

**REPORT OF THE WORKING GROUP ON
FISH STOCK ASSESSMENT**
(Hobart Australia, 7 to 17 October 2002)

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**REPORT OF THE WORKING GROUP
ON FISH STOCK ASSESSMENT**
(Hobart, Australia, 7 to 17 October 2002)

OPENING OF THE MEETING

1.1 The meeting of WG-FSA was held in Hobart, Australia, from 7 to 17 October 2002. The Convener, Dr I. Everson (UK), welcomed participants.

ORGANISATION OF THE MEETING AND ADOPTION OF THE AGENDA

2.1 Dr Everson outlined the work program for the meeting. A new work format had been developed in consultation with Members during the intersessional period (SC CIRC 02/01 and 02/18 and COMM CIRC 02/56). Key elements of this new approach were:

- a reorganisation of the meeting format, so that information essential to the assessments is considered during days 1 and 2 of the meeting in order to allow assessments to be run and completed during the first week;
- a reorganisation of the meeting report, so that background information and advice on future work of WG-FSA is removed from the report and will not be translated. They will be disseminated as background papers to the Scientific Committee which will reduce the size of the report of the Working Group and improve readability and access to information and advice necessary to the Scientific Committee;
- the development of species profiles for *Champscephalus gunnari* and *Dissostichus eleginoides* – these reference documents contain species parameters which will be reviewed and updated by WG-FSA as new information becomes available; and
- development of an assessment manual to be reviewed and updated each year.

2.2 The reorganisation of the meeting and intersessional work has consequential effects on the way in which the information discussed at the meeting is held and made available to Members. Dr Everson outlined his plans to achieve this. For the current year there would be an adopted report to the Scientific Committee and adopted background papers also to the Scientific Committee. These would be bound separately. During the intersessional period, the information in the background papers would be assimilated into the Species Profiles and Assessment Methods documents, both of which would be made available on the CCAMLR website. Reports of future meetings would consist of a report to the Scientific Committee and revisions to the Species Profiles and Assessment Methods. It was hoped that this process would lead to shorter reports and at the same time ensure that all relevant information was available to Members. The Working Group accepted this proposal.

2.3 Background information supporting the report of WG-FSA can be found in document SC-CAMLR-XXI/BG/27. The sections are arranged in agenda item order and numbered accordingly.

2.4 WG-FSA thanked Dr Everson for leading this initiative, and for his efforts in developing the extensive species profiles for *C. gunnari* and *D. eleginoides*. Dr A. Constable (Australia) was thanked for his work in the development of the assessment manual.

2.5 WG-FSA noted the successful electronic submission of meeting papers: 79 papers had been submitted by the deadline of 28 September (one week prior to the start of the meeting). WG-FSA thanked the Secretariat, and in particular Mrs R. Marazas, the Website and Information Services Officer, for promptly processing all papers and loading these onto the CCAMLR website.

2.6 WG-FSA agreed that a one-week deadline was the minimum amount of time required for participants to:

- read papers and prepare for the meeting;
- discuss tabled papers with colleagues prior to the meeting; and
- clarify with colleagues issues arising, including language difficulties.

2.7 WG-FSA also agreed that only papers submitted prior to the deadline would be accepted at future meetings, and only factual corrections to submitted papers would be permitted after the deadline. Accordingly:

- minor revisions to one paper were accepted;
- an addendum describing a major extension of a submitted paper was referred to the assessment group for consideration in the intersessional period; and
- one paper submitted after the deadline was rejected.

2.8 The Provisional Agenda was discussed and it was agreed to add the following subitems:

- 3.1.3 'Data Access';
- 5.3.2 '*Champtocephalus gunnari* South Shetlands (Subarea 48.1)';
- 5.3.3 'Myctophids South Georgia (Subarea 48.3)';
- 5.3.4 'Crabs South Georgia (Subarea 48.3)';
- 5.3.5 'Squid South Georgia (Subarea 48.3)';
- 5.3.6 'Other fisheries'; and
- 13.3 'Publication matters'.

Consequently, existing subitems 'Other' and 'Other matters' were renumbered as 3.1.4 and 13.4 respectively.

2.9 With these changes, the Agenda was adopted.

2.10 The Agenda is included in this report as Appendix A, the List of Participants as Appendix B and the List of Documents presented to the meeting as Appendix C.

2.11 The report was prepared by Dr D. Agnew (UK), Mr B. Baker (Australia), Dr M. Belchier (UK), Dr S. Candy (Australia), Dr M. Collins (UK), Dr A. Constable (Australia), Prof. J. Croxall (UK), Dr R. Gales (Australia), Dr S. Hanchet (New Zealand), Dr R. Holt (USA), Mr C. Jones (USA), Dr G. Kirkwood (UK), Dr K.-H. Kock (Germany), Ms J. Molloy (New Zealand), Dr D. Nel (South Africa), Dr R. O'Driscoll (New Zealand),

Dr D. Ramm (Secretariat), Dr K. Reid (UK), Ms K. Rivera (USA), Dr E. Sabourenkov (Secretariat), Mr N. Smith (New Zealand), Dr G. Tuck (Australia), Ms E. van Wijk (Australia), Mr B. Watkins (South Africa) and Mr R. Williams (Australia).

REVIEW OF AVAILABLE INFORMATION

Data Requirements Specified in 2001

Development of the CCAMLR Database

3.1 The Data Manager reported that the redesign of the trawl survey components of the survey database had now been completed. The new structure is event rather than trawl based, allowing the inclusion of other data such as that derived from CTD and acoustic surveys. The database now includes data from 17 surveys, including all UK and Russian surveys in Subarea 48.3 and US and German surveys in Subareas 48.1 and 48.2.

3.2 The Working Group expressed its pleasure that this revision has now been undertaken, and urged the Secretariat to make every effort to complete the loading of the data from all surveys reported to CCAMLR before the next meeting of WG-FSA.

3.3 The Working Group reviewed the design documents that detailed the schema for the new survey database. It was noted that the new design was based on survey events (e.g. trawl tow, CTD cast, acoustic transect) rather than a survey haul (i.e. trawl tow). It was agreed that the new schema fulfils the current requirements for a CCAMLR survey database. It was also noted that the new database fulfilled the data analysis requirements for the current meeting.

3.4 It was agreed that the Secretariat would not be required to develop an at-sea database. Rather, individual country databases would continue to be used, and data transferred to the Secretariat Data Centre is the current procedure. The Secretariat will provide a new protocol for this data exchange, mediated by a series of interface programs developed separately for each national database.

3.5 The new protocol would cover the format of the data, the method of transmission and methods for verifying and validating the data. It was agreed that the protocol will be developed by Secretariat staff in liaison with nominated responsible IT staff from each of the Member countries.

3.6 The Secretariat should provide design documents and specifications to Member countries, to allow them to create software that exports data from their databases in the agreed format. This format is yet to be decided on, but is likely to be either as a MS-Access 2000 database, or a platform-independent format, such as extensible mark-up language (XML). The Secretariat would develop software to verify and validate data received, and to import the data into the survey database.

3.7 Modifications to national databases will involve changes to the export software. Modifications to the CCAMLR database may additionally involve changes to national databases if such data are not already collected nationally. The Working Group urged Members to consider the data requirements in the new CCAMLR survey database, and ensure that all essential data are recorded and submitted to the Secretariat.

3.8 Errors in the databases are often noted during the course of analyses conducted either at working groups or during intersessional work. At the moment there is no mechanism for correcting the database once these are found. The Data Manager was requested to create such a mechanism before WG-FSA-03, and data originators were urged to provide updates and corrections to CCAMLR.

Data Access and Software Updates

3.9 The Working Group recognised that there may be concerns about the general accessibility of confidential data during working group meetings. At the same time there is a need to enable access to the full data so that the work of the group is not impeded. The following procedure should be followed at WG-FSA meetings:

- participants wishing to undertake analyses should continue to make requests for data to the Data Manager;
- requested data will be made available to participants in password-protected files; and
- at the end of the working group meeting, all data used for analyses will be archived, again in password-protected files.

3.10 Considerable difficulty was experienced with the wide variety of versions of software and operating systems on participants' computers. Whilst recognising that the Secretariat attempted to maintain its systems with the latest versions of software and operating systems, the Working Group requested that the Secretariat retain some older versions of operating systems also, especially of programs that are not particularly backwards compatible.

Fisheries Information

Catch, Effort, Length and Age Data Reported to CCAMLR

3.11 Eight fisheries were carried out under conservation measures in force:

- trawl fishery for *Euphausia superba* in Area 48;
- trawl fishery for *C. gunnari* in Subarea 48.3;
- longline and pot fishery for *D. eleginoides* in Subarea 48.3;
- pot fishery for crab in Subarea 48.3;
- trawl fishery for *C. gunnari* in Division 58.5.2;
- trawl fishery for *D. eleginoides* in Division 58.5.2;
- exploratory longline fishery for *Dissostichus* spp. in Subarea 88.1; and
- exploratory longline fishery for *Dissostichus* spp. in Subarea 88.2.

3.12 In addition, five other fisheries were carried out in EEZs within the Convention Area in the 2001/02 season:

- trawl fishery for *D. eleginoides* in Division 58.5.1 (French EEZ);
- longline fishery for *D. eleginoides* in Division 58.5.1 (French EEZ);
- longline fishery for *D. eleginoides* in Subarea 58.6 (French EEZ);

- longline fishery for *D. eleginoides* in Subarea 58.6 (South African EEZ); and
- longline fishery for *D. eleginoides* in Subarea 58.7 (South African EEZ).

3.13 Catches of target species by fishing season are reported in Table 3.1. Length data have been reported from all fisheries by observers.

Estimates of Catch and Effort from IUU Fishing

3.14 Considerable confusion arises in examining data on total removals because of the varying time periods over which data are available – split-year (July–June), fishing season (December–November) and calendar year (January–December). To simplify the presentation of these data, it had been agreed by the Scientific Committee to standardise all calculations to fishing season. The Secretariat therefore converted the data in WG-FSA-02/81 (which followed a similar form to SC-CAMLR-XX, Annex 5, Tables 3 to 8) to fishing season using the following methods (Tables 3.2 and 3.3):

- for reported catches, STATLANT data were used for past seasons, and catch and effort reports were used for the current season (unless otherwise indicated);
- for estimates of IUU catch, catch was reassigned from split-year to fishing year on a pro rata basis; and
- for CDS-derived catch data, recalculation was possible from the reported dates of capture.

3.15 It should be noted that fishing season time periods are very nearly coincident with calendar year, which is the reporting period used by many States for catches in their waters.

3.16 One consequence of the move to reporting catches by fishing season is that at the time that the Working Group meets, data are only available from December to September. The Working Group agreed that while Tables 3.2 and 3.3 should report the data currently available, for the purposes of estimating total extraction for assessments it would be necessary to make pro rata adjustments to the estimated catch to the end of a fishing season.

Methods for Estimating IUU Catch

3.17 Dr Agnew introduced WG-FSA-02/4 which described a new method for estimating IUU catch of fish and birds. It utilises high-quality well-documented cruise data from fishery protection vessels. The method takes explicit account of both ‘seen’ and ‘unseen’ IUU fishing through a simulation model, utilising estimates of the encounter efficiency of the fishery protection vessel derived from data taken from legitimate vessels. It also uses a spatial model to estimate different fish and bird catch rates in different parts of Subarea 48.3. Using the model, the authors estimate IUU catches of toothfish in Subarea 48.3 to have been 667, 1 015 and 196 tonnes in the 1998/99, 1999/2000 and 2000/01 fishing seasons respectively.

3.18 Dr Agnew reported that the model estimates IUU catch in the current 2001/02 season to have been zero. This is essentially the same as the Secretariat’s calculation of 3 tonnes (Table 3.2).

3.19 The Working Group welcomed the development of this method, which for the first time attempted to arrive at statistically rigorous estimates and confidence intervals of fish and bird catches by IUU vessels. The method is superior to the current CCAMLR methods of estimating IUU fishing and should be attempted in other areas. However, it was recognised that this would be dependent on the availability of suitable data sources.

3.20 It was noted that the method used to calculate the encounter rate assumed that legitimate vessels behaved in the same way as IUU vessels. While this may be generally true, it may also be the case that as IUU vessels gain more experience the encounter rate might drop. If the encounter rate is not re-estimated to account for this potential behaviour, it might introduce bias into the results.

3.21 WG-FSA-02/4 also showed that when coverage by a fishery protection vessel was low, the estimate of IUU fishing derived using the standard CCAMLR method (i.e. Table 3.2) provided underestimates of the extent of IUU fishing. For instance, CCAMLR estimates for 1998/99 and 1999/2000 (SC-CAMLR-XX, Annex 5, Table 6) were 369 and 356 tonnes respectively, lower than the estimates of 667 and 1 015 respectively in WG-FSA-02/4. When the protection vessel was present for more than 30% of the time, the statistical estimate was comparable with that derived by CCAMLR (for instance the CCAMLR estimate for 2000/01 was 176 tonnes and the statistical estimate was 196 tonnes). These results would imply that for CCAMLR subareas and divisions where coverage is low, the CCAMLR estimates of IUU catch may be underestimates of the total removals by IUU fishing.

3.22 The Working Group agreed for Subarea 48.3 to use the estimates of IUU fishing given in WG-FSA-02/4 for the fishing seasons 1998/99, 1999/2000 and 2000/01, and the Secretariat's calculation of 3 tonnes for the season 2001/02 to date.

Catch and Effort Data for Toothfish Fisheries in Waters adjacent to the Convention Area

3.23 The Working Group has usually had little information on catch rates of toothfish in areas immediately adjacent to the Convention Area. WG-FSA-02/67, describing observer-recorded data from fishing on William's Ridge (53°S 80.5°E), was therefore welcome. The paper reported that catch rates and the distribution of males, females and juveniles on the ridge was typical of areas in the Indian Ocean sector of the Convention Area. By-catch was typical for the Southern Ocean, consisting of rajids, *Muraenolepis* spp. and *Macrourus* spp.

3.24 In discussion, some questions were raised about the positions of these catches. The known bathymetry of William's Ridge shows that it is largely very deep (1 000–2 000 m) (SC-CAMLR-XXI/7). This would seem to run counter to the report in the paper that average fishing depth was 900 m. Further, the existence of large numbers of small fish in the catch was somewhat inconsistent with the very deep water that might be encountered. Clarification of these points from the Uruguayan observer would be welcome.

3.25 It was noted that William's Ridge extends to the west of 80°E, and therefore is both inside and outside the Convention Area. Toothfish living on the ridge are thus most likely a transboundary stock.

Scientific Observer Information

3.26 All information collected by scientific observers was summarised in WG-FSA-02/11 Rev. 1, 02/12 Rev. 1 and 02/14. Reports and longline data were submitted by international and national observers from a total of 40 cruises in the Convention Area and three longline cruises in FAO Areas 47 and 51. Target species were *Dissostichus* spp., *E. superba*, *C. gunnari* and *Paralomis* spp. on cruises comprising 24 longliners, 15 trawlers and 1 'pot' vessel. Longline cruises were represented in Subareas 48.3, 58.6, 58.7, 88.1 and 88.2, trawlers in Subarea 48.3 and Division 58.4.4 and 'pot' fishing in Subarea 48.3. Observers were deployed by eight Members: Australia (5), Chile (2), New Zealand (1), South Africa (7), Spain (2), Ukraine (2), UK (20) and Uruguay (1). Details are provided in Tables 1 of WG-FSA-02/11 Rev. 1, 02/12 Rev. 1 and 02/14.

3.27 Two logbooks and two cruise reports were outstanding from the longline fishery. All logbooks had been submitted in the standard CCAMLR format, but only three logbooks had been submitted in the new format in 2002.

3.28 In March 2002 updated versions of the observer logbook forms and cruise report format were placed on the CCAMLR website and distributed to all Members and technical coordinators (COMM CIRC 02/15). The Working Group recommended that all technical coordinators ensure that only the current versions of logbook forms be used. It was noted that further updates may take place at the request of the Scientific Committee.

3.29 Biological data were collected by observers in accordance with research priorities identified by the Scientific Committee in previous years (weight at length, length frequency, maturity, otolith/scales, CF, by-catch). The Working Group also noted that in WG-FSA-02/11 Rev. 1, Table 6, the main processing method for *D. eleginoides* was headed, gutted and tailed (HGT), with some observers also recording CF for headed and tailed (HAT) as well as headed and gutted (HAG) product. Observers reported a spread of CFs in the same fishing area and using the same processing method.

3.30 Background information and statistical analyses can be found in SC-CAMLR-XXI/BG/27.

Conversion of Processed Weight to Green Weight

3.31 Last year, the Working Group noted that detailed analyses of CFs need to be undertaken in order to better understand the patterns of differences between vessels and observers and what factors may be causing them, and that theoretical studies be carried out in an effort to derive better estimates of sampling precision and better procedures for estimating green weight caught from processed fish and landed weight (SC-CAMLR-XX, Annex 5, paragraphs 3.81 to 3.83).

3.32 The Working Group noted the new information available at this year's meeting (SC-CAMLR-XXI/BG/27, paragraphs 3.1 to 3.6).

3.33 Dr Candy used GLMs of available data to examine the factors that might influence estimates of CFs (SC-CAMLR-XXI/BG/27, paragraphs 3.7 to 3.12). The results of

this analysis showed significant trends of CFs with the length of fish being processed (SC-CAMLR-XXI/BG/27, Figure 3.1). Other factors had significant influence but, of those, variation between cruises was most important.

3.34 The Working Group thanked Dr Candy for such a detailed analysis and noted that this work has addressed many of the questions asked at previous meetings. The Working Group noted that some of the variation in CFs might arise because of the broad categories used to describe processing types. The Working Group agreed that a refinement of those categories would be appropriate and requested that, where possible, observers provide more information on the processing categories used. This could be achieved through continued reporting using diagrams of the cuts used in processing as well as refined categories in the observer reports. The Working Group requested that, where possible, observers be asked to continue to provide this information for consideration at next year's meeting.

3.35 The Working Group agreed that the next phase of the work was to develop an appropriate protocol for estimating CFs in the future. It noted that CFs were required for both the five-day reporting scheme and for converting landed weights to green weight for the purposes of the CDS. In this respect, the protocols will need to take account of both these requirements.

3.36 In the interim of these protocols being developed, the Working Group recommended that the observations and reporting of CFs remain as they are except for, where possible, the inclusion of greater detail on processing categories as described above.

3.37 The Working Group agreed to establish a Subgroup on Conversion Factors including Drs Candy and Agnew and Mr Smith. It was agreed that the subgroup would coordinate work intersessionally and involve, wherever possible, observers from toothfish fisheries.

Research Surveys

3.38 Four trawl surveys and one acoustic survey of demersal fish species were completed in the Convention Area during the 2001/02 fishing year:

- an Australian trawl survey of demersal fish species (in particular *D. eleginoides* and *C. gunnari*) was carried out in Division 58.5.2 in May and June 2002 (WG-FSA-02/70 and 02/47);
- a German trawl survey of demersal fish species was made around Elephant Island and the South Shetland Islands (Subarea 48.1) in January and February 2002 (WG-FSA-02/24);
- a UK trawl survey of demersal fish species (in particular *D. eleginoides* and *C. gunnari*) was carried out in Subarea 48.3 in January 2002 (WG-FSA-02/34); and
- a Russian trawl survey of demersal fish species (in particular *C. gunnari*) was carried out off South Georgia in February and March 2002 (WG-FSA-02/19). Midway during the bottom trawl survey, the Russian vessel completed an acoustic survey of *C. gunnari* and krill in the same area (WG-FSA-02/44).

3.39 Further information on these surveys can be found in SC-CAMLR-XXI/BG/27.

3.40 The data presented in these papers were referred to the subgroups on assessment of *D. eleginoides* and *C. gunnari* to determine how they might be used in assessments for this year.

3.41 The Working Group noted that the biomass estimates for Subarea 48.1 from the 2002 survey were comparable to those obtained from previous surveys. There was no evidence that stocks of *Notothenia rossii* had recovered to historic levels even in the absence of commercial fishing for the past 20 years, and that the abundance of finfish determined in this study would not support a reopening of the commercial fishery. It was suggested that a specific survey targeting *N. rossii* be conducted in the near future to properly assess the status of this stock.

3.42 The Working Group also noted the results of the Russian acoustic survey of *C. gunnari*. The biomass estimate from the acoustic survey was almost double that from the bottom trawl survey. Of this, about 30% of the biomass was in the pelagic region 8–58 m above the bottom. The Working Group agreed that this provided strong evidence that a substantial proportion of the icefish biomass is in the pelagic zone and is unavailable to the bottom trawl survey. It encouraged the further development of the acoustic technique for assessing fish stocks.

3.43 The subgroup on acoustic and trawl surveys for icefish recognised the value of acoustic surveys, particularly as data indicate a considerable portion of the biomass is off the sea floor. The subgroup recommended the establishment of an intersessional subgroup (coordinators Drs Collins and P. Gasiukov (Russia)) on fisheries acoustics, with representation from all interested Members. The objectives of the subgroup would be to evaluate the application of acoustics methods in estimating biomass of exploited fish in the CCAMLR Convention Area. In particular, the subgroup would be asked to re-examine the acoustic data from the Russian and UK surveys to provide a robust estimate of biomass, confidence intervals and age composition. Further details on this topic can be found in SC-CAMLR-XXI/BG/27.

PREPARATION FOR ASSESSMENTS

4.1 Dr Constable introduced the report on intersessional work of the Subgroup on Assessment Methods (WG-FSA-02/80) and highlighted the summary of preparatory work for this year's assessments undertaken by the subgroup. The report of the subgroup outlined the methods that have been introduced to the Working Group this year and the papers relevant to different aspects of the assessments, including estimates of biomass, recruitment and biological parameters. Dr Constable thanked the members of the subgroup for their work and, in particular, Drs Kirkwood and Gasiukov for furthering the development of assessment methods for use by the Working Group.

4.2 The Working Group noted the further developments of assessment methods in their application to *D. eleginoides*. In this respect, the Working Group noted the further work of an assessment of toothfish status in Subarea 58.7 using an Age-Structured Production Model (ASPM) (WG-FSA-02/76). It agreed that some discussion on future aspects of this assessment, including reconciling model outputs with the known length structure of the catch, would be needed as well as consideration of target levels for recovery for the species in this area.

4.3 WG-FSA-02/78 provided an application of a Dynamic Production Model (DPM) to the assessment of toothfish in Subarea 48.3. This approach is applied elsewhere in the world and is described in Punt and Hilborn (1996). It relies on fewer parameters than the GYM. The Working Group noted that:

- (i) this type of assessment may be difficult to apply in this case because of the biology and demography of toothfish, such as the high variability in recruitment and the need for the stock to be close to equilibrium prior to exploitation;
- (ii) it is very difficult to identify the ratio of the status of the stock just prior to exploitation relative to an equilibrium status; and
- (iii) the assessment using this method is sensitive to the magnitude of that ratio.

The Working Group agreed that some attention may need to be given to understanding how the dynamic nature of the environment in Subarea 48.3 might contribute to the dynamics of toothfish in the area. The Working Group encouraged further development of this work, particularly with respect to evaluating different approaches to assessing toothfish to be discussed in Item 9.

4.4 WG-FSA-02/64 updated a method presented to the Working Group last year (WG-FSA-01/48) for estimating length-based fishing selectivities of *D. eleginoides* in the longline fishery in Subarea 48.3. This revised method is based on an assumption that the proportions of the total CPUE in an area for a particular length class that are taken in different depth zones are Beta-distributed. This removes some of the ad hoc nature of the former estimation method. These length-based selectivities are then converted to age-based selectivities for use in the GYM. The Working Group welcomed this new development and agreed to apply this method this year.

4.5 The Working Group noted the developments of software provided by the Australian Antarctic Division (WG-FSA-02/68). It noted that the structure of the GYM had been modified so that the recruitment to the fish population occurred at the beginning of the projection year rather than at the end. This meant that the input of a time series of recruitments would correctly coincide with a time series of catches. This new structure (GYM401.EXE) was tested by the Working Group and it was agreed that it meant only slight changes to the assessments. It was accepted for use at this meeting.

4.6 A number of revisions and enhancements have been made to 'Fish Heaven', a general spatially-structured population projection model and tool for evaluating the effectiveness of management procedures. This includes an ability of Fish Heaven to utilise the GYM in its annual assessment procedure.

4.7 The Working Group welcomed the elaboration of detailed manuals and user interfaces for the GYM (WG-FSA-02/62), the software for estimating age composition from length-density data, CMIX (WG-FSA-02/61) and Fish Heaven (WG-FSA-02/63). Dr Constable provided tutorials on the use of the new interfaces for the GYM and for CMIX as well as tutorials on how to undertake the standard assessments using these software. The Working Group agreed that the combination of manuals, user interfaces and tutorials made the assessment process much more accessible to all members of the Working Group. In that regard, the Working Group thanked the authors of the manuals and the software for providing easier user interfaces and instructions for general users to follow.

4.8 In terms of its assessments this year, the Working Group agreed to undertake this work in a manner that would provide all members an opportunity to learn the different aspects of the process. In addition, the Working Group agreed to alter the archive of assessment materials so that it more closely related to the different parts of each assessment of a species in a given area. Dr Ramm provided a layout of the directory archive on the network that could be used to save all work relating to the assessments.

4.9 The Working Group also agreed to develop further summary descriptions of assessment methods that could be referenced in appropriate sections of the report. The first attempt at these summaries is provided in SC-CAMLR-XXI/BG/28. The Working Group also agreed to summarise the developments associated with the assessments in the Species Profiles (SC-CAMLR-XXI/BG/29 and BG/30).

ASSESSMENTS AND MANAGEMENT ADVICE

New and Exploratory Fisheries

New and Exploratory Fisheries in 2001/02

5.1 Thirteen conservation measures relating to exploratory fisheries were in force during 2001/02, but fishing only occurred in respect of three of these. Information on catches from active exploratory fisheries during 2001/02 is summarised in Table 3.1.

5.2 The Working Group observed that once again this year, only a small proportion of exploratory fisheries notifications made last year resulted in active fisheries. In this context, it appears rather surprising that many Members chose not to undertake notified exploratory fisheries inside the Convention Area, while CDS records submitted indicate considerable longline fishing by Members outside the Convention Area.

5.3 In most of the active exploratory fisheries, the numbers of days fished and the catches reported were relatively small. As was the case last year, the notable exception was the exploratory fishery for *Dissostichus* spp. in Subarea 88.1 conducted under Conservation Measure 235/XX. During 2001/02, New Zealand vessels took 1 275 tonnes of *Dissostichus* spp., although Russia, Japan and South Africa had made notifications but not fished.

5.4 The catches of by-catch species in the exploratory longline fishery for *Dissostichus* spp. in Subarea 88.1 all fell within the catch limits set in Conservation Measure 235/XX.

5.5 Data collected from the New Zealand exploratory longline fishery in Subareas 88.1 and 88.2 during the last five seasons are described and analysed in detail in WG-FSA-02/38 and related papers. The Working Group agreed that an assessment should be attempted for these subareas, using methods similar to those used for Subarea 88.1 last year.

5.6 The new bottom trawl fishery for *Macrourus* species notified by Australia last year was not activated. The Working Group noted that this fishery should therefore retain its 'new' status.

New and Exploratory Fisheries Notified for 2002/03

5.7 A summary of new and exploratory fisheries notifications for 2002/03 is given in SC-CAMLR-XXI/BG/9. The intended catches, numbers of vessels and gear for the notifications for new and exploratory fisheries for *Dissostichus* spp. in 2002/03 are shown, grouped by subarea or division, in Table 5.1. All notifications had been received by the Secretariat on or before the due date, with the exception of the Russian notification, for which only a statement of intent to submit a notification had been received. Subsequently it was clarified that Russia wished to carry forward their notification for the previous year and a formal notification was received on 6 September (CCAMLR-XXI/16). Dr Ramm advised that additional vessel details had been notified in relation to the notifications from New Zealand (CCAMLR-XXI/7) and Japan (CCAMLR-XXI/9). These are reflected in Table 5.2.

5.8 As was the case last year, there were multiple notifications of exploratory fisheries for *Dissostichus* spp. for several subareas or divisions (see Table 5.2). While this is of potential concern, the Working Group also noted that the experience of previous years suggested that a number of these may not be activated. In particular, it noted that notifications (often multiple) have been made for Subarea 48.6 each year since 1997, but so far no exploratory fishing has been reported for that subarea.

5.9 In reviewing Table 5.2, the Working Group observed that there remained inconsistencies in the way in which different notifications specified intended catches. Some notifications attempted to specify realistic levels of intended catches, while others simply specified an intended catch that was equal to the current precautionary catch limit. While this inconsistency continues, the task of assessing the likely effects of multiple exploratory fisheries in an area is made much more difficult. The Working Group emphasised that intended catch levels should be governed by what is required for economic viability and by operational and data acquisition considerations, as specified in Conservation Measure 65/XII.

5.10 There has been a large number of notifications for Subareas 48.6 (three notifications for up to seven vessels), 88.1 (five notifications for up to 15 vessels) and 88.2 (three notifications for up to seven 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. In addition, there is the potential in Subarea 88.2 for per-vessel catches to be sufficiently high that the catch limit may be reached in a very short period of time or be overshoot if all notified vessels participated in the fishery.

5.11 There are additional administrative problems in managing conservation measure provisions for fishing in fine-scale rectangles and SSRUs when many vessels are fishing simultaneously in a subarea or division. In this context, the Working Group requested that the Scientific Committee clarify what precisely is meant by vessel residence when restrictions are placed on the number of vessels allowed in an area at any one time.

5.12 With regard to provision of advice on precautionary catch limits for stocks likely to be subject to new or exploratory fisheries in 2002/03, the Working Group agreed that this would only be possible this year for Subareas 88.1 and 88.2. Assessment of allowable by-catch limits for macrourids is described in paragraphs 5.154 to 5.159.

5.13 The updated assessment of *D. eleginoides* in the Prince Edward Islands EEZ in WG-FSA-02/76 and the Working Group's conclusions regarding it (see paragraphs 5.126

to 5.130), suggested that the stock in that area had been greatly reduced from its unexploited level primarily by IUU fishing. The Working Group agreed that this raised concerns about the status of *D. eleginoides* stocks throughout Subarea 58.6. In this respect, the Working Group noted that, despite its request last year, the fine-scale data necessary for carrying out an assessment of the stock around the Crozet Islands have not been submitted to CCAMLR.

5.14 Two notifications have been made for exploratory longline fisheries in Subarea 58.6 (see Table 5.7), involving up to five vessels. The Working Group observed that notification of an exploratory fishery in an area at least implicitly implies that there is an expectation that it would be economically viable to fish there and it requested that any available information on the status of stocks in Subarea 58.6 outside national EEZs be forwarded to it. The Working Group agreed that exploratory fisheries in Subarea 58.6 should not proceed until appropriate information, such as from a stock survey, became available.

Notification of a Longline Fishery in Division 58.5.2

5.15 Australia had notified its intent to conduct a longline fishery for *D. eleginoides* in Division 58.5.2 (CCAMLR-XXI/10). Although this would be the first time such a fishery has operated in this division, the existence of an established trawl fishery in the division and the availability of a full assessment for the *D. eleginoides* stock in the division imply that the longline fishery would not fall under the classification of a new or exploratory fishery. As indicated in CCAMLR-XXI/10, Australia's aim in making this notification was to give as much advance notice and information to WG-FSA and the Commission as possible.

5.16 Dr Constable advised the Working Group that combined allowable catches for both the existing bottom trawl fishery and the longline fishery would be expected to be subject to the catch limit dictated by the trawl fishery stock assessment, as this would be lower than an equivalent catch limit for both fisheries combined, given that the trawl fishery selects for smaller fish. CCAMLR-XXI/10 detailed an operational plan for the longline fishery that ensures that the requirements of all by-catch mitigation measures will be met or exceeded. The research plan defines fishing in specific small-scale research units. Management of the fishery will apply and be consistent with the principles of the regulatory framework.

5.17 Dr Constable also drew the Working Group's attention to SC-CAMLR-XXI/7, which outlined a proposal to modify the boundaries of Division 58.5.2 to define the William's Ridge area, and to the recent declaration by Australia of a HIMI marine reserve and conservation zone in the Australian EEZ around the territory of Heard Island and McDonald Islands (SC-CAMLR-XXI/BG/18).

5.18 The Working Group welcomed the approach taken by Australia in providing this advance notification of the proposed longline fishery and the detailed explanation of the management provisions for that fishery.

Precautionary Catch Limits for Subarea 88.1

5.19 An exploratory longline fishery by New Zealand for *D. mawsoni* and *D. eleginoides* took place in Subarea 88.1 in 2001/02. The precautionary catch limit of *Dissostichus* spp. in

Subarea 88.1 for 2001/02 was 2508 tonnes, comprising catch limits of 171 tonnes north of 65°S and 584 tonnes in each of the four SSRUs to the south of 65°S (Conservation Measure 235/XX).

5.20 Further information on this fishery can be found in SC-CAMLR-XXI/BG/27.

5.21 A total of 1321 tonnes of *D. mawsoni* and 12 tonnes of *D. eleginoides* was caught during 2001/02. The catch limit was almost reached in SSRU C, but was not approached in any of the other SSRUs. All of the catch was taken by New Zealand vessels, which have now been involved in this exploratory fishery for the past five seasons. During that time, the total catches have been 41 tonnes in 1998, 296 tonnes in 1999, 745 tonnes in 2000, 659 tonnes in 2001 and 1333 tonnes in 2002.

5.22 The exploratory fishery over the last five seasons has seen a widespread distribution of effort. In the 2002 season all five SSRUs were fished and 14 new fine-scale rectangles were fished for the first time. From 28 to 91 fine-scale rectangles have been fished each year, and a total of 171 fine-scale rectangles have been fished overall (WG-FSA-02/38).

5.23 For the last two years the Working Group has used the approach for calculating precautionary catch limits for Subarea 88.1 outlined in SC-CAMLR-XIX, Annex 5, paragraphs 4.20 to 4.33. The Working Group agreed to continue to use this approach for this year's assessment of Subarea 88.1.

