

## HARVESTED SPECIES

### Krill resources

#### Status and trends

##### 2002/03 season

4.1 The total catch of krill for the 2002/03 season was 117 728 tonnes. Most of the catch came from within three of the 15 SSMUs in Area 48 (north of Livingston Island, west of Coronation Island and northeast of South Georgia) (Annex 4, paragraph 3.1).

##### 2003/04 season

4.2 The krill catch reported prior to the meeting was 87 133 tonnes (SC-CAMLR-XXIII/BG/1) (Table 2). Seven Members had been fishing for krill, all in Area 48. A single vessel from Vanuatu had also been fishing for krill in Area 48 and during the Scientific Committee meeting submitted its catch data to the Secretariat. This vessel caught 14 979 tonnes of krill bringing the total catch of krill in the Convention Area to 102 112 tonnes.

4.3 The Vanuatu-flagged vessel (the *Atlantic Navigator*) appears to be using new technology to catch and process krill. Dr E. Marschoff (Argentina) reported that Argentinian authorities had been approached by the Vanuatu-flagged vessel about landing krill in Ushuaia. The krill were being caught using a pumping system and the anticipated catch had been stated as 20 000–30 000 tonnes. The company had not responded to requests for more details.

4.4 The Scientific Committee was informed that the Vanuatu vessel carried a Uruguayan observer and that Uruguay would provide information to CCAMLR on the catch, fishing methods used and by-catch. Uruguay was requested to submit a paper to WG-EMM next year detailing the Vanuatu krill fishing operation.

4.5 The UK catch had been from an icefish vessel which had also fished experimentally for krill. The operation was unlikely to generate considerable catches in the future.

##### Fishing plans for 2004/05

4.6 All Members fishing for krill submitted details of their intentions on the pro forma developed at the 2003 meeting (SC-CAMLR-XXII, Annex 6). Eight Members announced the intention to fish for krill in Area 48 using 13 vessels and a total projected catch of 226 000 tonnes (Annex 4, Table 1). The Scientific Committee acknowledged that the submission of these data was a significant development.

4.7 The projected krill catch for 2004/05 (226 000 tonnes) was considerably higher than the 2003/04 catch and was also higher than the catch projected for the 2003/04 season

(165 000 tonnes; SC-CAMLR-XXII, Table 4). The Scientific Committee agreed that the predicted catches are likely to be estimates of potential catches and that a total catch of 160 000 tonnes in 2004/05 might be a more reasonable expectation.

4.8 Dr Sushin reminded the Scientific Committee that in contrast to the predicted catch which had increased during the last three years, the reported catch decreased by 25% from 126 000 tonnes in 2001/02 to 102 000 tonnes in 2003/04 season. This fact indicated that the krill fishery might actually be declining rather than increasing and that discussions of future trends should be based on factual data rather than on combined notifications.

4.9 The Scientific Committee noted that the krill fishery notifications should be used to indicate interest and trends in the fishery rather than to accurately predict future catches, and encouraged the future submission of this information. In particular, the number of vessels and the products derived might be useful indicators of trends.

4.10 Information on the trends in the krill fishery contained in SC-CAMLR-XXII, Table 4, would be most useful when viewed in a time series which would allow the detection of multi-year trends in fishing interest. It was recognised that projections of future catches were likely to be higher than actual catches but the Scientific Committee agreed that there was value in obtaining these data so that significant changes in the fishery might be detected in advance.

4.11 The entry of non-Members fishing for krill using new technology suggested that the nature of the fishery could change and that these changes could be driven by developments occurring outside the CCAMLR community. WG-EMM needs to be able to assess the effects of any changes in fishing technology on the krill fishery and the Scientific Committee noted the continued paucity of information on the economic and technological drivers of the krill fishery.

4.12 The Japanese krill catch is now less than 50% of the annual catch and the krill fishery is now being operated by vessels from a larger number of Member and non-Member nations. Such a situation will lead to greater uncertainty in long-term predictions of krill catches.

4.13 The Scientific Committee noted a report from ASOC (SC-CAMLR-XXIII/BG/25) addressing the conservation of krill within the Antarctic ecosystem and the factors which might affect the development of the fishery. The paper suggested that the subdivision of the krill catch in Area 48 into SSMUs should be accorded a high priority and indicated the utility of haul-by-haul data and scientific observers to the work of the Scientific Committee. The paper also recommended the use of VMS on krill vessels, the submission of detailed fishing plans and the coordination of scientific research on krill.

#### Advice to the Commission

4.14 The krill catch in 2003/04 was likely to be lower than 2002/03 but projected catch levels submitted by Members continued to indicate the potential to increase the catch substantially in 2004/05.

4.15 The Commission should note the utility of the information provided by Members on the newly developed fishing plan pro forma and the Scientific Committee recommended that submission of data using this form should continue.

4.16 The Commission's attention was drawn to the catch of krill taken by a vessel from a non-Member (Vanuatu, an Acceding State) and the Scientific Committee noted that this new entrant might be using new technology which could affect the operation of the krill fishery in future.

4.17 The Scientific Committee's ability to predict trends in the krill fishery was still being hampered by a lack of information on technological and economic developments.

## Fish resources

### Fishery Plans

4.18 The Scientific Committee noted that there had been a reorganisation and reconstruction of the database by the Secretariat that holds the time series of information used in the Fishery Plans. Information and revised layout for the Fishery Plan are set out in Annex 5, paragraphs 3.9 to 3.11.

4.19 The Scientific Committee was concerned that there may be different definitions of 'Fishery' in the revised Fishery Plan and Conservation Measure 32-01, as well as issues related to gear and fishery status. The Scientific Committee asked that all definitions contained in Fishery Plans should be harmonised with conservation measures.

### Status and trends

#### Fishing activity in the 2003/04 season

4.20 Nine finfish fisheries, including five exploratory fisheries, were conducted under the conservation measures in force in 2003/04. These included fisheries for *D. eleginoides* and *C. gunnari* in Subarea 48.3 and Division 58.5.2, and exploratory fisheries for *Dissostichus* spp. in Subareas 48.6, 88.1, 88.2 and Division 58.4.2 and 58.4.3b. Other fisheries for *D. eleginoides* occurred in the EEZs of South Africa (Subareas 58.6 and 58.7) and France (Subarea 58.6 and Division 58.5.1) by longlines.

4.21 The Scientific Committee noted that catches of target species by region and gear reported from fisheries conducted in the CCAMLR Convention Area in the 2003/04 fishing season are summarised in Table 3. These had been updated to 24 September 2004 and reported in SC-CAMLR-XXIII/BG/1.

4.22 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

4.23 Reported catches of *Dissostichus* spp. are shown in Annex 5, Table 3.1. Inside the CCAMLR Convention Area a total of 13 307 tonnes was reported during the 2003/04 season (Table 3) compared with 18 507 tonnes in the previous season (Table 4).

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

4.24 Catches outside the Convention Area were 10 966 tonnes during the 2003/04 season compared with 24 137 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 2003/04 was 6 342 and 3 701 tonnes for Areas 41 and 87 respectively, down from 10 001 and 5 745 tonnes respectively for 2002/03.

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

4.25 These results are set out in Annex 5, Tables 3.1 to 3.3.

4.26 The Scientific Committee noted that the highest level of IUU catch inside the Convention Area during the 2003/04 season was 643 tonnes from Division 58.5.1, down from 7 825 tonnes from this division during the 2002/03 season.

4.27 The Scientific Committee noted the sharp decrease in estimates of overall IUU catch. Issues related to trends in IUU fishing are discussed under Item 7 of this report.

Research surveys

4.28 The Scientific Committee noted the following research surveys undertaken in 2003/04: a multidisciplinary research survey in Subareas 48.3, 48.4 and 48.6 by the USA (Annex 5, paragraph 3.23); a random stratified bottom trawl survey in Division 58.5.2 by Australia (Annex 5, paragraph 3.24); a random stratified bottom trawl survey in Subarea 48.3 by the UK (Annex 5, paragraph 3.25); and a multidisciplinary research survey in Subarea 88.1 by New Zealand (Annex 5, paragraph 3.23).

4.29 A simulation approach to evaluating toothfish recruitment surveys (Annex 5, paragraph 3.27) was endorsed by the Scientific Committee, as well as endorsing research towards combining acoustic and trawl survey data to estimate *C. gunnari* standing stock size (Annex 5, paragraphs 3.33 to 3.39).

