

HARVESTED SPECIES

Krill resources

Status and trends

2005/06 season

4.1 Seven vessels from five Member countries fished for krill in the 2005/06 season. One vessel from Malta commenced fishing but was re-flagged to Poland during the season. A small amount of krill by-catch was reported by a UK-flagged vessel fishing for icefish.

4.2 A total catch of 105 084 tonnes of krill was reported to the Secretariat by 5 October 2006 (Table 2). Compared to the catch reported at the same time last season it appears that the total catch for the 2005/06 season will be at a similar level to that reported in the 2004/05 season (127 035 tonnes) (Table 3).

4.3 Fine-scale data had been received from all Members fishing for krill in 2004/05 and the historical series of haul-by-haul data for the Japanese krill fishery had also been received by the Secretariat. The Secretariat was requested to liaise with Members to ascertain whether haul-by-haul catch and effort data were available for seasons where aggregated data had been submitted in past seasons (Annex 4, paragraphs 3.3 to 3.5).

2006/07 season

4.4 Notifications of intentions to fish for krill in the 2006/07 season were received from eight Members (Table 4; see also paragraphs 15.10 to 15.16). All vessels except the *Saga Sea* (Norway) will use conventional trawls. The Chilean vessel (*Ocean Dawn*) will also conduct scientific research.

4.5 Most vessels fishing for krill in 2006/07 will carry scientific observers collecting data in accordance with the CCAMLR Scheme of International Scientific Observation (Table 4). The Scientific Committee reiterated the importance of these scientific observations for providing information on issues such as larval fish by-catch and for validating haul-by-haul data for use in developing CPUE indices (paragraph 11.14).

4.6 A list of reports from scientific observers is produced annually for WG-EMM (see WG-EMM-06/5, Appendix 1).

Advice from WG-EMM

4.7 There are indications that the krill fishery is in the process of expanding and the Scientific Committee noted that fine-scale information on the fishery will be necessary for management (paragraphs 15.10 to 15.16). There is also an urgent requirement for further information on the by-catch of larval and juvenile fish in the krill fishery (Annex 4, paragraph 3.36).

4.8 A standardised methodology for the routine collection of data on the incidence of larval and juvenile fish in krill catches by scientific observers was urgently needed (Annex 5, paragraphs 10.3 and 10.8). The Scientific Committee recognised that there was a need to develop a practical method for examining larval fish by-catch in the short term, but in the longer term a more quantitative approach would be needed.

4.9 Dr Shust reported that a Russian manual for assessing larval and juvenile fish in krill by-catch has been developed in the past. Dr Shust agreed to have the protocol translated and submitted to WG-EMM and WG-FSA. He also noted the utility of comparing data collected 20 years ago around South Georgia with current information on larval and juvenile fish by-catch in the krill fishery. Dr Naganobu pointed out that Japan had also been collecting information on fish by-catch in the krill fishery for more than 10 years and had regularly reported analyses of these data to WG-EMM.

4.10 Dr Kawaguchi agreed to convene a correspondence group to develop an interim standardised protocol for the assessment of the incidence of larval fish in krill catches to be implemented in the current season if possible. An identification guide for fish larvae will also be developed for use on board by observers. This correspondence group would include both krill and fish scientists, and the technical coordinators with expertise in the scientific observation scheme.

4.11 The Scientific Committee noted the discussions on the need to obtain information (e.g. by-catch, krill demographics and CPUE) from the continuous fishing system for krill in both working groups (Annex 4, paragraphs 3.51 to 3.64; Annex 5, paragraphs 14.17 to 14.22). The Scientific Committee noted that this information might not be available using the same techniques used in conventional trawling operations but acknowledged that this information has also proved difficult to obtain from conventional fisheries in the past.

4.12 In 2005, the Scientific Committee noted that the trawl fishery for krill using the continuous fishing system may have a potentially negative impact on the pelagic ecosystem, particularly through the by-catch of larval and juvenile krill and fish. The Scientific Committee also recognised that the fishery using this method would not be considered a new or exploratory fishery if there were an adequate description of the fishing selectivity, a characterisation of the haul (or catch rate) and information on the location of krill catches (SC-CAMLR-XXIV, paragraphs 4.8 and 4.9).

4.13 WG-EMM considered these issues at its meeting in July 2006 but the discussion was inconclusive because the trawler which used the continuous fishing system in the 2005/06 season had only been fishing for a few weeks prior to the deadline for submission of papers to WG-EMM. All data required from the vessel had been submitted within applicable deadlines. The issue was referred to WG-FSA where it was considered in October 2006. Although data from continuous and conventional trawls were analysed and presented to WG-FSA, the Working Group concluded that there were currently insufficient data from both continuous and conventional trawls to allow a robust comparison between the two methods (Appendix E, paragraph 4.21). The Working Group also identified the need for the development of standard methods for data collection of larval fish by-catch (Annex 5, paragraph 10.3) and a more systematic observer program on all krill vessels. The Scientific Committee was unable to resolve the abovementioned problem due to inadequate data (Annex 5, Appendix E, paragraph 4.8).

4.14 The Russian Delegation indicated that fishing for krill using the continuous fishing system is a new type of krill fishery and that there are concerns over the data collection from this fishery and its effects on the ecosystem. This fishing operation may be problematic for studying krill demography and for larval fish and juvenile krill by-catch. The patchy nature of krill distribution may mean that conventional haul-by-haul data are more reliable than data obtained from continuous fishing systems. It may take some time to obtain sufficient information to allow this method to be assessed in terms of its safety for the ecosystem. Nevertheless, the fishery using the new technique continues at a proposed scale comparable with that of the traditional krill fishery. The catch of krill by this method exceeded 48 000 tonnes in the 2004/05 season, but was only 8 770 tonnes in 2005/06. Norway notified 100 000 tonnes of krill per vessel for the forthcoming season. The catch from this type of operation was only going to increase, so these problems would remain and protocols for obtaining comparable data from continuous fishing systems were urgently needed.

4.15 The Russian Delegation also noted that although krill fishing using the continuous fishing system has already been conducted for three seasons, no adequate data on its selectivity and assessment of its impact on krill, fish larvae and juveniles have been obtained. This situation causes particular concern because there might be considerable potential for this type of fishing to impact on other elements of the ecosystem either through by-catch, particularly of fish and krill larvae, or through incidental mortality of juvenile krill, small pelagic hydrobionts, birds or marine mammals (SC-CAMLR-XXIV, paragraph 4.9).

4.16 The Scientific Committee noted that reports had been submitted from scientific observers on board the *Atlantic Navigator* and the *Saga Sea* which included by-catch data from the krill fishery (WG-FSA-06/57). The Norwegian Delegation also indicated that further information on larval fish by-catch caught by the continuous fishing system would be presented to the working groups and that improved CPUE data would be available from the *Saga Sea* in future because of a new catch-weighing technology which had been installed.

4.17 The Scientific Committee acknowledged that the use of the continuous fishing system in the krill fishery presented some unique challenges to recording effective fishing effort, catch and collection of biological data and by-catch data. The Scientific Committee has not yet defined a single effective measure of CPUE in conventional trawl or continuous fishing systems; nor is such a measure of CPUE used in stock assessments or management decision rules. Until such time as these issues have been addressed, all krill fisheries should provide information appropriate to the current management system (Annex 4, paragraphs 3.77 to 3.79).

4.18 The Scientific Committee noted the repeated requests for information on fishing methodologies, technology and fishing operations and the lack of response from most fishing nations. In particular, operational data were needed on fishing selectivity and total mortality. The Scientific Committee reiterated its request for detailed information from fishing nations so that their operations can be better understood and thus appropriately managed (Annex 4, paragraph 3.81).

Advice to the Commission

4.19 The Commission's attention was drawn to the increased interest being shown in the krill fishery as indicated by the projected catches for the 2006/07 season of 368 000 tonnes compared to a projection last year of 250 000 tonnes (Table 4; see also paragraphs 15.10 to 15.16). The Scientific Committee still had inadequate information from the fishery on which to base management advice (Annex 4, paragraphs 3.79 to 3.81).

4.20 The Scientific Committee drew the Commission's attention to the conclusion of WG-EMM which indicated a need for systematic scientific observation of all krill fishing activities (Annex 4, paragraph 3.8) and that of WG-FSA which recommended an increase in the levels of scientific observation across the krill fishing fleet (Annex 5, paragraphs 11.12(iv) and (vi)).

4.21 The Scientific Committee endorsed the estimation of γ using the biomass and CV estimates from the 2006 Australian survey in Division 58.4.2 (SC-CAMLR-XXV/8) and recommended a revised precautionary catch limit for krill in this division of 1.49 million tonnes per year.

Fish resources

Data requirements

4.22 The Scientific Committee noted the following work completed by the Secretariat during the intersessional period (Annex 5, paragraphs 3.1 to 3.4):

- (i) revision to data collection forms;
- (ii) development of a manual documenting procedures for extraction and mathematical manipulation of data used by WG-FSA;
- (iii) development of an electronic reference library of relevant meeting documents;
- (iv) initial validation of CASAL assessments;
- (v) processing of data;
- (vi) extending the time series of catch-weighted length-frequency data for *D. eleginoides* in Subarea 48.3;
- (vii) development of ageing and tagging databases.

4.23 The Scientific Committee also noted the work undertaken by Mr A. Dunn (New Zealand) and the Secretariat to validate tagging data held in the observer database using position data from the fine-scale data from Subareas 88.1 and 88.2. A number of discrepancies and errors in reporting east/west positional data about longitude 180° had been detected and rectified (Annex 5, paragraph 3.5).

4.24 The Scientific Committee discussed the potential for using VMS data to provide a timely and efficient validation of positions of tag releases in the observer data as well as validating data submitted on the fine-scale data forms. Such a validation should be undertaken by the Secretariat. The Data Manager reported that while the VMS data are held in a separate database, in principle a routine could be developed to access these data and compare them with the position information in the fine-scale and observer data. In the event that mismatches are discovered between the datasets, further investigations could be undertaken with the originators of the data to identify and rectify any errors as quickly as possible.

4.25 Noting the sensitive nature of the VMS data and the rules of access, the Scientific Committee requested that the Commission consider the feasibility of tasking the Secretariat with conducting such a data validation. The Scientific Committee also urged Flag States and scientific observers to check the reported positions in the data, especially near longitudes 0° (Subarea 48.6) and 180° (Subarea 88.1).

