

HARVESTED SPECIES

Krill resources

2003/04 season

4.1 The krill harvest during the 2003/04 fishing season was 118 116 tonnes (Table 2). Most of the catch was taken within three of the 15 SSMUs (north of Livingston Island, west of Coronation Island and northeast of South Georgia).

2004/05 season

4.2 The catch for the 2004/05 fishing season reported to the Secretariat by September 2005 was 124 535 tonnes (Table 3) and had already exceeded the level of the previous season's catch (SC-CAMLR-XXIV/BG/1). For comparison, the catch reported to September 2004 at CCAMLR-XXIII was 102 202 tonnes, some 16 000 tonnes less than the finalised total for the 2003/04 season.

4.3 The relative contributions to the total catch by Members have also changed, with the catch reported by Japan and Poland declining to approximately 40% of their previous levels, and recent increases in the catch reported by the Republic of Korea and Vanuatu (Table 4).

2005/06 season

4.4 Notifications of intention to harvest krill in the 2005/06 fishing season were submitted by Russia (15 000 tonnes), Japan (25 000 tonnes), the Republic of Korea (25 000 tonnes), Ukraine (30 000 tonnes), USA (50 000 tonnes) and Norway (100 000 tonnes), for a total of 245 000 tonnes (WG-EMM-05/6). Norway further indicated that the Vanuatu-flagged vessel *Atlantic Navigator* had ceased fishing for krill in August 2005. The commercial operator had replaced this vessel by the Norwegian-flagged vessel *Saga Sea*, which will begin fishing in December under the Norwegian notification. Members pointed out that this fishing operation was based on production of krill for industrial purposes and that the economics of such a fishery were uncertain.

4.5 The Scientific Committee noted the utility of the notification procedure for krill fisheries which has been operating for the last two seasons and encouraged Members to continue to submit these notifications, pointing out that the time series of such information will be extremely valuable in discerning trends in the fishery.

Changes in the pattern of the krill fishery

4.6 An analysis of historical catches indicated that only five out of 15 SSMUs in Area 48 contributed substantially to the total krill catch (Annex 4, paragraphs 3.28 to 3.31). A shift in operations was noted in SSMUs at the South Shetland Islands, where fishing has shifted from the December–February period to fishing in March–May. In the vicinity of the South Orkney

Islands the fishery has continued in the March–May period and at South Georgia the timing of operations has also remained relatively constant (June–August). This change in the season of the fishery may mean that the level of observer coverage (mainly in winter) may not be sufficient to understand the behaviour of the fishery or issues such as the by-catch of larval fish.

Catch reporting

4.7 The Scientific Committee noted that the Secretariat had produced a Fishery Report for Krill for WG-EMM (Annex 4, paragraphs 3.28 and 3.29) and recommended that such a report should be produced annually, similar to that for finfish fisheries in the Convention Area. This would move the krill fishery into a more analytical framework and would start to bring it into line with the other fisheries.

New technology

4.8 Uruguayan observers described a continuous fishing system used on board the *Atlantic Navigator*, where krill are pumped from the codend of a pelagic trawl without recovering the gear (Annex 4, paragraphs 3.23 to 3.28). The Scientific Committee agreed that this new technology would not be considered a ‘new and exploratory fishery’ if there is an adequate description of the selectivity of the method for krill, a characterisation of the haul (or catch rate) and information on the location of krill catches. In particular, because haul duration can extend for several days, there existed the potential for single hauls to occur in several different SSMUS. The Secretariat needs to revise the format for reporting data to accommodate the information arising from the new fishing method.

4.9 There might be considerable potential for this type of fishing gear to impact other elements of the ecosystem either through by-catch, particularly of larval fish, or through incidental mortality of either immature krill or other small pelagic species. Taking into account that the new krill fishing technology during the 2005/06 season will be used by the vessel bearing the Norwegian flag, the Scientific Committee recommended that such aspects be the subject of urgent study and urged Norway to provide a report for WG-EMM in 2006 on the operation of this type of technology and on its ecological impacts so that it can be adequately described.

4.10 The utility of scientific observers’ reports in helping to characterise this new approach to krill fishing was noted. Norway was asked by the Scientific Committee to take on board the vessel, the scientific observer designated in accordance with the CCAMLR scheme. It was also pointed out that the technology was such that sampling of the catch was possible, and the use of observers allowed the assessment of the ecosystem impact of this type of operation. The use of the fisheries questionnaire in understanding the behaviour of this fishery was highlighted.

Advice to the Commission

4.11 The krill fishery is changing in its pattern of operation, in respect of the nations involved, in the composition of its products and in the harvesting technology being used. There may also be evidence of gradual increases in overall catch levels. These developments will require changes in the type of data and reporting formats required from the fishery and in the level of observer coverage (paragraph 4.8).

Fish resources

Fishery Reports

4.12 The Scientific Committee noted that WG-FSA had continued the restructuring of its report as requested. Discussion of the report structure is given in Annex 5, paragraphs 2.4 to 2.7. In the 2005 report, WG-FSA had produced six subgroup reports as appendices to the main report and also eight Fishery Reports which describe the stock assessments for the assessed fisheries. The Scientific Committee agreed that Fishery Reports are very useful as stand-alone reports, with management advice and key supporting paragraphs included in the main body of the WG-FSA report.

4.13 The Scientific Committee discussed the large size of the 2005 report of WG-FSA and endorsed a recommendation that the Fishery Reports should be published in a separate electronic volume, and that these reports would be consistent and modified each year as new data becomes available.

4.14 Dr Shust noted that the current Fishery Reports are unbalanced, with some fisheries and species given considerably more attention than others. He recommended that each Fishery Report should be brief and limited to no more than 15 pages.

4.15 Other Members felt that although a brief Fishery Report is very desirable, it should not have a restricted size limit. The lengthy nature of the current report was required to adequately document the considerable amount of work completed by WG-FSA.

Data requirements

4.16 The Scientific Committee discussed the new trial electronic version of CCAMLR's *Statistical Bulletin* (eSB). The eSB allows users to replicate the six sections published in the hard copy of the bulletin, as well as access the complete dataset of statistics which are used to summarise data, generate tables and graphics, and extract selected data. The Scientific Committee thanked the Secretariat for developing the eSB. Also considered was the revision of CCAMLR databases and data checking routines, development of tagging and ageing databases, and receiving and processing fishery and observer data in time for the meeting.

4.17 The Scientific Committee endorsed the proposal for the Secretariat to develop a manual, which can be updated each year, that specifies its procedures and equations, where appropriate, for the extraction and mathematical manipulation of data, and to make this reference information available at the start of future meetings of WG-FSA.

4.18 The Scientific Committee noted the comments of WG-FSA on the publication of aggregated fine-scale data in the *Statistical Bulletin* (paragraphs 12.24 to 12.27).

Status and trends

Fishing activity in the 2004/05 season

4.19 Twelve finfish fisheries, including seven exploratory fisheries, were conducted under the conservation measures in force in 2004/05. These included fisheries for *D. eleginoides* and *C. gunnari* in Subareas 48.3 and Division 58.5.2, and exploratory fisheries for *Dissostichus* spp. in Subareas 48.6, 88.1, 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b. Other managed longline fisheries for *D. eleginoides* occurred in Subarea 48.4, and in the EEZs of South Africa (Subareas 58.6 and 58.7) and France (Subarea 58.6 and Division 58.5.1).

4.20 The Scientific Committee noted that catches of target species by region and gear reported from fisheries conducted in the CCAMLR Convention Area in the 2004/05 fishing season are summarised in Annex 5, Table 3.1. These had been updated to 21 September 2005 and reported in SC-CAMLR-XXIV/BG/1. The Scientific Committee noted that the Secretariat had also provided updates of the catch-weighted length frequencies (Annex 5, paragraph 3.18), catch histories of target and managed by-catch species (Annex 5, paragraph 3.21), and general maps of fishing locations (Annex 5, paragraph 3.17).

4.21 The Scientific Committee noted that catch, effort and length data were submitted for all fisheries managed under conservation measures, and that data were also submitted from fisheries operating in EEZs, albeit not all in the standard CCAMLR format.

