist administration of the SSRUs, the catch limits for SSRUs 881B, C and G were amalgamated into a 'north' region and those for SSRUs 881H, I and K were amalgamated into a 'slope' region. SSRU J was split at 170°E into two SSRUs – M and J.

5.73 Within Subarea 88.2, SSRU 882E was treated as a separate SSRU with its own catch limit, whilst SSRUs 882C, D, F and G were amalgamated with a single catch limit.

5.74 In all seasons, there was a broad mode of adult fish at about 120–170 cm. In 2005/06, there was a strong mode at about 60 cm in Subarea 88.2. These fish were predominantly caught at the edge of the continental shelf in SSRUs 882F and G. This mode was not apparent in 2006/07, as there was no fishing on the shelf in these SSRUs in 2006/07. This mode was again apparent in 2008/09, due to fishing on the shelf and slope in SSRUs 882D, E and F in 2008/09.

5.75 Under Conservation Measure 41-01, each longline vessel fishing in exploratory fisheries for *Dissostichus* spp. is required to tag and release *Dissostichus* spp. at a rate of one toothfish per tonne of green weight caught throughout the season.

5.76 A high-quality tag dataset for the assessment of *D. mawsoni* was selected on the basis of data-quality metrics for individual trips (WG-FSA-09/35). The method first selected an initial informative dataset comprising trips with (i) high (above median) rates of recovery of previously released tags, and (ii) where tags released on the trip were subsequently recaptured

at a high rate. The method then used these trips to define the upper and lower bounds of data-quality metrics that were informative with respect to tagging data. Other trips with data-quality metric values within these ranges were then added to the initial informative dataset.

5.77 Since 2000/01, more than 22 000 *Dissostichus* spp. have been tagged in Subareas 88.1 and 88.2, with almost 19 000 and 2 000 *D. mawsoni* in the Ross Sea and SSRU 882E respectively (WG-FSA-09/39). The selected trips' tag dataset contained a total of 13 308 releases and 474 recaptures that were used in the assessment of the Ross Sea (WG-FSA-09/40 Rev 1.), and 947 releases and 47 recaptures that were used in the assessment for SSRU 882E (WG-FSA-09/41).

5.78 The CASAL model, using catch-at-age and tag-recapture data, and *D. mawsoni* biological parameters, was used to estimate the current and initial population size, and to calculate the long-term annual yield that would satisfy the CCAMLR decision rules.

5.79 The constant catch for which there was median escapement of 50% of the median pre-exploitation spawning biomass level at the end of the 35-year projection period for the Ross Sea (Subarea 88.1 and SSRUs 882A–B) was 2 850 tonnes. At this yield, there is a less than 10% chance of spawning biomass dropping to less than 20% of the initial biomass. A yield of 2 850 tonnes is therefore recommended.

5.80 The constant catch for which there was median escapement of 50% of the median pre-exploitation spawning biomass level at the end of the 35-year projection period for SSRU 882E was 361 tonnes. At this yield, there is a less than 10% chance of spawning biomass dropping to less than 20% of the initial biomass. A yield of 361 tonnes is therefore recommended.

5.81 For SSRUs 882C, D, F and G the Working Group could provide no new advice, but noted that the catches in these areas had provided some useful biological data for toothfish. Therefore, the Working Group recommended the current catch limits in these SSRUs be continued for the 2009/10 season.

5.82 The Working Group recommended that the allocation method used to set the 2005/06 catch limits for SSRUs in Subarea 88.1 be continued for the 2009/10 season.

5.83 The Working Group recalled its advice that the current designations of SSRUs in Subareas 88.1 and 88.2 are almost certainly not optimal, but a detailed revision of these would require, at least, a consolidated movement model for fish in these subareas, which is not yet available. Such a revision should take account not only of the principal target species, but also of by-catch species and ecosystem considerations.

5.84 The Working Group noted that the method for selecting high-quality tag datasets still needs to be refined, and that potential biases caused by vessel preferences for localised fishing grounds are likely to require further investigation using the SPM.

5.85 The Working Group considered WG-FSA-09/7 on climate change, longevity, overfishing and management of the Area 88 toothfish fishery. The Working Group expressed concern that there were substantive errors of fact as well as an incorrect attribution of statements to references of the work of CCAMLR and its scientists in the paper. For example, including, but not restricted to, the following:

(i) The statement by the authors that CCAMLR's management strategy was to reduce the total biomass of toothfish to 50% of the virgin biomass is incorrect. Importantly, the reduction in biomass in the CCAMLR management strategy refers only to the spawning stock and is therefore quite a different consideration both for toothfish and in relation to ecosystem interaction.

(ii) The cited paper by de Vries et al. (2008) (WG-EMM-08/21) was reviewed by WG-EMM in 2008, which concluded that there was insufficient evidence to support the authors' assertions and requested that the full dataset be provided to the Secretariat for analysis and review (SC-CAMLR-XXVII, Annex 4, paragraphs 6.24 to 6.26). The Secretariat has still not received these data.

(iii) The primary climate change paper cited by the authors (Cheung et al., 2008) did not use CCAMLR catch data on the distribution of *D. mawsoni* throughout the Convention Area. Thus, for example, the largest fishery for this species, and probably the greatest density, is on the slope of the Ross Sea, but according to Cheung et al. (2008) this area currently has one of the lowest densities of *D. mawsoni* around the Antarctic continent. Furthermore, although the authors assert elsewhere that little is known about the early life history of *D. mawsoni*, they propose, with no evidence whatsoever, that *D. maw soni* spawning and juvenile survival are dependent on sea-ice.

(iv) Papers by Hanchet and Pinkerton are extensively cited, however, many of the statements from these papers are taken out of context or are factually incorrect. For example, in the first sentence of the introduction there is a statement that 'most of the older fish were removed in the first several years of the fishery'. However, the data shown in the paper by Hanchet et al. (2007) (WG-FSA-07/28) provides no evidence to support this. Likewise, the authors of the paper make the claim on page 5 that 'without a change in the overall TAC in Area 88, vessels have increased their proportional concentration on the Ross Sea continental slope and they have also been fishing deeper in this habitat'. However, the current fishing pattern is a deliberate consequence of the separate catch limit for the shelf, slope and northern regions of the Ross Sea. Furthermore, the depth fished by vessels has been remarkably constant over the past five years.

(v) There are also a number of conclusions developed in the paper which do not bear closer scrutiny. For example, the authors conclude that 'Antarctic toothfish are likely to spawn episodically, or recruitment is likely to be episodic (on a decadal, not necessarily annual scale)'. However, recent studies suggest that there is low year-class strength variability (e.g. WG-FSA-07/28, 09/36), and that once fully mature, individual fish are likely to spawn in most years (e.g. WG-FSA-09/37).

5.86 In light of these obvious inconsistencies, the Working Group was unable to fully evaluate the conclusions reached by the authors of the paper.

5.87 The Working Group recommended that the catch limits for Subarea 48.6 and Divisions 58.4.1, 58.4.2 and 58.4.3a be retained for 2009/10.

5.88 The Working Group recalled that the five-day catch and effort reporting system used in exploratory fisheries is not well suited to the monitoring of catch limits below 100 tonnes, and recommended that the Scientific Committee consider this matter further (paragraphs 3.14 and 3.15).

5.89 The Working Group was unable to provide management advice for the catch limits in Division 58.4.3b.

5.90 The Working Group agreed that measures in the research and data collection plans, including the requirement to tag toothfish at the rate of three toothfish per tonne and the requirement for research hauls as used in 2008/09, be retained for the exploratory fisheries in Subareas 48.6 and 58.4.

5.91 The Working Group agreed that the catch limits for *Dissostichus* spp. in Subarea 88.1 should be 2 850 tonnes and for *Dissostichus* spp. in SSRU 882E should be 361 tonnes and for SSRUs 882C, D, F and G should be 214 tonnes (paragraphs 5.79 to 5.81). The Working Group recommended that the allocation method used to set the 2005/06 catch limits for SSRUs in Subarea 88.1 be continued for the 2008/09 season (paragraph 5.82).

5.92 The Working Group agreed that other measures in the research and data collection plans, including the tagging requirement for one tag per tonne, be retained for the exploratory fisheries in Subareas 88.1 and 88.2.

5.93 The Working Group agreed that some vessels showed a very low level of commitment to tagging larger toothfish and that this was having a serious impact on the efficacy of the tagging program. It recalled that a paper had been submitted to WG-FSA in 2007 which outlined methods by which large toothfish could be tagged in good condition (WG-FSA-07/36). The Working Group recommended that the Scientific Committee once again strongly urge Members to request their vessels to fully comply with all aspects of Conservation Measure 41-01, Annex C.

5.94 The Working Group discussed the network of open and closed SSRUs in the new and exploratory fisheries (paragraphs 5.23 to 5.27). It agreed that it was important to have a good understanding of the distribution and abundance of *Dissostichus* spp. throughout the Convention Area, but noted that this had to be balanced against developing assessments for the fisheries which was best achieved by concentrating effort on a subset of SSRUs within the Convention Area. The Working Group was unable to provide consensus advice on the issue of maintaining the network of open and closed SSRUs in these subareas.

5.95 The Working Group reiterated its recommendation from last year that the relative merits of the different views on harvest strategies for toothfish in new and exploratory fisheries be evaluated using simulations. It recommended that such work be submitted to WG-SAM for review of the simulation methodologies before submitting the outcomes to WG-FSA for consideration.

Management advice to SCIC

5.96 The Working Group noted that the method developed to evaluate the degree of mismatch between the length-frequency distribution of the tagged fish and that of the fish caught, as outlined in paragraphs 5.12 to 5.14, could be used to assess consistency with Conservation Measure 41-01, Annex C, and referred this to SCIC for further consideration.

Closed fishery – Ob and Lena Banks Division 58.4.4

5.97 The longline fishery for *Dissostichus* spp. in Divisions 58.4.4a and 58.4.4b began as a new fishery in 1997/98 (Conservation Measure 138/XVI). These divisions were managed as a single area and a catch limit for *Dissostichus* spp. applied to fishing north of 60°S, and in waters outside areas of national jurisdiction. In 1999, the divisions were subdivided into SSRUs A, B, C and D.

5.98 In 2002, the Commission expressed concern regarding the low levels of stocks of *Dissostichus* spp. in Divisions 58.4.4a and 58.4.4b and the high levels of IUU fishing in that region (CCAMLR-XXI, paragraph 11.36). Consequently, the Commission prohibited directed fishing for *Dissostichus* spp. in these divisions and the fishery for *Dissostichus* spp. was closed (Conservation Measure 32-10). The Commission agreed that such prohibition should apply at least until further scientific information is gathered and reviewed by the Scientific Committee and WG-FSA.

5.99 Two licensed longline vessels operated the exploratory fishery for *Dissostichus* spp. in Divisions 58.4.4a and 58.4.4b in 1999/2000 and reported a total catch of 156 tonnes of *D. eleginoides*. The following season, a single vessel fished briefly, reporting a total catch of 8 tonnes of *D. elegino ides*. The fishery was closed in December 2002 (Conservation Measure 32-10). Most of the reported catch of *D. eleginoides* was taken in SSRUs A and D.

5.100 In 2007/08, one Japanese-flagged longliner conducted research fishing in accordance with a research plan submitted under Conservation Measure 24-01. The vessel caught 77 tonnes of *D. eleginoides* and <1 tonne of *D. mawsoni*.

5.101 In 2008, a Japanese proposal to carry out research fishing in Division 58.4.4 was submitted to the Scientific Committee, which recommended that before conducting additional research in this area, the results of the recent longline survey be reported to WG-FSA, the design of a future survey be discussed and agreed at WG-SAM, and that comparable fishing trials be carried out in areas other than Division 58.4.4, to attempt the calibration of the trotline gear with the other longline gear (SC-CAMLR-XXVII, paragraph 8.8).

5.102 This work has been completed with the Japanese survey results and revised research proposal being reviewed by WG-SAM (Annex 6, paragraphs 2.47 to 2.55). After taking into account the comments of WG-SAM-09, the proposal was submitted to WG-FSA for review as WG-FSA-09/12.

5.103 During the WG-FSA-09 meeting, Japan further revised the research proposal to survey *Dissostichus* spp. in 2009/10 as part of a 3–5 year tagging experiment.

5.104 Dr K. Taki (Japan) recalculated the necessary sample size as 81 tonnes for toothfish for this division that includes four SSRUs, taking into account the latest information on spawning stock biomass indices of the reference area (Subarea 48.4). To apply the mark and recapture studies, a tagging rate of five fish per tonne will be used. A total of 117 research hauls are allocated on a 10-minute latitude × 20-minute longitude grid point. A trotline system will be employed for 88 research hauls. In 29 hauls (25% of total sets), the experimental gear, which consists of three segments of trotline system and Spanish line system respectively within one fishing line, will be used. He indicated that the sample size of 81 tonnes is necessary to obtain reliable stock estimate parameters and complete coverage of the survey area.

5.105 The Working Group agreed on the following points:

(i) The Commission recalled the Scientific Committee's concern regarding the low levels of stocks of *Dissostichus* spp. in Division 58.4.4 and Subarea 58.6 and the high levels of IUU fishing (SC-CAMLR-XXI, paragraphs 4.106 and 4.108). The Commission agreed that directed fishing for *Dissostichus* spp. should be prohibited in these regions, and that such prohibition shall apply until at least such time that further scientific information is gathered and reviewed by the Scientific Committee and WG-FSA. Accordingly, Conservation Measures 32-10 (2002) and 32-11 (2002) were adopted to prohibit directed fishing for *Dissostichus* spp. in Division 58.4.4 and Subarea 58.6 respectively (CCAMLR-XXI, paragraph 11.36).

(ii) Information on IUU activities indicated high levels of IUU fishing, and the estimated annual catch of *Dissostichus* spp. exceeded 1 000 tonnes in each season between 1997/98 and 2000/01. An estimated total of 7 116 tonnes of *Dissostichus* spp. has been removed by IUU fishing. There was no evidence of IUU fishing in 2003/04, 2007/08 and 2008/09 (Appendix K).

(iii) The Working Group noted that the majority of fish captured in the survey in Divisions 58.4.4a and 58.4.4b were between 55 and 150 cm in length. However, due to the lack of information on the selectivity of the gear, it was not possible to infer absolute abundance of size classes based on these data alone.

(iv) The Working Group noted that the authors of WG-FSA-09/12 used a harvest rate of 3.8% of initial spawning stock biomass to estimate sustainable yields for the stock in Divisions 58.4.4a and 58.4.4b. The Working Group recalled that this figure was not derived from a stock-specific application of the CCAMLR decision rules for toothfish, but rather derived from analyses in WG-FSA-08/43, which estimated a harvest rate based on the ratio between the sustainable yield and SSB_0 estimated in the Ross Sea (Subarea 88.1) in 2007. The Working Group agreed that the apparent harvest rate, derived from a stock where the CCAMLR decision rules were applied, would depend on the stock-specific biological characteristics of toothfish, the selectivity of the gear used in fishing the stock and also the status of the stock relative to its unfished state.

5.106 Dr Welsford noted that it was inappropriate to apply a harvest rate of 3.8% to the stock in Divisions 58.4.4a and 58.4.4b, when this rate is derived from the Ross Sea, as the Ross Sea stock is estimated to be in a fish-down phase, and well above the target of 0.5 median SSB_0.

He also noted that the productivity of *D. mawsoni* in the Ross Sea and of *D. eleginoides* in Divisions 58.4.4a and 58.4.4b is likely to be substantially different. He further noted that, as the stock in Divisions 58.4.4a and 58.4.4b had been depleted by IUU fishing, and is unlikely to have fully recovered to a pristine state in the six years since it was closed, any removal rate must be significantly lower than 3.8% to be precautionary. Preliminary modelling using the GYM indicates that a *D. eleginoides* stock at 40% SSB_0 could sustain a harvest rate of ~1.6% if it is expected to recover to 0.5 SSB_0 over 25 years. Dr Welsford undertook to present the details of this analysis in a paper at the next meeting of WG-SAM.

5.107 Dr T. Ichii (Japan) noted that the proposed catch limit of 81 tonnes would not only be necessary to obtain reliable stock estimate parameters but would also be conservative so as not to impede the stock recovery of the division for the following reasons:

(i) The sample size was calculated using a precautionary exploitation rate of 2.7 %, which is an average of the value of 3.8%, which was applied for Divisions 58.4.1 and 58.4.2 (WG-FSA-08/43), and 1.6% which was recommended by Dr Welsford. Considering that 3.8% is the sustainable exploitation rate when the current stock level is 50% of B_0, while 1.6% is the sustainable exploitation rate when the stock size is 40% of B_0, Dr Ichii believed that the value of 1.6% may be overly precautionary.

(ii) Length-composition data showed young and adult toothfish in abundance.

(iii) This division was closed to fishing based not on scientific data, but on the belief that the stock might have been depleted by IUU fishing (SC-CAMLR-XXI, paragraph 4.106), suggesting that it is unclear whether the stock was actually depleted at the time of closure of the fishery in 2002/03.

(iv) Division 58.4.4 is considered to have been less attractive for IUU fishing since 2003/04 (SC-CAMLR-XXVII, Annex 5, Table 3) because a much higher catch rate has been obtained in adjacent divisions in the Indian Ocean, implying a possibility that the former division has not recently been subject to high levels of IUU fishing.

5.108 The Working Group agreed that the revised proposal had addressed most of the issues raised by WG-SAM, and that the spatial distribution of the sets would spread effort and tags evenly across the survey area, and that the proposed tagging rate of five tags per tonne would be a minimum rate. It noted that there was also an expectation that otoliths collected during the 2010 survey and the previous 2008 survey would be read using protocols developed by CON and presented to future meetings of WG-FSA. It also noted that there should be some longer-term commitment to the experiment and that, subject to the review of the 2010 survey, the vessel would be expected to return to the area in a future year (or years) to recapture the tagged fish.

5.109 The Working Group considered that if sufficient tags were recaptured, then an assessment could be carried out on the stock. However, it cautioned that the assessment of stock status would be uncertain because of the large unknown IUU catch and the likely sensitivity of the stock status to these estimates. The Working Group anticipated that the data could be collated for input into an integrated assessment framework such as CASAL and be submitted to WG-SAM for review by 2011 to 2012.

5.110 However, some members of the Working Group were concerned that the stock had been severely depleted and that the proposed level of catch may be deleterious to the stock. They noted that the required level of catch could be reduced, for example, by surveying a subset of the total area, setting shorter lines, or tagging and releasing a higher proportion of the fish.

5.111 The Working Group was unable to reach consensus on an appropriate level of catch for the survey.

Development of methods to assess exploratory fisheries

Data requirements for assessing exploratory fisheries

5.112 The Working Group noted the discussions at WG-SAM on:

(i) using longline data in estimating stock size (Annex 6, paragraphs 2.28 to 2.42);

(ii) standardisation of CPUE for different longline fishing methods (Annex 6, paragraphs 2.43 to 2.46);

(iii) use of research hauls in the exploratory fisheries for *Dissostichus* spp. (Annex 6, paragraphs 2.56 to 2.61);

(iv) estimating biomass using commercial longline data in Divisions 58.4.1 and 58.4.2 (Annex 6, paragraphs 2.62 to 2.65);

(v) spatially structured population models for use in evaluating management strategies (Annex 6, paragraphs 4.1 to 4.6).

5.113 The Working Group considered how research hauls can be implemented such that they will lead to, or improve, an assessment (paragraph 5.21) recalling that participation in exploratory fisheries represents a commitment towards undertaking research that will lead to a stock assessment before the stock is reduced to the target status. It noted that research programs will have to operate in a different manner in fisheries that have not been previously exploited compared to those which have been depleted. In the latter case, care need to be taken so that the research strategy ensures that research requirements do not impact on the ability of the fishery to recover.

5.114 The Working Group agreed that in evaluating research programs in data-poor fisheries, there were three questions that need to be addressed for the provision of advice on what research would be appropriate:

(i) What research needs to be undertaken to facilitate a preliminary assessment of stock status?

(ii) What is the mortality of fish that will likely occur as a result of undertaking the research without any additional catch? For example, if all fish in good condition were tagged and released, what proportion of the tagged fish would be in poor condition and die?

(iii) What is the quantity of fish that could be taken to offset the cost of the research, noting the possible status of the stock?

5.115 The Working Group further noted the successful development of the exploratory fishery in the Ross Sea following research to develop the stock assessments in that area. The evolution of that work has led to the development of the SPM (Annex 6, paragraphs 4.4 to 4.6). The Working Group agreed that strategies for acquiring information for data-poor stocks should be evaluated with the spatially structured population models, such as the SPM, in order to give confidence that pristine stocks are not reduced to below their target level and that the recovery of closed stocks is not impeded by research activities. The Working Group agreed that such work is now urgent for exploratory fisheries in Area 58. Members were encouraged to collaborate with this work.

5.116 The Working Group noted that some Members may not have expertise in stock assessment models but that there were opportunities for capacity building in this area. In particular, Mr Dunn offered the opportunity for scientists to spend time at NIWA in New Zealand to develop expertise in using CASAL and the SPM. The Working Group welcomed this offer and encouraged Members to participate, noting also that there are other mechanisms for building capacity in this area, including mentoring arrangements and web seminars. It also encouraged Members to correspond on how their work is proceeding in order to advance the outcomes for consideration next year.

5.117 The Working Group recalled that the development of assessments was compromised when vessels failed to comply with conservation measures specifying research conditions such as tagging rates.

5.118 The Working Group noted that notifications for exploratory fisheries included information on research plans but that this information was not always sufficient to assist in developing assessments (paragraph 5.5). The Working Group requested that the Scientific Committee provide standards and specifications on what was required for inclusion of proposed research activities in exploratory fishery notifications and the extent that these should be reviewed by WG-FSA.

5.119 The Working Group noted the importance of obtaining time series of catch-at-age data for *Dissostichus* spp. for exploratory fisheries as inputs to stock assessments. For example, otolith ages were not available for *D. mawsoni* for SSRUs in Subareas 88.1 and 88.2 for years in which New Zealand had not fished (paragraphs 3.33 to 3.36) and that some unvalidated ageing data for *D. mawsoni* are available from Division 58.4.1 (paragraph 4.15). The Working Group, therefore, recommended that Members fishing in exploratory fisheries should:

(i) provide a historical inventory of their otoliths to the Secretariat
(ii) provide to the Secretariat a dataset of fish ages for years and statistical areas in which Members had fished, and further that the ages be read in accordance with the validated ageing protocols developed by CON (paragraphs 9.4 to 9.8).

5.120 The Working Group further recommended that, in collaboration with other Members, Members fishing in exploratory fisheries should provide a characterisation of the fishery including catch, by-catch, tag and biological data, including length, sex and age-frequency distribution of the catch, and indicate how these data may lead to an assessment.

Dissostichus eleginoides South Georgia (Subarea 48.3)

5.121 The Fishery Report for *D. eleginoides* in Subarea 48.3 is contained in Appendix L. The catch limit for *D. eleginoides* in the 2008/09 season was 3 920 tonnes, and the recorded catch was 3 383 tonnes.

5.122 The Working Group agreed on a single CASAL assessment model, structurally similar to that presented in WG-FSA-09/28.

5.123 Likelihood profiles for the model (Appendix L, Figure 13) demonstrated that catch-at-length data from the early fleet, tag data from 2003 and the survey abundance index were relatively uninformative. Tag data from 2004 onwards and the catch-at-age data were highly informative. Good fits were achieved, with the exception of fits to catch-at-age in the 2009 season. Tag fits have improved considerably compared to those in the 2007 assessment model (SC-CAMLR-XXVI, Annex 5, Appendix J).

5.124 There are several possible explanations for the lack of fit to the 2009 catch-at-age data. Either recruitment (to the 2001 cohort) has been exceptionally high, or sampling from the fishery has not been representative, or the behaviour of the fishery has changed. The Working Group agreed that distinguishing between these hypotheses was difficult at the moment but will become clearer when the 2001 cohort has fully recruited to the fishery in one or two years' time.

5.125 The Working Group therefore considered two plausible scenarios for future recruitment in projections. The first assumes that future recruitment will be similar to the entire time series of past recruitment, and uses lognormal mean recruitment (CV 0.59) for the projections. The second assumes that future recruitment will be similar to the recent historically estimated recruitment, and uses the lognormal empirical time series of recruitments from 1991–2001 for the projections. This latter recruit series had both a lower overall recruitment level and lower variance (CV 0.56) than the former because of the removal of the very large 1990 cohort from the series.

5.126 The calculated yields that satisfy the CCAMLR decision rules for these two scenarios were 3 950 and 2 750 tonnes respectively.

Management advice

5.127 Given the uncertainty in recent recruitment to the stock, and its implications on future recruitment levels, the Working Group recommended that the catch limit should be set towards the lower end of the range 2 750–3 950 tonnes.

Dissostichus spp. South Sandwich Islands (Subarea 48.4)

5.128 A tagging experiment has been conducted in the Northern Area of Subarea 48.4 over the last four years. This experiment was extended to the Southern Area of Subarea 48.4 in the 2008/09 fishing season.

5.129 The catch limits for *D. eleginoides* and *D. mawsoni* in the Northern Area of Subarea 48.4 in the 2008/09 season were 75 and 0 tonnes (except for scientific purposes) respectively, with recorded catches of 59 and 0 tonnes respectively. The northern fishery was closed when the macrourid by-catch limit was reached. The catch limit for *Dissostichus* spp. in the Southern Area of Subarea 48.4 in the 2008/09 season was 75 tonnes, with a recorded catch of 74 tonnes. The Fishery Report for *D. eleginoides* in Subarea 48.4 is contained in Appendix M.

D. eleginoides in the Northern Area

5.130 The Working Group agreed on a single CASAL assessment model for *D. eleginoides* in the Northern Area of Subarea 48.4. This was based on the catch-at-length based CASAL model developed in 2007 for Subarea 48.3 (Hillary et al., 2006) and utilised catch-at-length and tag data. Good fits were achieved even with the relatively low levels of available data. The model confirmed that the fishery has been dominated by a single (1992) cohort, and that another cohort (2001) is just entering the fishery.

5.131 Stock status and the long-term yield for *D. eleginoides* in the Northern Area of Subarea 48.4 were calculated using MCMC samples for the assessment model. Long-term yield for the Northern Area that satisfies the CCAMLR decision rules was 41 tonnes, assuming lognormal mean recruitment (CV 1.07).

5.132 The Working Group commented on the success of the four-year experiment in Subarea 48.4 and attributed this success to the following key factors:

(i) the experiment was well designed and monitored closely;

(ii) vessels undertaking the experiment had committed to it over the whole period of the experiment, allowing for consistency and high standards in the execution of the research plan;

(iii) tags were released randomly throughout the area, with a wide range of tagged toothfish sizes.

5.133 The Working Group expressed its thanks to the vessels that participated in the Subarea 48.4 four-year experiment for their dedicated and high-quality work, essential to the success of the experiment.

Dissostichus spp. in the Southern Area

5.134 A report of the first year of the experiment in the Southern Area was given in WG-FSA-09/18. *Dissostichus mawsoni* were found throughout the area, and *D. eleginoides* only in the very northernmost part of the area.