Status and trends

Fishing activity in the 2005/06 season

4.26 Under the conservation measures in force in 2005/06, fishing took place in 13 fisheries targeting icefish (*C. gunnari*), toothfish (*D. eleginoides* and/or *D. mawsoni*) and krill (*Euphausia superba*):

- fishery for *C. gunnari* in Subarea 48.3
- fishery for *C. gunnari* in Division 58.5.2
- fishery for *D. eleginoides* in Subarea 48.3
- fishery for *D. eleginoides* in Subarea 48.4
- fishery for *D. eleginoides* in Division 58.5.2
- exploratory fishery for *Dissostichus* spp. in Subarea 48.6
- exploratory fishery for *Dissostichus* spp. in Division 58.4.1
- exploratory fishery for *Dissostichus* spp. in Division 58.4.2
- exploratory fishery for *Dissostichus* spp. in Division 58.4.3a
- exploratory fishery for *Dissostichus* spp. in Division 58.4.3b
- exploratory fishery for *Dissostichus* spp. in Subarea 88.1
- exploratory fishery for *Dissostichus* spp. in Subarea 88.2
- fishery for *E. superba* in Area 48.

4.27 In addition, four other managed longline fisheries targeting toothfish were conducted in the Convention Area in 2005/06:

- fishery for *D. eleginoides* in the French EEZ in Division 58.5.1
- fishery for *D. eleginoides* in the French EEZ in Subarea 58.6
- fishery for *D. eleginoides* in the South African EEZ in Subarea 58.6
- fishery for *D. eleginoides* in the South African EEZ in Subarea 58.7.

4.28 Catches of target species by region and gear reported from fisheries conducted in the Convention Area in the 2005/06 fishing season are summarised in Annex 5, Table 1 (see also Table 2).

4.29 Estimates of catches from IUU fishing for *Dissostichus* spp. inside the Convention Area in 2005/06 are provided in Annex 5, Table 2. The Scientific Committee endorsed the use of these estimates in stock assessments undertaken by WG-FSA at its 2006 meeting.

4.30 Combined total catches (reported and IUU) for *Dissostichus* spp. in the 2004/05 and 2005/06 seasons, both within the Convention Area and in adjacent areas, are provided in Annex 5, Table 3. Further discussion of IUU catches is provided under Agenda Item 7 (paragraphs 7.5 to 7.7).

4.31 The Scientific Committee noted the consideration by WG-FSA and ad hoc WG-IMAF of two papers describing longline fishing methods used in exploratory fisheries (Annex 5, paragraphs 3.14 to 3.16). These methods have the potential to reduce incidental mortality and by-catch through rapid deployment of lines and rapid sink rates and variable adjustable height of hooks above the sea floor.

4.32 The Scientific Committee recommended that Members be urged to conduct statistical evaluation of new methods to reduce incidental mortality and by-catch using rigorous experimental design, to assess the performance of new gear, its selectivity and impact on ecosystem components (Annex 5, paragraphs 3.17 and 6.52 to 6.54). The Scientific Committee also encouraged Members where possible to collaborate to obtain comparative data from vessels fishing side-by-side. Further discussion of incidental mortality is reported under Agenda Item 5.

Inputs for stock assessments

4.33 The Scientific Committee welcomed the review by WG-FSA of all available research data for updating stock assessments of fish in the Convention Area including catch-at-length/age data from fisheries, research surveys, CPUE analyses, tagging studies, biological parameters, stock structure and depredation (Annex 5, paragraphs 3.25 to 3.73). The Scientific Committee agreed that where possible all available data should be used in the current assessments.

4.34 In particular, the Scientific Committee noted the important contribution of three research surveys conducted in 2005/06 in Division 58.5.2 (by Australia), Subarea 48.3 (by the UK) and Subarea 48.1 (by the USA) to the analyses conducted by WG-FSA (Annex 5, paragraphs 3.27 to 3.29).

4.35 The Scientific Committee welcomed the continuing work on tagging toothfish and noted the significant contribution of the results of tagging studies to the assessments of both exploratory and assessed fisheries. In 2005/06, 4 451 toothfish were tagged in exploratory fisheries (Annex 5, Tables 7 and 8) and 113 tagged fish were recaptured. Toothfish were tagged at an average rate greater than the required one fish per tonne of green weight caught, although some Flag States in some SSRUs failed to achieve the required level (see Fishery Reports: Annex 5, Appendices F to K). In established fisheries, 4 660 toothfish were tagged in Subarea 48.3, 144 in Subarea 48.4, 1 825 in Division 58.5.2, 1 240 in Subarea 58.6 and at least 500 during a survey in Division 58.5.1 carried out just prior to the meeting. The Scientific Committee recognised the substantial contribution of the fishing industry, Flag States and scientific observers to the success of the tagging program. Several amendments to

Conservation Measure 41-01, Annex C, were proposed to clarify the roles and responsibilities of the vessel and observers in implementing the program in exploratory fisheries (paragraph 4.37).

4.36 The Scientific Committee noted a number of other key issues addressed by WG-FSA:

- (i) clarification of responsibility for provision of tag data to the Secretariat (Annex 5, paragraph 3.43);
- (ii) time-stamped photographic record of all returned tags (Annex 5, paragraph 3.45);
- (iii) future coordination of tagging programs (Annex 5, paragraphs 3.46 and 3.47);
- (iv) consideration of low recapture rate of tags in Subarea 88.1 (Annex 5, paragraphs 3.48 to 3.52).

Management advice (tagging program)

4.37 The Scientific Committee recommended that Conservation Measure 41-01, Annex C, be amended to clarify the roles and responsibilities of the vessel and observers, as follows:

1. The responsibility for ensuring the progress of tagging, tag recovery and correct reporting shall lie with the Flag State. The CCAMLR scientific observer, in cooperation with the fishing vessel, shall normally be expected ~~required~~ to undertake the tagging program.

3. All relevant tag data and any data recording tag recaptures shall be reported electronically in the CCAMLR format¹ to the Executive Secretary (i) by the vessel every month along with its monthly C2 reports, and (ii) by the observer as part of the data reporting requirements for observer data ~~within three months of the vessel departing the exploratory fisheries.~~

¹ In accordance with the CCAMLR Tagging Protocol for exploratory fisheries which is available from the Secretariat and at www.ccamlr.org.

4.38 In exploratory fisheries for toothfish species, for a single trial year (2006/07) observers should take a photographic record of all tags recovered and forward these photographs to the Secretariat.

4.39 The Scientific Committee recommended that the Secretariat should take responsibility for coordinating the tagging programs in new and exploratory fisheries starting from the 2007/08 season. All tags used by Members in exploratory fisheries should be purchased from the Secretariat for use in the 2007/08 season onwards.

4.40 The Scientific Committee requested that SCAF identify start-up funds required by the Secretariat in 2007 to coordinate the tagging program (paragraph 10.8). These funds will be recovered to the maximum extent possible through sale of tags and tagging kits to Members undertaking exploratory fisheries. The Data Manager provided a preliminary estimate of the funds needed to initiate the program. Approximately A\$100 000 would be required to cover

the cost of the advance purchase of tags to establish and maintain the required inventory, and the anticipated increase in the Secretariat's workload to administer the program.

4.41 Dr Holt noted that it would be unlikely that all the allocated funds would be recovered through the sale of tags and tagging kits due to the costs inherent in maintaining an inventory. The Scientific Committee further noted that the required inventory of tags would not be very large and one possibility was that the Secretariat recover funds through the establishment of an advance ordering system, thereby reducing the necessary financial outlay.

4.42 The Scientific Committee agreed that the requirement for tagging in those SSRUs in Subareas 88.1 and 88.2 which are closed but carry a 10-tonne research exemption for a single vessel in a single season, should be increased from one fish per tonne of green weight caught to a minimum of three fish per tonne and a target of 10 fish per tonne.

4.43 The Scientific Committee will keep under review the conduct of the tagging program and report its findings to the Commission, particularly with regard to vessels' crew taking over responsibility from scientific observers for tagging and tag recovery. The Scientific Committee agreed that any changes in tagging procedure by the vessel should be documented and reported to the Secretariat.

Biological parameters

4.44 The Scientific Committee noted the following new information on biological parameters provided to WG-FSA:

- (i) a review of biological parameters for skates in the Ross Sea (Annex 5, paragraph 3.57);
- (ii) age/length-at-maturity of *D. eleginoides* in Subarea 48.3 (Annex 5, paragraph 3.58);
- (iii) an estimate of natural mortality of *D. eleginoides* from tag data in Subarea 48.3 (Annex 5, paragraph 3.60).

Depredation

4.45 The Scientific Committee recalled its advice from last year's meeting regarding the need to develop a system to quantify the interactions between marine mammals and longline fisheries (SC-CAMLR-XXIV, paragraph 3.77). Several papers on depredation by marine mammals were considered by WG-FSA (Annex 5, paragraphs 3.66 to 3.73). The Scientific Committee noted that there remained some differences in the methods used to estimate depredation and recommended that standard protocols be developed within the Scheme of International Scientific Observation so that levels of depredation in the *Dissostichus* spp. fisheries in the Convention Area can be estimated.

4.46 The Scientific Committee noted that a general research program for WG-SAM was needed to consider the implications of depredation for the stock assessment. The Scientific Committee further noted the conclusions of WG-FSA that:

- (i) interpreting depredation as pure removals from the population would have little effect, but when included in CPUE calculations, it may become influential;
- (ii) depredation is likely to be a learning process, and that the assumptions that the rate remains constant over time will not apply;
- (iii) the selectivity of the depredation needs to be quantified;
- (iv) a depredation conference occurred recently, and that the proceedings from this could form a useful background for WG-SAM discussions.

General biology and ecology

4.47 The Scientific Committee noted WG-FSA's work in the area of biology and ecology. The following were the main points of discussion:

- (i) consideration of papers on biology and ecology (Annex 5, paragraphs 9.1 and 9.2);
- (ii) identification of three key areas where papers would be requested for WG-FSA-07; including reproduction of toothfish, stock structure in toothfish and taxonomy in Antarctic skates (Annex 5, paragraph 9.3);
- (iii) development and publication of species profiles – noting that a species profile for *D. mawsoni* had been completed in the intersessional period (Annex 5, paragraphs 9.4 to 9.6);
- (iv) further work by the CCAMLR Otolith Network (Annex 5, paragraphs 9.7 and 9.8);
- (v) the successful workshop on the ageing of *C. gunnari* in Kaliningrad, Russia, in June 2006 (Annex 5, paragraphs 9.9 to 9.17);
- (vi) discussion on the presence of exploitable stocks of sharks in the Convention Area (Annex 5, paragraphs 9.18 to 9.20).