Reported catches of *Dissostichus* spp. inside the Convention Area

4.22 Reported catches of *Dissostichus* spp. are shown in Annex 5, Table 3.1. Inside the Convention Area a total of 14 074 tonnes was reported during the 2004/05 season (Annex 5, Table 3.3) compared with 15 877 tonnes in the previous season (Annex 5, Table 3.3).

Reported catches of *Dissostichus* spp. outside the Convention Area

4.23 Catches outside the Convention Area were 8 511 tonnes during the 2004/05 season compared with 15 806 tonnes in the previous season. This information is detailed in Annex 5, Table 3.3. The Scientific Committee additionally noted that the catch of *Dissostichus* spp. outside the Convention Area, as reported in the CDS data, in 2004/05 was 4 465 and 3 873 tonnes for Areas 41 and 87 respectively, compared to 8 411 and 5 828 tonnes respectively for 2003/04.

Estimates of catch and effort from IUU fishing inside the Convention Area

4.24 The Scientific Committee reviewed estimates of IUU catches in the Convention Area prepared by the Secretariat and based on information submitted by 1 October 2005. The deterministic method presently used by the Secretariat to estimate IUU fishing effort was the same method as used in previous years. These results are set out in Annex 5, Tables 3.1 to 3.3 (paragraphs 7.4 to 7.8).

Research surveys

4.25 The Scientific Committee noted the following research surveys undertaken in 2004/05: a random stratified bottom trawl survey in Division 58.5.2 by Australia (Annex 5, paragraph 3.29), the results of which were toward updating assessments of toothfish and icefish in this division; a longline research survey in Subarea 88.3 carried out by New Zealand (Annex 5, paragraph 3.30); and a multidisciplinary research survey in Subarea 48.3 carried out by the UK (Annex 5, paragraphs 3.31 and 3.32).

Fish biology/ecology/demography

Tagging studies

4.26 The Scientific Committee noted that substantial progress has been made in fish tagging studies, and that information from these studies is becoming an increasingly important component of toothfish stock assessments in the Convention Area.

4.27 The Scientific Committee endorsed the continuation of toothfish tagging as a requirement for all new and exploratory toothfish fisheries (Conservation Measure 41-01, Annex C), and encouraged its use in all fisheries where appropriate.

4.28 Mr L. López Abellán (Spain) informed the Scientific Committee that due to lower survival, problems were encountered with the release of tagged large-size toothfish in the Division 58.4.3b exploratory fisheries (Annex 5, paragraph 3.41). The Scientific Committee requested that more information be made available as to the nature of the difficulties.

4.29 The Scientific Committee agreed that tagging studies may lead to the development of assessments for by-catch species such as skates and rays, given some of the difficulties and issues unique to tagging these species are resolved.

Biological parameters

4.30 The Scientific Committee noted new information on biological parameters (Annex 5, paragraphs 3.44 to 3.52), including a summary of biological parameters for *D. eleginoides* in Subarea 48.3; age and growth parameters for *Macrourus whitsoni* in Subarea 88.1; a summary of age and growth parameters for *C. gunnari*; a range of length-mass relationships for

D. mawsoni in Subarea 88.1; age validation of *D. eleginoides* in Division 58.5.2; age-at-maturity of *D. mawsoni* in Subarea 88.1; and estimates of growth and selectivity of *D. eleginoides* in Division 58.5.2. The Scientific Committee encouraged continued work on population parameters important for the assessment process.

General biology and ecology

4.31 The Scientific Committee noted that species profiles have not been updated since 2003. Species profiles will be updated for consideration at the 2006 meeting of WG-FSA (Annex 5, paragraph 9.4).

4.32 The Scientific Committee endorsed the recommendations of WG-FSA in matters relevant to the CCAMLR Otolith Network set out in Annex 5, paragraphs 9.5 to 9.9.

4.33 The Scientific Committee endorsed the proposed workshop on the ageing of *C. gunnari*, as described in Annex 5, paragraphs 9.10 and 9.11. Following the meeting of WG-FSA and after further discussion with the Vice-Director of AtlantNIRO (Dr Sushin) on the organisation of the workshop, the Convener of WG-FSA will write a letter to the Russian Fisheries Agency in order to seek approval to hold such a workshop at AtlantNIRO in Kaliningrad, Russia, between early April and the end of June 2006.

Developments in assessment methods

4.34 The Scientific Committee noted the substantial progress made on assessment methods by WG-FSA-SAM at its intersessional meeting held at the National Research Institute of Fisheries Science, Yokohama, Japan, from 27 June to 1 July 2005. Results of this subgroup meeting are summarised in Annex 5, paragraphs 4.1 to 4.11. The Scientific Committee noted that WG-FSA had tasked 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, paragraph 12.24. The Scientific Committee further noted the conclusion of WG-FSA-SAM that the participation of an invited outside assessment method expert (Dr Maunder) was valuable to the work of WG-FSA-SAM.

4.35 WG-FSA-SAM discussed at its intersessional meeting a number of elements contributing to assessment methods. These were noted by the Scientific Committee. The papers dealt with a wide range of issues, many of which are considered in the assessment sections of the Fishery Reports. Refinements to parameter estimates for use during the course of the assessments, including recommendations pertaining to natural mortality, recruitment, selectivity, age and growth, and movement. The Scientific Committee endorsed further evaluation of assessment methods using operating models in the intersessional period.

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

4.37 The Scientific Committee noted that members of the assessment subgroup of WG-FSA met during the week prior to WG-FSA, and that a number of papers with elements

contributing to assessment methods were tabled (summarised in Annex 5, paragraphs 4.18 to 4.35). Six papers provided preliminary stock assessments for active fisheries in the Convention Area. Some of these assessments involved existing ‘CCAMLR approved’ methods (i.e. short-term projection for icefish and recruitment-based long-term yield for toothfish), whilst others used alternative approaches (e.g. CASAL and ASPM).

4.38 The points concerning the assessment timetable this year were noted by the Scientific Committee. These are set out in Annex 5, paragraphs 4.36 to 4.39. The Scientific Committee endorsed the evaluation of assessment methods, which include:

- (i) the validation of the implementing software, scripts or worksheets
- (ii) examination of the methods to see that the assumptions are met
- (iii) sensitivity trials to examine the robustness of consequent advice with respect to CCAMLR objectives.

4.39 The Scientific Committee noted that all the assessments undertaken by WG-FSA this year were initially based on preliminary assessment working papers that were subsequently reviewed independently by WG-FSA.

4.40 The Scientific Committee endorsed the recommendation that integrated assessments continue to be developed for toothfish fisheries in Subareas 48.3, 58.6, 58.7, 88.1 and 88.2 and Division 58.5.2 where possible.

Assessment and management advice

Assessed fisheries

4.41 The Scientific Committee welcomed the continued development of Fishery Reports and Summary of Fishery Reports compiled by WG-FSA. 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: toothfish and icefish
- (ii) Division 58.5.1: toothfish
- (iii) Division 58.5.2: toothfish and icefish
- (iv) Subareas 58.6 and 58.7: toothfish (South African EEZ)
- (v) Subarea 58.6: toothfish (French EEZ)
- (vi) Subareas 88.1 and 88.2: toothfish.

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

D. eleginoides at South Georgia (Subarea 48.3)

4.42 The fishery report for *D. eleginoides* in Subarea 48.3 is contained in Annex 5, Appendix G.

4.43 In 2004, Subarea 48.3 was subdivided into areas, one containing the South Georgia–Shag Rocks (SGSR) stock and other areas, to the north and west, that do not include the SGSR stock. Within the SGSR area, three management areas (A, B and C) were defined (Conservation Measure 41-02/A). Catch limits for the areas to the north and west were set at zero for 2004/05.