## Fish biology/ecology/demography

### Tagging studies

4.30 The Scientific Committee noted that substantial progress has been made in fish tagging studies, endorsed the continuation of toothfish tagging as a requirement for all new and exploratory toothfish fisheries (Conservation Measure 41-01, Annex C), and encouraged their use in all fisheries where appropriate. The Scientific Committee recognised the substantial progress made to advance CCAMLR Member tagging programs in the Convention Area (Annex 5, paragraphs 3.43 to 3.47), and endorsed recommendations and changes to tagging protocols set out in these paragraphs.

4.31 The Scientific Committee requested that contact names for the various Member country tagging programs be made available to the Secretariat.

4.32 Dr Constable noted that Australian research of t-bar tag detection using wire-coded Tirus tags demonstrated that there can be a lower detection of t-bar tags when these tag types are used without the addition of wire-coded tags. Dr Constable encouraged other tagging programs to evaluate tag detection levels using similar methods, as accurate estimates of tag detection rate was an important parameter in the use of tagging data to estimate biomass.

### Biological parameters

4.33 The Scientific Committee noted new information on biological parameters (Annex 5, paragraphs 3.53 to 3.58), including length–mass relationships for *D. mawsoni* in different areas in Subarea 88.1; estimates of age and growth of *Amblyraja georgiana* in Subarea 88.1; partial age validation of *D. eleginoides* in Division 58.5.2; new growth curves for *D. eleginoides* in Subarea 48.3; a comparison of age densities of *C. gunnari* between CMIX and direct ageing; and a review of icefish biology including length–mass and growth. The Scientific Committee encouraged continued work on population parameters important for the assessment process.

4.34 The Scientific Committee invited papers that considered the relationship between life-history parameters, such as natural mortality (M) and von Bertalanffy growth parameters. The Scientific Committee noted that the life-history theory predicts that such relationships should be constant within species, and that changes in the state of ecosystems due to harvest and environmental changes may alter these relationships.

### Stock structure

4.35 The Scientific Committee noted that several papers investigated stock structure of species in different parts of the Convention Area. These are summarised in Annex 5, paragraphs 4.34 to 4.36.

4.36 The Scientific Committee agreed that *D. eleginoides* in Subarea 48.3 should be separated into three parts for the purposes of assessment and management. It endorsed the

recommendation that the assessment only be applied to the area around Shag Rocks/South Georgia and that Maurice Ewing Bank to the north and the North Scotia ridge in the west be considered as separate areas for which there is no information.

#### General biology and ecology

4.37 The Scientific Committee noted a large number of papers tabled at WG-FSA which contained substantial biological information on target and non-target species (Annex 5, paragraph 9.1).

4.38 Subjects addressed in these papers included diet of *D. eleginoides* and *D. mawsoni*; diet, ageing methods, and population biology of *C. gunnari*; spawning information and population biology of *D. mawsoni* in the Ross Sea; and new information on by-catch species, ichthyoplankton sampling, a marine biodiversity initiative, a detailed review of icefish biology, and biology of various other icefish species.

4.39 The Scientific Committee agreed that species profiles are a valuable tool for summarising the history of research and current understanding of target species for assessments, and considered it important that they are updated annually with new information either presented to, or generated by, WG-FSA.

4.40 The Scientific Committee noted information relating to a proposed age determination workshop on *C. gunnari* (Annex 5, paragraphs 9.8 to 9.12). The Scientific Committee endorsed this workshop and saw it as an important first step towards reconciling difficulties in age determination of this species.

#### Developments in assessment methods

4.41 The Scientific Committee noted the substantial progress made on assessment methods by WG-FSA-SAM at its intersessional meeting held at the University of Siena, Siena, Italy, from 5 to 9 July 2004. Results of this workshop are summarised in Annex 5, paragraphs 4.3 to 4.12. 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 4.15.

4.42 A number of papers with elements contributing to assessment methods were noted by the Scientific Committee. These papers are summarised in Annex 5, paragraphs 4.18 to 4.33. The papers dealt with a wide range of issues, many of which are considered in the assessment sections of the Fishery Reports. Six papers provided preliminary stock assessments for active fisheries in the CCAMLR 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. tagging estimators, ASPM) proposed for application to *D. eleginoides*.

4.43 The points concerning the assessment timetable this year were noted by the Scientific Committee. These are set out in Annex 5, paragraph 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.

#### Assessment and management advice

##### Assessed fisheries

4.44 The Scientific Committee welcomed the development of Fishery Reports compiled by WG-FSA for assessed fisheries (Annex 5, Item 5), and noted each Fishery Report included:

1. Details of the fishery
2. Stocks and areas
3. Parameter estimation
4. Stock assessment
5. Fish and invertebrate by-catch
6. Bird and marine mammal by-catch
7. Ecosystem implications/effects
8. Harvest controls.

##### *D. eleginoides* at South Georgia (Subarea 48.3)

4.45 The catch limit for the *D. eleginoides* fishery in Subarea 48.3 in the 2003/04 season was 4 420 tonnes (Conservation Measure 41-02). The catch from this fishery during the 2003/04 season, as reported by 1 October 2004 in the catch and effort reporting system, was 4 482 tonnes, the vast majority of which had been taken by longline. The fishery was active from 1 May to 21 August 2004 (Annex 5, paragraph 5.103, Table 5.13).

4.46 The Scientific Committee noted the revised areas for inclusion of catches in the assessment of the South Georgia and Shag Rocks stocks of *D. eleginoides* in Subarea 48.3 defined in Annex 5, Figure 5.5, and used by WG-FSA for determining catches to be included in the 2004 assessment (Annex 5, Table 5.14). The Scientific Committee recommended that the revised areas be adopted for the current and future assessments.

4.47 The Scientific Committee thanked the Working Group for the considerable work undertaken, intersessionally and at this year's meeting, to review and revise the assessment of long-term yield for *D. eleginoides* in Subarea 48.3 (Annex 5, paragraphs 5.104 to 5.115).

4.48 The Scientific Committee recalled its request for a review of methods to estimate recruitment of *D. eleginoides* from surveys (SC-CAMLR-XXII, paragraphs 4.49 and 4.50), and noted the progress made by the Working Group with respect to evaluation of survey design and use of CMIX (Annex 5, paragraphs 3.27 and 5.115 to 5.120).

4.49 The Scientific Committee welcomed the progress that had been made with the development of the ASPM approach (Annex 5, paragraphs 5.138 to 5.141). The Scientific Committee noted that at this stage the results of the ASPM were highly sensitive to the weighting factors applied to the different data inputs and values specified for fixed parameters

and encouraged further development and evaluation of the ASPM in order to better understand the properties of the model and the potential application of the approach to *D. eleginoides*.

4.50 The Scientific Committee recalled the problems identified last year with the estimates of recruitment for *D. eleginoides* in Subarea 48.3 (SC-CAMLR-XXII, paragraphs 5.104 to 5.111). WG-FSA has corrected the problems identified with the survey data and revised the assessment of recruitment-based long-term annual yield (Annex 5, paragraphs 4.3 and 4.4). At its last meeting, the Commission noted that should previous catches have been above precautionary yield levels, then this will be taken into account when calculating subsequent precautionary yields (CCAMLR-XXII, paragraph 4.50; SC-CAMLR-XXII, paragraph 5.123). The Scientific Committee noted the following results from WG-FSA this year using the method adopted in 1995, including the method for giving greater emphasis to simulation trials that have similar trends to the standardised CPUE time series, and using the revised recruitment data (Annex 5, Table 5.26, Series FSA-04 48.3 vB) with all other input parameters the same as last year (called the 'base-case' scenario):

- (i) the new series of recruitments had a substantially lower mean;
- (ii) without adjusting for the CPUE series, the stock would have a 0.67 probability of depletion over the next 35 years with zero catch over that time (Figure 3);
- (iii) 31% of simulation trials in this unadjusted calculation had insufficient fish in the simulated population for the annual catches in the historical catch record to be taken;
- (iv) by taking account of the standardised CPUE, thereby substantially reducing the influence of trials that could not produce the historical catch series, the revised probability of depletion is 0.52 (Figure 4);
- (v) if this assessment is correct then the binding part of the decision rule would be the probability of depletion (Annex 5, paragraph 5.146), which indicates a zero catch;
- (vi) the long-term annual yield arising from this set of parameters but without any historical fishing or recruitment series was estimated to be 1 900 tonnes.

4.51 The reanalysed standardised CPUE series showed similar downward trends over the whole time series to those shown in the past but showed no downward trend over the period since 1996. It was noted that the general long-term trend in the CPUE was evident in the trends in median vulnerable biomass from the simulation trials. The stable pattern of CPUE in the most recent years, however, was not shown in the trials, which show a downward trend in vulnerable biomass (Annex 5, Figure 5.14a). There is a question whether the CPUE series could be hyperstable, where the fishing fleet concentrates on aggregations while the overall abundance declines. This will need to be explored using spatial analytical tools.