4.48 With regard to the publication of species profiles (paragraph 4.47(iii)), the Scientific Committee noted that these profiles were constructed specifically for use by the Scientific Committee and its working groups. As such, they contain much useful information on the biology of the exploited species, but some of this information is from unpublished sources, and may be used in very specific ways in the assessments. Making these data freely available by publishing the species profiles raises the concern that the data may be misinterpreted and potentially used in assessments without the full knowledge and understanding of the limitations to their applicability. The Scientific Committee also noted that the species profiles are being continually updated with new information. A publication, however, would quickly

become out of date with respect to the current assessments being undertaken by the working groups. However, the Scientific Committee noted that updated versions of the species profiles could be posted on the CCAMLR website.

4.49 The Scientific Committee agreed to review the options for publication at next year's meeting once the species profiles are complete.

Sharks

4.50 The Scientific Committee noted the advice of WG-FSA that there are three species of shark which could occur in commercial quantities in the Convention Area, but their potential for exploitation has not yet been assessed (paragraphs 11.18 and 11.19).

Developments in assessment methods

4.51 The Scientific Committee noted the substantial progress made on assessment methods by WG-FSA-SAM¹ at its intersessional meeting held at the Pelican Bay Hotel, Walvis Bay, Namibia, from 10 to 14 July 2006. Results of this subgroup meeting are summarised in Annex 5, paragraphs 4.7 to 4.22. The Scientific Committee noted that WG-FSA had identified future work priorities for WG-FSA-SAM, and endorsed the recommendations for the development and evaluation of assessment methods as set out in Annex 5, paragraphs 12.4 to 12.14. The Scientific Committee further noted the conclusion of WG-FSA-SAM that the participation of an invited assessment expert (Dr Maunder) was valuable to the work of WG-FSA-SAM.

4.52 WG-FSA-SAM discussed at its intersessional meeting a number of elements contributing to assessment methods. The Scientific Committee noted WG-FSA-SAM was tasked to examine three priority areas of work: (i) estimation of parameters; (ii) continued development and evaluation of methods; and (iii) review of stock assessment methods for WG-FSA-06.

4.53 The Scientific Committee noted recommendations for revision of parameter estimates adopted by WG-FSA-06, including a natural mortality (M) value of 0.13, a steepness (h) value of 0.75, and a recruitment variability (σ_R) value of 0.60 be used for *Dissostichus* spp. when no other data are available.

4.54 The Scientific Committee agreed that the default parameters recommended by WG-FSA represented expert advice. However, it was recognised that these parameters may be further refined as a result of future work.

4.55 Dr Constable noted the increasing stability in the results, in terms of catch limits, of annual assessments of toothfish fisheries in Subarea 48.3 and Division 58.5.2 and questioned the need to conduct automatically a new assessment every year. Conducting full assessments on a longer time interval would benefit WG-FSA by freeing up time to progress more

¹ Now WG-SAM (see paragraph 13.12).

strategic issues relating to the further development of management procedures (Annex 5, paragraph 12.4).

4.56 In supporting this position, Prof. Beddington noted that the assessment of the yield of toothfish involved a projection over 30 years. In view of the stability of the results of annual assessments it is therefore reasonable to set catch limits for multiple years without the need to undertake revised assessments every year.

4.57 There was, however, the option for WG-FSA to undertake an assessment in any given year if new or refined methods of assessment recommended by WG-SAM become available, parameters used in the assessment are revised significantly, or the fishery status changes in an unexpected way (e.g. an unexpected drop in the catch rates reported from the fishery).

4.58 Dr Holt noted that while there would be benefits in adopting this approach, the current stability in the assessment results had only been evident for two years, and WG-FSA should be prepared to undertake a full assessment at its meeting in 2007.

4.59 The Scientific Committee agreed that providing management advice for multiple years without the need for interim assessments would allow additional time for progress on other high-priority issues such as Management Strategy Evaluations (MSEs), which provide a mechanism for measuring efficacy of methods towards achieving management objectives. The Committee recommended that simulation experiments be conducted to examine the robustness of the assessment outputs to changes in input data and model assumptions and provide further insight into consequences of such an assessment timetable on the management of the target species and the fishery. This topic was discussed further under Agenda Item 13.

4.60 The Scientific Committee thanked participants of WG-FSA-SAM for their effort and the considerable progress made in advancing methods for the assessment of toothfish stocks.

4.61 The Scientific Committee noted that several assessments undertaken by WG-FSA this year were initially based on preliminary assessment working papers that were subsequently reviewed independently by WG-FSA. These are set out in Annex 5, paragraphs 4.25 to 4.45. In most cases, issues that had been raised at WG-FSA-SAM had been examined and incorporated into preliminary stock assessments for consideration by WG-FSA.

4.62 With regard to the assessment of *D. eleginoides* in Subarea 48.3, the Scientific Committee noted that papers using two approaches (CASAL and ASPM) had been discussed. The Scientific Committee noted the decision reached last year (SC-CAMLR-XXIV, paragraphs 4.55 to 4.57), and the requests by WG-FSA (SC-CAMLR-XXIV, Annex 5, paragraph 12.13) and WG-FSA-SAM (WG-FSA-06/6, paragraph 2.75) that tag data be included in the ASPM. Because tag data cannot currently be incorporated into the ASPM, the Scientific Committee endorsed the view of WG-FSA that only the integrated assessment using CASAL be used to provide management advice for the 2006/07 fishing season for *D. eleginoides* in Subarea 48.3.

4.63 The Scientific Committee noted that WG-FSA examined two assessment approaches for *D. mawsoni* in the Ross Sea (Subarea 88.1 and SSRUs 882A and B) – CASAL and TSVPA (Annex 5, paragraphs 4.35 to 4.42). The CASAL integrated assessment updated the 2005 assessment using new parameter estimates along with revised catch, CPUE, catch-at-age and tag-recapture data. The TSVPA assessment method has been used by ICES and was

applied to the Ross Sea fishery using, primarily, catch-at-age data and the time series of standardised CPUE. The TSVPA estimates of spawning stock biomass were very large, and input data used for the analysis should be verified for possible errors. It was requested that these issues be explored in the intersessional period and the method be reviewed by WG-SAM for potential future use in assessing the Ross Sea toothfish fishery. The Scientific Committee also recommended that the incorporation of tag data into this approach be explored. The Scientific Committee endorsed the recommendation of WG-FSA that the integrated assessment using CASAL be used to provide management advice for the 2006/07 fishing season for *Dissostichus* spp. in the Ross Sea.

4.64 With regard to the assessment of *D. eleginoides* in Division 58.5.2, the Scientific Committee noted that two potential approaches (GYM and CASAL) were available. The Scientific Committee agreed that the CASAL approach offered an advantage over the GYM, as the integrated approach can allow for the inclusion of more of the available data in the assessment process. The Scientific Committee endorsed the view of WG-FSA that only the integrated assessment using CASAL be used to provide management advice for the 2006/07 fishing season for *D. eleginoides* in Division 58.5.2.

4.65 The Scientific Committee agreed that assessments of *C. gunnari* in Subarea 48.3 and Division 58.5.2 use the short-term projection approach, as has been previously employed.

Assessments and management advice

Assessed fisheries

4.66 All assessment work at WG-FSA 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 (Annex 5, Appendices L to R). Fishery Reports that have been revised or developed as a result of analyses and deliberations during the course of WG-FSA are:

- (i) Subarea 48.3 – *D. eleginoides* and *C. gunnari*
- (ii) Division 58.5.1 – *D. eleginoides*
- (iii) Division 58.5.2 – *D. eleginoides* and *C. gunnari*
- (iv) Subareas 58.6 and 58.7 – *D. eleginoides* (South African EEZ)
- (v) Subarea 58.6 – *D. eleginoides* (French EEZ)
- (vi) Subarea 88.1 and SSRU 882E – *Dissostichus* spp. (paragraphs 4.193 to 4.211).

The Fishery Reports are available in electronic format only and can be downloaded from the ‘Publication’ section of the CCAMLR website (www.ccamlr.org).

Dissostichus eleginoides at South Georgia (Subarea 48.3)

4.67 The Fishery Report for *D. eleginoides* in Subarea 48.3 is contained in Annex 5, Appendix L.

4.68 The catch limits for *D. eleginoides* in the 2005/06 season for areas A, B and C were 0, 1 067 and 2 489 tonnes respectively, with an overall catch for SGSR of 3 556 tonnes. The total declared catch was 3 534 tonnes. There was no recorded IUU catch for the 2005/06 season. Catches in areas A, B and C were 10, 983 and 2 541 tonnes respectively.

4.69 The Scientific Committee endorsed the assessment undertaken by WG-FSA (Annex 5, paragraphs 5.76 to 5.83).

4.70 The Scientific Committee noted the following details of the assessment carried out by WG-FSA:

- (i) The standardised GLMM CPUE analyses were updated. Standardised CPUE (for the whole SGSR fishery) showed a slight increase between 2005 and 2006. The CPUE data display high levels of variability up to 1995, and lower variability from 1996 to the present, the apparent discontinuity arising during a period of major and rapid change in the structure of the fleet and management of the fishery. Major changes occurring between 1993 and 1996 include changes in the spatial distribution of fishing, a change in the nationalities fishing, the introduction of 100% observer coverage and a shift to night setting and a winter fishery. The three periods of the fishery (1985–1992, 1993–1996, 1997–2006) therefore have very different characteristics. Interpreting the CPUE as a single series was not possible. Accordingly, the two-fleet CASAL model developed by WG-FSA last year was used for the basic assessment model this year.
- (ii) A single CASAL assessment model was used, which was structurally similar to that presented at WG-FSA-05. A simple update of that assessment (which included both low $M = 0.13$ and low $L_{\infty} = 152.8$ cm) resulted in a reduced estimate of B_0 , principally due to the influence of the 2006 tag returns. Revisions were made to some input parameters, following the advice of WG-FSA-SAM-06, including new parameter values for steepness, recruitment variability and maturity at age. The data and parameters used in the assessment model, as well as the structure of the model are outlined in Annex 5, Appendix L, Table 8.
- (iii) Stock status and the long-term yield were calculated using the MCMC samples for the assessment model, as was done last year, with the appropriate long-term yield being 3 554 tonnes. The critical decision rule was the requirement that spawning biomass at the end of a 35-year projection period should be at least 50% of initial spawning biomass. This rule was implemented following the new recommended procedure outlined in the fishery reports for the assessments for toothfish in Subarea 48.3, the Ross Sea and Division 58.5.2.

Management advice

4.71 The Scientific Committee recommended that the catch limit for toothfish in Subarea 48.3 (SGSR stock) should be 3 554 tonnes for the 2006/07 fishing season.

4.72 The catch limits for management areas A, B and C should be adjusted in a pro-rata manner to 0, 1 066 and 2 488 tonnes respectively. By-catch limits for skates/rays and macrourids should remain at the level of 5%, that is 177 and 177 tonnes respectively.