5.135 Following comparison of CPUE and fishable area between the Northern and Southern Areas of Subarea 48.4, the Working Group concluded that a catch of 75 tonnes, taken over the three years of the experiment, was unlikely to deplete the stock in the Southern Area to the point where it would require recovery.

Management advice

5.136 The Working Group recommended that the catch limit for *D. eleginoides* in the Northern Area of Subarea 48.4 should be set at 41 tonnes.

5.137 The Working Group recommended that the catch limit for *Dissostichus* spp. in the Southern Area of Subarea 48.4 should remain at 75 tonnes, and that the experiment should be extended for a further two years.

5.138 The Working Group recommended that Conservation Measure 41-03 should be updated during the two-year tagging experiment to incorporate a threshold catch of 150 kg of *Macrourus* spp. above which the move-on rule would be triggered, and that it should be reviewed on an annual basis. The existing move-on rules for rajids in the Southern Area of Subarea 48.4 should be retained.

Dissostichus eleginoides Kerguelen Islands (Division 58.5.1)

5.139 The Fishery Report for *D. eleginoides* in Division 58.5.1 is contained in Appendix N.

5.140 The catch of *D. eleginoides* reported for this division to 31 August 2009 was 3 108 tonnes. Only longlining is currently permitted in the fishery. The estimated IUU catch for the 2008/09 season was zero inside the French EEZ. Some IUU fishing may have occurred outside the EEZ as reported in WG-FSA-08/10 Rev. 2.

5.141 The CPUE standardisation for Division 58.5.1 was not updated by the Working Group.

Management advice

5.142 The Working Group encouraged the estimation of biological parameters for *D. eleginoides* in Division 58.5.1 and the development of a stock assessment for this area. It also encouraged cooperative work in the intersessional period between France and Australia on analyses of catch and effort data and other data that could be used to progress understanding of fish stocks and fishery dynamics for Divisions 58.5.1 and 58.5.2 and Subarea 58.6. The Working Group encouraged France to continue its tagging program in Division 58.5.1.

5.143 The Working Group recommended that avoidance of fishing in zones of specific high rates of by-catch should also be considered.

5.144 No new information was available on the state of fish stocks in Division 58.5.1 outside areas of national jurisdiction. The Working Group therefore recommended that the prohibition of directed fishing for *D. eleginoides*, described in Conservation Measure 32-13, remain in force.

5.145 The Working Group noted that France had made significant progress in mitigating by-catch, including area/season closures (SC-CAMLR-XXVI, Annex 6, paragraph II.23). It noted that the CPUE analysis would probably be robust to these changes so long as detailed haul-by-haul data continued to be available.

Dissostichus eleginoides Heard Island (Division 58.5.2)

5.146 The Fishery Report for *D. eleginoides* in Division 58.5.2 is contained in Appendix O.

5.147 The catch limit of *D. eleginoides* in Division 58.5.2 west of 79°20'E for the 2008/09 seasons was 2 500 tonnes (Conservation Measure 41-08) for the period from 1 December 2008 to 30 November 2009. The catch of *D. eleginoides* reported for this division to 11 October 2009 was 2 177 tonnes. Of this, 1 000 tonnes was taken by trawl, 1 164 tonnes by longline and the remainder by pot (<1%). The estimated IUU catch for the season was 0 tonnes.

5.148 The Working Group endorsed the scenario used in the preliminary assessment presented in WG-FSA-09/20, however, it requested that the model should assume catches to the end of the 2008/09 season. Including these catches, allocated in proportion to expected catches in sub-fisheries to the end of 2008/09, resulted in a minor alteration to the estimated B_0 and status relative to that shown in WG-FSA-09/20.

5.149 Long-term annual yield under the revised scenario was estimated to be 2 550 tonnes.

5.150 The Working Group noted that under this scenario, as presented in WG-FSA-09/20, the median SSB appears to remain below the target level for several years, before returning to the 0.5 SSB at the end of the 35-year projection period. The Working Group recalled that the stock is currently estimated to be above the target level, and that while a stock is likely to fluctuate around the target level through natural variability, this indicated a need for continued scrutiny of this stock into the future.

5.151 The Working Group noted the program of future work, including plans to:

(i) continue regular surveys across Division 58.5.2;

(ii) re-estimate the von Bertalanffy growth function using the additional length-age data obtained in 2008 and 2009;

(iii) investigate simplification of the spatial structuring of fishing selectivity functions;

(iv) use aged recaptures and catch-at-age data to estimate natural mortality, *M*, either independently of CASAL or within the current CASAL estimation framework,

(v) investigate whether the model could be developed as a two-sex model;

(vi) investigate improvements in the model structure that can be made to allow the inclusion of tagging data to assist the estimation of parameters in the model, besides *M* given in (iv) above, using CASAL;

in order to provide it with some confidence that significant progress in understanding key uncertainties, common to all toothfish assessments, that occur for this division before it is forecast that stock trajectory of SSB reaches the target level.

Management advice

5.152 The Working Group recommended that the catch limit for *D. eleginoides* in Division 58.5.2 west of 79°20'E should be 2 550 tonnes for the 2009/10 fishing season.

Dissostichus eleginoides Crozet Islands (Subarea 58.6)

5.153 The Fishery Report for *D. eleginoides* in Subarea 58.6 (French EEZ) is contained in Appendix P.

5.154 The catch of *D. eleginoides* reported for this subarea to October 2009 was 746 tonnes. Only longlining is currently permitted in the fishery. The estimated IUU catch for the 2008/09 season was zero inside Subarea 58.6 as reported in WG-FSA-09/5 Rev. 1.

5.155 The CPUE series for this fishery was not updated by the Working Group.

Management advice

5.156 The Working Group encouraged the estimation of biological parameters for *D. eleginoides* in Subarea 58.6 (French EEZ), and the development of a stock assessment for this area. The Working Group encouraged France to continue its tagging program in Subarea 58.6.

5.157 The Working Group recommended that avoidance of zones of high by-catch abundance should also be considered.

5.158 No new information was available on the state of fish stocks in Subarea 58.6 outside areas of national jurisdiction. The Working Group therefore recommended that the prohibition of directed fishing for *D. eleginoides*, described in Conservation Measure 32-11, remain in force.

5.159 The Working Group noted that France had made significant progress in mitigating by-catch, including area/season closures (SC-CAMLR-XXVI, Annex 6, paragraph II.23). It noted that the CPUE analysis would probably be robust to these changes so long as detailed haul-by-haul data continued to be available.

Dissostichus eleginoides Prince Edward and Marion Islands
(Subareas 58.6 and 58.7)

5.160 The Fishery Report for *D. eleginoides* in Subareas 58.6 and 58.7 inside the South African EEZ is contained in Appendix Q.

5.161 The catch limit of *D. eleginoides* in the South African EEZ for the 2008/09 season was 450 tonnes for the period from 1 December 2008 to 30 November 2009. The catch reported for Subareas 58.6 and 58.7 as of 5 October 2009 was 4 tonnes, all of which was taken by longlines. There was no evidence of IUU catch in 2008/09.

5.162 The CPUE series was not updated by the Working Group in 2009.

Management advice for *D. eleginoides* at Prince Edward and Marion Islands (Subareas 58.6 and 58.7) inside the EEZ

5.163 Dr Leslie noted that South Africa is considering the adoption of an Operational Management Procedure (SC-CAMLR-XXVII, Annex 7, paragraphs 6.1 to 6.3) approach as a basis for provision of management advice, and a catch limit for 2010 has not been set as yet, but it is likely to be in the range of 250–450 tonnes. Details are provided in Appendix Q.

5.164 In 2005 the Scientific Committee noted that the advice on the appropriate levels of future catch provided in WG-FSA-05/58 (see also WG-FSA-06/58 and 07/34 Rev. 1) was not based on the CCAMLR decision rules. Therefore, the Working Group was unable to provide management advice for the fishery in the South African EEZ at the Prince Edward Islands. The Working Group recommended that CCAMLR decision rules also be used in estimating yields for this fishery. It noted that an Operational Management Procedure is proposed to address the concerns over the sensitivity of the ASPM to weightings used for different data sources and the estimation of recruitment levels for forward projections.

Management advice for *D. eleginoides* at Prince Edward Islands (Subareas 58.6 and 58.7 and Division 58.4.4) outside the EEZ

5.165 No new information was available on the state of fish stocks in Subareas 58.6 and 58.7 and Division 58.4.4 outside areas of national jurisdiction. The Working Group therefore recommended that the prohibition of directed fishing for *D. eleginoides* , described in Conservation Measures 32-10, 32-11 and 32-12, remain in force.

Champsocephalus gunnari South Georgia (Subarea 48.3)

5.166 The Fishery Report for *C. gunnari* at South Georgia (Subarea 48.3) is contained in Appendix R.

5.167 In the 2008/09 fishing season the catch limit set for *C. gunnari* in Subarea 48.3 was 3 834 tonnes. During the 2008/09 season the fishery caught 1 837 tonnes by the end of October 2009.

5.168 In January 2009 the UK undertook a random stratified bottom trawl survey of the South Georgia and Shag Rocks shelves (WG-FSA-09/9). The survey employed the same trawl gear and survey design as previous UK surveys in Subarea 48.3.

5.169 The Working Group agreed that a short-term assessment should be implemented in the GYM, using the one-sided bootstrap lower 95% confidence bound of total biomass from the 2009 survey.

5.170 The fixed parameters for the assessment remained unchanged from 2008.

Management advice

5.171 The Working Group recommended that the catch limit for *C. gunnari* should be set at 1 548 tonnes in 2009/10 and 949 tonnes in 2010/11 based on the outcome of the short-term assessment.

5.172 The Working Group recommended that the season start date be altered to 1 December to reflect the start dates of other CCAMLR fishing seasons.

Champsocephalus gunnari Heard Island (Division 58.5.2)

5.173 The Fishery Report for *C. gunnari* in Division 58.5.2 is contained in Appendix S.

5.174 The catch limit of *C. gunnari* in Division 58.5.2 for the 2008/09 season was 102 tonnes for the period from 1 December 2008 to 30 November 2009. The catch reported for this division as of 5 October 2008 was 99 tonnes.

5.175 A large 3+ year class, probably the result of spawning by the 4+ year class dominant in 2006, was observed to dominate the population in the survey undertaken in April 2009.

5.176 The short-term assessment was implemented in the GYM, using the one-sided bootstrap lower 95% confidence bound of total biomass from the 2009 survey. All other parameters were the same as in previous years.

5.177 The Working Group recalled that the current strategy of spreading catch over two years, while meeting the escapement rule, was to provide for two years of spawning (SC-CAMLR-XVI, Annex 5). The Working Group noted that the 3+ cohort had been reproductively mature for one year and that following another year, it was likely that the cohort would disappear (SC-CAMLR-XX, Annex 5, Appendix D, Figure 1). Further, the Working Group noted that due to the large increase in biomass of this cohort in the recent survey, relative to the 2008 survey, suggests that last year's assessment is likely to have underestimated the precautionary yield from this cohort in 2008/09. Therefore, the escapement of these fish is likely to have been greater than 75%.

Management advice

5.178 The Working Group agreed that a strategy for fishing on the current 3+ year class could be similar to that applied in the 2005/06 season (SC-CAMLR-XXIII, Annex 5, Appendix M), allowing the catch to be taken in one year (2009/10) with the expectation of no exploitation of that cohort in the following year (2010/11). The Working Group recalled that, due to the strong three-year cycle evident in the icefish population in Division 58.5.2, it is unlikely that there will be another sizeable cohort available to the fishery until after 2010/11. When estimated in a scenario based on all fishing in one year and no catch in the second year, the yield estimate for 2009/10 is 1 658 tonnes, with a fishing mortality of 0.288.

Assessment and management advice for other fisheries

Antarctic Peninsula (Subarea 48.1) and South Orkney Islands (Subarea 48.2)

5.179 The Working Group noted that WG-FSA-09/31 reported the recovery of *Notothenia rossii* populations in Potter Cover, South Shetland Islands, to levels close to that of the early 1980s, however, it cautioned that extrapolation of these findings to a subarea scale was premature.

5.180 On the basis of the results of a multi-species research survey in Subarea 48.2 (WG-FSA-09/19), the Working Group agreed that the populations of previously exploited species, including *C. gunnari* and *N. rossii*, show little sign of recovery despite the closure of the fishery after the 1989/90 season (see paragraph 3.41).

Management advice

5.181 The Working Group recommended that the existing Conservation Measures 32-02 and 32-04 on the prohibition of finfishing in Subareas 48.1 and 48.2 respectively, remain in force.

Crabs (*Paralomis* spp. Area 48)

5.182 Crabs were not exploited in the 2008/09 season. Russia notified the Commission of its intention to fish for crabs in Subareas 48.2, 48.3 and 48.4 in 2009/10 (CCAMLR-XXVIII/23) in accordance with the requirements of Conservation Measures 52-01, 52-02 and 52-03.

Management advice

5.183 The Working Group recommended that Conservation Measures 52-01, 52-02 and 52-03 on crabs remain in force, noting the recommended changes to the experimental harvest block regime detailed in paragraph 10.33.

Squid (*Martialia hyadesi*) (Subarea 48.3)

5.184 Squid were not exploited in 2008/09 and no proposals for fisheries of squid were received for the 2009/10 season.

Management advice

5.185 The Working Group recommended that Conservation Measure 61-01 remain in force. Noting that this advice had not changed for a number of years, the Working Group agreed to remove this item from its agenda until such time as a research notification was received.

FISH AND INVERTEBRATE BY-CATCH

6.1 The Working Group discussed the following:

(i) review of by-catch in trawl and longline fisheries in the CAMLR Convention Area;

(ii) review of the 2008/09 Year-of-the-Skate in new and exploratory fisheries, including:

(a) numbers of skates tagged and tag rates
(b) biological data collection rates
(c) continuation of Year-of-the-Skate methods;

(iii) by-catch mitigation:

(a) review of move-on rule in Subarea 48.4;

(iv) identification guides for benthic invertebrate by-catch.

By-catch rates in trawl fisheries

6.2 By-catch in trawl fisheries for icefish (Subarea 48.3 and Division 58.5.2) and toothfish (Division 58.5.2) derived from fine-scale (C2) data was similar to levels observed in 2007/08. The by-catch in the trawl fishery for *C. gunnari* in Subarea 48.3 was negligible (<0.5% of target species). The Working Group noted that the latter fishery is still open and additional low levels of by-catch are possible before the end of the season. In Division 58.5.2 trawl fisheries, the by-catch of *Channichthys rhinoceratus* was 47 tonnes (31% of the catch limit). The catch for all other by-catch species was less than 12% of their catch limit in Division 58.5.2.

By-catch rates in longline fisheries

6.3 Fine-scale (C2) data detailing total removals of by-catch species reported from longline fisheries within the CAMLR Convention Area during the 2008/09 season are shown in Table 13.

Rajids

6.4 Reported rajid by-catch (as a percentage of *Dissostichus* spp. catch) in longline fisheries within the Convention Area in 2008/09 was low (<2% *Dissostichus* spp.), except in those areas where a high proportion of rajids caught are retained and processed (French EEZs: Division 58.5.1 and Subarea 58.6, which constituted 9% and 6% of *Dissostichus* spp. respectively) (Table 13). Rajid catches did not approach the limits for these species in any subarea.

6.5 During the 2008/09 season, numbers of rajids caught (i.e. those retained or discarded) were slightly greater in a number of subareas compared with numbers caught in the 2007/08 season (Table 14). The Working Group considered that this higher catch is most likely to be a result of changes to guidelines for handling rajid by-catch and the associated reporting requirements implemented throughout the 2008/09 Year-of-the-Skate (see paragraph 6.10). In Division 58.5.2, higher numbers of released rajids in 2008/09 were also likely to result partly from the inclusion of an additional longline vessel in the fishery, in which previously only one longline vessel and one trawl vessel have operated. As in the 2007/08 season, very few skate were caught in Subarea 48.6, Subareas 58.6 and 58.7 South African EEZ, Division 58.4.1 and Division 58.4.2 during the 2008/09 season.

Macrourids

6.6 By-catch rates for macrourids (as a percentage of *Dissostichus* spp. catch) for the 2008/09 fishing season ranged from 1.6 to 22.8%. By-catch limits were reached in one Subarea 48.4 (Northern Area), resulting in the closure of the fishery for toothfish in the Northern Area on 18 May 2009 at a time when 79% of the catch limit of toothfish had been taken. The highest catch rates (as a percentage of *Dissostichus* spp.) were in the French EEZs (Division 58.5.1 and Subarea 58.6) and in Subarea 48.4.

6.7 Overall levels of macrourid by-catch in longline fisheries (as a percentage of *Dissostichus* spp. catch) were broadly similar to those observed in 2007/08. Two subareas (48.3 and 88.2) reached greater than 50% of their by-catch limits for macrourids. The Working Group noted that the higher catches in Subarea 88.2 might be a result of more fishing on the slope and shelf than in previous years.

Other species

6.8 By-catch of other species was generally low (<3% *Dissostichus* spp.). The 33 tonnes attributed to other species in Subarea 48.3 was largely *Antimora rostrata*. Other species comprised 10% of the toothfish catch in Subarea 58.6 and also comprised mainly *A. rostrata*.

CCAMLR Year-of-the-Skate

6.9 During CCAMLR-XXVII (CCAMLR-XXVII, paragraph 4.55), the Commission recommended that during the Year-of-the-Skate:

(i) all skates should be brought on board or alongside the hauler to be correctly identified, scanned for tags and for their condition to be assessed;

(ii) all skates that are likely to survive if released (condition 3 or 4) should be released by cutting the snood as close to the hook as possible or cutting the snood and removing the hook from the skate, providing this does not further injure the skate;

(iii) all skates which are dead or with life-threatening injuries (condition 1 or 2 in the logbook) should be retained by the vessels;

(iv) skates released alive should be doubled-tagged (i.e. two tags per skate) at a rate of one skate in every five skates caught in exploratory fisheries, up to a maximum of 500 skates per vessel;

(v) tagged skates should be identified to species, measured before they are released and that, where possible, tagging experiments be undertaken to compare different tag types and estimate tag-shedding rates;

(vi) the tagging program will be coordinated by the Secretariat, which will be the repository for skate tagging kits;

(vii) when skates are caught on a line, they should be randomly sampled by observers at a rate of three skates per thousand hooks for the purpose of collecting biological measurements;

(viii) skates should not be sacrificed for biological sampling, and female maturity stage should only be recorded if the skate is dead or has sustained life-threatening injuries (conditions 1 and 2);

(ix) all live skates which are part of the biological sampling, which have not sustained life-threatening injuries, should be handled with care and released after biological information has been recorded, if they are still suitable for release (i.e. still in condition 3 or 4).

6.10 Of these recommendations, (i) and (iii) may have contributed to increases in numbers of skate caught (discarded or retained, see data map in CCAMLR-XXVI/BG/17) during 2008/09, as previously skates in condition 2 (i.e. with life-threatening injuries) might have been cut from the line and included in numbers released in fine-scale (C2) data.

6.11 Discharge of offal is not permitted in areas south of 60°S (Conservation Measure 26-01) or in other new and exploratory fisheries (Conservation Measures 41-04 and 41-11). However, the Working Group noted that some skates have been reported as discarded for Divisions 58.4.3a and 58.4.3b and Subareas 88.1 and 88.2 in the 2008/09 season. This indicates that further clarification is needed for vessels with respect to the fate of skates caught in different conditions and the corresponding reporting requirements.

6.12 The Working Group noted that this could be achieved through provision of a one-page laminated guide for vessel crew clarifying which skates should be retained/discarded or released along with corresponding reporting guidelines and recommended this be developed by the Secretariat prior to the 2009/10 season. The Working Group also recommended that the Scientific Committee remind Members to ensure that their vessels are aware of the appropriate fields in which to record data on skates caught in the different conditions, and are aware of the prohibition of discharging offal (discarding) in new and exploratory fisheries.

6.13 In order to explore whether skate tag rates had been met within new and exploratory fisheries, fine-scale (C2) data for numbers of skate caught were used to generate total numbers of skate hauled (i.e. combining numbers retained, discarded and released) from which a tag rate could be estimated using scientific observer data on numbers of skates tagged. Tables 14(a) and (b) detail these data for both the 2007/08 and 2008/09 seasons to explore whether improvements to tag rates for skates had been achieved through implementation of the Year-of-the-Skate.

6.14 In new and exploratory fisheries, rates of skate tagging increased in Divisions 58.4.3a and 58.4.3b and in Subareas 88.1 and 88.2 where the target tagging rate of 20% of skates caught was exceeded. Tagging rates were also higher in 2008/09 when compared with 2007/08 in a number of other subareas, including Subareas 48.3 and 48.4 (Northern Area) and Division 58.5.2.

6.15 Tag recaptures did not increase in 2008/09 relative to 2007/08; the Working Group noted that increases in tag returns might be expected in forthcoming years.

6.16 The Working Group also explored whether tag rates had been consistent between all vessels operating within new and exploratory fisheries; details are given in Table 15. For those vessels which had reported rajid by-catch in these areas, most vessels met or exceeded the required tagging rate. However, in Division 58.4.3b one vessel caught >400 skates, but no skates were reported as tagged. In Division 58.4.3a another vessel caught >600 skates but the tagging rate was 5% of skates caught.

6.17 The Working Group requested that the Scientific Committee seek advice from Members on reasons for the low tagging rates observed or specific difficulties experienced with implementing the tagging requirements in new and exploratory fisheries under the relevant conservation measures. In order to avoid confusion with interpretation of the

required tagging rate for skates, the Working Group also recommended that the relevant conservation measures be amended to 'at least one skate per five skates caught (including those released alive)'.

6.18 The Working Group noted that the use of T-bar tags for tagging skates during the Year-of-the-Skate appears to have been successful.

6.19 Observers are required to record the condition of skates caught during their standard observation periods under the following options in the L5 form: discarded dead, released in poor health, released in average health, released in good health, released in unknown condition, released but predated on, released with tags, retained with tags and retained without tags. This fine-scale level of fate data is expected by the Working Group to be used in future assessments of skate populations in order to infer potential survivorship of released skates. A summary of these data collected by observers across all subareas is provided in Table 16(a) and in Table 16(b) the number of skates recorded in each field is given as a proportion of all skates observed.

6.20 The Working Group noted that these data illustrate the variation among subareas in proportions of skates released by condition and the difficulties in assessing skate condition during observations and agreed to review condition categories for skates at WG-FSA in 2010. These data also highlight potential errors in reporting skate discards in subareas where this activity is prohibited.

6.21 In 2008 the Scientific Committee recommended that WG-FSA review the required biological sampling rate for skates during the Year-of-the-Skate in 2009. Numbers of skates measured for length and numbers of skates sexed were collated by subarea from observer data reported in Table 7 of WG-IMAF-09/4 Rev. 2 and Table 5 of WG-FSA-08/5 Rev. 1. Numbers of skates measured or sexed increased within Subareas 88.1 and 88.2 (combined) from 281 and 311 in 2007/08 to 1 076 and 1 111 in 2008/09 respectively, representing an almost four-fold increase in sampling. However, across new and exploratory fisheries within Subarea 58.4, numbers of biological measurements taken on skates were lower in 2008/09 than those collected in 2007/08.

6.22 The Working Group recommended that in order to determine whether the sampling rate of three skates per thousand hooks had been adhered to, analyses of haul-by-haul data should be carried out intersessionally, taking into account the numbers of skates released in good health which could not contribute to the numbers available for biological sampling. The Working Group agreed to review the sample rate next year.

6.23 The Working Group agreed that the introduction of the Year-of-the-Skate in 2008/09 had largely been successful and recognised that in order for the full benefits of its implementation to be realised, tagging and sampling requirements should be continued for a further year.

6.24 The Working Group therefore recommended to the Scientific Committee that the Year-of-the-Skate protocols be continued for the 2009/10 season at least, in order to allow for sufficient data to be collected for preliminary assessments to be made in the future.

6.25 In order to clarify skate by-catch handling and reporting requirements in different subareas and fisheries, the Working Group recommended that a slight revision be made to the Year-of-the-Skate guidelines (CCAMLR-XXVII, paragraph 4.55(iii)), as follows:

> 'all skates which are dead or with life-threatening injuries (condition 1 or 2 in the logbook) should be retained by the vessels fishing in areas where discharge of offal is not allowed, but may be discarded in other subareas.'

Skate biology

6.26 WG-FSA-09/43 presented new information on the ecology of three species of rajid, *Bathyraja eatonii, B. irrasa* and *B. murrayi* which are widely distributed over the Kerguelen Plateau and are commonly taken as by-catch in the longline and trawl fisheries operating in the region. Different spatial and bathymetric distributions for the three species were observed. Analysis of CPUE data from Division 58.5.2 showed that there was currently no evidence of depletion of rajids. Current CCAMLR conservation measures and the establishment of marine reserves in Division 58.5.2 appear to provide effective protection for rajid species. The authors recommended ongoing monitoring of by-catch levels and further research on the life-history parameters of these species.

6.27 The Working Group congratulated Australia and France on their work and further encouraged such collaborative work to be conducted in the Kerguelen Plateau region.

Mitigation measures

Move-on rule in Subarea 48.4

6.28 The Working Group reviewed the current move-on rule for by-catch species in the Southern Area of Subarea 48.4 (Conservation Measure 41-03) (SC-CAMLR-XXVII, paragraph 4.198) which currently triggers a move-on rule if the catch of skates and rays exceeds 5% of the catch of *Dissostichus* spp. in any one haul or set, or if the catch of *Macrourus* spp. exceeds 16% of the catch of *Dissostichus* spp. in any one haul or set.

6.29 The Working Group noted that the move-on rule was triggered 52 times from a total of 106 (49%) hauls made. It was noted that the move-on rule was frequently triggered when catches of *Dissostichus* spp. were very low, i.e. <3 fish.

6.30 The Working Group agreed that the high frequency with which the move-on rule was triggered made it difficult to tag sufficient numbers of toothfish in some areas and had the potential to compromise the experimental design and put unnecessary constraints on the vessels operating in the fishery. The Working Group agreed that a threshold level of 150 kg of *Macrourus* spp., above which the move-on rule would be triggered, was precautionary and would reduce the high frequency with which the move-on rule is triggered. Application of a 150 kg threshold level of *Macrourus* spp. in 2008/09 would have reduced the frequency of the by-catch trigger from 49% to 26% of hauls.

6.31 The Working Group recommended that Conservation Measure 41-03 should be updated during the two-year tagging experiment to incorporate a threshold catch of 150 kg of *Macrourus* spp. above which the move-on rule would be triggered, and that this should be reviewed on an annual basis. The existing move-on rules for rajids in the Southern Area of Subarea 48.4 should be retained.

Identification guides for benthic invertebrate by-catch

6.32 The Working Group noted the 'Field identification guide to Heard Island and McDonald Islands (HIMI) benthic invertebrates: a guide for scientific observers aboard fishing vessels' (SC-CAMLR-XXVIII/BG/12) and congratulated the authors, noting that the guide had been useful for the identification of benthic invertebrates in other areas and encouraged other Members to develop similar guides for other regions of the Convention Area.

INCIDENTAL MORTALITY OF MAMMALS AND SEABIRDS ASSOCIATED WITH FISHING (WG-IMAF)

7.1 The Co-conveners of WG-IMAF presented a summary of items of interest to WG-FSA. In response, the Working Group discussed the following items.