4.52 An analysis of tagging data undertaken by the working group indicated a current vulnerable biomass of around 51 000–61 000 tonnes. While the confidence regions were relatively narrow, it was noted that a number of uncertainties remained about the estimates, including the relative contribution of some areas where the estimation of abundance from tags



have much wider confidence intervals (northeast South Georgia), the low number of releases and recoveries in the assessment to date and the need to further explore the assumptions concerning mixing of tags and constant recapture rate. Although some of the issues in the tagging analysis concerning tag mixing and the distribution of fishing effort were examined at the working group, some issues will need further investigation in the intersessional period to resolve these uncertainties.

4.53 The Scientific Committee noted that the results of the tagging analysis and the results of the assessment of vulnerable biomass in the simulation trials based on the set of parameters applied in the base-case scenario above were incompatible.

4.54 The Scientific Committee noted the discussion by WG-FSA concerning the outcomes of its assessment work this year (Annex 5, paragraphs 5.165 to 5.172) and used these as the basis for the following discussion.

4.55 The Scientific Committee agreed that the set of parameters in the base-case scenario need to be urgently reviewed as it is unlikely that the current parameter set is the one that should be used in the future. It noted, however, that a number of parameters could be altered to result in a vulnerable biomass consistent with the estimate from the tagging assessment (Annex 5, Figure 5.13, Table 5.29), including:

- (i) the time series of recruitment in the years immediately prior to the historical catch and survey series;
- (ii) the magnitude of the initial biomass;
- (iii) the degree of bias, if present, in the estimates of abundance of recruits from surveys, leading to bias in the mean recruitment used in the simulation trials;
- (iv) the value (or range) of natural mortality;
- (v) the growth rate of fish; and/or
- (vi) the vulnerability of the population to the fishery.

4.56 The Scientific Committee noted that should the surveys be negatively biased, as discussed by WG-FSA, then an estimate of long-term annual yield consistent with the results of the tagging data would be between 4 200 and 4 900 tonnes. However, if other parameters are altered in the assessment to give the estimate of vulnerable biomass, then the status of the spawning stock might be lower, requiring a lower long-term yield.

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

4.57 There was insufficient information from analyses for the Scientific Committee to choose between options without further work to refine the parameter inputs and examine the sensitivity of the assessment to uncertainties in these inputs. It agreed that there was a need to undertake work in the coming year to attempt to resolve these uncertainties. In the interim, the Scientific Committee felt that: (i) the status of the spawning stock is unlikely to be as low

as that indicated by the base-case scenario (Annex 5, Figure 5.14a); and (ii) that it was unlikely to be as high as when the recruitment series is scaled to the tagging analysis (Annex 5, Figure 5.14b).

4.58 The Scientific Committee was unable to recommend a specific catch limit for *D. eleginoides* in Subarea 48.3 for the coming season. The Scientific Committee directed the Commission to the following two approaches developed by the Scientific Committee in determining a catch limit for the coming season:

- (i) The first approach is to choose a catch that, given the base-case conditions, should not substantially increase the probability of the spawning stock being depleted. Figure 3 is provided to indicate the change in probability of depletion given a specified annual catch. The probabilities that account for the CPUE series are those where greater emphasis is given to simulation trials that have similar trends during the historical catch series to the trends indicated by the standardised CPUE. The increase in the slope of both graphs around a catch level of 2 000 tonnes is a reflection that the base-case assesses sustainable yield at 1 900 tonnes. The Scientific Committee agreed that the decision of what level of catch could be taken without a 'substantial increase in the probability of depletion' was not a scientific issue and fell within the remit of the Commission.
- (ii) The second approach is based on the tagging estimates and scaled recruitment series. These suggest annual yields of 4 200 to 4 900 tonnes, but considering the uncertainty surrounding some of the assumptions discussed above, a more conservative yield could be calculated by taking the lower 95% confidence limit of the tagging analysis. This gives an annual yield of 3 050 to 3 750 tonnes.

4.59 A further precautionary approach to the fishery that is recommended by the Scientific Committee for the forthcoming season is to divide the catch limit into areas (Annex 5, paragraph 5.173). The Scientific Committee recommended that the catch limit should be distributed according to the areas shown in Figure 4 by the following proportions:

- Area 1 (West Shag Rocks): 0%
- Area 2 (Shag Rocks): 30%
- Area 3 (South Georgia): 70%.

4.60 The CPUE in West Shag Rocks has shown a substantial decline over the last five years. Hence the Scientific Committee recommended closure of that area. In the last three years 38% of the total catch from Areas 2 and 3 has been taken from Shag Rocks. The proposal will therefore reduce the proportion of the catch taken in this area.

4.61 In order to ensure the monitoring of the stock in the West Shag Rocks area, the Scientific Committee recommended that research fishing be undertaken in this area that would be subject to the research exemption limit of 10 tonnes and any catch taken from this area will be counted towards the catch limit.

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

4.62 The Scientific Committee agreed that it was important to use assessment methods that are robust to assumptions about the relationship between vulnerable biomass and spawning stock status and requested that WG-FSA provide advice on the assessment methods in this regard.

4.63 The Scientific Committee noted the issues identified by WG-FSA and requested that it consider the following issues in order to resolve the outstanding uncertainties in the current status of the stock and estimated long-term yield for *D. eleginoides* in Subarea 48.3:

- (i) recruitment
  - (a) revision of survey design in Subarea 48.3 to estimate abundance of pre-recruit *D. eleginoides*, particularly in the areas around Shag Rocks;
  - (b) review of the effect of stratification on estimates of abundance of cohorts using CMIX (Annex 5, paragraph 5.123);
  - (c) review of length-at-age relationship and estimated growth parameters for use in the CMIX analysis (Annex 5, paragraphs 5.116 to 5.120);
- (ii) fine-scale spatial analyses of catch and effort data to further examine the potential for hyperstability in the CPUE series;
- (iii) assessment methods
  - (a) further sensitivity analysis and evaluation of the GYM assessment (paragraph 4.55);
  - (b) further development and evaluation of the current and alternative tagging estimators (Annex 5, paragraph 5.135);
  - (c) further development and evaluation of the ASPM (Annex 5, paragraph 5.141).

#### *D. eleginoides* at Kerguelen Islands (Division 58.5.1)

4.64 The Scientific Committee thanked Prof. G. Duhamel (France) for the provision of haul-by-haul catch and effort data for Division 58.5.1 for the second year. This allowed the analyses completed by WG-FSA in 2003 to be updated for the 2003/04 season.

4.65 The Scientific Committee recalled that it had considered it imperative to substantially reduce total removals in Division 58.5.1 in light of the increase in total removals and corresponding decline in standardised CPUE evident in the results of last year's analysis.

Management Advice for *D. eleginoides*  
(Division 58.5.1)

4.66 The Scientific Committee welcomed the substantial reduction in total removals reported for the 2003/04 season but noted that in the absence of a stock assessment, it was not possible to judge whether this reduction in catches, if sustained, would allow the declining trends in standardised CPUE and mean length of fish to be halted, or reversed (Annex 5, paragraphs 5.177 to 5.180).

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

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

4.68 The catch limit for *D. eleginoides* in Division 58.5.2 for the 2003/04 season was 2 873 tonnes (Conservation Measure 41-08) for the period from 1 December 2003 to 30 November 2004. The catch reported for this division as of 1 October 2004 was 2 269 tonnes. It is expected that the catch limit will be taken before the end of the current fishing season.

4.69 The Scientific Committee noted that for the purposes of assessment, the long-term yield and setting of catch limits apply to the area to the west of 79°20'E.

4.70 Prof. J. Beddington (UK) reiterated his concern (SC-CAMLR-XXII, paragraph 4.85) about the internal consistency of life-history parameters used in the assessment, in particular the values of K and M, but acknowledged that it may be important to consider the potential impacts of changes in the nature of populations and the broader ecosystem due to fishing and other human interventions.

4.71 Dr Constable indicated that the von Bertalanffy parameters for *D. eleginoides* in Division 58.5.2 are derived from an ongoing program of work using ages from readings of otoliths which have been validated using strontium marks, tag-recapture data and, more recently, daily growth increments. He also noted that the results of recent preliminary analyses undertaken in collaboration with Dr M. Collins (UK), using the lengths of larval *D. eleginoides* for Subarea 48.3 (provided in Belchier, 2004 (WG-FSA-04/92)) to estimate growth curve, indicated that this helps to better describe the lower end of the growth curve but has negligible effect on the length-at-age relationship in the range used in the assessment of yield.