4.44 The catch limits in the 2004/05 season for Areas A, B and C were 0 (excepting 10 tonnes for research fishing), 915 and 2 135 tonnes, with an overall catch for SGSR of 3 050 tonnes. The total declared catch was 3 018 tonnes. An additional 23 tonnes were taken by a single IUU vessel reported by the UK prior to the fishery. The total removals were therefore 3 041 tonnes. Catches in Areas A, B and C were 9, 910 and 2 122 tonnes respectively. The proportion of catches in Areas A and B declined from 35% in 2003/04 to 30% in 2004/05.

4.45 The updated standardised GLMM CPUE dropped slightly between 2003/04 and 2004/05. Separate GLMM analyses of CPUE data for Shag Rocks and South Georgia confirmed a relatively constant CPUE at South Georgia in recent years compared with some variability at Shag Rocks.

4.46 During 2004/05, a further 3 944 tagged *Dissostichus* were released in SGSR, bringing the total number of tagged fish released to around 8 000 fish. Ninety-three recaptures of tagged fish were reported in 2005. Estimates of vulnerable biomass for 2005 using the modified Petersen estimator were between 53 000 and 54 000 tonnes, with 95% confidence intervals of approximately 44 000–63 000 tonnes, depending on the selectivity curve used in the analysis.

4.47 The Scientific Committee considered two separate assessments which used different modelling strategies provided in the Fishery Report. The first was an integrated assessment, implemented in CASAL, that used data on catches, standardised catch rates, catches-at-length, recruitment indices-at-age and tag–recapture data. The base case involved two fleets with separate estimated selectivity curves and separate catchability estimates for each time series of catch rates. The second assessment used an augmented ASPM, implemented in an Excel spreadsheet, which used data on catches, standardised catch rates and catches-at-length. The ASPM base case involved a single fleet with two periods of different selectivity (estimated outside the model) and a single catchability estimate across the catch rate time series plus estimation of the steepness of the recruitment relationship.

4.48 The Scientific Committee noted that although the underlying basic age-structured population dynamics models assumed in CASAL and ASPM were similar, there were considerable differences in assumptions and implementation of the two methods. The primary differences are set out in the table following paragraph 5.71 in Annex 5. The Scientific Committee agreed that differences in assessment results between the two methods could reasonably be attributed to differences in assumptions and input data, rather than fundamental differences in the assessment methods.

4.49 The Scientific Committee examined separate assessment runs that were identified by WG-FSA, set out in Annex 5, paragraphs 5.72 and 5.73, for CASAL and ASPM respectively. A full description of the models, their assumptions, their diagnostics, their fits to the data, and their results is given in Annex 5, Appendix G.

4.50 Prof. Beddington commented that information that would better allow the Scientific Committee to more critically assess the model performance was not carried forward to the assessment summary in the main body of the report. Dr Constable noted that the main body of the report directs the Scientific Committee to the detailed model description and discussions set out in Annex 5, Appendix G.

4.51 Dr Hanchet commented that although both assessment approaches were endorsed for use by WG-FSA-SAM, there was no critical discussion of the ASPM during the course of the assessment subgroup pre-meeting. Further, that on the final day of deliberations by WG-FSA, the Executive Secretary of CCAMLR reminded the Working Group that the report risked not being translated in time for the meeting of the Scientific Committee unless completed immediately, which may have curtailed additional discussions and resolution by WG-FSA.

4.52 The Scientific Committee recognised that considerable progress had been made in addressing these issues surrounding the assessment of toothfish in Subarea 48.3.

4.53 The Scientific Committee acknowledged that the divergence of opinions on modelling approaches from WG-FSA resulted in no single estimate of precautionary long-term yield under existing CCAMLR decision rules. The contrasting opinions are summarised in Annex 5, paragraphs 5.79 and 5.80.

4.54 The Scientific Committee agreed that the discussions and results provided in the fishery report were potentially useful for generating advice. The five projections of yield are set out in Annex 5, paragraph 5.76. In respect of the CASAL results, the MCMC projections of yield are as follows:

- | | | |
|-------|------------------|---------------|
| (i) | base case | 5 629 tonnes |
| (ii) | low L_{∞} | 3 407 tonnes |
| (iii) | low M | 5 876 tonnes |
| (iv) | one fleet | 5 428 tonnes. |

In respect of the ASPM run, the GY projections of yield are as follows:

- | | | |
|-----|-----------|-------------|
| (v) | base case | 696 tonnes. |
|-----|-----------|-------------|

4.55 The Scientific Committee agreed that these assessments represented a considerable amount of work, though there is substantially more that must be done to advance assessments in order to generate advice for a specific catch limit for *D. eleginoides* in Subarea 48.3. In addition, the Scientific Committee agreed that this assessment, as well as all other assessments of CCAMLR finfish stocks, represents work in progress.

4.56 The Scientific Committee agreed that some uncertainties remain with each approach, and that there were differences in the opinion of which model demonstrated a better fit to the available data, given the complexity of the models and assumptions. However, there was consensus that the ASPM was likely providing an underestimation of the current spawning stock biomass and a consequent underestimation of long-term yield.

4.57 The Scientific Committee further agreed that there were ample reasons that the tagging data should be included in the assessment process, and that use of these data would be more desirable than excluding them for the purposes of generating advice, together with all relevant information currently used.

4.58 Dr Shust pointed out the fits of the CASAL and ASPM models to the CPUE time series in recent years (Annex 5, paragraph 5.79). The CPUE since 1996 has been relatively stable but at a lower level than previous years. This demonstrates that the catch limit for *D. eleginoides* in Subarea 48.3 in the next season should follow a precautionary approach.

Management advice for *D. eleginoides*
(Subarea 48.3)

4.59 The Scientific Committee agreed that the management advice should be based on the assessment approach that used the growth model indicating low L_{∞} (Annex 5, Appendix G, Figure 10). Using this would be more desirable in this particular assessment, as it makes use of all the available data. However, the Scientific Committee agreed that it would have been desirable to examine a case with a low M coupled with the low L_{∞} .

4.60 The Scientific Committee agreed that the most appropriate approach for generating advice should be the method that uses tagging data (CASAL) employing the low L_{∞} projection adjusted by the ratio of the low M and base case projections. This would result in a long-term yield of approximately $[3407 * 5876/5629 =]$ 3 556 tonnes.

4.61 The Scientific Committee recommended that the catch limit for the 2005/06 season should be 3 556 tonnes.

4.62 The remaining provisions of Conservation Measure 41-02 should be carried forward for the 2005/06 season.

Future work for *D. eleginoides* (Subarea 48.3)

4.63 The Scientific Committee endorsed the future work to be conducted towards furthering assessments of toothfish in Subarea 48.3. This work is outlined in Annex 5, paragraph 12.3. The Scientific Committee agreed that further work should be undertaken during the intersessional period examining alternate scenarios for the integrated models used to generate management advice in this subarea.

D. eleginoides at Kerguelen Islands (Division 58.5.1)

4.64 The Fishery Report for *D. eleginoides* in Division 58.5.1 is contained in Annex 5, Appendix H. The catch reported for this division as of 1 September 2005 was 3 186 tonnes. Only longlining occurs in the fishery. The estimated IUU catch for the 2004/05 season was zero inside the French EEZ. Some IUU fishing may occur outside the EEZ as reported in SCIC-05/10 Rev. 2.

4.65 The Scientific Committee noted that GLM analyses show a general decreasing trend in the standardised CPUE with two steps (i.e. 1999–2000 and 2002–2005). Mean weight declined from 1999 to 2003, but has been stable since then. No stock assessment has been carried out.

4.66 By-catch removals are important for this toothfish fishery (longline) 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*
(Division 58.5.1)

4.67 The Scientific Committee encouraged WG-FSA to further work towards the estimation of biological parameters for toothfish at the Kerguelen Islands. The Scientific Committee also noted that a preliminary stock assessment could be carried out if CPUE, catch-weighted length frequencies and biological parameters were available. The Scientific Committee agreed that tag-recapture experiments and a recruitment survey planned for 2006 would be very beneficial for an assessment of toothfish stocks on the Kerguelen Plateau.

4.68 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.