Dissostichus eleginoides at Kerguelen Islands
(Division 58.5.1)

4.73 The Fishery Report for *D. eleginoides* in Division 58.5.1 is contained in Annex 5, Appendix M.

4.74 The catch of *D. eleginoides* reported for this division to 31 August 2006 was 3 045 tonnes. Only longlining is currently permitted in the fishery. The estimated IUU catch for the 2005/06 season was zero inside the French EEZ. Some IUU fishing may occur outside the EEZ as reported in WG-FSA-06/11 Rev. 2.

4.75 No stock assessment for this fishery was carried out by WG-FSA at this year's meeting. The Scientific Committee noted the following details from the report of WG-FSA (Annex 5, paragraphs 5.88 to 5.90):

- (i) GLMM analyses show a general decreasing trend in the standardised CPUE up until 2003 followed by a period up to the current year for which the CPUE estimates are relatively constant. The trend in decreasing standardised average weight with fishing season continued for the 2005/06 season and probably indicates that the older age classes are less numerous in the exploited stock.
- (ii) A survey was carried out between 30 August and mid-October 2006, the results of which will be presented to WG-FSA in 2007. This survey included more than 200 trawls and more than 500 tagged fish. Prof. Duhamel noted that the data from this survey are still being compiled and will be reported to the Secretariat in due course.
- (iii) By-catch is important for this fishery and the majority of the catch is processed but no stock assessment is available for evaluation of the impact on affected populations.

Management advice

4.76 As at last year's meeting, the Scientific Committee encouraged the estimation of biological parameters for Kerguelen. The Scientific Committee reiterated its advice from last year that a preliminary stock assessment could be carried out by WG-FSA if CPUE, catch-weighted length frequencies and biological parameters were available.

4.77 The Scientific Committee welcomed the information regarding the recent survey and fish tagging and looked forward to receiving the results at next year's meeting.

4.78 As is the practice for other longline fisheries in the Convention Area, the Scientific Committee recommended that, where possible, all unprocessed rajids should be cut from the

line while still in the water, except on the request of the observer. Avoidance of fishing in zones of specific high rates of abundance in by-catch should also be considered.

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

Dissostichus eleginoides at Heard Island
(Division 58.5.2)

4.80 The Fishery Report for *D. eleginoides* in Division 58.5.2 is contained in Annex 5, Appendix N.

4.81 The catch limit of *D. eleginoides* in Division 58.5.2 west of 79°20'E for the 2005/06 season was 2 584 tonnes (Conservation Measure 41-08) for the period from 1 December 2005 to 30 November 2006. The catch of *D. eleginoides* reported for this division as of 5 October 2006 was 1 825 tonnes. Of this, 1 097 tonnes (60%) was taken by trawl and the remainder by longline. The estimated IUU catch for the 2005/06 season, 112 tonnes, was the lowest since IUU fishing began in 1995/96.

4.82 The Scientific Committee noted that WG-FSA had adopted a new assessment this year based on the CASAL model. The Scientific Committee welcomed this development particularly because it can enable the use of all available information in undertaking the assessment. The Scientific Committee noted several differences in the application of the model in assessing this fishery (Annex 5, paragraph 5.98) and recommended that WG-FSA further consider the issues outlined in Annex 5, paragraph 5.103.

4.83 The Scientific Committee noted the following details additional from the report of WG-FSA (Annex 5, paragraphs 5.96, 5.97 and 5.100):

- (i) The length-at-age vector from 2005 was revised using a two-segment linear model as discussed in 2005. The new vector better estimates the size of young fish. Young fish (<6 years old) are fast-growing. Fish older than six years are slower growing than previously estimated. Natural mortality was assumed to be 0.13 year^{-1} as for the other toothfish assessments.
- (ii) Additional length-at-age samples for fish of age >20 years can be obtained from the longline fishery. The Scientific Committee encouraged the collection of these data in order to improve the ability of the growth model to accurately predict mean length-at-age for these older fish.
- (iii) The CASAL assessment used abundance-at-length estimated from the surveys, catch-at-length from the fisheries and standardised CPUE time series to estimate current and initial population size and year-class strengths since 1981. These results were then used in projections to estimate the long-term annual yield that satisfies the CCAMLR decision rules for toothfish.

4.84 The long-term annual yield for *D. eleginoides* was estimated to be 2 427 tonnes giving 50% escapement with a probability of depletion of 0.06.

4.85 The Scientific Committee noted the successful progress in developing an integrated assessment of *D. eleginoides* in CASAL and endorsed the program of further work to refine this assessment proposed by WG-FSA (Annex 5, paragraphs 5.103 to 5.105).

Management advice

4.86 The Scientific Committee recommended that the catch limit for toothfish in Division 58.5.2 west of 79°20'E should be 2 427 tonnes for the 2006/07 fishing season.

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

4.87 The Fishery Report for *D. eleginoides* at Prince Edward and Marion Islands (Subareas 58.6 and 58.7) inside the South African EEZ is contained in Annex 5, Appendix P.

4.88 The catch limit of *D. eleginoides* in the South African EEZ for the 2005/06 season was 450 tonnes for the period from 1 December 2005 to 30 November 2006. The catch reported for Subareas 58.6 and 58.7 as of 5 October 2006 was 46.6 tonnes, all of which was taken by longlines. The IUU catch for the 2005/06 season was assumed to be equal to the IUU catch in the previous year, estimated to be 156 tonnes.

4.89 Cetacean depredation of longline catches is reported to be significant, implying that total removals are greater than just the estimated fishery catches. It was noted that the pot fishery which avoided cetacean depredation was discontinued.

4.90 The CPUE series was updated for the meeting and the biological parameters altered to match those used in Subarea 48.3.

4.91 An augmented ASPM that used catches, standardised CPUE, and catch-at-length data was used to estimate a long-term annual yield. The results from the model were only slightly sensitive to whether or not cetacean depredation was included in the calculations and whether or not year-specific weights were used with the CPUE indices. The model estimated the spawning biomass of the resource to be between 36 and 44% of its average pre-exploitation level, although significant uncertainties remain in the assessment.

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

4.92 The Scientific Committee noted that the advice on the appropriate levels of future catch provided in WG-FSA-06/58 was not based on the CCAMLR decision rules. Therefore it was unable to provide management advice for the fishery in the South African EEZ at the Prince Edward Islands. The Scientific Committee recommended that CCAMLR decision

rules be used in estimating yields for this fishery and that the concerns of WG-FSA over the sensitivity of the ASPM to weightings used for different data sources be noted.

4.93 The Scientific Committee also noted the recommendations by ad hoc WG-IMAF with respect to mitigation of seabird mortalities (SC-CAMLR-XXIII, Annex 5, paragraphs 5.289 and 5.290).

D. eleginoides at Prince Edward Islands (Subarea 58.7)
outside the EEZ

4.94 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 Scientific Committee 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.

D. eleginoides at Crozet Islands (Subarea 58.6)
inside the EEZ

4.95 The Fishery Report for *D. eleginoides* at Crozet Island (Subarea 58.6) inside the French EEZ is contained in Annex 5, Appendix O.

4.96 The catch of *D. eleginoides* reported in Appendix O for this subarea to 31 August 2006 was 641 tonnes. Only longlining is currently permitted in this fishery. The estimated IUU catch for the 2005/06 season was zero inside the French EEZ. Some IUU fishing may occur outside the EEZ as reported in WG-FSA-06/11 Rev. 2.

4.97 Depredation on toothfish catches by killer whales (*Orcinus orca*) is becoming a major problem for this longline fishery.

4.98 GLM analyses show a general decreasing trend in standardised CPUE to 2002/03, with a subsequent slight increase in 2003/04 and 2004/05 and a substantial increase for the 2005/06 season. The trend of decreasing standardised average weight from 1998/99 to 2004/05 showed a slight upturn in 2005/06.

4.99 During the season, 1 240 toothfish were tagged by observers on board commercial vessels. The Scientific Committee encouraged France to continue with its tagging program.

4.100 By-catch removals are important for the longline fishery and the majority of the catch is processed but no stock assessment is available for evaluation of the impact on affected populations.

Management advice for *D. eleginoides* at Crozet Islands
(Subarea 58.6) inside the EEZ

4.101 The Scientific Committee encouraged the estimation of biological parameters for *D. eleginoides* at Crozet Island. It also noted that a preliminary stock assessment could be

carried out if CPUE, catch-weighted length frequencies and biological parameters were available.

4.102 Estimated total removals have declined steadily over the last eight seasons and are at substantially lower levels than those taken before then. Standardised CPUE has fallen substantially from 1999/2000 to 2002/03 but has since increased. In the absence of a stock assessment, the Scientific Committee agreed that it was unable to recommend appropriate levels of catch for this fishery.

4.103 The Scientific Committee recommended that, where possible, all unprocessed rajids should be cut from the line while still in the water, except on the request of the observer. Avoidance of zones of specific high by-catch abundance should also be considered.

Management advice for *D. eleginoides* at Crozet Islands (Subarea 58.6) outside the EEZ

4.104 No new information was available on the state of fish stocks in Subarea 58.6 outside areas of national jurisdiction. The Scientific Committee therefore recommended that the prohibition of directed fishing for *D. eleginoides*, described in Conservation Measure 32-13, remain in force.

C. gunnari at South Georgia (Subarea 48.3)

4.105 The Fishery Report for *C. gunnari* at South Georgia (Subarea 48.3) is contained in Annex 5, Appendix Q.

4.106 In the 2005/06 fishing season the catch limit set for *C. gunnari* in Subarea 48.3 was 2 244 tonnes. During the 2005/06 season the fishery caught 2 171 tonnes. The fishery opened on 15 November 2005 and was closed on advice of the Secretariat on 30 September 2006.

4.107 In January 2006, the UK undertook a random stratified bottom trawl survey of the South Georgia and Shag Rocks shelves. The raw swept-area biomass estimates from surveys suggest that icefish stock size was between 20 000 and 50 000 tonnes throughout the 1990s (with the exception of the very large stock seen in 1990), and has steadily increased since 2000 to about 117 000 tonnes in 2006.

4.108 The catch-weighted length frequencies obtained from the commercial fishery and trawl surveys indicated that the population was dominated by a strong cohort of fast-growing 2+ fish that were considerably larger (23.6 cm TL compared with 19.8 cm TL) than expected.