4.72 Prof. Duhamel noted that the proportion of the catch of *D. eleginoides* taken by longline in Division 58.5.2 had increased between the 2003 and 2004 seasons and asked whether this had been accounted for in the vulnerability function used in the assessment. He also asked what was the expected trend in the future with respect to the proportion of the catch taken by trawl and longline.

4.73 Dr Constable indicated that the future trend in proportion of the catch to be taken by longline in Division 58.5.2 was unclear at this stage, although it was likely that it would

increase. He confirmed that the assessment has been performed using the trawl vulnerability function, which is age based and incorporates variation in length-at-age, and that this approach was considered precautionary by WG-FSA and the Scientific Committee. He also noted that the Working Group had requested a review of the vulnerabilities used in the assessment and that this would be pursued in the intersessional period.

4.74 The Scientific Committee noted the recommended exemption from night-setting requirements for autoline vessels operating in Division 58.5.2 in 2005, subject to the conditions proposed in Annex 5, paragraph 7.86 (paragraph 5.48(ii)).

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

4.75 The Scientific Committee recommended that the catch limit for Division 58.5.2 in the 2004/05 season be revised to 2 787 tonnes, representing the long-term annual yield estimate from the GYM. This catch limit is recommended to pertain only to the assessment area which is to the west of 79°20'E.

4.76 The remaining provisions of Conservation Measure 41-08 should be carried forward for the 2004/05 season.

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

4.77 The Scientific Committee noted the updated analyses of haul-by-haul catch and effort data conducted by WG-FSA for Subarea 58.6.

4.78 The Scientific Committee reiterated its previous concern (SC-CAMLR-XXII, paragraph 4.92) about the declining trend in CPUE and the decreasing average weight of fish in the legal catch evident from the results of these analyses (Annex 5, paragraphs 5.297 and 5.298).

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

4.79 The Scientific Committee noted the dramatic decline in CPUE since 2000, even under the relatively low levels of total removals in recent years, and stressed that it is imperative that future total removals be reduced until an assessment of the current status of the stock is available.

4.80 In this regard, the Scientific Committee recommended that a tag–recapture experiment be conducted, consistent with other toothfish fisheries in the CCAMLR Convention Area, and noted that a recruitment survey would greatly assist in conducting a stock assessment for Subarea 58.6.

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

4.81 The Scientific Committee welcomed the revised assessment of *D. eleginoides* in the South African EEZ around the Prince Edward Islands (Annex 5, paragraphs 5.269 to 5.295) and noted that despite revisions to the assessment it had not been possible to resolve the conflicting signals between the trends in CPUE and length frequency of the catch. The Scientific Committee encouraged further development of the assessment model, in particular ways in which it may be applied to the CCAMLR decision rules.

4.82 The Scientific Committee noted that the Fishery Report for the Prince Edward Islands extends: over much of Subarea 58.7, east into Subarea 58.6, south into Division 58.4.4, and north into Area 51 (Annex 5, paragraph 5.276). The Scientific Committee agreed to request advice from the Commission on the most appropriate area for considering the assessment of toothfish in Subarea 58.7.

4.83 The Scientific Committee indicated that, should South Africa choose to initiate a tagging program for *D. eleginoides* in Subarea 58.7, then it would be the natural depository for the coordination of tag returns from that area.

4.84 The Scientific Committee noted that in respect to mitigation, Conservation Measure 33-03 was in force within the South African EEZ.

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

4.85 The Scientific Committee recommended that the prohibition of directed fishing in Subarea 58.7 outside the Prince Edward Islands EEZ (Conservation Measure 32-12) should continue.

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

4.86 The Scientific Committee recommended that Conservation Measure 32-01, which prohibits targeted fishing for *D. eleginoides* outside the EEZ, remain in force.

*C. gunnari* at South Georgia (Subarea 48.3)

4.87 The catch limit for the fishery for *C. gunnari* in Subarea 48.3 in the 2003/04 season was 2 887 tonnes (Conservation Measure 42-01). All fishing took place between 9 December 2003 and 25 April 2004 with a total catch of 2 686 tonnes.

4.88 The estimate of yield was calculated using the established short-term assessment method using the results of the 2004 UK survey and updated catches (Annex 5, paragraphs 5.219 to 5.234).

4.89 The Scientific Committee noted the conclusion of the Working Group that bottom trawl surveys underestimate the abundance of *C. gunnari* due to all age classes spending time in midwater and therefore not being sampled by the bottom trawl.

4.90 The Scientific Committee noted that estimates of the midwater biomass of *C. gunnari* from acoustics had been used in the 2003 assessment (SC-CAMLR-XXII, Annex 5, paragraph 5.153), but that an estimate of the biomass of *C. gunnari* from an acoustic survey was not available for 2004.

4.91 The Scientific Committee requested that approaches to the use of combined estimates of biomass from trawl and acoustic surveys, including accounting for variations in trawl gear between surveys, be given further consideration by WG-FSA-SAM. It also requested consideration of whether a constant scaling factor can be used to routinely adjust survey catches from particular trawl years. The Scientific Committee noted the already heavy workload planned for the 2005 meeting of WG-FSA-SAM and acknowledged that it may not be possible to fully consider this issue in the coming intersessional period.

4.92 Prof. Beddington enquired whether there was a substantial proportion of the biomass of *C. gunnari* in the midwater in Division 58.5.2.

4.93 Dr Constable noted the Scientific Committee's previous considerations of this issue, and recalled that the results presented at the 2000 WAMI workshop (SC-CAMLR-XX, Annex 5, paragraph 7.19) demonstrated that there were very few occasions in which the distribution of *C. gunnari* in Division 58.5.2 would not be fully sampled by the bottom trawl.

4.94 Dr Collins concurred with Dr Constable and stated that it was important to recognise that there were significant differences in the nature of the ecosystems in Subarea 48.3 and Division 58.5.2 that resulted in different feeding behaviours and depth distributions. In particular, he noted that *C. gunnari* in Subarea 48.3 feed predominantly on krill (*E. superba*), while in Division 58.5.2, where *E. superba* are absent, they feed on a broader range of invertebrates and fish.

4.95 The Scientific Committee agreed that there are likely to be differences in the nature of the ecosystems and population dynamics of target and by-catch species among areas due to different biophysical characteristics and histories of exploitation.

4.96 Dr Constable noted that the proposal for a bottom trawl fishery for *C. gunnari* in this area is an exploratory fishery because of the need to acquire and review data with respect to impacts of this fishing method on benthic habitats and the efficiency of bird mitigation. In other respects, the fishery would be expected to have the same fishing selectivity as the pelagic trawl fishery. As such, the catch from a bottom trawl fishery would be considered as part of the total assessed yield for *C. gunnari* in Subarea 48.3.

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

4.97 The Scientific Committee recommended that the catch limit for *C. gunnari* should be revised to 3 574 tonnes for the period from 1 December 2004 to 30 November 2005.

4.98 The Scientific Committee had no information from which to consider or revise its advice of 2003 in respect of the current seasonal limitation in Conservation Measure 42-01. It therefore recommended that these aspects of the conservation measure should be unchanged.

4.99 The Scientific Committee recommended the continuation of other aspects of Conservation Measure 42-01, pending the Commission decision on the proposal for an exploratory bottom trawl fishery for *C. gunnari* in Subarea 48.3. If approved by the Commission, the prohibition of bottom trawling contained in Conservation Measure 42-01 would need to be lifted. The Scientific Committee's views on this proposal are contained in paragraphs 4.127 to 4.134.

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

4.100 The Fishery Report for *C. gunnari* in Division 58.5.2 is provided in Annex 5, paragraphs 5.243 to 5.268.

4.101 The Scientific Committee noted the trawl fishery for *C. gunnari* in Division 58.5.2 has caught 51 tonnes from a catch limit of 292 tonnes in the 2003/04 fishing season (Conservation Measure 42-02). Historical reported catches along with the respective catch limits and number of vessels active in the fishery are shown in Annex 5, Table 5.55.

4.102 The assessment of yield followed the short-term projection method updated with catches for the 2003/04 season and results of the 2004 survey (see Annex 5, paragraphs 5.258 to 5.260).

4.103 The Scientific Committee noted there was a substantial increase in recruitment for age-2 fish, but a lack of age-3 fish in the length-frequency plots. Dr Constable noted that this is consistent with age structure and estimates of recruitment from previous years, and should be expected. Prof. Beddington noted with concern that there may be problems with the CMIX program in fitting and decomposing age groups, and recommended that sensitivities in the CMIX program be evaluated. Dr Constable agreed with the need to examine the issues raised by WG-FSA with respect to CMIX, and recommended that CMIX be investigated as part of the work of WG-FSA-SAM. The Scientific Committee agreed that simulation approaches should be adopted for evaluation of all CCAMLR methods.