D. eleginoides at Heard and McDonald Islands
(Division 58.5.2)

4.69 The catch limit of *D. eleginoides* in Division 58.5.2 west of 79°20'E for the 2004/05 season was 2 787 tonnes (Conservation Measure 41-08) for the period from 1 December 2004 to 30 November 2005. The catch reported for this division as of 1 October 2005 was 2 783 tonnes. Of this, 2 170 tonnes (78%) was taken by trawl and the remainder by longline. The estimated IUU catch for the 2004/05 season, 0–265 tonnes, was the lowest since IUU fishing began in 1995/96.

4.70 The Scientific Committee noted the reduction in the overall catch taken by bottom trawls from this fishery.

4.71 The Scientific Committee also noted that the use of longlines and pots in this fishery will result in the taking of larger fish because of their selectivity and because they will be operating in deeper water than the trawl fishery. Consequently, the overall vulnerability of the stock in future years is likely to include a greater proportion of larger fish than is currently the case in the trawl fishery. A vulnerability pattern that combines trawl, longline and pots was calculated for use in the assessments.

4.72 The GYM, using the updated time series of recruitment estimates and the updated length-at-age vector, was used to estimate the long-term annual yield that would satisfy the CCAMLR decision rules (Annex 5, paragraphs 5.91 to 5.96).

4.73 Three main model runs were carried out based on the parameters considered for the assessment and including the 2005 survey of juvenile fish and the revised length-at-age vector from the two-segmented linear model:

- | | | |
|-------|--|--------------|
| (i) | $M = 0.13\text{--}0.20 \text{ year}^{-1}$, trawl vulnerability in future projections | 2 303 tonnes |
| (ii) | $M = 0.13\text{--}0.20 \text{ year}^{-1}$, combined gear (trawl, longline, pot) vulnerability in future projections | 2 439 tonnes |
| (iii) | $M = 0.13\text{--}0.165 \text{ year}^{-1}$, trawl vulnerability in future projections. | 2 440 tonnes |

Each of these was undertaken with IUU catch in the 2004/05 season at 265 tonnes.

4.74 The Scientific Committee discussed these alternative model runs and agreed that the overall selectivity of the fishery had changed with the increase in mainly longline and pot fishing rather than trawl fishing. Therefore it supported the second model option above. However, they considered the natural mortality values used in this run were too high based on the validated age data and corrected the GYM yield based on the ratio between the first and third model runs. The new estimate was $(2\,439 * 2\,440 / 2\,303)$ or 2 584 tonnes.

4.75 At WG-FSA, Dr P. Gasyukov (Russia) had suggested that short-term projections be used to estimate yields. However, for a long-lived species such as *D. eleginoides* this was not appropriate and it was noted that a short-term assessment will require different decision rules and appropriate assessment methods. The consequences of changes in the decision rules as well as evaluating methods for assessing yield in *D. eleginoides* would need to be evaluated in order to be confident that the advice derived from those assessments is robust to uncertainties (Annex 5, paragraphs 5.98 and 5.99).

4.76 The Scientific Committee endorsed the following Working Group recommendations on future work:

- (i) further development of an integrated assessment of *D. eleginoides* in CASAL, including an evaluation of the assessment methods and overall management strategy for this division (Annex 5, Appendix I, paragraph 41);
- (ii) the means by which recruitment cohort strength is estimated from toothfish survey data should be reviewed in the intersessional period, including investigating the possible effects of using the new two-segment growth model (Annex 5, Appendix I, paragraph 42);
- (iii) given the lack of defined modes in the length-density data, it would be useful to use age-length keys, if possible, as an alternative method for estimating densities of cohorts (Annex 5, Appendix I, paragraph 42);
- (iv) studies on optimal sampling schemes for establishing age-length keys should be encouraged (Annex 5, Appendix I, paragraph 42).

Management advice for *D. eleginoides* at
Heard and McDonald Islands (Division 58.5.2)

4.77 The Scientific Committee recommended that the catch limit for Division 58.5.2 in the 2005/06 season be revised to 2 584 tonnes, representing the long-term annual yield estimate from the GYM as described in paragraph 4.74. The Scientific Committee agreed that this should apply to the trawl, longline and pot fishing gears. This catch limit is recommended to pertain only to the assessment area which is to the west of 79°20'E.

4.78 The remaining provisions of Conservation Measure 41-08 should be carried forward for the 2005/06 season.

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

4.79 The catch limit of *D. eleginoides* in the South African EEZ for the 2004/05 season was 450 tonnes for the period from 1 December 2004 to 30 November 2005. The catch reported for Subareas 58.6 and 58.7 as of 5 October 2005 was 141 tonnes. Of this, 103.5 tonnes (73.4%) was taken by pots and the remainder by longlines. The IUU catch for the 2004/05 season was estimated to be 156 tonnes.

4.80 The total estimated removals in 2004/05 was 297 tonnes, although cetacean predation 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 was reported not to be subject to cetacean predation.

4.81 There was no catch-weighted length frequency information available for the 2004/05 season, although it was suggested that the pot fishery was selecting for larger fish than the longline fishery. The CPUE series was updated for the meeting.

4.82 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 sensitive to the relative weightings given to CPUE and catch-at-length data, because these two sources of data suggest different degrees of resource depletion. In addition, the model was sensitive to changes in the assumed natural mortality value and to whether or not cetacean predation was included in the calculations.

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

4.83 The Scientific Committee noted that the advice on the appropriate levels of future catch provided in WG-FSA-05/58 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. As the pot fishery is reported not to be subject to cetacean predation, South Africa should consider this in formulating management measures for this fishery.

4.84 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

4.85 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

4.86 The catch reported for this division as of 1 September 2005 was 385 tonnes. Only longlining occurs in this fishery. The estimated IUU catch for the 2004/05 season was zero inside the French EEZ. Some IUU fishing may occur outside the EEZ as reported in SCIC-05/10 Rev. 2.

4.87 Depredation on toothfish catches by killer whales (*Orcinus orca*) is becoming a major problem for this longline fishery and total mortality is believed to double the reported catch level. National observers in the fishery have been instructed to record the loss of fish from the lines. These data will be reported to CCAMLR in 2006.

4.88 GLM analyses show a general decreasing trend in the standardised CPUE to 2002/03 with no further decrease indicated between then and the present. Mean weight declined from 1999 to 2003, but has been stable since then. No stock assessment has been carried out.

4.89 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 stabilised since then. In the absence of a stock assessment, the Working Group had not been able to recommend appropriate levels of catch for this fishery to the Scientific Committee.

4.90 The Scientific Committee complimented France on the proposal to institute tag-recapture experiments in the 2005/06 season as a first step to assessing the stock. This represents a major step forward in the determination of stock status.

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

4.91 The Scientific Committee was not able to provide any advice on catch limits for this fishery, but noted the proposal to institute tag–recapture experiments in the area.

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

4.92 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)

4.93 In the 2004/05 fishing season the catch limit set for icefish in Subarea 48.3 was 3 574 tonnes. The fishery caught 200 tonnes in December 2004 and early January 2005. The fishery will close on 14 November 2005.

4.94 There was no new bottom trawl survey for this species in Subarea 48.3 in 2005. The Scientific Committee noted that the Working Group therefore had used the results of the January 2004 biomass survey as the basis of its assessment (Annex 5, Appendix L). Additional insight into the situation of the stock was gained through consideration of the results of an acoustic research survey that covered part of Subarea 48.3 in 2005; information from the fishery in 2004/05; and a recalculation of the mixture analysis of 2004 survey data undertaken by Dr Gasyukov (WG-FSA-05/78).

4.95 Neither the acoustic research survey nor the fishery found large concentrations of fish, and possible reasons for this were discussed by the Scientific Committee.

4.96 Two alternative assessments were completed by WG-FSA (Annex 5, Appendix L) based on the following hypotheses:

- (i) Through some change in behaviour or distribution, possibly related to spawning, concentrations of icefish were not available to the fishery or the acoustic research survey, but icefish were dispersed over Subarea 48.3. Periodic dispersion and re-appearance of icefish has been noted before, for instance in 1998/99–1999/2000, and spawning behaviour and factors affecting distribution are not well understood for this species. The 2005/06 yield appropriate to this hypothesis was 4 760 tonnes.
- (ii) The difference in commercial length frequencies between 2003/04 and 2004/05 might indicate that most age 4+ fish were no longer present in the population at South Georgia, whether due to a mortality or other event. This event did not apply to age-3 fish (which were age 2 in the January 2004 survey). The 2005/06 yield appropriate to this hypothesis was 2 244 tonnes.