5.24 As in last year's assessment, separate yield estimates were calculated for each SSRU. Last year's yields were updated based on data collected during the 2001/02 fishing year (see SC-CAMLR-XXI/BG/27, paragraphs 5.1.8 to 5.1.15 for more details). Estimates of seabed area, fishing selectivity, relative CPUE, precautionary pre-exploitation harvest levels (?), and yield estimates for Subarea 88.1 are given in Table 5.3. The overall yield for Subarea 88.1 has more than doubled since last year. This increase was mainly due to the large increase in CPUE in Subarea 88.1 in 2001/02, and the increased recruitment estimates for Subarea 48.3.

5.25 The Working Group noted that the yields for Subarea 48.3 presented here are based on assumptions and parameters which seem appropriate for this assessment in Subareas 88.1 and 88.2 and should not be compared to the actual assessment undertaken for Subarea 48.3.

5.26 The Working Group noted that whilst the current assessment incorporates several improvements over earlier assessments of this area, there was still considerable uncertainty about the assessments. This stems from uncertainty in biological and fishery parameters for both *Dissostichus* spp., and in particular from the assumed relationship between CPUE and density.

5.27 The Working Group noted that there had been a large increase in CPUE in Subarea 88.1 during the 2001/02 fishing year (WG-FSA-02/38). This could be attributed to the good ice conditions encountered in the 2001/02 fishing year, which allowed the vessels access to some of the better fishing grounds, and to the presence of only the two most experienced vessels in the fishery. There is concern that the increased experience in fishing toothfish may have led to an upward bias in CPUE. This is because the high CPUE for one or two smaller grounds is extrapolated over the entire fished area. However, any such bias would be difficult to quantify without a better definition of the main fishing grounds. There was no time to complete a reanalysis of the main fishing grounds, and the Working Group recommended that this be investigated in the intersessional period.

5.28 The Working Group also considered that the existing approach could be further improved by treating selectivity differently. It recommended that estimates of selectivity in next year's assessment should try and take into account depths fished by the vessels, which is currently being used in the assessment of *D. eleginoides* in Subarea 48.3.

5.29 The Working Group considered that the CPUE series used in the current assessment should not be updated further because of potential biases as the fishers become more experienced. However, revision of this assessment would be appropriate with better information on area boundaries, fishing selectivities and other biological parameters.

5.30 Because of the problems outlined above, the Working Group agreed that the revised estimates of yield should be treated with caution and that a discount factor should again be applied to the results of this assessment. In this respect, the Working Group noted that discount factors of 0.3 and 0.5 had been used for *D. mawsoni* in Subarea 88.1 in the last two years.

5.31 The Working Group also noted that an analysis of the catch and effort data collected over the past five years would allow the identification of the main fishing grounds in the area. Such an analysis would provide a good basis for designating more appropriate SSRU boundaries.

Management Advice

5.32 Using new data resulting from the exploratory fishery in Subarea 88.1, estimates of precautionary yields for this subarea have been calculated by SSRU. These estimates are given in Table 5.3.

5.33 The estimated yield for Subarea 88.1 has more than doubled since last year to 13 882 tonnes. This increase was due to the large increase in CPUE in Subarea 88.1 in 2001/02, as well as the increased recruitment estimates for Subarea 48.3.

5.34 The Working Group agreed that the revised estimates of yield should be treated with caution and that a discount factor should again be applied to the results of this assessment. In this respect, the Working Group noted that discount factors of 0.3 and 0.5 had been used for *D. mawsoni* in Subarea 88.1 in the last two years. Recent catches, catch limits and estimated yields for each SSRU are given in Table 5.4.

Precautionary Catch Limits for Subarea 88.2

5.35 The same approach as taken above for Subarea 88.1 was used for calculating precautionary catch limits for *D. mawsoni* in Subarea 88.2.

5.36 Only 10 sets were completed in SSRU A in Subarea 88.2 in the 2001/02 fishing year. This was considered too few to carry out a bootstrap analysis. The Working Group therefore assumed the mean CPUE ratio for this area to be the same as that for the whole of Subarea 88.1 (Table 5.3).

5.37 Estimates of seabed area, fishing selectivity, relative CPUE and precautionary pre-exploitation harvest levels (?) for Subarea 88.2 are given in Table 5.3. Based on this

assessment the resulting estimate of precautionary yield in Subarea 88.2 is given in Table 5.3. Equivalent estimates of yield, the catch limit adopted and the catch actually taken in 2001/02 are shown in Table 5.4.

5.38 The Working Group noted that there is also uncertainty about the assessment for Subarea 88.2 and agreed that a discount factor again needs to be applied.

Management Advice

5.39 Using new data resulting from the exploratory fishery in Subarea 88.2, an estimate of precautionary yield for this subarea has been calculated (Table 5.4). The Working Group agreed that a discount factor should be applied to this yield estimate. The Working Group noted that this yield estimate applies only to SSRU A.

Comments on Research Plans

5.40 In each of the exploratory fishery notifications, the research plans proposed at least met the minimum requirements specified in Conservation Measure 227/XX and in some aspects exceeded them.

5.41 The Working Group acknowledged the value of the research components of exploratory fisheries in the past and previous seasons, noting in particular the extent to which it has been possible to make progress towards a precautionary assessment of Subareas 88.1 and 88.2.

5.42 An important element of this was the development of time series of CPUE data in Subarea 88.1 obtained from research and exploratory sets in SSRUs. In view of the utility of these data, the Working Group encouraged further investigation of effective means of deploying effort in order to maintain and enhance this time series. Should vessels from more than one country participate in this fishery, it would also be valuable to consider how they could also contribute catch and effort information for the time series.

5.43 While standardised CPUE data will allow monitoring of trends in relative abundance, a thorough stock assessment for Subarea 88.1 will not be possible until an estimate of absolute abundance has been obtained. At present, the location and extent of juvenile *Dissostichus* habitat in Subarea 88.1 is unknown, so it is not possible to undertake trawl surveys similar to those undertaken in Subarea 48.3 and Division 58.5.2. On the other hand, the mark–recapture experiments undertaken over several years by New Zealand do show promise, and the Working Group strongly encouraged continuation of these by New Zealand and by any other Member participating in the exploratory fishery in this subarea.

5.44 Information presented in WG-FSA-02/35 suggested that the boundaries for the existing SSRUs in Subarea 88.1 may need revision. The Working Group encouraged further examination of this during the intersessional period.

Advice to the Scientific Committee

5.45 Thirteen conservation measures relating to exploratory fisheries were in force during 2001/02, but fishing only occurred in respect of three of these. In most of the active exploratory fisheries, the numbers of days fished and the catches reported were small. The notable exception was the exploratory fishery for *Dissostichus* spp. in Subarea 88.1 conducted under Conservation Measure 235/XX. During 2001/02 vessels from New Zealand took 1 275 tonnes of *Dissostichus* spp.

5.46 Eight notifications of new or exploratory fisheries were made for 2002/03 (Table 5.1), and Australia also notified the commencement of a longline fishery for *D. eleginoides* in Division 58.5.2. There were multiple notifications of exploratory fisheries for *Dissostichus* spp. for several subareas or divisions (Table 5.2). While this is of potential concern, the Working Group also noted that the experience of previous years suggested that many of these may not be activated.

5.47 Inconsistencies remain in the way in which different notifications specified intended catches. As was the case last year, some notifications attempted to specify realistic levels of intended catches, while others simply specified an intended catch that was equal to the current precautionary catch limit. While these inconsistencies continue, the task of assessing the likely effects of multiple new or exploratory fisheries in an area is made much more difficult.

5.48 There has been a large number of notifications for Subareas 48.6, 88.1 and 88.2. 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 in high latitudes where fishing imposes considerable operational difficulties. In Subarea 88.2 the likely catch limit could potentially be taken in a short time or to be overshoot if all notified vessels participate.

5.49 There are additional administrative problems in managing conservation measure provisions for fishing in fine-scale rectangles and SSRUs when many vessels are fishing simultaneously in a subarea or division. In this context, the Working Group requested that the Scientific Committee clarify what precisely is meant by vessel residence when restrictions are placed on the number of vessels allowed in an area at any one time.

5.50 With regard to provision of advice on precautionary catch limits for stocks likely to be subject to new or exploratory fisheries in 2002/03, the Working Group agreed that this would only be possible this year for Subareas 88.1 and 88.2. For all the other subareas and divisions for which notifications have been made, the Working Group is unable to provide any new advice on precautionary catch limits.

5.51 Using new data resulting from the exploratory fishery in Subarea 88.1, estimates of precautionary yields for this subarea have been calculated by SSRU. These estimates are given in Table 5.3.

5.52 The estimated yield for Subarea 88.1 has more than doubled since last year to 13 882 tonnes. This increase was due to the large increase in CPUE in Subarea 88.1 in 2001/02, as well as the increased recruitment estimates for Subarea 48.3.

5.53 The Working Group agreed that the revised estimates of yield should be treated with caution and that a discount factor should again be applied to the results of this assessment. In

this respect, the Working Group noted that discount factors of 0.3 and 0.5 had been used for *D. mawsoni* in Subarea 88.1 in the last two years. Recent catches, catch limits and estimated yields for each SSRU are given in Table 5.4.

5.54 Using new data resulting from the exploratory fishery in Subarea 88.2, an estimate of precautionary yield for this subarea has been calculated (Table 5.4). The Working Group agreed that a discount factor should be applied to this yield estimate. The Working Group noted that this yield estimate applies only to SSRU A.

5.55 The assessment of *D. eleginoides* in the Prince Edward Islands EEZ, which suggested that the stock in that area had been greatly reduced from its unexploited level primarily by IUU fishing, raises major concerns about the status of *D. eleginoides* stocks throughout Subarea 58.6. The Working Group agreed that exploratory fisheries notified for Subarea 58.6 in 2002/03 should not proceed until appropriate information on stock status, such as from a stock survey, became available.

5.56 The Working Group strongly encouraged continuation of mark-recapture experiments by New Zealand and by any other Member participating in the exploratory fishery in Subareas 88.1 and 88.2.

Assessed Fisheries

Dissostichus eleginoides South Georgia (Subarea 48.3)

Trends in Fishing Vulnerability

Estimating Age-specific Vulnerabilities for Subarea 48.3

5.57 At its 2001 meeting WG-FSA assumed in its calculation of long-term annual yields for the longline fishery for *D. eleginoides* in Subarea 48.3 that prior to 1998 all fish above 79 cm were fully selected. For fish below that length, a length-specific vulnerability ogive operated, with zero vulnerability at 55 cm. From 1998 onwards it assumed that fish were subject to the age-specific vulnerability function given in SC-CAMLR-XX, Annex 5, Table 25. These were calculated using the method described in WG-FSA-01/48.

5.58 WG-FSA-02/64 presented a revised method for estimating length- and age-specific vulnerabilities that used more statistically rigorous procedures than those in the previously described method. The new method was applied to historical data for 1997 to 2000 and revised data provided by the Secretariat for 2001 and 2002. Two sets of estimates of vulnerabilities were calculated initially: one in which the areas of depth and area strata were taken into account and one in which they were not. On review of these preliminary results and their underlying assumptions, WG-FSA agreed that analyses that assumed fish within a length class were evenly distributed across the entire bottom area contained within the shallower and deeper depth zones may lead to underestimates of the vulnerabilities of the smallest and largest fish. Accordingly, it agreed that the vulnerabilities should be calculated using the method that did not take areas into account.

5.59 Review of the length-specific vulnerabilities estimated for the years 1997–2001 and of the depth distribution of longline fishing around South Georgia and Shag Rocks since the early 1990s suggested there had been two typical patterns of fishing over that period: a ‘deep’

fishing pattern concentrating on depths around 1200 m, with little fishing shallower than 600 m, and a ‘shallower’ pattern in which fishing extended to depths down to 400 m and shallower. The ‘deep’ fishing pattern was used in years up to and including 1997 and since 2001, with the shallower fishing pattern applying from 1998 to 2000. The age-specific vulnerabilities estimated for the two fishing patterns are illustrated in Table 5.5 and Figure 5.1.

Recruitment and CPUE Series

5.60 The 2002 UK survey of South Georgia and Shag Rocks was used to update the recruitment series for Subarea 48.3. Length-density data (numbers/km² at each length) were derived for each haul, weighted by stratum, using the equation:

$$D'_{o,s} = D_{o,s} \frac{\sum_s n A_s}{n_s \sum_s A}$$

where $D_{o,s}$ is the density of fish of a certain length in a single haul o in stratum s , n_s is the number of hauls taken in a given stratum, A_s is the corresponding area of the stratum, and S is the number of strata.

5.61 Stratification was by the three depth strata (50–150 m, 150–250 m and 250–500 m). This is consistent with the strata used to create the recruitment series for past years (Table 5.6). The new CMIX spreadsheet add-in was applied, with allowance for constant CV and mixture components set based on the growth curve used for the assessment (Table 5.7) starting at age 2. The bounds on the final bin were widened to take account of all other ages.

5.62 The fitted length-density plot (Figure 5.2) showed strong peaks at ages 2 and 3. Tables 5.6 and 5.8 show that the estimates of recruitment density for these age groups is high, indeed amongst the highest in the series.

5.63 Haul-by-haul catch and effort data for Subarea 48.3 (fine-scale data) for the 1985/86 to 2001/02 fishing seasons were examined. Details can be found in SC-CAMLR-XXI/BG/27, paragraphs 5.2.1 to 5.2.4. GLM analyses were conducted using this dataset (updated to August 2002), except for data for the first season (1985/86), when fishing had been restricted to very shallow depths (mainly less than 300 m). As in the previous year, WG-FSA agreed that data for all months be included in the analyses.

5.64 CPUE in kg/hook was used as the response variable, and nationality, season, month, area (East South Georgia, NW South Georgia, South Georgia, West Shag Rocks and Shag Rocks), depth and bait type were considered as predictor variables. Depth information was additionally treated as a categorical variable with four levels (0–500 m, 500–1 000 m, 1 000–1 500 m, 1 500 m and above). GLM analyses were conducted on positive CPUE data only, with an adjustment for zero catches being made afterwards.

5.65 The standardised time series of CPUEs in kg/hook is plotted in Figure 5.3. The standardisation is with respect to Chilean vessels fishing at depths of 1 000 to 1 500 m. This time series has also been adjusted for the presence of hauls with zero catches, by multiplying the standardised CPUEs predicted from the GLMs by the proportions of non-zero catches.

Adjusted standardised catch rates have fluctuated around a relatively constant level between 1986/87 and 1994/95. The adjusted standardised catch rates declined substantially between 1994/95 and 1996/97. Since this decline, catch rates have demonstrated a slightly increasing trend from 1997/98 to 2001/02.

5.66 Further information on standardisation of CPUE in this fishery can be found in SC-CAMLR-XXI/BG/27.

Assessment

5.67 The Working Group conducted assessments incorporating the following changes from the assessment conducted in 2001:

- (i) the change in the GYM software to take account of the different timing of recruitment (paragraph 4.5);
- (ii) the new catch series resulting from the change from split-year to fishing season (Table 5.9);
- (iii) the addition of the 2002 UK survey estimates of toothfish recruitment;
- (iv) the use of the Agnew and Kirkwood estimates of IUU catch from 1998/99 to 2000/01 (WG-FSA-02/5);
- (v) the use of the new selectivity-at-age schedules indicated in Table 5.5;
- (vi) a more precise definition of the fishing period as 1 May to 31 August from the 1994/95 fishing season onwards; and
- (vii) the new CPUE series.

5.68 In order to investigate the influences of these various changes to the input data for the GYM, a number of runs were performed in which the changes were incrementally added. The first trial repeated the assessment conducted in 2001, to see what effect was caused by the change in GYM software to take account of fishing season (run 1 in Table 5.10). Secondly, the effects of the recruitment calculated from the UK 2002 survey were investigated by adding the recruitment for age 5, age 4 and age 3 sequentially (runs 2 to 4 in Table 5.10). Finally, the new fishing season catch series, selectivity at age and fishing period were added (runs 5 to 7 in Table 5.10). The most significant change was the addition of the new recruitment data, which created some large cohorts of age 4 in 2000/01, 2001/02 and 2002/03 and which thereby increased the size of the population over the subsequent 35 years in the projection. The results are therefore consistent with having a high estimate of recruitment in the current year. The change from split-year to fishing year, the addition of the new IUU catch data, and the use of the new selectivity and fishing period series, had relatively small effects.

5.69 Concern was expressed that the survey may have exhibited higher catchability for toothfish than previous surveys. Further intersessional examination of this aspect of survey design in Subarea 48.3, and how variability in survey catchability can be incorporated in the assessments, were encouraged.

5.70 The Working Group recognised that although it was not possible to determine whether the estimates of recruitment from 2002 were overestimates, additional estimates of the size of the cohorts represented in the 2002 survey would be likely to be made by future surveys. Thus the density of age-3 fish in the 2002 survey would be estimated again by the density of age-5 fish in a survey in 2004. Furthermore, recruitment for future cohorts (in the projections within GYM) is derived from a distribution parameterised using all past recruitment values, not just the most recent year.

5.71 In this context, it was emphasised that the currency of the assessment performed by the GYM is the end of the 35-year time period of the projection. Thus, the assessment indicated the catch that could sustainably be caught over the full 35-year future period, taking into account current data, even if no further assessments were undertaken. However, the Working Group would not expect to use the results of the assessment in this manner, but would normally expect to update the assessment each year as more information becomes available.

5.72 The point was also made that although Figure 5.2 indicated that the mixture analysis was easily able to separate cohorts from the survey data this year, this has not necessarily always been the case with past surveys in Subarea 48.3. Determination of the ages of toothfish caught on both present and (if possible) past surveys should therefore be undertaken.

5.73 It was noted that summary catch-weighted length-frequency plots from the fishery were presented in SC-CAMLR-XIX, Annex 5 (Figure 11). There was not enough time to do the calculations necessary for these plots at the 2002 meeting, but it was agreed that they should be produced by the Secretariat in the intersessional period.

5.74 Two final assessments were undertaken (runs 8 and 9 in Table 5.10). Each used the new catch series, the new recruitment series, the new fishing period and the new historical selectivities, as presented in Tables 5.6 to 5.9. They differed in the selectivity at age assumed for future years. The first assessment assumed that future selectivity was that characterised by deep-water fishing, and the second assumed that future selectivity was that characterised by shallow-water fishing.

5.75 Runs 8 and 9 (Table 5.10) show that the precautionary catch limit is lower if it is assumed that fishing will take place in shallow water for the next 35 years than if it is assumed to take place in deep water. This is consistent with the fact that shallow-water fishing takes more smaller fish (per tonne of catch) than does deep-water fishing. Since at the moment the fishery is not restricted to fish in any particular depth, the conservative assumption would be that it will take place in shallow water. The Working Group therefore calculated the final precautionary yield, including the CPUE adjustment, using the shallow-water selectivity at age for projected years in the assessment (Table 5.11).

5.76 Standard plots from the final run of the assessment are shown in Figure 5.4. Vulnerable biomass (the biomass in the fishing period that is available to fishing according to the vulnerability (selectivity) function) shows an initial decline at the start of the fishery. Following a period of unchanging biomass in the first half of the 1990s, vulnerable biomass shows a further decline around 1995/96 which coincides with the decline seen in the CPUE series (Figure 5.3). A gradual rise throughout the late 1990s and early 2000s is also consistent with the trends seen in the CPUE series. The peak in vulnerable biomass in about 2004/05 corresponds with the time at which one might expect 3- to 4-year-old fish detected by the 2002 UK survey to have recruited to the fishery as 6- to 7-year-old fish.

Management Advice

5.77 The Working Group recommended that the catch limit for *D. eleginoides* for the 2002/03 fishing season be set at 7 810 tonnes.

5.78 The Working Group noted that the overall yield for Subarea 48.3 (7 810 tonnes) has increased substantially from last year (5 820 tonnes). This is mostly due to the large recruitments estimated from the 2002 survey.

5.79 The remaining provisions of Conservation Measure 221/XX should be carried forward for the 2002/03 season.

5.80 Any catch of *D. eleginoides* taken in other fisheries (such as the pot fishery) in Subarea 48.3 should be counted against this catch limit.

Additional Comments on the Toothfish Assessment in Subarea 48.3

5.81 Dr Gasiukov drew the Working Group's attention to the fact that the GYM-based method used to assess the catch of *D. eleginoides* only gives potential yield but not the standing stock estimates. In his opinion, there is a high degree of uncertainty associated with the model input data, which are revised by WG-FSA almost every year. Therefore, there is no certainty that the derived yield estimates have a proper scientific basis. He further commented and drew attention to the results of stock assessments calculated using alternative methods as follows:

- (i) First of all, there are serious doubts about the *D. eleginoides* recruitment estimates, which are based on trawl survey data and a mathematical technique for mixture distribution analysis based on the Δ -distribution. It is known (Syrjala, 2000) that if the hypothesised Δ -distribution is not correct, the estimates could be 2 to 3 times higher than the true values.
- (ii) There are also serious doubts concerning the estimates of natural mortality rates and, in relation to selectivities-at-age, it is impossible to confirm that selectivity drops substantially below one for toothfish aged 10 years and older.
- (iii) Application of other well-known assessment methods, widely used by other international organisations, indicates unsatisfactory status of the *D. eleginoides* stocks. For example, the DPM (WG-FSA-02/78), which does not use the same input data as listed above, shows a decrease in the toothfish biomass to less than 0.5 of its original size since 1989/90. At the same time, in 11 out of 16 years of the toothfish fishery, catches have exceeded MSY, and the fishing effort has exceeded E_{MSY} in 12 cases out of 16; on four occasions the difference was more than twofold.
- (iv) When the ASPM was applied (WG-FSA-00/46) it showed a similar reduction in biomass. The method extensively uses data similar to the GYM input data.

- (v) CCAMLR ought to give some attention to the contradiction existing between standing-stock estimates derived by different methods, showing a decrease in the toothfish stock in Subarea 48.3, and a constant increase of yield values estimated with the use of the GYM.

5.82 The Working Group noted Dr Gasiukov's comments, but it also noted that each of the issues raised had been discussed by the Working Group and they were scheduled for further detailed intersessional work by the assessment subgroup (paragraphs 9.1 and 9.10). In addition, further discussion on the use of the DPM and the ASPM is given in paragraph 4.3 and SC-CAMLR-XIX, Annex 5, paragraph 4.105 respectively.

Dissostichus eleginoides Kerguelen Islands
(Division 58.5.1)

5.83 As was the case last year (SC-CAMLR-XX, Annex 5, paragraphs 4.127 and 4.128), the Working Group was unable to conduct an assessment or give advice on *D. eleginoides* in Division 58.5.1 because recent haul-by-haul data had not been provided.

5.84 The Working Group reaffirmed that the presence of a French scientist at the meeting and the submission of information from the fishery at WG-FSA were essential for undertaking assessments on the state of stocks in Division 58.5.1 and the area adjacent to the Crozet Islands in Subarea 58.6.

Dissostichus eleginoides Heard and McDonald Islands
(Division 58.5.2)

5.85 The final catch of *D. eleginoides* for the trawl fishery in the 2000/01 CCAMLR fishing season was 2 987 tonnes (catch limit = 2 995 tonnes, Conservation Measure 197/XIX).

5.86 The catch limit of *D. eleginoides* in Division 58.5.2 for the 2001/02 season was 2 815 tonnes (Conservation Measure 222/XX) for the period from 1 December 2001 to the end of the Commission meeting in 2002. The catch reported for this division at the time of the 2002 WG-FSA meeting was 1 916 tonnes.

Determination of Long-term Annual Yields using the GYM

5.87 SC-CAMLR-XX, Annex 5, paragraphs 4.131 to 4.143 described the assessment of long-term annual yield for *D. eleginoides* in Division 58.5.2 used at the 2001 meeting. The same methodology was applied for the assessment at this meeting.

5.88 WG-FSA-02/70 set out a preliminary assessment of *D. eleginoides* for Division 58.5.2 based on the standard method of previous years. Tables of inputs for the assessment are given in Tables 5.12 to 5.15. Table 3.3 gives the time series of total removals. The reported catch for the 2001/02 season has been projected for the remainder of the season (2 815 tonnes).

Assessment

5.89 The input parameters for the GYM are shown in Table 5.12. The assessment of WG-FSA-02/70 was checked using the standard GYM assessment based on the recruitment series. The results of the paper were confirmed. The assessment was repeated using the updated series of total removals (reported according to fishing season) for Division 58.5.2 given in Table 3.3. The decision rule concerning escapement was binding in this assessment. The yield at which median escapement of 50% of median pre-exploitation spawning biomass level over 35 years was 2879 tonnes. The yield for which there is a 0.1 probability of depletion below 20% of the pre-exploitation median spawning biomass was 3 085 tonnes.

5.90 The Working Group noted SC-CAMLR-XXI/BG/18 on Australia's declaration of a marine reserve and conservation zone in its EEZ around Heard and McDonald Islands. It agreed that the assessments of *D. eleginoides* in Division 58.5.2 are not affected by this declaration.

5.91 The Working Group also noted SC-CAMLR-XXI/7 on the differentiation of William's Ridge from the Heard Island Plateau area by waters deeper than 2 000 m. It agreed that the assessments of yield for *D. eleginoides* arising from the survey and other work on the Heard Island Plateau were solely applicable to *D. eleginoides* on the plateau. Thus, it was agreed that the advice from these assessments pertains to the area in Division 58.5.2 west of 79°20'E.

Management Advice for *Dissostichus eleginoides* (Division 58.5.2)

5.92 The Working Group recommended that the catch limit for Division 58.5.2 in the 2002/03 season be revised to 2 879 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.

5.93 The Working Group noted that the introduction of longline fishing to Division 58.5.2 (CCAMLR-XXI/10) could involve a change in the assessment in future years. However, the Working Group recommended the general application of the catch limit above to trawl and longline operations as this is a suitable precautionary approach at this stage (paragraph 5.16).

5.94 The remaining provisions of Conservation Measure 222/XX should be carried forward for the 2002/03 season.

Champscephalus gunnari South Georgia (Subarea 48.3)

Surveys

5.95 Biomass estimates were available from two bottom trawl surveys undertaken in 2002. The *Dorada* (UK) completed 63 stations in January 2002 (WG-FSA-02/34), whilst the *Atlantida* (Russia) completed 73 stations in February 2002 (WG-FSA-02/19). During both cruises acoustic biomass estimates were made either simultaneously with the trawl (*Atlantida*) or by repeating the trawl track after the trawl (*Dorada*) (WG-FSA-02/56). In addition the *Atlantida* undertook a dedicated icefish acoustic survey (WG-FSA-02/44) in February–

March. The Working Group acknowledged and welcomed the considerable amount of work that had gone into both these surveys and the workshop (WG-FSA-02/58) held by Russia and the UK which had attempted to analyse the various datasets (WG-FSA-02/59). The results of these various surveys, as described in the papers, are given in Table 5.16.

Acoustic Surveys

5.96 In WG-FSA-02/56 acoustic tracks which were run in parallel with trawls were analysed from both the *Dorada* and *Atlantida* surveys. The acoustic biomass estimates were approximately 1.5 times higher than the trawl estimates.

5.97 The dedicated acoustic survey on the *Atlantida* produced an estimate of 92 300 tonnes of icefish in Subarea 48.3, approximately twice the swept-area biomass estimate of 44 581 tonnes from the Russian trawl survey (WG-FSA-02/59, Table 5) and 2.1 times higher than the estimate of 43 915 tonnes from the UK trawl survey (WG-FSA-02/34, Table 4).

5.98 Summarising the results of both types of acoustic surveys it was clear that acoustic estimates were higher than trawl estimates because:

- (i) about 30% of the estimated icefish biomass in the acoustic survey came from the pelagic region 8–58 m above the bottom, not sampled by the bottom trawl; and
- (ii) acoustic estimates from the trawl zone (1–8 m above the bottom) were about 1.5 times higher than trawl estimates, suggesting the trawl does not catch all the fish in the swept area (catchability less than 1). The pelagic part of the biomass largely comprised 1+ and 2+ fish.

5.99 The Working Group identified areas of uncertainty in the application of acoustics to the assessment of icefish biomass. These were uncertainty associated with: mark identification and species composition, the decibel difference method for separating fish from krill, the TS of species used to partition acoustic backscatter from the fish fraction, and the TS of icefish. These four factors introduce uncertainty, and potentially bias, into the acoustic biomass estimate.

5.100 Time constraints and the absence of experts in fisheries acoustics from many nations, meant it was not possible to re-examine the data to resolve the issues presented above. Consequently, it was also not possible to derive new estimates of biomass and confidence intervals that would allow the use of these data in assessments.

5.101 The Working Group expressed its appreciation of the work of Russian and UK scientists in advancing this new aspect of survey work directed at estimating biomass of icefish, and strongly encouraged them to continue with their work on acoustics for icefish. It considered the resolution of the various issues raised above to be of a high priority, and therefore decided that a fish acoustic subgroup be convened in the intersessional period. The objectives of the subgroup would be to evaluate the application of acoustics methods in estimating biomass of exploited fish in the CCAMLR Convention Area. In particular the subgroup would be asked to re-examine the acoustic data from the Russian and UK surveys,

if possible resolving the issues above and providing a robust estimate of biomass, confidence intervals and age composition. Should the subgroup be successful in deriving these quantities, the results would be incorporated in the 2003 icefish assessment.

Assessment at this Year's Meeting

5.102 The Working Group followed the short-term projection approach used previously to reassess catch limits for the 2002/03 season. The data inputs required for the short-term assessment are biomass estimate, distribution of numbers at age, an estimate of M , a selection function, von Bertalanffy growth parameters, a weight-length relationship and known catches since the time of the biomass estimate.

5.103 In 2001 the Working Group analysed all Russian and UK surveys from 1984 to 2000 which were likely to be comparable. It was concluded that the Russian gear had a higher catchability than the UK gear, by a factor of 2.59. Accordingly, the UK data were multiplied by this factor in the calculation of combined biomass estimates (SC-CAMLR-XX, Annex 5, paragraph 4.217). Unfortunately the surveys in the 1980s and 1990s did not always record details of the net geometry and comparison of these surveys are not always robust. The Working Group therefore recalculated the correction factor that should be applied to the UK survey using only the 2000 and 2002 survey data from the CCAMLR database and the methods outlined in WG-FSA-02/59. The UK and Russian surveys in these years were undertaken at similar times and accurately recorded net parameters, making comparison between them more valid. This produced a correction factor of 1.241. A difference of this magnitude is consistent with the differences between the trawl headline height of the UK (6.1 m) and Russian trawls (7.2 m).

5.104 Following this analysis, four estimates of biomass of icefish in Subarea 48.3 were calculated by area and depth sector using the bootstrap swept area method (Table 5.17). Separate biomass estimates were calculated using the haul-by-haul data from the Russian and UK surveys. A third estimate was calculated from a combined dataset of UK and Russian haul-by-haul data, without the application of any correction factor. The fourth estimate was calculated from a combined dataset, with the UK haul-by-haul data multiplied by the factor 1.241 reported above. This last approach is consistent with that adopted by the Working Group in 2000 and 2001, but uses the new estimate of the relative catchabilities of the Russian and UK surveys. For the estimates using the combined UK and Russian datasets, bootstrapping was performed by resampling within each survey separately. This is thought more appropriate than the method used to calculate the combined survey biomass in 2001, where the resampling was undertaken from within the complete combined dataset, because it did not assume the same population distribution across the two surveys. The geographic distribution of the strata is illustrated in SC-CAMLR-XIX, Annex 5, Figure 24.

5.105 Length densities from all three datasets (UK alone, Russian alone and combined) were corrected for sampling bias and analysed using the CMIX program to estimate numbers of fish at age. Initial bounds on the means of the distributions of length at age were set according to the von Bertalanffy parameters used in the previous year (SC-CAMLR-XX, Annex 5, Table 35). CMIX parameters were set with the component standard deviations linearly related to the means, with the slope constrained to be greater than zero. Initial runs on each set of data failed to converge, with CMIX not able to discriminate 4-year-old fish. Subsequent runs were undertaken omitting the 4-year-old component and fish at the extremes

of the distribution (i.e. <180 and >410 mm). Runs produced SD to mean slopes close to zero (i.e. SDs approximately equal) and final runs were undertaken with the slope constrained to be greater than 0.02 and intercept <15.

5.106 The results of the CMIX analysis are presented in Table 5.18 and Figure 5.5. Concern was expressed by the Working Group that the CMIX program was unable to identify 4-year-old fish in either the Russian or UK data. Figure 5.5 clearly shows the lack of fish of 335 mm length, where one would expect 4-year-old fish. It was pointed out that the 2000 survey had identified a large number of 2 year olds (SC-CAMLR-XX, Annex 5, Table 40), so the apparent complete absence of 4 year olds in both the current surveys was puzzling. A number of issues may contribute to this including:

- (i) ages of fish in either survey had been incorrectly attributed (for instance age-2 fish identified in 2000 were actually age 3);
- (ii) density dependent growth has contributed to a mixing of the cohorts; and
- (iii) survey design and timing may contribute to apparent differences between years.

Retrospective age determination from otolith samples from these cruises may help resolve some of these issues. The Working Group reiterated the importance of obtaining reliable age determinations in *C. gunnari* to assist with these assessments.

5.107 Short-term projections were undertaken according to methods that have been described in earlier reports. The input data are presented in Table 5.19. A value of 0.71 was used for natural mortality. The selection of this value was considered in detail at the previous Working Group meeting (SC-CAMLR-XX, Annex 5, paragraphs 4.207 to 4.210). The von Bertalanffy parameters were those approved by WG-FSA-01 (SC-CAMLR-XX, Annex 5, paragraphs 4.196 to 4.206) following the WAMI meeting.

5.108 Of the Subarea 48.3 commercial catch of 2656 tonnes, 471 tonnes were taken in February after the assumed time of application of the joint surveys (30 January) and this value was included in the projection.

5.109 The Working Group considered the results of the four projections (Table 5.20) and agreed that the most appropriate estimate of biomass was that calculated using combined data, with the UK survey data multiplied by 1.24. This is consistent with the approach taken in 2000 and 2001. This gives a projected yield of 2 181 tonnes in year 1 and 1 361 tonnes in year 2.

Management Advice

5.110 The Working Group recommended that the precautionary catch limit for *C. gunnari* in 2002/03 should be set at 2 181 tonnes.