Fishing methods in use in the Convention Area

7.2 The Working Group queried whether seabird entanglement in paravanes is a new issue or if entanglements have been observed in the past, as paravanes have been commonly used since the prohibition of net monitoring cables (net sonde cables). The WG-IMAF Co-conveners noted that the historic level of entanglements in paravanes was unclear, however, one seabird was observed entangled in a paravane in 2008/09 (Annex 7, paragraph 3.14). Accordingly, WG-IMAF has requested further information from observers on the use of, and descriptions of, paravanes in the Convention Area (Annex 7, paragraph 7.8) in order to better understand the risk to seabirds from paravanes.

7.3 The Working Group noted the continued concern regarding fishing practices which result in the discarding of hooks in offal or by-catch, given that a high number of hooks were found in the nests of wandering albatrosses at Bird Island (Annex 7, paragraphs 3.34, 3.35 and 13.7). Noting the potential link between increased frequency of hooks in wandering albatross nests and the use of trotlines within their foraging range during chick-rearing, the Working Group sought clarification about the method used to remove by-catch fish from the trotlines used in the Convention Area. Japan noted that the cutting of snoods to remove by-catch from trotlines before bringing by-catch on board does not occur on its vessels in the Convention Area.

Streamlining the work of the Scientific Committee

7.4 The Working Group noted that WG-IMAF recommended that it now only needs to meet on a biennial basis. The Working Group queried the implications for WG-FSA of WG-IMAF meeting biennially in future. The Working Group agreed that those items of the WG-IMAF agenda where there was a requirement to provide advice on an annual basis, i.e. summary of incidental mortality (Items 3.1 and 3.2), implementation of Conservation Measures (Item 3.3) and notifications for new and exploratory fisheries (Item 10), have become largely mechanistic and could readily be completed by WG-FSA with support from the Secretariat (Annex 7, paragraph 14.7). The Working Group noted that other core WG-IMAF tasks would be addressed by that Working Group on a biennial basis.

7.5 On the basis of this advice, and noting that the small amount of additional work for WG-FSA would occur in those years when WG-FSA was not conducting assessments, the Working Group endorsed the recommendation to the Scientific Committee that WG-IMAF meet biennially in future and that its next meeting should be in October 2011.

EVALUATION OF THREATS ARISING FROM IUU ACTIVITIES

8.1 The Working Group reviewed the catch history of *Dissostichus* spp. taken by IUU fishing in the Convention Area (paragraphs 3.18 to 3.24, Table 3). This time series had been updated using estimates reported in WG-FSA-09/5 Rev. 1.

8.2 The Working Group noted that the number of IUU fishing vessels observed in the Convention Area had decreased from nine in 2007/08 to six in 2008/09. The level of surveillance coverage by Members, particularly in respect to Division 58.4.3b, appears to be at similar levels to previous years and may have increased in Division 58.4.1 (WG-FSA-09/5 Rev. 1).

8.3 The Working Group noted that information on IUU activities had been received for six vessels fishing in the Convention Area. All six were assumed to be fishing using gillnets.

8.4 Some data regarding catch in gillnets was provided for the first time. This resulted from the hauling of an abandoned gillnet, one boarded and inspected gillnet vessel and interviews of two IUU vessel captains (paragraph 3.20). This information was used to calculate preliminary catch rates, trip duration etc. (Table 2), noting there is very high uncertainty regarding catch rates and IUU fishery operations using gillnets.

8.5 The Working Group agreed that the provided information was an improvement over information used to calculate estimates in past years, however, it recognised that estimates made using this information result in highly conservative estimates and in reality IUU catches using this method are likely to be much greater.

8.6 The Working Group agreed that estimates on IUU fishing (Table 3) made during the last few years when gillnets were known to be utilised in the Convention Area should be recalculated using data on catch rates, net fishing duration etc., acquired this year and updated in the future as new data becomes available.

8.7 Impacts of using gillnets are unknown. Gillnetting is more indiscriminate than longlining and gillnets have the ability to fish for long durations and, if abandoned, may continue to catch fish for years. In addition, gillnets potentially have large by-catches. The Working Group agreed that the use of gillnets is an abhorrent fishing method and should be eliminated from the Convention Area.

BIOLOGY, ECOLOGY AND DEMOGRAPHY OF TARGET AND BY-CATCH SPECIES

9.1 A full account of section 9 of the report can be found in Appendix D.

Papers submitted to the Working Group

9.2 Seventeen papers containing information on the biology, ecology and demography of target and by-catch species in the fishery were submitted to the Working Group (Appendix D, section 9.1) (WG-FSA-09/9, 09/10, 09/11, 09/13, 09/15, 09/18, 09/19, 09/21, 09/24, 09/25, 09/26, 09/27, 09/29, 09/32, 09/37, 09/43, 09/P1).

Species profiles

9.3 WG-FSA agreed in 2005 to produce a new set of species profiles for *D. eleginoides*, *D. mawsoni* and *C. gunnari* (Appendix D, section 9.2). While work on *D. mawsoni* and *C. gunnari* was completed in 2006 and 2007, work on *D. eleginoides* had not been completed by October 2009. Drs Welsford, Belchier and Hanchet agreed to complete the species profile of *D. eleginoides* by October 2010. The two existing species profiles on *D. mawsoni* and *C. gunnari* will undergo revision in 2009/10.

CCAMLR Otolith Network

9.4 Considering the development of length-based assessment techniques for the fisheries of *C. gunnari* at South Georgia (Appendix D, section 9.3), the Working Group concluded that further work on the ageing of otoliths was considered unnecessary for use in these assessments.

9.5 In order to advance the work of CON, the Working Group recommended that an intersessional group should:

- prepare an inventory of those laboratories undertaking ageing of *Dissostichus* spp.
- foster an exchange of age-reading methods between laboratories
- establish a reference collection of otoliths of both species from all areas fished
- establish protocols of how otoliths are prepared for ageing and how annuli are identified.

In addition, it was requested that age determination based on otolith analyses of samples from *Dissostichus* spp. be included in the research plan as part of the notification for fishing in new and exploratory fisheries (Item 5.2).

9.6 The Working Group recommended that the Scientific Committee request Members to submit to the Secretariat an inventory of *Dissostichus* spp. otoliths collected from CCAMLR fisheries, indicating the number of otoliths collected and the number read by fishery, season and Flag State of the fishing vessel (see also paragraph 5.119).

9.7 Results of ageing and a detailed description of how ageing was conducted need to be submitted to the Working Group on a regular basis. Ageing data should be submitted to the Secretariat to help develop its database that will be used to store ageing data for use in assessments.

9.8 Quality control of the otolith ageing readings, including validation of ageing and cross-validation between laboratories, will be of great importance to ensure consistency in ageing *Dissostichus* spp. Close collaboration of CON with WG-SAM should be sought with respect to the development of efficient sampling schemes for otolith collection and subsampling for reading. Dr Belchier volunteered to establish an intersessional correspondence group to initiate the work outlined above.

CONSIDERATIONS OF ECOSYSTEM MANAGEMENT

Bottom fishing activities and VMEs

10.1 The Working Group recalled the Scientific Committee's discussions and agreements on approaches to avoid significant adverse impacts on VMEs (SC-CAMLR-XXI, paragraphs 4.159 to 4.171; SC-CAMLR-XXII, paragraphs 4.207 to 4.284) and Commission (CCAMLR-XXVI, paragraphs 5.9 to 5.20; CCAMLR-XXVII, paragraphs 5.4 to 5.30). It also noted the discussions this year by WG-SAM (Annex 6, paragraphs 4.7 to 4.19), WG-EMM (Annex 4, paragraphs 5.1 to 5.14) and the outcomes of WS-VME (Annex 10).

10.2 The Working Group noted that the Commission requires advice on the following:

(i) whether proposed bottom fishing activities would contribute to having significant adverse impacts on VMEs and whether proposed or additional mitigation measures would prevent such impacts (Conservation Measure 22-06, paragraph 8(ii));

(ii) Risk Areas arising from the implementation of Conservation Measure 22-07, and advice on proposed research and other activities in Risk Areas (Conservation Measure 22-07, paragraph 9);

(iii) the magnitude of the existing footprint of bottom fisheries covered by Conservation Measure 22-06 (CCAMLR-XXVII, paragraph 5.15);

(iv) notifications of VMEs (CCAMLR-XXVII, paragraph 5.16);

(v) known and anticipated impacts of bottom fishing activities covered by Conservation Measure 22-06 (CCAMLR-XXVII, paragraph 5.18(i));

(vi) available knowledge on VMEs, the potential for significant adverse impacts, risk assessments and potential for impacts arising from bottom fisheries, with such advice provided in a report akin to the Fishery Reports on 'Bottom Fisheries and Vulnerable Marine Ecosystems' (CCAMLR-XXVII, paragraph 5.18(ii));

(vii) a precautionary strategy that will avoid significant adverse impacts on VMEs until impact assessments are completed and long-term mitigation strategies are developed (CCAMLR-XXVII, paragraph 5.19);

(viii) results of simulations of different management approaches (CCAMLR-XXVII, paragraph 5.21);

(ix) mitigation measures and practices when evidence of VMEs is encountered, including outcomes of reviews of scientific observer data and vessel data and the results of the VME workshop (CCAMLR-XXVII, paragraph 5.22);

(x) scientific aspects of the implementation and operation of Conservation Measure 22-07 (CCAMLR-XXVII, paragraph 5.25).

10.3 The Working Group also noted that Conservation Measure 22-06 will be reviewed by the Commission this year (Conservation Measure 22-06, paragraph 16). In that respect, it noted the following elements of the conservation measure had scientific components that may require reviewing:

(i) assessment by the Scientific Committee on whether individual bottom fishing activities would contribute to having significant adverse impacts on VMEs, where such reviews will include consideration of preliminary assessments by Contracting Parties (Conservation Measure 22-06, paragraph 8);

(ii) information required for evaluating notifications of VMEs (Conservation Measure 22-06, paragraph 9);

(iii) advice by the Scientific Committee on the known and anticipated impacts of bottom fishing activities on VMEs, including recommending practices when evidence of a VME is encountered in the course of fishing operations (Conservation Measure 22-06, paragraph 11);

(iv) advice on where VMEs are known to occur or are likely to occur and on potential mitigation measures (Conservation Measure 22-06, paragraph 14).

Assessment of bottom fishing

10.4 The Working Group noted that the Commission requires advice with respect to Conservation Measure 22-06, paragraph 8:

(i) submissions of preliminary assessments by Contracting Parties
(ii) whether proposed bottom fishing activities would contribute to having significant adverse impacts on VMEs.

10.5 The Working Group reviewed the summarised assessments by Contracting Parties of known and anticipated impacts of proposed bottom fishing activities on VMEs as required by Conservation Measure 22-06 and described by the Secretariat in CCAMLR-XXVIII/18. Of nine Members submitting notifications for new and exploratory fisheries in 2009/10, only seven included the required assessments of proposed bottom fishing activities relative to VMEs. Two Members' notifications provided no preliminary assessments at all (Republic of Korea and Russia). The Secretariat received a preliminary assessment from Korea after the deadline in Conservation Measure 21-06; the Working Group did not consider this assessment. This is an improvement compared to the 5 of 11 submissions in 2008 (SC-CAMLR-XXVII, paragraph 4.276), but still poses challenges in the provision of comprehensive advice.

10.6 As part of its comments on the submitted assessments, the Working Group developed a report card approach to summarising the quality and quantity of information supplied in each assessment (Table 17).

10.7 The Working Group noted that the quality of information provided in accordance with the requirements of Conservation Measure 22-06 varied greatly among notifications. In some cases the pro forma was incomplete or contained minimal detail. For example, although fishing gear diagrams were typically provided, the estimated footprint of that gear type, and potential severity of impact within the footprint, were not addressed. Members providing detailed information interpreted the instructions differently; as a consequence it was difficult to extract and assemble consistent information across fisheries that could be used in an assessment of known and anticipated impacts.

10.8 The Working Group noted that notifications were provided in several languages, which limited its ability to evaluate the proposals without significant additional translation effort by the Secretariat. The Working Group requested that the Scientific Committee consider how this issue may be overcome in the future.

10.9 The Working Group further noted that no assessment was available for proposed pot fishing for crabs in Subarea 48.2, or for proposed pot fishing for toothfish in Subareas 88.1 and 88.2. The development of pot fishing for both fish and crabs may require further consideration of gear code definitions.

10.10 The Working Group noted that WG-SAM-09/P1 described an impact assessment framework to estimate the footprint and impact of bottom fishing activity for a fishery. The approach has been designed to facilitate standardised application by fisheries in different areas and employing different fishing gear types. To date, the framework has been tested in estimating impacts from some fleets utilising the autoline longline method. The Working Group agreed that acquiring the data for assessing the footprint and potential impacts on VME taxa by other bottom fishing methods, i.e. Spanish longlines, trotlines and pots, is a high priority.

10.11 The Working Group noted the comments on the use of this method by WG-SAM (Annex 6, paragraph 4.9) and the VME workshop (Annex 10, paragraph 4.3), and

commended the authors for further developing this method. It noted that it will be useful for WG-SAM to review how this method might best be applied under circumstances where VMEs may be locally concentrated within the area for which the footprint is being calculated, such as has been proposed for combining the method with the approach outlined in WG-FSA-09/42 (Annex 10, paragraph 4.4).

10.12 Consistent with SC-CAMLR-XXVII (paragraph 4.228) and the recommendations of the VME Workshop (Annex 10, paragraphs 4.3 to 4.5), the Working Group applied the WG-SAM-09/P1 framework, using historical effort data from the Secretariat databases, to estimate a cumulative historical footprint for all bottom longline fishing methods in areas where Conservation Measure 22-06 applies. Although specific assumptions regarding footprint width remain subject to great uncertainty (Annex 10, paragraph 4.3), the Working Group represented the upper and lower bounds of estimated footprint size by assuming footprint widths of 25 or 1 m per line respectively (as in SC-CAMLR-XXVII, paragraph 4.228), and noted that the validity of the 1 and 25 m estimates requires additional work and may vary among fishing methods. The results summarise the fishing effort by subarea and gear type (Table 18(a)), and provide an estimate of cumulative footprint size as a proportion of total fishable area within the bounds defined (Table 18(b)). The data in Table 18(a) do not yet include fishing with pot gear, historical bottom trawl, footprints from non-fishery (e.g. research) vessels, or from IUU fishing. The relative contribution from different longline method types to total estimated footprint in each subarea/division is shown in Figure 11. The Working Group noted that these results provide an indication of relative total footprint among areas, and that corresponding estimates of impact on VMEs will be subject to uncertainty, particularly in relation to locally concentrated VMEs, and will likely change as new data becomes available (SC-CAMLR-XXVII, Annex 7, paragraph 4.18).

10.13 The Working Group noted that the estimates in Table 18(b) are of total footprint, not total impact. The Working Group agreed that further consideration is needed of how these estimates might be used to assess whether proposed bottom fishing activities would contribute to having significant adverse impacts on VMEs.

10.14 The Working Group noted that because not all preliminary assessments were available, and proposed effort in standard units were not available for all preliminary assessments provided, fishery-scale estimates of the increase in footprint for proposed activities could not yet be determined. The Working Group noted that work conducted to date on bottom fishing activities at the fishery scale (with associated uncertainties) involves only retrospective analyses. The Working Group recognised that future work will need to take into account proposed fishing activities to avoid significant adverse impacts on VMEs when formulating advice to the Scientific Committee.

10.15 Data are available through the Secretariat to show the spatial distribution of bottom fishing gear for each subarea or division, and have been provided previously on the basis of total hooks deployed (SC-CAMLR-XXVII, Annex 5, Figure 7). The Working Group agreed that the appropriate measure of effort to index the footprint of bottom longline and pot gear is the total length of line deployed (Table 19(iii)) in each 0.25° latitude × 0.50° longitude pixel, noting that the exact area of impact will need to take account of the different interactions from the different gear types (paragraphs 10.19 to 10.23). The Working Group also agreed that the total cumulative line length deployed by gear type, SSRU or subdivision, should be extracted on an annual basis and utilised to inform the review of proposed bottom fishing activities

required under Conservation Measure 22-06. In an effort to automate this procedure in the future and adopt the appropriate measure of footprint, development of the code to generate these maps will be done intersessionally.

10.16 The Working Group recommended that the technical issues of creating a cumulative fishery-scale footprint map at a fine scale be resolved intersessionally to facilitate standardised estimation of cumulative footprint as required by CCAMLR-XXVII, paragraph 5.15, in map form. Higher-resolution representations of footprint and impact are likely to be more valuable than summaries at the scale of an entire subarea as in Table 18(b), as they may allow habitat-specific or depth-stratum specific estimates of footprint and impact.

10.17 The Working Group recommended that, as appropriate data become available to update the footprint assessments, Tables 18(a) and (b) and the footprint maps should be updated on an annual basis and provided as part of the 'Bottom Fisheries and VMEs' report (SC-CAMLR-XXVII, paragraph 4.243).

10.18 In summarising preliminary assessments, reviewing data, Risk Areas and notifications, the Working Group developed several tables, figures and summary data that would be useful in developing an annual report on 'Bottom Fisheries and VMEs'. However, because of the lack of information, and the need to synthesise information by fishery, these reports will be developed next year pending the provision of appropriate assessment information.

10.19 Given the lack of detail in notifications in accordance with Annex 22-06/A of Conservation Measure 22-06 (paragraph 10.7), the Working Group requested that the Scientific Committee reinforce to the Commission the need for this information to undertake its work. At present, it is difficult for the Working Group to review whether proposed fishing activities will contribute to significant adverse impacts on VMEs. The Working Group agreed that section 1.2 of Annex 22-06/A is essential information for the review. It also agreed that other information concerning deployment of the gear needs to be included to understand the differences between gears in the area that might be impacted. This is detailed in Table 19.

10.20 The Working Group considered whether the procedure in Annex 22-06/A could be simplified so that Members only need provide new and updated information in each notification. Table 19 is developed as a set of guidelines, which would result in only requiring information needed to update the notification for the proposed activities. The Working Group recommended that the Scientific Committee consider whether these guidelines, 'Members' Bottom Fishing Gear Assessments', could be included in Conservation Measure 22-06 and replace section 1.2 of Annex 22-06/A.

10.21 The Working Group further considered the information needed to review the impacts of the gears. It recommended that section 2 of Annex 22-06/A be simplified to obtain information, judgements or quantitative estimates that Members may have of the vulnerabilities of benthic taxa in the fishing areas to the gears, including any potential differences in vulnerabilities between components of the gear. This could be included in the guidelines for Members' Bottom Fishing Gear Assessments.

10.22 The Working Group wished to advise the Scientific Committee that collection of this information on gears and the vulnerabilities of benthic taxa are required for all operations but are a particularly high priority for trotlines, trotlines with cachaloteras, Spanish longlines, fish pots and crab pots.

10.23 The Working Group noted that, should the Members' Bottom Fishing Gear Assessments pro forma be adopted in Conservation Measure 21-02, then Members submitting notifications under that measure would, following their first submission of the assessment form for their particular gear configuration, only need to provide effort estimates for their proposed fishing activities in the upcoming season. This approach should provide all information necessary to estimate their proposed spatial footprint and potential impact for the coming season.

10.24 The Working Group recommended that the Scientific Committee consider a revision to the new and exploratory fisheries notification guidelines developed from Conservation Measure 21-02 (paragraph 5(ii) (Fishery Operations Plan)) for Members to provide the following new information with each notification:

(i) reference to the relevant Bottom Fishing Gear Assessment that adequately describes the fishing method and gear configuration to be deployed;

(ii) notification of any exceptions or changes – e.g. gear changes, alternate fishing practices, altered impact assumptions, mitigation measures adopted etc. – that may be expected to cause the actual impact of the proposed fishing activity to be different from that described in the relevant Bottom Fishing Gear Assessment;

(iii) an estimate of fishing effort proposed by the Member for the upcoming fishing season, detailed by subarea and SSRU, in units compatible with the estimation of footprint size used in the relevant Member's Bottom Fishing Gear Assessment.

10.25 The Working Group noted that if all notifications provided the required standardised information (Table 19), estimates of future footprint based on expected effort deployment in the upcoming season could be derived and added to the cumulative historical effort in a template table such as Table 18(b). If Bottom Fishing Gear Assessments are available for all relevant methods, only the estimated incremental effort would need to be updated on an annual basis.

2008/09 fishing season review

10.26 Following advice from the Scientific Committee (SC-CAMLR-XXVII, paragraphs 4.268 and 4.281(ii)(c)), the Working Group reviewed the observer and vessel VME indicator taxa by-catch data as supplied by the Secretariat in WG-EMM-09/8, WG-FSA-09/6 and CCAMLR-XXVIII/BG/6, taking account of the results of WS-VME. The Working Group noted that although almost all vessels (30 of 33) reported total benthos for each five-day reporting period as required in Conservation Measure 23-01, the response to reporting VME indicator taxa by line segment was much more variable. Only 19 of 33 vessels reported any line segment data, nine reported line segment data for more than 50% of sets, and only four reported line segment data for every set (CCAMLR-XXVIII/BG/6,

Table 6). Some vessels did not report VME indicator taxa unless the amount exceeded the notification trigger level of five VME indicator units. The Workshop on VMEs recommended (Annex 10) that segment-specific VME taxa weight, and to the extent possible, segment-specific fish weight data could be used to develop advice on the scale, distribution and association of VMEs with specific taxa and habitats (Annex 10, paragraphs 5.9, 5.11, 5.12, 5.26 and 6.10).

10.27 The Working Group agreed that the catch of VME indicator units must be reported by vessels for each set even if the amount is zero. The Working Group also emphasised the importance of collecting segment-specific data, as the scale of VME patch size is likely to be much smaller than the length of a longline.

10.28 The Working Group joined the Workshop on VMEs in commending those vessel skippers and observers who collected detailed and high-quality data in the first year of implementing Conservation Measure 22-07, and in demonstrating that observers can accurately classify VME taxa given the appropriate materials and training (TASO-09/8; SC-CAMLR-XXVIII/BG/12; Annex 10, paragraph 5.5; WG-FSA-09/23).

10.29 The Working Group noted that approximately 14 000 segments were deployed in the 2008/09 season and that the number of reported notifications from exploratory bottom fishing under Conservation Measure 22-07, where at least five VME indicator units in a segment were landed, totalled 30. Of these, seven notifications consisted of at least 10 VME indicator units, which resulted in seven Risk Areas being declared (see WG-FSA-09/6 and CCAMLR-XXVIII/BG/6). Risk Areas identified through Conservation Measure 22-07 remain closed to bottom fishing as a precautionary measure until reviewed and management actions are determined by the Commission. However, no process for review or evaluation of the area as a VME is specified in the measure. The Working Group requested that the Scientific Committee clarify the process for reviewing Risk Areas as required in Conservation Measure 22-07.

10.30 The Working Group noted that 28 notifications of evidence of encounters with VMEs were received under Conservation Measure 22-06 and described in WG-EMM-09/32. WG-EMM noted that thresholds adapted in WG-EMM-09/32 from longline by-catch trigger levels in Conservation Measure 22-07 appeared to be too high when compared to video observations of VME taxa on the sea floor (Annex 4, paragraphs 5.6 to 5.9), suggesting that lower thresholds, taxon-specific thresholds, or alternative approaches be developed to classify areas as VMEs. WG-EMM referred the proposal to WG-FSA for comments and operational considerations (Annex 4, paragraph 5.8), and to WS-VME to consider the appropriate depth range, trigger levels for 'light' taxa, and the treatment of rare or endemic taxa (Annex 4, paragraph 5.9).

10.31 The Working Group agreed that all 28 areas notified in WG-EMM-09/32 (areas with supporting video observations and areas based on trawl by-catch only) showed compelling evidence of VMEs and recommended that they are registered in the VME registry as VMEs.

10.32 The Working Group noted that these VMEs were relatively close together, and that the total distribution of patches of vulnerable communities was not known. The small scale of notified areas and their patchy distribution suggests that larger areas should be protected while further information is collected and analysed.

10.33 The Working Group recommended that the Scientific Committee consider whether the management areas defined in Conservation Measure 52-02 as part of the experimental harvest program containing these VMEs (Areas A, C, E) should be closed to protect the known VMEs and likely others in similar nearby areas (Figure 12).

10.34 The Working Group noted that the quantities of VME taxa recovered in several areas sampled did not reach the derived threshold used in WG-EMM-09/32. The Working Group agreed there are many approaches and ecological reasons available for proposing areas as VMEs, and noted that 'trigger levels' apply to longline by-catch rather than non-fishery data, and that specific sampling abundance thresholds, although useful, are not required to propose a VME based on non-fishery data. The Working Group encouraged additional analyses of the data collected. The Working Group also commended the authors for giving priority to VME-related research and implementing the conservation measures.

10.35 The Working Group reviewed the recommendations provided by WG-SAM (Annex 6, paragraphs 4.16 to 4.19), WG-EMM (Annex 4, paragraphs 5.3, 5.8, 5.11 and 5.14) and WS-VME (Annex 10, paragraph 7.1).

10.36 The Working Group noted that the development of Conservation Measures 22-06 and 22-07 has generated several new terms and that the process for information flow and review has not been clearly defined. The Working Group also noted that, although a generalised process for information flow and review by working groups was adopted in SC-CAMLR-XXVI, paragraph 4.171, the Scientific Committee had recognised that the process will need to be refined as experience is gained (SC-CAMLR-XXVI, paragraph 4.165).

10.37 The Working Group requested the Scientific Committee clarify the procedural framework for notification and the review of notifications under Conservation Measure 22-06, the review of data collected under Conservation Measure 22-07 (SC-CAMLR-XXVII, paragraphs 4.240 and 4.268; Conservation Measure 22-07, paragraph 10), as well as the integration of this information with notifications of proposed fishing impacts reviewed annually under new and exploratory fishery notifications. The Working Group proposed amending the framework adopted in 2007 (SC-CAMLR-XXVI, paragraph 4.164) to include the requirements in Conservation Measures 22-06 and 22-07, and to clarify the procedures needed to integrate the information and provide advice to the Scientific Committee. The proposed amended procedure is shown in Figure 13.

10.38 The Working Group requested the Scientific Committee provide advice regarding which working group is to provide review and evaluation of data, notifications and proposals generated under Conservation Measures 22-06 and 22-07 as shown in Figure 13, noting previous advice in CCAMLR-XXVII, paragraph 5.16.

10.39 The Working Group reviewed Secretariat papers WG-FSA-09/6 and 09/45. The Working Group agreed that further development of the Secretariat's capability to manage, store, process and summarise data resulting from Conservation Measures 22-06 and 22-07 is necessary. The Working Group noted that some data may be linked through SCAR-MarBIN and/or other organisations in order to expand analytical opportunities in the use of these data. The Working Group recommended that a work plan and budget be developed, prioritising the capability to provide real-time data, and to provide data for use by the Secretariat and its working groups (WG-FSA-09/6, paragraphs 16(a) and (c)). The Working Group also agreed

that the review of CCAMLR's approach to managing bottom fishing impacts on VMEs (WG-FSA-09/45) would be a valuable contribution to the development of management approaches to avoid significant adverse impacts to VMEs by other organisations. The Working Group recommended that a process for the publication of Secretariat papers should be considered by the Scientific Committee.