4.97 The Scientific Committee noted that there are additional hypotheses consistent with the observation from the fishery and research survey in 2004/05. One hypothesis is that there has been a decline in the population across all age classes, whether due to an increase in mortality or other events.

4.98 Based on the results of the two hypotheses (Annex 5, paragraph 5.123) the catch limit for icefish in Subarea 48.3 in the 2005/06 fishing season could be 2 244 or 4 760 tonnes.

4.99 The Scientific Committee agreed that, given the inability of the commercial fishery and acoustic research survey to find concentrations of icefish in 2004/05, the yield suggested by hypothesis 1 (4 760 tonnes) would be inappropriate.

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

4.100 The Scientific Committee recommended that the catch limit for *C. gunnari* should be revised to 2 244 tonnes for the period from 15 November 2005 to 14 November 2006. Any catch taken between 1 October 2005 and the end of the 2004/05 fishing season (14 November 2005) should be counted against the catch limit for the 2005/06 fishing season.

4.101 All other components of Conservation Measure 42-01 should remain in force.

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

4.102 The catch limit of *C. gunnari* in Division 58.5.2 for the 2004/05 season was 1 864 tonnes (Conservation Measure 42-02) for the period from 1 December 2004 to 30 November 2005. The catch reported for this division as of 1 October 2005 was 1 791 tonnes.

4.103 Catch-weighted length frequencies in the 2004/05 season were dominated by a single year class of 3+ fish. This cohort was observed to dominate the population in the survey undertaken in June 2005.

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

4.105 The Scientific Committee considered the following advice from WG-FSA:

- (i) The projection of age 3+ fish from 2004/05 gives a projected yield of 647 tonnes in the 2005/06 season in the scenario of spreading the catch over two years. If all catch is taken in the first year and zero catch on this cohort in the second year, then the yield could be 1 210 tonnes in the coming season. The Working Group agreed that either of these approaches would satisfy the objectives of the Commission (Annex 5, Appendix M, paragraph 24).

- (ii) In considering these different options, the Working Group had noted (Annex 5, Appendix M, paragraph 25):
 - (a) the cohort has been reproductive for one year and will have 75% escapement over the next two years, having the opportunity to reproduce again;
 - (b) although it seems unlikely because of the absence of any indication of a strong 1+ year class in the 2005 survey, should a survey in 2006 show a 2+ cohort entering the fishable population, then it may be difficult to have a fishery in the 2006/07 season that results in a negligible catch of the current cohort, which would be 4+ during that survey.
- (iii) Other measures in the conservation measure be retained.

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

4.106 The Scientific Committee recommended that the catch limit in 2005/06 be 1 210 tonnes.

4.107 In making this recommendation, the Scientific Committee noted that:

- (i) this catch would primarily be on age-4 fish, which would have been reproductively mature for at least one year;
- (ii) the catch of this cohort in the following year (2006/07) should be zero in order to satisfy the decision rule that the biomass of the stock should be greater than, or equal to, 75% of that which would have been present after two years in the absence of fishing;
- (iii) this strategy would provide for three years of reproduction by this cohort, although the strategy of having the catch concentrated in one year may slightly reduce the capacity for reproduction in the cohort's fifth year;
- (iv) although it seems unlikely because of the absence of any indication of a strong 1+ year class in the 2005 survey, should a survey in 2006 show a 2+ cohort entering the fishable population, then it may be difficult to have a fishery in the 2006/07 season that results in a negligible catch of the current dominant cohort, which would be 4+ during that survey.

4.108 The Scientific Committee also requested that WG-FSA investigate the ages at which *C. gunnari* is likely to be most successful in reproduction. In doing so, WG-FSA is asked to consider how best to frame decision rules that satisfy the objectives of CCAMLR in terms of reproduction of the stock and the maintenance of predators, especially given the unusual demographic characteristics of this species. It requested that the development and evaluation of a management procedure for *C. gunnari* be considered a high priority.

4.109 The remaining provisions of Conservation Measure 42-02/B should be carried forward to the 2005/06 season.

Other finfish fisheries

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

4.110 CCAMLR closed commercial finfishing in the Antarctic Peninsula (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.

4.111 The last surveys of the two areas occurred in 2003 (Subarea 48.1) and 1999 (Subarea 48.2). They showed no improvement in the condition of the stocks which would give rise to considerations of reopening the two areas for commercial finfishing. No new information has become available since then as no surveys were conducted in the 2004/05 season.

Management advice (Subareas 48.1 and 48.2)

4.112 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 should remain in force.

D. eleginoides at South Sandwich Islands (Subarea 48.4)

4.113 Prior to the current season, commercial fishing has not occurred at the South Sandwich Islands since exploratory longline fishing in 1993 by Bulgarian and Chilean vessels (Ashford et al., 1994). Following results from the 1993 cruise, CCAMLR set a catch limit of 28 tonnes of *Dissostichus* spp. for this subarea (Conservation Measure 41-03).

4.114 During the 2004/05 season, one UK-flagged vessel fished around the South Sandwich Islands and caught 27 tonnes of *D. eleginoides* (CCAMLR-XXIV/BG/13). During this time, fish were tagged in order to start a mark–recapture program to assess the toothfish population. Preliminary results from the survey indicated catch rates were similar to those experienced in Subarea 48.3 (Annex 5, paragraph 5.141).

4.115 The UK proposed to undertake a more extensive mark–recapture experiment in Subarea 48.4 during the period 2005/06 to 2007/08 in accordance with Conservation Measure 24-01 (WG-FSA-05/57). The objective of the experiment will be to assess toothfish population structure, size, movement and growth.

4.116 The Scientific Committee welcomed this proposal and noted that the proposed mark–recapture program will be a valuable tool for contributing to an assessment in the future. The proposed catch is for a fixed term and is only slightly greater than the total catch that might have been taken under the existing conservation measure had it been activated each year. The current catch limit is not based on an assessment. It was noted that some consideration will

need to be given by the Commission to ensure that the experiment is not affected by other fishing activities and that the total catch in Subarea 48.4 does not exceed 100 tonnes at least in the 2005/06 fishing season.

4.117 The Scientific Committee recommended that an appropriate mechanism for this would be to restrict the fishery to participation only by vessels undertaking the tagging experiment.

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

4.118 The Scientific Committee recommended that the mark-recapture program for *Dissostichus* spp. be established for the next three to five years in Subarea 48.4 with a 100 tonne catch limit per season, noting the comments in Annex 5, paragraph 5.143 and the need to ensure that the experiment is not affected by other fishing activities.

Electrona carlsbergi (Subarea 48.3)

4.119 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)

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

C. gunnari at Kerguelen Islands (Division 58.5.1)

4.121 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)

4.122 The Scientific Committee recommended that the fishery for *C. gunnari* within the French EEZ of Division 58.5.1 should remain closed in the 2005/06 season until information on stock status is obtained from a survey.

New and exploratory fisheries

New and exploratory fisheries in 2004/05

4.123 Last year the Commission agreed to seven exploratory longline fisheries for *Dissostichus* spp. in the 2004/05 season (Conservation Measures 41-04, 41-05, 41-06, 41-07, 41-09, 41-10 and 41-11). Activities in these fisheries are summarised in Annex 5, Table 5.1.

Catches of *Dissostichus* spp. in excess of 100 tonnes were reported in the exploratory fisheries in Divisions 58.4.1 (480 tonnes), 58.4.2 (127 tonnes), 58.4.3a (110 tonnes) and 58.4.3b (295 tonnes), and Subareas 88.1 (3 079 tonnes) and 88.2 (412 tonnes).