5.111 The Working Group noted that the yield for Subarea 48.3 (2 181 tonnes) was only one-third of the yield calculated in 2001 (5 557 tonnes). This is due to the use of the 2002 survey estimates, which were lower than the 2000 survey estimates, and the use of the lower CF for the UK survey (1.241 compared with the factor 2.59 used in 2001).

5.112 The Working Group had no information from which to consider or revise its advice of 2001 in respect of the current seasonal limitation in Conservation Measure 219/XX. It therefore recommended that these aspects of the conservation measure should be unchanged.

5.113 The Working Group recommended the continuation of other aspects of Conservation Measure 219/XX, except for aspects subject to consideration of recommendations in paragraph 6.233, including that it may be appropriate to reconsider whether bottom trawl gear might be permitted under appropriate conditions (paragraphs 6.202 and 6.233(iii)).

Champocephalus gunnari Kerguelen Islands (Division 58.5.1)

5.114 The Working Group noted that icefish surveys in Division 58.5.1 have been conducted regularly by two vessels between 1996/97 and 2001/02 (WG-FSA-02/65). Preliminary results indicated that the biomass of *C. gunnari* in the survey area has remained at low levels since 1996/97, with no sign of a recovery to previous high levels. Possible reasons for the observed continued low abundance of *C. gunnari* are discussed in SC-CAMLR-XXI/BG/27, paragraph 7.2. The Working Group understood that the fishery for *C. gunnari* within the French EEZ of Division 58.5.1 would remain closed in the 2002/03 season (see also paragraph 5.84).

Champocephalus gunnari in Division 58.5.2

Commercial Catch

5.115 The commercial fishery for *C. gunnari* around Heard Island (Division 58.5.2) was open from the end of the Commission meeting in November 2001 to 30 November 2002. The catch limit agreed by the Commission for this period was 885 tonnes to be taken on the Heard Island Plateau area only (Conservation Measure 220/XX). This conservation measure included several other conditions applied to this fishery, including per haul by-catch limits, a provision to reduce the catch of small (<24 cm) fish, data reporting on a haul-by-haul basis, and the presence of a scientific observer on every vessel. Overall by-catch limits covering all fishing activities in Division 58.5.2 also applied (Conservation Measure 224/XX).

5.116 The commercial catch in the 2001/02 fishing season was 850 tonnes up to 7 October 2002, although the fishing season will remain open until 30 November 2002. This fishery was based on the strong cohort, now believed to be age 4, that was detected as 3 year olds in a survey in May 2001.

Surveys

5.117 A survey was conducted on the Heard Island Plateau and Shell Bank in May–June 2002 to assess the abundance and size structure of the *C. gunnari* populations. This survey used the same methodology as previous surveys in this area in 1997, 1998, 2000 and 2001 and detected a high abundance of fish of modal length 325 mm on the Heard Island Plateau. These fish were assumed to be 3 year olds in the previous year. No fish were caught on Shell

Bank, so this stratum was not included in the survey results. Compared to previous years, the population was more uniformly spread in the southeast with relatively high densities in that stratum.

Assessment at this Year's Meeting

5.118 WG-FSA-02/47 presented an assessment of short-term yield over the next two years based on the survey in May–June 2002. Survey results from 2002 indicated that a single large cohort dominated the population. Results from last year's survey would suggest that these fish should largely comprise age-4 fish. However, results of the mixture analysis gave a mean length for this cohort of 329 mm which is less than that expected of age-4 fish (340 mm) from an application of the growth curve (WAMI-01/4). The results of the mixture analysis are presented in Table 5.21 and Figure 5.6. Mean lengths at the time of the survey estimated from the growth curve are provided in Table 5.22. WG-FSA-02/47 suggested that age-4 fish may not have grown as fast as the 3 year olds in the last year, nor as fast as would be expected from the von Bertalanffy growth curve. The Working Group agreed to assume that the large cohort was composed of 4-year-old fish and apply the survey modal length of 325 mm for these fish as input to determine the initial numbers at age for the short-term projections. Data inputs for the short-term projections are provided in Table 5.23. It was agreed that intersessional work should be conducted to reconcile differences between mean lengths from the mixture analysis and mean lengths at age from the growth curve.

5.119 With a fishing mortality of 0.14 for 2002/03 and 2003/04, the catch limit satisfying the agreed criteria is 5 130 tonnes over two years. This is made up of 2 980 tonnes in the first year and 2 150 tonnes in the second year. The increase in yield from that presented last year (1 600 tonnes over two years) is largely due to an increase from 7 052 tonnes to 20 510 tonnes of the one-sided lower 95% confidence bound of biomass estimated from the trawl surveys in 2001 and 2002 respectively.

5.120 WG-FSA-02/47 suggested that a strong cohort may become legal size towards the end of the 2003/04 fishing season. This cohort will not be able to be assessed in the forthcoming season. The Working Group agreed that this issue needed further consideration and recommended that the Scientific Committee consider what issues may need to be addressed this year and what approaches it may wish to have considered.

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

5.121 The Working Group agreed that the total catch limit should be revised to 2 980 tonnes for the period from 1 December 2002 to 30 November 2003.

5.122 The remaining provisions of Conservation Measure 220/XX should be carried forward to the 2002/03 season.

Fishery Closure Mechanism

5.123 The Secretariat annually forecasts closure dates for fisheries by analysing the most recent three reporting periods and projecting those catch rates into the future. If the projection

indicates that the catch limit will be exhausted before the Secretariat receives data from the next reporting period, the Secretariat informs Members that the fishery will be closed on this date. In this calculation the Secretariat assumes no change to fishing effort will occur in the future.

5.124 The Working Group recalled that when this rule was established, there was relatively little information available to the Secretariat on vessel movements. This situation has now changed, since vessels are now required to inform the Secretariat when they enter and exit fishing areas (Conservation Measure 148/XX).

5.125 In light of this, the Working Group recommended that the Secretariat continue to estimate future catches to predict closure dates, but that in applying the method it should incorporate information available to it on future vessel movements into its estimation of future effort. This will increase the accuracy of the prediction of closure dates, which in turn should reduce the level of under- or overshoot of the catch limit.

Other Fisheries

Dissostichus eleginoides in Subarea 58.7

Prince Edward Islands EEZ

5.126 WG-FSA-02/76 presented an assessment of the *D. eleginoides* resource in the South African EEZ around the Prince Edward Islands. The paper indicated that the stock of *D. eleginoides* was subject to high levels of illegal catch in the mid-1990s and a sharp decline in the longline catch rate. ASPMs fitted to catch rate data indicated a substantial decline in abundance since 1996, with spawning biomass estimated to have been depleted to only a few percent of its average pre-exploitation abundance.

5.127 Length-frequency data were incorporated into the model but fits showed some inconsistency with the trends shown in the catch rate data. Further model development is encouraged, in particular with regard to fits to the length-frequency data.

5.128 It was noted that projections based on results from WG-FSA-02/76 would suggest that the annual allowable catch in the Prince Edward Islands EEZ could be up to 400 tonnes, subject to target levels of recovery that might be adopted by the Commission. The Working Group also expressed grave concern about the continuation of this fishery given the extremely low estimated level of current spawning biomass relative to pre-exploitation levels.

Outside Prince Edward Islands EEZ

5.129 Following advice of recent years, the Scientific Committee's and Commission's attention is again drawn to the high levels of uncertainty associated with estimates of *D. eleginoides* stock levels in Subarea 58.7 in general. The negative role of illegal and unregulated fishing in increasing such uncertainty is also re-emphasised.

5.130 Given the prevailing circumstances, the prohibition of directed fishing for *D. eleginoides* in Subarea 58.7 (Conservation Measure 160/XVII) should continue.

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

5.131 Biomass estimates of finfish from the 2002 German survey with RV *Polarstern* around Elephant Island and in the South Shetland Islands (Subarea 48.1) were presented in WG-FSA-02/24. The authors concluded that, as in 2001, the overall biomass of all species in the area has yet to reach a level at which commercial exploitation would be advisable.

5.132 With respect to *N. rossii*, the authors suggested that further consideration should be given to the development of a survey strategy which takes account of the very patchy distribution of the species. They encouraged further work on this matter in the intersessional period.

5.133 There have been no bottom trawl surveys conducted in the South Orkney Islands (Subarea 48.2) since March 1999. A new survey is planned by the US AMLR Program to be conducted in March 2003.

Management Advice

5.134 There appears to be little scope to reopen the fishery in either of the two subareas in the near future given the comparatively low biomass of all abundant species. The Working Group therefore recommended that Conservation Measures 72/XVII and 73/XVII should remain in force.

South Sandwich Islands (Subarea 48.4)

5.135 No new information was made available to the Working Group on which an update of the previous assessment could be based.

Management Advice

5.136 The Working Group recommended that Conservation Measure 180/XVIII be retained until new information becomes available and a new assessment could be attempted.

Electrona carlsbergi South Georgia (Subarea 48.3)

5.137 The Working Group noted that the last year in which there were catches from the fishery for *E. carlsbergi* in Subarea 48.3 was 1992, and that this fishery was last assessed by WG-FSA in 1994. The precautionary catch limit for the fishery was derived from an assessment based on the krill yield model (precursor to GYM) which used a biomass estimate from a survey conducted in 1987/88. WG-FSA had expressed concern in 1994 that the biomass estimate was out of date and, as a consequence, the catch levels should be viewed with caution (SC-CAMLR-XIII, Annex 4, paragraph 4.93).

5.138 WG-FSA agreed that the assessment for *E. carlsbergi* should be revised at its 2003 meeting. In the meantime, it was agreed that the provisions of Conservation Measure 223/XX should be retained and carried forward to the 2002/03 season.

Crabs (*Paralomis spinosissima* and *P. formosa*) (Subarea 48.3)

General Information about the Fishery

5.139 On 15 April 2002 the Japanese fishing vessel *Kinpo Maru No. 58* initiated its first season of participation in the commercial crab fishery in Subarea 48.3 in accordance with Conservation Measure 225/XX. The vessel targeted and retained two species of crabs, *P. spinosissima* and *P. formosa*. Fishing activities ended on 31 May 2002.

5.140 The vessel conducted fishery-based research in accordance with the data requirements described in Annex 225/A of the measure and completed effort-spreading measures according to the experimental harvest regime for the crab fishery outlined in Conservation Measure 226/XX and Annex 226/A. A total of 112 sets were made, with 51 997 pots deployed for a combined 1.473 million pot hours of fishing effort.

5.141 Data from the 2001/02 crab fishing season were submitted to the Secretariat in accordance with the 10-day catch and effort reporting system set forth in Conservation Measure 61/XII, and monthly fine-scale catch and effort as set out in Conservation Measure 122/XIX (haul-by-haul form), and in the form of observer reports.

5.142 Further information regarding the crab fishery in Subarea 48.3 and details of the analyses undertaken during the Working Group meeting can be found in SC-CAMLR-XXI/BG/27.

Assessment

5.143 The Working Group agreed that the information submitted from the *Kinpo Maru No. 58* was valuable, particularly given the paucity of information on stocks of *P. formosa* around South Georgia. Nevertheless, there was insufficient information on which to conduct a rigorous stock assessment of either species of crab based on the 2001/02 commercial catch data.

5.144 The Working Group recognised the utility of the experiments on crab survivorship described in WG-FSA-01/32 and undertaken by the *Kinpo Maru No. 58*. It recommended that similar experiments be performed by all vessels when they first start fishing for crabs.

Management Advice

5.145 Although there was insufficient information on which to conduct an assessment, the Working Group recognised the value of the experimental harvest regime and recommended that Conservation Measure 226/XX remain in force.

5.146 The Working Group agreed that there was insufficient new biological information available on size and maturity of *P. formosa* and *P. spinosissima* that warranted a revision of Conservation Measure 225/XX pertaining to the minimum carapace width of crabs which may be retained. The Working Group recommended that the catch and effort limitations of Conservation Measure 225/XX remain in force until new information is made available that would scientifically support changes to the existing management scheme for the crab fishery in Subarea 48.3. The Working Group recommended that all existing data on male cheliped height and length be submitted to CCAMLR, and that a more comprehensive analysis of size of male maturity be conducted.

5.147 A proposal submitted by the Japanese Delegation to revise paragraph 6 of Conservation Measure 225/XX ('crab processed at sea shall be frozen as crab sections') was discussed by the Working Group. The proposed revision states that 'When crabs are processed at sea, the international scientific observer of CCAMLR on board shall carry out proper random sampling of crabs to be processed, and shall confirm that every carapace width of sampled crab is not less than minimum carapace width regulated'.

5.148 The reason that this request has been put forward is that the proposed processing method does not include the retention of crab sections. The current conservation measure specifies the retention of these sections so that observers can determine the size of retained crabs.

5.149 The Working Group recognised that paragraph 6 of Conservation Measure 225/XX was adopted prior to the requirement of an international observer on crab fishing vessels, and agreed that observers could sample crabs after sorting by the crew as long as the scientific observer is given unrestricted access to the catch for proper statistical random sampling. It was emphasised that the observer should continue to sample the whole catch prior to sorting as well as sampling after sorting.

Martialia hyadesi South Georgia (Subarea 48.3)

5.150 No notification had been submitted for this fishery in the 2002/03 season. The Working Group agreed that the provisions of Conservation Measure 238/XX should be retained and carried forward to the 2002/03 season.

By-catch

5.151 The long-term status of by-catch species has been identified as an issue for urgent attention by the Scientific Committee (SC-CAMLR-XX, paragraph 5.101). At last year's meeting, the Working Group identified several key issues that needed to be addressed in order to progress work on by-catch species, namely:

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

5.152 WG-FSA-02/49 is the report of the intersessional subgroup on by-catch and presents the work plan of the group and a summary of completed work.

5.153 Further information on macrourids in Subarea 88.1 and Division 58.5.2 can be found in SC-CAMLR-XXI/BG/27.

Assessments of the Status of By-catch Species or Groups

5.154 The priority by-catch taxa for which assessments of status are required are the macrourids and rajids (SC-CAMLR-XX, Annex 5, paragraphs 4.311 and 4.315).

5.155 Biological information was available for *Macrourus holotrachys* and *Amblyraja* spp. in Subarea 48.3 (WG-FSA-02/26 and 02/54) and *Amblyraja* spp. in Subarea 88.1 (WG-FSA-02/42), however this was insufficient to calculate estimates of the precautionary pre-exploitation harvest level (γ).

Macrourus spp.

5.156 Sufficient biological data to calculate γ were available for *Macrourus whitsoni* in Subarea 88.1 (WG-FSA-02/32 and 01/43) and for *Macrourus carinatus* in Division 58.5.2 (WG-FSA-02/48 and van Wijk et al., 2000). Estimates of γ were calculated using the GYM and the input parameters presented in Table 5.24. A detailed description of the assessment method is provided in SC-CAMLR-XXI/BG/27.

5.157 The decision rule used to assess γ was that the median escapement of the spawning stock at the end of 20 years of exploitation is 50% of the pre-exploitation spawning stock biomass, and that the probability of depletion below 20% of the median pre-exploitation spawning biomass is no greater than 0.1 over a 20-year period.

Macrourus whitsoni (Subarea 88.1)

5.158 The estimate of γ for *M. whitsoni* in Subarea 88.1 was 0.02165. This resulted in a median escapement of 0.74 and probability of depletion of 0.10.

5.159 Estimating a precautionary yield for *M. whitsoni* in Subarea 88.1 using γ requires an estimate of B_0 for the population. There are currently no estimates of B_0 in Subarea 88.1 or adjacent areas. Thus the Working Group was not in a position to calculate an estimate of precautionary yield for *M. whitsoni*.

Macrourus carinatus (Division 58.5.2)

5.160 The estimate of γ for *M. carinatus* in Division 58.5.2 was 0.03226. This resulted in a median escapement of 0.51 and a probability of 0.10. This estimate of γ was very close to the value (0.033) determined in a previous assessment of *M. carinatus* in Division 58.5.2 (WG-FSA-99/69).

5.161 An estimate of B_0 for *M. carinatus* in Division 58.5.2 was calculated using the mean density of *M. carinatus* ($176 \pm 14 \text{ kg/km}^2$) obtained from a research survey of BANZARE Bank (van Wijk et al., 2000), prorated to the area of seabed in the same depth range (600–1 500 m) in Division 58.5.2. This gave a mean biomass for *M. carinatus* in Division 58.5.2 of 14 402 tonnes, with a range of 13 256 to 15 547 tonnes. Applying a value of γ of 0.03226, gives a mean estimate of yield of 465 tonnes, with a range of 428 to 502 tonnes.

5.162 The Working Group noted that the value of natural mortality used in this assessment was approximately 1–2 times k and that this range may be too low. The Working Group recommended that sensitivity tests of the GYM to variations in estimates of M and other parameters, such as age and growth, coefficient of variation of biomass and the standard deviation of the lognormal recruitment function, be undertaken for *M. carinatus* in Division 58.5.2 and *M. whitsoni* in Subarea 88.1 during the intersessional period.

5.163 Dr Hanchet noted that one of the vessels from the longline fishery in Subarea 88.1 may be involved in future longlining operations in Division 58.5.2 and flagged that this may afford the opportunity to obtain comparative CPUE estimates.

Management Advice

5.164 The Working Group noted that the estimates of γ for *M. whitsoni* and *M. carinatus* suggest that these species have relatively low productivity and thus may be vulnerable to overexploitation.

5.165 The Working Group reiterated the request made at last year's meeting (SC-CAMLR-XX, Annex 5, paragraphs 4.311 and 4.315) that in order to undertake assessments for by-catch species more information is required on:

- estimation of standing stock;
- taxonomic descriptions of species;
- length–mass relationships;
- total length to pre-anal length relationships;
- age and growth parameters;
- reproductive information; and
- tagging studies to investigate migration and growth.

5.166 The Working Group recommended that future work include research towards generating updated population parameters and estimates of standing stock for macrourids and rajids.

5.167 The Working Group recommended that the mean estimate of precautionary yield for *M. carinatus* in Division 58.5.2 (465 tonnes) be considered as the precautionary by-catch limit. Further intersessional work is recommended to improve the input parameters and to conduct sensitivity trials as discussed above.

5.168 The Working Group agreed that the application of by-catch limits is to provide adequate protection for by-catch species, with the understanding that the fishery takes steps to reduce by-catch rates. However it was agreed that these by-catch limits, with their attendant

uncertainties, should not be used as a reflection of a long-term sustainable annual yield. In that context, sustained by-catch at these levels over a number of years would require a revised assessment.

5.169 In the absence of assessments for by-catch species, the Working Group recommended that precautionary measures that place upper limits on by-catch and reduce the potential for localised depletion be adopted.

Assessment of the Expected Impact of Target Fisheries on By-catch

Estimated Total Removals

5.170 In order to assess the impact of fisheries on by-catch species, accurate information is required on the total removals of by-catch taxa. At last year's Working Group meeting the by-catch subgroup attempted to calculate total removals from observer data for each fishery. Due to the limitations of the data, this was not achieved (SC-CAMLR-XX, Annex 5, paragraphs 4.277 to 4.286). The Scientific Committee recommended that the observers logbook and forms be revised intersessionally according to the recommendations in SC-CAMLR-XX, paragraph 5.97.

5.171 The observers electronic logbook and forms were revised at the beginning of the 2001/02 fishing season and distributed to technical coordinators in early 2002. An analysis of observer reports from the 2001/02 fishing season indicated most had been submitted to the Secretariat on the old forms. The Working Group reiterated the importance of observers using the current versions of the forms. Even though the new forms were not generally used, some nations have collected the data required to calculate total removals using their own versions of the observer database. The Working Group requested that these nations liaise with the Secretariat intersessionally to ensure that all by-catch data are adequately transferred.

5.172 Estimates of total removals of rajids and macrourids were available for Division 58.5.2 (WG-FSA-02/46) and Subarea 88.1 (WG-FSA-02/38 and 02/40) and were calculated from datasets submitted by Australia (Division 58.5.2), France (Subarea 58.6) and South Africa (Subareas 58.6 and 58.7). Total removals could not be estimated for Subarea 48.3 (WG-FSA-02/55).

5.173 WG-FSA-02/46 reviewed fish and invertebrate by-catch by split-year and fishing ground in the *D. eleginoides* and *C. gunnari* trawl fisheries in Division 58.5.2. From 1996/97 to 2001/02, a total of 95 tonnes of by-catch were caught in the *D. eleginoides* fishery and 46 tonnes in the *C. gunnari* fishery. These values represent 1 and 2% respectively of the total catch weight in each fishery. In the 2001/02 split-year 5 tonnes of macrourids and 2 tonnes of rajids were caught in both fisheries.

5.174 WG-FSA-02/38 gave an overview of by-catch in the *D. mawsoni* fishery in Subareas 88.1 and 88.2. *M. whitsoni* accounted for 10% of the total catch in 2002. Macrourids (as a percentage of total catch) have varied considerably between years and SSRUs from less than 1 to 27%. Rajids (*Bathyraja eatoni* and *Amblyraja georgiana*) comprised only 2% of the total catch in 2002. *A. georgiana* was the most abundant species

with a catch rate more than 28 times higher than that for *B. eatoni*. The proportion of skates in the total catch varied between years and SSRUs from less than 1 to 15%. Other by-catch taxa contributed less than 1% to the total catch.

5.175 WG-FSA-02/55 provided preliminary estimates of catches of rajids in Subarea 48.3 in 2001. Estimates were calculated by vessel where reliable observer data on the number of hooks set, proportion of hooks observed and skate numbers (including discards) were available. The catch rate of rajids varied between vessels from 0.08 to 6.99 rays/thousand hooks. This translates to catches of rays by vessels (in numbers) between 65 and 5450. These estimates did not provide coverage of the whole fleet and were not scaled up to reflect total removals due to the lack of complete data. Many observers were experiencing difficulties in identifying rays to species level and in accurately observing discards.

5.176 Estimates of total removals of rajids and macrourids by the fishery for the 2001/02 split-year are in Tables 5.25 to 5.28. The data in these tables have been derived from the papers and datasets discussed in paragraph 5.172 and from the Secretariat database. Table 5.25 presents estimates of total removals of by-catch by fishery and as a percentage of target catch, obtained from observer data. By-catch removals as a percentage of the target catch are approximately 10% for macrourids and less than 10% for rajids. The high figure for macrourids in Subarea 58.7 is due to the low target species catch in this area.

5.177 The Working Group also noted the new standard of reporting by fishing season and not split-year. It therefore recommended that future estimates of by-catch removals be presented by fishing season.

5.178 The Working Group noted that the seabed area in Division 58.5.1 is roughly comparable to the seabed area in Division 58.5.2 and that the estimate of total removals for macrourids in Division 58.5.1 approaches the estimate of yield calculated for *M. carinatus* in Division 58.5.2.

5.179 The Working Group noted the very low estimates of by-catch removals in the current trawl fishery in Division 58.5.2 and flagged that these may increase if longlining proceeds in this division in the next fishing season.

Comparison of By-catch Datasets

5.180 By-catch data are reported to CCAMLR in three different forms: STATLANT data, fine-scale catch and effort data and observer data (Tables 5.26 and 5.27).

5.181 The Working Group noted that the various types of data used to estimate total removals of skates and rays (catch, discard and those cut from the longline) are reported inconsistently in observer data. The current versions of the observers logbook and forms allow for the inclusion of all types of by-catch data. The Working Group reiterated that complete information on by-catch of skates and rays should be reported in observer data.

5.182 The Working Group noted that STATLANT data grossly underestimate by-catch in most fisheries (Tables 5.26 and 5.27).

5.183 The quality of by-catch information from fine-scale catch and effort datasets is variable. In Division 58.5.1 and Subarea 88.1, the total removals estimated from fine-scale

by-catch data (Table 5.26) are close to those from observer data. However in other areas, fine-scale data vary by vessel and can show significant departures from observer estimates. Thus caution should be applied when considering by-catch information derived from fine-scale catch and effort data.

Management Advice

5.184 The Working Group strongly emphasised the need for accurate reporting of by-catch.

5.185 The Working Group reiterated that discarded skates should be included in observer data.

5.186 The Working Group noted that IUU fishing is also likely to result in removals of by-catch species. In the absence of information, the estimates of total removals presented here should be treated as minimum estimates.

Operation of By-catch Precautionary Measures

5.187 WG-FSA-02/40 reported that the total by-catch limits imposed by fine-scale rectangle (50 tonnes for rajids and 100 tonnes for macrourids) were not exceeded during the 2001/02 fishing season. The number of times that the 1 tonne move-on rule was triggered during 2001/02 ranged from 0–22% of longline sets for macrourids and 0–4% of longline sets for rajids. Alternative trigger rates of 500 kg and 2 tonnes were examined, however the current 1 tonne trigger seems appropriate in Subarea 88.1.

5.188 WG-FSA-02/46 reviewed the operation of the move-on rule in the trawl fisheries in Division 58.5.2. The move-on rule was only triggered on two occasions over the last four fishing seasons and thus does not hinder fishing operations.

Correlation of By-catch with Target Catch and Other Variables

5.189 WG-FSA-02/40 examined the relationships between by-catch rates for macrourids and rajids with other variables such as fishing ground, depth, bait type and length of line. The most important variable in predicting high by-catch rates for both rajids and macrourids was fishing ground. Areas with high by-catch also yielded high catches of target species. For rajids, bait type and length of line were also important, while for macrourids, depth and longitude were important variables.

5.190 The Working Group noted that the CPUE analyses for by-catch species are influenced by the same issues that apply to toothfish and suggested that collaborative work continue intersessionally.

Consideration of Mitigation Measures

5.191 WG-FSA-02/24 described how changes to fishing gear minimised the by-catch of benthos, without reducing the catchability of finfish, during a bottom trawl survey by Germany around Elephant Island. Rubber disks replaced the steel bobbins of the ground tackle and size and weight of trawl doors were reduced. The tendency of the trawl to become hooked on the bottom was greatly decreased, and the by-catch of benthos at Elephant Island substantially reduced from 9.76 tonnes in 1996 (Kock et al., 1998) to 1.61 tonnes in 2002.

5.192 The potential impact of fishing operations on benthic habitats was raised as an important issue for future consideration. The Working Group encouraged the quantitative reporting of benthic invertebrate by-catch in all fisheries in order to improve the available information. Intersessional work could consider the methods used in other fisheries to deal with benthic by-catch, and how these might apply to CCAMLR.

5.193 WG-FSA-02/42 presented preliminary results from the first three years of a tagging program for rajids in the Ross Sea (Subarea 88.1). Skates were tagged in the water and were cut from the line. Fourteen skates were recaptured from a total of 6 014 (0.26%), indicating at least some long-term survival. This recapture rate is comparable to that for *D. eleginoides* in Subarea 88.1 (Table 5.29). Examination of skates recaptured between seasons showed that hooks were absent from mouth parts and that there was good healing around hook and tag wounds.

5.194 The by-catch subgroup noted anecdotal evidence from Members that the weighting of longlines and the height of hooks from the sea floor could have a large impact on the by-catch rate of rajids. Setting hooks a few metres above the bottom considerably reduced rajid by-catch in some cases.

Management Advice

5.195 The Working Group recommended that wherever possible during longlining operations:

- live rajids should be cut from the line whilst still in the water to increase chances of survivorship; and
- vessels should be encouraged to develop methods to minimise rajid by-catch, for instance setting hooks above the sea floor.

5.196 The Working Group recognised the issues surrounding by-catch of rajids and the need to obtain information on:

- the vulnerability of rajids to capture;
- methods for adequately assessing survivorship of animals released;
- methods for handling rajids that maximise survivorship; and
- methods for adequately documenting the biological characteristics, including size, of rajids hooked but not landed.

The Working Group encouraged intersessional work that might address these issues.

Regulatory Framework

5.197 The Working Group noted that the Scientific Committee has identified the establishment of fishery plans as being fundamental to the operation of the regulatory framework. For those fisheries with fishery plans, the regulatory and scientific requirements would be specified in the plan. For those without plans, the Commission would need to establish entry-level conditions, which has already been done in the context of new and exploratory fisheries (SC-CAMLR-XX, paragraph 7.9). This negates the need to define fishery types or stages (SC-CAMLR-XX, paragraph 7.10).

5.198 The Secretariat has made considerable progress with defining fishery plans. Fishery plans are now available for *C. gunnari* in Subarea 48.3 and Division 58.5.2, crabs in Subarea 48.3, krill in Area 48, *D. eleginoides* in Subarea 48.3 (longline and pot) and Division 58.5.2 and *D. mawsoni* in Subarea 88.1.

5.199 The Working Group expressed its appreciation of the development of the fishery plans by the Secretariat, and noted that they considerably assisted the Working Group in understanding and tracing changes that have taken place in the various fisheries over time. Specific comments were made that it would be useful to see, on the fishery plans, specification of the conservation measures that specifically relate to by-catch, the catch of the target species in other fisheries for that species, and the total catch of by-catch by species.

5.200 These changes are relatively minor. The Working Group suggested that further changes, which may involve rather more information being included on the forms, be considered carefully since their addition might lead to a loss of the current admirable simplicity of the forms.

5.201 Dr Constable observed that an essential part of the framework is notification of intent with regard to CCAMLR fisheries. He observed that the notification by Australia for a longline fishery for toothfish in Division 58.5.2 (CCAMLR-XXI/10) was conceived as part of the requirements of the new regulatory framework. The Working Group expressed its appreciation that Australia had taken this step.

Evaluation of the Threats Arising from IUU Activities

Review of Historical Trends in IUU Activity

5.202 Tables 3.3, 5.30 and 5.31 present various summaries of IUU fishing activity from 1995/96 to date. Taking the Convention Area as a whole, from a peak of about 32 673 tonnes in the 1996/97 fishing season, the level of IUU fishing appears to have declined to a low point in the 1998/99 fishing season and then increased again to 10 898 tonnes in 2001/02 (Table 5.31). However, these global trends mask a variety of patterns that have been evident in different subareas or divisions.

5.203 In Subarea 48.3, the start of the legitimate fishery in 1988/89 was followed by a rise in IUU catches in 1990/91 to a level of about 4 000 tonnes in 1992/93 and 1993/94 (Table 3.3). IUU catches then fell as IUU activity transferred to the Indian Ocean sector, but appears to have risen again in 1998/99 and 1999/2000. In 2000/01 IUU catches in Subarea 48.3 fell

again, and in 2001/02 they were at negligible levels. These levels have been so low that the total extractions from Subarea 48.3 have been lower than the catch limit for both of the previous two years.

5.204 The Working Group recalled its previous discussion of WG-FSA-02/4 (paragraphs 3.17 to 3.22). The figures for IUU fishing in Subarea 48.3 in the years 1998/99, 1999/2000 and 2000/01 are the statistical estimates calculated by the methods detailed in that paper. Although changes to IUU vessel behaviour might introduce bias into the results of this model they are not reflected in changes to the encounter rate, the estimates remain considerably more robust than estimates made using the existing CCAMLR method (i.e. estimates of days fishing and catch rate in Table 3.2). The results of WG-FSA-02/4 also indicated that the CCAMLR estimates are likely to be underestimates of IUU fishing activity if the observing vessels (for instance fishery protection vessels) are not present in the area for substantial periods of time during the year.

5.205 Subareas 58.6 and 58.7 saw their greatest IUU catches in 1995/96 and 1996/97 (Table 3.3). Since then, IUU catches in Subarea 58.7 have been very low, at about the same level as legitimate catches. IUU catches in Subarea 58.6 have also been at the same level as legitimate catches since 1999/2000, although at a higher level than for Subarea 58.7.

5.206 Divisions 58.5.1 and 58.5.2 also saw high levels of IUU fishing in 1995/96 and 1996/97, but unlike Subareas 58.6 and 58.7, although they declined in 1998/99, IUU catch levels have recently increased to very high levels. In Division 58.4.4, IUU fishing appears to have started in 1996/97 and then stayed at a level of about 1 300 tonnes until 2001/02.

5.207 The Working Group noted that in the Indian Ocean sector, total catches for subareas or divisions (legitimate + IUU catches) have generally exceeded the catch limits that have been set (Table 5.30).

5.208 Finally, the Working Group noted with concern the recent appearance of IUU catches from areas adjacent to the Antarctic Continent, namely in Division 58.4.2 and Subarea 88.1 (Table 3.3).

5.209 Estimates of catches taken in high seas waters outside the Convention Area are derived from CDS data. Table 5.31 shows that 14 659 tonnes are estimated to have been taken outside the Convention Area in 2001/02. It is acknowledged that there is some potential for double counting of these catches. This will arise if IUU catches are estimated to have come from within the Convention Area but are subsequently declared as having come from outside the Convention Area on a *Dissostichus* catch document.

5.210 The Working Group noted that in 2001 the Scientific Committee had concluded that practically all the toothfish catches reported from Area 51 represented catches taken as a result of IUU fishing in other areas inside the Convention Area. The only information that the Working Group had to judge the veracity of this statement was the calculations of the area of seabed made by the Secretariat (Table 5.32 and Figure 5.7).

5.211 By way of illustration, for Area 51, 30 000 km² of seabed is within the depth range 0–1 800 m. If this were to be compared with Division 58.5.2, where the seabed area is 171 000 km², and a similar productivity was assumed for Area 51 as for Division 58.5.2, one might expect a spawning biomass of about 16 000 tonnes and a sustainable catch of about

500 tonnes. If this analogy were realistic, it is clear that the current CDS-recorded catches from Area 51 (14 168 tonnes in 2000/01 and 8 237 tonnes in 2001/02; Table 5.30) would not be sustainable. It is doubtful even if they could be obtained by 'mining' the biomass.

5.212 The above is offered simply by way of illustration. The Working Group agreed that in order to arrive at a more informed opinion of the likelihood of catches from Areas 51 and 57 actually being caught there it would be important to have information not only on the extent of fishable seabed areas north of the Convention Area, but also on the likely catch rates and size and productivity of stock in these areas. Thus scientific papers describing the biology and distribution of toothfish in areas north of the Convention Area would be particularly useful.

5.213 The Working Group drew attention to the fact that there are some high seas areas adjacent to the Convention Area where toothfish are known to occur. Examples of these areas would be Delceno Rise and William's Ridge in Areas 51 and 57 respectively (see paragraph 3.25). Where these areas straddle the boundary of the Convention Area, it is quite likely that the stocks they contain are transboundary stocks, i.e. stocks that occur both inside and outside the Convention Area.