4.109 The Scientific Committee 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 2006 survey.

4.110 Most input parameters for the assessment remained unchanged from 2005 except for an update of the length-weight parameters derived from the latest survey data and a change of

selectivity function. A linear selectivity vector was used for *C. gunnari*, starting at and being fully selected by 2 years. This is a greater selectivity on 2-year-olds than is usually chosen (normally a selectivity of 0.5 on 2-year-old fish is assumed). Full selectivity was assumed this year because the fish were larger than usual for 2-year-olds.

4.111 Some concern was expressed that the fishery had been catching 2-year-old fish, which are not generally assumed to be mature. Mesh size regulations and a move-on rule for large catches of fish smaller than 24 cm applies in this fishery, and should protect most 2-year-old fish (which normally have a modal length of about 20 cm). In 2005/06 the fish were larger than usual, which resulted in them being selected by the fishery. Concern was expressed that the fishery might also catch significant numbers of 2-year-old fish in the 2006/07 fishing season, if they were again unusually large. There is no information on the abundance or size of these recruits. On the other hand, if next year's recruits are normal-sized the fishery will, as usual, only partially select them.

4.112 The issue of future fishing on cohorts that have not been assessed, and for which there is no other estimate of recruitment, was raised in 2005 and remains a point of uncertainty in setting catch levels for icefish stocks (SC-CAMLR-XXIV, Annex 5, Appendix L, paragraph 30). The Scientific Committee recommended that more work be directed at understanding this issue.

Management advice for *C. gunnari* (Subarea 48.3)

4.113 The Scientific Committee recommended that the catch limit for *C. gunnari* should be revised to 4 337 tonnes in 2006/07 and 2 885 tonnes in 2007/08 based on the outcome of the short-term assessment.

4.114 All other components of Conservation Measure 42-01 should remain in force with an appropriate pro rata catch limit for catch taken in the period 1 March to 31 May (1 084 tonnes).

C. gunnari at Heard and McDonald Islands (Division 58.5.2)

4.115 The Fishery Report for *C. gunnari* at Heard and McDonald Islands (Division 58.5.2) is contained in Annex 5, Appendix R.

4.116 The catch limit of *C. gunnari* in Division 58.5.2 for the 2005/06 season was 1 210 tonnes for the period from 1 December 2005 to 30 November 2006. The catch reported for this division as of 5 October 2006 was 263 tonnes (see also Table 2).

4.117 Catch-weighted length frequencies in the 2005/06 season were dominated by a single year class of 4+ fish. This cohort was observed to dominate the population in the survey undertaken in May–June 2006.

4.118 The short-term assessment was implemented in the GYM, using the one-sided bootstrap lower 95% confidence bound of total biomass from the 2006 survey. All other parameters were the same as in previous years.

Management advice for *C. gunnari* (Division 58.5.2)

4.119 The Scientific Committee recommended that the catch limit for *C. gunnari* in 2006/07 be no more than 42 tonnes.

4.120 The Scientific Committee noted the issues raised by WG-FSA relative to providing advice to the Commission on Conservation Measure 42-02 for *C. gunnari* in Division 58.5.2:

- (i) Prior patterns in population dynamics of *C. gunnari* in Division 58.5.2 are such that the dominant 4+ age class is unlikely to be available to the fishery in 2006/07. The Scientific Committee noted that WG-FSA supported a scenario where projected yields were estimated only for classes <4+. As these year classes are low in abundance, the estimated yield is low, at 42 tonnes in the coming season, and 44 tonnes in the 2007/08 season. Yield in the second year is slightly increased due to the recruitment to the fishery in 2007/08 of the small 1+ age class evident in the 2006 survey. In considering this scenario, the Scientific Committee noted that a low yield estimate was not unexpected, as:
 - (a) the catch limit for 2005/06 was set in 2005 with the expectation that the dominant 4+ cohort would be unavailable to the fishery in 2006/07;
 - (b) the absence of any indication of a strong 1+ or 2+ year class in the 2006 survey indicates that yields are likely to be low in future until a cohort as large as the 1+ cohort detected in the 2003 survey becomes evident.
- (ii) A catch limit as low as 42 tonnes may be difficult to target commercially without over-catch. There is also a small risk that the trawl fishery for *D. eleginoides* in Division 58.5.2 might take *C. gunnari* as by-catch. However, the Scientific Committee noted that the by-catch of *C. gunnari* in the trawl fishery targeting *D. eleginoides* in Division 58.5.2 has never been large (<0.1 tonnes in 2005/06).

4.121 The remaining provisions of Conservation Measure 42-02, Annex B, should be carried forward to the 2006/07 season.

4.122 The Scientific Committee recommended that further work on developing a management procedure for *C. gunnari* is a high priority.

Other finfish fisheries

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

4.123 The Scientific Committee recalled that the Commission had closed commercial finfishing in the Antarctic Peninsula and South Shetland Islands (Subarea 48.1) and the South Orkney Islands (Subarea 48.2) after the 1989/90 season. Both subareas should only be reopened to commercial fishing if scientific surveys had demonstrated that the condition of fish stocks had improved to the extent which would allow commercial harvesting.

4.124 The Scientific Committee noted that Argentina reported on a long-term study conducted on juvenile *Notothenia rossii*, on *Gobionotothen gibberifrons* and *N. coriiceps* in Potter's Cove (King George Island, Subarea 48.1) from 1983 to 2006. The abundance of *N. coriiceps* fluctuated with no apparent trend while *N. rossii* declined following fishing in Subarea 48.1 in 1979/80 until the late 1990s and has been steadily increasing in abundance since then. Abundance of *G. gibberifrons* has been declining steadily over the years. Their numbers have remained close to zero for several years. Dr Barrera-Oro further noted that the situation in the South Shetland Islands is different to regions along the central Antarctic Peninsula (Danco Coast), particularly for *G. gibberifrons*. In the latter regions, there is evidence that *G. gibberifrons* is one of the most abundant species, and this is likely related to the fact that this area has remained outside the effect of the commercial fishery.

4.125 The USA conducted a bottom trawl survey in the region of the northern Antarctic Peninsula part of Subarea 48.1 including the previous fishing grounds for icefish (*Chaenodraco wilsoni*) exploited between 1978 and 1987. The Scientific Committee noted that biomass of all finfish species in that region of Subarea 48.1 is currently not at a level which would allow a reopening of the fishery.

4.126 The last survey of the South Orkney Islands occurred in 1999. No improvement in the condition of the stocks was observed which would give rise to considerations of reopening the area for commercial finfishing. No new information has become available since then as no survey was conducted in the 2005/06 season.

Management advice (Subareas 48.1 and 48.2)

4.127 The Scientific Committee recommended that Conservation Measures 32-02 and 32-03 on the prohibition of taking finfish in Subareas 48.1 and 48.2 respectively, should remain in force.

D. eleginoides at South Sandwich Islands (Subarea 48.4)

4.128 During the 2004/05 season, one UK-flagged vessel started a tagging program on *D. eleginoides* in Subarea 48.4. Two vessels from the UK and New Zealand fished in the area in 2005/06 and continued the tagging program. *Dissostichus eleginoides* formed 99% of the toothfish caught. A total of 134 *D. eleginoides* and 10 *D. mawsoni* were tagged over the northern shelf. The UK proposed to continue the mark-recapture experiment in Subarea 48.4 over the 2006/07 and 2007/08 fishing seasons in order to assist in the assessment of the toothfish population structure and size in accordance with Conservation Measure 41-03.

4.129 The Scientific Committee welcomed this proposal and recalled comments of WG-FSA from last year (SC-CAMLR-XXIV, Annex 5, paragraphs 5.143 to 5.145).

Management advice for *D. eleginoides* (Subarea 48.4)

4.130 The Scientific Committee recommended that the mark–recapture program for *Dissostichus* spp. continue over the next three to five years in Subarea 48.4 with a catch limit for *D. eleginoides* of 100 tonnes per season (Conservation Measure 41-03), noting the comments in SC-CAMLR-XXIV, Annex 5, paragraphs 5.143 to 5.145, and the need to ensure that the experiment is not affected by other fishing activities.

Electrona carlsbergi (Subarea 48.3)

4.131 No new information was made available to WG-FSA for *E. carlsbergi* in Subarea 48.3 on which to base an assessment.

Management advice for *E. carlsbergi* (Subarea 48.3)

4.132 The Scientific Committee noted that Conservation Measure 32-17 remains in force.

C. gunnari at Kerguelen Islands (Division 58.5.1)

4.133 No new information has been provided to the Scientific Committee on icefish in Division 58.5.1.

Management advice for *C. gunnari* (Division 58.5.1)

4.134 The Scientific Committee recommended that the fishery for *C. gunnari* within the French EEZ of Division 58.5.1 should remain closed in the 2006/07 season until information on stock status is obtained from a survey.

New and exploratory fisheries in 2005/06
and notifications for 2006/07

4.135 In 2005 the Commission agreed to seven exploratory longline fisheries for *Dissostichus* spp. in the 2005/06 season (Conservation Measures 41-04, 41-05, 41-06, 41-07, 41-09, 41-10 and 41-11), and no new fisheries had been notified for 2005/06. Activities in the exploratory fisheries are outlined below and summarised in Annex 5, Table 4.

4.136 Notifications for exploratory fisheries in 2006/07 are summarised in Annex 5, Table 5. Twelve 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. There were no notifications for new fisheries, and no notifications were received for fisheries in closed areas.

4.137 The Scientific Committee did not attempt to determine whether the notifications for exploratory fisheries satisfied the requirements of the notification procedure (Conservation Measure 21-02) (paragraphs 11.5 and 11.6).

4.138 Under Conservation Measure 41-01, each longline vessel fishing in exploratory fisheries for *Dissostichus* spp. is required to tag and release *Dissostichus* spp. at the rate of one toothfish per tonne of green weight caught throughout the season. In 2005/06, 4 451 *Dissostichus* spp. were reported to have been tagged and released in exploratory fisheries (Annex 5, Table 7), and 113 tags were recovered (Annex 5, Table 8). The number of individual *Dissostichus* spp. tagged and released, total reported catch and tagging rate in each subarea and division for vessels operating in the exploratory fisheries are shown in Table 5.

Progress towards assessments of new and exploratory fisheries

4.139 The Scientific Committee noted for the second year that substantial progress had been made in assessing stocks of *Dissostichus* spp. in Subareas 88.1 and 88.2 (see Annex 5, paragraphs 5.54 to 5.62 and Appendix F) to develop management advice.

4.140 For the other subareas and divisions in which exploratory fisheries are conducted, the Scientific Committee was unable to develop management advice based on assessments of yield and was therefore unable to provide any new advice on catch limits for these fisheries. The reported catches in these fisheries are summarised in Annex 5, Table 9.