4.124 The exploratory fishery in Subarea 48.6 was undertaken by two Members with a total catch of 49 tonnes of *Dissostichus* spp. taken against a total catch limit of 900 tonnes (455 tonnes north of 60°S and 455 tonnes south of 60°S).

4.125 The exploratory fishery in Division 58.4.1 was undertaken by four Members with a total catch of 480 tonnes of *Dissostichus* spp. against a catch limit of 600 tonnes.

4.126 The exploratory fishery in Division 58.4.2 was undertaken by four Members with a total catch of 127 tonnes of *Dissostichus* spp. against a catch limit of 780 tonnes.

4.127 The exploratory fishery in Division 58.4.3a was undertaken for the first time. Three Members fished with a total catch of 110 tonnes of *Dissostichus* spp. against a catch limit of 250 tonnes.

4.128 The exploratory fishery in Division 58.4.3b was undertaken by three Members with a total catch of 295 tonnes of *Dissostichus* spp. against a catch limit of 300 tonnes. The fishery was closed on 14 February 2005. The closure was triggered by the catch of *Dissostichus* spp. (total catch was 98% of the catch limit).

4.129 The exploratory fishery in Subarea 88.1 was undertaken by six Members with a total catch of 3 079 tonnes of *Dissostichus* spp. taken against a catch limit of 3 250 tonnes. The fishery was closed on 27 March 2005 (see CCAMLR-XXIV/BG/13, Table 2). During the course of fishing, a number of SSRUs were closed, as detailed in Annex 5, paragraph 5.7.

4.130 The catch limit for *Dissostichus* spp. in SSRU C in Subarea 88.1 was exceeded by 92% (206 tonnes). This over-run illustrates the difficulty in forecasting closures when a number of vessels fish in an area where catch rates are high relative to the catch limits. The fishing events which resulted in the over-run in SSRU C are summarised in CCAMLR-XXIV/BG/13 and Annex 5, paragraph 5.9.

4.131 Catch limits were over-run on four other occasions in SSRUs in Subarea 88.1 (two catch limits for *Dissostichus* spp. and two catch limits for *Macrourus* spp.). Key factors in these over-runs included rapid changes in fishing effort and/or catches, and the late submission of catch and effort reports.

4.132 Despite these over-runs, the Scientific Committee noted that the total catch of *Dissostichus* spp. in Subarea 88.1 was only 95% of the overall catch limit. Given the five-day reporting period and the relatively small size of SSRU catch limits, the Scientific Committee agreed that both under-runs and over-runs of SSRU catch limits are inevitable. Provided these more or less balance over the season within subareas or divisions, these do not pose a conservation threat to the stock.

4.133 The exploratory fishery in Subarea 88.2 was undertaken by three Members with a total catch of 412 tonnes of *Dissostichus* spp. (110% of the catch limit of 375 tonnes). The fishery was closed on 5 February 2005.

4.134 Under Conservation Measure 41-01 all vessels operating in exploratory fisheries are required to carry out a research plan which includes completing a minimum number of research sets on entering an SSRU. Some vessels exceeded their required quota of research sets. However, there were a number of instances where vessels failed to complete any research sets. There were also cases where a vessel conducted some research sets but failed to complete the required quota even though more commercial sets were completed.

4.135 The aim of requiring research sets with substantial biological sampling in new and exploratory fisheries is to obtain an understanding of the distribution and abundance of target and by-catch species on as wide a geographical scale as possible at an early stage of the fisheries' development. For most exploratory fisheries, this requirement is still relevant and should remain. The Scientific Committee agreed, however, that for Subareas 88.1 and 88.2 the required geographical spread of fishing has now been achieved.

4.136 Accordingly, the Scientific Committee recommended that the requirement to carry out specific research sets as defined in Annex 41-01/B of Conservation Measure 41-01 within Subareas 88.1 and 88.2 be removed. In its place, it recommended that there be a requirement that all fish of each *Dissostichus* spp. in a haul (up to a maximum of 35 fish) be measured and randomly sampled for biological studies (cf. paragraphs 2(iv) to (vi) of Annex 41-01/A) from all lines hauled within Subareas 88.1 and 88.2.

4.137 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 for implementation next year.

4.138 An additional requirement of Conservation Measure 41-01 is that 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 catch throughout the season. All vessels fishing reported tagging *Dissostichus* spp. in exploratory fisheries with a total of 4 858 *Dissostichus* spp. tagged in 2004/05 (Annex 5, Appendix T, Tables 1 and 2). However, some vessels did not fully meet the requirements of the conservation measure.

4.139 The Scientific Committee noted with concern that the research set and tagging requirements of Conservation Measure 41-01 were not being met by all vessels. The Scientific Committee reiterated the importance of both these requirements and drew this matter to the attention of the Commission.

4.140 Prof. Moreno observed that there is a need for Conservation Measure 41-01 to be as explicit as possible in its requirements, to avoid possible misinterpretation by vessels. As an example, he cited a Chilean vessel that had more than met the required tagging rate over the season, but had not met this in every area fished. He also noted that there can be entirely innocent reasons why the research set requirement is not met; for example the same Chilean vessel was in the process of completing the required number of research sets when the area in which it was fishing was closed.

4.141 To facilitate analyses of tagging data, the Scientific Committee recommended that vessels be asked to record a unique identifier on the C2 data forms for every set made and that observers ensure that this identifier is also recorded on their data forms.

Notifications for new and exploratory fisheries in the 2005/06 season

4.142 A summary of new and exploratory fisheries notifications for 2005/06 is given in Table 1 of SC-CAMLR-XXIV/BG/5. No notifications have been received from Members for exploratory fisheries in closed areas. No notifications have been made for new fisheries.

4.143 Twelve Members submitted paid notifications for exploratory fisheries for *Dissostichus* spp. in Subareas 48.6, 88.1, 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b.

4.144 The Scientific Committee did not attempt to determine whether all the notifications for new and exploratory fisheries satisfied the requirements of Conservation Measure 21-02 paragraphs 4, 5 and 7.

4.145 Notifications for exploratory fisheries for *Dissostichus* spp. in 2005/06 are summarised, grouped by subarea or division, along with the numbers of vessels, in Table 2 of SC-CAMLR-XXIV/BG/5. Two Members submitted notifications after the deadline of 24 July 2005, however all payments were received by the deadline of 24 August 2005. As was the case last year, there were multiple notifications of exploratory fisheries for *Dissostichus* spp. for several subareas or divisions.

4.146 There has been a large number of notifications for fishing in Subareas 88.1 (9 notifications and 21 vessels), 88.2 (8 notifications and 17 vessels) and Subarea 48.6 and Divisions 58.4.1, 58.4.2 and 58.4.3b (4–6 Members and 6–11 vessels). Depending on the size of the precautionary catch limits, this implies that if all vessels operated simultaneously, the available catch per vessel could be lower than that required for economic viability, especially for those vessels operating in high latitudes where fishing imposes considerable operational difficulties.

4.147 It is likely that, once again, there will be additional administrative problems in determining closure dates for fishing in SSRUs when many vessels are fishing simultaneously in a subarea or division (CCAMLR-XXIV/BG/13).

4.148 In several notifications, individual vessels have been notified for more than one subarea or division. The Scientific Committee noted that this may increase operational flexibility and provide access in the case of areas being closed or constricted by factors such as heavy sea-ice. In such circumstances, it recommended that the notification should include an indicative fishing plan including projected timings for fishing in different areas.

4.149 Dr Constable advised that the Australian notifications (CCAMLR-XXIV/17 to 20), represented precisely such a case. The intent of the single vessel notified is mainly to fish in Division 58.4.3b. Other areas will be fished according to prevailing conditions and whether or not a catch is available when the vessel wishes to enter an area.

Progress towards assessments of new and exploratory fisheries

4.150 Substantial progress has again been made this year in assessing stocks of *Dissostichus* spp. in Subareas 88.1 and 88.2, with an assessment of yield having been completed for the first time for the Ross Sea and SSRU 882E.

4.151 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. In this context, it noted that with the continuing tagging programs in all areas, in the next year or two it may be possible to obtain mark–recapture estimates of abundance provided that sufficient tags are deployed each year.