5.214 There are two other FAO areas where substantial catches are declared in CDS data to have been taken in high seas waters: Areas 41 and 87 (Table 5.30). In each of these, there seem to be significant fishable areas at depths at which toothfish might be found. In these two areas there are also substantial fisheries in areas under national jurisdiction. In particular, in Area 41 there are extensive well known high seas fishing grounds for toothfish (WG-FSA-02/66).

Evaluation of Future Threats of IUU Activity

5.215 The effects of IUU fishing can be both catastrophic and chronic.

5.216 Catastrophic effects are those such as were seen in Subarea 58.7. In 1995/96 and 1996/97 a total of 12 285 tonnes of IUU catch was taken from this subarea, which together with the legitimate catch of 2 061 tonnes depleted stocks severely (paragraphs 5.126 and 5.128; WG-FSA-02/69). This level of fishing effectively 'mined' the stock, resulting in very rapid depletion and a concomitant reduction in catch rates.

5.217 The Working Group noted that there was still considerable potential for such catastrophic mining to occur. The total IUU catch is now estimated to be 10 868 tonnes (Table 5.31), not dissimilar to that taken in 1996/97 in Subarea 58.7. If all this IUU catch was concentrated in a single subarea or division, it could have a catastrophic effect on the stock in that area. Such concentration would, however, require considerable coordination of all vessels and companies currently involved in IUU fishing.

5.218 WG-FSA-02/69 examined the chronic effects of IUU fishing on the catch limit indicated by the current GYM. In situations where the IUU catch was 33% of the catch limit, and was taken in addition to the catch, current assessment methods, using the GYM, would respond by slowly reducing the catch limit (Figure 5.8).

5.219 For IUU catches equal to or greater than the catch limit, current assessment methods will respond by reducing the catch limit more rapidly than in the previous case. This will

continue until the stock is depleted to the point where there is a very high probability of stock being less than 20% of median pre-exploitation biomass. The assessment method will indicate a zero catch limit.

5.220 The Working Group recognised that the particular trajectory taken by the catch limits will depend on the time series of (both IUU and legitimate) catches. Thus it would not apply uniformly to all areas. However, for areas where there has been an extended period in which the combined IUU and legitimate catch has exceeded the catch limits, that combined catch would be unsustainable. Furthermore, the decline in the stock might be greater than indicated by the decline in the catch limit.

5.221 The reason that the GYM estimates a gradual rather than immediate reduction in catch limit following an IUU catch, is that the model takes account of past levels of IUU fishing by averaging out their effects over the future 35 years of the projections. Thus the effect of an IUU catch is spread over the future projection years, rather than reducing a single future year by an amount similar to the IUU catch.

5.222 The Working Group advised that, in situations where the IUU and legitimate catches together exceed the catch limit, the combined catch will not be sustainable and using current assessment methods, one would expect to see a decline in the catch limit in future years. The actual sustainable catch levels will also, of course, be influenced by the recruitment series and other data in the assessment.

5.223 Whilst past IUU catches are taken into account in the assessment, no allowance is made for the possibility of there being IUU catches in the future. The Working Group's advice is normally that the catch limit should be set to the sustainable catch limit calculated by the assessment. The Working Group suggested that the Scientific Committee might comment on whether the assessments currently conducted by the Working Group are adequate with respect to IUU fishing, and if not what additional calculations might be required.

Advice to the Scientific Committee

5.224 The Working Group recommended that the Scientific Committee take note of all subareas and divisions where the total catch is greater than the sustainable catch, and the consequences that this will have on the stock and on future trends in sustainable catch.

5.225 Whilst past IUU catches are taken into account in the assessment, no allowance is made for the possibility of there being IUU catches in the future. The Working Group's advice is normally that the catch limit should be set to the precautionary yield calculated by the assessment. The Working Group suggested that the Scientific Committee might comment on whether the assessments currently conducted by the Working Group are adequate with respect to IUU fishing, and if not what additional calculations might be required.

5.226 Scientific information from areas adjacent to the Convention Area where toothfish might occur is urgently needed to assess the likely origin of catches reported from high seas areas outside the Convention Area.

5.227 To assist with the interpretation of the origin of high seas catches taken outside the Convention Area, the Working Group recommended that the CDS be amended to include a

requirement to report data by the smallest appropriate FAO statistical division. In the South Atlantic, this would mean attributing catches by division (41.3.1, 41.3.2 and 41.3.3) or by subarea (41.2, 47.4 and 47.3). If subdivision of Areas 51 and 57 were possible, this would also be an advantage in tracing the origin of catches on *Dissostichus* catch documents.

INCIDENTAL MORTALITY OF MAMMALS AND SEABIRDS ARISING FROM FISHING

Intersessional Work of Ad Hoc WG-IMAF

6.1 The Secretariat reported on the intersessional activities of ad hoc WG-IMAF according to the agreed plan of intersessional activities for 2001/02 (SC-CAMLR-XX, Annex 5, Appendix F). The report contained records of all activities planned and results of their completion (WG-FSA-02/83).

6.2 The Working Group thanked the Science Officer for his work on the coordination of IMAF activities and the technical coordinators for their extensive support. It also thanked the Scientific Observer Data Analyst for his work on the processing and analysis of data submitted to the Secretariat by international and national observers during the course of the 2001/02 fishing season.

6.3 The Working Group concluded that most tasks planned for 2001/02 had been successfully implemented. The list of current intersessional tasks was reviewed and a number of changes were agreed in order to consolidate specific tasks in future plans. The Working Group agreed that the plan of intersessional activities for 2002/03, compiled by the Convener, be appended to its report (Appendix D).

6.4 The membership of ad hoc WG-IMAF was reviewed. The Working Group noted with regret that Mr J. Cooper (South Africa) had resigned from the group due to his changed commitments. The Working Group especially welcomed Ms T. Hewitt (Australia), Dr D. Nel (South Africa), Mr M. McNeill (New Zealand) and Dr Reid who attended the meeting for the first time. In particular, it was noted that, thanks to Mr McNeill's participation, expert advice on operational aspects of fishing vessels had become available to the group. Members were asked to review their representation on ad hoc WG-IMAF intersessionally, to suggest additional members and to facilitate the attendance of their representatives at the meetings.

Incidental Mortality of Seabirds during Regulated Longline Fishing in the Convention Area

2002 Data

6.5 Data were available from 22 longline cruises conducted within the Convention Area during the 2001/02 season (details in WG-FSA-02/11 Rev. 1 and Table 6.1).

6.6 The Working Group noted that the proportion of hooks observed was similar to last year for Subareas 48.3 (22% (range 19–31) compared with 24% (10–81)), 58.6 and 58.7 (37% (range 9–59) compared with 39% (range 6–63)) and 88.1 and 88.2 (42% (range 40–45)

compared with 56% (range 37–89)), but with generally greater consistency across vessels. Only for three cruises (*Suidor One* (9%), *Isla Camila* (19%), *Isla Santa Clara* (19%)) was the proportion of hooks observed lower than 20%.

6.7 The Working Group noted that WG-FSA-02/52 indicated that for the purposes of detecting a substantial (order-of-magnitude) change in by-catch rate from the present very low levels, observation of at least 25% of hooks would be appropriate. Technical coordinators were requested to try to ensure that this minimum level of hook observation is achieved by each vessel.

6.8 As usual, the total observed seabird catch rate was calculated using the total number of hooks observed and the total seabird mortality observed (Table 6.2). The estimated total catch of seabirds by vessel was calculated using the vessels observed catch rate multiplied by the total number of hooks set.

Subarea 48.3

6.9 The total estimated seabird mortality was 27 birds (Table 6.2) compared with 30 birds last year and 21 the year before (Table 6.3). The overall catch rate was 0.0015 birds/thousand hooks compared to 0.002 in the two previous years (Table 6.3). Of the six birds observed killed (all at night), four were southern giant petrels, one was a northern giant petrel and one a Cape petrel (Table 6.4).

South African EEZs in Subareas 58.6 and 58.7

6.10 No seabirds were observed killed in these parts of Subareas 58.6 and 58.7, compared to 199 and 516 birds estimated killed in the two previous years (Table 6.3). It was noted that WG-FSA-02/17, which also reported on the seabird by-catch in this fishery, included observations of two birds killed from fishing in the South African EEZs in these subareas, but that these records relate to fishing outside the Convention Area.

6.11 The effort in this fishery was substantially reduced from 2001, involving only three cruises and 1.67 million hooks set this year compared with 11 cruises and 6.56 million hooks last year.

6.12 There was no indication of the circumstances by which such a major reduction (to zero) of seabird by-catch within this fishery had been achieved. Nevertheless it was clearly a remarkable and encouraging achievement.

Subareas 88.1 and 88.2

6.13 No incidental mortality of seabirds was observed in fishing operations whose level and nature were closely similar to those in previous years. This was the fourth successive year of zero seabird by-catch in the fishery in Subarea 88.1.

French EEZs in Subarea 58.6 and Division 58.5.1

6.14 No data were received for the 2001/02 season. Given the high levels of seabird by-catch reported for these fisheries for 2000 and 2001, it was important that such data for the current season be submitted to the Secretariat as soon as possible, using the CCAMLR data reporting forms and formats.

6.15 Some data had been received for the 1999/2000 and the 2000/01 fishing seasons in respect of these areas but had arrived after the deadline for submission of papers for consideration at this year's meeting. These data would be evaluated by the Secretariat during the intersessional period.

General

6.16 The Working Group noted that the total numbers of birds reported as caught but released alive (42) was greater than the numbers landed dead (six). It noted that some proportion of birds landed alive were likely to have sustained injuries (e.g. broken wing) prejudicial to their subsequent survival. Such birds should be regarded as part of the total of birds killed. It was recommended that appropriate changes be made to the observer logbook to enable birds landed alive but with potentially fatal injuries to be distinguished from those released alive with no or minor injury.

Compliance with Conservation Measure 29/XIX

6.17 Data from observer reports on compliance with this conservation measure in 2001/02 are provided in WG-FSA-02/13 Rev. 1 and summarised in Tables 6.5 and 6.6. Comparison with similar data from previous years is provided in Table 6.7.

Streamer Lines

6.18 Compliance with streamer line design has markedly improved since last year, with observers reporting full compliance of the design of the streamer lines deployed on 19 of the 22 cruises (86%) (WG-FSA-02/13 Rev. 1 and Table 6.5). This compares with 66% overall compliance in 2000/01 and 33% in 1999/2000. The two vessels that did not fully comply failed on total length (*Eva I*) and height of attachment point (*Koryo Maru No. 11* on one cruise) (Table 6.6).

6.19 All vessels fishing in Subareas 58.6, 58.7, 88.1 and 88.2 used streamer lines on all sets. In Subarea 48.3, 12 vessels undertook some sets without using a streamer line. Of these, four vessels (*Isla Camila*, *Argos Georgia*, *Polarpesca 1*, *Atlantic No. 52*) undertook 10 or more sets without a streamer line (Table 6.1 and WG-FSA-02/13 Rev. 1).

Offal Discharge

6.20 There was 100% compliance with the requirement to either hold offal on board, or to discharge on the opposite side to where the line was hauled (Table 6.5). All but one vessel complied fully with the requirement to not dump offal during setting; the *Viking Bay* was observed dumping offal during four (2%) sets (WG-FSA-02/13 Rev. 1).

Night Setting

6.21 Compliance with night setting has remained high in Subarea 48.3, up from 95% last season to 99% this season (Table 6.5). In Subareas 58.6 and 58.7 compliance was considerably higher than the previous season, up from 78% to 99% (Table 6.5). In Subarea 48.3 observers reported some difficulty in achieving exact compliance with this measure, due to the lack of sufficiently precise tables to define nautical twilight (paragraph 6.48).

6.22 In Subarea 88.1 night setting increased to 33%. However, vessels operating in this area do so under Conservation Measure 235/XX, which contains an exemption from night setting requirements south of 65°S for vessels which demonstrate a consistent minimum line sink rate of 0.3 m/s.

Line Weighting – Spanish System

6.23 In 2000 the Commission accepted WG-IMALF's recommendation for an alternative line-weighting regime for vessels using the Spanish method of longline fishing. Conservation Measure 29/XIX requires vessels to use either 8.5 kg weights spaced at no more than 40 m or 6 kg weights at no more than 20 m. The addition of the option of 8.5 kg weights at no more than 40 m was made because of concern that the existing regime placed practical constraints on fishers.

6.24 This year compliance with line weighting for Spanish longline systems (6 kg every 20 m or 8.5 kg every 40 m) had significantly improved (Table 6.5 and Figure 6.1). Ten (63%) cruises in Subarea 48.3 and 2 (66%) cruises in Subareas 58.6 and 58.7 complied with this line-weighting regime. All vessels met the weight spacing requirement and nine (53%) either met the weighting requirement or were within 95% of the required weight. The median weight and line spacing for Subareas 48.3, 58.6 and 58.7 were 8.6 kg every 40 m and 6.6 kg every 40 m respectively.

6.25 The results from last season strengthen the Working Group's conclusion that the current line-weighting requirements can be complied with. Once again it recommended that vessels unable to meet the line-weighting requirement of Conservation Measure 29/XIX should be prohibited from fishing in the Convention Area.

Line Weighting – Autoline System

6.26 In Subareas 88.1 and 88.2 vessels fishing south of 65°S in daylight were required to use line weights to achieve a consistent minimum line sink rate of 0.3 m/s (Conservation Measure 216/XX). The Working Group noted that both vessels complied with this measure.

Thawed Bait

6.27 Two vessels used frozen bait when setting longlines on more than one occasion; *Isla Santa Clara* (15%) and *Tierra del Fuego* (1%) (WG-FSA-02/13 Rev. 1).

General

6.28 The Working Group noted that if compliance with Conservation Measure 29/XIX is interpreted strictly (i.e. 100% in all elements of the conservation measure), only three vessels (*San Aotea II*, *Janas* and *Argos Helena*) fully complied with all elements at all times. Eight further vessels were within 95% of the minimum requirements of all elements of Conservation Measure 29/XIX (Table 6.5). The Working Group emphasised that the specifications in the conservation measure are minimum standards, and vessels should be advised to exceed these to prevent compliance failure due to marginal shortcomings.

6.29 The Working Group again recommended that vessels which do not comply with all elements of Conservation Measure 29/XIX should be prohibited from fishing in the Convention Area (SC-CAMLR-XX, paragraph 4.41).

Fishing Seasons

6.30 In 2000 the Scientific Committee advised the Commission that once full compliance with Conservation Measure 29/XIX was achieved, together with negligible levels of seabird by-catch, any relaxation of closed seasons should proceed in a stepwise fashion and the results of this carefully monitored and reported (SC-CAMLR-XIX, paragraph 4.42).

6.31 On the basis of the data for the 2001/02 fishing season in Subarea 48.3, seabird by-catch levels were very low (at levels negligible in terms of the population dynamics of the species concerned) for the third successive season. However, only one vessel (*Argos Helena*) fully complied with Conservation Measure 29/XIX.

6.32 In light of the fact that full compliance by the vessels fishing in Subarea 48.3 is possible in the near future if past trends continue, the Working Group considered options for the future that could allow a season extension with minimal risk to seabirds. A number of factors were taken into account.

6.33 The Working Group recalled the information obtained from the French EEZ in the 1999 and 2000 seasons when, despite reported use of Conservation Measure 29/XVI,

8 491 white-chinned petrels were killed. This indicates that the current conservation measures may not be able to adequately mitigate the capture of this species during the summer season.

6.34 The Working Group also recalled its advice to the Scientific Committee two years ago (SC-CAMLR-XIX, Annex 5, paragraph 7.150) that current indications are that allowing fishing in summer, at night, using streamer lines, proper offal discharge practices and c. 40 m between weights on longlines (existing practice for Spanish system vessels) will still result in unacceptably high mortality of seabirds, and further experimentation into the effectiveness of line-weighting concepts and underwater setting devices with the Spanish system is important. The Working Group proposed and outlined an experiment (WG-FSA-01/29), but funding to undertake this has not been found despite considerable effort (WG-FSA-02/30).

6.35 The Working Group also noted that information from Subareas 58.6 and 58.7 shows that white-chinned petrels are less susceptible to by-catch at the beginning of the breeding season during September when they are incubating eggs, compared to the chick-rearing period between January and April (WG-FSA-01/08, now Nel et al., 2002).

6.36 In the light of these considerations the Working Group proposed that a cautious and stepwise approach be taken in terms of a season extension, in order to minimise risk to seabirds.

6.37 Three options for season extension were considered by the Working Group:

- (i) An extension of the season for two weeks in September, once there was full compliance with Conservation Measure 29/XIX, and subject to a limit of three birds per vessel, assuming fishing effort was maintained at current levels. Vessels would be required to carry two observers, so that the limit could be monitored accurately, and either two streamer lines or a single streamer line with a boom-and-bridle system would be required.
- (ii) An extension of the season for the last two weeks in April once there was full compliance with Conservation Measure 29/XIX, and subject to a limit of three birds per vessel, assuming fishing effort was maintained at current levels. Vessels would be required to carry two observers, so that the limit could be monitored accurately, and either two streamer lines or a single streamer line with a boom-and-bridle system would be required.
- (iii) In the forthcoming season to allow only vessels in Subarea 48.3 that were adjudged to have complied fully with Conservation Measure 29/XIX in 2001/02 to fish during the last two weeks of April to enable a preliminary assessment of seabird by-catch during this period. As part of the access arrangement during this period, the vessel would be required to collect data to allow a more reliable assessment of the risk to seabirds during this period. This would include collection of data on the sink rate of longlines, and observations of seabird behaviour around the vessel. A limit of three birds would be applied to the vessel; two observers would be required so that the limit could be monitored accurately; two streamer lines or a single streamer line with a boom-and-bridle system would be required.

6.38 The Working Group noted that of the two options (i) and (ii) outlined in paragraph 6.37 above, it regarded option (i) as preferable, in terms of leading to an extension to the fishing season at a time of lower potential risk to seabirds.

6.39 These options for extensions to the toothfish fishing season were further discussed. From the perspective of the assessments by WG-FSA, while there might be potential difficulties arising from CPUE overlap, mix of maturity stages and the need to incorporate season (rather than whole year) into the assessments, these did not present real obstacles.

6.40 It was noted that the toothfish fishery in Subarea 48.3 currently reaches the catch limit several weeks before the end of the fishing season.

6.41 Although extending the fishing season so that it more closely approaches the current timing of the meetings of WG-FSA, the Scientific Committee and the Commission, could create difficulties for ensuring that observer reports and fishing data were available in time for consideration at these meetings, it was likely that these issues could be addressed by appropriate changes to administrative and management practice. The Working Group agreed to address the topic of how to manage year-round fisheries for toothfish at its meeting next year.

6.42 It was recollected that one of the original aims of extending the toothfish fishing season was to avoid this fishery being restricted to the winter months when the weather was worst and vessel safety particularly critical.

6.43 However, in view of the experiences of fishing in winter over the last several years, the extent to which this argument still applied was not clear to the Working Group.

6.44 Nevertheless, safe fishing practice might affect the feasibility of option (iii) in paragraph 6.37 because current best practice in this fishery in Subarea 48.3 is for vessels to operate in pairs.

6.45 For all three options, concerns were also raised about the difficulties of ensuring compliance with the proposed bird by-catch limit, both in terms of the potential requirement for near real-time reporting and of the levels of observation needed to achieve accurate monitoring of the seabird by-catch.

6.46 The Working Group re-emphasised the importance of not compromising the status of scientific observers by their close involvement in issues of compliance, especially where these involve decisions as to whether or not a vessel continued fishing (SC-CAMLR-XX, paragraph 4.85).

Research into and Experiences with Longline Mitigation Measures

Night Setting

6.47 The Working Group noted that night setting continued to be one of the most effective methods of mitigating albatross incidental mortality (WG-FSA-02/36). In high-latitude areas of lower risk for seabird by-catch, full compliance with strict line-weighting requirements (e.g. as in Conservation Measure 216/XX) had resulted in some daylight setting without seabird by-catch.

6.48 The Working Group discussed the definition of nautical twilight (paragraph 6.21) and noted the revised tables available in the new observer logbooks. The Working Group encouraged technical coordinators to ensure the new forms are used.

Bait

6.49 No new research on bait relating to mitigating incidental seabird mortality was reported.

Line Weighting

6.50 Significant progress had been made during the intersessional period in exploring the application of longlines with integrated weight (IW) for autoline vessels (WG-FSA-02/22). Longlines with 0 g/m, 25 g/m, 50 g/m, 75 g/m and 100 g/m sank to 15 m depth at 0.11 m/s, 0.23 m/s, 0.27 m/s and 0.32 m/s respectively (the sink rate required under Conservation Measure 216/XX is 0.3 m/s). No adverse effects on fishing operations or on the catch rate of the target fish species (ling, *Genypterus blacodes*) were noted.

6.51 Dr G. Robertson (Australia) and Mr Smith indicated that the New Zealand Ling Longline Working Group, in collaboration with New Zealand Longline Ltd, the Australian Antarctic Division, New Zealand Department of Conservation and New Zealand Ministry of Fisheries, plans to conduct a trial in New Zealand waters in November 2002 of the effectiveness of the 50 g/m IW longline as a method for mitigating incidental seabird catches. The trial will also examine the effects of IW longlines on catch rates of target fish species, as well as operational aspects of fishing. Results of the trial will be presented to the 2003 meeting of CCAMLR. The Working Group welcomed this experiment.

6.52 One of the additional likely benefits of IW lines is that baits reach the ocean floor more quickly than on unweighted lines, and as a result baits are likely to retain their attractiveness for longer, resulting in increased effective fishing time.

6.53 WG-FSA-02/25 reported on the intrinsic sink rates (under controlled conditions) of the types of longlines most commonly used in the world's autoline fisheries. Silver line (mixture of dan line and polypropylene) sank at 0.18–0.21 m/s, whereas polyester line sank at 0.23 m/s. Polyester line set from a typical Norwegian-built autoliner sank at 0.16 m/s, 11% slower than the intrinsic sink rate; the difference is thought to be due to propeller turbulence and sea state. The paper provides a useful background against which future line-weight manipulation can be judged. In terms of new vessel design for autoliners, the direction of the propeller rotation and the side of the vessel from which the line is set are important considerations in relation to optimising longline sink rate.

6.54 Additional progress had been made during 2001/02 in the implementation of a practical line-weighting regime for vessels using the Spanish longline system. The line-weighting regime prescribed in Conservation Measure 29/XIX (8.5 kg weights spaced at no more than 40 m apart) was used during 10 cruises (up from five in 2000/01). No vessels using the Spanish longline system were active in the Convention Area where Conservation

Measure 216/XX applies, and no further data have been collected on how the Spanish longline system may perform in relation to the 0.3 m/s line sink rate requirement in this conservation measure.

6.55 Outside the Convention Area, research into the use of line weighting in pelagic longline fisheries was reported in Anderson and McArdle (2002). The research highlighted that the position of weight placement on pelagic longline snoods was an important variable. Considerable variability in sink rate was noted between individual hooks; with unweighted snoods, 10% of hooks were still less than 2 m deep at a distance beyond the areal coverage of the streamer line. Although weighting generally improved hook sink rate, further research was required into both sink characteristics and operational practicality of the method in pelagic longline fisheries.

6.56 The new method of measuring line sink rate (the 'bottle test' described in Conservation Measure 216/XX) had been successfully applied in the longline fisheries in Subareas 88.1 and 88.2 during the 2001/02 season. The method had provided real-time feedback on the actual line sink rate achieved. Observers reported that calculating line sink rate with the 'bottle test' was considerably easier and cheaper than using time depth recorders and had saved considerable time, whilst allowing more data to be collected (two vessels, 345 results in 2001/02 versus three vessels, and ~100 results in 2000/01).

6.57 One problem highlighted by observers was that the 15 m attachment of the 'bottle test' meant that by the time the bottle was pulled under, the distance of the bottle from the vessel made it sometimes invisible for recording the time of sinking. The use of a 10 m attachment was suggested. The Working Group noted that on the basis of previous research, the longline had reached terminal velocity at 10 m depth, and that it would be reasonable to monitor the sink rate at 10 m depth instead of at 15 m.

Line Shooter

6.58 No new research on line shooters relating to mitigating incidental seabird mortality was reported.

Underwater Setting

6.59 No further information on the effectiveness of underwater setting for Spanish or autoline vessels was available.

6.60 Mr Baker reported the results of a trial of an underwater setting device in the Australian domestic pelagic tuna fishery. The concept of setting baits under water was tested as a seabird mitigation measure in Australian conditions during the summer of 2001/02. The objective of the trial was to assess the effectiveness of an underwater line-setting chute under normal fishing conditions and without any other mitigation measures to mitigate seabird by-catch. The success of the trial was to be measured against the by-catch rate of 0.05 birds/thousand hooks specified in the Australian 'Threat Abatement Plan for the incidental catch (or by-catch) of seabirds during oceanic longline fishing operations' (Environment Australia, 1998).

6.61 A total of 253 observer seadays was completed, with 101 203 hooks (123 sets) observed. Of these, 58 323 hooks (58%) were deployed through the chute, 46 455 (46%) during daylight hours. The total incidental seabird by-catch rate for the period was 1.581 birds/thousand hooks, with 2.777 birds/thousand hooks for day sets and 0.889 birds/thousand hooks for night sets. Flesh-footed shearwaters (*Puffinus carneipes*) made up 97% of the total incidental seabird mortalities with wedge-tailed shearwaters (*P. pacificus*) and great-winged petrels (*Pterodroma macroptera*) making up the remainder.

6.62 Based on the limited data collected, the trial concluded that the chute, used alone, is not an effective seabird by-catch mitigation measure in Australian east coast pelagic fisheries. However, the chute did prove to be capable of setting lines under water by effectively setting baited hooks at a depth of approximately 5 m. The high incidental seabird by-catch rates indicate that the concept of only setting baits under water may not entirely remove the potential for some seabird species to see and attack baited hooks. To reduce or remove the potential for seabird interactions with baited hooks, additional measures may have to be used in conjunction with the concept of setting baited hooks under water. A preliminary report on the trial is available at www.afma.gov.au.

6.63 Ms Rivera reported that the same device was also tested at sea in waters off Hawaii in the pelagic longline fishery. Initial results from that trial indicate some reduction in incidental mortality is likely, and that the chute was operationally practical for this fishery. An additional benefit noted was an increase in the number of baits staying on hooks and a subsequent increase in fishing efficiency. Two key differences from the trial in Australia were that the device was used in conjunction with other mitigation measures (line weighting, offal control) in Hawaii, and a different suite of species with differing vulnerability to being incidentally caught are present in the two study areas. The final report is expected in late 2002.

6.64 Ms Molloy reported initial results of further trials of the capsule underwater setting device, in particular that operational elements of the device were still being refined. This device is quite different from the chute in that it sets baits to 10 m depth. The Working Group requested that results of these trials be reported to it next year and encouraged the further development of the underwater setting capsule.

Offal

6.65 Noting the successful experience of retaining offal on board in Subareas 88.1 and 88.2, the Working Group reiterated its previous advice that all vessels in all areas should use scupper screens to trap processing offal and discarded baits. The Working Group noted that where used, it was important to ensure that scupper screens are clean and functional, made of a material suitable for the saltwater environment, and kept clear to avoid vessel stability hazards. Dual scupper screens on board are recommended to allow scuppers to remain covered whilst dirty screens are cleaned. Spare covers should be on board in the event that one is lost.

6.66 The Working Group also noted that, wherever possible, offal retention, as occurs in the Subarea 88.1 fishery, is preferable. There may be practical difficulties in doing this on some vessels operating in other parts of the Convention Area; however, the Working Group strongly urged Members to ensure such issues were taken into consideration when new vessels were being built.

6.67 Based on detailed observation of processing operations on the *Argos Georgia* in Subarea 48.3 over an 82-day fishing period in 2001/02, the report of the scientific observer indicated that an estimated 15 828 fish heads were discarded with hooks still in them. This level of hook discard in fish heads is consistent with the continued high frequency of hooks found in the albatross colonies on Bird Island, South Georgia (SC-CAMLR-XXI/BG/7). The much greater frequency of hooks/line found in association with wandering albatrosses is consistent with their larger size and hence their ability to swallow entire fish heads. The hooks found in the albatross colonies were of the type used in the regulated toothfish fishery in Subarea 48.3 (SC-CAMLR-XXI/BG/7).

6.68 The Working Group attempted to investigate further the magnitude of this problem, but was unable to do so as observers do not currently report sufficient relevant data. The Working Group recommended that these data be collected in future.

6.69 The Working Group reiterated its previous advice that such potential hazards to albatrosses could be easily avoided by the removal of hooks from the fish heads, fish offal and fish by-catch prior to their discard. The Working Group again proposed that such a recommendation be added to existing conservation measures (SC-CAMLR-XX, Annex 5, paragraph 7.162), but noted that if Conservation Measure 29/XIX is not revised at CCAMLR-XXI, some alternative means of getting this message to the relevant fishers and fisheries should be considered.

6.70 The Working Group commended a scheme reported as operating on at least two vessels (*Polarpesca 1*, *Tierra del Fuego*) from Chile, whereby a bounty was paid for hooks collected by crew from processed fish heads.

Streamer Lines

6.71 The boom-and-bridle system (WG-FSA-01/44 and 01/60) was used by two New Zealand vessels in the fishery in Subareas 88.1 and 88.2 throughout the 2001/02 season. This system allows the skipper to move the position of the streamer line either to the starboard or port so that it is always directly over the longline during setting, irrespective of the wind direction. With zero seabird by-catch in the fishery in Subareas 88.1 and 88.2, data to support the effectiveness of this design in other circumstances are not readily available. However, Dr Robertson noted, from personal observation on a cruise outside the Convention Area, that this style of streamer line performed better than any other he had previously observed and was probably as effective as paired streamer lines.

6.72 Paired streamer lines have yet to be trialled in the Convention Area. Two studies on the effectiveness of multiple lines have been conducted outside the Convention Area. WG-FSA-02/36 reported on trials of paired/triple streamer lines in Falkland/Malvinas waters. Incidental seabird catch rates for single streamer lines were 0.72 birds/thousand hooks, for paired lines 0.18 birds/thousand hooks and 0.02 birds/thousand hooks for triple streamer lines, although sample sizes were small for some of the trials, and some elements of the streamer lines used were different from the specifications which apply in Conservation Measure 29/XIX. WG-FSA-02/53 reported on trials of paired lines in the Alaska demersal longline fishery and the subsequent revisions to seabird mitigation regulations that will be promulgated in that fishery. Paired streamer lines of specified areal coverage standards were found to reduce seabird incidental catch by 88–100% relative to controls with no deterrents.

6.73 The Working Group noted that given the effectiveness of paired/multiple streamer lines and boom-and-bridle design streamer lines outside the Convention Area, they would likely have considerable benefit if applied within the Convention Area.

6.74 The Working Group also attempted to investigate the effect of the areal coverage of streamer lines on their effectiveness from observer reports. Unfortunately, adequate data are not currently collected by observers to undertake such an analysis. The Working Group recommended that such data be collected to help with designing improvements to the streamer line specification in Conservation Measure 29/XIX.

6.75 Accordingly, the Working Group strongly recommended that fishing within the Convention Area be conducted using either paired streamer lines or boom-and-bridle design streamer lines, especially including trials to test their utility in reducing incidental seabird mortality, so that additional data are available to assist review of the streamer line specification in Conservation Measure 29/XIX.

Research Needs relating to the Spanish Method of Longline Fishing

6.76 Last year, on the basis of WG-FSA-01/29, strong support was given to a proposal to determine the effectiveness of mitigation measures either singly or in combination on vessels using the Spanish longline method (SC-CAMLR-XX, Annex 5, paragraphs 7.187 and 7.188). The research is important, as the Spanish system is the most common gear deployment system in the Convention Area as well as being commonly used in adjacent non-Convention waters frequented by Convention Area albatrosses and petrels. This experiment was strongly endorsed by the Scientific Committee (SC-CAMLR-XX, paragraph 4.63) and the Commission (CCAMLR-XX, paragraph 6.26). WG-FSA-02/30 reported that the experimental design and project cost projections had been completed, vessel availability addressed and some 50 organisations approached for funding. A small amount of funding had been offered. However, at this time it was not possible to go ahead with the research, as considerable additional funding was still required.

6.77 The Working Group commended the considerable efforts to raise funds for this research. It reiterated that this experimentation is considered particularly important, and again urged Members to facilitate the financing, planning and undertaking of this study.

Research into and Experiences with Trawl Mitigation Measures

6.78 This topic is discussed, in relation to experiences in the Convention Area, in paragraphs 6.197 and 6.199.

6.79 WG-FSA-02/36 reported on trials on trawlers fishing around the Falkland/Malvinas Islands of a device designed to prevent birds colliding with trawl warps.

Revision of Conservation Measures 29/XIX and 216/XX

6.80 In light of the data and experiences reported above, the Working Group reviewed the relevant elements of Conservation Measures 29/XIX and 216/XX.

6.81 The following minor changes are recommended for Conservation Measure 216/XX:

- (i) in paragraph B1(iii): 15 m be changed to 10 m;
- (ii) in paragraph B2(v): 15 m be changed to 10 m;
- (iii) in paragraph B5: 15 m be changed to 10 m; and
- (iv) in paragraph B8: the numerator of the formula be adjusted to 10.

6.82 The review of Conservation Measure 29/XIX concluded that several elements of the measure, relating to line weighting for autoliners, streamer lines and hooks in discards and offal, will need to be reviewed in the near future; however, sufficient data with which to propose all potential improvements are not yet available.

6.83 The Working Group noted that as the incidental mortality of Convention Area seabirds both within and outside the Convention Area continues to be of concern, initiatives should be taken to:

- (i) encourage the use of paired/multiple streamer lines, or a boom-and-bridle design streamer line in all Convention Area longline fisheries;
- (ii) support experiments to determine the effectiveness of paired/multiple streamer lines, or boom-and-bridle design streamer lines;
- (iii) encourage fishers to remove hooks from fish heads, fish offal and whole fish to be discarded in all Convention Area longline fisheries; and
- (iv) provide additional data on the numbers of hooks discarded in fish heads, fish offal and whole fish in Convention Area longline fisheries.