4.104 The Scientific Committee noted that the current method for estimating an annual catch limit is appropriate in the absence of alternative approaches, but noted that there may be other methods that could be explored in the future. The Scientific Committee requested that WG-FSA give further consideration to the development of alternative assessment methods that would provide for a robust long-term management procedure.

4.105 Prof. Fernholm drew the attention of the Scientific Committee to the comment that by-catch of benthos in Division 58.5.2 monitored by observers is much lower in areas that have subsequently become the main fishing grounds (Annex 5, paragraph 5.212). Dr Sushin requested that scientific data be presented that further elucidated this finding. Dr Constable noted that data on by-catch has been supplied to CCAMLR, and is available for WG-FSA to analyse.



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

4.106 The Scientific Committee recommended that the catch limit for *C. gunnari* should be revised to 1 864 tonnes for the period from 1 December 2004 to 30 November 2005.

4.107 The remaining provisions of Conservation Measure 42-02/B should be carried forward to the 2004/05 season.

*C. gunnari* at Kerguelen Islands (Division 58.5.1)

4.108 No new information has been provided to WG-FSA on icefish in Division 58.5.1.

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

4.109 The Scientific Committee recommended that the fishery for *C. gunnari* within the French EEZ of Division 58.5.1 should remain closed in the 2004/05 season until information on stock status is obtained from a survey.

Other finfish fisheries

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

4.110 No surveys have been conducted during the 2003/04 season in these two areas, and there was no information available for which to revise the current prohibition of fishing.

Management advice (Subareas 48.1 and 48.2)

4.111 The Scientific Committee recommended that Conservation Measures 32-02 and 32-03 should remain in force.

*D. eleginoides* at South Sandwich Islands  
(Subarea 48.4)

4.112 No new information was made available to WG-FSA for *D. eleginoides* in Subarea 48.4 (South Sandwich Islands) on which to base an assessment.

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

4.113 The Scientific Committee recommended that Conservation Measure 41-03, paragraph 7, be carried forward for 2004/05.

*Electrona carlsbergi* (Subarea 48.3)

4.114 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)

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

New and exploratory fisheries

New and exploratory fisheries in the 2003/04 season

4.116 Ten conservation measures relating to 12 exploratory fisheries were in force during the 2003/04 season, but fishing only occurred in respect of five conservation measures and five fisheries. There was no reported fishing activity with respect to the following areas: Subarea 48.6 south of 60°S, Divisions 58.4.1 and 58.4.3a (Annex 5, Table 5.1).

4.117 Fishing occurred only in the following areas: Subarea 48.6 north of 60°S, Divisions 58.4.2 and 58.4.3b, and Subareas 88.1 and 88.2. Fishery Reports have been prepared only for Subareas 88.1 and 88.2, as these were the only areas with significant levels of fishing activity.

4.118 In most of the active exploratory fisheries, the fishing effort was low and the catches reported were relatively small. As has been the case for the last few years, the notable exception was the exploratory fishery for *Dissostichus* spp. in Subarea 88.1 conducted under Conservation Measure 41-09. A total of 2 166 tonnes of *Dissostichus* spp. was taken against a catch limit of 3 250 tonnes (see Annex 5, Table 5.2).

4.119 The catch limit of 375 tonnes was taken by three New Zealand-flagged vessels in the exploratory *Dissostichus* spp. fishery in Subarea 88.2 (see Annex 5, Table 5.3).

4.120 The exploratory fishery in Division 58.4.2 was undertaken by one Australian-flagged vessel which caught 20 tonnes of *Dissostichus* spp. against a catch limit of 500 tonnes. Fishing was carried out in SSRUs D and E.

4.121 An exploratory fishery was undertaken in Division 58.4.3b for the first time by one Australian-flagged vessel which caught 7 tonnes of *Dissostichus* spp. against a catch limit of 300 tonnes.

4.122 The exploratory fishery in Subarea 48.6 (north of 60°S) was undertaken by one Japanese-flagged vessel which caught 7 tonnes of *Dissostichus* spp. against a catch limit of 455 tonnes.

4.123 Conservation Measure 41-01 requires all vessels to carry out a research plan which includes completing a minimum number of research sets on entering an SSRU, and to tag and release *Dissostichus* spp. at the rate of one toothfish per tonne of green-weight catch throughout the season. WG-FSA had requested advice from the Scientific Committee regarding presentation of these data on research sets and tagging rates.

4.124 The Scientific Committee agreed that it was unable to respond fully at this meeting, but noted that it would be useful if WG-FSA could at least present time series of CPUE data based on research sets that could be compared with similar time series of data from normal commercial fishing. In this context, the methodology suggested in Annex 5, paragraph 5.20, may allow some progress to be made

#### Notifications for new and exploratory fisheries in the 2004/05 season

4.125 A summary of new and exploratory fisheries notifications for 2004/05 is given in Table 1 of SC-CAMLR-XXIII/BG/3. No notifications have been received from Members for exploratory fisheries in closed areas. No notifications have been made for new fisheries.

4.126 Thirteen members submitted a total of 26 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.

#### Notification for exploratory bottom trawling in Subarea 48.3

4.127 There was one notification for an exploratory bottom trawl fishery for *C. gunnari* in Subarea 48.3 (CCAMLR-XXIII/16). As described in Annex 5, paragraph 5.28, the motivation behind the notification was to find a method of fishing, combining both bottom and midwater trawls, that would reduce the impact of the icefish fishery on birds while minimising, as far as possible, impacts on benthos.

4.128 Dr Kock noted that the seabird by-catch in the current fishery, while of concern, was not so large that it posed a conservation threat to the species concerned. He also noted that the by-catch was concentrated on a small number of hauls on some vessels, usually on trawls where some problem occurred during setting and hauling, leading the pelagic trawl to remain unduly long at the surface. Further, some trawlers caught no birds while others took a number of birds. Thus the potential exists for reducing seabird by-catch by improving current fishing methods. In contrast, use of bottom trawl gear would inevitably have at least a local effect on the benthos, especially the epi-benthos, and would result in an increased by-catch of other species (e.g. *Chaenocephalus aceratus*, *Gobionotothen gibberifrons*). In particular, he drew attention to the nest guarding strategy used by *C. aceratus*, which would lead this species to be potentially impacted by bottom trawls that damage the seabed in the months following spawning. He therefore advised against resumption of bottom trawling.

4.129 Dr Jones reiterated his concerns about resumption of bottom trawling expressed in Annex 5, paragraph 5.32, noting that a recent research cruise (WG-FSA-04/61) had demonstrated sponge-dominated communities and that the western part of the shelf contained invertebrate communities that included glass sponges and corals. In his view, it is not known whether or not a switch to bottom trawling would actually reduce the seabird by-catch, whereas it is well known that use of a bottom trawl will damage the benthos and lead to by-catch of other fish species.

4.130 Dr Sullivan noted that the principal reason for undertaking the exploratory bottom trawl fishery was to attempt to mitigate the seabird by-catch. In his view, it would be preferable that further trials of mitigation measures were undertaken using the current pelagic trawl gear, rather than initiating bottom trawling operations that inevitably would carry with it the risk of by-catch of both benthos and other fish species.

4.131 Dr Marschoff concurred with this view and noted that there was a worldwide trend towards the elimination of bottom trawling.

4.132 In response, Dr D. Agnew (UK) drew attention to Annex 5, paragraphs 5.28 and 5.29. He reiterated that the reason for the exploratory fishery proposal (CCAMLR-XXIII/16) was to explore alternative methods of fishing for icefish in Subarea 48.3 that might reduce the incidental mortality of seabirds whilst minimising impacts on other ecosystem components such as benthos and by-catch fish species. He thanked WG-FSA and the Scientific Committee for their comments and noted that the research and data collection plan would be modified following the suggestions made by WG-FSA. The area for exploratory bottom trawling was defined so that known areas of high benthic vulnerability would be avoided, and data on benthic interactions would be collected from as wide an area as possible so as to identify areas where impacts on benthos might be low. This would provide the essential data that would enable an assessment of the future potential for bottom trawling to both reduce seabird mortality and minimise benthic impacts, to be made next year (Annex 5, paragraphs 5.37 and 5.38). Currently such data are unavailable to WG-FSA.