Exploratory fishery for *Dissostichus* spp. in Subareas 88.1 and 88.2

4.152 The Fishery Report for *Dissostichus* spp. in Subareas 88.1 and 88.2 is contained in Annex 5, Appendix F and discussed in Annex 5, paragraphs 5.41 to 5.64.

4.153 The CASAL model, using catch-at-age, CPUE and tag–recapture data and *D. mawsoni* biological parameters, was used to undertake an assessment and to calculate long-term annual yields that would satisfy the CCAMLR decision rules.

4.154 This assessment split Subareas 88.1 and 88.2 into two regions (i) the Ross Sea (Subarea 88.1 and SSRUs 882A and B), and (ii) SSRU 882E.

4.155 The long-term yield for the Ross Sea that satisfies the CCAMLR decision rules was estimated to be 2 964 tonnes. For SSRU 882E, the long-term yield that satisfies the CCAMLR decision rules was estimated to be 273 tonnes.

4.156 Prof. Beddington noted that, given the reported catches in Subareas 88.1 and 88.2 during the 2004/05 season (3 079 tonnes and 412 tonnes respectively), it was likely that the total of the catches taken in the combined areas assessed using CASAL exceeded the estimated long-term yields.

4.157 The Scientific Committee noted that SSRU 882E could be separated from the remaining SSRUs in Subarea 88.2 because it has an assessment of its own. No catches have been taken so far in SSRUs 882C, D, F and G and so, in the absence of information about these SSRUs, the Scientific Committee is unable to provide advice as to appropriate catch limits in these SSRUs.

4.158 For Subarea 88.1 and SSRUs 882A and B, the Scientific Committee agreed that advice would be needed for catch limit allocation amongst the SSRUs for the coming season.

4.159 In developing its advice, the Scientific Committee recalled:

- (i) the SSRUs and associated catch limits used in Subarea 88.1 in the 2002/03 season provided larger catches per SSRU than the current system (Table 5);
- (ii) the SSRUs now used (Table 5) were designed to be more consistent with the bathymetric features of the subarea, including the south–north variation from shelf areas to slope areas to northern seamount areas as well as the west–east variation between open and coastal waters;
- (iii) the difficulties in administering catch limits in small SSRUs, noting the catch over-runs in some areas as well as the by-catch limits being reached in some SSRUs (Table 5);

- (iv) a desire to spread effort across the subarea during the early phase of the fishery to understand the distribution of toothfish in this area but that ice variability caused the fishing effort to be concentrated in different areas in different years;
- (v) variability in catch rates between SSRUs (Table 5);
- (vi) differences in the amount of fishable area between SSRUs (Table 5).

4.160 The Scientific Committee noted the advice of WG-FSA on proportional allocation between SSRUs based on the combination of historical CPUE in each area and the fishable area (Annex 5, Appendix F, Table 22; Tables 5 and 6).

4.161 In further considering the issue of allocation, the Scientific Committee agreed that the allocation should be based on the proportion of the estimate of yield that can be taken in a given SSRU, such that a change in the overall catch limit for the Ross Sea can be easily translated into a catch limit in each SSRU. The proportional allocations are developed in Table 6, which shows the proportional allocation applied in the 2004/05 season and the model provided by WG-FSA this year. It also gives the proportions that would arise if the Commission chose to use the WG-FSA model of allocation but only have catches in SSRUs for which the catch limit would exceed 100 tonnes (Annex 5, Appendix F, Table 22; Table 6).

4.162 The Scientific Committee endorsed the recommendations of WG-FSA that:

- (i) the Ross Sea assessment comprises Subarea 88.1 (primarily SSRUs B, C, G, H, I, J, K, L) plus SSRU 882A and B;
- (ii) the assessment represents considerable progress in developing assessments in this fishery and was achieved because of the concentration of fishing in the slope areas over the course of the fishery, despite the interannual variability in ice conditions;
- (iii) the area of the fishery remains very large by comparison to assessed fisheries in Subarea 48.3 and Division 58.5.2;
- (iv) uncertainty in stock structure in the Ross Sea remains because most recorded movement is within SSRUs rather than between them, although the data obtained from the fishery suggests that young fish recruit to the southern part of the Ross Sea, move to the slope areas as they get older and then onto the northern areas, including the seamounts, to reproduce;
- (v) more tag recoveries from tag–release areas are needed in order to improve assessments, noting that if the fishery is dispersed, then the uncertainties may remain unresolved for 10 to 15 years.

4.163 The Scientific Committee agreed that there is a need to concentrate fishing in areas of greatest activity in the short term in order to address these issues. These areas are primarily in the slope region of the Ross Sea, its location being characterised by the 1 000 m contour, comprising predominantly SSRUs 881H, I and K. It also agreed that an experiment for three years is needed to help resolve these issues, after which time it will be better understood how to gain the information necessary to establish catch limits in other areas of the Ross Sea.

4.164 The Scientific Committee agreed that this experiment should be concentrated in a north–south series of SSRUs – 881B, C, G, H, I, J, K, L – and that the estimate of yield from the assessment be distributed among these according to the recommendation of the WG-FSA. The remainder of the SSRUs in the Ross Sea (881A, D, E, F and 882A and B) would be closed for the duration of the experiment in order to ensure that fishing effort was retained in the area of the experiment. The proportions of catch in each SSRU for this experiment and the respective catch limits are shown in Table 6.

4.165 The Scientific Committee considered the implications of this allocation for managing catch limits and by-catch and noted that the arrangements could be improved while maintaining the experiment and the conservation of by-catch species by amalgamating SSRUs 881B, C, G into a northern SSRU and SSRUs 881H, I and K into a ‘slope’ SSRU. This proposal forms the foundation of advice to the Commission (Table 7).

4.166 The Scientific Committee noted that some slope areas may be in SSRU 881J and requested that WG-FSA review the boundaries to this SSRU so that these slope areas are appropriately included in the adjacent slope areas.

Management advice

General

4.167 Catch limits were over-run on five occasions in SSRUs in Subarea 88.1 (three catch limits for *Dissostichus* spp. and two catch limits for *Macrourus* spp.). Despite these over-runs, the total catch of *Dissostichus* spp. in Subarea 88.1 was only 95% of the overall catch limit. The Scientific Committee agreed that both under-runs and over-runs of SSRU catch limits are inevitable. Provided these more or less balance over the season within subareas or divisions, they do not pose a conservation threat to the stocks.

4.168 To facilitate analyses of tagging data, the Scientific Committee recommended that vessels be asked to record a unique identifier on the C2 data forms for every set made and that observers ensure that this identifier is also recorded on their data forms.

4.169 The Scientific Committee did not attempt to determine whether all the notifications for new and exploratory fisheries satisfied the requirements of Conservation Measure 21-02 paragraphs 4, 5 and 7.

4.170 There has been a large number of notifications for fishing in Subareas 88.1, 88.2 and 48.6 and Divisions 58.4.1, 58.4.2 and 58.4.3b. Depending on the size of the precautionary catch limits, this implies that if all vessels operated simultaneously, the available catch per vessel could be lower than that required for economic viability, especially for those vessels operating in high latitudes where fishing imposes considerable operational difficulties. There are also additional administrative problems in determining closure dates for fishing in SSRUs when many vessels are fishing simultaneously in a subarea or division.

4.171 The Scientific Committee recommended that, where individual vessels have been notified for more than one subarea or division, the notification should include an indicative fishing plan including projected timings for fishing in different areas.

4.172 The Scientific Committee reiterated the importance of completion of the research sets and tagging requirements of Conservation Measure 41-01. Not all vessels met these requirements during the 2004/05 season and the Scientific Committee drew this to the attention of the Commission.

Subareas 88.1 and 88.2

4.173 The Scientific Committee recommended that the requirement to carry out specific research sets as defined in Annex 41-01/B of Conservation Measure 41-01 within Subareas 88.1 and 88.2 be removed. In its place, it recommended that there be a requirement that all fish of each *Dissostichus* spp. in a haul (up to a maximum of 35 fish) be measured and randomly sampled for biological studies (cf. paragraphs 2(iv) to (vi) of Annex 41-01/A) from all lines hauled within Subareas 88.1 and 88.2.