10.40 To aid in clarifying the process and terminology associated with Conservation Measures 22-06 and 22-07, the Working Group discussed developing a glossary to minimise confusion in the use of terminology with the many new concepts related to VMEs. The Working Group agreed to work intersessionally to develop succinct, simple and functional definitions for selected terms through a correspondence group.

10.41 The Working Group noted that the VME Invertebrate Classification Guide implemented in the 2008/09 season was very useful in aiding observers to correctly classify VME indicator taxa. Upon review by WS-VME (Annex 10), the guide has been edited and updated to include new taxa. The new version could be implemented in 2009/10 for the entire CCAMLR area applicable to Conservation Measure 22-06. The Working Group recommended that the guide be called the 'CCAMLR VME Taxa Classification Guide' and be made available as a CCAMLR document on the website, and that funds be made available through the Secretariat to provide laminated double-sided copies for those not equipped to produce their own.

10.42 WS-VME reviewed Conservation Measure 22-06, Annex B, and recommended that it be reconfigured to reflect its use mainly for research vessels and encounters not otherwise reported under Conservation Measure 22-07 (Annex 10, paragraph 3.11). The Working Group recommended that Annex 22-06/B be revised to indicate that notifications of encounters with VMEs should be prepared as proposals/research papers to be submitted to WG-EMM for review via the Secretariat. Further, WG-EMM could recommend a classification of the area(s) and forward data and metadata associated with locations of VMEs, and links to the supporting review documents, to be added to the VME register. The annex would no longer be necessary as a data form. Rather, the annex would become guidelines specifying categories of information to include in the submitted notification. If adopted, the Conservation Measure Drafting Group could consider revisions to Conservation Measure 22-06, paragraph 9, for consistency. A draft revised annex is provided in Figure 14.

10.43 The Working Group reviewed the implementation of Conservation Measure 22-07 and advice of WS-VME (Annex 10, paragraphs 5.12, 6.8 and 6.9; Conservation Measure 22-07, paragraph 10) and noted the responsibility for reporting VME indicator units is a vessel, not an observer, responsibility. The Working Group also noted that recording either weight or volume as currently written, creates problems with data quality and limits analysis of by-catch data.

10.44 The Working Group recommended that:

(i) segment midpoint locations should be reported as DD.MM and fractional minutes along with the geodetic datum set in the navigation system, with care to report longitude as negative degrees in the western hemisphere;

(ii) from a data analysis and simplicity perspective, weight and the units used to quantify VME taxon by-catch should be reported as a minimum requirement;

(iii) vessels should report sets and segments resulting in zero VME indicator units;

(iv) segment-level VME indicator units and target species catch will be needed to analyse correlations in their distributions;

(v) development of trigger levels for a range of VME taxa should be considered intersessionally, along with options to enable taxon-specific weights to be collected to provide advice for next year.

Review of conservation measures

10.45 The Working Group had insufficient time to review the conservation measures or to provide advice on the points expected by the Commission (paragraph 10.2). It agreed that the following program of work for the intersessional period will assist in reviewing Conservation Measures 22-06 and 22-07 next year:

(i) developing plausible scenarios of the types and dynamics of VMEs and the spatial and temporal interactions of the fishery with VMEs;

(ii) evaluating management strategies within the conservation measures along with other possible strategies for avoiding significant adverse impacts on VMEs.

10.46 WG-FSA-09/42 described the simulation model, 'Patch', which has been developed for use by CCAMLR to evaluate, using computer simulations, proposed within-season and post-season assessment and fisheries management strategies for avoiding significant adverse impacts on VMEs. It is designed to capture important properties of benthic habitats, including patch heterogeneity, decay, recovery and connectivity between areas, and interactions of fisheries with those habitats. Most importantly, the model enables uncertainties to be evaluated in a straightforward manner to assist CCAMLR in maintaining its precautionary approach in managing Antarctic fisheries. The model is ready for use by WG-FSA to begin evaluating management strategies to conserve VMEs having been updated according to the recommendations of WG-SAM, WG-EMM and WS-VME. The manual is included as an attachment to the paper.

10.47 The Working Group noted the developments of the simulation software, Patch, and that the author had undertaken the work requested by WG-SAM, WG-EMM and WS-VME. It also noted that it is designed to assist in:

(i) assessing whether proposed bottom fishing activities would contribute to having significant adverse impacts on VMEs and whether proposed or additional mitigation measures would prevent such impacts;

(ii) evaluating management strategies to avoid significant adverse impacts on VMEs.

10.48 The Working Group welcomed the development of this software and recommended that it be used to develop evaluations of VME management strategies for review by WG-SAM next year. It encouraged Members to participate in this work through the Subgroup on VMEs.

Future work

10.49 The Working Group wished to advise the Scientific Committee that the review of Conservation Measures 22-06 and 22-07 should proceed in the intersessional period with the aim of providing advice on these measures next year.

10.50 With respect to the report on 'Bottom Fisheries and VMEs', the Working Group noted that WS-VME had insufficient time to provide a draft template for this report (SC-CAMLR-XXVII, paragraph 4.243) or recommendations on how it be compiled and updated. The Working Group had insufficient time to develop such a template as well, but recommended that the work undertaken at this meeting be further developed by the Subgroup on VMEs during the intersessional period and that a template be provided for consideration by WG-EMM and WG-FSA next year.

10.51 As part of developing the bottom fisheries report, the Working Group agreed that the methodology, including the code for generating maps, for presenting the cumulative footprint should be reviewed and refined by the Subgroup on VMEs in the intersessional period.

Development of ecosystem models

10.52 The Working Group noted the report and endorsed the recommendations of the Second Workshop on Fisheries and Ecosystem Models in the Antarctic (FEMA2), which was held during the first two days of WG-EMM (Annex 4, paragraphs 2.1 to 2.53).

10.53 In particular, the Working Group:

(i) encouraged Members to participate in collating literature and to further develop the documentation on the food web in the Ross Sea (Annex 4, paragraph 2.33);

(ii) encouraged Members to develop spatially structured population and food-web models to better explore the spatial overlaps between the toothfish population, the fishery and predator requirements (Annex 4, paragraphs 2.43, 2.48, 2.51 and 2.53);

(iii) agreed that these simulation models should be used to determine the data needed to refine the management strategy for the fishery.

Depredation

10.54 The Working Group noted the work undertaken by France on depredation in the toothfish fishery in Subarea 58.6, as described in WG-IMAF-09/12, and noted that an average estimate of 41% of the toothfish catch from 2003 to 2008 may be taken by cetaceans in this subarea. Trials with fish pots in 2010 will be initiated to address this issue.

10.55 The Working Group noted the discussion of WG-FSA-09/16 in paragraphs 3.60 to 3.62.

Other interactions with WG-EMM

10.56 The Working Group noted that the advice from WG-EMM on a number of matters common to both working groups, such as VMEs and *C. gunnari*, has been taken up in the relevant agenda items.

10.57 The Working Group noted that the text of the Russian guide to identification of larval fish (SC-CAMLR-XXVI, paragraph 11.5 and Annex 5, paragraph 10.10) had now been translated and was available from the Secretariat. Dr Shust thanked the Secretariat for this translation and suggested that the utility of the guide would be greatly increased if the figure legends were also available in English.

10.58 The Working Group also noted the request from WG-EMM (SC-CAMLR-XXVI, Annex 4, paragraph 4.37) to provide information to observers in the krill fishery on the available information for the identification of larval fish by-catch, and that there are a number of Members who have developed identification guides of larval fish in the Southern Ocean. It requested Members to provide details of the relevant information for review by WG-FSA next year. The aim of this review would be to provide advice to scientific observers on the key identification features of the most frequently encountered by-catch species in order to facilitate the routine collection of these data from the krill fishery.

SCHEME OF INTERNATIONAL SCIENTIFIC OBSERVATION

11.1 In accordance with CCAMLR's Scheme of International Scientific Observation, scientific observers were deployed on all vessels in all finfish fisheries in the Convention Area.

11.2 Information collected by scientific observers was summarised in WG-IMAF-09/4 Rev. 2, 09/5 Rev. 2, 09/6 Rev. 2 and 09/7.

11.3 The Working Group reviewed the report of the second meeting of ad hoc TASO held in Bergen, Norway, on 4 and 5 July 2009 (Annex 9), and considered the various questions referred to it by TASO:

(i) The Working Group endorsed ad hoc TASO's recommendation that a reference library of all the different types of gear used in the different fisheries in the Convention Area be developed and included in the *Scientific Observers Manual* and on the webpage using standard nomenclature for the various gear items (paragraph 10.40). Members' technical coordinators and the Secretariat should be tasked with this work.

(ii) The Working Group noted ad hoc TASO's comments with respect to IUU gillnet fishing and VMEs. These points are considered in more detail elsewhere in this report (sections 8 and 10 respectively).

(iii) Ad hoc TASO recommended that a photographic maturity staging guide for toothfish be developed and included in the *Scientific Observers Manual*. The Working Group noted that:

(a) photographic maturity guides for toothfish and other species exist in the observers manuals developed by various Members and recommended that this material be drawn upon. The guide should contain a series of photographs, especially of the transitions between maturity stages, not just a single photograph of the 'ideal case' of each maturity stage;

(b) the maturity scale for toothfish be simplified to only three maturity stages: immature, developing and mature, and actively spawning (ripe running).

11.4 The minimum sampling requirements recommended by the Working Group at CCAMLR-XXVII as an interim level still apply (see SC-CAMLR-XXVII, Annex 5, paragraph 11.8 for the recommended reduction in *Dissostichus* spp. sampling in the coming season to accommodate the additional requirements associated with the Year-of-the-Skate). The Working Group noted that New Zealand has indicated its intention to submit a paper on the optimum sampling requirements for toothfish in Subareas 88.1 and 88.2 to WG-SAM in 2010.

11.5 The Working Group noted that there may be cases where toothfish have been incorrectly identified to species. It recommended that the relevant section of the *Scientific Observers Manual* be improved to enable observers and crew to better distinguish between *D. eleginoides* and *D. mawsoni*.

11.6 Recognising that data collected by observers is an important source of information used by the Scientific Committee to assess the status of resources in the CCAMLR region, the Working Group encouraged the efforts made by ad hoc TASO towards developing guidelines for accrediting CCAMLR observer programs (outlined in SC-CAMLR-XXVIII/BG/9). The Working Group agreed that this would help to standardise and improve the accurate collection of data across all fisheries.

Future work

11.7 The Working Group noted that, to assist the creation of the accreditation program, areas need to be defined in which data collected by observers are not of sufficient quality to be used in analyses conducted by working groups. The Working Group suggested that the following steps be considered:

(i) identify the subset of the data collected by observers that are used in the development of management advice;

(ii) develop data metrics that can be used to assess the quality of those data;

(iii) identify the specific aspects of the data collected by observers where the quality or standard across vessels is not sufficient, and document the data standard required.

FUTURE ASSESSMENTS

12.1 The Working Group noted that the Year-of-the-Skate had been successfully implemented and recommended that a continuation of the Year-of-the-Skate protocols should be extended for at least another year (paragraphs 6.9 to 6.25). The Working Group noted that the increased levels of rajid data (particularly from tag returns) that were becoming available from *Dissostichus* spp. fisheries should facilitate the move towards more formal assessments for rajids in some subareas and divisions as outlined by WG-SAM (SC-CAMLR-XXVI, Annex 7, paragraph 3.20). The Working Group recommended that WG-SAM consider the most appropriate methods to progress rajid assessments.

12.2 The Working Group discussed the development of a length-based assessment model for icefish in Subarea 48.3 (WG-FSA-09/27 and paragraphs 4.24 and 4.25) and recalled that a number of areas for further consideration were raised during WG-SAM (Annex 6, paragraphs 3.29 to 3.31). The Working Group recommended that further investigation into alternative methods of estimating the growth-transition matrix is undertaken before the length-based assessment method could be used to develop assessment advice for *C. gunnari* in Subarea 48.3.

12.3 The Working Group endorsed the recommendations of WG-SAM and WG-EMM (FEMA2 in Annex 4, paragraphs 2.1 to 2.53) to continue the use and development of spatially explicit assessment models.

12.4 The Working Group recommended that the development of formal assessments of *Dissostichus* spp. in subareas and divisions where exploratory fisheries operate should be continued. Further research fishing surveys planned for the 2009/10 season should assist with the future development of advice for the assessment of fisheries in these areas.

12.5 The Working Group noted the need for the continued development of models, including Patch, to advance assessments of VMEs (paragraph 10.46).

Frequency of assessments

12.6 The Working Group reviewed the move to a biennial assessment cycle for three stocks (Subarea 48.3, Division 58.5.2 and the Ross Sea management area) following a full cycle of this process. The Working Group recalled that at last year's meeting (SC-CAMLR-XXVII, Annex 5, paragraph 12.6) the move to biennial assessments was considered highly successful, and allowed time at the meeting to consider a wide range of other issues. The Working Group further endorsed this view and noted that the change to biennial assessments of some stocks had not changed the ability of the Working Group to provide assessment advice to the Scientific Committee.

12.7 The Working Group noted that the timing of the provisions of datasets could constrain the ability to undertake assessments that include the most recent year's observational data at WG-FSA.

12.8 The Working Group recommended that WG-SAM consider the impact on assessment advice of the non-inclusion of subsets of the latest year's observations on assessment results, and make recommendations as to the extent that the latest year's observations may be safely omitted without significantly impacting advice.

FUTURE WORK

Organisation of intersessional activities of subgroups

13.1 The Working Group thanked all subgroups for their contributions and encouraged each one to continue its work in the forthcoming intersessional period, focusing, where possible, on key issues identified below. The Working Group re-emphasised that the membership to the subgroups was open to all participants, and new participants are encouraged to contact the Secretariat for further information on the subgroups (see also paragraph 2.5 for a list of subgroups and coordinators).

13.2 The Working Group noted the following subgroup work planned for the intersessional period:

- complete the species profile for *D. elegin oides* and revise the profiles for *D. mawsoni* and *C. gunnari* (paragraph 9.3);
- advance the work of CON (paragraph 9.5) and verify otolith readings (paragraph 5.39);
- advance the work on VMEs (paragraphs 10.49 to 10.51), including further development and use of Patch (paragraph 12.5).

13.3 The Working Group also thanked Mr Dunn for undertaking to coordinate a correspondence group to further develop and facilitate use of the SPM (paragraph 5.116).

13.4 The Working Group briefly reviewed progress in the development of a larval and juvenile fish guide for use in the krill fishery. The Russian guide had been translated by the Secretariat and further work was required to develop a compilation of all available information (paragraphs 10.57 and 10.58). The Working Group requested that Dr S. Kawaguchi (Australia) continue to coordinate a small group to collate the available information and develop a proposal for consideration by WG-FSA in 2010.

13.5 Dr Jones agreed to contact subgroup coordinators two weeks prior to the next meeting of the Working Group in order to review subgroup work plans for that meeting in light of the Working Group's priorities, meeting agenda and submitted papers.

Intersessional meetings

13.6 During the course of its meeting, the Working Group identified a number of matters which it referred to WG-SAM, ad hoc TASO and SG-ASAM:

(i) WG-SAM –

- review of the simulation methodologies to assess harvest strategies for toothfish in exploratory fisheries (paragraph 5.28);
- consider the most appropriate methods to progress rajid assessments (paragraph 12.1);
- further investigate alternative methods of estimating the growth-transition matrix for *C. gunnari* in Subarea 48.3 (paragraph 12.2);
- review developments of the SPM and Patch (paragraphs 13.2 and 13.3);
- optimum sampling requirements for *Dissostichus* spp. in exploratory fisheries (paragraph 11.4);

(ii) ad hoc TASO –

- development of guidelines for accrediting CCAMLR observer programs (paragraph 11.7);
- development of gear profiles (paragraphs 11.3(i) and section 10, also includes technical coordinators and the Secretariat);
- methods by which large toothfish could be tagged in good condition (paragraph 5.17);

(iii) SG-ASAM –

- further development of quantitative methods to include acoustic estimates in the assessments for *C. gunnari*;
- development of automated procedures to estimate large-scale spatial and seasonal variability in the relative abundance of mesopelagic fish assemblages and *C. gunnari*, using opportunistic platforms (e.g. commercial fishing vessels), towed transducers and moored arrays. Dr Constable agreed to submit a paper to SG-ASAM and ICES WGFAST to outline the concept, and its potential application to the work of working groups, including ecosystem monitoring and the assessment of *C. gunnari*.

Notification of scientific research activities

13.7 The Working Group noted that the following Members would be conducting scientific research activities in 2010 and in accordance with Conservation Measure 24-01:

Australia: research on the vulnerability of habitats in high latitudes to impacts by bottom fishing gear (December 2009 to January 2010, Divisions 58.4.1 and 58.4.2)
possible survey for *C. gunnari* in Division 58.5.2 (early 2010)
bottom fish survey in Division 58.5.2 (May–June 2010)

Japan: research fishing in Division 58.4.4 (paragraphs 5.101 to 5.111; see also WG-FSA-09/12)

UK: bottom fish survey in Subarea 48.3 (January–February 2010)
deeper-water bottom fish survey on the slope in Subarea 48.3 (February 2010).

13.8 The Working Group noted that Members participating in scientific research activities which fall under Conservation Measure 24-01 are required to submit the following to the Secretariat:

- a notification of research vessel activity (Conservation Measure 24-01, Annex A, Format 1 or Format 2);
- five-day catch and effort reports during the research activity;
- annual STATLANT returns which include catches taken during the research activity;
- a summary report within 180 days of the completion of the research activity and a full report within 12 months.

General matters

13.9 The Working Group identified the following general items of future work:

(i) CCAMLR database operation, development and documentation (paragraph 3.5);

(ii) development of IUU catch estimates (paragraphs 3.23 and 8.6);

(iii) increase capability to have otoliths effectively sampled and read (paragraph 3.36);

(iv) relationship between environmental variability and *C. gunnari* abundance (paragraph 3.39);

(v) include CVs when reporting biomass estimates derived from surveys (paragraph 3.43);

(vi) submission of CPUE data and analyses of *Dissostichus* spp. in Division 58.4.1 (paragraphs 3.44 and 4.19);

(vii) development of standardised methods and data sources for deriving bathymetric information for the Convention Area and establishment of a common data repository (paragraphs 3.58 and 3.59);

(viii) presentation of catch-at-age proportions by year-class and likelihood profiles in CASAL assessments (paragraph 4.21);

(ix) biological sampling rate of skates (paragraph 6.22);

(x) include selected items from the WG-IMAF agenda in the agenda of WG-FSA in alternate years when WG-IMAF does not meet (paragraph 7.4);

(xi) inventory of *Dissostichus* spp. otoliths (paragraph 9.6);

(xii) development of map routine for bottom fishing footprint (paragraph 10.16);

(xiii) development of a work plan and budget for further developing the VME registry (paragraph 10.39);

(xiv) development of a glossary on VME terminology (paragraph 10.40);

(xv) revisions to the *Scientific Observers Manual* (paragraph 11.5);

(xvi) quality of scientific observer data used in analyses conducted by working groups (paragraph 11.7);

(xvii) continued development of models, including Patch, to advance assessments of VMEs (paragraph 12.5).

13.10 The Working Group recommended that the Scientific Committee request Members to submit to the Secretariat an inventory of otoliths from *Dissostichus* spp. collected from CCAMLR fisheries, indicating the number of otoliths collected and the number read by fishery, season and Flag State of the fishing vessel (see also paragraph 5.119).

13.11 The Working Group urged authors of working group documents to clearly annotate all graphs presented, particularly the scales and relevant attributes of the axes, for example, where ambiguous measures of abundance should specify the relevant sample unit such as count per set or count per thousand hooks.

ADVICE TO THE SCIENTIFIC COMMITTEE AND ITS WORKING GROUPS

14.1 The Working Group identified the following advice to the Scientific Committee and its working groups:

(i) Development of assessments –

(a) alleviation of workflow pressure points in the development of stock assessments (paragraph 3.7 and Figure 1);

(b) use of data-quality metrics to select high-quality data used in stock assessments (paragraphs 3.48, 3.49 and 5.84);

(c) use of assumed harvest rates based on experience from fully assessed fisheries (paragraph 4.20);

(d) development of research plans in exploratory fisheries (paragraph 5.118);

(e) development of characterisation of exploratory fisheries (paragraph 5.120);

(f) further work on ageing of *C. gunnari* using otoliths was considered unnecessary for use in assessments (paragraphs 9.4 to 9.8);

(g) biennial assessment cycle in assessed fisheries (paragraph 12.6);

(h) Secretariat-based assessment scientist (paragraph 15.6).

(ii) IUU fishing –

(a) IUU fishing (paragraphs 3.21 and 8.6).

(iii) Fishery management advice –

(a) fishery for *D. eleginoides* in Subarea 48.3 (paragraph 5.127);

(b) fishery for *D. eleginoides* (Northern Area) and *Dissostichus* spp. (Southern Area) in Subarea 48.4 (paragraphs 4.9 and 5.136 to 5.138);

(c) fishery for *D. eleginoides* in Division 58.5.1 (paragraphs 5.142 to 5.145);

(d) fishery for *D. eleginoides* in Division 58.5.2 (paragraph 5.152);

(e) fishery for *D. eleginoides* in Subarea 58.6, Crozet Islands (paragraphs 5.156 to 5.159);

(f) fishery for *D. eleginoides* in Subareas 58.6 and 58.7, Prince Edward and Marion Islands (paragraphs 5.163 to 5.165);

(g) fisheries for *Dissostichus* spp. in Subareas 48.6 and 58.4 (paragraphs 5.87 to 5.96);

(h) fisheries for *Dissostichus* spp. in Subareas 88.1 and 88.2 (paragraphs 5.79 to 5.84);

(i) fishery for *C. gunnari* in Subarea 48.3 (paragraphs 5.171 and 5.172);

(j) fishery for *C. gunnari* in Division 58.5.2 (paragraph 5.178);

(k) other fisheries (paragraphs 5.181, 5.183 and 5.185);

(l) implementation of the tagging program for *Dissostichus* spp. (paragraphs 5.10, 5.14 and 5.17);

(m) implementation of research hauls in exploratory fisheries in Subareas 48.6 and 58.6 (paragraph 5.19);

(n) open and closed SSRUs (paragraphs 5.25, 5.28 and 5.94).

(iv) By-catch –

(a) extend the Year-of-the-Skate (paragraph 6.24);

(b) clarify skate tagging rate in the conservation measures and revise guidelines for the Year-of-the-Skate (paragraphs 6.17 and 6.25);

(c) implementation of the tagging program for skates (paragraphs 6.12 and 6.17);

(d) one-page guide for vessels with respect to the fate of skates caught, corresponding reporting requirements and limitations on discards (paragraphs 6.11 and 6.12);

(e) Members' advice on difficulties in implementing tagging requirements in new and exploratory fisheries (paragraph 6.17);

(f) introduction of a threshold level in the move-on rule for macrourids in the Southern Area of Subarea 48.4 (paragraphs 5.138 and 6.31).

(v) VMEs –

(a) development of bottom fishing footprints (paragraphs 10.16 and 10.17);

(b) development of Bottom Fishing Gear Assessments (paragraphs 10.20 and 10.24);

(c) Conservation Measure 22-06 and notifications of encounters with VMEs, (paragraphs 10.8, 10.31, 10.37, 10.38 and 10.42);

(d) Conservation Measure 22-07 and review and evaluation of risk areas, (paragraphs 10.29, 10.37, 10.38, 10.43 and 10.44);

(e) consideration of a paper on CCAMLR's approach to managing bottom fishing impacts on VMEs (paragraph 10.39);

(f) CCAMLR VME Taxa Classification Guide (paragraphs 6.32 and 10.41).

(vi) Scientific observers –

(a) revisions to the *Scientific Observers Manual* (paragraphs 11.3 and 11.5);

(b) reference library of fishing gear types (paragraph 11.3(i));

(c) guidelines for accrediting CCAMLR observer programs (paragraphs 11.6 and 11.7).

(vii) Other –

(a) implications for WG-FSA of WG-IMAF meeting biennially in future (paragraphs 7.4 and 7.5);

(b) implementation of daily reporting of catches and gear deployed in situations where catch limits are small or reach a minimum threshold (paragraph 3.15);

(c) regular review of the Secretariat resources required to develop and operate the CCAMLR database (paragraph 3.5);

(d) development of standardised methods and data sources for deriving bathymetric information for the Convention Area and establishment of a common data repository (paragraphs 3.58 and 3.59);

(e) research fishing in Divisions 58.4.4a and 58.4.4b (paragraph 5.111);

(f) report adoption (paragraph 15.1);

(g) report preparation and translation (paragraph 15.12).

OTHER BUSINESS

Adoption of report

15.1 The Working Group noted that, in recognition of concerns raised by non-native English-speaking participants from France, Germany, Japan, Russia and Ukraine at the time of adoption of the report, adopting extended and important sections of the report (such as section 10) at short notice would be problematic in future meetings. The Working Group requested the Scientific Committee provide advice on how this issue should be addressed at future meetings of the Working Group.

Assessment scientist

15.2 The Working Group recognised that its work in developing and conducting assessments is placing ever-increasing demands on participants and Secretariat staff. It also noted that substantial future work is required to develop assessments including those for exploratory fisheries in Subareas 48.6 and 58.4, and to address fisheries management requirements identified by the Performance Review.

15.3 The Working Group agreed that is was essential that new steps be implemented to:

(i) alleviate the workload of Working Group participants and the Secretariat
(ii) share the burden of future work
(iii) facilitate documentation and archiving of assessment methodologies
(iv) provide greater transparency and transfer of knowledge
(v) provide expertise and continuity in developing assessments.

15.4 The Working Group considered a proposal to establish a new Secretariat-based position for an assessment scientist in order to:

(i) conduct detailed validation of preliminary assessments submitted to WG-FSA;

(ii) assist with developing and archiving documentation on assessment methodologies;

(iii) participate in the development of assessments methodologies and provide training in their use;

(iv) conduct preliminary assessments;

(v) provide additional transparency and impartiality in the assessment procedures.

15.5 The Working Group recognised that the appointment of an assessment scientist based in the Secretariat would require careful consideration, including:

(i) the terms of employment and budget implications;

(ii) development of a detailed position description and a review of related, existing positions within the Secretariat including the Data Manager's role in assessment validation and support;

(iii) options for providing support and maintenance of assessment expertise within the Secretariat's environment;

(iv) long-term requirements of WG-FSA, other working groups and the Scientific Committee.

15.6 The Working Group proposed the following draft terms of reference for an assessment scientist:

(i) Administration and maintenance of stock assessments –

(a) validation of input data and assessment results submitted to working groups;

(b) collation and development of documentation of methodologies used in assessments;

(c) development and maintenance of a registry of assessment codes and programs.

(ii) Research and development –

(a) provide advice and assistance in developing assessments in areas of interest to the Scientific Committee and Commission;

(b) develop assessment methodologies, including methodologies for assessing exploratory fisheries in Subareas 48.6 and 58.4;

(c) facilitate the use of assessment methodologies, including training.

(iii) Assessment support –

(a) Conduct preliminary assessments prior to working group meetings.