4.141 Given the large number of notifications for 2006/07, the Scientific Committee reiterated the urgent need to develop a means for estimating abundance and providing assessments of stock status in exploratory fisheries other than in Subareas 88.1 and 88.2.

General management advice for new and exploratory fisheries

4.142 The Scientific Committee reiterated the necessity for Members fishing in exploratory fisheries for *Dissostichus* spp. to conduct the fishery-based research outlined in Conservation Measure 41-01, and submit data to the Secretariat in a timely manner.

4.143 In addition, the Scientific Committee reiterated the importance for Members to conduct tagging and to submit data as part of the Research and Data Collection Plan (Conservation Measure 41-01). Members are also urged to emphasise to their vessels the need to inspect captured fish for tags and submit accurate tag–recapture data to the Secretariat in a timely manner (Annex 5, paragraphs 3.5 and 3.6).

4.144 The Scientific Committee noted that there are significant differences in the tagging rates achieved by different Members in some areas, and not in others (Table 5). It is important to understand whether this is due to operational constraints which might suggest differences in mark–recapture model parameters, or to other reasons.

4.145 In some cases the differences in tagging rates may be attributed to operational constraints, as was the case with one Chilean-flagged vessel noted by Prof. Moreno. The

vessel was damaged by sea-ice and had to withdraw prematurely from the fishery, thus not achieving the required tagging rate.

4.146 The Scientific Committee noted that large toothfish, which are taken in some fisheries, may be difficult to tag and release unharmed and that this may result in low tagging rates in those regions. Fish which remain near the surface after being released may experience heavy bird predation. It was emphasised that great care should be taken to release all tagged fish in good condition and with a high probability of survival. If a fish is tagged and released in poor condition or is injured or eaten on release, that tag number should be recorded as released but lost, and the tag data should be removed from the database.

4.147 The Scientific Committee recognised that IUU fishing would remove tagged fish but it noted that the assessments using CASAL accounted for tagged and untagged fish in all catches in the same proportion as existed in the region, and the resultant yield calculations would not be affected.

4.148 However, the removal of tagged fish by IUU fishing using alternative gear such as trammel nets, which may have different selectivity than longlines or trawls employed by the regulated fisheries, may affect yield calculations. The Scientific Committee agreed that WG-FSA should consider what these effects might be.

4.149 With the exception of Subareas 88.1 and 88.2, the Scientific Committee was unable to provide any new advice on catch limits for *Dissostichus* spp. or any by-catch species in any of the exploratory fisheries.

4.150 For the other areas and divisions in which exploratory fisheries are conducted, the Scientific Committee reiterated the urgent need to develop a means for estimating abundance and providing assessments of stock status for all exploratory fisheries. In this context, it noted that with the continuing tagging programs in a number of areas, in the medium to long term it may be possible to obtain mark–recapture estimates of abundance provided that sufficient tags are deployed and recovered each year.

4.151 The Scientific Committee recommended that the tagging rate for *Dissostichus* spp. in exploratory fisheries be increased to (Annex 5, paragraphs 3.56 and 5.49; see also paragraph 11.8):

- a minimum of three fish per tonne and a target of 10 fish per tonne in those SSRUs in Subareas 88.1 and 88.2 which are closed but carry a 10-tonne research exemption for a single vessel in a single season;
- a minimum of three fish per tonne in exploratory fisheries in Divisions 58.4.1 and 58.4.2.

Dissostichus spp. (Subarea 48.6)

4.152 One vessel (Japan) fished in the exploratory fishery in Subarea 48.6 in 2005/06. The precautionary catch limit for *Dissostichus* spp. was 900 tonnes and the total catch was 137 tonnes. Information on this fishery is summarised in Annex 5, paragraphs 5.16 to 5.20 and Appendix G.

4.153 The fishery operated predominantly in SSRU A and the main species caught was *D. eleginoides* over the course of the fishery, although 46% of the catch in 2005/06 was *D. mawsoni*. The Scientific Committee noted that there is uncertainty in the spatial distribution of the two species of *Dissostichus* in SSRU A. This requires further investigation over the intersessional period to help with reviewing this fishery.

4.154 There is no information on sightings or landings available to estimate the level of IUU fishing in Subarea 48.6.

4.155 A total of 205 *D. eleginoides* and seven *D. mawsoni* (total 212 fish) have been tagged and released, mostly in SSRU A, and three fish (all *D. eleginoides*) have been recaptured.

4.156 The Scientific Committee noted disproportionately fewer *D. mawsoni* tagged relative to *D. eleginoides*. It noted that *D. mawsoni* may be larger fish and difficult to tag as previously discussed (paragraph 4.146).

4.157 The Scientific Committee noted that Conservation Measure 41-01 specifies the tagging rate for *Dissostichus* spp. generally. It was agreed that in regions where both species occur, the tagging rate should be in proportion to the species and sizes of *Dissostichus* spp. present in the catches (paragraphs 11.7 to 11.11). However, the Scientific Committee recognised that there may be other ramifications associated with this requirement, and requested that WG-FSA examine this issue.

4.158 To ensure adequate numbers of fish of each species are tagged, the Scientific Committee noted that in regions where both species occur, it may be necessary to increase the rate that fish are tagged from the present rate of one fish per tonne to three fish per tonne as is being recommended in other regions (paragraph 4.192).

4.159 The Scientific Committee noted that determining the optimal number of tagged fish and recaptures required before an assessment can be conducted is complex; however, it was noted that in SSRU 882E a stock assessment was completed this year after 1 324 fish had been tagged with 55 tag returns (Annex 5, Tables 7 and 8).

4.160 The Scientific Committee recognised that in addition to the deployment and recovery of sufficient tagged fish, other information such as biological data may be required before an assessment can be completed.

4.161 Dr Naganobu suggested that toothfish densities in Subarea 48.6 may be lower than those in Subareas 88.1 and 88.2, so any comparison of tagging efforts among the areas may need further investigation. He advised against increasing the tagging rate in Subarea 48.6 at this time.

4.162 Dr Constable noted that the surface area of SSRU A in Subarea 48.6 is similar to the area of Subarea 88.1 as a whole. Therefore, it would be useful if WG-FSA could consider the need to subdivide SSRU A in Subarea 48.6 into smaller SSRUs in order to facilitate assessments similar to that for the fishery in SSRU 882E.

4.163 Four Members (Japan, Republic of Korea, New Zealand and Norway) and a total of five vessels notified their intention to fish for *Dissostichus* spp. in Subarea 48.6 in 2006/07.

Management advice for Subarea 48.6

4.164 The Scientific Committee recommended that all the requirements of the fishery, including fishery-based research (Conservation Measure 41-01), by-catch limits (Conservation Measure 33-03) and associated measures, be carried forward to the 2006/07 season.

Dissostichus spp. (Subarea 58.4)

4.165 The Scientific Committee noted that there were four divisions within Subarea 58.4 that were fished for *Dissostichus* spp. during 2005/06.

Dissostichus spp. (Division 58.4.1)

4.166 Five Members (Chile, Republic of Korea, New Zealand, Spain and Uruguay) and six vessels fished in the exploratory fishery in Division 58.4.1 in 2005/06. The precautionary catch limit for *Dissostichus* spp. was 600 tonnes and the reported catch was 425 tonnes. The closure of SSRUs C (15 February 2006) and G (27 January 2006) was triggered by the catch of *Dissostichus* spp. and the Scientific Committee noted that the over-run of the catch limit in SSRU C (by 50 tonnes) was partly attributed to an amendment to the reported catch which was submitted to the Secretariat after the closure of the fishery (CCAMLR-XXV/BG/3). Information on this fishery is summarised in Annex 5, Appendix H.

4.167 The fishery targets *D. mawsoni* and has operated in SSRUs C, E and G. Information on IUU activities indicated that approximately 689 tonnes of *Dissostichus* spp. was taken in 2005/06. The Scientific Committee noted that most of the catch reported in 2005/06 was taken in SSRUs C and G and that it was possible that these SSRUs were also the focus of IUU fishing. If this were the case, then the total extraction of *Dissostichus* spp. from these SSRUs in 2005/06 was higher than the precautionary catch limit and may not be sustainable.

4.168 A total of 908 *D. mawsoni* and 23 *D. eleginoides* (total 931 fish) have been tagged and released; there are no reports of recaptures. Most of the fish tagged and released were from SSRUs C (427 fish), E (180 fish) and G (324 fish).

4.169 Six Members (Australia, Republic of Korea, Namibia, New Zealand, Spain and Uruguay) and a total of nine vessels notified their intention to fish for *Dissostichus* spp. in Division 58.4.1 in 2006/07.

Dissostichus spp. (Division 58.4.2)

4.170 Three Members (Chile, Republic of Korea and Spain) and four vessels fished in the exploratory fishery in Division 58.4.2. The precautionary catch limit for *Dissostichus* spp. was 780 tonnes and the reported catch was 164 tonnes. Information on this fishery is summarised in Annex 5, Appendix I.

4.171 The fishery targets *D. mawsoni* and has operated in SSRUs A, C and E in recent seasons. Information on IUU activities indicated that approximately 221 tonnes of *Dissostichus* spp. was taken in 2005/06.

4.172 A total of 463 *D. mawsoni* and 15 *D. eleginoides* (total 478 fish) have been tagged and released; there are no reports of recaptures. Most of the fish tagged and released were from SSRUs A (237 fish) and E (190 fish). The fishery appears to have caught small and large fish in the early years but the smaller length classes have not been caught in more recent years.

4.173 The Scientific Committee noted that the catch of macrourids reported in 2004/05, when fishing was concentrated in SSRU A, was relatively higher (22% of the catch of *Dissostichus* spp.) than in other seasons (2–10% of the catch of *Dissostichus* spp.) when fishing was concentrated in SSRU E.

4.174 Six Members (Australia, Republic of Korea, Namibia, New Zealand, Spain and Uruguay) and a total of nine vessels notified their intention to fish for *Dissostichus* spp. in Division 58.4.2 in 2006/07. The Scientific Committee noted that if all these vessels fished, this would represent a doubling of fishing effort by Members in this division. There was also a rapid increase in IUU fishing in this division (Annex 5, paragraphs 5.94 to 5.105).

Dissostichus spp. (Division 58.4.3a)

4.175 Two vessels (Spain) fished in the exploratory fishery in Division 58.4.3a. The precautionary catch limit for *Dissostichus* spp. was 250 tonnes and the reported catch was 89 tonnes. Information on this fishery is summarised in Annex 5, Appendix J.

4.176 The fishery targets *D. eleginoides* and the Scientific Committee noted that the catch-weighted length frequencies for this species were similar to those reported for *D. eleginoides* taken by longline in Division 58.5.2 (see Annex 5, Appendix N). Information on IUU activities indicated that approximately 98 tonnes of *Dissostichus* spp. were taken in 2004/05; there was no information on IUU fishing in 2005/06.