4.174 The Scientific Committee recommended that the catch limit for SSRU 882E for 2005/06 should be 273 tonnes.

4.175 The Scientific Committee was unable to provide advice on suitable catch limits for SSRUs 882C, D, F and G.

4.176 The Scientific Committee recommended that:

- (i) the catch of *Dissostichus* spp. be limited to 2 964 tonnes in the areas comprising Subarea 88.1 and SSRUs A and B in Subarea 88.2;
- (ii) the SSRUs in Subarea 88.1 be retained except that SSRUs B, C and G be considered as a single area – ‘northern SSRU’ and that SSRUs H, I and K be considered a single area – ‘slope SSRU’;
- (iii) the proportions of the catch limit allocated to each of these SSRUs be managed as an experiment for three years and that these be:

88.1 northern SSRU – 0.12

88.1 slope SSRU – 0.64

88.1 J – 0.18

88.1 L – 0.06

88.1 A, D, E, F – 0.0

88.2 A, B – 0.0.

- (iv) the catch limits in each of the SSRUs be:

88.1 northern SSRU – 348 tonnes

88.1 slope SSRU – 1 893 tonnes

88.1 J – 551 tonnes

88.1 L – 172 tonnes

88.1 A, D, E, F – 0 tonnes

88.2 A, B – 0 tonnes.

4.177 Mr Pshenichnov objected to this recommendation and noted that no SSRU should have a zero catch limit on the basis of the following:

- (i) it is important to obtain catch statistics from all areas in the SSRUs to assess the status of the stocks in these areas;
- (ii) the variability in ice cover means that all SSRUs should be open for fishing;
- (iii) the concentration of 64% of the catch limit into a small part of the slope area may result in impacts on that part of the population;
- (iv) the need both to tag fish in all areas and to permit tag recoveries from all SSRUs.

4.178 The Scientific Committee thanked New Zealand for its efforts in completing an assessment of toothfish in Subareas 88.1 and 88.2. This represents the first instance for an exploratory fishery to have an assessment completed.

Other subareas and divisions

4.179 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. taken in exploratory fisheries. No new advice is available on catch limits for any by-catch species in any of the exploratory fisheries.

4.180 The Scientific Committee reiterated the urgent need to develop a means for estimating abundance and providing assessments of stock status for exploratory fisheries, other than those in Subareas 88.1 and 88.2. With the continuing tagging programs in all areas, in the next year or two it may be possible to obtain mark-recapture estimates of abundance, provided that sufficient tags are deployed each year.

Crab resources

4.181 No target fishery for stone crabs was carried out in the last three seasons and no proposal for their harvest has been received by CCAMLR for the 2005/06 season.

Advice to the Commission

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

Squid resources

Martialia hyadesi (Subarea 48.3)

4.183 No target fishery for squid (*Martialia hyadesi*) was carried out in the last three seasons and no new request has been submitted to CCAMLR to continue exploratory fishing in the 2005/06 season.

Advice to the Commission

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

Fish and invertebrate by-catch

4.185 The subjects of interest which were brought to the attention of the Scientific Committee are as follows:

- assessment of the status of by-catch species and groups of species
- estimation of levels and rates of by-catch
- reporting of by-catch data
- evaluation of risk, in terms of both geographical area and demography of populations.

A work plan was developed to address each of these issues.

Assessment of the status of by-catch species and groups

4.186 No new assessment had been conducted which would enable the recommended catch limits to be revised in 2005. 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.

4.187 The Scientific Committee also recommended that future work should include research aimed at generating population parameters for the estimation of standing stocks of rays and grenadiers.

Estimation of by-catch levels and rates

4.188 Estimates of total removals of by-catch in the longline and trawl fisheries are shown in Appendix N, Tables 2 and 3 respectively, of the WG-FSA report (Annex 5).

4.189 Because of an underestimation of by-catch resulting from the way in which by-catch is reported on the relevant forms, the Scientific Committee highlighted the need to take particular care to report such data accurately.

4.190 IUU fishing may also contribute to an underestimation of real removals.

Reporting of by-catch data

Observer information

4.191 Data on catch composition and biological data obtained simultaneously are summarised by the Secretariat in documents WG-FSA-05/7 (longline) and WG-FSA-05/8 (trawl). Data reporting for Subareas 88.1 and 88.2 is very poor (WG-FSA-05/24).

4.192 In order to address these problems, the Scientific Committee recommended that the catch composition form L5 to be completed by observers, be modified by adding fields for recording 'number of hooks observed for by-catch', and the total estimated number and weight of each species retained or discarded during longline hauling (i.e. observed numbers and weights, scaled in proportion to the number of hooks observed). These additional fields would assist in validation and cross-checking of by-catch records.

Reporting of data on rays cut off the line

4.193 The Scientific Committee noted that data on rays cut off the line by snood section before landing on board are not uniformly and accurately recorded.

4.194 The Scientific Committee recommended that all vessels engaged in the fishery record the number of rays cut off the line, by adding a new field to form C2, entitled 'number of rays released (including tagged specimens)'. These would not be counted against by-catch limits.

4.195 The Scientific Committee urged the observers to fill out form L11 correctly so as to include information on rays cut off the line. This form should be filled out at each longline haul, or an observation recorded, as a minimum requirement, at least once every 48 hours.

Identification of levels of risk in terms of geographical area and demography of populations

4.196 The Scientific Committee encouraged Members engaged in fisheries to collect information necessary to establish levels of risk, as used in the development of the level of risk for species such as the grenadier *M. whitsoni* and the ray *Amblyraja georgiana* in the exploratory fishery in the Ross Sea. Ways in which this could be linked to assessment and management should be explored in conjunction with ad hoc WG-IMAF (Annex 5, paragraphs 14.1 to 14.6).

Consideration of mitigation measures

Factors influencing by-catch rates

4.197 In order to develop mitigation and avoidance measures for by-catch species, it is necessary to determine factors which influence catch rates. An initial study on grenadiers in the Ross Sea (Subareas 88.1 and 88.2) showed the influence of fishing method, depth, geographical area, bait type etc. For rays, however, these factors cannot be so reliably determined because of poor reporting of specimens cut off the line.

4.198 The Scientific Committee recommended that work should be continued in the intersessional period to compare by-catch rates arising from different fishing gear to determine whether this information would be useful when recommending mitigation and avoidance measures for by-catch species.

4.199 The Scientific Committee requested Members and observers to submit to the Secretariat, where feasible, reports on fishing methods and strategies likely to reduce by-catch of non-target species.

4.200 The Scientific Committee recommended that a field specifying whether integrated weighting was used for longlines be added to the C2 data form.

Release of rays

4.201 The Scientific Committee recommended that vessels be advised that, where possible, they should release rays from the lines by cutting the snoods when the rays are still in the water, unless requested not to do so by the observer during his biological sampling period.

4.202 It has become current practice by fishing crews to cut snoods to release rays, however there was no new information available to WG-FSA this year from studies of the survival and vulnerability of species released in this way.

4.203 The Scientific Committee recommended a relaxation of the above requirement to cut all rays from lines whilst still in the water when observers are carrying out particular tasks aimed at collecting further information on rays during the sampling period. Examples of such tasks include:

- (i) collection of biological data – for example measurement of length, weight, sex, maturity stage, stomach contents, samples of vertebrae and thorns for age determination;
- (ii) landing rays in order to assess their condition, as if these animals had been released whilst still in the water. It would be necessary to observe hauling procedures to ensure that wounds were not sustained during hauling;
- (iii) assessment of the probability of detecting tagged rays. It is likely to be difficult to detect tagged individuals when they are released in the water, particularly when the sea is rough.

4.204 The Scientific Committee recommended the adoption of a new 4-category scale (Annex 5, Appendix N, paragraph 87) to assess the condition of specimens when they are returned to the water. This data should be accurately recorded for at least one observation period every 48 hours.