6.84 The Working Group noted that in addition to the application of conservation measures to the issue of reducing incidental seabird mortality, the following issues should be taken into consideration when new vessels are built for longline fishing:

- (i) Propeller rotation:
The deployment position of longlines in relation to the rotation direction of the propeller can have a major bearing on longline sink rates. Naval architects and engineers involved in vessel construction are encouraged to research the relationship between the rotation direction of the propeller and longline sink rates to identify the optimal position in the vessel from which longlines should be deployed. Computer modelling techniques and flume tank tests of scaled-down versions of vessels might identify such 'sweet spots'.
- (ii) Meal plants:
Offal from processed fish discharged into the sea attracts seabirds to fishing vessels. This practice maintains the interest of seabirds in vessels, and exposes them to line setting operations when baited hooks are deployed and to the risk of ingestion of hooks embedded in fish heads, offal and discarded fish. Fish processing plants would greatly reduce this problem while at the same time

providing fish meal product for sale. With vessels of suitable size, vessel designers are encouraged to build fish meal plants into new longline vessels to minimise the attractiveness of vessels to seabirds.

- (iii) Vessel attachment points for streamer lines:
The greater the areal extent of streamer lines, the more effective they are in deterring seabirds. Areal coverage is improved if streamer lines can be attached to points high on the vessel superstructure. In the case of the boom-and-bridle system, capacity should exist for the components of this system to be fitted to vessels. Vessel designers are encouraged to consider these issues in new vessels, with particular attention given to the location and strength of anchor points of gear on vessels.
- (iv) Through-the-hull line setting:
Longlines deployed deep under water (beneath the upwelling effects of the propeller) are likely to reduce contact between baited hooks and seabirds, particularly species that feed by surface seizure. This will have dividends for both seabird conservation and fishing efficiency, since fewer baits will be taken from hooks. Vessel designers are encouraged to incorporate underwater setting in the design and construction of new longline vessels.
- (v) Moon pool:
Hauling aboard longlines in a manner that exposes seabirds to baited hooks increases the likelihood of live captures. Through-the-hull line hauling – or the ‘moon pool’ concept – would eliminate this problem; it would also reduce the contact between seabirds and non-target fish species flicked off longlines, because these species would sink out of reach of birds by the time they are clear of the vessel. Vessel designers are encouraged to adopt moon pool line hauling concepts in the construction of new longline vessels.
- (vi) Deck lighting:
Lights that illuminate the water where longlines are deployed provide visual cues for night-feeding seabirds to attack baited hooks. Vessel designers are encouraged to locate lights in positions that minimise illumination astern, while maintaining suitable on-board illumination to ensure crew safety is not compromised.

6.85 The Working Group requested further information from France in relation to their statement last year concerning the design of their five new longline fishing vessels (CCAMLR-XX, paragraph 6.13).

Incidental Mortality of Seabirds during Unregulated Longline Fishing in the Convention Area

General

6.86 As no information is available on seabird by-catch rates from the unregulated fishery, estimates of the incidental mortality of seabirds during IUU fishing within the Convention Area present a number of difficulties, requiring various assumptions to be made.

6.87 In previous years the Working Group has prepared estimates using both the average catch rate for all cruises from the appropriate period of the regulated fishery in a particular area and the highest catch rate for any cruise in the regulated fishery for that period. Justification for using the worst catch rate from the regulated fishery is that unregulated vessels accept no obligation to use any of the mitigation measures prescribed in CCAMLR conservation measures. Therefore catch rates, on average, are likely to be considerably higher than in the regulated fishery.

6.88 This year, a new method of estimating IUU catch of toothfish in Subarea 48.3 was presented in WG-FSA-02/4 and 02/5 (paragraphs 3.17 to 3.22).

6.89 The model described in WG-FSA-02/4 also estimates the numbers of seabirds caught by IUU fishing in Subarea 48.3, presenting mean and confidence limits for estimates rather than the minimum and maximum estimates currently presented in CCAMLR reports. The derivation of IUU seabird by-catch rates used in WG-FSA-02/4 was described in WG-FSA-02/5. Summer rates were calculated using the 1997 observer data up to the end of March, and winter rates were calculated using the data from 15 April (Table 6.8). It has been assumed in the past that, since regulated CCAMLR fishing vessels were operating largely without mitigation measures in 1997, their seabird by-catch rates would be indicative of those of IUU vessels.

6.90 One of the vessels fishing in 1997, the *Isla Isabel*, reported very high by-catch rates on one cruise but caution has previously been expressed about these data since only 10% of hooks were observed (SC-CAMLR-XVI, Annex 5, paragraph 7.55). WG-FSA-02/4 provided calculations with and without these data. The Working Group suggested that all the *Isla Isabel* data should be included, because very high seabird by-catch rates are not unknown in this and other fisheries, but that the seabird by-catch estimates should be included into the main model in WG-FSA-02/4 as weighted rather than unweighted bootstraps. Weighting could, for instance, use both total hooks set and hooks observed to reflect sampling density.

6.91 The Working Group agreed that these papers represented significant advances in the estimation of IUU catches of both seabirds and fish. It would be useful to see if the method could be applied to other CCAMLR areas. However, it was also recognised that there are many more data available from Subarea 48.3 than other CCAMLR areas, and this may limit its wider application.

6.92 The Working Group agreed to develop a simpler way of estimating potential by-catch of seabirds associated with IUU fishing in the Convention Area and a clearer way of presenting the results of this. Dr Agnew agreed to investigate this further intersessionally in collaboration with ad hoc WG-IMAF, the Secretariat and with Members who may hold appropriate data. In addition, the Secretariat was requested to implement the seasonal delimitation suggested in WG-FSA-02/4 and 02/5 for all the estimated seabird by-catch data available to date.

Unregulated Seabird By-catch in 2002

6.93 In view of the fact that:

- (i) seabird by-catch rates in the regulated fishery have been reduced substantially since 1997, due to much better compliance with CCAMLR conservation measures, including those relating to closed seasons; and

- (ii) it is unreasonable to assume that the unregulated fishery made comparable improvements to the timing and practice of its operations;

the Working Group decided that it should continue to use the seabird by-catch rates from 1997, as was done in previous assessments. The assessment this year, therefore, followed the identical procedure to that used in previous years, except that the calculation was prepared on a fishing season basis, in place of the split-season used in the past. The assessment has been incorporated into a background paper (SC-CAMLR-XXI/BG/23). It should be noted that applying some of the seabird catch rates used in SC-CAMLR-XXI/BG/23 to the whole unregulated fishery may produce a considerable overestimate of seabird by-catch, at least in some areas.

Results

6.94 It was noted that in addition to the change from split-year to fishing season, the review by WG-FSA of data on IUU removals of *Dissostichus* spp. resulted in several changes to historical data. Therefore the estimates of IUU removals of seabirds for all previous years show differences from previously reported values.

6.95 Commensurate with changes in IUU effort since last year, estimates of seabird by-catch have decreased in Subareas 48.3, 58.6 and 58.7 and Division 58.4.4, and increased in Divisions 58.5.1 and 58.5.2. For the first time, IUU catches were potentially taken from Subarea 88.1, producing a low level of assumed estimated seabird by-catch in this area.

6.96 The overall estimated totals for the whole Convention Area indicate a potential seabird by-catch in the unregulated fishery of 39 000–52 000 (lower level) to 70 000–93 000 seabirds (higher level) in 2001/02. These values, in relation to the estimates from previous years, are shown in Figure 6.2.

6.97 As in previous years, it was emphasised that the values in SC-CAMLR-XXI/BG/23 are very rough estimates (with potentially large errors). The present estimates should only be taken as indicative of the potential levels of seabird mortality occurring in the Convention Area due to unregulated fishing and should be treated with caution.

6.98 Nevertheless, even taking this into account, the Working Group endorsed its conclusions of recent years that such levels of mortality continue to be unsustainable for the populations of albatrosses and giant and white-chinned petrels breeding in the Convention Area.

Summary Conclusion

6.99 Ad hoc WG-IMAF once again urgently drew the attention of WG-FSA, the Scientific Committee and the Commission to the numbers of albatrosses and petrels being killed by unregulated vessels fishing in the Convention Area. Since 1996, an estimated total of 278 000 to 700 000 seabirds have been killed by these vessels. Of these:

- (i) 74 000 to 144 000 were albatrosses, including individuals of four species listed as globally threatened (Vulnerable) using the IUCN threat classification criteria (BirdLife International, 2000);

- (ii) 13 000 to 24 000 were giant petrels, including one globally threatened (Vulnerable) species; and
- (iii) 203 000 to 378 000 were white-chinned petrels, a globally threatened (Vulnerable) species.

6.100 These levels of loss of seabirds from the populations of these species and species groups are broadly consistent with such data as exist on the population trends of these taxa, including deterioration in conservation status as measured through the IUCN criteria.

6.101 These and several other albatross and petrel species are facing potential extinction as a result of longline fishing. The Working Group again urgently requested the Commission to continue to take action to prevent further seabird mortality by unregulated vessels in the forthcoming fishing season.

Incidental Mortality of Seabirds during Longline Fishing outside the Convention Area

6.102 The Working Group considered papers reporting on seabird mortality from fisheries conducted outside the CCAMLR Convention Area but which affected birds that breed within it.

6.103 WG-FSA-02/36 reported on by-catch of seabirds in the longline fishery for *D. eleginoides* around the Falkland/Malvinas Islands (Area 41) during 2001/02. A total of 8 066 014 hooks was set in this fishery and a total of 25 dead birds was observed on 860 120 hooks (0.029 birds/thousand hooks¹). These by-catch rates are much lower than earlier reports for this fishery. Almost all (23) mortalities were black-browed albatrosses, which were likely to have been from the local population. Only two white-chinned petrels were killed. Regression models suggest that by-catch of black-browed albatrosses increased with abundance of birds present during setting. This paper also provided a very useful historic summary of fishery–seabird interactions around the Falkland/Malvinas Islands.

6.104 WG-FSA-02/18 reported on by-catch of seabirds in the longline fishery for *D. eleginoides* around southern Chile (Area 87) from September 2001 to June 2002. Black-browed albatrosses were caught most frequently in this fishery. Sooty shearwaters, Cape petrels and white-chinned petrels were also caught in lesser numbers. The mortalities to the latter two species were likely to be from breeding populations within the Convention Area. Seabird by-catch rates increased markedly during October and November compared to earlier in the year.

6.105 WG-FSA-02/82 reported on by-catch of seabirds in the *D. eleginoides* longline fishery operating in Argentine waters on the Patagonian shelf (Area 41) from 1999 to 2001. A total of 9 696 196 hooks was observed during this period and 710 seabird mortalities (0.07 birds/thousand hooks) were reported. The annual by-catch rate varied between 0.04 and 0.27 birds/thousand hooks. Given a fishing effort of 20 million hooks per annum, the total seabird by-catch for this fishery could range between 800 and 5 400 birds per annum². Black-browed albatrosses (53%) and white-chinned petrels (26%) were caught most

¹ Given as 0.017 birds/thousand hooks in WG-FSA-02/36

² Given as 1 500–8 000 birds in WG-FSA-02/82

frequently, the former from the breeding populations of the Falkland/Malvinas Islands, most or all of the latter from the populations breeding in the Convention Area. Wandering albatrosses, grey-headed albatrosses, southern royal albatrosses, southern giant petrels, Cape petrels, sooty shearwaters and grey petrels were also killed. Many of these birds are likely to have been from breeding populations within the Convention Area.

6.106 In a document submitted to the Secretariat, Uruguay reported that in six toothfish longline fishing voyages in FAO Statistical Areas 47, 51 and 57 during 2001/02, observers did not report any seabird mortality.

6.107 Two white-chinned petrels were killed in toothfish longline fishing operations by South Africa, within its EEZ but outside the Convention Area, during 2001/02 (WG-FSA-02/17).

6.108 WG-FSA-02/43 reviewed spatio-temporal trends of longline fishing effort in the Southern Ocean and implications for seabird by-catch. It described the extent and magnitude of demersal and pelagic longline fisheries (mainly for tuna) in southern waters and the deficiencies in management of some of these fisheries relating to both fishery and seabird by-catch monitoring and regulation. These deficiencies include the poor recording of effort statistics, a lack of adequate at-sea monitoring and an inability to control illegal fishing. The spatial and temporal distributions of effort in the pelagic and demersal fisheries have changed markedly over time. These distributions also differ between fleets (often depending on target species) and within a fleet over a season. Changes in the magnitude of effort and the major fleets of influence can have substantial implications for interactions with seabirds. Effort statistics presented in this paper underestimate the true level. However, it is clear that longline effort in southern waters has increased markedly since the late 1960s and early 1970s. The total reported effort from all longline fleets is now well over 250 million hooks per year and has been at this level since the early 1990s. Recent substantial increases in illegal fishing have occurred in both the pelagic and demersal longline fisheries. Estimates of by-catch from IUU fishing for toothfish alone would suggest that current levels of seabird mortality are not sustainable. When combined with the impacts from regulated fisheries, some of which show either inconsistent use of mitigation devices or none at all, the long-term viability of many Southern Ocean species of seabird may be in jeopardy. The Working Group noted the importance of this study in addressing the global impacts of longline fishing on seabirds occurring in the Convention Area.

6.109 The Working Group recommended that responses be sought by the Secretariat on seabird by-catch levels, mitigation measures in use (and whether voluntary or mandatory) and observer programs from all Members and other countries conducting or permitting longline fishing in areas where seabirds from the CCAMLR Convention Area are killed.

Research into the Status and Distribution of Seabirds

6.110 Following last year's request for information summarising national research on seabirds (albatrosses and *Macronectes* and *Procellaria* petrels) vulnerable to longline fisheries interactions, papers were presented by the USA (WG-FSA-02/72) and New Zealand (WG-FSA-02/37), and information submitted during the meeting by Chile and Australia. Reference to research on albatrosses by South Africa is included in WG-FSA-02/16 and

research by Chile in WG-FSA-02/18. Of the countries known to be conducting relevant research on these species, no reports were received from the UK and France (both of which provided full reports last year) and Argentina.

6.111 The US report (WG-FSA-02/72) included details of current research into methods to monitor and mitigate seabird by-catch. This was viewed by the Working Group as an additional valuable contribution to its work. All Members are requested to include details of mitigation research in their annual update to the Working Group on the current status of relevant research programs.

6.112 Previously it was noted that the information regarding assessments of population dynamics and foraging ranges was insufficient for comparisons with levels of by-catch and fishing effort. Consequently Members were requested to provide additional details to assist these important assessments (SC-CAMLR-XIX, Annex 5, paragraphs 7.10 and 7.11). New Zealand (WG-FSA-02/37) and Chile were the only Members to provide new information this year.

6.113 All information provided to date was summarised in SC-CAMLR-XXI/BG/22, which updates SC-CAMLR-XX, Annex 5, Tables 49 and 50. All Members were again requested to provide any new or outstanding details of population dynamics studies and foraging ranges. The submission of the population and foraging research information to next year's meeting of WG-IMAF should enable a timely review of the level of information available for each population.

6.114 The most recent assessments of the global status of albatrosses, giant petrels and *Procellaria* petrels are reflected in SC-CAMLR-XXI/BG/22. This summary reflects the revised status of the black-browed albatross from Near-Threatened to Vulnerable (SC-CAMLR-XXI/BG/22). This change was principally based on population declines newly reported for the Falkland/Malvinas Islands where 70% of the world population breeds. The species now meets the IUCN criteria for Vulnerable status, whereby it is inferred that the species has declined in numbers by >30% over the last 30 years (probably owing to mortality caused by longline fisheries), and it is projected that declines will continue into the future.

6.115 To enable revisions to the population status of populations vulnerable to fishery-related mortality in the Convention Area, Members are requested to provide information on the most recent assessment of population size (year and population size estimate, and population trend) for each population, where this information is available. No new compiled datasets were received this year. New information was extracted for specific populations from information provided by Australia (WG-FSA-02/23), Chile (WG-FSA-02/18) and South Africa (WG-FSA-02/23). This information has been incorporated in SC-CAMLR-XXI/BG/22 to update SC-CAMLR-XX, Annex 5, Table 49.

6.116 Information on the breeding population of black-browed albatrosses at Heard Island between 1947 and 2000 (Woehler et al., 2002) was reviewed. Census data were collected on 16 of 53 visits, but all colonies were surveyed on only three occasions, albeit at different stages of the breeding season. Comparisons of the survey data were interpreted in the paper to reflect a trebling of the population since 1947, with approximately 600 pairs in 2000. The Working Group was cautious about the interpretation of the increasing trend given the disparate nature of the data. The Working Group commended the initiation of systematic surveys of the population and recommended the continuation of the monitoring of this population.

6.117 The population dynamics of wandering albatrosses at Marion Island were described with respect to the effects of environmental (ENSO) and anthropogenic (longlining) influences (WG-FSA-02/16). The proportion of first-time breeders was positively correlated with a maximum ENSO index, whereas the annual survival rates of breeding adults was negatively correlated with Japanese longline fishing effort in the Southern Indian Ocean. Survival rates of adult females were lower than those of adult males, although survival rates of juveniles were not gender specific. Overall, adult survival rates were consistent with those recorded at other Indian Ocean sites (Crozet) but differed from Atlantic sites (South Georgia), suggesting common factors operating at ocean-basin scale. The authors recommend the implementation of international conservation initiatives to reduce the impact of longline fishing on wandering albatrosses at Marion Island.

6.118 Of the 12 breeding sites for black-browed albatrosses, three occur in Chile – Diego de Almagro, Ildefonso and Diego Ramirez Islands. Populations at these locations have been censused only once previously. In light of decreases recorded elsewhere, an urgent need has been long recognised to recensus the Chilean populations and assess their conservation status. WG-FSA-02/23 reported on the results of a census in 2001 of the black-browed albatrosses on Diego de Almagro. Six colonies, and a total of 15 600 albatrosses were recorded for the island. To consolidate our knowledge of the status of albatrosses breeding in Chile, many of which forage in the Convention Area (paragraphs 6.120 and 6.121; SC-CAMLR-XXI/BG/22), the populations at Ildefonso and Diego Ramirez are in urgent need of reassessment.

6.119 The Working Group welcomed the progress report of Chilean research on albatross ecology and conservation (WG-FSA-02/18). Population surveys of black-browed albatrosses at Gonzalo Island have varied between 3 862 and 5 173 pairs, although interannual variation makes assessments of trends premature. Similarly, the high level of interannual variability of grey-headed albatrosses (range of 2 335 to 4 501 pairs between 1980 and 2001), together with their biennial breeding frequency, precludes confident assessment of trends.

6.120 The foraging distributions of black-browed and grey-headed albatrosses during the 2001/02 breeding seasons were reported in WG-FSA-02/18. Black-browed albatrosses prospected shelf waters during incubation and chick brooding stages, foraging in more southerly waters (south of 55°S) when foraging to feed large chicks. Grey-headed albatrosses showed a more extensive pelagic distribution during the breeding season, foraging in increasingly more southerly waters as the season progressed.

6.121 The foraging information was compared with the locations of longline setting operations in the toothfish fishery in southern Chile (WG-FSA-02/18). There was extensive overlap by black-browed albatrosses with fishing operations, whereas overlap by grey-headed albatrosses with the fishery was relatively limited. Both albatross species were foraging in CCAMLR Subareas 48.1 and 88.3 during summer months. Further tracking will be required to assess the risks faced by these populations at sea.

6.122 With the exception of the Chilean satellite-tracking studies, no new research programs focussing on populations relevant to the Convention Area have been started since 1999. Assessments of population size and trends of many populations and species affected by longline fishing remain absent. The most detailed studies are for the *Diomedea* albatrosses, with considerably less known for the *Thalassarche*, *Phoebetria*, *Macronectes* and *Procellaria* respectively. It is disturbing that, of all the species killed on longlines in southern waters, our understanding of the population size, trends and foraging ranges remains most deficient for white-chinned petrels, the species most commonly killed in the Convention Area.

6.123 The summary of foraging ranges of relevant albatross and petrel populations (at different times of year and stages of the breeding cycle), has been updated in SC-CAMLR-XXI/BG/22. Ultimately it is envisaged that these data will be assessed with respect to overlap with fisheries operations, and ultimately, to compare at-sea distributions with data on fishing effort. Incomplete provision and availability of data are preventing further progress. Further information on the CCAMLR areas prospected by the different populations will enable refined estimates of ranges of relevance to regional risk assessments.

6.124 The deficiencies resulting from the lack of relevant research into population dynamics and foraging ecology of most populations still persist, as noted last year (SC-CAMLR-XX, Annex 5, paragraph 7.21). If sufficient information is available next year, the Working Group intends to reassess the status of knowledge at a population level.

6.125 Recognising the importance of validating the species of birds killed, as well as determining their sex, age, and where possible provenance, the observer logbooks were modified in 1996 to require an entry indicating the place of deposition and the scientists responsible for relevant material (SC-CAMLR-XV, Annex 5, paragraph 7.20).

6.126 In view of the importance of trying to identify the population of origin of birds killed on longlines and the substantial progress with the ability to determine provenance via DNA profiles, the Working Group reiterated the requirement to retain specimens wherever possible. The Working Group also requested that Members be asked to supply information regarding the extent and location of their seabird by-catch collections.

International and National Initiatives relating to Incidental Mortality of Seabirds in relation to Longline Fishing

Second International Fishers' Forum (IFF2)

6.127 The Western Pacific Regional Fishery Management Council will host the Second International Fishers' Forum (IFF2) in Honolulu, Hawaii, USA, from 19 to 22 November 2002. In November 2000, New Zealand hosted the First International Fishers' Forum (IFF1) which focused on methods to solve the incidental catch of seabirds by longline fishing gear. IFF2 will build on the efforts made by the participants at IFF1, and will also include discussions on sea turtle biology and behaviour, and on reducing and minimising the harmful effects of interactions between sea turtles and longline gear.

6.128 The mission of the forum is to convene an international meeting of fishers to address possible solutions to incidental by-catch of sea turtles and seabirds by longline fishing gear. The primary objectives are to:

- (i) increase the awareness of fishers that incidental longline catch of seabirds and sea turtles may pose a serious problem to these populations and to the continued operations of longline fishing;
- (ii) promote the development and use of practical and effective seabird and sea turtle management and mitigation measures by longline fishers;

- (iii) foster an exchange and dissemination of information among fishers, scientists, resource managers, and other interested parties on the use of mitigation measures, and the development of coordinated approaches to testing new measures;
- (iv) promote the development and implementation of collaborative mitigation research studies by scientists, fishers, resource managers, and other interested parties; and
- (v) build on IFF1 to encourage continued progress and new participants.

6.129 Detailed information on IFF2 can be found at www.wpcouncil.org/iff2.htm. Forms are available for registration, travel assistance applications, poster and exhibit registration. The Working Group encouraged CCAMLR Members to promote the active participation of their longline fishers, scientists, gear technologists, fishery managers and any other interested parties. Effective solutions to seabird (and sea turtle) by-catch problems can best be solved by collaborative and cooperative approaches such as those provided through this international forum.

Agreement on the Conservation of Albatrosses and Petrels (ACAP)

6.130 Since 1999, parties to CMS have been pursuing the development of ACAP (SC-CAMLR-XX, Annex 5, paragraphs 7.195 to 7.198). Progress was noted on ACAP's current status (SC-CAMLR-XXI/BG/20). To date, ACAP has eight signatories (Australia, Brazil, Chile, France, New Zealand, Peru, Spain and the UK) and two (Australia and New Zealand) of the necessary five ratifications required for entry into force.

6.131 In April 2002, Spain became the most recent signatory to ACAP. Spain is the first major fishing nation to recognise the importance of ACAP in the conservation of albatrosses and petrels in the southern hemisphere.

6.132 At the recent CMS Conference of Parties held in Bonn, Germany, two other parties (South Africa and the UK) both confirmed their intention to ratify shortly.

6.133 Australia, in its role as Interim Secretariat, has established a website for ACAP with the aim of keeping all Range States and interested organisations informed of current progress with ACAP and related issues. Further information can be obtained at www.ea.gov.au/biodiversity/international/index/html.

6.134 Australia is optimistic that ACAP will receive the remaining three ratifications required for the agreement to enter into force in 2003 (SC-CAMLR-XXI/BG/20).

FAO's International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA-Seabirds)

6.135 The Working Group noted the Commission's continued request to Members to develop and implement national plans in support of the FAO IPOA-Seabirds (CCAMLR-XX, paragraph 6.27).

6.136 Last year the Working Group requested CCAMLR Members, especially Argentina, Brazil, Chile, European Community, France (in respect of its overseas territories), Namibia, Norway, South Africa, UK (in respect of its overseas territories) and Uruguay to submit reports of their progress towards developing and implementing NPOA-Seabirds to the Working Group at its next meeting (SC-CAMLR-XX, Annex 5, paragraph 7.206).

6.137 The Working Group noted the following new information regarding the status of development on National Plans of Action (NPOA-Seabirds):

- (i) New Zealand has spent two years working with a range of interests to develop a national plan of action to reduce albatross and petrel incidental catch in trawl and longline fishing. The NPOA has been consulted on once and submissions incorporated into a new version. This is currently being finalised for a last consultation. Provided that New Zealand approves the NPOA for consultation, this will occur in late 2002. Upon final approval, the NPOA will then be implemented early in 2003.
- (ii) Falkland/Malvinas Islands, South Africa, Taiwan, Australia, Norway and Uruguay (WG-FSA-02/50), and Chile are at various stages of NPOA-Seabirds preparation.
- (iii) the European Community is continuing to collect information on the seabird by-catch issue but further progress has apparently not occurred on its Preliminary Draft Proposal for a Community Plan of Action that was submitted to FAO's COFI in 2001.
- (iv) Japan indicated it would review comments made by WG-IMAF on its NPOA (SC-CAMLR-XX, Annex 5, paragraphs 7.209 to 7.213) and would then modify and improve the plan if necessary and practicable (CCAMLR-XX, paragraph 6.29). CCAMLR has not yet received a response from Japan to a request on the status and content of its NPOA, and the nature and status of relevant mitigating measures.

6.138 FAO members will be reporting on the implementation status of IPOA-Seabirds at the next COFI biennial meeting in February 2003. The Working Group continued to highlight the need for nations and fishing entities to develop effective NPOAs for fisheries that interact with seabirds from the Convention Area. The Working Group encouraged the CCAMLR Observer to FAO to address this point at the COFI meeting.

Regional Fishery Management Organisations (RFMOs),
Tuna Commissions and International Governmental Organisations

6.139 Last year, the Commission noted the view of the Scientific Committee that the greatest threats confronting the conservation at sea of albatrosses and petrels breeding in the Convention Area are the levels of mortality likely to be associated with IUU longline fishing inside the Convention Area, and with longline fishing for species other than *Dissostichus* in areas adjacent to the Convention Area (CCAMLR-XX, paragraph 6.33). It agreed that there is an urgent need for collaborative work with appropriate regional fisheries organisations.

The Commission requested Members to give every assistance to developing appropriate collaboration and data exchange with the relevant tuna commissions and other regional fisheries organisations (SC-CAMLR-XX, paragraphs 4.73 and 4.74).

6.140 In pursuit of this endeavour, the CCAMLR Secretariat provided briefing materials on CCAMLR activities on seabird-related matters to CCAMLR Members attending meetings of the relevant regional fishery management organisations (RFMOs) and tuna commissions, and especially to those nominated to observe on behalf of CCAMLR. CCAMLR observers or, in the absence of nominated observers, Members of CCAMLR to whom information was sent, were requested, individually or collectively as appropriate, to provide feedback on the discussion of seabird by-catch in general, and the responses to the CCAMLR questions in particular, to the CCAMLR Secretariat.

6.141 Intersessionally, the CCAMLR Secretariat provided this seabird-related briefing material directly to appropriate RFMOs (CCSBT, ICCAT, IOTC, IATTC, SPC, FFA and CPPS) and requested the following information:

- (i) existing data on levels of seabird by-catch;
- (ii) the nature of measures to mitigate seabird by-catch currently in use and whether voluntary or mandatory; and
- (iii) the nature and coverage of observer programs and whether these include observation of seabird by-catch and whether the observers are involved in assisting in the correct use of mitigating measures in relation to seabird by-catch.

6.142 The CCAMLR Observer to CCSBT (Australia) attended the meeting of its Working Group on Ecologically Related Species (ERSWG) in November 2001. Seabird-related information was discussed and would be of interest to CCAMLR. A report of the ERSWG meeting will be provided by the CCAMLR Observer once it is available from CCSBT. It was noted that the Republic of Korea is a recent member of CCSBT.

6.143 Although ICCAT has not directly responded to CCAMLR's requests for seabird-related information, the Working Group noted that three draft proposals for resolutions on seabird by-catch were presented at the ICCAT meeting in November 2001 and that this marked the first time that ICCAT had ever circulated draft proposals regarding seabirds. Due to lack of time, these proposals will be reconsidered at the November 2002 meeting. The Working Group encouraged CCAMLR Members that are also members of ICCAT to support the strongest possible resolution for taking action to address the seabird by-catch problem.

6.144 Additionally, the Working Group noted that BirdLife International presented information about its efforts to protect threatened seabirds to ICCAT's Scientific Committee on Research and Statistics at the Committee's meeting in September 2002 in Madrid.

6.145 IOTC had responded that there is no direct evidence from fishermen, observer programs, or experimental longline cruises (Russia, Japan, France and Seychelles) of any seabird by-catch in the fisheries monitored by IOTC, which cover mainly the tropical tunas and, to a lesser extent, the swordfish fishery extending to about 30°S.

6.146 However, fisheries data provided by IOTC (WG-FSA-02/43) does indicate pelagic longline effort by Japan and Taiwan in the Indian Ocean south of 40°S, areas overlapping

with the foraging distribution of several albatross species that breed in the Convention Area. Based on knowledge of seabird by-catch associated with longline fisheries in analogous areas, the Working Group believed that, without use of appropriate mitigating measures, seabird by-catch was highly likely in fisheries monitored by IOTC, at least in the southern parts of its area. It urged IOTC and CCAMLR Members who are also members of IOTC to try to ensure that this topic receives serious attention at forthcoming IOTC meetings.

6.147 IATTC indicated that its observer program in the purse seine fishery has never documented the incidental catch of a seabird. IATTC has measures in place calling for the reduction of non-target catches which are not landed, but no impact on seabirds is noted given the lack of observations on seabird incidental catch.

6.148 As advised in the information provided by IATTC, the CCAMLR Secretariat requested information from the USA regarding its observer program of a pelagic longline fishery in the IATTC Convention Area. This information was provided (WG-FSA-02/39). The Working Group commended the example of an RFMO member establishing a voluntary observer program which collects information on seabird by-catch. It encouraged IATTC to establish observer programs in longline fisheries carried out within those parts of its area of responsibility which have risks of substantial associated seabird by-catch, including birds from the CCAMLR Convention Area.

6.149 The Science Officer reported that the response provided by SPC was very helpful. He had been informed in correspondence with members of IMAF that for some countries, however, the data holdings were not comprehensive.

6.150 Mr Smith informed the Working Group that the Standing Committee on Tuna and Billfish receives national reports that include non-target catch information, including seabird by-catch. This offers opportunities for sharing and exchanging relevant information with CCAMLR; the Working Group encouraged CCAMLR to pursue these opportunities.

6.151 To date, the CCAMLR Secretariat has not received responses to its seabird by-catch queries to FFA and CPPS.

6.152 With the entry into force of UNFSA in December 2001, it was noted that it is reasonable to anticipate an improved exchange of information between CCAMLR and other RFMOs on possible interactions between species for which CCAMLR is responsible and fisheries outside the Convention Area. UNFSA Articles 7 ('Compatibility of Conservation Management Measures') and 8 ('Cooperation for Conservation and Management') clearly mandate such improvement. In particular, UNFSA Article 8(6) provides for consultation between RFMOs, and through them with their members, on matters relating to living resources where management action may impact on measures already adopted by, or which are also within the competence of, more than one RFMO.

6.153 To promote this sharing of information, the Working Group requested that when CCAMLR Members submit seabird-related information to RFMOs, a courtesy copy should also be sent to CCAMLR.

6.154 The Working Group acknowledged the continuing importance of RFMOs in addressing seabird by-catch issues, particularly for distant water fleets. It encouraged the CCAMLR observers to these organisations to continue reporting on seabird-related activities

and to press for inclusion of this seabird by-catch topic on RFMO agendas. This international collaboration is vital to addressing the identified threat to albatrosses and petrels of longline fishing activity in areas adjacent to the Convention Area.

6.155 The Working Group was pleased to learn that Chile is continuing to pursue submission of a proposal to the Fisheries Working Group of the Asia-Pacific Economic Cooperation (APEC) to address seabird by-catch issues in the longline fisheries. This proposal was initially discussed by several participants at IFF1 in 2000; support was noted from Australia, New Zealand and the USA.

Other International Organisations and Initiatives, including Non-governmental Organisations

6.156 Ms Molloy reported on the formation of Southern Seabird Solutions – a new alliance of government, fishing industry and environmental groups within New Zealand – created to work cooperatively with other countries on solving the incidental capture of birds. Southern Seabird Solutions members include pelagic and demersal longline skippers, fishing company managers, fishery skills trainers, ecotourism operators, international and national policy experts, environmental campaigners and communication experts. The group had recognised a critical need to accelerate progress on solving the issue within New Zealand.

6.157 The Working Group noted that Southern Seabird Solutions is addressing the by-catch issue of albatrosses and petrels that breed in the Convention Area and commended the group for its efforts. This multi-group initiative could represent a model for the effective implementation of regional efforts to address seabird by-catch. The Working Group commended New Zealand for establishing this innovative group.

6.158 Ms Molloy reported that the International Coalition of Fisheries Associations (ICFA) adopted a resolution at its annual meeting in September 2002 that supports the efforts of Southern Seabird Solutions including the development and adoption of industry driven Codes of Practice that provide practical ways to avoid seabird capture.

6.159 Dr Nel reported that the BirdLife International Seabird Conservation Programme has several ongoing activities of note that relate to albatrosses and petrels that breed in the Convention Area:

- (i) regional workshops that focus on sharing technical and practical information on which mitigation methods work best and ways to further reduce seabird by-catch and improve fishing efficiency (a South American workshop recently held in Uruguay and an Asian-focused workshop being planned in Taiwan);
- (ii) incentive programs to promote the development of more seabird-friendly fishing methods and raise awareness; and
- (iii) participate in the development of various databases for the estimation of global by-catch levels for at-risk seabird species and for GIS satellite-tracking information on Procellariiformes.