4.177 A total of 303 *D. eleginoides* have been tagged and released and six fish have been recaptured.

4.178 Three Members (Japan, Republic of Korea and Spain) and a total of four vessels notified their intention to fish for *Dissostichus* spp. in Division 58.4.3a in 2006/07.

Dissostichus spp. (Division 58.4.3b)

4.179 Three Members (Chile, Spain and Uruguay) and four vessels fished in the exploratory fishery in Division 58.4.3b. The precautionary catch limit for *Dissostichus* spp. was 300 tonnes and the reported catch was 361 tonnes. The fishery targets *D. mawsoni* and fishing took place outside the prescribed season, in accordance with Conservation Measure 41-07. The closure of the fishery (13 March 2006) was triggered by the catch of *Dissostichus* spp. and the Scientific Committee noted that the over-run of the catch limit (61 tonnes) was partly attributed to an amendment to the reported catch which was submitted

to the Secretariat after the closure of the fishery (CCAMLR-XXV/BG/3). Information on this fishery is summarised in Annex 5, Appendix K.

4.180 Information on IUU activities indicated that approximately 1 015 tonnes of *Dissostichus* spp. was taken in 2004/05, and 1 808 tonnes in 2005/06. The Scientific Committee expressed concern that the total extraction of *Dissostichus* spp. in the 2004/05 and 2005/06 seasons exceeded the precautionary catch limit by a factor of 4.4 and 7.2 respectively. The Scientific Committee agreed that such extractions were unlikely to be sustainable.

4.181 A total of 392 *D. mawsoni* and 14 *D. eleginoides* (total 406 fish) have been tagged and released and seven fish have been recaptured.

4.182 The Scientific Committee noted that tagging rates by vessels in this area have apparently been much lower than tagging rates by the same vessels in other areas (Table 5). The Scientific Committee requested information from the vessels and observers operating in Subarea 58.4 on the reasons for this lower tagging rate which may be due to operational constraints or the poor condition of toothfish caught.

4.183 Six Members (Australia, Japan, Republic of Korea, Namibia, Spain and Uruguay) and a total of eight vessels notified their intention to fish for *Dissostichus* spp. in Division 58.4.3b in 2006/07. The Scientific Committee noted that if all these vessels fished, this would represent a doubling of the number of vessels which fished in 2005/06.

Overview of *D. mawsoni* fisheries in Subarea 58.4

4.184 The Scientific Committee noted the increasing levels of fishing activity occurring in the range of *D. mawsoni* in the Indian Ocean sector (notably in Divisions 58.4.1, 58.4.2 and 58.4.3b), particularly the attention being given to the region between 60°E and 110°E along the margins of the continental shelf of Antarctica and BANZARE Bank. The estimated total removals from these divisions in 2005/06 was 3 668 tonnes (this total comprised 74% IUU). Given the proximity of these fisheries to one another, the Scientific Committee agreed that the separation of these fisheries may prove to be inappropriate once there is an understanding of stock structure in the region. In light of this, the combined scale of these removals is greater than the catch limit for Subarea 88.1, which is based on assessments of stock status and long-term annual yield. However, the Scientific Committee noted that although the sizes of the two subareas are similar, the fishable grounds in Subarea 58.4 are limited to the margins of the continental shelf of Antarctica and BANZARE Bank, unlike Subarea 88.1 where fishable grounds are much larger.

4.185 On the basis of the fishery reports for these divisions, the Scientific Committee also noted:

- (i) by-catch rates, particularly for *Macrourus* spp., seem unusually low, especially when compared to rates experienced in comparable areas in Subareas 88.1 and 88.2 and to the common occurrence of these fish in an earlier trawl survey of BANZARE Bank (SC-CAMLR-XVIII, Annex 5, paragraph 3.79; van Wijk et al., 2000);

- (ii) the total number of tagged fish released in these divisions is 1 815 but it is unclear how many of these fish have survived because the Scientific Committee was advised that observers in the fishery have reported a great difficulty in tagging these large fish and that many of them do not recover from the process of tag and release, remaining on the surface after release and becoming vulnerable to predators, such as being attacked by giant petrels;
- (iii) the tagging rate in Division 58.4.3b, which is the region for which most catch is taken, has not reached the required level of one fish per tonne in the last two seasons.

4.186 The Scientific Committee recalled that an Australian survey in 1999 had not detected any young *Dissostichus* spp. in Division 58.4.3b. Commercial data (see Fishery Report) confirm that the *D. mawsoni* found in this area are on average about 140 cm long with a minimum at about 100 cm. The absence of smaller fish and the relatively small area of BANZARE Bank and low CPUE compared to Subareas 88.1 and 88.2 suggest a small stock size, while the dynamics, including stock structure and productivity, are completely unknown. On the basis of information available and the outcomes of the Ross Sea assessment, which is for a much larger area, extractions of *Dissostichus* spp. at the level of 2 000 tonnes a year are unlikely to be sustainable.

4.187 The Scientific Committee had similar concerns about the productivity of the populations of *D. mawsoni* in Divisions 58.4.1 and 58.4.2, although there appear to be some young fish in Division 58.4.2.

4.188 Given the comparatively high level of total removals across these divisions, the low level of reporting on removals (the available data are only for 26% of the total estimated catch), and the potential unreliability of the tagging program, the Scientific Committee considered that there was an urgent need to review how to acquire information on the status of the stocks in the region, including stock structure, such as through otolith-based studies, and how to assess productivity and yield, such as through more structured experimental fishing. This will not be possible until the meeting of WG-FSA in 2007.

4.189 The Scientific Committee agreed that the tagging program should be accelerated (Annex 5, paragraph 5.46). Some vessels fishing in these three divisions have achieved tagging rates of three fish per tonne and greater. Tagging rates in Division 58.4.3b have been low, none reaching the required level of one fish per tonne over the last two years. The Scientific Committee recommended that tagging rates in Divisions 58.4.1 and 58.4.2 should be raised to three fish per tonne. Furthermore, it agreed that all fish recorded as being tagged and released should be healthy and not have been subjected to seabird predation. The Scientific Committee urged Members to correspond with each other in order to implement appropriate methods for achieving the required level of tagging in all divisions.

Management advice for *D. mawsoni* in Subarea 58.4

4.190 The Scientific Committee recommended urgent consideration of how to acquire appropriate data for assessments of stock status and yield of *D. mawsoni* in the Indian Ocean

sector because of (i) the lack of progress towards assessments in these divisions, and (ii) a rapidly escalating catch in the region.

4.191 The Scientific Committee requested submissions by Members on stock structure, biological parameters (e.g. growth, length–weight relationship, maturity), recruitment and methods for assessment of these stocks.

4.192 The Scientific Committee agreed that the tagging program should be accelerated (Annex 5, paragraph 5.46). Some vessels fishing in these three divisions have achieved tagging rates of three fish per tonne and greater. Tagging rates in Division 58.4.3b have been low, none reaching the required level of one fish per tonne over the last two years. The Scientific Committee recommended that tagging rates in Divisions 58.4.1 and 58.4.2 should be raised to three fish per tonne. Furthermore, it agreed that all fish recorded as being tagged and released should be healthy and not have been subjected to seabird predation. The Scientific Committee urged Members to correspond with each other in order to implement appropriate methods for achieving the required level of tagging in all divisions (paragraph 4.189).

Dissostichus spp. (Subareas 88.1 and 88.2)

4.193 Six Members (Argentina, New Zealand, Norway, Russia, UK and Uruguay) and 13 vessels fished in the exploratory fishery in Subarea 88.1. The precautionary catch limit for *Dissostichus* spp. was 2 964 tonnes and the total catch was 2 952 tonnes. The fishery was closed on 6 February 2006 (CCAMLR-XXV/BG/3), and the following SSRUs were closed during the course of fishing:

- SSRUs B, C, G closed 3 January, triggered by the catch of *Dissostichus* spp. (total catch 343 tonnes; 99% of the catch limit);
- SSRUs H, I, K closed 19 January, triggered by the catch of *Dissostichus* spp. (total catch 1 976 tonnes; 104% of the catch limit);
- SSRU J closed 5 February, triggered by the catch of *Dissostichus* spp. (total catch 548 tonnes; 99% of the catch limit).

The IUU catch for the 2005/06 season was estimated to be zero tonnes.

4.194 Nine Members (Argentina, Republic of Korea, New Zealand, Norway, Russia, South Africa, Spain, UK and Uruguay) and a total of 21 vessels notified their intention to fish for *Dissostichus* spp. in Subarea 88.1 in 2006/07.

4.195 Five Members (Argentina, New Zealand, Norway, Russia and the UK) and seven vessels fished in the exploratory fishery in Subarea 88.2. The precautionary catch limit for *Dissostichus* spp. was 487 tonnes and the total catch was 465 tonnes. The fishery was closed on 15 February 2006 (CCAMLR-XXV/BG/3). The IUU catch for the 2005/06 season was estimated to be 15 tonnes. Information on this fishery and management advice is summarised below.

4.196 Seven Members (Argentina, New Zealand, Norway, Russia, Spain, UK and Uruguay) and a total of 16 vessels notified their intention to fish for *Dissostichus* spp. in Subarea 88.2 in 2006/07.

4.197 The Fishery Report for *Dissostichus* spp. in Subareas 88.1 and 88.2 is in Annex 5, Appendix F.

4.198 In 2005 the Scientific Committee 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.

4.199 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. 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.

4.200 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.

4.201 In 2005/06, all but five vessels achieved a tagging rate of more than one toothfish per tonne of toothfish landed (Table 5). The vessels that failed to achieve the required tagging rate were the *Antartic II* (Argentina), *Volna* (Russia) and *Yantar* (Russia) in both Subareas 88.1 and 88.2; the *Viking Sur* (Uruguay) in Subarea 88.1; and the *Frøyanes* (Norway) in Subarea 88.2.

4.202 Since 2000/01, more than 11 000 *Dissostichus* spp. have been tagged in Subareas 88.1 and 88.2 (WG-FSA-06/34), and 250 tagged fish recaptured. Since 2000/01 a total of 5 678 *D. mawsoni* have been tagged by New Zealand vessels in the Ross Sea (Subarea 88.1 and SSRUs 882A–B) and 94 of these were recaptured by New Zealand vessels. The New Zealand vessel data were used as inputs for the base-case model, as complete data (i.e. some release data for 2004) for other vessels were unavailable for the assessment (WG-FSA-06/34).