15.7 The Working Group recommended that the Scientific Committee consider this proposal for a Secretariat-based assessment scientist and seek the advice of all working

groups on the nature and extend of work which may be conducted under the new position. The Scientific Committee may also wish to consider the role and position description of assessment scientists employed by other Secretariats (e.g. IATTC) and other international organisations (e.g. ICES).

15.8 Dr Miller proposed that the incoming Executive Secretary be tasked with formulating a position description and terms of appointment based on the advice of the Scientific Committee and its working groups in 2010. He also proposed that, as far as practicable, such work should be available by CCAMLR-XXIX and should take into account the various requirements outlined by the Scientific Committee and the respective working groups.

Report preparation and translation

15.9 The Working Group recalled the efforts made in recent years to reduce the size of its reports and alleviate the workload and cost associated with the preparation, translation and publication of these reports. Significant changes had been implemented, including the introduction of web-based fishery reports in 2005 to provide concise reference documents for use principally by participants (SC-CAMLR-XXIV, Annex 5, paragraph 13.12).

15.10 Nonetheless, the Working Group's annual reports continue to increase in size and cost as assessments are developed and refined. In addition, new work has emerged following the implementation of initiatives including tagging programs in exploratory fisheries and the consideration of the impact of fishing on VMEs. Further work was also identified by the Performance Review in 2009.

15.11 The Working Group advised the Scientific Committee and the Commission that it is doing the best it can to produce reports which were both concise and provided long-term documentation of its work. The development of concise text was an arduous task which is shared by many during the meetings, and the Working Group is unable to further reduce the volume of its reports given its workload and time constraints during meetings.

15.12 The Working Group requested that the Scientific Committee and Commission consider ways of assisting WG-FSA in the preparation, translation and publication of its reports, including the use of a dedicated report writer/editor and a review of the Secretariat's budget for publishing annual reports.

ADOPTION OF THE REPORT

16.1 The report of the meeting was adopted.

CLOSE OF MEETING

17.1 Dr Jones thanked the subgroup coordinators, rapporteurs, all other participants and the Secretariat staff for their contributions and involvement in the work of WG-FSA, including the intersessional activities. The contributions were outstanding and had led to a very productive meeting.

17.2 The Working Group noted that Dr Miller will be retiring as Executive Secretary in February 2010. Dr Jones, on behalf of the Working Group, thanked Dr Miller for his long-standing expert contribution and dedication to the work of CCAMLR, including WG-FSA. The Working Group presented Dr Miller with a small gift.

17.3 Dr Constable, on behalf of the Working Group, thanked Dr Jones for convening the Working Group. The Working Group's deliberations had been challenging at times, and Dr Jones had led the meeting with insight and calm determination.

17.4 The meeting was closed.

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Smith, P., and P.M. Gaffney. 2005. Low genetic diversity in the Antarctic toothfish (*Dissostichus mawsoni*) observed with mitochondrial and intron DNA markers. *CCAMLR Science*, 12: 43–52.

Table 1: Total reported catches (tonnes) of target species in fisheries in the Convention Area in 2008/09. **Bold**: fishery closed. (Source: catch and effort reports to October 2009 unless otherwise indicated.)

Target species	Region	Fishery	Fishing season		Conservation measure	Catch (tonnes) of target species		Reported catch (%limit)
			Start	End		Reported	Limit	
Champsocephalus gunnari	48.3	Trawl	15-Nov-08	14-Nov-09[a]	42-01 (2008)	1 837	3 834	48
	58.5.2	Trawl	01-Dec-08	30-Nov-09[a]	42-02 (2008)	99	102	97
Dissostichus eleginoides	48.3	**Longline**, pot	01-Dec-08	30-Nov-09[a]	41-02 (2008)	3 383	3 920	86
	48.4 Northern Area	**Longline**	01-Apr-09	20-May-09	41-03 (2008)	59	75	79
	58.5.1[b]	Longline	ns	ns	ns	3 108	ns	
	58.5.2	longline, trawl	01-Dec-08	30-Nov-09[a]	41-08 (2008)	2 026	2 500	81
	58.6 French EEZ[b]	Longline	ns	ns	ns	746	ns	
	58 South African EEZ	Longline	ns	ns	ns	4	ns	
Dissostichus spp.	48.4 Southern Area	**Longline**	01-Apr-09	11-Apr-09	41-03 (2008)	74	75	99
	48.6	Longline	01-Dec-08	30-Nov-09[a]	41-04 (2008)	282	400	71
	58.4.1	**Longline**	01-Dec-08	12-Mar-09	41-11 (2008)	222	210	106
	58.4.2	**Longline**	01-Dec-08	23-Feb-09	41-05 (2008)	66	70	95
	58.4.3a	**Longline**	01-May-09	31-Aug-09	41-06 (2008)	31	86	36
	58.4.3b	**Longline**	01-May-09	09-Feb-09	41-07 (2008)	104	120	87
	88.1	**Longline**	01-Dec-08	25-Jan-09	41-09 (2008)	2 434	2 700	90
	88.2	**Longline**	01-Dec-08	31-Aug-09	41-10 (2008)	484	567	85
Euphausia superba	48.1, 48.2, 48.3, 48.4	Trawl	01-Dec-08	30-Nov-09	51-01 (2008)	123 948	620 000	20
	48.6	Trawl	01-Dec-08	30-Nov-09	51-02 (2002)	No fishing	15 000	-
	58.4.1	Trawl	01-Dec-08	30-Nov-09	51-02 (2008)	No fishing	440 000	-
	58.4.2	Trawl	01-Dec-08	30-Nov-09	51-03 (2008)	No fishing	452 000	-
Lithodidae	48.2	Pot	01-Dec-08	30-Nov-09	52-02 (2008)	No fishing	250	-
	48.3	Pot	01-Dec-08	30-Nov-09	52-01 (2008)	1 (by-catch)	1 600	<1
	48.4	Pot	01-Dec-08	30-Nov-09	52-03 (2008)	No fishing	10	-
Martialia hyadesi	48.3	Jig	01-Dec-08	30-Nov-09	61-01 (2008)	No fishing	2 500	-

[a] Under review
[b] Reported in fine-scale data
ns Not specified by CCAMLR

Table 2: Estimated effort, catch rates and total catches from IUU fishing for *Dissostichus* spp. in the Convention Area in 2008/09. The estimates are derived from information on gillnetters, using the deterministic method and information submitted by Members of sightings by surveillance operations and legal fishing vessels to 30 September 2009. No reports of undocumented landings were received in 2008/09. (Source: WG-FSA-09/5 Rev. 1)

Division	Estimated start of unregulated fishery	No. of vessels sighted[1]	Estimated number of days fished	Mean catch rate per day (tonnes)	Estimated IUU catch
58.4.1	2005	1	80	1.9	152
58.4.2	2002	1	80	2.2	176
58.4.3b	2003	4	320	1.9	608
58.4.3b (hauled gillnet)	2003	1			2
Total					938

[1] Division 58.4.1: *Bigaro*; Division 58.4.2: Unknown gillnet vessel; Division 58.4.3b: *Constant*, *Trosky*, *Typhoon-1*, *Draco-1*, unknown gillnet vessel.

Table 3: Catch history of *Dissostichus* spp. taken by IUU fishing in the Convention Area. IUU fishing was first detected in 1988/89, and estimates are derived from longlining and gillnetting activities. Blank: no estimate; zero: no evidence of IUU fishing. (Source: WG-FSA-09/5 Rev. 1 and SC-CAMLR reports)

Season	Subarea/division													All areas
	Unknown	48.3	58.4.1	58.4.2	58.4.3a	58.4.3b	58.4.4	58.5.1	58.5.2	58.6	58.7	88.1	88.2	
1988/89		144						0		0				144
1989/90		437						0	0	0				437
1990/91		1 775						0	0	0				1 775
1991/92		3 066						0	0	0				3 066
1992/93		4 019						0	0	0				4 019
1993/94		4 780						0	0	0				4 780
1994/95		1 674						0	0	0				1 674
1995/96		0						833	3 000	7 875	4 958			16 666
1996/97		0					375	6 094	7 117	11 760	7 327	0		32 673
1997/98		146					1 298	7 156	4 150	1 758	598	0		15 106
1998/99		667					1 519	1 237	427	1 845	173	0		5 868
1999/00		1 015					1 254	2 600	1 154	1 430	191	0		7 644
2000/01		196					1 247	4 550	2 004	685	120	0		8 802
2001/02		3		295			880	6 300	3 489	720	78	92	0	11 857
2002/03		0		98			110	5 518	1 274	302	120	0	0	7 422
2003/04		0		197		246	0	536	531	380	48	240	0	2 178
2004/05	508	23		86	98	1 015	220	268	265	12	60	23	0	2 578
2005/06	336	0	597	192	0	1 903	104	144	74	55	0	0	15	3 420
2006/07		0	612	197	0	2 293	109	404	0	0	0	0	0	3 615
2007/08		0	93	0	0	247	0	489	0	153	0	186	0	1168
2008/09		0	152	176	0	610	0	0	0	0	0	0	0	938
All seasons	844	17 945	1 454	1 241	98	6 314	7 116	36 129	23 485	26 975	13 673	542	15	135 830

Table 4: Catch (tonnes) of *Dissostichus* spp. reported from licensed fishing, and estimated from IUU fishing in the Convention Area, and reported in the CDS in areas outside the Convention Area in 2007/08 and 2008/09. (Source: reported catch – past season from STATLANT data, and current season from catch and effort reports and fine-scale data reported by France; IUU catch – WG-FSA-09/5 Rev. 1; CDS catch – data to October 2009.)

2007/08 season

Inside	Subarea/division	Reported catch	IUU catch	Total CCAMLR	*Catch limit**
	48.3	3 864	0	3 856	*3 920*
	48.4	98		98	*100*
	48.6	24		24	*400*
	58.4.1	410	93	503	*600*
	58.4.2	217	0	217	*780*
	58.4.3	151	247	398	*450*
	58.4.4	76**		76	*0*
	58.5.1	4 850	489	5 339	*0 outside EEZ*
	58.5.2	2 280	0	2 280	*2 500*
	58.6	878	153	1 031	*0 outside EEZs*
	58.7	69	0	69	*0 outside EEZ*
	88.1	2 259	186	2 445	*2 700*
	88.2	416	0	416	*567*
	88.3	0		0	*0*
	Total inside	15 813	1 168	16 981	

Outside	Area	CDS catch EEZ	CDS catch high seas	Total outside CCAMLR
	41	4 292	3 349	7 641
	47	13	187	200
	51	26	192	218
	57			0
	81	378		378
	87	3 785	129	3 913
	Total outside	8 494	3 857	12 351
Global total				29 332

* Includes catch limits for research fishing, limits for Divisions 58.4.3a and 58.4.3b are combined.
** Research fishing/survey

2008/09 season

Inside	Subarea/division	Reported catch	IUU catch	Total CCAMLR	*Catch limit**
	48.3	3 383	0	3 383	*3 920*
	48.4	133		133	*150*
	48.6	282		282	*400*
	58.4.1	222	152	374	*210*
	58.4.2	66	176	242	*70*
	58.4.3	135	610	745	*206*
	58.4.4	0		0	*0*
	58.5.1	3 108	0	3 108	*0 outside EEZ*
	58.5.2	2 177	0	2 177	*2 500*
	58.6	746	0	746	*0 outside EEZs*
	58.7	4	0	4	*0 outside EEZ*
	88.1	2 434	0	2 434	*2700*
	88.2	484	0	484	*567*
	88.3	0		0	*0*
	Total inside	13 223	938	14 161	

(continued)

Table 4 (continued)

Outside	Area	CDS catch EEZ	CDS catch high seas	Total outside CCAMLR
	41	2 888	2 170	5 058
	47		74	74
	51	18	59	77
	57			0
	81	503		503
	87	4 292	62	4 354
	Total outside			10 065
Global total				24 226

* Limits for Divisions 58.4.3a and 58.4.3b are combined.

Table 5: Reported catch of *Dissostichus* spp. in exploratory fisheries. (Source: STATLANT data for past seasons, and catch and effort reports for current season.)

Season	Reported catch (tonnes) of *Dissostichus* spp. in exploratory fisheries							
	48.6	58.4.1	58.4.2	58.4.3a	58.4.3b	88.1	88.2	All exploratory fisheries
1996/97						<1	<1	<1
1997/98						42	<1	42
1998/99						297		297
1999/00						751	<1	751
2000/01			<1			660	<1	660
2001/02						1 325	41	1 366
2002/03			117			1 831	106	2 055
2003/04	7	<1	20	<1	7	2 197	375	2 605
2004/05	51	480	126	105	297	3 105	411	4 575
2005/06	163	421	164	89	361	2 969	514	4 680
2006/07	112	634	124	4	251	3 091	347	4 562
2007/08	24	410	217	9	142	2 259	416	3 476
2008/09	282	222	66	31	104	2 434	484	3 624
Total	639	2 167	834	238	1 162	20 961	2 693	28 693

Table 6: Summary of Members and vessels notified in 2009/10 in (a) exploratory longline fisheries for *Dissostichus* spp. (with corresponding number of participating Members, number of vessels and catch limits agreed in conservation measures in force in 2008/09), (b) exploratory trawl fisheries for krill, and (c) exploratory pot fisheries for crab. (Source: CCAMLR-XXVIII/13)

Member notifications	Number of vessels notified by subarea/division						
	48.6	58.4.1	58.4.2	58.4.3a	58.4.3b	88.1	88.2
(a) Notifications for exploratory longline fisheries for *Dissostichus* spp. in 2009/10							
Argentina[1]						1	1
Japan	1	1	1	1	1		
Korea, Republic of	3	5	4	2	3	6	5
New Zealand		3	2			4	4
Russia						2	2
South Africa	1				1		
Spain		1	1			1	1
UK						3	3
Uruguay		1	1		1	1	1
Number of Members	3	5	5	2	4	7	7
Number of vessels	5	11	9	3	6	18	17
Corresponding conservation measures in force in 2008/09							
Number of Members	2	6	4	1	3	9	9
Number of vessels	1*	13	7	1	1*	21	19
Target species catch limit (tonnes)	400	210	70	86	120**	2 700	567

Member notifications	Number of vessels notified by subarea/division
	48.6
(b) Notifications for exploratory trawl fisheries for krill in 2009/10	
Norway	1
Total	1
Corresponding conservation measures in force in 2008/09	
Target species catch limit (tonnes)	15 000

Member notifications	Number of vessels notified by subarea/division	
	48.2	48.4
(c) Notifications for exploratory pot fisheries for crab in 2009/10		
Russia	1	1
Total	1	1
Corresponding conservation measures in force in 2008/09		
Target species catch limit (tonnes)	250	10

* Maximum number per Member at any one time
** Excluding research fishing
[1] The notification includes a proposal for pot fishing if approved.

Table 7: Unstandardised CPUE (kg/hook) of *Dissostichus* spp. in exploratory longline fisheries reported between 1996/97 and 2008/09. (Source: fine-scale data from commercial and fishery-based research hauls, with SSRUs as defined in Conservation Measure 41-01 (2008).)

Subarea/ division	SSRU	Season												
		1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
48.6	A								0.04	0.07	0.11	0.15		
	D											0.05		
	E									0.08		0.13		0.46
	G								0.02	0.07	0.16	0.07	0.12	0.23
58.4.1	C									0.13	0.18	0.15	0.19	0.22
	D												0.09	
	E									0.22	0.10	0.14	0.12	0.13
	F											0.07	0.05	
	G									0.20	0.22	0.24	0.12	0.10
	H												0.15	
58.4.2	A									0.08	0.08	0.13	0.20	0.20
	C							0.10		0.07	0.17		0.42	
	D							0.19	0.06					
	E							0.21	0.11	0.14	0.22	0.15	0.21	0.23
58.4.3a	A									0.05	0.05	0.02	0.08	0.08
58.4.3b	A								0.04	0.08		0.15	0.17	0.22
	B								0.14	0.23	0.17	0.12		
	C									0.07		0.04	0.12	
	D									0.08	0.18	0.03	0.12	0.18
	E									0.10	0.08	0.05		0.21
88.1	A	0.01				0.02		0.16			0.08	0.05		
	B	0.05	0.03			0.17	0.25	0.26	0.11	0.55	0.07	0.33	0.15	0.39
	C					0.44	0.87	0.59	0.31	0.53	1.06	0.71	0.36	0.46
	E		0.07	0.06		0.03		0.05	0.08	0.28		0.02		
	F		0.00					0.03				0.16		
	G		0.06	0.02		0.13	0.12	0.12	0.12	0.15				
	H		0.17	0.26	0.38	0.41	0.74	0.46	0.22	0.77	0.59	0.37	0.40	0.34
	I		0.37	0.23	0.29	0.29	0.43	0.19	0.15	0.43	0.40	0.34	0.43	0.52
	J			0.12	0.18	0.04			0.11	0.19	0.21	0.32	0.18	0.25
	K		0.32	0.15	0.40		0.45		0.01	0.34	0.51		0.28	0.49
	L					0.12			0.10	0.14	0.19		0.17	0.10
	M			0.08		0.08				0.00	0.58	0.39	0.31	
88.2	A									0.14	0.06			
	B						0.82		0.11	0.47	0.54			
	D								0.06					
	E										0.43	0.31	0.19	0.14
	F							0.35	0.42	0.70	0.33	0.22	0.49	0.20
	G										0.26	0.02	0.39	0.16

Table 8: Number of individuals of *Dissostichus* spp. tagged and released and the tagging rate (fish per tonne of green weight caught) reported by vessels operating in 2008/09 in fisheries for *Dissostichus* spp. which have tagging requirements outlined in the conservation measures. The required tagging rate (required rate) for *Dissostichus* spp. is listed for each subarea and division, and does not include any additional requirements when conducting research fishing in closed SSRUs. Vessels which tagged more than 500 fish are indicated (see Conservation Measure 41-01, Annex C). The number of *D. eleginoides* tagged is indicated in parentheses. (Source: observer data and catch and effort reports)

Subarea/division (required rate)	Flag State	Vessel name	*Dissostichus* spp. tagged and released		
			Number of fish		Tagging rate
48.4 (5)	New Zealand	*San Aspiring*	432	(309)	5.84
	UK	*Argos Georgia*	319	(249)	5.36
	Total		751	(558)	
48.6 (3)	Japan	*Shinsei Maru No. 3*	421	(79)	3.83
	Korea, Republic of	*Insung No. 22*	520	(0)	3.01
	Total		941	(79)	
58.4.1 (3)	Korea, Republic of	*Insung No. 1*	418	(0)	3.77
		Insung No. 2	533	(14)	8.89
	Uruguay	*Banzare*	176	(0)	3.44
	Total		1127	(14)	
58.4.2 (3)	Japan	*Shinsei Maru No. 3*	60	(1)	3.12
	Korea, Republic of	*Insung No. 22*	217	(7)	4.61
	Total		277	(8)	
58.4.3a (3)	Japan	*Shinsei Maru No. 3*	113	(113)	3.65
	Total		113	(113)	
58.4.3b (3)	Japan	*Shinsei Maru No. 3*	126	(74)	3.15
	Uruguay	*Banzare*	230	(1)	3.58
	Total		356	(75)	
88.1 (1)	Chile	*Isla Eden*	93	(0)	0.95*
	Korea, Republic of	*Hong Jin No. 707*	237	(84)	1.22
		Insung No. 1	158	(15)	1.29
		Jung Woo No. 2	242	(0)	1.09
		Jung Woo No. 3	164	(0)	1.52
	New Zealand	*Antarctic Chieftain*	185	(0)	1.09
		Janas	166	(0)	1.09
		San Aotea II	186	(0)	1.1
		San Aspiring	271	(1)	1.12
	Spain	*Tronio*	507	(13)	1.36
	UK	*Argos Froyanes*	307	(1)	1.13
		Argos Helena	338	(1)	1.3
	Uruguay	*Ross Star*	54	(0)	1.05
	Total		2908	(115)	
88.2 (1)	Chile	*Isla Eden*	3	(0)	0.7*
	Korea, Republic of	*Hong Jin No. 707*	17	(0)	1.27
	New Zealand	*Antarctic Chieftain*	78	(0)	1.84
		Janas	58	(0)	1.22
	South Africa	*Ross Mar*	120	(0)	1.02
	Spain	*Tronio*	15	(0)	1.18
	UK	*Argos Froyanes*	54	(0)	2.32
		Argos Georgia	182	(0)	1.06
		Argos Helena	24	(0)	1.94
	Uruguay	*Ross Star*	53	(0)	1.4
	Total		604	(0)	

* Corrigendum: The *Isla Eden* tagged and released 139 fish in Subarea 88.1 (tagging rate: 1.41) and 5 fish in Subarea 88.2 (tagging rate: 1.17).

Table 9: Number of *Dissostichus* spp. tagged and released in exploratory longline fisheries. (Source: scientific observer data submitted to CCAMLR)

Subarea/ division	Season									Total
	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	
48.6				4	62	171	129		941	1 307
58.4.1					462	469	1 507	1 134	1 127	4 699
58.4.2					342	136	248	673	277	1 676
58.4.3a					199	104	9	41	113	466
58.4.3b					231	175	289	417	356	1 468
88.1	326	960	1 068	2 251	3 223	2 972	3 608	2 574	2 908	19 890
88.2		12	94	433	341	444	278	389	604	2 595
Total	326	972	1 162	2 688	4 860	4 471	6 068	5 228	6 326	32 101

Table 10: Number of tagged *Dissostichus* spp. recaptured in exploratory longline fisheries. (Source: scientific observer data submitted to CCAMLR)

Subarea/ division	Season									Total
	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	
48.6						3	2		2	7
58.4.1							4	6	7	17
58.4.2									1	1
58.4.3a						6		2	2	10
58.4.3b					1	6	1	1	1	10
88.1	1	4	13	32	59	71	206	216	103	705
88.2				18	17	28	33	36	56	188
Total	1	4	13	50	77	114	246	261	172	938

Table 11: Overlap between the catch-weighted length frequency of *Dissostichus* spp. reported by vessels in the exploratory fisheries in 2008/09, and the length frequency of individuals tagged and released. High ≥60% overlap, Medium ≥30 to <60%, Low <30%. - – Overlap not calculated where less than 30 fish were caught.

Species	Flag State	Vessel name	Subarea/division						
			48.6	58.4.1	58.4.2	58.4.3a	58.4.3b	88.1	88.2
D. mawsoni	Chile	*Isla Eden*						Low	Low
	Japan	*Shinsei Maru No. 3*	High		Medium	-	Medium		
	Korea, Republic of	*Hong Jin No. 707*						Low	Medium
		Insung No. 1		Low				Low	
		Insung No. 22	Low	Low	Low				
		Jung Woo No. 2						Low	
		Jung Woo No. 3						Low	
	New Zealand	*Antarctic Chieftain*						Medium	High
		Janas						Medium	High
		San Aotea II						High	
		San Aspiring						High	
	South Africa	*Ross Mar*							Medium
	Spain	*Tronio*						Low	Low
	UK	*Argos Froyanes*						Medium	Medium
		Argos Georgia							Medium
		Argos Helena						Medium	Medium
	Uruguay	*Banzare*		Medium			Medium		
		Ross Star						Medium	High
D. eleginoides	Japan	*Shinsei Maru No. 3*	Low		-	Medium	Low		
	Korea, Republic of	*Hong Jin No. 707*						Low	
		Insung No. 1		-				-	
		Insung No. 22		-	-				
	New Zealand	*Janas*						-	
		San Aotea II						-	
		San Aspiring						-	
	South Africa	*Ross Mar*							-
	Spain	*Tronio*						Medium	
	UK	*Argos Froyanes*						-	
		Argos Helena						-	
	Uruguay	*Banzare*					-		

Table 12: Summary of proximity of vessel haul locations to allocated haul locations for research hauls carried out in Subareas 58.4 and 48.6 during the 2008/09 season. [#] – mean minimum distance (n miles) between the start positions for allocated and actual research lines; * – mean distance (n miles) between the geographic mid-points of the research lines, and number of lines less than the required minimum of 5 n miles; [$] – research haul location (F – Fished; L – lightly fished; U – unfished). Comments – reasons why allocated positions could not be reached.

Vessel	SSRU	Mean minimum distance (n miles)[#]	Mean distance between mid-points (n miles)*	No. lines <5 n miles apart	Number of actual (and allocated) research hauls in stratum[$]			Number of hauls in allocated locations	% hauls in allocated location	Comments
					F	L	U			
Banzare	5841C	28	11	6	10 (5)	0	0 (5)	5	50	Sea-ice + vessel
	5843bD	74	15	0	0 (5)	10 (5)	0	5	50	
	5843bE	53	14	0	0 (5)	3 (5)	7	3	30	
Insung No. 1	5841C	49	15	2	10 (5)	0	(5)	5	50	Sea-ice + vessel
	5841E	2	35	0	5 (5)	0	5 (5)	10	100	
Insung No. 22	486E	2	34	0	5 (5)	0	5 (5)	10	100	
	5841G	1	34	0	5 (5)	5 (5)	0	10	100	
	5842E	0	51	0	5 (5)	5 (5)	0	10	100	
Shinsei Maru No. 3	486E	6	23	2	6 (5)	0	5 (5)	10	100	Sea-ice
	486G	0	45	0	5 (5)	5 (5)	0	10	100	
	5842A	0	53	0	5 (5)	0	(5)	5	50	Fishery closure
	5842E	0	60	0	5 (5)	5 (5)	0	10	100	
	5843aA	0	44	0	5 (5)	5 (5)	0	10	100	
	5843bA	0	48	0	5 (5)	5 (5)	0	10	100	
	5843bE	1	30	0	5 (5)	5 (5)	0	10	100	

Table 13: Catches for macrourids, rajids and other species taken as by-catch from longline fisheries in 2008/09, and reported in fine-scale (C2) data. Catches are given in tonnes and as a percentage of the catch of *Dissostichus* spp. (TOT) reported in fine-scale data. (Rajids released from longlines are not included in these estimates.)

Subarea/division	Toothfish catch (tonnes)	Macrourids				Rajids				Other species		
		Catch (tonnes)	% TOT	Catch limit	% Catch limit	Catch (tonnes)	% TOT	Catch limit	% Catch limit	Catch (tonnes)	% TOT	Catch limit
48.3	3382	110	3.3	196	56.1	22	0.7	196	11.2	33	1	-
48.4 Northern Area	59	12	20.2	12	100.0	1	1.7	4	25.0	0	0.7	-
48.4 Southern Area	74	14	19	na	-	1	0.9	na	-	1	1.2	-
48.6	282	5	1.6	64	7.8	0	0	100	0.0	2	0.6	140
58.4.1	222	8	3.4	33	24.2	0	0	50	0.0	0	0.2	60
58.4.2	66	1	2.1	20	5.0	0	0	50	0.0	0	0.2	60
58.4.3a	31	2	5	26	7.7	2	6	50	4.0	2	8	20
58.4.3b	104	4	3.5	80	5.0	1	1.4	50	2.0	0	0.4	80
58.5.1 French EEZ*	3108	473	15.2	na	-	273	8.8	na	-	19	0.6	na
58.5.2***	1159	110	9.5	360	30.6	15	1.3	120	12.5	9	0.7	50
58.6 French EEZ**	746	170	22.8	na	-	42	5.6	na	-	75	10	na
58 South African EEZ	2	0	6.8	na	-	0	0	na	-	0	1.5	na
88.1	2448	183	7.5	430	42.6	7	0.3	135	5.2	16	0.6	160
88.2	484	58	12.1	90	64.4	0	0	50	0.0	14	2.9	100

* Data to 9 August 2009
** Data to 10 July 2009
*** Longline only, does not include trawl data.