National Initiatives

6.160 The USA reported on various aspects of its NPOA implementation (WG-FSA-02/50) which may be of interest to CCAMLR, including:

- (i) revisions being made to regulations for Alaskan demersal longline fishers that call for the use of paired streamer lines with a specified areal coverage (paragraphs 6.72 to 6.74); and
- (ii) promotion of IPOA-Seabirds implementation and NPOA development through bilateral fisheries meetings, intergovernmental communications with 23 longline nations (and entities) and participation in meetings of RFMOs.

6.161 Last year the Working Group received reports on recent developments in the use of video monitoring and urged Members to report on such developments and any trials undertaken (SC-CAMLR-XX, Annex 5, paragraphs 7.100 to 7.103). The USA reported on two current initiatives (WG-FSA-02/72) to evaluate the effectiveness of video technology to monitor seabird interactions on vessels. One is a collaboration with the International Pacific Halibut Commission (IPHC) to assess the feasibility of: (i) monitoring compliance with regulated use of bird avoidance devices, and (ii) detecting and identifying seabirds that are incidentally taken during longline fishing operations. Preliminary results suggest that it is possible to detect the seabirds coming up on the longlines and to differentiate between certain species groups (albatrosses can be differentiated from fulmars and shearwaters). The second initiative is a collaboration with Archipelago Research of British Columbia in Canada, a company with extensive experience of developing video monitoring applications in commercial fishery venues. The focus of this second project is to evaluate the feasibility of using video technology to detect and identify interactions of seabirds with trawl fishing operations. Results will be reported to WG-IMAF once they are available.

Incidental Mortality of Seabirds in relation to New and Exploratory Fisheries

Assessment of Risk in CCAMLR Subareas and Divisions

6.162 As in previous years, the Working Group assessed the numerous proposals for new fisheries and the potential for these new and exploratory fisheries to lead to substantial increases in seabird incidental mortality.

6.163 In order to address these concerns, the Working Group reviewed its assessments for relevant subareas and divisions of the Convention Area in relation to:

- (i) timing of fishing seasons;
- (ii) need to restrict fishing to night time; and
- (iii) magnitude of general potential risk of by-catch of albatrosses and petrels.

6.164 Comprehensive assessments on the potential risk of interaction between seabirds and longline fisheries for all statistical areas in the Convention Area are carried out each year and have been previously combined into a background document for use by the Scientific Committee and the Commission (last year this was SC-CAMLR-XX/BG/11 Rev. 2).

6.165 This year new data on at-sea distribution of albatrosses and petrels from satellite-tracking and other studies was provided in WG-FSA-02/18. This information was used to update the assessment of potential risk of interaction between seabirds and longline fisheries for Subareas 48.1 and 88.3. Other changes were made to the advice provided for conservation measures that should be applied to all statistical areas. These largely reflect operational procedures for high-latitude areas, now accepted by CCAMLR and currently embodied in Conservation Measure 216/XX. These areas have been previously assessed as having a low to average risk of potential interaction between seabirds, especially albatrosses, and longline fisheries. Relevant subareas and divisions are 48.1, 48.2, 48.4, 48.5, 48.6, 58.4.1, 58.4.2, 58.4.3, 58.4.4, 88.1, 88.2 and 88.3. The revised assessments incorporating new information made available at the meeting (with changes/additions underlined) have been issued as SC-CAMLR-XX/BG/21.

New and Exploratory Longline Fisheries Operational in 2001/02

6.166 Of the 24 proposals last year for new and exploratory longline fisheries in seven subareas and divisions, only two were actually undertaken: by New Zealand in Subareas 88.1 and 88.2.

6.167 No seabird by-catch was reported to have been observed in any of these fisheries. Clearly the strict adherence in Subareas 88.1 and 88.2 to the specific requirements set out in Conservation Measure 216/XX with respect to line-weighting regimes, combined with fishing in areas of average-to-low, and average risk, has proven successful in achieving zero incidental by-catch of seabirds.

New and Exploratory Fisheries Proposed for 2002/03

6.168 The areas for which proposals for new and exploratory longline fisheries were received by CCAMLR in 2002 were:

Subarea 48.6 (north of 60°S)	South Africa
Subarea 48.6	Japan, New Zealand
Division 58.4.2	Australia
Division 58.4.3a	Australia, Japan
Division 58.4.3b	Australia, Japan
Division 58.4.4	Japan, South Africa
Division 58.5.2	Australia
Subarea 58.6	Japan, South Africa
Subarea 88.1	Japan, New Zealand, Russia, South Africa, Spain
Subarea 88.2	Japan, New Zealand, Russia.

6.169 All the areas listed above were assessed in relation to the risk of seabird incidental mortality according to the approach and criteria set out in paragraphs 6.163 and 6.165, and SC-CAMLR-XX/BG/11 Rev. 2. A summary of risk level, risk assessment, IMAF recommendations relating to fishing season and any inconsistencies between these and the proposals for new and exploratory longline fisheries in 2002, is set out in Table 6.9.

6.170 The only obvious inconsistency needing resolution (highlighted in Table 6.9), was that Russian proposals for Subareas 88.1 and 88.2 did not specify their intent to comply with Conservation Measure 235/XX.

6.171 In previous years, fishing proposals in exploratory fisheries in Subareas 48.6 (south of 60°S), 88.1 and 88.2 have received a derogation in respect of the requirement of Conservation Measure 29/XIX to set longlines at night. This exemption has been given providing that vessels complied fully with measures specified in Conservation Measure 216/XX, designed to ensure that a line sink rate of at least 0.3 m/s was achieved during daytime fishing operations.

6.172 To date all vessels fishing in the exploratory fisheries in Subareas 88.1 and 88.2 have experienced zero seabird mortalities. The Working Group believed that this result could be attributed largely to strict adherence to this requirement, although there is a need to exercise caution in this interpretation because seabird abundance and risk of incidental mortality is only low (risk level 1), or average to low (risk level 2), in the higher latitudes of Subareas 88.1 and 88.2.

6.173 Last year (SC-CAMLR-XX, Annex 5, paragraph 7.137) the Working Group agreed that this proven protocol could be extended to other vessels fishing experimentally in similar average-to-low risk areas (risk levels 1, 2 or 3). Accordingly, the Working Group recommended that the provisions of Conservation Measure 216/XX could be extended to exploratory fisheries proposed for Divisions 58.4.1, 58.4.3a, 58.4.3b and 58.4.4 in 2002/03. However, to extend this measure to higher-risk areas, such as Subarea 58.6, would be premature at this stage.

6.174 Setting longlines within the Convention Area during daylight hours using currently approved fishing gear still represents a risk for seabirds. In all instances where the provisions of Conservation Measure 216/XX are applied, there remains the need for continued review of performance with respect to incidental mortality of seabirds during fishing operations. The Working Group recommended that any vessel operating under the provisions of this conservation measure, and which catches a total of three seabirds shall revert to night setting in accordance with Conservation Measure 29/XIX. Similar provisions were specified for the 2001/02 season in Conservation Measures 228/XX, 235/XX and 236/XX.

6.175 The Working Group noted that the proposal by Australia to fish in Division 58.4.2 during the breeding season of southern giant petrels may potentially pose a risk to the small populations of this species breeding in the area. The Australian proposal stated an intention to conduct line-weighting trials, and to adopt other mitigation measures such as the use of twin streamer lines and retention of offal. These provisions would exceed the requirements of Conservation Measure 29/XIX, and thus further reduce the potential for catching giant petrels during line setting. However, the potential for giant petrels to be caught during line hauling still remained, and the imposition of a total seabird catch of three seabirds during daylight operations would be an important element for managing incidental mortality in this fishery.

6.176 With respect to the prescription of a seabird by-catch level, the Working Group also noted there did not appear to exist a statement on the precise definition of the status of birds 'caught'. Accurate definition of this needs to be provided, *inter alia*, to assess more accurately in by-catch assessments the numbers of birds killed.

6.177 Agreement may also be needed on the level of observation necessary for accurate determination of the numbers of birds caught, specifically in relation to conservation measures which specify a limit on reaching which fishing should cease. This issue is clearly

of relevance to fisheries where exemptions from elements of conservation measures have been made, dependent on prescribed performance criteria, as well as to other aspects of CCAMLR's work.

6.178 One approach would be to accept that full observer coverage (100% of hooks observed) would be required to reliably detect all birds caught. Thus if there was 100% coverage, a by-catch of three birds would be allowed. If observer coverage is less than 100%, we would expect that so long as it is greater or equal to about 25% over the course of a fishery, we could derive a reliable statistical estimate of the number of birds caught by a vessel over a season (paragraph 6.7). However, concern was expressed that levels of observer coverage less than 100% would not be sufficient to ensure a good estimate of birds. Therefore the by-catch limit would be prorated down if observer coverage was less. Taking into account that the by-catch should be set to integer birds, this would imply a limit of three birds for rates of observation of 100%, two birds for rates of 60–100% of hooks and one bird for rates of 25–60% of hooks. Once a cap has been reached at a certain level of coverage, daylight setting operations should cease. Coverage should not be increased to potentially meet a higher bird cap level.

Other Incidental Mortality

Interactions involving Marine Mammals with Longline Fishing Operations

6.179 There were no reports of marine mammal mortality associated with longline vessels.

6.180 Interactions with marine mammals, in which there was loss of fish, were reported from 73% of vessels fishing in Subarea 48.3 and 30% of vessels in Subareas 58.6/58.7 (WG-FSA-02/13 and summarised in Table 6.10 with comparison to previous years). However, the depth at which interactions with marine mammals occur means that direct observation of fish removal is often very difficult. While the quantification of the interactions is clearly problematic, all vessels operating in Subarea 48.3 provided anecdotal reports of reduced catches and/or damaged fish when large numbers of killer (*Orcinus orca*) and/or sperm (*Physeter catodon*) whales were present at the time of hauling.

6.181 No such interactions were reported for Subarea 88.1, despite sightings of killer whales from the fishing vessels on most cruises.

Interactions involving Marine Mammals and Seabirds with Trawl and Pot Fishing Operations

6.182 A single penguin was found dead in the net of a Japanese vessel fishing for krill in Subarea 48.2. Two Antarctic fur seals (*Arctocephalus gazella*) were released alive from a Japanese vessel fishing for krill in Subarea 48.3 (from Japan's Report of Member's Activities in 2001/02 as posted on the CCAMLR website).

6.183 The scientific observer recorded no incidental mortality associated with the single vessel (*Kinpo Maru No. 58*) that participated in the pot fishery for crabs in Subarea 48.3.

6.184 In respect of trawl fisheries for *C. gunnari* and *D. eleginoides* in Division 58.5.2 there was only one report of incidental mortality – that of a single southern elephant seal (*Mirounga leonina*) (WG-FSA-02/12).

6.185 In respect of trawl fisheries for *C. gunnari* in Subarea 48.3, there were no reports of marine mammal entanglement or incidental mortality.

6.186 The Working Group recollected that last year, in order to restrict seabird by-catch in this fishery to low levels, pending the collection of data to propose appropriate mitigation measures, the Commission decided that an interim precautionary seabird by-catch limit of 20 birds per vessel trawl fishing for icefish in Subarea 48.3 would be appropriate (CCAMLR-XX, paragraphs 6.38 and 6.39).

6.187 Last year a total of 132 seabird entanglements was reported, of which 92 were fatal, 40 birds being released alive (SC-CAMLR-XX, Annex 5, paragraph 8.5), by the five vessels engaged in this fishery.

6.188 This year, based on data from observer logbooks and supplementary material in the observer reports, a total of 125 seabird entanglements was reported, of which 73 were fatal and 52 birds were released alive (Table 6.11). The birds killed comprised 20 black-browed albatrosses, 52 white-chinned petrels and 1 Antarctic prion (*Pachyptila desolata*); the birds released comprised 13 black-browed albatrosses and 39 white-chinned petrels.

6.189 Two vessels (*In Sung Ho* and *Argos Vigo*) appeared to have reached the by-catch limit; a third vessel (*Robin M. Lee*) closely approached this limit.

6.190 The Working Group noted that the level of seabird mortality in the trawl fisheries for *C. gunnari* in Subarea 48.3 in 2002 was an order of magnitude greater than that in the regulated longline fishery in the same subarea.

6.191 Data from observer reports indicate that 25% of bird deaths in 2002 were recorded during setting; however, the Working Group noted that it was unlikely that birds captured during setting would be retained in the net until hauling.

6.192 There was no significant relationship between total fish catch and bird by-catch ($r = -0.46$, $P < 0.05$). The *Argos Vigo*, which had the equal greatest reported bird by-catch, fished for the shortest period of time and had the lowest fish catch (data from observer reports). The *Zakhar Sorokin* and the *Bonito* fished for a longer period and caught fewer birds than other vessels. Last year (SC-CAMLR-XX, Annex 5, paragraph 8.14) an indication was given that the operational characteristics of the *Zakhar Sorokin* may have contributed to its zero seabird by-catch in 2001; if these characteristics were maintained they may have contributed to its relatively low seabird by-catch in 2002.

6.193 Last year (SC-CAMLR-XX, Annex 5, paragraph 8.20) the Working Group requested that provision be made in the *Scientific Observers Manual* logbook data recording and reporting sheets and instructions to scientific observers, for recording:

- (i) the nature and timing of offal discharge (noting that Conservation Measure 173/XVIII prohibits this during shooting and hauling of trawl gear);

- (ii) the location, level and direction of deck lighting in use during hauling operations (for which recommendations are made in Conservation Measure 173/XVIII); and
- (iii) any other details relevant to entanglement and mortality of seabirds, including video recording as feasible, together with suggestions as to how these could be avoided.

6.194 In addition, the Commission (CCAMLR-XX, paragraph 6.37) recommended that in respect of vessels trawl fishing for icefish in Subarea 48.3 in 2001/02:

- (i) new data recording and reporting arrangements be put in place for scientific observers, to ensure that more data are available to investigate and resolve the causes of the problem; and
- (ii) mitigating measures be tested with the aim of incorporating appropriate recommendations into Conservation Measure 173/XVIII.

6.195 Offal discharge during setting and hauling was recorded during a small number of hauls on the *Bonito* and *Argos Vigo* (Table 6.19). However, the amount of offal would be expected to be relatively small as the icefish catch was frozen whole. Information about deck lighting was received from three vessels and was consistent with safe vessel operation (Table 6.19). No video material accompanied any of the observer reports.

6.196 There were two scientific observers on board all vessels except the *Robin M. Lee*; however, the only vessel which indicated that there was a dedicated seabird observer was the *Argos Vigo*. The report from the *Argos Vigo* contained detailed information on observations of seabird interaction with nets during setting and hauling and of tests of mitigation measures.

6.197 Tests of mitigation measures conducted on the *Argos Vigo* included cable mitigation measures (consisting of two poles, 4 m in length, suspended from the A-frame, with streamers and bottles attached to produce a visible and audible deterrent). These measures may have reduced potential seabird interactions with trawl cables but they had limited impact on seabird interactions with nets, which generally occurred up to 150 m astern of the vessel. Ensuring that the net was cleaned of enmeshed fish prior to setting apparently made the net less attractive to birds; however, there were indications from other vessels that this made little difference to the level of seabird interactions, although this was not quantified. Scaring devices (fireworks) were also tested. Their deployment was restricted to the period of net hauling due to the limited number available. The average period that the net was at the surface during hauling was 26 minutes; deploying fireworks during this period dispersed feeding aggregations of seabirds for up to 7 minutes, but more often only for 1 minute.

6.198 Much of the mortality of the two main species involved, black-browed albatross and white-chinned petrel, arose as a result of seabirds diving into the net to obtain food and being unable to escape. As reported last year (SC-CAMLR-XX, Annex 5, paragraph 8.11) seabirds were primarily caught in the large mesh at the wings and mouth of the net. There was no reported mortality associated with seabirds colliding with warps; however, observation of seabird interactions with trawl vessels in Subarea 48.3 was primarily directed towards setting and hauling nets, rather than to trawl warp interactions. It is apparent from other studies of seabird interaction with trawl vessels that detection of particular incidents, such as impact with trawl warps, is likely to go unreported unless there is specific observation of warps during the period of fishing (WG-FSA-02/36 and 02/59).

6.199 WG-FSA-02/36 reported the results of a detailed investigation of seabird mortality associated with trawl fishing around the Falkland/Malvinas Islands. All the seabird mortality (mainly of black-browed albatrosses and giant petrels) occurred as a result of collisions with trawl warps, especially when birds became entangled with warp splices. There were no records of seabirds caught in the net; however, the mesh size of the mouth of the net was 120–140 mm compared to a 400 mm mesh width at the mouth of the nets used in the trawl fishery for icefish in Subarea 48.3.

6.200 Last year (SC-CAMLR-XX, Annex 5, paragraph 8.12) the Working Group indicated that high seabird by-catches might be related to specific aspects of vessels or fishing operations. This year's data indicate that all vessels operating in the fishery caught seabirds; of the three that did so in substantial numbers, two were new to the fishery and catch levels of the third (*Argos Vigo*) were similar to last year.

6.201 Mr Williams indicated that the trawl fishery for icefish in Division 58.5.2 did not experience a similar by-catch of seabirds (see also SC-CAMLR-XX, paragraph 4.82). He noted that the vessels operating in this fishery had fish meal plants on board and did not discharge offal, making them much less attractive as a source of food for seabirds. In addition, vessels used bottom trawl gear that is heavier, has a smaller mesh at the mouth and is present at the surface for a much shorter period of time than the midwater trawl gear used in Subarea 48.3.

6.202 It was noted that the use of bottom trawls is currently prohibited in Subarea 48.3 (Conservation Measure 219/XX). It may be appropriate to reconsider whether it is bottom trawling which was intended to be prohibited and whether the use of bottom trawl gear, fished off the bottom, might be permitted, under appropriate conditions.

6.203 It was suggested that the high seabird by-catches in Subarea 48.3 might reflect the much higher densities of breeding seabirds around South Georgia than in other areas where icefish are fished. However, this was not supported by experiences with high densities of seabirds associated with trawling operations elsewhere in the Convention Area and in adjacent areas.

6.204 On the basis of the discussion, the Working Group advised that the by-catch of seabirds associated with the icefish trawl fishery in Subarea 48.3 was likely related to the nature of the fishing gear, especially midwater trawls, being used. It recommended that this be investigated further by continuing the work recommended by the Commission last year (CCAMLR-XX, paragraph 6.37).

6.205 The Working Group recommended investigation into the effect of season and densities of seabirds on incidental mortality rates associated with trawling operations. Technical coordinators were asked to facilitate the collection of these data wherever possible.

6.206 The Working Group noted the comments of the Scientific Committee concerning the potential closure of the icefish fishery during critical periods, as specified for the longline fishery, in relation to reducing the levels of seabird by-catch (SC-CAMLR-XX, paragraph 4.90). It recognised that its evaluation of the problem was not complete. However, it recommended that unless the levels of seabird by-catch in the icefish fishery could be more effectively mitigated, consideration should be given to restricting the fishing season, at least during the main chick-rearing period of black-browed albatrosses and white-chinned petrels (January–April).

6.207 The Working Group also noted that as most seabirds captured during setting are unlikely to be recorded at hauling (see paragraph 6.191), some birds killed at hauling are not brought onto the vessel and that a proportion of the birds released alive have injuries prejudicial to their survival, it is necessary to define precisely what is meant by the number of birds caught (paragraph 6.176) and to take account of this in any review of the seabird by-catch limit.

6.208 It would also be necessary to make appropriate provision in the *Scientific Observers Manual* logbook data recording and reporting forms, and instructions to scientific observers, for distinguishing birds landed alive but with potentially fatal injuries from those released alive with no or minor injury (paragraph 6.16).

Advice to the Scientific Committee

General

6.209 The plan of intersessional work (Appendix D) summarises requests to Members and others for information of relevance to the work of the Working Group (paragraphs 6.1 to 6.3). Members are particularly invited to review the membership of the Working Group, to suggest additional members and to facilitate attendance of their representatives at meetings (paragraph 6.4).

Incidental Mortality of Seabirds during Regulated Longline Fishing in the Convention Area in 2002

- 6.210 (i) For Subarea 48.3 the total estimated seabird by-catch in 2002 was only 27 birds at a rate of 0.0015 birds/thousand hooks, very similar to the values of the last two years (paragraph 6.9).
- (ii) No observed seabird by-catch was reported from within the South African EEZs in Subareas 58.6 and 58.7, a substantial reduction from the estimated 199 birds last year (paragraph 6.10). The causes of this marked improvement are unknown, although fishing effort was greatly reduced (paragraphs 6.11 and 6.12).
- (iii) No incidental mortality of seabirds was observed in Subarea 88.1 for the fourth successive year, due to strict compliance with conservation measures (paragraph 6.13).
- 6.211 (i) No data were reported from longline fishing within the French EEZs in Subarea 58.6 and Division 58.5.1 in 2002; some data for the 2000 and 2001 seasons, when very high rates of seabird by-catch occurred, had recently been supplied to the Secretariat (paragraphs 6.14 and 6.15).
- (ii) Submission to CCAMLR of 2002 data was requested, together with submission of 2003 data in time for analysis and evaluation at WG-IMAF (paragraph 6.14).

Compliance with Conservation Measure 29/XIX

- 6.212 (i) Overall compliance with this conservation measure this year, compared to last year, was substantially improved in all subareas and divisions and was again complete in Subarea 88.1. Elsewhere, one vessel fully complied with all elements of this measure at all times and eight other vessels were within 95% of the minimum requirements of all elements (paragraph 6.28).
- (ii) Streamer lines – compliance with streamer line design was 86% compared with 66% last year (paragraph 6.18). In Subareas 58.6, 58.7, 88.1 and 88.2 all vessels used streamer lines on all sets; in Subarea 48.3 only four of 15 vessels did so.
- (iii) Offal discharge – all vessels complied with the requirement either to hold offal on board, or to discharge on the opposite side to where the line was hauled. Only one vessel was observed to discharge offal during setting (paragraph 6.20).
- (iv) Night setting – in Subarea 48.3 compliance improved from 95% last season to 99%; in Subareas 58.6 and 58.7 it improved from 78% to 99% (paragraph 6.21).
- (v) Line weighting (Spanish system) – appropriate weighting was used in 63% and 66% of cruises in Subareas 48.3 and 58.6/58.7 respectively, compared with 21% and 18% in 2001 and zero in 2000 (paragraph 6.24).
- (vi) Line weighting (autoline system) – the requirement to achieve a line sink rate of 0.3 m/s when fishing in daylight in Subareas 88.1 and 88.2 south of 65°S was met by both vessels (paragraph 6.26).

6.213 The Working Group again recommended that vessels which do not comply with all elements of Conservation Measure 29/XIX should be prohibited from fishing in the CCAMLR Convention Area (paragraphs 6.25 and 6.29).

Fishing Seasons

6.214 On the basis of the data for the 2001/02 fishing season in Subarea 48.3, seabird by-catch levels were very low (negligible in terms of the population dynamics of the species concerned), for the third successive season. Full compliance with Conservation Measure 29/XIX was only achieved by one vessel (paragraph 6.31). Recommendations relating to potential future extensions to the fishing season for Subarea 48.3 are provided in paragraphs 6.37 and 6.38 and discussed in paragraphs 6.39 to 6.46. Full compliance by all vessels should readily be achievable next year with small improvements to operational practice.

Research into and Experiences with Mitigating Measures

- 6.215 (i) Line weighting – significant progress is reported with the development of integrated weights for autoline vessels in achieving the sink rates required under Conservation Measure 216/XX; tests under operational conditions are due in November 2002 (paragraphs 6.50 and 6.51).

- (ii) Underwater setting – tests of the chute were successful in the Hawaiian pelagic longline fishery but less so, at least as a sole mitigation measure, in the Australian demersal tuna fishery. Development of the underwater setting capsule continues (paragraphs 6.60 to 6.64).
- (iii) Offal discharge – offal retention should be carried out whenever practicable (paragraph 6.66); appropriate scupper screens should be used at all times (paragraph 6.65); hooks should be removed from fish heads, fish offal and fish by-catch prior to their discard (paragraphs 6.67 to 6.69); a bounty scheme for retaining hooks was commended (paragraph 6.70).
- (iv) Streamer lines – it is recommended, based on successful experiences outside the Convention Area, that paired streamer lines and boom-and-bridle design streamer lines should be used in the Convention Area (paragraphs 6.71 to 6.75).
- (v) General – advice is provided on issues of particular importance for mitigating seabird by-catch, that should be taken into account when new longline vessels are built; information is sought from France on the relevant design specifications of their five new vessels (paragraphs 6.84 and 6.85).

6.216 The key experiment designed to determine the effectiveness of mitigation measures (either singly or in combination) for the Spanish method of longline fishing was developed, costed and submitted, with only limited success, to more than 50 funding organisations. Members were again encouraged to support this important experiment (paragraph 6.34).

Revision of Conservation Measure 216/XX

6.217 Based on its successful use last year, specific advice is provided for a minor revision to the bottle test element of this measure (paragraphs 6.56, 6.57 and 6.81).

Revision of Conservation Measure 29/XIX

6.218 Full proposals for revision of several elements of this measure (those relating to streamer lines, line weighting for autoliners and hooks in offal) are likely to be developed next year; some specific indications are given together with recommendations for data collection (paragraphs 6.68, 6.69, 6.82 and 6.83).

Assessment of Incidental Mortality of Seabirds during IUU Longline Fishing in the Convention Area

6.219 (i) The estimates of potential seabird by-catch by area for 2002 (SC-CAMLR-XXI/BG/23) were:

Subarea 48.3:	10–20 to 50–70 seabirds;
Subareas 58.6 and 58.7:	5 900–8 000 to 10 800–14 400 seabirds;
Divisions 58.5.1 and 58.5.2:	24 300–32 600 to 43 900–59 100 seabirds;
Division 58.4.4:	8 100–10 900 to 14 700–19 700 seabirds; and
Subarea 88.1:	100–200 seabirds.

- (ii) The overall estimated totals for the whole Convention Area (paragraph 6.96) indicate a potential seabird by-catch in the unregulated fishery of 39 000–52 000 (lower level) to 70 000–93 000 birds (higher level) in 2001/02. This is broadly consistent with values from previous years (Figure 6.2; SC-CAMLR-XXI/BG/23).
- (iii) Since 1996 the overall total estimated potential seabird by-catch is 278 000–700 000 seabirds, comprising 74 000–144 000 albatrosses, 13 000–24 000 giant petrels and 203 000–378 000 white-chinned petrels (paragraph 6.99).
- (iv) The Working Group endorsed its conclusions of recent years that such levels of mortality remain entirely unsustainable for the populations of albatrosses, giant petrels and white-chinned petrels breeding in the Convention Area (paragraph 6.100), many of which are declining at rates where extinction is possible.
- (v) The Working Group recommended that the Commission take even more stringent measures to combat IUU fishing in the Convention Area (paragraph 6.101).

Incidental Mortality of Seabirds during Longline Fishing outside the Convention Area

- 6.220
- (i) Reports were received from Argentina, Chile, Falkland/Malvinas Islands, South Africa and Uruguay on levels of seabird by-catch observed in longline fisheries operating in areas adjacent to the Convention Area (paragraphs 6.103 to 6.107).
 - (ii) A review of the spatio-temporal trends of longline fishing efforts in the Southern Ocean concluded that a combination of the consistently high effort (250 million hooks per annum) in the regulated fisheries and the substantial increase in IUU fishing, threatens the long-term viability of many Southern Ocean seabird species (paragraph 6.108).
 - (iii) The Working Group recommended that responses continue to be sought on seabird by-catch levels, mitigation measures in use (and whether voluntary or mandatory) and observer programs from all Members and other countries conducting or permitting longline fishing in areas where seabirds from the CCAMLR Convention Area are killed (paragraph 6.109).

Research into the Status and Distribution of Seabirds at Risk

6.221 Submitted data on:

- (i) size and trends of populations of albatross species and of *Macronectes* and *Procellaria* petrels vulnerable to interactions with longline fisheries;
- (ii) the foraging ranges of populations of these species adequate to assess overlap with areas used by longline fisheries; and

- (iii) genetic research relevant to determining the origin of birds killed in longline fisheries;

are still insufficient for a comprehensive review of these topics. All Members are requested to submit relevant data to next year's meeting (paragraphs 6.110 and 6.112 to 6.115).

6.222 Important results from submitted information on the above topics are:

- (i) potential increases in the population of black-browed albatrosses at Heard Island over the last 50 years (paragraph 6.116);
- (ii) survival rates of adult wandering albatrosses breeding at Marion Island were negatively correlated with the Japanese longline fishing effort in the Southern Ocean (paragraph 6.117);
- (iii) extensive data from recent research on albatrosses at breeding sites in Chile, establishing baseline population data and showing that birds forage in the Convention Area at certain times of year. Black-browed albatrosses are at particular risk from domestic toothfish longline fisheries (paragraphs 6.118 to 6.121); and
- (iv) studies of population size, trends and foraging ranges are still inadequate for many seabird species in the Convention Area threatened by longline fishing mortality, especially white-chinned petrels (paragraph 6.122).

6.223 Members are requested to provide information on the extent and location of their seabird by-catch collections to facilitate the development of collaborative research to investigate the origins of birds killed (paragraphs 6.125 and 6.126).

International and National Initiatives relating to Incidental Mortality of Seabirds in relation to Longline Fishing

6.224 Information was reported on important new international initiatives under the auspices of:

- (i) IFF2 – meeting in Hawaii, USA, in November 2002 (paragraphs 6.127 to 6.129);
- (ii) ACAP – potential entry into force during 2003 (paragraphs 6.130 to 6.134); and
- (iii) FAO-NPOAs – noting rather limited progress in development and even more so in implementation; Members reporting on implementation to COFI in February 2003 are requested also to report to CCAMLR (paragraphs 6.135 to 6.138).

6.225 Recollecting that the greatest threats confronting the conservation at sea of albatrosses and petrels breeding in the Convention Area are the levels of mortality likely to be associated with IUU longline fishing inside the Convention Area and with longline fishing for species other than *Dissostichus* in areas adjacent to the Convention Area (CCAMLR-XX, paragraph 6.33), CCAMLR made a particular effort to contact intersessionally all relevant RFMOs (paragraphs 6.140 and 6.141):

- (i) CCSBT – report from November 2001 meeting still not released (paragraph 6.142);
- (ii) ICCAT – no direct response but three draft resolutions relating to seabird by-catch may be discussed at the November 2002 meeting; Members encouraged to support strongest possible resolution (paragraphs 6.143 and 6.144);
- (iii) IOTC – reported no evidence of seabird by-catch; however the Working Group noted extensive overlap of at-risk seabirds with longline fisheries in the southern part of the IOTC area (paragraphs 6.145 and 6.146); and
- (iv) IATTC – no relevant data available; based on a US example, recommended establishment of observer programs in areas where Convention Area birds are likely to be caught (paragraphs 6.147 and 6.148).

6.226 To assist in fulfilling obligations under the newly ratified UNFSA, Members were requested to copy to CCAMLR submissions of relevant data and information to RFMOs (paragraphs 6.152 and 6.153).

6.227 The Working Group encouraged CCAMLR observers to RFMOs to continue reporting on seabird-related activities and to press for inclusion of this seabird by-catch topic on RFMO agendas (paragraph 6.154).

6.228 The Working Group commended recent initiatives addressing by-catch issues of albatrosses and petrels breeding in the Convention Area by New Zealand, USA and BirdLife International (paragraphs 6.156 to 6.161).

Incidental Mortality of Seabirds in relation to New and Exploratory Fisheries

- 6.229 (i) Of the 24 exploratory longline fisheries approved for 2001/02, only two, in Subareas 88.1 and 88.2, were operational; no seabird by-catch was reported in either of these fisheries (paragraphs 6.166 and 6.167).
- (ii) The assessment of potential risk of interactions between seabirds and longline fisheries for all statistical areas in the Convention Area was reviewed, revised and provided as advice to the Scientific Committee and Commission in SC-CAMLR-XXI/BG/21. There were no changes to this advice in relation to levels of risk of seabird by-catch for any part of the Convention Area. However, the potential for exemptions for daylight setting in areas of lower risk to seabirds has been incorporated into the advice (paragraphs 6.171 to 6.174).
- (iii) The 21 proposals by five Members for new and exploratory longline fisheries in eight subareas/divisions of the Convention Area in 2002/03 were addressed, in relation to advice, in SC-CAMLR-XXI/BG/21 and Table 6.9 (paragraphs 6.168 and 6.169).
- (iv) The only potential problems apparently needing resolving (Table 6.9 and paragraphs 6.170 and 6.176 to 6.178) are:

- (a) to check that Russia intends to comply with Conservation Measure 236/XX in Subareas 88.1 and 88.2;
- (b) the need to define the nature and status of birds caught, in relation to the limits on seabird by-catch (paragraph 6.176); and
- (c) the potential need to specify appropriate levels of observation to detect accurately low levels of bird by-catch (paragraphs 6.177 and 6.178).

Other Incidental Mortality

6.230 (i) In the Convention Area in 2002, there were no reports of marine mammal mortality in the longline fishery; one southern elephant seal was reported killed by a trawl vessel in Division 58.5.2 (paragraphs 6.179 and 6.184).

(ii) A single penguin was found dead in the net of a krill trawler in Subarea 48.2 (paragraph 6.182).

6.231 No instances of incidental mortality of marine mammals or seabirds had been recorded in the pot fishery for crabs in Subarea 48.3 in 2002 (paragraph 6.183).

6.232 (i) In trawl fishing for icefish in Subarea 48.3, 125 seabirds were entangled, at least 73 fatally, a total an order of magnitude greater than the reported total seabird by-catch mortality for all regulated longline fishing in Subarea 48.3 in 2002 (paragraphs 6.185 to 6.190).

(ii) All vessels engaged in the fishery caught seabirds; detailed observations indicate that seabirds were caught when they became entangled in the large mesh at the mouth of the midwater trawls (paragraphs 6.198 and 6.200).

(iii) Despite vessel-specific differences in levels of seabird by-catch the problem mainly appears to be gear-related and associated with the use of midwater trawls during the period December–March in Subarea 48.3 (paragraphs 6.199, 6.201 and 6.204).