4.133 In answer to the issues raised by Drs Kock, Sullivan, Jones and Marschoff, Dr Agnew confirmed that the exploratory fishery would take place earlier than April and so would not disrupt the spawning behaviour of *C. aceratus*. He noted that fish by-catch would be regulated according to Conservation Measure 33-01, which is already in place. Furthermore, although Dr Kock may not consider that catches of 80–100 seabirds in the midwater trawl fishery was cause for concern, it was still worth exploring alternative fishing methods that might reduce these levels of seabird by-catch.

4.134 Finally, Dr Agnew drew attention to the fact that the Commission currently sanctions a bottom trawl fishery for icefish in Division 58.5.2. Annex 5, paragraphs 5.211 and 5.268 reported that the potential impacts of fishing gear on benthic communities in Division 58.5.2 are limited by the strategy of fishing trawling gear lightly or just off the bottom coupled with a marine reserve. The UK proposal (CCAMLR-XXIII/16) notified the intent to use exactly the same gear and fishing techniques in Subarea 48.3 as are used in Division 58.5.2, which should have similarly negligible effects on benthos. In Division 58.5.2, large areas of ground sensitive to the effects of bottom trawling are protected (Annex 5, paragraph 5.211). The UK proposal also clearly identified large areas of the South Georgia and Shag Rocks shelf,

comprising 75% of the fishable area in Subarea 48.3, which would be protected from bottom trawling. Therefore, and similar to the situation in Division 58.5.2, the size and number of grounds that could be trawled this year would be small.

#### Notifications of exploratory fisheries for *Dissostichus* spp.

4.135 Notifications for exploratory fisheries for *Dissostichus* spp. in 2004/05 are summarised, grouped by subarea or division, along with the numbers of vessels, in Table 2 of SC-CAMLR-XXIII/BG/3. All notifications were submitted by the deadline. As was the case last year, there were multiple notifications of exploratory fisheries for *Dissostichus* spp. for several subareas or divisions.

4.136 There has been a large number of notifications for fishing in Subareas 88.1 (10 notifications for up to 21 vessels), 88.2 (five notifications for up to 10 vessels) and Subarea 48.6 and Divisions 58.4.1, 58.4.2 and 58.4.3b (between 7 and 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.

4.137 If a large number of vessels actually undertake exploratory fishing, this may lead to problems with the standardisation of CPUE data for assessments and it may also reduce the effectiveness of the move-on rule for by-catch.

4.138 It is likely that there will also be additional administrative problems in determining closure dates for fishing in SSRUs when many vessels are fishing simultaneously in a subarea or division (see CCAMLR-XXIII/38).

4.139 WG-FSA-04/18 summarised a proposal by the Delegation of Japan to extend the fishing season for the exploratory fishery for *Dissostichus* spp. in Subarea 48.6 north of 60°S in the 2004/05 season. Conservation Measure 41-04 (2003) currently defines the fishing season as being from 1 March to 31 August. Noting that an extension to the fishing season would not conflict with the ad hoc WG-IMAF assessment (Annex 5, paragraphs 7.193 to 7.196 and Table 7.16), the Scientific Committee recommended that the fishing season for this region during 2004/05 be extended to cover the full year from 1 December 2004 to 31 November 2005.

#### Progress towards assessments of new and exploratory fisheries

4.140 The Scientific Committee was unable to develop management advice based on assessments of yield and is therefore unable to provide any new advice on catch limits for any of the exploratory fisheries.

4.141 Given the large number of notifications for 2004/05, the Scientific Committee reiterated the urgent need to develop a means for estimating abundance and providing

assessments of stock status for exploratory fisheries. In this context, it welcomed progress in the development of methods for monitoring abundance and estimating precautionary yields described in WG-FSA-04/36 and WG-FSA-SAM-04/8 (see also paragraph 4.152).

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

4.142 The Fishery Report for the exploratory fishery in Subareas 88.1 and 88.2 is given in Annex 5, paragraphs 5.50 to 5.91.

4.143 The fishery saw a steady expansion of effort from 1997/98 to 2000/01, a slight drop in 2001/02, followed by an increase in 2002/03, and an almost three-fold increase in 2003/04. The catch of *D. mawsoni* has shown a steadier increasing trend over the same period, peaking at 2 166 tonnes in Subarea 88.1 and 374 tonnes in Subarea 88.2 for the 2003/04 season. There has been a general trend towards fishing deeper over the course of the exploratory fishery, though in 2003/04 fishing was slightly shallower than in 2002/03.

4.144 Although the total catch was about 67% of the catch limit for Subarea 88.1, catch limits in the four SSRUs B, C, G and H (see Figure 4) were exceeded by 1.8, 2.2, 0.1 and 199 tonnes respectively. Heavy ice conditions restricted fishing south of 73°S. Consequently little catch was taken in SSRUs J–L. With the southern SSRUs closed by ice, the fishery was effectively closed from mid-March 2004.

4.145 It was noted that the catch limits were exceeded because of the rapid changes in fishing pattern, the late submission of catch and effort reports, difficulties in forecasting closures in SSRUs, time lags in reporting, small catch limits in some SSRUs, and communication problems between the Secretariat, some Members and vessels (CCAMLR-XXIII/38).

4.146 Analysis of the genetic diversity for *D. mawsoni* from Subareas 48.1, 88.1 and Division 58.4.2 found weak genetic variation between the three areas. For assessment purposes, WG-FSA agreed that Subareas 88.1 and 88.2 should be treated as a single stock unit (Annex 5, paragraph 5.63).

4.147 Referring to Annex 5, Figure 5.2, Dr Constable noted that, while the evidence for genetic differentiation was not strong, there were some indications that the Ross Sea and adjacent areas off continental Antarctica could be separated for management purposes. In this context he suggested that, as part of a precautionary approach, it may be preferable that SSRUs D, E and F were considered separately from the other SSRUs.

4.148 Dr Hanchet noted that to date SSRUs A, D, E and F have contributed little to catches in Subarea 88.1, and fish taken there tend to be smaller than in the rest of the subarea. However, in his opinion there was as yet insufficient evidence to draw conclusions on stock structure.

4.149 Dr K. Shust (Russia) agreed that there was not enough information to be definitive about stock structure and that for the moment the two subareas should be treated as a single stock.

4.150 The Scientific Committee requested that WG-FSA examine the stock structure in Subareas 88.1 and 88.2 in greater detail next year.

4.151 A standardised CPUE analysis of the three main fishing grounds in Subarea 88.1 showed no significant trend from 1998/99 to 2002/03, but showed a large decline in 2003/04 (Annex 5, Table 5.6). The decline in 2003/04 was thought to be related to a combination of extreme ice conditions and effects from a large number of vessels operating in a confined area.

4.152 It has not yet been possible to undertake a stock assessment for Subareas 88.1 and 88.2, but the Scientific Committee welcomed the development by New Zealand of an integrated assessment model for Subarea 88.1 (WG-FSA-04/36), which is able to analyse data on catch, CPUE, proportions-at-age in the catch, and tag–release and recapture data. It also noted that WG-FSA-SAM-04 had recommended that tag–recapture experiments be used in conjunction with experimental manipulation of effort to monitor toothfish and the wider ecosystem effects of toothfish fisheries.

4.153 The Scientific Committee expressed concern that three by-catch limits were exceeded in Subarea 88.1 during the 2003/04 exploratory fishery:

- (i) the limit of 124.2 tonnes for *Macrourus* spp. in SSRU I was exceeded by 141 tonnes (114%);
- (ii) the limit of 20 tonnes for *Macrourus* spp. in SSRU E was exceeded by 12.2 tonnes (61%);
- (iii) the limit of 20 tonnes for ‘all other combined species’ in SSRU I was exceeded by 1.8 tonnes (9%).

4.154 Three options for allocation of macrourid by-catch between SSRUs in Subarea 88.1 based on the current total catch limit of 520 tonnes were explored. For the 2004/05 season, it was agreed that the current SSRU by-catch limits should remain unchanged. For further discussion of this, see paragraphs 4.175 to 4.180.

4.155 Dr L. Pshenichnov (Ukraine) presented a proposal from Ukraine to amend a number of conservation measures that relate to exploratory *Dissostichus* spp. fisheries (SC-CAMLR-XXIII/7). The intention of the paper was to ensure that these conservation measures met the requirements of paragraph 2 of Conservation Measure 41-01, to ensure the spread of fishing throughout the geographic and bathymetric range of the stock.

4.156 In Subarea 88.1, some Members were concerned that Conservation Measure 41-09, which sets catch limits for every SSRU, had set a catch limit of zero in some SSRUs. They considered that alternative catch limits for SSRUs were possible, such that a nominal catch limit (e.g. 20 tonnes) could be set in areas which had not previously been fished but where there was adequate seabed suitable for fishing (e.g. SSRU D).