4.203 The CASAL model, using catch-at-age, CPUE, 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.

Management advice for *Dissostichus* spp.
in Subareas 88.1 and 88.2

4.204 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 3 072 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 3 072 tonnes is therefore recommended.

4.205 For SSRU 882E, assuming a future fishing selectivity equal to the maturity ogive, the constant catch for which there was a 10% chance of spawning biomass dropping to less than 20% of the initial biomass was 353 tonnes. A yield of 353 tonnes is therefore recommended.

4.206 For SSRUs 882C, D, F and G the Scientific Committee could provide no new advice, but noted that the catches in these areas had provided some useful biological data for toothfish. Therefore, the Scientific Committee recommended the current catch limits in these SSRUs be continued for the 2006/07 season.

4.207 The Scientific Committee recommended that the allocation method used to set the 2005/06 catch limits for SSRUs in Subarea 88.1 be continued for the 2006/07 season.

4.208 The Scientific Committee agreed 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.

4.209 The Scientific Committee recommended that tagging be continued as part of the Research and Data Collection Plan (Conservation Measure 41-01) and urged all Members to continue to tag fish at the required rate.

4.210 The Scientific Committee also considered that the introduction of more structured research plans for exploratory fisheries may lead to a more effective and efficient collection of research data. It therefore recommended that development of such plans should be considered during the intersessional period.

4.211 The Scientific Committee recommended that there should continue to be provision for a 10-tonne research exemption in all SSRUs in Subareas 88.1 and 88.2 having a zero catch limit so as to provide additional opportunities for research and tagging in areas where, often, data are scarce. However, paragraphs 12 and 13 of Conservation Measures 41-09 and 41-10, should be revisited in order to:

- clarify that a 10-tonne research exemption will be granted only for a single vessel in a single SSRU, not one vessel per Member. This will limit the total catch in a closed SSRU to 10 tonnes. On receipt of a notification under Conservation Measure 24-01, Annex A, from a Member that it intends to undertake research under the 10-tonne research exemption in a particular SSRU, the Secretariat will notify all Members of this fact and will not allow additional notifications for that SSRU in that season;
- clarify that paragraphs 12 and 13 of Conservation Measures 41-09 and 41-10 override the normal interpretation of Conservation Measure 24-01 in respect of multiple notifications by Members in a single SSRU;
- clarify that there is an allowance for the retention of 10 tonnes green weight of *Dissostichus* spp.;
- clarify that by-catch and *Dissostichus* spp. that are tagged and returned do not count against the 10-tonne limit. The retained catch of toothfish should count against the overall catch limit for the larger area within which the SSRU lies;

- increase the required tagging rate under the 10-tonne research exemptions to a minimum of three fish per tonne and a target rate of 10 fish per tonne (paragraph 4.151). This will also require a change to Conservation Measure 41-01, Annex C, paragraph 2(i).

Review of potential destructive fishing practices

Interim prohibition on the use of gillnets in the Convention Area

4.212 The Scientific Committee was asked to comment on a proposal to prohibit deep-sea gillnet fishing in the Convention Area (WG-FSA-06/46). Gillnets considered in the document are those described by FAO which include trammel nets. The Scientific Committee noted information exists that fishing vessels with gillnets have been observed in the Convention Area. The Scientific Committee agreed that gillnets are non-selective fishing devices and if not utilised correctly could take mobile species indiscriminately. In addition, gillnets may have adverse impacts if dragged along the bottom and have the potential to ‘ghost’ fish over long time periods when lost or discarded. The Scientific Committee agreed that it would be reasonable to have an interim prohibition of deep-sea gillnetting in the Convention Area until the Scientific Committee has investigated and reported on the potential impacts of this gear in the Convention Area and the information has been reviewed by the Commission.

4.213 The Scientific Committee also noted that the suggested interim prohibition would apply only to commercial vessels and not for research purposes. At present some Members utilise gillnets in inshore areas to sample fish populations. These programs have been conducted using approved methods for a number of years. If Members wished to initiate new research programs using gillnets, the Scientific Committee should be notified in order that the proposals be reviewed and approved before being undertaken. The Scientific Committee noted that action with respect to regulating the use of gillnets in the Convention Area should not jeopardise existing research programs in coastal waters, which occur in waters less than 150 m deep.

Bottom trawl fishing and destructive fishing practices within the CAMLR Convention Area

4.214 The Scientific Committee was also asked to comment on a proposal to address the negative impacts of bottom trawl fishing on oceanic ecosystems, and in particular vulnerable marine ecosystems, in the Convention Area (CCAMLR-XXV/BG/33). The proposal was that:

- (i) in high-seas areas where there is an RFMO with competence to regulate bottom fisheries, that RFMO would take action to:
 - (a) immediately freeze the footprint of bottom-trawl fishing (e.g. no expansion into new areas or in existing areas), unless the RFMO determines that such expansion would not cause significant adverse harm to vulnerable marine ecosystems;

- (b) end all bottom trawling by 2009, unless the RFMO determines that its continuation would not cause significant adverse harm.

4.215 The Scientific Committee noted that it supports attempts to remove destructive fishing practices in the Convention Area. It noted that at present bottom trawl fishing is prohibited around the Antarctic Continent and there are no plans to initiate new bottom trawl fishing.

4.216 However, some Members noted that in the case of the present proposal, the issue would best be examined by the Commission which may wish to provide further guidance to the Scientific Committee to be considered at its next meeting.

Crab resources

4.217 No target fishery for crabs was carried out in the last four seasons and no proposal for their harvest has been received by CCAMLR for the 2006/07 season.

Advice to the Commission

4.218 The Scientific Committee recommended that the existing Conservation Measures 52-01 and 52-02 on crabs should remain in force.

Squid resources

Martialia hyadesi (Subarea 48.3)

4.219 No target fishery for squid (*Martialia hyadesi*) was carried out in the last four seasons and no new request has been submitted to CCAMLR to continue exploratory fishing in the 2006/07 season.

Advice to the Commission

4.220 The Scientific Committee recommended that the existing Conservation Measure 61-01 on *M. hyadesi* should remain in force.

Fish and invertebrate by-catch

4.221 The long-term status of by-catch taxa has been identified as an issue for urgent attention by the Scientific Committee (SC-CAMLR-XXI, Annex 5, paragraphs 5.151 to 5.153). The key issues that need to be addressed are:

- assessments of the status of by-catch taxa (particularly rajids and macrourids)
- assessments of the expected impact of fisheries on by-catch species
- consideration of mitigation measures.

4.222 Consideration of fish by-catch in krill fisheries is not included in this section. See section 2.

Assessment of the status of by-catch species and groups

4.223 No new assessment had been conducted which would enable the recommended catch limits to be revised in 2006. As a result, the Scientific Committee recommended that precautionary measures should be adopted so as to set an upper limit on by-catch, thus reducing the possibility of localised depletion.

4.224 The Scientific Committee recalled that the assessment of rajids and macrourids remains a priority. The acquisition of biological data on rajids caught during longline fishing is continuing in Subareas 88.1 and 88.2, and tagging programs are also being undertaken in these subareas, as well as in Division 58.5.2 and Subarea 48.3. The Scientific Committee encouraged these efforts, and looked forward to receiving the results of intersessional work aimed at providing an initial assessment of rajid stocks.

Estimation of by-catch levels and rates

4.225 Estimates of total removals of by-catch in the longline and trawl fisheries are shown in Tables 10 and 11 respectively of the WG-FSA report (Annex 5). Rajids and macrourids constitute the majority of by-catch in longline fisheries, followed by the morid *Antimora rostrata*, which predominates in the category 'Other Species'. *Channichthys rhinoceratus* and *Pseudochannichthys georgianus* were predominant in by-catch in icefish fisheries in Division 58.5.2 and Subarea 48.3 respectively, but were found in much smaller proportions than is observed in by-catch of longline fisheries. Icefish is itself caught as a by-catch in the krill fishery in Subarea 48.3.

4.226 Estimates of fish by-catch were equivalent to those obtained in previous years using fine-scale data (C2 forms). By-catch of macrourids on longlines in Subarea 88.1 have, however, decreased considerably, probably partly because of a decrease in the requirement to conduct longline research hauls, and also as a result of the implementation of the move-on rule when by-catch levels are high.

Reporting of by-catch data

4.227 Estimates of longline by-catch of fish from observer data were compared with those from fine-scale data (C2). While there is consistency between the two types of data for macrourids, this is not the case for rajids, for which data reporting seems unsatisfactory except in the areas in which they are retained and processed. It was also noted that estimates of catch rates still include little information on drop-offs (whether deliberate or accidental) of

rays from hooks on the line. The Scientific Committee emphasised that observers should complete all fields of data reporting forms correctly and asked WG-FSA to review the performance of the 2006/07 season.

4.228 The Scientific Committee agreed that L5 observer forms have become too complex and recommended that observers' tasks should be simplified. In particular, the requirement to record the total weight of each by-catch taxon for every haul should be relaxed. The mean weight of by-catch species should be obtained from observations made during the biological sampling period and not the tally period.

4.229 The Scientific Committee recommended that the instructions to observers with respect to sampling longlines for by-catch be simplified as follows:

Tally period –

- 25% of hooks should be observed for tally counts each day
- the tally period may be broken up into several periods each day
- tally period includes counts of target fish species, fish and invertebrate by-catch, and interactions of birds and mammals with the fishing gear.

Biological data –

- Biological sampling periods and tally periods should be consecutive (the mean weight of by-catch is worked out during the biological sampling period).

Rajids –

- Skate and ray observations should be conducted at least once every 48 hours and, if possible, should cover approximately 10% of the hooks hauled.

4.230 The Scientific Committee recommended that observers be thoroughly briefed by technical coordinators regarding the guidelines for recording by-catch data.

Mitigation measures

4.231 The Scientific Committee endorsed WG-FSA's recommendations that the by-catch move-on rule (Conservation Measure 33-03, paragraph 5) should not be modified, as this measure seems to have been effective, at least in Subarea 88.1, in reducing by-catch and the number of times individual SSRUs would have had to be closed following by-catch limits being reached.

4.232 In view of the development of new longline fishing techniques, the Scientific Committee encouraged Members experimenting with such methods to monitor closely the impact of fishing operations on all species (target species, fish and invertebrate by-catch and marine mammals and birds).

Management advice

4.233 The Scientific Committee recommended that the by-catch move-on rule (Conservation Measure 33-03, paragraph 5) remain unmodified for this year, but recommended that it be reviewed at WG-FSA-07. It requested that the Secretariat provide data for the analysis of by-catch (as shown in Annex 5, Tables 10 to 12) for the start of that meeting.

4.234 Management advice regarding the recommendations for scientific observation is included in section 2.