6.233 The Working Group recommended that:

(i) further data be collected to try to define appropriate mitigating measures for the icefish trawl fisheries in Subarea 48.3, continuing the work recommended by the Commission last year (paragraph 6.204);

(ii) unless the levels of seabird by-catch in the icefish fishery can be more effectively mitigated, consideration should be given to restricting the fishing season, at least during the main chick-rearing period of black-browed albatrosses and white-chinned petrels (January–April) (paragraph 6.206);

(iii) it may be appropriate to reconsider whether Conservation Measure 219/XX seeks specifically to prohibit bottom trawling or the use of bottom trawl gear in Subarea 48.3 and whether the use of bottom trawl gear might be permitted under appropriate circumstances (paragraph 6.202); and

- (iv) it is necessary to define precisely what is meant by the number of birds caught and to take account of this in any review of the seabird by-catch limit (paragraph 6.207).

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

7.1 A summary of papers submitted to WG-FSA dealing with aspects of the biology, demography or ecology of fish or invertebrates of interest to the Working Group is contained in SC-CAMLR-XXI-BG/27.

7.2 The Working Group welcomed the large number of contributions on a wide range of subjects. A number of contributions dealt with the biology of the important by-catch groups skates and rays and macrourids. These provided the basis to make a first attempt to determine some important parameters for some species and areas, but the parameters need refinement in most cases. Members were encouraged to continue to collect biological data on by-catch species. In particular, information on biomass of the important species is needed for the calculation of potential yield.

7.3 Length data for macrourids was still in some cases being recorded as total length, even though WG-FSA has recommended for several years that pre-anal length be recorded. Members are reminded to reiterate this instruction to their observers. The Working Group also felt that more information on invertebrate by-catch would be useful, particularly for those groups likely to be most affected by the fisheries. Specific examples are large sponges.

7.4 Several other papers dealt with age, growth, movements and reproductive biology of the target species *D. eleginoides*, *D. mawsoni* and *C. gunnari*. A number of laboratories have compared readings of otoliths of *D. eleginoides* under the CCAMLR Otolith Network (CON), and it is encouraging that differences in readings are generally small. However, an inherent bias may also be associated with identifying the age of the first annulus. It is important to resolve these biases especially when the age bracket in the important models used in assessments only spans about 10 years. It is important to understand why such a discrepancy exists and to resolve it.

7.5 The Working Group thanked those who have participated in CON and encouraged the continuation of this important work. It also recognised the need to establish criteria to decide at what stage the ageing techniques would be considered satisfactory. Even after this point is reached, CON will still be necessary to ensure proper quality control of the various readers.

7.6 Considerable progress has been made towards the validation of otolith ageing in *D. mawsoni*, however there is still a need to confirm growth zones in fish aged 3 to 10 years (WG-FSA-02/33). The Working Group encouraged further work on the validation of toothfish ageing for both species such as the use of otolith marking compounds in conjunction with tagging experiments, and comparison with length-frequency distributions in young fish.

7.7 Icefish otoliths were exchanged between laboratories following recommendations by WG-FSA in 2001 (SC-CAMLR-XX, Annex 5, paragraph 4.201). The preliminary results of these exchanges are outlined in WG-FSA-02/57. It was concluded that there were structures visible in the otoliths that might be used for age determination. Such a topic might be investigated through a practical workshop meeting. Dr Gasiukov noted that further whole

otolith samples had been sent to Instituto Español de Oceanografía, Tenerife, Spain, for reading. Initial results suggest that there is great variability in age readings between institutes. It was recommended that the otolith exchange program should continue intersessionally involving laboratories currently involved in CON. Several of the issues which have been addressed for ageing *D. eleginoides* need to be assessed for icefish otoliths. Of particular importance are an assessment of the use of different otolith preparation methods, between-reader variability and inter-laboratory variability. The need for validation studies was also highlighted.

7.8 A significant decline in the condition of *D. mawsoni* in Subarea 88.1 was observed leading up to the spawning season in May. This had not been documented in *Dissostichus* spp. before and the Working Group encouraged observers to look out for this phenomenon in other fisheries for these species.

CONSIDERATIONS OF ECOSYSTEM MANAGEMENT

Interactions with WG-EMM

8.1 Last year, the Workshop on Approaches to the Management of Icefish requested that WG-EMM consider the importance of *C. gunnari* to predators in the Antarctic ecosystem in order to evaluate the escapement of *C. gunnari* required from the fishery to provide for predators (SC-CAMLR-XX, Annex 5, Appendix D, paragraph 8.7).

8.2 WG-EMM noted that information on the importance of *C. gunnari* to predators might be used to estimate a desired escapement. Along these lines, WG-EMM had noted that the 'species profile' of *C. gunnari* would also be useful for building models that describe the role of this fish in the ecosystem. Ultimately, a model that describes the role of *C. gunnari* in the ecosystem will need to examine the effects of fishing for both krill and the fish itself, and this will require collaborative work between WG-EMM and WG-FSA (Annex 4, paragraph 3.100).

8.3 Prof. Croxall noted that, in the context of the CEMP review, WG-EMM was requesting information regarding the potential suitability of icefish as an indicator species for CEMP. In addition, it would wish to consider any attributes of icefish which might be used to distinguish between changes due to natural and harvest-induced effects. Members of WG-FSA were encouraged to supply any relevant data in time for the WG-EMM meeting next year.

8.4 The Working Group noted that in two years' time WG-EMM will be focussing on food-web and trophic interaction models. It would be useful to identify the types and amounts of data (e.g. data pertaining to stock structure, production, distribution etc.) which would benefit the work of WG-EMM and to identify any potential products from the work of WG-EMM which would be of use to WG-FSA.

8.5 Therefore the Working Group agreed there is a need for additional discussions among WG-FSA members and members of WG-EMM.

8.6 WG-EMM also noted that time-series data are available for icefish (e.g. survey estimates of biomass), and these data might be useful in expanding the scope of CEMP to consider predator-prey interactions based on species other than krill and for furthering the

work of the CEMP review (Annex 4, paragraph 3.101). The Working Group noted there exist data from Subareas 48.1, 48.2 and 48.3 and Division 58.5.2 which may provide icefish time series.

8.7 WG-EMM noted the proposal (WG-EMM-02/24) that the original invitation from the World Fisheries Congress (WFC) to Prof. I. Boyd (UK) to lead a session on 'Reconciling Fisheries with Conservation in the Antarctic' (Vancouver, Canada, 2 to 6 May 2004) might be extended to enable greater potential participation by CCAMLR scientists. WG-EMM agreed with this proposal and recommended that the conveners of WG-EMM and WG-FSA should join Prof. Boyd as co-leaders of this session. The Working Group concurred with this and recommended that CCAMLR should publicise the existence of this session at the WFC as an important opportunity to present CCAMLR science and management in a global context (Annex 4, paragraphs 7.1 to 7.4). Dr Everson noted that abstracts needed to be submitted by April 2003 to be considered for oral presentations.

8.8 From 7 to 15 August 2002, WG-EMM conducted a Workshop on Small-Scale Management Units, such as Predator Units (Annex 4, Appendix D). The distribution and indices of abundance of predators were used to help determine centres of foraging activity in the South Atlantic. These included four main groups of krill predators: Antarctic fur seals, penguins including macaroni, gentoo, chinstrap and Adélie, black-browed albatrosses and krill-eating fish species. The spatial distribution and abundance of krill-eating finfish biomass on shelf regions in Area 48 was assessed using data obtained from a recent research trawl survey conducted by the US AMLR Program in the South Shetland Islands (1998, 2001) and the South Orkney Islands (2000), and from Russian and UK surveys around South Georgia (2000) (Annex 4, Appendix D, paragraphs 4.7 to 4.13). These were used to define potential small-scale management units.

8.9 The Interim Steering Committee for the CEMP Review was convened by Prof. Croxall on 3 August 2002 (Annex 4, Appendix E). The Steering Committee noted that long-term data on icefish, particularly from studies in the South Georgia region, would be a valuable contribution to the workshop. Prof. Croxall would consult with Dr Everson, the author of the WG-FSA profile of this species, to determine which were the most useful data to have available for analysis at the workshop (Annex 4, Appendix E, paragraph 48). The Steering Committee also agreed to request WG-FSA to recommend any time-series data which might be suitable for the purposes of the 2003 workshop (Annex 4, Appendix E, paragraph 56 and Attachment 4, item 18).

FUTURE ASSESSMENTS

9.1 The Working Group used the report on intersessional work of the Subgroup on Assessment Methods (WG-FSA-02/80) as a basis for discussion of work on future assessments. It agreed that the main points for discussion concerned: (i) the preparation for assessments in 2003, (ii) the development of an agenda of intersessional work on assessment methods including the potential for holding an intersessional meeting of the subgroup, (iii) the means by which assessment methods might be introduced and adopted by the Working Group for use in its annual assessments, and (iv) a timetable of intersessional work leading up to the 2003 meeting of the Working Group.

9.2 The Working Group agreed that the outline provided in pages 3 to 14 of WG-FSA-02/80 was a useful contribution to planning assessment work for the meeting. As

such, the Working Group requested the Subgroup on Assessment Methods to continue to provide such an outline of available assessment methods, data and other information in time for use by the Working Group next year. It was agreed that attempts should be made to compile this information well in advance of the meeting through circulars to members of the Working Group. The Working Group also asked the subgroup to continue the development of descriptions of the standard methods used by the Working Group as this is an important adjunct to this work.

9.3 In discussing the intersessional work plan of the Subgroup on Assessment Methods, the Working Group agreed that establishing an active correspondence group combined with the potential for holding an intersessional meeting of the subgroup would provide the opportunities not currently available for developing assessment methods for use by the Working Group. It was agreed that such a format might also allow the involvement of other specialists in this work without the necessity for attending the meeting of WG-FSA.

9.4 The Working Group agreed that an intersessional meeting of the subgroup of between 10 to 20 participants for four days would be a valuable step in this process. Notification of such a meeting would need to be made to the whole Working Group well in advance of the meeting. It was agreed that the timing of such a meeting was likely to be best adjacent to, probably before, WG-EMM. The Working Group noted that a host would need to be found for a meeting of this kind but also noted that there would be no expectation of the host to provide computing facilities and Secretariat support and that the subgroup would be relatively self sufficient. The Working Group also noted that the meeting would not require Secretariat support in terms of organisation or preparation of the report during the meeting. It was agreed that the report of such a meeting would be compiled and adopted by correspondence following the meeting. It was also noted that the outcomes of the work of the subgroup would need to be endorsed by the Working Group before implementation of recommendations could be accepted as outcomes of the Working Group.

9.5 With regard to the agenda of work of the subgroup, the Working Group agreed that it was important for the subgroup to begin examining and evaluating alternative methods of assessment and to determine what methods might be used for estimating stock status of toothfish, taking account of the difficulties the Working Group has had in the past of estimating stock status and applying short-term assessment methods. In this respect, the Working Group endorsed the work plan on pages 15 to 17 of WG-FSA-02/80 and agreed that assessments of stock status for toothfish remain to be developed and need to be added to the work plan. Also, recent published work indicates that the subgroup needs to include an evaluation of the use of the delta lognormal distribution in the mixture analyses (CMIX) and estimation of abundance from trawl surveys (TRAWLCI) (Annex 4, paragraphs 5.39 and 5.40). The Working Group noted that a number of methods and software are available to other fisheries assessment bodies and that the subgroup is encouraged to identify and evaluate candidate methods and software that could be used by WG-FSA.

9.6 The Working Group welcomed the discussion in the subgroup report (pages 18 to 24, WG-FSA-02/80) on an evaluation framework in which assessment methods could be evaluated and developed to meet the operational objectives of the Commission. It agreed that the subgroup needs to consider and evaluate appropriate candidate methods for assessments and that it would be difficult to develop a single simulation environment for testing these methods. The Working Group encouraged Members to provide evaluations of candidate methods that demonstrate the robustness of these methods to uncertainties and underlying

assumptions in their potential application in CCAMLR. It was agreed that this would be an important part of the intersessional program of work of the subgroup. This would help ensure that CCAMLR remains open to using methods developed for purposes outside CCAMLR.

9.7 The Working Group agreed that this work is a priority and that an increase in resources of the Secretariat may be required over the next few years to help with the evaluation, computing, validation and archiving of this work.

9.8 The Working Group endorsed the timetable for preparation for assessments in 2003 provided in WG-FSA-02/80, included here as Table 9.1. It was noted that a circular to the Working Group early in the intersessional period would be helpful. The Working Group encouraged all Members to participate in the submission of information that will be requested for preparing for assessments in 2003. The Working Group agreed that the main sections of an intersessional meeting would address the following questions:

- (i) What are the candidate assessments to be considered for use by WG-FSA and what is required to evaluate them?
- (ii) What can be done for assessments in 2003?
- (iii) What timetable can be developed for the short and long term in the development of assessment methods and the estimation of key parameters in the assessment process?
- (iv) What resources will be needed from the Secretariat to help with this work?

9.9 The Working Group noted that the work of the subgroup will have budgetary implications in the form of reports, computing and support for participating in the work, including validation and archiving of the relevant materials associated with the evaluations.

9.10 In terms of preparation for next year, the Working Group noted the broader participation this year as a result of greater access and involvement in each of the assessment processes. The Working Group encouraged all Members to continue exploring and experimenting with the assessment tools and helping the subgroup further develop the descriptions of standard methodologies and the provision of new and improved tools. The Working Group requested that the subgroup include in the descriptions of standard methodologies, the methods used by the Secretariat for extracting data from the database for use in assessments. It also requested that the subgroup develop with the Secretariat a list of data extractions that could be undertaken prior to the meeting of WG-FSA in order to help streamline the assessment process during the meeting.

9.11 The Working Group thanked Dr Constable for coordinating the Subgroup on Assessment Methods and for advancing the process for preparing for assessments at this meeting.

SCHEME OF INTERNATIONAL SCIENTIFIC OBSERVATION

Summary of Information Extracted from Observer Reports and/or provided by Technical Coordinators

10.1 A summary of information extracted from scientific observer reports was summarised in WG-FSA-02/11 Rev. 1, 02/12 Rev. 1 and 02/14 (paragraph 3.26).

Implementation of the Observer Program

10.2 The Working Group considered that it was technically feasible for observers to collect both pre-sorting and post-sorting data from the crab fishery. It noted that pre-sorting data provided important biological information and the observer would need unrestricted access to the catch to obtain these data. The Working Group agreed that all crabs that were measured should be sexed and male chelae measured. It recommended that these changes in sampling procedures be included in the *Scientific Observers Manual*.

10.3 Some observers reported difficulty in determining nautical twilight (paragraph 6.21); the Working Group encouraged technical coordinators to ensure that the new forms are used (paragraph 6.48). In addition, observers in high-latitude areas, where daily change in nautical dawn and nautical dusk is substantial during summer, have difficulty in extrapolating from the monthly 5° of latitude tables on a day-by-day basis. The Working Group requested that the algorithm used to develop the summary tables should be provided to technical coordinators to develop area-specific day-by-day, degree-by-degree tables; it noted, however, that the large size of such files made their inclusion in the observer logbook impractical.

10.4 Hook discard in fish heads is a substantial problem and more data collection is required from observers (paragraphs 6.67 and 6.68). On two Chilean vessels, a bounty was paid for hooks collected by crew from processed fish heads (paragraph 6.70). This worked successfully and the Working Group encouraged its wider use, where possible.

10.5 In 2001 the Working Group and the Commission requested provision be made in the *Scientific Observers Manual* to record offal discharge, level of deck lighting, entanglement of seabirds and video recording in trawl fisheries for icefish in Subarea 48.3 (paragraphs 6.193 and 6.194). Limited information on deck lighting had been reported and technical coordinators were requested to ensure that this part of the form was completed (paragraph 6.195).

10.6 Observers reported birds as being caught and released alive but the Working Group noted there was a need to distinguish between birds with potentially fatal injuries from those released with no or minor injury (paragraph 6.16). A clear definition was needed in the manual of the status of birds 'caught' as well as the development of a definition on what a dead seabird was. The latter definition had potentially similar implications for skates and rays. There may also be a need to indicate the level of observation necessary for accurate determination of the number of birds caught. This is of particular importance in fisheries for which closure is in part dependent on the number of birds killed (paragraphs 6.177 and 6.178).

10.7 The Working Group noted that in the trawl fishery for *C. gunnari* five-day catch and effort reports submitted to the Secretariat included fish by-catch levels but not those of seabirds.

10.8 The Working Group also noted that more detailed data collection by observers into seabird densities and mortalities in this trawl fishery would be helpful (paragraphs 6.204 and 6.205).

10.9 The Working Group agreed that the *Species Identification Sheets* should be updated with new information (WG-FSA-02/29, 02/32 and 02/54) (SC-CAMLR-XXI/BG/27, paragraph 7.20); further updates will be coordinated intersessionally by Dr Collins. It is planned that digital images will be put on disc to form a field guide.

10.10 The Working Group recommended that changes to the format of the *Scientific Observers Manual* should be coordinated through the technical coordinators.

10.11 WG-FSA-01 asked the intersessional subgroup on sampling catches from longlines to develop recommendations on: (i) subsampling methods using frames and sampling units based on time and gear, (ii) the allocation of observer effort within longline haul and between hauls, and (iii) the allocation of observer effort directed toward fishery target species versus ecological interactions. The results of this work using information from Subarea 48.3 are discussed in WG-FSA-02/52.

10.12 Both subsampling methods essentially follow a multi-stage cluster sampling design, which could be implemented more rigorously if the present objective was changed from sampling 60 fish/day to sampling a set length of each line or number of hours each day.

10.13 The subgroup had suggested that instead of sampling the first 60 fish in a biological sampling period, that all fish on a fixed number of hooks be sampled for biological data. This would be a gear-based sampling system. It was pointed out that this might lead to very large or very small samples of fish, in which case every third or fifth fish might be sampled.

10.14 The Working Group agreed that this would be a very difficult task to ask of observers. An alternative suggestion was that a gear-based method be undertaken only every fifth day of an observer cruise. The observer should monitor the average number of hooks required to obtain 60 fish in the previous four days, and then only monitor this number of hooks. Every fish would be sampled from this time, whether the sample was greater or less than 60 fish. The Working Group agreed that this procedure be tested in the 2002/03 period.

10.15 The subgroup had no data on sampling for age of *Dissostichus* spp. but noted it seemed reasonable, unless otherwise specified, to sample approximately every 30th fish for otoliths during each haul. However, the first fish to be sampled would be randomly selected from 1–30 and would result in an expected number of 112 fish sampled for otoliths in a 60-day voyage; approximating to two otoliths collected per day. The Working Group noted that where there are few vessels in an area, otolith collecting should be more intense. The Working Group also noted that sampling two otoliths/day may not account for segregation in the stock and that for this situation the design of otolith collection would need to be more stringent. Overall there is a need to obtain an unbiased sample and at the same time to collect additional samples in case future work is required.

10.16 Considering the current low level of seabird mortality, the Working Group noted that a 25% observation coverage of the hooks was sufficient (paragraph 6.7). There would be, however, a need for additional observers in the event that by-catch levels increased as higher observation rates are unlikely to be achieved by a single observer.

10.17 Observers are reminded that the standard unit of measurement for macrourids is pre-anal length.

10.18 The subgroup did not address sampling designs for trawling, either commercially or in research surveys.

10.19 The Working Group noted the advice of ad hoc WG-IMAF that Conservation Measure 29/XIX might be simplified, in respect of the streamer line element, if data were available on the areal coverage of streamer lines behind the vessel. The Working Group recommended that indicative values be collected by observers (paragraph 6.74).

Advice to the Scientific Committee

10.20 Additions and modifications to the *Scientific Observers Manual* logbooks data recording and reporting sheets, and instructions to scientific observers, should be made in respect of:

- (i) provision of algorithms for calculation of the times of nautical dawn and dusk (paragraph 10.3);
- (ii) measuring and sampling procedures for crabs (paragraph 10.2);
- (iii) collecting and reporting adequate data on hook discards in fish heads and offal (paragraph 10.4);
- (iv) better recording and reporting of offal discharge, deck lighting and entanglement of seabirds in the trawl fishery for icefish in Subarea 48.3 (paragraphs 10.5, 10.7 and 10.8);
- (v) data on areal coverage of streamer lines (paragraph 10.19);
- (vi) advice to observers on sampling fish and on observation of hooks to record seabird by-catch (paragraphs 10.15 and 10.16);
- (vii) measurement of pre-anal lengths for macrourids (paragraph 10.17);
- (viii) a revision of the observer protocols for by-catch as in section 5.4 (paragraphs 5.151 to 5.196);
- (ix) distinction between birds with potentially fatal injuries from those released with minor or no injury (paragraph 10.6); and
- (x) distinction between skates and rays released alive from those landed or discarded (paragraph 5.181).

10.21 The *Species Identification Sheets* should be updated in time for the 2002/03 season (paragraph 10.9).

10.22 In respect of by-catch such as seabirds, skates and rays there is a need to develop a definition of what constitutes a 'catch' and also to consider how the categories 'dead' and 'alive' might be defined (paragraph 10.6).

10.23 There is a need to consider levels of observations appropriate for accurate determination of the number of birds caught, especially in relation to fisheries for which closure is, in part, dependent on the number of birds killed (paragraph 10.6).

CCAMLR WEBSITE

11.1 The Working Group expressed its pleasure at the operation and use of the CCAMLR website. In particular, the Working Group appreciated the speed at which papers for the meeting had been placed on the website, and made available to participants. The Working Group thanked Mrs Marazas for her excellent work.

11.2 The Working Group noted that an electronic bibliography of WG-FSA working documents had been made available during the meeting. A similar bibliography, containing WG-EMM working documents, had been made available at WG-EMM-02 (WG-EMM-02/8). The Working Group encouraged the Secretariat to further develop this bibliography, including providing website access.

FUTURE WORK

12.1 Future work identified by the Working Group is summarised in Table 12.1 and Appendix D (ad hoc WG-IMAF), together with the persons or subgroups identified to take the work forward and references to sections of this report where the tasks are described. The Working Group noted that these summaries contain only those tasks identified at the meeting, and do not include ongoing tasks undertaken by the Secretariat, such as data processing and validation, publications and routine preparations for meetings.

12.2 The Scientific Committee's attention is drawn to the following tasks which may have financial implications for the 2003 CCAMLR budget:

- (i) for this year only, the Working Group agreed that the background papers arising from the meeting would be collated into a bound companion volume to the report of WG-FSA (paragraph 2.2); and
- (ii) updates to the *Scientific Observers Manual* (paragraph 10.20 and Appendix D, Item 6.2).

12.3 The Working Group recommended that the Secretariat provide, if possible, a proper network facility for the meeting rather than an FTP site as has been used at this and previous meetings. This would facilitate the work of the group.

12.4 The Working Group reviewed the activities of subgroups that had worked during the intersessional period. These subgroups, with the support of the Secretariat, had produced

valuable work and information that had contributed to the assessments and review of information available at the meeting. WG-FSA agreed that the activities of several of these groups should be extended during the 2002/03 intersessional period. Where possible, each subgroup would focus on a small number of key issues. The subgroups would also provide a conduit for information on a wide range of related research. In addition, other tasks were specifically assigned to the Secretariat and/or Members.

12.5 The Working Group reminded participants that membership to the subgroups was open.

12.6 The subgroups for the intersessional period are:

- (i) a subgroup to review observer reports and information, coordinated by Dr E. Balguerías (Spain) and Mr Smith;
- (ii) a subgroup to continue developing assessment methods coordinated by Dr Constable. This subgroup will interact and coordinate activities in the middle of the year (as detailed in Item 9);
- (iii) a subgroup to review, and where necessary assess, the biology and demography of species considered by the Working Group (Convener to appoint coordinator);
- (iv) a subgroup on by-catch coordinated by Ms van Wijk;
- (v) a subgroup to identify, in conjunction with the SCAR EVOLANTA Program, up-to-date information on stock identity for species within the Convention Area, coordinated by Dr E. Fanta (Brazil);
- (vi) a subgroup on conversion factors, coordinated by Mr Smith;
- (vii) a subgroup on fisheries acoustics, coordinated by Drs Collins and Gasiukov;
- (viii) a subgroup on estimation of IUU, coordinated by Dr Ramm; and
- (ix) a subgroup on otolith exchange (CON), coordinated by Dr Belchier.

12.7 Each subgroup was requested to develop a work plan for the intersessional period, in consultation with the appropriate colleagues and with the Convener of WG-FSA and the Chair of the Scientific Committee.

12.8 The responsibilities for coordinating the intersessional activities of ad hoc WG-IMAF are set out in Appendix D.

OTHER BUSINESS

Consideration of a Proposal to list Toothfish
under CITES Appendix II

13.1 This proposal was not submitted to the meeting so the Working Group did not consider this issue.

FAO's Fisheries Global Information System

13.2 SC-CAMLR-XXI/6 presented information on FAO's Fisheries Global Information System (FIGIS) and an outline for a possible partnership between CCAMLR and FIGIS.

13.3 The Working Group noted that FIGIS (www.fao.org/fi/figis) was a web-based network encompassing fisheries resources, biology, technology, aquaculture and trade which was intended to support the global analysis of fisheries issues. A key component of this system, which was being developed by FAO, was a Fishery Resources Monitoring System (FIRMS).

13.4 FIRMS sought to draw together a partnership of international organisations, regional fisheries bodies and national institutes collaborating within a formal agreement to report and share information on fishery resources.

13.5 The Working Group was unable to identify any obvious benefits which the proposed partnership may have for the future work of WG-FSA. The Working Group stressed that the proposed partnership should not impinge on the resources needed for the priority work of WG-FSA.

STATLANT Data

13.6 The Working Group considered three matters regarding STATLANT data:

- electronic access to the data;
- accuracy of the data; and
- publication of the *Statistical Bulletin*.

13.7 The Working Group thanked the Secretariat for developing an electronic version of the *Statistical Bulletin*. This version was developed in Excel format, and contained the complete time series of data (only the most recent 10-year period is published in the *Statistical Bulletin*).

13.8 The Working Group encouraged the Secretariat to further develop electronic access to STATLANT data. These data lie in the public domain, and it would be advantageous to users if the STATLANT database could be queried online, and if data could be extracted for any required combination of species, month and area.

13.9 The Working Group expressed concern at the inconsistencies which had been noted in the STATLANT data during the determination of total removals (Item 3) and the analysis of by-catch (Item 5). It is apparent that some STATLANT data do not reflect Members' official record of catches or may not contain information on all species caught in the Convention Area. The Working Group encouraged Members to review their submissions of STATLANT data and ensure that these data provide the complete and correct official record of catch and effort.

13.10 The Working Group also noted that, for the first time, its analyses were consistently based on the CCAMLR fishing season. Consequently, it was proposed that the next hard copy publication of the *Statistical Bulletin* (Volume 15, due in April 2003) should be arranged by season rather than split-year. The Working Group recognised that publication by season

would require the Bulletin to be published later each year, possibly in June/July. The deadline for the submission of STATLANT data would also need to be amended. This proposal was referred to the Scientific Committee.

Publication Matters

13.11 The Working Group recalled last year's discussion regarding the provision of assistance with the preparation, in English, of manuscripts submitted to *CCAMLR Science* by non-native English-speaking authors (SC-CAMLR-XX, Annex 5, paragraphs 11.7 to 11.11). Concerns were expressed that *CCAMLR Science* may not be accepting valuable scientific contributions due to poor English composition. This matter had been further discussed by the Scientific Committee (SC-CAMLR-XX, paragraphs 14.2 and 14.3).

13.12 Although the Scientific Committee recognised the value of such a service, it was unable to reach consensus on which languages would be supported by such editorial assistance. This issue was referred to the Editorial Board of *CCAMLR Science* for further consideration.

13.13 WG-FSA-02 identified a range of possible solutions, including:

- (i) reinstating a grey literature publication such as *Selected Scientific Papers*;
- (ii) providing funds for editorial assistance by CCAMLR translators; and
- (iii) developing a network of associated editors to *CCAMLR Science* to provide assistance.

13.14 The Working Group advised that this matter should be further discussed by the Editorial Board before being considered by the Scientific Committee.

Advice to the Scientific Committee

13.15 The Working Group was unable to identify any obvious benefits for WG-FSA in becoming a partner in FIGIS (paragraph 13.5).

13.16 Members of CCAMLR were encouraged to review their submissions of STATLANT data (paragraph 13.9).

13.17 The issue of assistance with preparation of manuscripts submitted to *CCAMLR Science* by non-native English-speaking authors was remitted to the Editorial Board for further consideration (paragraphs 13.11 to 13.14).

ADOPTION OF THE REPORT

14.1 The report of the meeting was adopted.

CLOSE OF MEETING

15.1 Details of the future convenership of WG-FSA were referred to the Scientific Committee.

15.2 In closing the meeting, the Convener thanked the participants and the Secretariat for a very successful meeting. He also thanked Dr Constable for his intersessional work which had contributed extensively to the new format of the meeting. Dr Holt, on behalf of WG-FSA, thanked Dr Everson for his continued hard work and leadership.

15.3 The meeting was closed.

REFERENCES

- Alekseyeva, Ye.I., F.Ye. Alekseyeva, V.V. Konstantinov and V.A. Boronin. 1993. Reproductive biology of grenadiers, *Macrourus carinatus*, *M. whitsoni*, *Coelorinchus fasciatus* (Macrouridae), and *Patagonotothen guntheri shagensis* (Nototheniidae) and the distribution of *M. carinatus*. *J. Ichthyol.*, 33 (1): 71–84.
- Anderson, A. and B. McArdle. 2002. Sink rate of baited hooks during deployment of a pelagic longline from a New Zealand fishing vessel. *New Zealand Journal of Marine and Freshwater Research*, 36: 185–195.
- BirdLife International. 2000. *Threatened Birds of the World*. BirdLife International/Lynx-Edicions, Cambridge, Barcelona.
- Environment Australia. 1998. *Threat Abatement Plan for the Incidental Catch (or By-catch) of Seabirds during Oceanic Longline Fishing Operations*. Environment Australia Biodiversity Group, Canberra.
- Kock, K.-H., L. Döllefeld, P.A. Hulley, H.-P. Jährg, W. Petzel, C. Pusch, V. Siegel and M.G. White. 1998. The composition and abundance of the demersal fish fauna around Elephant Island. In: Kattner, G. (Ed.). *The Expedition Antarktis XIV/2 of RV 'Polarstern' in 1996/97. Berichte zur Polarforschung*, 274: 11–14.
- Myers, R.A., J. Bridson and N.J. Barrowman. 1995. *Summary of Worldwide Spawner and Recruitment Data*. Department of Fisheries and Oceans, Northwest Atlantic Fisheries Centre, Canada.
- Nel, D.C., P.G. Ryan and B.P. Watkins. 2002. Seabird mortality in the Patagonian toothfish longline fishery around the Prince Edward Islands. *Ant. Sci.*, 14: 151–161.
- Punt, A.E. and R. Hilborn. 1996. Biomass dynamics model: users manual. *FAO Computerised Information Series*, 10: p. 62.
- Syrjala, S.E. 2000. Critique on the use of the delta distribution for the analysis of trawl survey data. *ICES J. Mar Sci.*, 57: 831–842.
- van Wijk, E.M., A.J. Constable, R. Williams and T. Lamb. 2000. Distribution and abundance of *Macrourus carinatus* on BANZARE Bank in the southern Indian Ocean. *CCAMLR Science*, 7: 171–178.

Woehler, E.J., H.J. Auman and M. Riddle. 2002. Long-term population increase of black-browed albatrosses *Thalassarche melanophrys* at Heard Island, 1947/1948–2000/2001. *Polar Biology*: published online www.link.springer.de/link/service/journals/00300/contents/02/004.

Table 3.1: Catches (tonnes) of target species reported for the 2001/02 fishing season to date. Source: Catch and effort reports submitted by 7 October 2002.

Target Species	Conservation Measure	Region	Gear	Catch of Target Species (tonnes)			
				Limit	Fishery	Other ¹	Total
<i>Chaenodraco wilsoni</i> (exploratory fishery)							
	237/XX	58.4.2	Trawl	500	0	0	0
<i>Champscephalus gunnari</i>							
	219/XX	48.3	Trawl	5 557	2 656	0	2 656
	220/XX	58.5.2	Trawl	885	8 50 ²	-	850 ²
<i>Dissostichus</i> spp.							
	221/XX	48.3	Longline and pot	5 820	5 617	<1	5 617
	180/XVIII	48.4	Longline	28	0	0	0
	222/XX	58.5.2	Trawl	2 815	1 812 ²	-	1 812 ²
	na	58.5.1 (French EEZ)	Longline and trawl	-	-	-	2 930 ³
	na	58.6 (French EEZ)	Longline	-	-	-	989 ³
	na	58.6 (South African EEZ)	Longline	-	57	0	57
	na	58.7 (South African EEZ)	Longline	-	37	0	37
<i>Dissostichus</i> spp. (exploratory fisheries)							
	234/XX	58.6	Longline	450	0	0	0
	229/XX	48.6	Longline	455	0	0	0
	229/XX	48.6 North of 60°S	Longline	455	0	0	0
	230/XX	58.4.2 South of 60°S	Trawl	500	0	0	0
	233/XX	58.4.4	Longline	103	0	0	0
	235/XX	88.1 North of 60°S	Longline	171	58	0	58
	235/XX	88.1 North of 65°S	Longline	2 337	1 275	0	1 275
	236/XX	88.2 South of 65°S	Longline	250	41	0	41
<i>Electrona carlsbergi</i>							
	223/XX	48.3	Trawl	109 000	0	0	0
<i>Euphausia superba</i>							
	32/XIX	48	Trawl	4 000 000	114 245	0	114 245
	106/XIX	58.4.1	Trawl	440 000	0	0	0
	45/XX	58.4.2	Trawl	450 000	0	0	0
Lithodidae							
	225/XX	48.3	Pot	1 600	113	0	113
<i>Macrourus</i> spp. (new fishery)							
	230/XX	58.4.2	Trawl	150	0	0	0
<i>Martialia hyadesi</i> (exploratory fishery)							
	238/XX	48.3	Jig	2 500	0	0	0

¹ Taken as by-catch in other fisheries in the region

² Verified landed weights reported by Australia

³ 1 November 2001 to 31 August 2002 reported by France

na Not applicable

Table 3.2: Estimated effort (fishing days), mean catch rate (tonnes/day) and total catch (tonnes) by subarea and division in the unregulated fishery for *Dissostichus* spp. in the 2001/02 season to date, based on data submitted to the Secretariat. Estimates for the 2000/01 season, recalculated from split-year to season, are given in parentheses (adapted from WG-FSA-02/81 Rev. 1).