4.157 The Scientific Committee discussed the difference between areas within Subarea 88.1; west of 170°E along the continental coastal margin was considered very different from the Ross Sea area east of this longitude, where the exploratory fishery has concentrated to date. Dr Constable suggested the development of a consistent strategy for coastal Antarctic fisheries outside the Ross Sea was required.

4.158 The Scientific Committee recommended that to maximise the return of information from the tagging program in Subarea 88.1 to the east of 170°E, the 2003/04 catch limits for those SSRUs be retained in 2004/05.

4.159 In Divisions 58.4.1 (Conservation Measure 41-05) and 58.4.2 (Conservation Measure 41-11), a system of open and closed areas was put in place for the last fishing season. Some Members felt that the conservation measures provided adequate opportunities for fishing in these divisions, which had not been fully taken up (only one vessel fished in Division 58.4.2 in 2003 for a total catch of 20 tonnes). Others felt that all areas should be open to the exploratory fishery but with reduced catch limits for each SSRU.

4.160 Dr Pshenichnov advised that the Delegation of Ukraine proposed to discuss at the Commission meeting all the items contained in SC-CAMLR-XXIII/7 which were not discussed at the Scientific Committee.

4.161 The Scientific Committee noted that there were many issues that the Commission would need to consider in managing new and exploratory fisheries, including: (i) ensuring the development of a fishery does not outpace the Scientific Committee's ability to provide assessments and advice so that the Commission can achieve its objectives; (ii) ensuring that activities do not prejudice future options for the Commission, including conservation and rational use; and (iii) providing the ability to detect changes in the ecosystem arising from fishing.

#### Management advice

4.162 The Scientific Committee reiterated the necessity for Members fishing in exploratory fisheries to ensure that the required research sets are completed (Conservation Measure 41-01) and submitted to the Secretariat in a timely and accurate format. In addition, *Dissostichus* spp. should be tagged and data submitted in accordance with Conservation Measure 41-01. All tagging should be conducted according to the revised tagging protocol.

4.163 For high-latitude areas with narrow continental shelves, the Scientific Committee recommended that the existing depth limit should be retained in order to avoid impact on benthic communities in shallower waters. It would also provide opportunities to better understand and assess the potential effects of fishing before it occurs throughout the area. In this respect the Scientific Committee recommended the extension of the approach from Division 58.4.1 into Division 58.4.2.

4.164 A large number of notifications was received for exploratory fisheries in 2004/05 in Subareas 48.6, 88.1 and 88.2 and Divisions 58.4.1, 58.4.2 and 58.4.3b. Large numbers of vessels fishing in a particular SSRU may lead to difficulties with the standardisation of CPUE data for assessments and may also reduce the effectiveness of the move-on rule to limit by-catch in the fishery (Annex 5, paragraphs 6.72 and 6.73).

4.165 As indicated in CCAMLR-XXIII/38, there are additional administrative problems in determining closure dates for fishing in SSRUs when many vessels are fishing simultaneously in a subarea or division.



4.166 The Scientific Committee noted that the number of vessels participating in the Subarea 88.1 toothfish fishery had increased substantially in the 2003/04 season, and had the largest number of vessels fishing in any of the CCAMLR statistical areas in this season. The Scientific Committee reiterated the urgent need for data that will lead towards a formal assessment, and welcomed the progress with the tagging program and the development of an integrated stock assessment model. Because of the potential importance of tagging data for stock assessments in this subarea, it assigned a very high priority to carrying out further mark-recapture experiments.

4.167 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. However, for Subarea 88.1, the Scientific Committee had agreed that the current SSRU by-catch limits should remain unchanged (paragraph 4.154) and it also recommended the 2003/04 catch limits for *Dissostichus* spp. east of 170°E be retained in 2004/05 (paragraph 4.158).

4.168 The Scientific Committee reiterated the urgent need to develop a means for estimating abundance and providing assessments of stock status for all exploratory fisheries.

4.169 Advice on incidental mortality of seabirds in relation to new and exploratory fisheries is given in paragraph 5.23.

4.170 The Scientific Committee was unable to reach consensus on its views regarding the exploratory bottom trawl fishery for *C. gunnari* in Subarea 48.3 (paragraphs 4.127 to 4.134).

#### Fish and invertebrate by-catch

4.171 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.

A work plan was agreed which addressed these issues as described below.

#### Assessment of the status of by-catch species or groups

4.172 The macrourids and rajids were identified as priority by-catch taxa for which assessments of status are required (SC-CAMLR-XXI, Annex 5, paragraphs 5.151 to 5.154).

4.173 The Scientific Committee endorsed the advice of WG-FSA that there was insufficient information on which to base an estimate of  $\gamma$  for *A. georgiana* in Subarea 88.1 (Annex 5, paragraphs 6.4 and 6.5). The Scientific Committee was also in agreement that there was currently no new information with which to update the estimates of  $\gamma$  for macrourids (Annex 5, paragraphs 6.6 and 6.16 to 6.18).

4.174 Mean standardised catch rates for *M. whitsoni* and *B. eatoni* were calculated from two SSRUs in Subarea 88.1 (Annex 5, Table 6.1) based on data from the NZ BioRoss survey. The information was also used to estimate  $B_0$  for *M. whitsoni* in two SSRUs in Subarea 88.1. The biomass estimate rates for *M. whitsoni* in these two SSRUs are given in Annex 5, paragraph 6.11. The Scientific Committee, however, agreed that given the low number of survey tows these estimates of yield should not be used for management advice (Annex 5, paragraphs 6.7 to 6.14).

#### Management of by-catch limits by SSRU in Subarea 88.1

4.175 By-catch limits for macrourids were exceeded in SSRU E and I in the 2003/04 fishery, even though the total macrourid by-catch was only 69% of the subarea catch limit (Annex 5, paragraphs 5.77 and 6.22). Considerable variation between SSRUs and mean macrourid CPUE was found in Subarea 88.1 (Annex 5, paragraph 6.23).

4.176 Allocation of catch limits as the product of the proportional CPUE and the proportional seabed area in SSRUs which are open for fishing was proposed (WG-FSA-04/20) but the conclusion reached was that it was not clear if this approach provided better catch limits than using the existing rule.

4.177 The Scientific Committee encouraged further work to examine by-catch limits in SSRUs in Subarea 88.1 (SC-CAMLR-XXII, paragraph 4.199).

4.178 The Scientific Committee noted that WG-FSA emphasised that it had no additional information to revise scientific advice on the overall catch limit, which is currently set at 16% of the *Dissostichus* spp. catch limit. This was derived from the by-catch limit for *Macrourus* spp. in Division 58.5.2 which was 16% of the catch limit for *Dissostichus* spp. in 2002/03 (CCAMLR-XXI, paragraph 11.53). Three options for the allocation of macrourid by-catch between SSRUs in Subarea 88.1 were developed and are listed below. Indicative catch limits under all three options (Annex 5, Table 6.2) were based on the 2003/04 macrourid catch limit of 520 tonnes.

##### Option 1 – status quo

16% of the catch limit of *Dissostichus* spp. or 20 tonnes whichever is greater.

##### Option 2 – CPUE proportional limits

Catch limits as the product of the proportional CPUE and the proportional seabed area in SSRUs which are open for fishing (WG-FSA-04/20).

##### Option 3 – fixed SSRU limits

Low catch limits (e.g. 20 tonnes) in northern and southern SSRUs where few rattails occur. Higher catch limits (e.g. 150 tonnes) in the other SSRUs.

4.179 The Scientific Committee recommended that the move-on rule requiring vessels to move to another location at least 5 n miles distant if the by-catch of any one species is equal to or greater than 1 tonne (Conservation Measure 33-03) should be retained for any of the proposed options.

4.180 The Scientific Committee discussed the advantages and disadvantages of these three options (Annex 5, paragraph 6.26) and recommended that the status quo option remain for the 2004/05 season, or until additional information is available for a revised assessment.

#### Estimation of by-catch levels and rates

4.181 By-catch information from STATLANT data, fine-scale data (haul-by-haul), and catch and effort data (reported by vessel in 5-day, 10-day or monthly periods) was compared in 2003 and WG-FSA concluded that fine-scale data is the most comprehensive of the three datasets for estimating levels of total removals of by-catch (SC-CAMLR-XXII, Annex 5, paragraph 5.283).