Table 14: Numbers of rajids retained, discarded and released as reported in fine-scale (C2) data in (a) the 2007/08 season and (b) the 2008/09 season and calculated total numbers of rajids hauled on lines; and numbers of rajiids tagged and recaptured as reported in scientific observer data submitted to CCAMLR in (a) the 2007/08 season and (b) the 2008/09 season, and calculated tag rates across subareas.

(a)

Subarea/division	Retained (*n*)	Discarded (*n*)	Released (*n*)	Tagged (*n*)	Total hauled (*n*)	Tag rate	Tags recaptured (*n*)
48.3	12	1 586	19 558	885	21 156	0.04	29
48.4 Northern Area	0	724	8 276	112	9 000	0.01	0
48.6	0	0	0	0	0	0.00	0
58 South African EEZ	0	0	0	0	0	0.00	0
58.4.1	11	0	0	0	11	0.00	0
58.4.2	74	0	0	0	74	0.00	0
58.4.3a	332	0	0	0	332	0.00	0
58.4.3b	151	1	157	0	309	0.00	0
58.5.1	65 133	18 829	3 593	0	87 555	0.00	0
58.5.2	1 903	0	6 125	1 115*	8 028	0.13	0
58.6 French EEZ	1 186	11 422	11 397	0	24 005	0.00	0
88.1	416	15	7 190	1 301	7 621	0.17	36
88.2	0	0	0	0	0	0.00	0

* Tags released as part of a national tagging program, not reported in scientific observer data submitted to CCAMLR.

(continued)

Table 14 (continued)

(b)

Subarea/division	Retained (*n*)	Discarded (*n*)	Released (*n*)	Tagged (*n*)	Total hauled (*n*)	Tag rate	Tags recaptured (*n*)
48.3	108	2 869	23 709	1 596	26 686	0.06	32
48.4 Northern Area	0	188	6 501	254	6 689	0.04	0
48.4 Southern Area	0	120	3 266	0	3 386	0.00	0
48.6	1	0	0	6	1	0.00	0
58 South African EEZ	0	0	0	0	0	0.00	0
58.4.1	1	0	0	0	1	0.00	0
58.4.2	0	0	0	0	0	0.00	0
58.4.3a	0	586	57	34	643	0.05	0
58.4.3b	4	400	102	5	506	0.01	0
58.5.1	43 939	13 562	2 729	0	60 230	0.00	0
58.5.2	1 824	0	8 204	858*	10 028	0.09	6
58.6 French EEZ	2 128	14 600	16 843	0	33 571	0.00	0
88.1	864	46	7 088	1 907	7 998	0.24	23
88.2	10	4	265	99	279	0.35	0

* Tags released as part of a national tagging program, not reported in scientific observer data submitted to CCAMLR.

Table 15: Individual vessels' rajid tagging rates calculated from total numbers of rajids tagged (source: scientific observer data submitted to CCAMLR) and total numbers of rajids caught (source: fine-scale (C2) data) for vessels in new and exploratory fisheries during the 2008/09 season.

Subarea/division	Nationality	Vessel	Total caught*	Total tagged	Tagging rate
48.6	JPN	*Shinsei Maru No. 3*	0	0	na
	KOR	*Insung No. 22*	7	6	0.86
58.4.1	KOR	*Insung No. 1*	0	0	na
	KOR	*Insung No. 22*	0	0	na
	URY	*Banzare*	0	0	na
58.4.2	JPN	*Shinsei Maru No. 3*	0	0	na
	KOR	*Insung No. 22*	0	0	na
58.4.3a	JPN	*Shinsei Maru No. 3*	646	34	0.05
58.4.3b	JPN	*Shinsei Maru No. 3*	16	5	0.31
	URY	*Banzare*	489	0	0
88.1	CHL	*Isla Eden*	440	38	0.09
	KOR	*Hong Jin No. 707*	153	32	0.21
	KOR	*Insung No. 1*	201	16	0.08
	KOR	*Jung Woo No. 2*	90	24	0.27
	KOR	*Jung Woo No. 3*	18	0	0
	NZL	*Antarctic Chieftain*	1327	261	0.2
	NZL	*Janas*	2569	505	(>500 fish)
	NZL	*San Aotea II*	1339	376	0.28
	NZL	*San Aspiring*	1016	262	0.26
	ESP	*Tronio*	7	6	0.86
	GBR	*Argos Froyanes*	764	350	0.46
	GBR	*Argos Helena*	35	21	0.6
	URY	*Ross Star*	115	16	0.14
88.2	CHL	*Isla Eden*	0	0	na
	KOR	*Hong Jin No. 707*	0	0	na
	NZL	*Antarctic Chieftain*	2	1	0.5
	NZL	*Janas*	35	11	0.31
	ZAF	*Ross Mar*	0	0	na
	ESP	*Tronio*	0	0	na
	GBR	*Argos Froyanes*	110	55	0.5
	GBR	*Argos Georgia*	0	0	na
	GBR	*Argos Helena*	81	25	0.31
	URY	*Ross Star*	44	7	0.16

* Total caught includes those fish tagged and released.

Table 16: Fate of rajid by-catch caught during scientific observation periods as reported in scientific observer data (L5) reported to CCAMLR for the 2008/09 season, given in (a) numbers and (b) as a percentage of all rajids observed.

(a)

Subarea/ division	Discarded dead	Released in good health	Released in average health	Released in poor health	Released, condition unknown	Released, but predated on	Retained without tags	Retained with tags	Released with tags	Total caught not released with tags	Total caught
48.3	318	1554	1887	243	2032	196	43	9	1596	6282	7878
48.4	29	2241	672	187	720	18	21	-	254	3888	4142
48.6	-	4	-	-	-	-	-	-	6	4	10
58.4.3a	95	30	-	-	-	-	-	-	34	125	159
58.4.3b	3	8	76	-	-	-	-	-	5	87	92
58.5.2	629**	538	150	90	1773	2	1343	1	*	4526	4526
88.1	97	4214	1278	308	90	14	933	22	1907	6956	8863
88.2	-	102	10	-	14	-	12	-	99	138	237

* Tagging not reported to CCAMLR in L5 forms.

** This figure is likely to include large numbers of skates, incorrectly coded by observers, that were actually retained without tags. Australia has undertaken to resubmit the observer data for rajid by-catch used to generate this table.

(b)

Subarea/ division	Discarded dead	Released in good health	Released in average health	Released in poor health	Released, condition unknown	Released, but predated on	Retained without tags	Retained with tags
48.3	4.0	19.7	24.0	3.1	25.8	2.5	0.5	0.1
48.4	0.7	54.1	16.2	4.5	17.4	0.4	0.5	0.0
48.6	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0
58.4.3a	59.7	18.9	0.0	0.0	0.0	0.0	0.0	0.0
58.4.3b	3.3	8.7	82.6	0.0	0.0	0.0	0.0	0.0
58.5.2	13.9**	11.9	3.3	2.0	39.2	0.0	29.7	0.0
88.1	1.1	47.5	14.4	3.5	1.0	0.2	10.5	0.2
88.2	0.0	43.0	4.2	0.0	5.9	0.0	5.1	0.0
Average	10.3	30.5	18.1	1.6	11.2	0.4	5.8	0.0

** This figure is likely to include large numbers of skates, incorrectly coded by observers, that were actually retained without tags. Australia has undertaken to resubmit the observer data for rajid by-catch used to generate this table.

Table 17: Evaluation report card of assessments of bottom fishing activities submitted under the pro forma in Conservation Measure 22-06, Annex A. NA – unknown, NR – information not provided, L – minimal detail or summary information, M – some detailed information provided, some discussion, H – detailed data provided, detailed discussion of potential impacts, - – no, + – yes.

Member/gear	Argentina	Japan	Korea, Republic of	New Zealand	Russia	South Africa	Spain	UK	Uruguay	Total
Number of vessels	1	1	6	4	3	2	1	3	2	23
Number of subareas/divisions	2	5	7	4	3	2	4	2	5	
Notifications (vessel × fishery)	2	5	28	13	5*	2	4	6	5	70
Assessment submitted	+	+	-	+	-	+	+	+	+	7/9
1.1 Scope										
1.2 Proposed fishing activity										
1.2.1 Detailed description of gear	M	M		H		M	M	L	M	
1.2.2 Scale of proposed activity (number of sets)	170	400		500		NA	110	471	NA	
1.2.3 Spatial distribution of activity	L	L		L		L	L	L	L	
1.3 Mitigation measures to be used	+	+		+		+	+	+	+	
Effectiveness	NA	NA		NA		NA	NA	NA	NA	
2.1 Assessment of known/ anticipated impacts on VMEs	L	M		H		NR	NA	M	L	
2.1.1 Estimated spatial effort footprint *Please provide details of % area covered by fishing effort.*	1.2 km^2	NR		NA		<20%	0.37%	0.0035%	NA	
2.1.2 Summary of potential VMEs present within areas of activity	L	L		H		NR	M	H	NR	
2.1.3 Probability of impacts	L	L		H		L	M	H	NR	
2.1.4 Magnitude/severity of the interaction of the proposed fishing gear with VMEs	L	L		H		L	H	M	NR	
2.1.5 Physical and biological/ecological consequences of impact	L	L		H		L	H	L	NR	
2.2 Estimated cumulative footprint	NR	L		0.0088%		NR	NR	0.12%	NR	
2.3 Research activities related to provision of new information on VMEs										
2.3.1 Previous research	L	L		H		L	M	M	NR	
2.3.2 In-season research	L	L		L		L	M	M	L	
2.3.3 Follow-on research	L	L		H		L	M	L	NR	
Cumulative assessment quality	L	L		H		L	M	M	L	

* Includes Subarea 48.2 but not Subarea 48.4.

Table 18(a): Total historical fishing effort for all bottom longline methods, within subareas/divisions with new and exploratory fisheries, and proposed additional effort by new and exploratory fisheries. tbd – to be determined; na – not applicable.

Fishing method	Historical fishing effort, by subarea/division							
	48.2	48.6	58.4.1	58.4.2	58.4.3a	58.4.3b	88.1	88.2
Autoliner	0	1 840 214	226 240	1 325 478	237 800	2 647 200	56 000 000	10 000 000
Not reported	0	0	0	0	0	0	221 100	0
Spanish longline	23 749	4 377 160	22 000 000	6 594 434	7 062 076	10 000 000	36 000 000	3 591 511
Trotline	0	1 233 000	923 115	185 400	902 371	1 470 557	355 800	0
Total length (m)	23 749	7 450 374	23 149 355	8 105 312	8 202 247	14 117 757	92 221 100	13 591 511
Historical non-fishery or IUU effort	tbd	tbd	tbd	tbd	tbd	tbd	tbd	tbd
	New and exploratory fishery notifications							
Number of vessels	1	5	11	9	3	6	18	17
Number of Members	1	3	5	5	2	4	7	7
Proposed line length for upcoming season	na	na	na	na	na	na	na	na
Estimated total (incl. upcoming season)	na	na	na	na	na	na	na	na

Table 18(b): Estimated cumulative historical footprint for all bottom longline methods combined, as a proportion of total fishable area, within subareas for exploratory fisheries.

Total cumulative line length (m) – (from Table 18(a))	23 749	7 450 374	23 149 355	8 105 312	8 202 247	14 117 757	92 221 100	13 591 511
Total fishable area (km^2) 600–1 800 m	na	84 116	210 314	115 258	18 605	130 678	238 148	31 285
Line per fishable area (m/km^2)	na	88.5726	109.128	70.3232	440.863	108.197	389.37	437.326
% footprint per area (1 m width)	na	0.00886	0.01091	0.00703	0.04409	0.01082	0.03894	0.04373
% footprint per area (25 m width)	na	0.22143	0.27282	0.17581	1.10216	0.27049	0.97343	1.09332

Table 19: Guidelines for the preparation of Members' Bottom Fishing Gear Assessments.

(i)	A detailed description of the physical fishing gear and its deployment process (as in WG-FSA-05/54) with relevant diagrams and a detailed breakdown of the different functional components of the gear – including weight, size, material properties (e.g. breaking strain), sink rates in water etc. – so that impact estimates can be derived separately for each gear component if necessary. If possible and appropriate, this description can cross-reference gear descriptions to be included in the developing CCAMLR gear library.
(ii)	A detailed description of the fishing process and the known or expected behaviour of the gear with emphasis on the extent and nature of contact between fishing gear and the sea floor, including gear movement during the setting, soaking and hauling process.
(iii)	A numerical estimate of the fishing activity 'footprint' (in m^2) – i.e. the maximum spatial extent within which contact with the ocean floor can occur – per unit of fishing effort. Effort should be reported in units used in the relevant Bottom Fishing Gear Assessment. An explicit discussion of uncertainty regarding the assumptions used in estimating the standard gear footprint is an essential component to be included in the discussion.
(iv)	A description of non-standard gear deployment scenarios (e.g. line breakage, gear loss) that can be expected to change the footprint size or impact level associated with fishing activity, with numerical estimates of their frequencies of occurrence and associated spatial extent as in (iii) above.

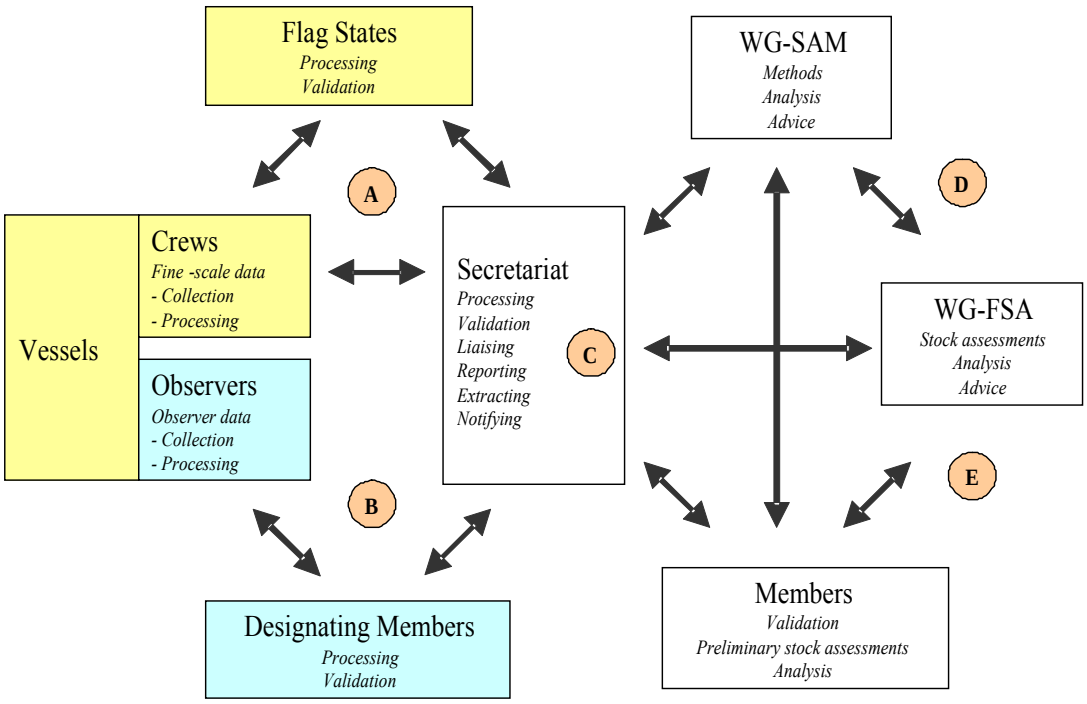


Figure 1: Workflow associated with fishery fine-scale data and scientific observer data, from collection on board the vessels to input to stock assessments, with potential pressure points A–E. A: fine-scale data are submitted to the Secretariat either from the vessel or via the Flag State (submission deadline: end of the month following the month of data collection). B: scientific observer data are submitted to the Secretariat via the Designating Members' technical coordinators (submission deadline: within one month of the observer returning to their home port). C: Data are usually processed within 2–3 weeks of receipt, validation is usually done within 2–4 months of processing. D: WG-SAM usually meets 2–3 months prior to WG-FSA. E: The deadline for the submission of meeting documents, including preliminary assessments, is two weeks prior to the meeting.

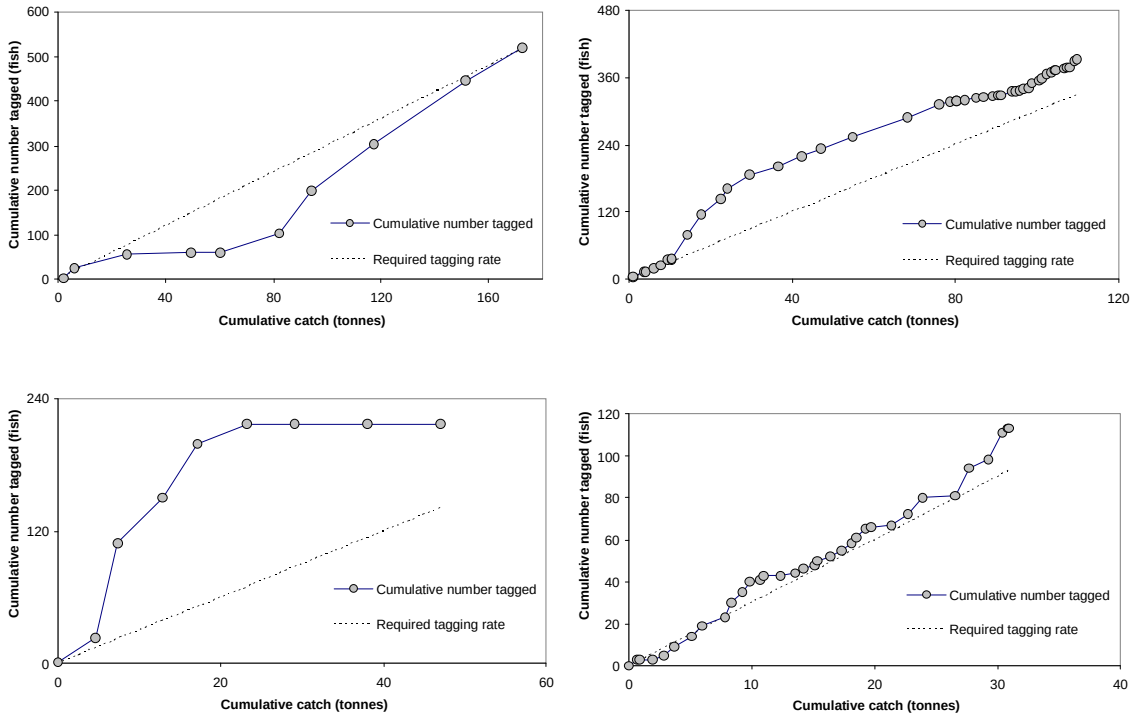


Figure 2: Cumulative catch of *Dissostichus* spp. versus cumulative number of *Dissostichus* spp. tagged for selected vessels engaged in the exploratory fisheries for *Dissostichus* spp. in Subareas 48.6 (top) and 58.4 (bottom) in 2008/09. Left-hand panels are examples of vessels tagging at variable rates throughout the fishing period with right-hand panels showing examples where tagging effort was more constant (source: catch – C2 data; number tagged – observer data).

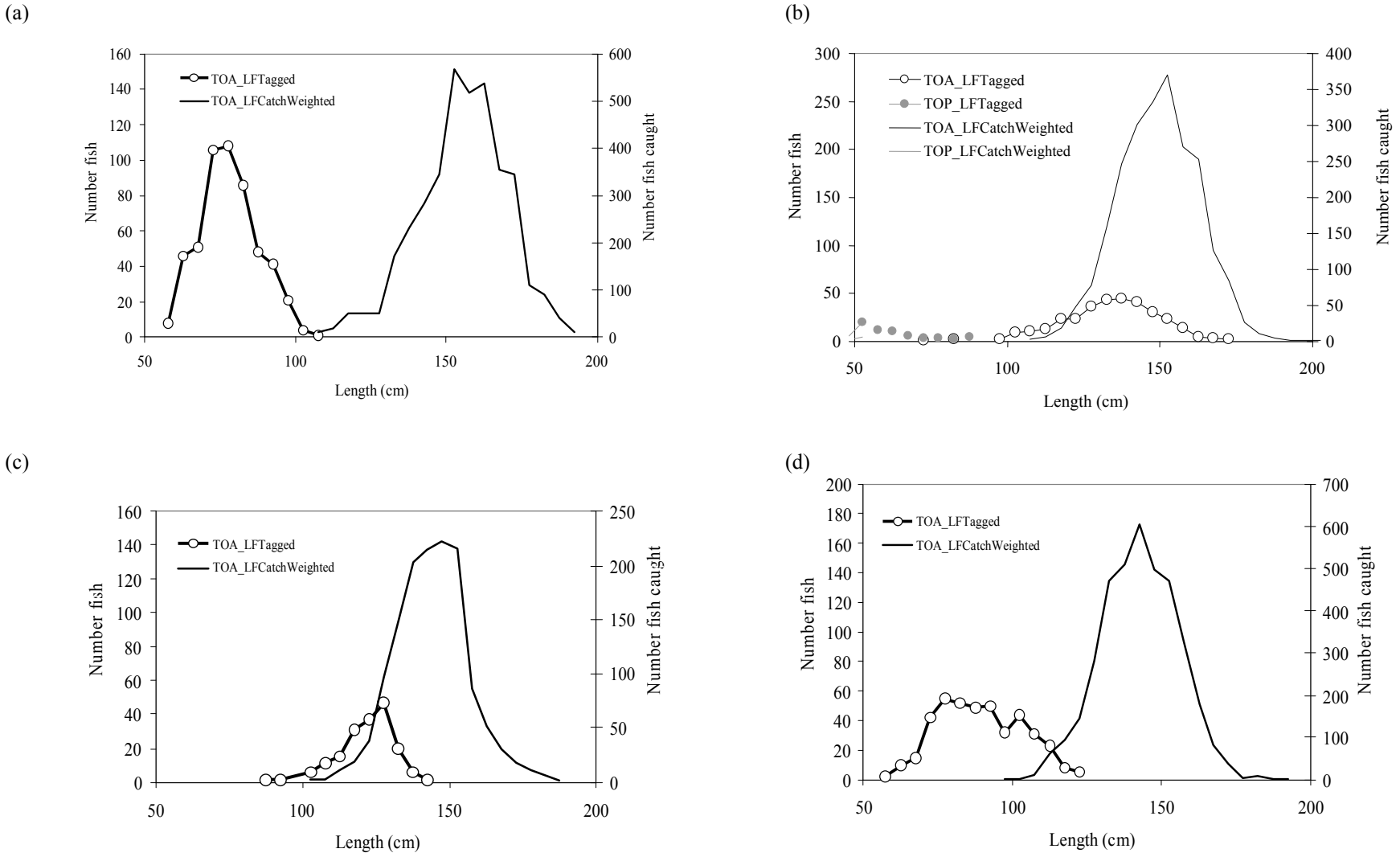


Figure 3: Plots of distributions of the length frequency of catch and length frequency of fish tagged for selected vessels fishing in areas where overlap data metrics were (a) Low, (b) High, (c) Medium and (d) Low respectively (see paragraph 5.13 and Table 11).

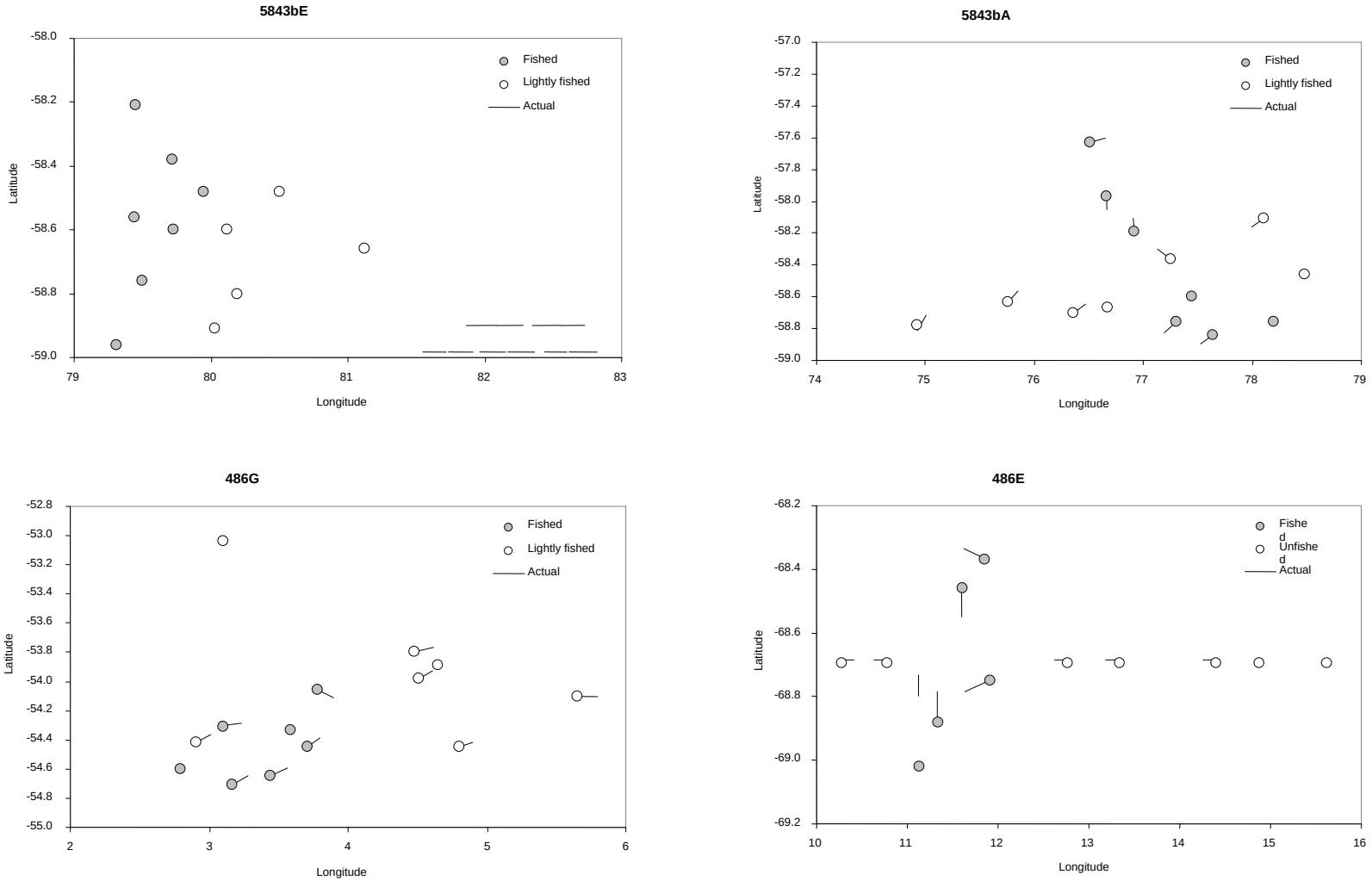
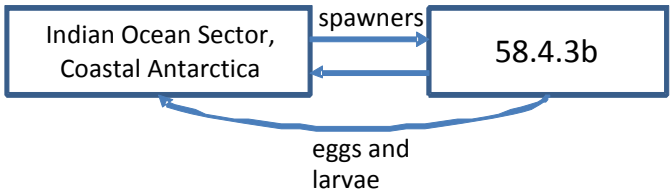
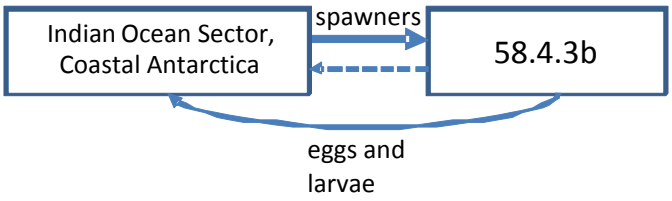


Figure 4: Plots of start positions of research hauls allocated in each stratum (fished, lightly fished, unfished) and the position of research hauls deployed (actual) by selected vessels in Division 58.4.3 (top panels) and Subarea 48.6 (bottom) illustrating the variability in the level of consistency with designation of research hauls. Figures from WG-SAM-09/6.