4.182 Estimates of total by-catch removals by area for the 2003/04 fishing season are presented for longline fisheries (Annex 5, Table 6.3) and trawl fisheries (Annex 5, Table 6.4). In general, rajid (skate and ray) by-catch during 2003/04 was considerably lower than macrourid by-catch in all areas, with the exception of Division 58.5.2. However it is important to note that the estimates for rajids are conservative and do not include those individuals cut or lost from longlines.

4.183 Discrepancies between estimates of total removals based on fine-scale data extracted during WG-FSA and those presented in CCAMLR-XXIII/38, WG-FSA-04/20 and 04/68 were noted by the Working Group and it urged the Secretariat to develop standard methods to summarise by-catch removals by area and species prior to WG-FSA-05. It also recommended that the by-catch subgroup liaise intersessionally with the Secretariat to try and improve the reporting, transferral and extraction of by-catch data.

#### Identification of levels of risk

4.184 WG-FSA considered the possibility of producing risk assessments for fish and invertebrate by-catch species in a similar way to the assessment of seabirds.

4.185 The Scientific Committee noted that defining risk was problematic but considered it possible to categorise risk for marine species. This 'risk categorisation' might include (but not be restricted to) consideration of:

- (i) life history characteristics which would make a species vulnerable to fishing activities (e.g. growth rates, age at maturity, habitat range, spawning behaviour, diet, trawl or longline catchability and co-occurrence with exploited species);
- (ii) the overlap between the distribution of the species and fishing or other human activities. The overlap could be considered on a proportional basis if the distribution is known. When the distribution is not known, then it would be noted where overlap exists;
- (iii) any assessments or other information about population status;
- (iv) conservation measures in place to avoid and mitigate by-catch.

4.186 The Working Group prepared a summary table on the risk assessment for the sleeper shark (*Somniosus antarcticus*) in Division 58.5.2 (Annex 5, Table 6.5). This table was extracted from WG-FSA-03/69 and serves as an example to encourage Members to collate information intersessionally to allow risk categorisation for other major by-catch species in the CCAMLR Convention Area.

#### Consideration of mitigation measures

4.187 The Working Group compared by-catch rates by vessel in the 2003/04 season and the analysis suggested that the use of the Spanish longline system, as opposed to autolining, may reduce by-catch rates of *Macrourus* spp. in Subarea 88.1 (Annex 5, Figure 6.1b). There was, however, little difference in mean relative by-catch of rajids between the two gear configuration in Subarea 88.1 (Annex 5, Figure 6.1a). Understanding why some vessels catch more or less by-catch may yield information that could be used to develop mitigation and avoidance measures for by-catch.

4.188 At WG-FSA-04, the Working Group recommended that, wherever possible, vessels should cut all rajids from their lines whilst still in the water, except on the request of the observer during the observer's biological sampling period (Annex 5, paragraph 6.75).

4.189 WG-FSA had indicated to the Scientific Committee that it may be difficult to detect tagged rays if they are cut off at the sea surface rather than being brought on board. Depending on sea state, identification of the tags may be possible when the rajids break the surface. If the tag identification rate is low, WG-FSA suggested a relaxation of the requirement to cut all rajids from the line on specified vessels and/or for specified time periods.

4.190 The Scientific Committee noted that where there are a large number of vessels operating within a new and exploratory fishery, the 'move-on rule' (paragraph 4 of Conservation Measure 33-03) may be ineffective to mitigate by-catch when another vessel moves into the area vacated by a vessel forced to move after exceeding the by-catch limit.

4.191 The Scientific Committee noted that some conservation measures, including Conservation Measure 33-03, contain by-catch move-on provisions originally based on the trawl method of fishing. The definitions currently used are not appropriate to define the operations of a longline vessel. The Scientific Committee recommended that a more appropriate definition of the path of a longline is a line between the position of the first anchor on the line being deployed and the position at which the last anchor of that set is deployed.

4.192 The Scientific Committee suggested the following modification be made to appropriate conservation measures:

'...if, in the course of a directed fishery, the by-catch of any one species is equal to or greater than x tonnes in any one haul or set, then the fishing vessel shall move to another location at least 5 n miles distant. The fishing vessel shall not return to any point within 5 n miles of the location where the by-catch exceeded x tonnes for a period of at least five days. The location where the by-catch exceeded x tonnes is defined as the path followed by the fishing vessel. For a trawl the path is defined from the point at which the fishing gear was first deployed from the fishing vessel to the

point at which the fishing gear was retrieved by the fishing vessel. For a longline the path is defined from the point at which the first anchor of a set was deployed to the point at which the last anchor of that set was deployed.’

4.193 In order to adequately assess by-catch levels and rates, it is necessary to have accurate reporting of information on the total removals of by-catch taxa at a fishery level. The Scientific Committee noted the concern of WG-FSA on the paucity of information about rajids lost from longlines and that observer logbooks and forms have been revised to improve by-catch data information due to uncertainty by observers about by-catch data recording protocols.

#### Management advice

4.194 There were no new assessments of by-catch species in 2004.

4.195 There was no new information to update the estimate of precautionary by-catch limit of 360 tonnes for *M. carinatus* in Division 58.5.2 (SC-CAMLR-XXII, paragraph 4.134).

4.196 There was no new information to update the estimates of precautionary yield for *Macrourus* spp. of 26 tonnes in Division 58.4.3a and 159 tonnes in Division 58.4.3b (SC-CAMLR-XXII, Annex 5, paragraph 5.259).

4.197 The Scientific Committee agreed that trawl survey estimates of *M. whitsoni* in Subarea 88.1 did not provide reliable estimates of standing stock because of the small number of tows, which did not provide a representative sample of the overall area.

4.198 In the absence of assessments for by-catch species, the Scientific Committee recommended that precautionary measures, which place upper limits on by-catch and reduce the potential for localised depletion, be adopted.

4.199 The Scientific Committee recommended that future work include research towards generating population parameters and estimates of standing stock for macrourids and rajids.

4.200 The Scientific Committee suggested that the development of avoidance and mitigation measures for by-catch species be given high priority.

4.201 The Scientific Committee considered alternative options for managing macrourid by-catch by SSRU in Subarea 88.1 (Annex 5, paragraph 6.26). It was agreed that Option 1, status quo (16% of the catch limit of *Dissostichus* spp. or 20 tonnes whichever is the greater), should remain in force. The Scientific Committee agreed more data on distribution and abundance of *Macrourus* spp. in Subarea 88.1 is needed in order to revise allocation of catch limits between SSRUs.

4.202 It was recommended by the Scientific Committee that, at the next meeting of WG-FSA, time be allocated to discussing issues of potential mutual interest and importance to WG-FSA and WG-IMAF. Such issues should include:

- (i) assessment of the status of by-catch species and groups;

- (ii) estimation of by-catch levels and rates;
- (iii) assessment of risk, both in terms of geographical areas and population demography;
- (iv) mitigation measures;
- (v) by-catch reporting.

4.203 The Scientific Committee strongly reiterated the need for accurate reporting of by-catch in all data formats and recommended that estimates of total removals by area be summarised by the Secretariat for all by-catch species prior to WG-FSA-05.

4.204 The Scientific Committee noted that IUU fishing is also likely to result in mortality of by-catch species. Therefore the estimates of total removals presented here should be treated as minimum estimates.

4.205 Members were encouraged by the Scientific Committee to collate information to allow risk characterisation for major by-catch species in the CCAMLR Convention Area.

4.206 The Scientific Committee recommended that further work should be carried out in the intersessional period to compare by-catch levels arising from different gear configurations and to determine whether this information could be used to develop mitigation and avoidance measures for by-catch.

4.207 It was recommended that vessels be advised that, where possible, they should cut all rajids from their lines whilst the rajids were still in the water, except on the request of the scientific observer.

4.208 The Scientific Committee noted that a relaxation of the above requirement to cut all rajids from lines whilst still in the water may be necessary so that tag and recapture programs could be conducted in longline fisheries if the detection probability of tagged rajids at the sea surface is low. Members and observers were requested, where feasible, to provide a report to the Secretariat on methods or strategies of fishing that minimise non-target fish by-catch.

4.209 WG-FSA requested that the Scientific Committee note the potential impact of competition between vessels in new and exploratory fisheries on by-catch mitigation (Annex 5, paragraph 6.73).

#### Crab resources

4.210 No target fishery for stone crabs was carried out in 2002/03 or 2003/04, and no proposal for the harvest of crabs has yet been received by CCAMLR for the 2004/05 season.

#### Advice to the Commission

4.211 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)

4.212 No target fishery for squid (*Martialia hyadesi*) was carried out in 2002/03 or 2003/04, and no new request has been submitted to CCAMLR to continue exploratory fishing for this species in 2004/05.

### Advice to the Commission

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