Scenario 1 – Regular movement, Division 58.4.3b main spawning area



Scenario 2 – Sporadic movement, Division 58.4.3b main spawning area



Scenario 3 – Regular movement, only large fish move to Division 58.4.3b

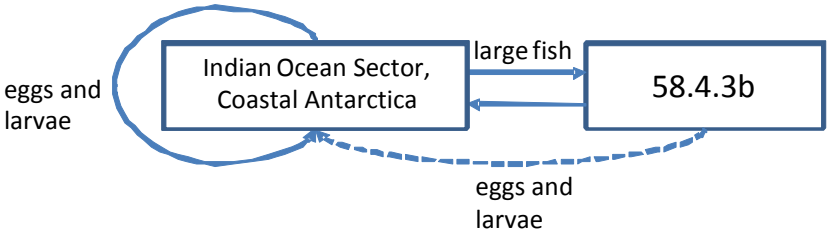


Figure 5: Diagram illustrating possible scenarios for the *Dissostichus mawsoni* stock on BANZARE Bank (Division 58.4.3b). Solid arrows indicate regular movements of fish, dashed arrows indicate sporadic movement of fish.

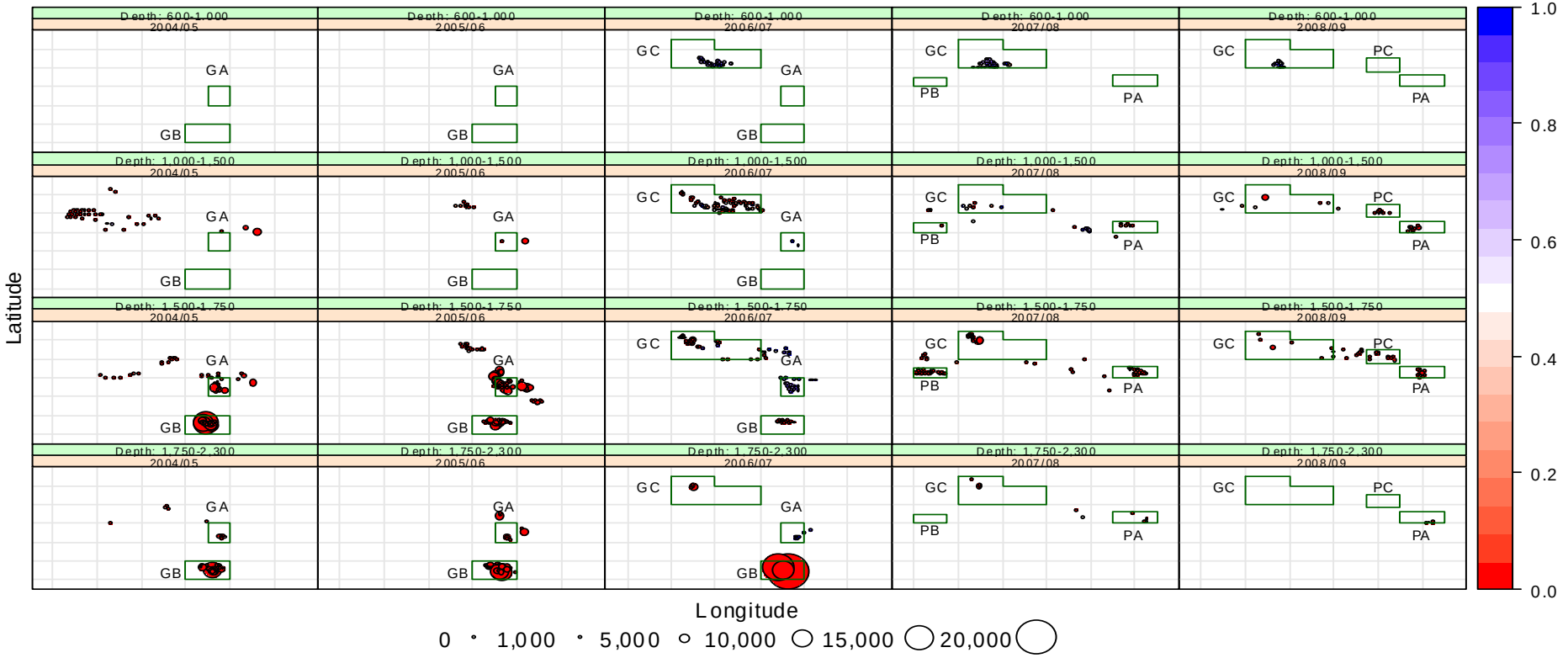


Figure 6*: Bubbleplot showing total toothfish removals (kg) proportional to symbol size for individual longlines fished in BANZARE Bank, showing different panels for season and depth fished. Colour on a red-blue gradient represents *Dissostichus eleginoides* catch as a proportion of total catch (i.e. blue = *Dissostichus eleginoides*, red = *Dissostichus mawsoni*). Also shown are Grounds A–C defined in McKinlay et al. (2008) and Patches A–C defined in WG-FSA-09/44, and the seasons in which they were analysed.

* This figure is available in colour on the CCAMLR website.

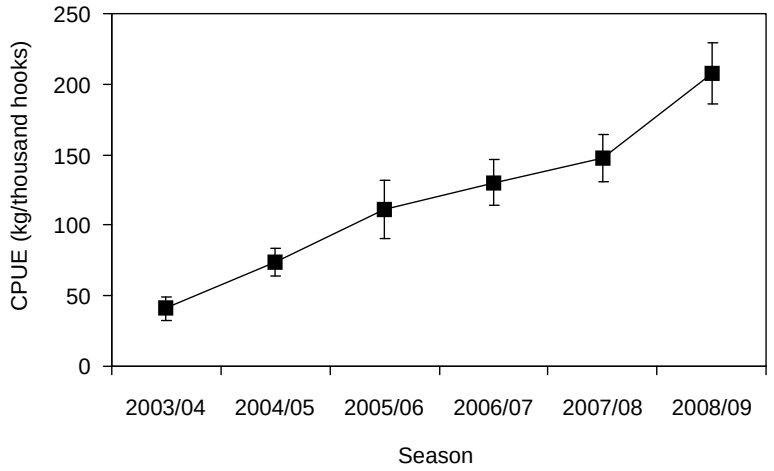


Figure 7: Unstandardised CPUE (kg/thousand hooks) of *Dissostichus* spp. in the exploratory longline fishery in Division 58.4.3b (source: fine-scale catch and effort data). Error bars: 95% confidence limits.

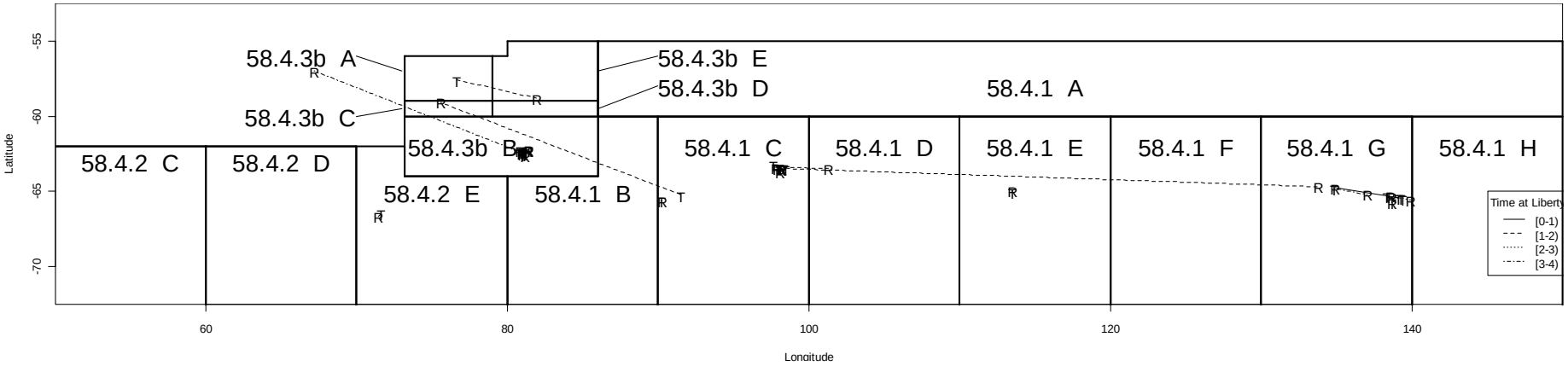


Figure 8: Plot of tag recaptures in Divisions 58.4.1, 58.4.2 and 58.4.3b recorded between 2003/04 and 2008/09. 'T' indicates the release location and 'R' indicates the recapture location.

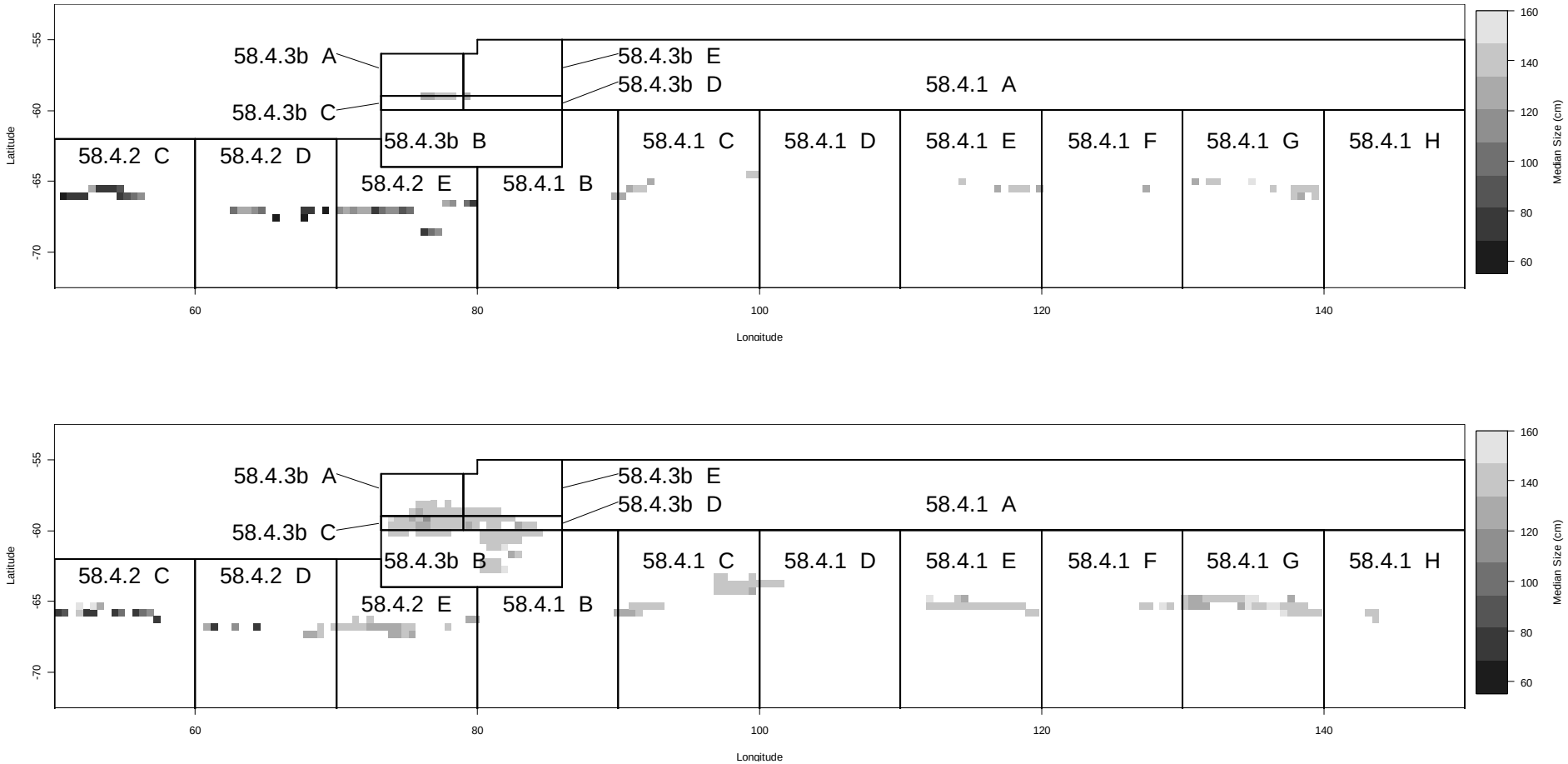


Figure 9: Plot of median lengths for longlines sampled in Divisions 58.4.1, 58.4.2 and 58.4.3b between 2003/04 and 2008/09, aggregated into 0.5° latitude × 0.5° longitude boxes. The upper panel shows data for fishing in depths shallower than 1 000 m, the lower panel for fishing in depths deeper than 1 000 m. Note darker squares indicate smaller median length; lighter squares indicate larger median length.

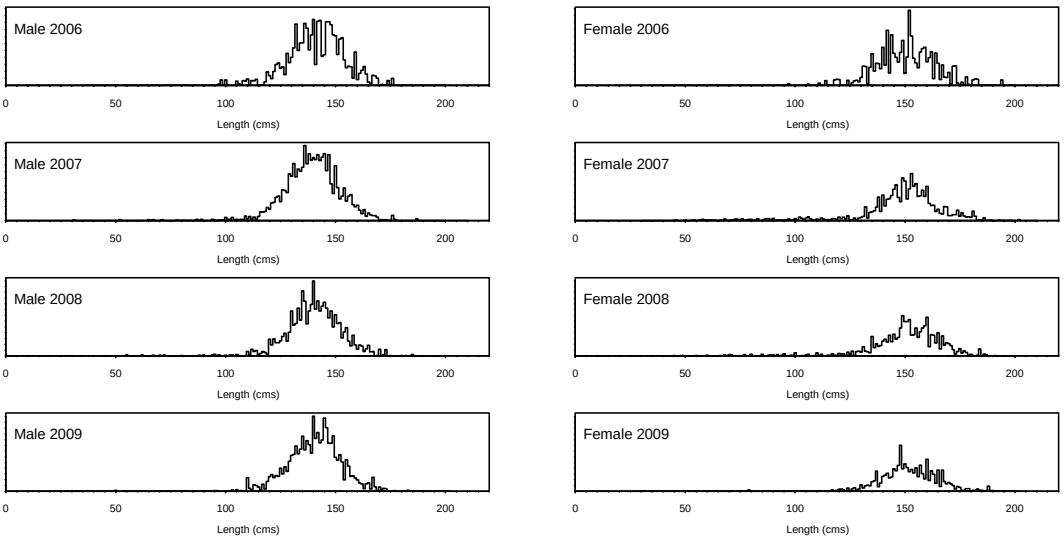


Figure 10: Scaled length frequency of male and female *Dissostichus mawsoni* in the north fishery of the Ross Sea (WG-FSA-09/36), for the years 2006–2009.

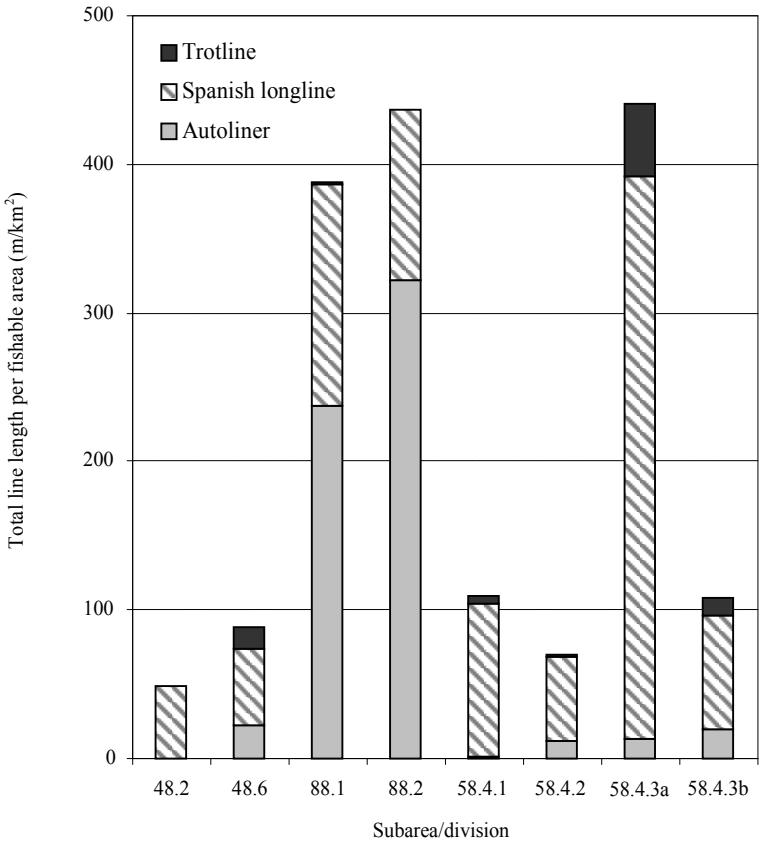


Figure 11: Cumulative total line length per km² of fishable area in each subarea/division, summed by recorded longline gear type.

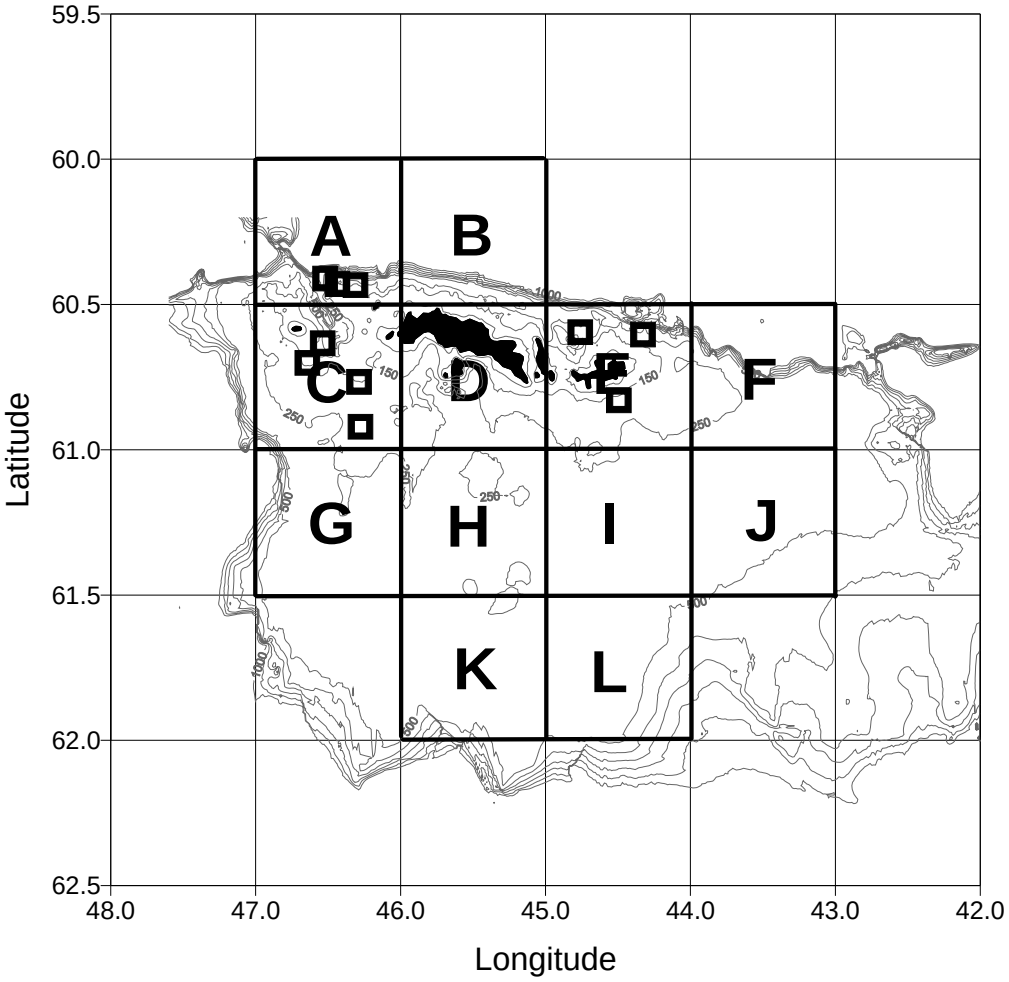
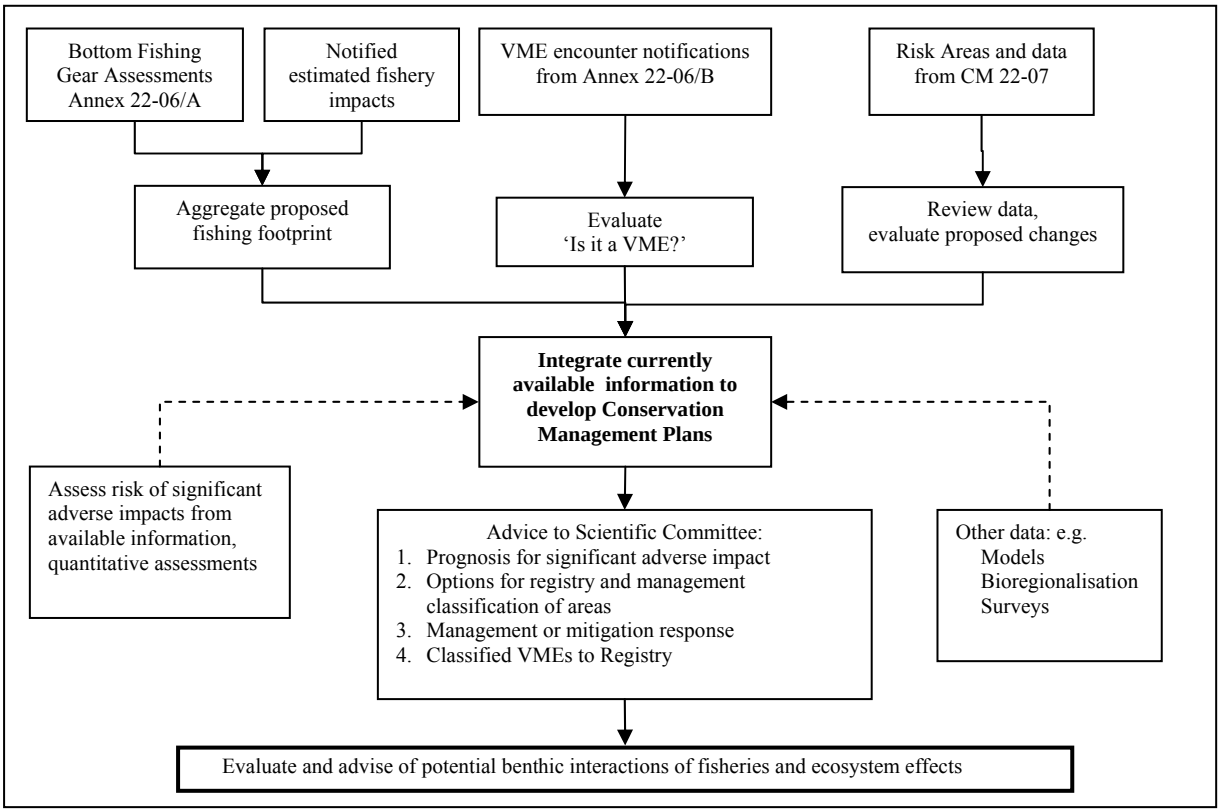


Figure 12: Operational area of phase I of the experimental harvest regime for the crab fishery in Subarea 48.2 (Conservation Measure 52-02, Annex B) with VMEs notified under Conservation Measure 22-06 (see WG-EMM-09/32) indicated by squares.



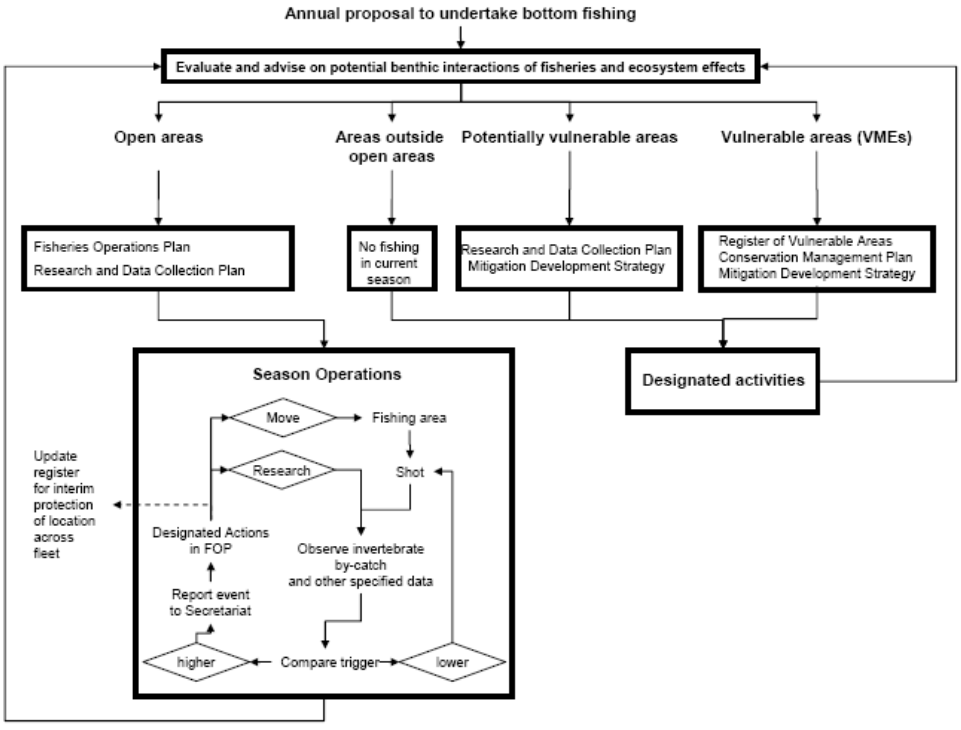


Figure 13: Proposed framework for managing flow and review of information resulting from implementation of Conservation Measures 22-06 and 22-07 (top panel) leading to the evaluation and advice on potential benthic interactions of fisheries and ecosystem effects (from SC-CAMLR-XXVII, Figure 1, bottom panel).

1. General information Include contact information, nationality, vessel name(s) and dates of data collection. Preferably, the notification should be prepared as a proposal, using these guidelines and submitted as a meeting document to WG-EMM for review.
2. VME location Start and end positions of all gear deployments and/or observations. Maps of sampling locations, underlying bathymetry or habitat and spatial scale of sampling. Dept h(s) sampled.
3. Sampling gear Indicate sampling gears used at each location.
4. Additional data collected Indicate additional data collected at or near the locations sampled. Data such as multibeam bathymetry, oceanographic data such as CTD profiles, current profiles, water chemistry, substrate types recorded at or near those locations, other fauna observed, video recordings, acoustic profiles etc.
5. Supporting evidence Provide supporting evidence, rationale, analysis, and justification to classify the indicated areas as vulnerable marine ecosystems.
6. VME taxa For each station sampled, provide details of all the VME taxa observed, including their relative density, absolute density, or number of organisms if possible.

Figure 14: Proposed guidelines for preparation and submission of notifications of encounters with VMEs under Conservation Measure 22-06.

APPENDIX A

LIST OF PARTICIPANTS

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Information Technology Support Specialist	Tim Byrne

APPENDIX B

AGENDA

Working Group on Fish Stock Assessment
(Hobart, Australia, 12 to 23 October 2009)

1. Opening of the meeting

2. Organisation of the meeting and adoption of the agenda

   2.1 Organisation of meeting
   2.2 Subgroup organisation and coordination

3. Review of available information

   3.1 Data requirements specified in 2008
      3.1.1 Development of the CCAMLR database
      3.1.2 Data processing
      3.1.3 Fishery plans

   3.2 Fisheries information
      3.2.1 Catch and effort data reported to CCAMLR
      3.2.2 Estimates of catch and effort from IUU fishing
      3.2.3 Catch and effort data for toothfish fisheries in waters adjacent to the Convention Area
      3.2.4 Scientific observer information

   3.3 Inputs for stock assessment
      3.3.1 Catch-at-length/age from fisheries
      3.3.2 Research surveys
      3.3.3 CPUE analyses
      3.3.4 Tagging studies
      3.3.5 Biological parameters
      3.3.6 Stock structure and management areas
      3.3.7 Depredation

4. Preparation for assessments and assessment timetable

   4.1 Report from the Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM)
   4.2 Report from the Working Group on Statistics, Assessments, and Modelling (WG-SAM)
   4.3 Review of preliminary stock assessment papers
   4.4 Assessments to be carried out and assessment timetable

5. Assessments and management advice

5.1 New and exploratory fisheries
- 5.1.1 New and exploratory fisheries in 2008/09
- 5.1.2 New and exploratory fisheries notified for 2009/10
- 5.1.3 Progress towards assessments of exploratory fisheries
- 5.1.4 Update Fishery Report for Subarea 48.6
- 5.1.5 Update Fishery Reports for Divisions in Subarea 58.4
- 5.1.6 Update Fishery Report for Subareas 88.1 and 88.2
- 5.1.7 Research plan for *Dissostichus* spp. Ob and Lena Banks (Division 58.4.4)

5.2 Development of methods to assess exploratory fisheries
- 5.2.1 Data requirements for assessing exploratory fisheries
- 5.2.2 Research designs in exploratory toothfish fisheries

5.3 Update Fishery Reports for the following assessed fisheries
- 5.3.1 *Dissostichus eleginoides* South Georgia (Subarea 48.3)
- 5.3.2 *Dissostichus* spp. South Sandwich Islands (Subarea 48.4)
- 5.3.3 *Dissostichus eleginoides* Kerguelen Islands (Division 58.5.1)
- 5.3.4 *Dissostichus eleginoides* Heard Island (Division 58.5.2)
- 5.3.5 *Dissostichus eleginoides* Crozet Islands (Subarea 58.6)
- 5.3.6 *Dissostichus eleginoides* Prince Edward and Marion Islands (Subareas 58.6 and 58.7)
- 5.3.7 *Champsocephalus gunnari* South Georgia (Subarea 48.3)
- 5.3.8 *Champsocephalus gunnari* Heard Island (Division 58.5.2)

5.4 Assessment and management advice for other fisheries
- 5.4.1 Antarctic Peninsula (Subarea 48.1) and South Orkney Islands (Subarea 48.2)
- 5.4.2 Crabs (*Paralomis spinosissima* and *P. formosa*) (Subareas 48.2, 48.3 and 48.4)
- 5.4.3 *Martialia hyadesi* (Subarea 48.3)

6. Fish and invertebrate by-catch

6.1 Year-of-the-Skate activities
6.2 Estimation of by-catch levels and rates
6.3 Assessment of by-catch species
6.4 Mitigation measures

7. Incidental mortality of mammals and seabirds associated with fishing (WG-IMAF Report)

8. Evaluation of the threats arising from IUU fishing activities

8.1 Development of approaches for estimating total removals of toothfish
8.2 Review of historical trends in IUU fishing activity

9. Biology, ecology and demography of target and by-catch species

9.1 Review information available to the meeting
9.1.1 Target species
9.1.2 By-catch species

9.2 Species profiles

9.3 CCAMLR Otolith Network

10. Considerations of ecosystem management

10.1 Bottom fishing activities and vulnerable marine ecosystems (VMEs)
10.1.1 Risk assessments
10.1.2 Review of fishery- and research-based notifications for 2008/09
10.1.3 Review of conservation measures
10.1.4 Advice to Scientific Committee

10.2 Development of ecosystem models

10.2.1 Report of the Second Workshop on Fisheries and Ecosystem Models (FEMA2)
10.2.2 Other modelling approaches

10.3 Depredation

10.4 Other Interactions with WG-EMM

11. Scheme of International Scientific Observation

11.1 Report from the ad hoc Technical Group for At-Sea Observations (TASO)

11.2 Summary of information extracted from observer reports and/or provided by technical coordinators

11.3 Implementation of the Scheme of International Scientific Observation
11.3.1 *Scientific Observers Manual*
11.3.2 Sampling strategies and priorities

12. Future assessments

12.1 Generic and specific work for developing assessments
12.2 Frequency of future assessments

13. Future work

13.1 Organisation of intersessional activities in subgroups

13.2 Intersessional meetings
13.2.1 Meeting of WG-SAM
13.2.2 Meeting of ad hoc TASO
13.2.3 Meeting of SG-ASAM
13.2.4 Other

13.3 Notification of scientific research

14. Advice to Scientific Committee

15. Other business

16. Adoption of the report

17. Close of the meeting.

APPENDIX C

LIST OF DOCUMENTS

Working Group on Fish Stock Assessment
(Hobart, Australia, 12 to 23 October 2009)

WG-FSA-09/1	Provisional Agenda and Provisional Annotated Agenda for the 2009 Meeting of the Working Group on Fish Stock Assessment (WG-FSA)
WG-FSA-09/2	List of participants
WG-FSA-09/3	List of documents
WG-FSA-09/4	CCAMLR fisheries: 2009 update Secretariat
WG-FSA-09/5 Rev. 1	Estimation of IUU catches of toothfish inside the Convention Area during the 2008/09 fishing season Secretariat
WG-FSA-09/6	Development of a registry of vulnerable marine ecosystems in the Convention Area Secretariat
WG-FSA-09/7	Climate change, longevity overfishing and precautious management of the Area 88 toothfish fishery D. Ainley (USA), M. Massaro, G. Ballard (New Zealand) and J.T. Eastman (USA)
WG-FSA-09/8	First experimental settings of deepwater vertical longlines in the Antarctic toothfish fishery *Dissostichus mawsoni* Norman, 1937 (Perciformes, Nototheniidae) in the Amundsen Sea N.V. Kokorin (Russia) and V.V. Serbin (Ukraine)
WG-FSA-09/9	Report of the UK groundfish survey at South Georgia (CCAMLR Subarea 48.3) in January 2009 M. Belchier, R.E. Mitchell, M.A. Collins, L. Kenny, M. Taylor, J. Nelson and L. Featherstone (United Kingdom)
WG-FSA-09/10	Book review: *In the seas of Antarctic Region and Southern Ocean* by V.L. Juhov Delegation of Ukraine

WG-FSA-09/11	Book review: *Whales of the Southern Hemisphere: biology, whaling, and perspectives of population recovery* by Y.A. Mikhalev Delegation of Ukraine
WG-FSA-09/12	Revised research plan for toothfish in Division 58.4.4a and b by *Shinsei Maru No. 3* in 2009/10 Delegation of Japan
WG-FSA-09/13	Information on spawning and fecundity of icefish *Chionobathyscus dewitti* V. Prutko and D. Chmilevsky (Russia) (*CCAMLR Science*, submitted)
WG-FSA-09/14 Rev. 1	Antarctic toothfish stock assessment in Division 58.4.1 on the basis of catch and CPUE data D. Vasilyev, K. Shust, A. Petrov, V. Tatarnikov and I. Istomin (Russia)
WG-FSA-09/15	Skate diet at South Georgia indicates benthic habit of krill C.E. Main and M.A. Collins (United Kingdom)
WG-FSA-09/16	Depredation around South Georgia and the implications on stock assessment of *D. eleginoides* J. Moir Clark, D.A. Agnew, P. McCarthy and M. Unwin (United Kingdom) (*CCAMLR Science*, submitted)
WG-FSA-09/17	Assessment of Patagonian toothfish population in the north of Subarea 48.4 using data from a four-year tagging experiment J. Roberts and D.J. Agnew (United Kingdom)
WG-FSA-09/18	Proposal for an extension to the mark–recapture experiment to estimate toothfish population size in the South of Subarea 48.4 J. Roberts and D.J. Agnew (United Kingdom)
WG-FSA-09/19	Standing stock, spatial distribution, and biological features of demersal finfish from the 2009 US AMLR bottom trawl survey of the South Orkney Islands (Subarea 48.2) C.D. Jones (USA) and K.-H. Kock (Germany)
WG-FSA-09/20	Update of the integrated stock assessment for the Patagonian toothfish (*Dissostichus eleginoides*) for the Heard and McDonald Islands (Division 58.5.2) S.G. Candy and D.C. Welsford (Australia)

WG-FSA-09/21	Otolith-based ageing of the Patagonian toothfish (*Dissostichus eleginoides*) for the Heard and McDonald Islands: modelling fixed and random reader error using multiple readings of a reference collection S.G. Candy, G.B. Nowara, D.C. Welsford and J.P. McKinlay (Australia)
WG-FSA-09/22 Rev. 1	Comparison of the precision of direct versus age–length key methods of estimating catch-at-age proportions S.G. Candy (Australia)
WG-FSA-09/23	Accuracy of benthic invertebrate by-catch identification by observers operating in the Heard Island and McDonald Islands Patagonian toothfish longline fishery T. Hibberd (Australia)
WG-FSA-09/24	Comparative characteristics of Patagonian (*Dissostichus eleginoides*) and Antarctic (*D. mawsoni* Norman) toothfish inhabiting different sectors of the Southern Ocean K.V. Shust, I.P. Zarikhin, I.G. Istomin, A.F. Petrov, V.A. Tatarnikov and N.S. Demina (Russia)
WG-FSA-09/25	Results of investigations on Antarctic toothfish (*D. mawsoni* Norman, 1937) (Perciformes, Nototheniidae) feeding in Subarea 48.6 SSRU E during the 2008/09 season A.F. Petrov and V.A. Tatarnikov (Russia)
WG-FSA-09/26	The histological analysis of oogenesis and maturity of Antarctic toothfish from the Ross Sea S.V. Piyanova and A.F. Petrov (Russia)
WG-FSA-09/27	Length-based assessment for mackerel icefish (*Champsocephalus gunnari*) in Subarea 48.3 R.M. Hillary (Australia), C.T.T. Edwards, R.E. Mitchel and D.J. Agnew (United Kingdom)
WG-FSA-09/28 Rev. 1	Preliminary assessment of toothfish in Subarea 48.3 D.J. Agnew and T. Peatman (United Kingdom)
WG-FSA-09/29	New fish species for Southern Ocean – *Lepidion schmidti* L. Pshenichnov (Ukraine)
WG-FSA-09/30	Distribution and biology on Antarctic king crab *Paralomis formosa* caught as by-catch in fishery for toothfish (*Dissostichus eleginoides*) on Patagonian continental slope Yu.V. Korzun (Ukraine)

WG-FSA-09/31	Observed recovery of *Notothenia rossii* and further decline of *Gobionotothen gibberifrons* in scientific catches at Potter Cove, South Shetland Islands E. Marschoff, E. Barrera-Oro, N. Alescio and E. Moreira (Argentina)
WG-FSA-09/32	Temporal clarification of the transition from blue phase fingerling to early juvenile brown phase in *Notothenia rossii* from the South Shetland Islands E. Barrera-Oro, E. Moreira, N. Alescio and E. Marschoff (Argentina)
WG-FSA-09/33	Preliminary assessment of mackerel icefish (*Champsocephalus gunnari*) in the vicinity of Heard Island and McDonald Islands (Division 58.5.2), based on a survey in April 2009, using the generalised yield model D.C. Welsford (Australia)
WG-FSA-09/34	Report on a random stratified trawl survey to estimate distribution and abundance of *Dissostichus eleginoides* and *Champsocephalus gunnari* in the Heard Island region (Division 58.5.2) for 2008 and 2009 G.B. Nowara (Australia)
WG-FSA-09/35	The selection of trips based on data metrics for the assessment of Antarctic toothfish in the Ross Sea D.A.J. Middleton (New Zealand)
WG-FSA-09/36	A characterisation of the toothfish fishery in Subareas 88.1 and 88.2 from 1997/98 to 2008/09 S.M. Hanchet, A. Dunn and S. Mormede (New Zealand)
WG-FSA-09/37	Length and age at spawning of Antarctic toothfish (*Dissostichus mawsoni)* in the Ross Sea S.J. Parker and P.J. Grimes (New Zealand) (*CCAMLR Science*, submitted)
WG-FSA-09/38	Developing a 'best available science' bathymetric data framework for fisheries management in the Ross Sea S.J. Parker, S.M. Hanchet, B. Wood and A. Dunn (New Zealand)
WG-FSA-09/39	Descriptive analysis of the toothfish (*Dissostichus* spp.) tagging program in Subareas 88.1 and 88.2 for the years 2000/01 to 2008/09 A. Dunn, S.M. Hanchet and J. Devine (New Zealand)

WG-FSA-09/40 Rev. 1	Assessment models for Antarctic toothfish (*Dissostichus mawsoni*) in the Ross Sea for the years 1997/98 to 2008/09 A. Dunn and S.M. Hanchet (New Zealand)
WG-FSA-09/41	Assessment models for Antarctic toothfish (*Dissostichus mawsoni*) in Subarea 88.2 SSRU E for the years 2002/03 to 2008/09 A. Dunn and S.M. Hanchet (New Zealand)
WG-FSA-09/42	Further developments of a simulation model, 'Patch', for evaluating management strategies to conserve benthic habitats (vulnerable marine ecosystems) which are potentially vulnerable to impacts from bottom fisheries A.J. Constable (Australia)
WG-FSA-09/43	Distribution and abundance of skates on the Kerguelen Plateau (CCAMLR Divisions 58.5.1 and 58.5.2) G.B. Nowara, D.C. Welsford, T. Lamb (Australia), N. Gasco, P. Pruvost and G. Duhamel (France)
WG-FSA-09/44	Development of recovery plans for depleted toothfish stocks in the Indian Ocean sector of the Southern Ocean D.C. Welsford, A.J. Constable and J.P. McKinlay (Australia)
WG-FSA-09/45	Conserving Antarctic from the bottom up: Implementation of UN General Assembly Resolution 61/105 by the Commission for the Conservation of the Antarctic Marine Living Resources (CCAMLR) Secretariat

APPENDIX D

BIOLOGY, ECOLOGY AND DEMOGRAPHY OF TARGET AND BY-CATCH SPECIES

The following papers contained information on the biology, ecology and demography of target and by-catch species in the fishery (WG-FSA-09/9, 09/10, 09/11, 09/13, 09/15, 09/18, 09/19, 09/21, 09/24, 09/25, 09/26, 09/27, 09/29, 09/32, 09/37, 09/43, 09/P1).

9.1 Review of information available to the meeting

9.1.1 Target species

9.1.1.1 *Champsocephalus gunnari* (mackerel icefish)

Diet of *C. gunnari* at South Georgia (CCAMLR Subarea 48.3) in January 2009 was dominated by the hyperiid *Themisto gaudichaudii* with very low levels of krill, usually the main prey item found (WG-FSA-09/9). This was likely to have been the result of the anomalous hydrographical conditions experienced around the island at that time.

9.1.1.2 *Dissostichus eleginoides* (Patagonian toothfish)

A two-stage approach of modelling ageing error using otolith readings for ageing *D. eleginoides* made efficient use of the data in that only half the number of combination of error class by readability by age are required compared to modelling Integer Error classes directly (WG-FSA-09/21). This approach differs from other studies of ageing error in that it takes into account the otolith readability score and the integer nature of ring count data. It demonstrated that ageing error decreases as readability improves.

9.1.1.3 *Dissostichus mawsoni* (Antarctic toothfish)

Two papers (WG-FSA-09/10 and 09/11) provided information primarily on whaling in the Southern Ocean which is outside the remit of CCAMLR. One of the papers (WG-FSA-09/10), however, provided some early findings on *D. mawsoni* and its role in the diet of sperm whales (*Physeter macrocephalus*), much of which was published in Yukhov (1982).

Information on the feeding of *D. mawsoni* in the eastern Lazarev Sea (Subarea 48.6) suggested that the icefish *Chionobathyscus dewitti* was a more important food item than in other parts of the Southern Ocean. This species, together with the grenadier *Macrourus whitsoni* and the Antarctic giant squid *Mesonychotheuthis hamiltoni*, formed the bulk of the diet (WG-FSA-09/25). The mass of stomach contents in males was larger than in females.

Histological analyses of *D. mawsoni* caught in December–February 2005/06 in the Ross Sea revealed that fish had developing gonads (WG-FSA-09/26). These observations were in line with previous findings that *D. mawsoni* spawns from June to August.

The oogenesis of *D. mawsoni* was described in WG-FSA-09/37. Oocytes accumulate at the cortical alveoli stage at least a year prior to spawning. Individual oocytes are then recruited into the vitellogenic phase over at least a 6–12 month period, resulting in a developed batch of oocytes accumulating at the final maturation stage by May (paragraph 3.56). The authors noted that the spawning ogive includes females on the slope which do not appear to spawn every year. Because all southern fish sampled appear to have spawned, the overall population ogive would be shifted towards younger fish depending on the proportion of mature fish in the northern area.

A 63 cm long *D. mawsoni* was tagged in the D'Urville Sea and was recovered largely digested in the stomach of a 162 cm long *D. mawsoni* 36 days later (WG-FSA-09/P1). From the location the small *Dissostichus* was tagged, and the location the large *Dissostichus* was caught, the authors anticipated a migration speed of the small individual of 6 km per day. This was questioned by the Working Group as digestion time and other parameters had not been taken into consideration by the authors (see discussion under Agenda Item 3.3.4).

Dissostichus mawsoni have long been known, from stomach contents of sperm whales and Soviet midwater trawl catches in various areas of the high-Antarctic, to occur regularly off the bottom (230–950 m above the bottom) (WG-FSA-09/8). Using vertical longlines, *M. whitsoni* were caught more than 500 m above the bottom in the Amundsen Sea in Subarea 88.2 in the last season. *Dissostichus mawsoni* were taken as high as 146 m above the bottom. The occurrence of both benthic and bentho-pelagic species in sperm whale stomachs suggests that *D. mawsoni* undertake regular vertical migrations to feed in the water column.

9.1.1.4 Both *Dissostichus* species

Gonad development was very much more advanced in *D. mawsoni* than in *D. eleginoides* caught around the South Sandwich Islands in April 2009, both in terms of relative weight of gonads to body weight (GSI) and maturity index (GMI) (WG-FSA-09/18). *Dissostichus mawsoni* gonads tended to be mainly GMI stage III (developed), whilst *D. eleginoides* gonads were mostly stage II (developing/resting).

WG-FSA-09/24 compared information on the life cycle and differences in diet composition of *D. eleginoides* and *D. mawsoni* from different areas of the Southern Ocean. The comparative analyses of fish from different areas revealed considerable differences in food spectra both in the early pelagic stage and later during the period of their habituation on the shelf and continental slope in the different areas. *Dissostichus eleginoides* off South Georgia (Subarea 48.3) have a more abundant food base. The individuals are much larger on average than in the Kerguelen Islands area (Division 58.5.1). In turn, *D. mawsoni* individuals in the Indian Ocean sector (Subarea 58.4) are larger than in the Ross Sea (Subarea 88.1). This is largely determined by the much more abundant food resources in pelagic waters of the shelves and slopes of the Indian Ocean sector.

9.1.1.5 Other species

The diet of 33 species of finfish (including *C. gunnari* and *D. mawsoni*) was studied in the course of a bottom trawl survey conducted around the South Orkney Islands (Subarea 48.2) in February/March 2009 (WG-FSA-09/19). Icefish and notothenioids (in part) fed primarily on krill. Fish formed the secondary food items in many species (see also Agenda Item 5.4.1).

WG-FSA-09/13 summarised information on reproductive characteristics of the deep-water icefish *C. dewitti* taken as by-catch in longline fisheries on *D. mawsoni* in the Ross Sea. A substantial part of the information contained in this paper was already contained in Kock et al. (2006) which was not cited in WG-FSA-09/13.

The diet of the skate, *Amblyraja georgiana*, was studied at South Georgia (WG-FSA-09/15). Preferred prey included fish (particularly for larger individuals) and *Euphausia superba* (Antarctic krill), as well as amphipods, polychaetes and other benthic fauna. The species appears to be an opportunistic predator and the presence of *E. superba* in this skate's diet indicates the regular occurrence of krill at, and/or close to, the bottom.

Three species of skate occur regularly as by-catch in longline and trawl fisheries for *D. eleginoides* and trawl fisheries for *C. gunnari* on the Kerguelen Plateau (WG-FSA-09/43). The species show a different spatial distribution which was primarily linked with different depth preference. *Bathyraja eatonii* and *B. irrrasa* occurred down to depths of 1 100 and 2 300 m respectively. The much smaller *B. murrayi* is restricted to shallower waters down to 700 m.

For the first time *Lepidion schmidti* was recorded in the Southern Ocean (WG-FSA-09/29).

Ageing of the scales and otoliths of blue-phase pelagic fingerlings (7–7.6 cm total length) and small demersal *Notothenia rossii* (8.5–20.9 cm total length) from Potter Cove, King George Island (South Shetland Islands), confirmed that they belonged to age classes 0, 1 and 2 (WG-FSA-09/32). A von Bertalanffy growth curve was fitted to age–length data of the juvenile *N. rossii* from this and a previous study at Potter Cove, and literature data from the offshore adult population, and resulted in $L_t = 86.9\ (1\text{-}e^{-0.091(t-0.668)})$ which is very similar to results obtained by Freytag (1980) (see also Agenda Item 5.4.1).

9.2 Species profiles

WG-FSA agreed in 2005 to produce a new set of species profiles for *D. eleginoides*, *D. mawsoni* and *C. gunnari* (SC-CAMLR-XXIV, Annex 5, paragraph 9.2). Work on *D. mawsoni* was completed in 2006 (WG-FSA-06/26), that on *C. gunnari* in 2007 (WG-FSA-07/11). Work on *D. eleginoides*, however, had still not been completed by the meeting of WG-FSA in October 2009, delaying the publication of the species profiles.

In order to speed up the process of completion of the *D. eleginoides* profile, the Working Group agreed to hand over the task of completion to Drs D. Welsford (Australia), M. Belchier (UK) and S. Hanchet (New Zealand). The two existing species profiles on *D. mawsoni* and *C. gunnari* will undergo revision during the 2009/10 interesessional period. It is hoped that the complete set of species profiles will be available for adoption by the Working Group at its meeting in 2010.

The Working Group encouraged Members to start work on species profiles of by-catch species such as *Gobionotothen gibberifrons*, *Chaenocephalus aceratus*, skates and macrourids.

9.3 CCAMLR Otolith Network (CON)

CON was established following:

- the Workshop on Estimating Age in Patagonian Toothfish in July 2001 (SC-CAMLR-XX, Annex 5, paragraphs 3.94 to 3.97);

- the WAMI Workshop in October 2001 when otoliths of *C. gunnari* were exchanged between several laboratories and read comparatively (SC-CAMLR-XXI, Annex 5, paragraph 7.7).

Initial results were promising, however, limited progress within CON has been made recently with respect to the ageing of *D. eleginoides*.

A second workshop on ageing *C. gunnari*, this time restricted to material of the South Georgia population, was conducted in June 2006 (SC-CAMLR-XXV, Annex 5, paragraphs 9.9 to 9.17). The workshop noted the plausible methods that exist for age validation in the species which had either already been used or needed more detailed exploration in the future. Otoliths were read comparatively by several laboratories in the UK, Spain and Russia subsequent to the workshop.

In 2008, the Working Group requested that calibration work on otoliths of *C. gunnari* should be completed in 2008/09 and a report on the outcome of the otolith exchange be submitted to the meeting of the Working Group in October 2009 (SC-CAMLR-XXVII, Annex 5, paragraph 9.23). No such report has been received.

The Working Group reviewed what activities would be needed in the future to arrive at validated ageing for these target species.

Noting that fishing is currently restricted to primarily 2–4-year-old *C. gunnari* and the development of length-based assessment techniques for the fisheries of *C. gunnari* at South Georgia (WG-FSA-09/27), the Working Group therefore concluded that age determination from otoliths for use in the assessments was unnecessary.

With the exception of the ageing workshop on *D. eleginoides* in 2001, activities with respect to ageing *Dissostichus* spp. have been conducted mostly on a national basis with little coordination by CCAMLR. With the extension of the fisheries to more nations, it is likely that more Members will start ageing these species.

In order to better coordinate the age determination of *Dissostichus* spp., the Working Group recommended that an intersessional group should:

- prepare an inventory of those laboratories undertaking ageing of *Dissostichus* spp.
- foster an exchange of age-reading methods between laboratories
- establish a reference collection of otoliths of both species

- establish protocols of how otoliths are prepared for ageing (target number of otoliths to be collected, as set out in the *Scientific Observers Manual*, sagittal or longitudinal cutting, burning etc.) and how annuli are identified.

In addition, it was requested that ageing of *Dissostichus* spp. be included in the research plan as part of the notification for fishing in new and exploratory fisheries.

Results of ageing and a detailed description of how ageing was conducted need to be submitted to the Working Group on a regular basis. The Secretariat has produced a database to store these data in the future. Quality control of the readings, including validation of ageing and cross-validation between laboratories, will be of great importance to ensure consistency in ageing of *Dissostichus* spp. Close collaboration of CON with WG-SAM should be sought with respect to the development of efficient sampling schemes for otolith collection and subsampling for reading. Dr Belchier volunteered to establish an intersessional correspondence group to initiate the work outlined above.

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Appendices E–S (Fishery Reports) are only available electronically at:
www.ccamlr.org/pu/e/e_pubs/fr/drt.htm