Area/ Subarea/ Division	Estimated Start of Unregulated Fishery	No. of Vessels Sighted in Unregulated Fishery ^{5,6}	No. of Licensed Fishing Vessels	Estimated No. of Vessels Fishing Illegally	Estimated No. of Days Fishing per Fishing Trip	No. of Trips/Year	Estimated Effort in Days Fishing ³ (1)	Mean Catch Rate per Day ² (tonnes) (2)	Estimated Unreported Catch (1) x (2) ⁴	Estimated Total Catch ¹
48.3	1991	2	14 (15)	1 (1)	30	1	2 (100)	1.5	3 (196)	5 620 (4 156)
58.4.2	Jan 2002	2 ⁵ + 2 ⁷ (-)	0 (0)	4 (-)	41	1.5	246 (-)	1.2	295 (-)	295
58.4.4	Sep 1996	0 (0)	0 (0)	4 ⁸ (7)	40	2.5	400 (700)	2.2	880 (1 247)	880 (1 256)
58.5.1	Dec 1996	24 (18)	8						6 300 (4 550)	9 230 (9 297)
58.5.2	Feb–Mar 1997	2 ⁵ + 8 ⁸	2	10 ⁹	27	1	270		2 500 (2 004)	4 312 (4 991)
58.6	Apr–May 1996	6	4 (6)	6 ⁹ (6)	40	2.5	600 (600)	1.2	720 (685)	1 766 (1 812)
58.7	Apr–May 1996	1 ¹⁰	4 (4)	1 ⁹	40	1.5	60 (100)	1.3	78 (120)	115 (355)
88.1		0 (0)	2	1 (-)	40	1	40	2.3	92 (0)	1 425 (660)
88.2		0 (-)	1	0 (-)					0 (-)	42 (0)
Total		37							10 898 (8 802)	23 685 (22 527)

¹ Estimated total catch = estimated unreported catch plus reported catch.

² Catch and effort data from the Secretariat.

³ Calculated as number of vessels fishing illegally x number of fishing days/trip x number of trips/year.

⁴ Division 58.5.2 based on data provided by Australia; Subarea 48.3 based on data provided by the UK; Division 58.4.2 from CDS data.

⁵ Vessel sightings/apprehensions (sources): Australia, France, observers (South Africa, UK).

⁶ This may include more than one sighting of the same vessel.

⁷ CDS data from the Secretariat.

⁸ No sightings, but presence of vessels in the area otherwise reported.

⁹ Estimated number of vessels not in area throughout period, but moving between areas.

¹⁰ Minimum number of vessels detected on radar.

Table 3.3: Reported catch (tonnes) and estimated catch from IUU fishing for *Dissostichus* spp. in Subarea 48.3, Divisions 58.4.2, 58.4.4, 58.5.1 and 58.5.2 and Subareas 58.6, 58.7 and 88.1. Estimates of IUU catches go back as far as the 1988/89 season(see footnote c).

Season (Dec–Nov)	Subarea 48.3			Division 58.4.2			Division 58.4.4			Division 58.5.1		
	Reported Catch	Estimated IUU Catch	Total Removal	Reported Catch	Estimated IUU Catch	Total Removal	Reported Catch	Estimated IUU Catch	Total Removal	Reported Catch	Estimated IUU Catch	Total Removal
1988/89	7 060 ^a	144 ^c	7 204	0 ^a		0	0 ^a		0	1 311 ^a		1 311
1989/90	6 785 ^a	437 ^c	7 221	1 ^a		1	0 ^a		0	1 243 ^a		1 243
1990/91	1 756 ^a	1 775 ^c	3 532	0 ^a		0	0 ^a		0	3 008 ^a		3 008
1991/92	3 809 ^a	3 066 ^c	6 875	0 ^a		0	0 ^a		0	7 758 ^a		7 758
1992/93	3 020 ^a	4 019 ^c	7 039	0 ^a		0	0 ^a		0	3 597 ^a		3 597
1993/94	658 ^a	4 780 ^c	5 438	0 ^a		0	0 ^a		0	5 381 ^a		5 381
1994/95	3 371 ^a	1 674 ^c	5 045	0 ^a		0	0 ^a		0	5 596 ^a		5 596
1995/96	3 602 ^a	0 ^c	3 602	0 ^a		0	0 ^a		0	4 710 ^a	833 ^c	5 544
1996/97	3 812 ^a	0 ^c	3 812	0 ^a		0	0 ^a	375 ^c	375	5 059 ^a	6 094 ^c	11 153
1997/98	3 201 ^a	146 ^c	3 347	0 ^a		0	0 ^a	1 298 ^c	1 298	4 714 ^a	7 156 ^c	11 870
1998/99	3 636 ^a	667 ^d	4 303	0 ^a		0	0 ^a	1 519 ^c	1 519	4 730 ^a	1 237 ^c	5 967
1999/2000	4 941 ^a	1 015 ^d	5 956	0 ^a		0	156 ^a	1 254 ^c	1 410	6 139 ^a	2 600 ^c	8 739
2000/01	3 960 ^a	196 ^d	4 156	0 ^a		0	9 ^a	1 247 ^c	1 256	4 747 ^a	4 550 ^c	9 297
2001/02*	5 617 ^b	3 ^e	5 620	0 ^b	295 ^e	295	0 ^b	880 ^e	880	2 930 ^f	6 300 ^e	9 230

(continued)

Table 3.3 (continued)

Season (Dec–Nov)	Division 58.5.2			Subarea 58.6			Subarea 58.7			Subarea 88.1		
	Reported Catch	Estimated IUU Catch	Total Removal									
1988/89	0 ^a		0									
1989/90	1 ^a		1	0 ^a		0	0 ^a		0	0 ^a		0
1990/91	0 ^a		0									
1991/92	0 ^a		0									
1992/93	0 ^a		0									
1993/94	0 ^a		0	56 ^a		56	0 ^a		0	0 ^a		0
1994/95	0 ^a		0	115 ^a		115	0 ^a		0	0 ^a		0
1995/96	0 ^a	3 000 ^c	3 000	76 ^a	7 875 ^c	7 951	869 ^a	4 958 ^c	5 827	0 ^a		0
1996/97	1 868 ^a	7 117 ^c	8 985	466 ^a	11 760 ^f	12 226	1 193 ^a	7 327 ^c	8 520	0 ^a		0
1997/98	3 671 ^g	4 150 ^c	7 821	1 053 ^a	1 758 ^c	2 811	637 ^a	598 ^c	1 235	42 ^a		42
1998/99	3 659 ^g	427 ^c	4 086	1 152 ^a	1 845 ^c	2 996	301 ^a	173 ^c	474	297 ^a		297
1999/2000	3 566 ^g	1 154 ^c	4 720	1 096 ^a	1 430 ^c	2 526	1 015 ^a	191 ^c	1 206	751 ^a		751
2000/01	2 987 ^g	2 004 ^e	4 991	1 127 ^a	685 ^e	1 812	235 ^a	120 ^e	355	660 ^a		660
2001/02*	1 812 ^g	2 500 ^e	4 312	1 046 ^h	720 ^e	1 766	37 ^b	78 ^e	115	1 333 ^b	92 ^e	1 425

* To date (based on data available to the Secretariat on 7 October 2002)

^a STATLANT data

^b Five-day catch and effort report

^c Converted to season from IUU catches reported in SC-CAMLR-XV, Annex 5, Table 6 and SC-CAMLR-XX, Annex 5, Table 6.

^d WG-FSA-02/4

^e Table 3.2

^f STATLANT data to June 2002 and catches for July and August 2002 reported by G. Duhamel (pers. comm. 11 October 2002).

^g Verified weights provided by A. Constable (pers. comm. 11 October 2002).

^h South African EEZ: five-day catch and effort reports (57 tonnes); French EEZ: STATLANT data to June 2002 and catches for July and August 2002 reported by G. Duhamel (989 tonnes; pers. comm. 11 October 2002).

Table 5.1: Summary of notifications for new and exploratory fisheries in 2002/03.

Member	Subarea/Division	Target Species	Fishery	Paper
Australia	58.4.2	<i>Dissostichus</i> spp.	Exploratory longline	CCAMLR-XXI/12
Australia	58.4.3a, 58.4.3b	<i>Dissostichus</i> spp.	Exploratory longline	CCAMLR-XXI/11
Australia	58.5.2	<i>Dissostichus eleginoides</i>	Longline	CCAMLR-XXI/10
Japan	48.6, 58.6, 58.4.3a, 58.4.3b, 58.4.4, 88.1, 88.2	<i>Dissostichus</i> spp.	Exploratory longline	CCAMLR-XXI/9
New Zealand	48.6	<i>Dissostichus</i> spp.	Exploratory longline	CCAMLR-XXI/8
New Zealand	88.1, 88.2	<i>Dissostichus</i> spp.	Exploratory longline	CCAMLR-XXI/7
Russia*	88.1, 88.2	<i>Dissostichus</i> spp.	Exploratory longline	CCAMLR-XXI/16
South Africa	48.6 (north of 60°S), 58.6, 58.4.4, 88.1	<i>Dissostichus</i> spp.	Exploratory longline	CCAMLR-XXI/6
Spain	88.1	<i>Dissostichus</i> spp.	Exploratory longline	CCAMLR-XXI/5

* Summary of notification submitted to the Secretariat on 6 September 2002.

Table 5.2: Summary of intended catches and number of vessels per area in new and exploratory fisheries notifications for *Dissostichus* spp. in the 2002/03 season. In each cell: top figure – number of vessels nominated; middle letter L – longline, T – trawl; bottom figure – intended catch; N – north, S – south. Figures in parentheses in the ‘Total notifications’ and ‘Maximum no. of vessels’ rows are values for the 2001/02 season notifications.

Country	48.1	48.2	48.4	48.6	58.4.2	58.4.3a	58.4.3b	58.4.4	58.5.1	58.5.2	58.6	58.7	88.1	88.2	88.3
Australia					1 L 500 t	1 L 250 t	1 L 300 t			1 L 15–29% of TAC					
Japan ^a				2 L 250 t (N) 250 t (S)		2 L 100 t	2 L 100 t	2 L 60 t			2 L 100 t		2 L 60 t (N) 500 t (S)	2 L 60 t	
New Zealand ^b				2 L 455 t (N)* 455 t (S)*									6 L 1300 t*	6 L 40 t*	
Russia ^c													4 L 170 t (N) 1500 t (S)	4 L 250 t (S)	
South Africa				3 L 250 t (N)				3 L 60 t			3 L 100 t		2 L 60 t (N) 500 t (S)		
Spain													1 L 170 t (N) 480 t (S)		
Total notifications	0 (0)	0 (0)	0 (0)	3 (4)	1 (1)	2 (2)	2 (2)	2 (5)	0 (0)	1 (0)	2 (4)	0 (0)	5 (4)	3 (4)	0 (0)
Maximum no. of vessels	0 (0)	0 (0)	0 (0)	7 (8)	1 (2)	3 (3)	3 (3)	5 (10)	0 (0)	1 (0)	5 (7)	0 (0)	15 (11)	12 (7)	0 (0)
Catch limit set at CCAMLR-XX	0	0	28 t	455 t (N) 455 t (S)	500 t	250 t	300 t	103 t	N/A	2815 t	450 t	0	171 t (N) 2337 t (S)	250 t	0

* The figures stated represent minimum anticipated catches. New Zealand reserves the right to access on a competitive basis any precautionary catch limit established by the Commission for these fisheries.

^a Details of a second vessel were notified on 30 September 2002.

^b Details of six vessels were notified on 2 September 2002.

^c Notification received 6 September 2002 (see also SC-CAMLR-XXI/BG/16 Rev. 1).

Table 5.3: Assessment of long-term annual yield for the exploratory fishery by SSRU for *Dissostichus* spp. in Subarea 88.1 and for all SSRUs combined in Subarea 88.2, based on fished seabed area.

	88.1					88.2	48.3
	A	B	C	D	E		
Fished seabed area (km ²)	3 407	10 484	13 041	11 668	28 074	2 384	32 035
Fishing selectivity (mean)	135	115	120	80	80	115	75
Fishing selectivity (range)	30	70	60	20	20	50	20
Ratio total: recruited biomass	2.551	1.683	1.818	1.131	1.131	1.651	1.158
γ	0.048	0.040	0.041	0.037	0.037	0.041	0.034
CPUE ratio	0.578	0.391	0.823	0.495	0.525	0.587	1.0
Estimated yield (tonnes)	1 536	1 772	5 129	1 533	3 912	602	(7 970)

Table 5.4: Summary of catch limits and catches for *Dissostichus* spp. in Subareas 88.1 and 88.2 for the 2000/01 and 2001/02 seasons and precautionary yields for 2002/03.

	2000/01		2001/02		2002/03		
	Catch Limit	Catch	Catch Limit	Catch	Yield	Yield *0.3	Yield *0.5
Subarea 88.1							
SSRU A	175	67	171	57	1 536	461	768
SSRU B	472	287	584	333	1 772	532	886
SSRU C	472	184	584	565	5 129	1 539	2 564
SSRU D	472	46	584	195	1 533	460	766
SSRU E	472	75	584	179	3 912	1 174	1 956
Total	2 063	659	2 508	1 319	13 882	4 164	6 941
Subarea 88.2 ¹							
	-	-	250	41	602	181	301
Total				41	602	181	301

¹ Note Subarea 88.2 is divided into seven longitudinal sections each 10° apart, with a maximum 50 tonnes catch in any one SSRU. To date, only SSRU A has been fished.

Table 5.5: Average age-specific relative vulnerabilities for *Dissostichus eleginoides* in Subarea 48.3.

Age	Deep Pattern Vulnerability (1986–1997)	Shallower Pattern Vulnerability (1998–2000)
0	0.00	0.00
4.9	0.00	0.00
6.17	0.50	0.72
6.67	0.69	1.00
6.91	0.74	1.00
7.17	0.78	0.99
7.42	0.82	0.99
7.68	0.86	0.99
7.95	0.89	0.99
8.21	0.92	0.98
8.49	0.94	0.98
8.77	0.96	0.98
9.05	0.97	0.98
9.34	0.99	0.97
9.64	0.99	0.97
9.94	1.00	0.96
10.25	1.00	0.95
10.56	1.00	0.94
10.88	0.99	0.94
11.21	0.98	0.92
11.54	0.97	0.91
11.88	0.96	0.90
12.23	0.94	0.88
12.59	0.91	0.86
12.96	0.89	0.84
13.33	0.86	0.82
13.72	0.83	0.80
14.12	0.80	0.77
14.52	0.76	0.74
14.94	0.72	0.71
15.37	0.68	0.68
15.81	0.63	0.64
16.27	0.58	0.60
55.0	0.58	0.60

Table 5.6: Cohort strengths of *Dissostichus eleginoides* from surveys undertaken in Subarea 48.3 since 1987. Observed and expected data, the closeness of which indicates the quality of the fit, are from the mixture analyses.

Survey Year	Country	Time (years) since previous 1 December	Area (km ²)	Observed	Expected	Age 3		Age 4		Age 5		Age 6		Age 7	
						Density (n.km ⁻²)	SE	Density (n.km ⁻²)	SE	Density (n.km ⁻²)	SE	Density (n.km ⁻²)	SE	Density (n.km ⁻²)	SE
1987	USA/Poland	0.99	40 993	49.8	47.3	20.5	7.1	26.9	4.4						
1988	USA/Poland	0.08	40 993	21.3	22.1			14.5	11.3	8.7	12.6				
1990	UK	0.17	40 993	468.5	473.3	165.1	116.8	195.9	105.1	85.1	42.0	32.3	19.7		
1992	UK	0.17	40 993	287.6	281.2	281.4	174.4								
1994	Argentina	0.25	40 993	48.0	49.6	2.6	2.7	47.4	9.3						
1994	UK	0.17	40 993	122.5	125.9	36.3	20.1	89.8	32.6						
1995	Argentina	0.25	40 993	60.5	65.6	8.3	5.2	21.9	9.2	35.7	8.8				
1996	Argentina	0.33	40 993	167.9	165.3	114.6	44.2	16.9	6.0	22.7	9.8	18.5	10.0		
1997	Argentina	0.33	40 993	122.9	124.8	25.0	8.2	45.8	15.5	15.6	9.2	17.5	6.0	8.6	6.4
1997	UK	0.82	40 993	100.4	111.3	51.0	33.7	37.2	37.3	24.2	37.1				
2000	UK	0.17	40 993	140.3	126.0	38.2	11.6								
2002	UK	0.12	40 993	1148.7	1140.3	259.6	50.1	86.5	24.4	68.4	19.0				

Table 5.7: Input parameters for the GYM to assess the long-term annual yield of *Dissostichus eleginoides* taken by longline and pots in Subarea 48.3.

Category	Parameter	Values
Age structure	Recruitment age	4 years
	Plus class accumulation	35 years
	Oldest age in initial structure	55 years
Recruitment		See Table 5.6
Natural mortality	Mean annual M	0.132–0.198
von Bertalanffy growth	t_0	-0.21 years
	L_∞	1 946 mm
	k	0.066 year ⁻¹
Weight at age	Weight–length parameter – A (kg)	3.96E-08 kg
	Weight–length parameter – B	2.8
Maturity	L_{m50}	930 mm
	Range: 0 to full maturity	780–1 080 mm
Fishing season	(years 1994 onwards only)	1 May–31 Aug
Spawning season		1 Aug–1 Aug
Simulation characteristics	Number of runs in simulation	1 001
	Depletion level	0.2
	Seed for random number generator	-24 189
Characteristics of a trial	Years to remove initial age structure	1
	Observations to use in median SB_0	1 001
	Year prior to projection	1987
	Reference start date in year	01/12
	Increments in year	24
	Vector of known catches	See Tables 5.5 and 5.9
	Years to project stock in simulation	35
	Reasonable upper bound for annual F	5.0
Tolerance for finding F in each year	0.000001	
Fishing mortality		See Tables 5.5 and 5.9

¹ Adjusted from estimated parameter of $t_0 = -2.56$ years to start of fishing season on 1 December.

Table 5.8: Time series of recruitments (millions of fish) for *Dissostichus eleginoides* in Subarea 48.3 from the assessments over the last three years. The year indicates the year at the birthday of the fish, which is likely to be the calendar year before the survey. These recruitment series are estimated from cohort densities in Table 5.6 based on a value for natural mortality, $M = 0.165 \text{ y}^{-1}$.

Year Age 4 Birthday	Assessment			
	1999	2000	2001	2002
1986	1.146	1.108	1.347	1.349
1987	0.722	0.747	0.980	0.845
1988	4.106	4.377	4.187	4.214
1989	8.055	8.282	8.174	9.374
1990	5.786	5.739	5.842	6.700
1991	no obs	no obs	no obs	no obs
1992	10.19	5.815	10.287	11.799
1993	2.061	2.053	1.888	2.130
1994	0.961	1.006	0.950	1.003
1995	0.701	0.718	0.633	0.691
1996	2.649	2.405	2.652	2.947
1997	1.119	0.962	1.037	1.140
1998		0.386	no obs	no obs
1999		no obs	no obs	no obs
2000		1.496	1.522	2.504
2001		1.927		4.207
2002				10.694
Mean	3.185	2.517	3.292	4.257
CV	1.01	0.95	0.97	0.91

Table 5.9: Catch history for *Dissostichus eleginoides* in Subarea 48.3. Fishing seasons are given (i.e. 1988/89 is 1 December 1988 to 30 November 1989). * – estimates from Table 3.3 extended pro rata to the end of the fishing season in 2001/02. Although there were some removals prior to 1988/89, they were not from longliners and were not used in the assessment.

Fishing Season	Catch Series (Reported and IUU) used in 2001 (tonnes)	New Fishing Season Reported Catch	New Fishing Season IUU Catch (1998/99 to 2000/01 from WG-FSA-02/04, 2001/02 pro rata from Table 3.3)	Total Extractions used in 2002 Assessment
1988/89		7060	144	7204
1989/90	8501	6785	437	7221
1990/91	4206	1756	1775	3532
1991/92	7309	3809	3066	6875
1992/93	5589	3020	4019	7039
1993/94	6605	658	4780	5438
1994/95	6171	3371	1674	5045
1995/96	4362	3602	0	3602
1996/97	2619	3812	0	3812
1997/98	3201	3201	146	3347
1998/99	4300	3636	667	4303
1999/2000	5337	4941	1015	5956
2000/01	4354	3960	196	4156
2001/02*		5617	4	5621

Table 5.10: Sensitivity runs undertaken on the Subarea 48.3 toothfish assessment. The departure point was a re-run of the assessment conducted in 2001 and reported in SC-CAMLR-XX, Annex 5, Table 30. Note that the sustainable catch limits are rough interpolations in this table, whereas the final assessments (Table 5.11) are accurate results. Runs 1–7 were undertaken with the future projection selectivity at age unchanged from that used in 2001.

Trial Description	Interpolated Estimate of Sustainable Catch (tonnes)
1. 2001 run with the small change (paragraph 5.67(i)) to the GYM software. This should be comparable with the figure of 5 675 tonnes, trial 3 (without CPUE adjustment) from SC-CAMLR-XX, Annex 5, Table 30. This assessment has the split-year catch series up to 2000/01 only, the old selectivity-at-age series, and assumes fishing will take place over the whole year.	5726
2. Run 1 + 2001/02 catch and age-3 recruitment from the 2000 UK survey altered to take account of the 2002 UK age-5 survey results.	6461
3. Run 1 + 2001/02 catch and 2002 UK survey results only for ages 4 and 5.	6286
4. Run 1 + 2001/02 catch and full UK survey data for 2002 (ages 3, 4 and 5).	7461
5. Run 4 + changes to historical catch series associated with change to fishing season.	7617
6. Run 5 + changes to historical age-based selectivities according to Table 5.5.	7647
7. Run 6 + changes to fishing period.	7468
8. Run 7 + future (projected) years with deep-water selectivity at age.	7650
9. Run 7 + future (projected) years with shallow-water selectivity at age.	7580

Table 5.11: Final assessment of toothfish in Subarea 48.3, incorporating the CPUE adjustment. These assessments incorporated inputs presented in Tables 5.6 to 5.9.

	Sustainable Catch Limit (tonnes)	Depletion Probability	Median Escapement
Future (projected) years with shallow-water selectivity at age	7580	0.099	0.517
Including CPUE adjustment	7810	0.100	0.519

Table 5.12: Input parameters for GYM to assess the long-term annual yield of *Dissostichus eleginoides* taken by trawl in Division 58.5.2.

Category	Parameter	Values
Age structure	Recruitment age	4 years
	Plus class accumulation	35 years
	Oldest age in initial structure	55 years
Recruitment		See Tables 5.13 and 5.14
Natural mortality	Mean annual M	0.13–0.2
von Bertalanffy growth	t_0	-2.46 ¹ years
	L_8	2465 mm
	k	0.029 year ⁻¹
Weight at age	Weight–length parameter – A (kg)	2.59E-09 kg
	Weight–length parameter – B	(mm ^B) 3.2064
Maturity	L_{m50}	930 mm
	Range: 0 to full maturity	780–1080 mm
Spawning season		1 Jul–1 Jul
Simulation characteristics	Number of runs in simulation	1 001
	Depletion level	0.2
	Seed for random number generator	-24 189
Characteristics of a trial	Years to remove initial age structure	1
	Observations to use in median SB ₀	1 001
	Year prior to projection	1985
	Reference start date in year	01/12
	Increments in year	24
	Vector of known catches	See Table 5.15
	Years to project stock in simulation	35
	Reasonable upper bound for annual F	5.0
Tolerance for finding F in each year	0.000001	
Fishing mortality		See Table 5.14

¹ Adjusted from estimated parameter of $t_0 = -2.56$ years to start of fishing season on 1 December.

Table 5.13: Cohort strengths from surveys undertaken in Division 58.5.2 since 1990. Observed and expected data are from the mixture analyses, the closeness of which indicates the quality of the fit.

Survey Year	Time	Area (km ²)	Observed	Expected	Density (n.km ²)						
					Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	
1990	0.58	97 106	107.2	108.1	Mean	8.080	33.508	20.208	0.827	25.226	0.000
					SE	5.897	13.552	11.251	11.505	14.082	0.000
1992	0.25	70 271	51.7	51.8	Mean	14.117	13.200	14.501	3.430	0.019	2.117
					SE	5.156	7.036	7.845	4.473	5.449	3.342
1993	0.85	71 555	97.4	114.7	Mean	13.567	38.259	8.191	16.961	3.066	20.884
					SE	8.804	18.172	13.483	12.606	30.294	16.333
1999	0.41	85 428	366.2	357.9	Mean	17.741	16.206	138.11	56.785	60.897	40.323
					SE	7.862	13.323	42.657	55.348	50.870	38.189
2000	0.55	41 144	185.0	179.5	Mean	28.124	21.969	47.817	59.121	7.565	10.989
					SE	5.298	7.996	14.885	20.578	15.142	11.383
2001	0.56	85 169	247.5	252.4	Mean	19.542	34.018	38.172	45.538	32.165	16.738
					SE	7.798	12.849	20.534	30.762	42.367	41.086
2002	0.56	85 910	208.5	204.8	Mean	18.590	29.333	59.400	20.726	53.199	
					SE	6.722	11.475	21.202	21.993	17.117	

Table 5.14: Time series of recruitments (millions of fish) for *Dissostichus eleginoides* in Division 58.5.2 based on a mean natural mortality of 0.165 year⁻¹.

Year at Age 4 Birthday	WG-FSA-2000	WG-FSA-2001	Revised Estimates following 2002 Survey
1986		4.321	4.321
1987	1.550	0.120	0.120
1988	1.590	2.586	2.586
1989	3.649	3.790	3.790
1990	1.956	1.118	1.118
1991	1.793	0.667	0.667
1992	4.575	1.447	1.447
1993	2.435	0.825	0.825
1994	2.944	7.205	7.205
1995	5.674	9.226	9.226
1996	9.548	7.295	7.295
1997	21.557	15.043	15.043
1998	3.440	3.487	6.532
1999	1.059	2.291	2.332
2000	0.241	1.465	1.931
2001	0.152	1.632	2.236
2002			1.625
Mean	4.144	3.907	4.018
CV	1.297	1.021	0.975

Table 5.15: Catch histories and fishing vulnerabilities (selectivities) for *Dissostichus eleginoides* in Division 58.5.2.

Season	Catch (Reported and IUU) (tonnes)	Size/Age (Vulnerability)	Size/Age Units
1995/96	3000	550 (0), 790 (1)	mm
1996/97	8985	(0), 6.0 (0.0), 7.0 (1), 7.9 (1), 8.0 (0)	years
1997/98	7821	0.0 (0), 6.0 (0.0), 10.0 (1), 10.0 (1), 12.0 (0)	years
1998/99	4086	0.0 (0), 5.5 (0.0), 6.0 (1), 13.0 (1), 15.0 (0)	years
1999/2000	4720	0.0 (0), 4.0 (0.0), 8.0 (1), 14.0 (1), 15.0 (0)	years
2000/01	4991	0.0 (0), 4.0 (0.0), 8.0 (1), 14.0 (1), 15.0 (0)	years
2001/02	Catch limit 2815 tonnes + illegal catch of 2500 tonnes = 5315 tonnes	0.0 (0), 4.0 (0.0), 8.0 (1), 14.0 (1), 15.0 (0)	years

Table 5.16: Estimates of mean biomass from Russian and UK surveys in 2002.

Survey (Country and Type)	Mean Biomass Estimate (tonnes)
UK 2002 trawl	43 915
Russia 2002 trawl	44 581
Russia 2002 acoustic	92 300
Russia bottom trawl and acoustic (bottom 8 m)	73 848

Table 5.17: Biomass estimates for *Champtocephalus gunnari* in Subarea 48.3 subdivided by strata. Data are given for the UK, Russian and combined surveys, and for the combined surveys with the UK survey multiplied by 1.241.

Stratum	Russian		UK		Combined		Combined with UK*1.241	
	Mean	One-Sided Lower 95% CI	Mean	One-Sided Lower 95% CI	Mean	One-Sided Lower 95% CI	Mean	One-Sided Lower 95% CI
SR 50–150 m	175.0	89.0	273.3	117.9	210.9	101	273.5	159.4
SR 150–250 m	201.5	63.9	232.7	114.9	217.6	86.4	257.6	152.9
SR 250–500 m	16.5	0.0	3.6	0.0	5.1	0	9.7	1.3
SG NW 50–150 m	4 795.6	36.4	1 482.2	184.3	2 197.7	153.8	3 481.7	484.9
SG NW 150–250 m	24 753.5	115.5	17 884.6	818.1	2 0704.3	521.7	23 656.9	568.7
SG NW 250–500 m	99.5	35.7	652.9	429.4	194	101.8	366.1	155.2
SG NE 50–150 m	1 645.5	223.8	3 643.8	175.9	2 112.4	162	2 724.1	489.1
SG NE 150–250 m	4 208.5	1 621.7	1 202.8	609.1	1760	838.3	2 770.7	1 418.9
SG NE 250–500 m	28.4	3.6	141.6	32.7	42.8	7.2	116.8	31.3
SG S 50–150 m	3 459.1	475.1	5 469.9	5 469.9			3 792.0	581.1
SG S 150–250 m	4 967.2	696.2	9 284.4	5 178.5	7 419.6	3 173.1	8 131.6	4 326.1
SG S 250–500 m	230.3	56.4	3 642.7	367.4	356.4	61.1	1 660.4	216.3
Shag Rocks	393.1	215.1	509.6	298.6	445.1	250.0	540.8	359.2
South Georgia	44 187.7	12 857.0	43 404.9	18 398.8	43 735.3	16 281.5	446 700.3	21 967.2
Subarea 48.3	44 580.7	13 145.9	43 914.5	18 899.0	44 197.6	16 336.0	47 241.1	22 705.6

Table 5.18: Cohort strength from surveys undertaken in Subarea 48.3 in 2002 estimated from the mixture analysis for *Champscephalus gunnari*. Component standard deviations linearly related to cohort means (intercept constrained <15; slope constrained >0.02).

Combined UK and Russian Surveys 2002						
Sum of the observed densities = 66 486.7						
Sum of the expected densities = 63 329.9						
	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
Means of mixture components	-	240.787	292.27	-	361.244	409.884
Standard deviations of mixture components	-	20.889	22.148	-	23.835	25.02
Total density of each mixture component	-	41 601.5	16 621.7	-	4 188.7	940
SD of each mixture component density	-	89.878	3 575.3	-	1 067.9	1 089
Parameters of linear standard deviations	Intercept = 14.999		Slope = 0.244			
Length classes included	180–410 mm					
Atlantida (Russia) Survey 2002						
Sum of the observed densities = 61 471.2						
Sum of the expected densities = 56 883.1						
	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
Means of mixture components	-	245.24	293.629	-	370.11	404.167
Standard deviations of mixture components	-	19.838	20.3358	-	22.3358	23.017
Total density of each mixture component	-	42 927.4	11 608.6	-	1 820.37	584.96
SD of each mixture component density	-	13 835.8	5 007.44	-	1 592.39	1 595.42
Parameters of linear standard deviations	Intercept = 14.933		Slope = 0.200			
Length classes included	180–440 mm					
Dorada (UK) Survey 2002						
Sum of the observed densities = 108 975						
Sum of the expected densities = 104 496						
	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
Means of mixture components	-	233.853	289.422	-	352.69	394.606
Standard deviations of mixture components	-	21.1164	22.57	-	24.2253	25.322
Total density of each mixture component	-	53 977.3	36 889.5	-	11 689.1	2687.1
SD of each mixture component density	-	18 404.4	10 602.6	-	5 241.3	1 135.85
Parameters of linear standard deviations	Intercept = 14.9987		Slope = 0.26160			

Table 5.19: Data inputs for short-term projections of *Champocephalus gunnari* in Subarea 48.3.

		UK Survey January 2002	Russian Survey February 2002	Combined Surveys (with UK multiplied by 1.24)
Lower single-sided 95% CI (tonnes)		18 899 Numbers (%)	13 146 Numbers (%)	22 706 Numbers (%)
Numbers at age	2	8.385941 x 10 ⁷ (51.3)	1.247902 x 10 ⁸ (75.4)	1.140645 x 10 ⁸ (65.7)
	3	5.731126 x 10 ⁷ (35.0)	3.374485 x 10 ⁷ (20.4)	4.557261 x 10 ⁷ (26.2)
	4	0	0	0
	5	1.816019 x 10 ⁷ (11.1)	5.290802 x 10 ⁶ (3.2)	1.148295 x 10 ⁷ (6.6)
	6	4.17456 x 10 ⁶ (2.6)	1.697708 x 10 ⁶ (1.0)	2.577357 x 10 ⁶ (1.5)
	Total	1.6350542 x 10 ⁸	1.6552356 x 10 ⁸	1.73697417 x 10 ⁸
Method		Length Density + CMIX	Length Density + CMIX	Length Density + CMIX
Natural mortality		0.71	0.71	0.71
Age when fully selected		3	3	3
Age when selection begins		2	2	2
von Bertalanffy	birthday (days since start of year)	245	245	245
	<i>t</i> ₀	-0.58	-0.58	-0.58
	<i>L</i> ₈	557.6	557.6	557.6
	<i>k</i>	0.17	0.17	0.17
Weight length	A (kg)	6.17E-10	6.17E-10	6.17E-10
	B	3.388	3.388	3.388
Survey timing: days since start of year		15	45	30
Catch since survey (to first year of projection)		471	471	471

Table 5.20: Yield estimates of *Champscephalus gunnari* in Subarea 48.3 derived from the short-term projections based on the *Dorada* (UK), *Atlantida* (Russia) and the combined surveys. The final row is the combined data with the *Dorada* data multiplied by a factor of 1.24.

	Year 1 2003	Year 2 2004
<i>Dorada</i> (UK) Survey	1662	1006
<i>Atlantida</i> (Russian) Survey	1369	876
Combined survey (no correction)	1581	990
Combined (including UK*1.241)	2181	1361

Table 5.21: Densities (n.km²) of *Champscephalus gunnari* (Division 58.5.2) by mean length for each component from mixture analysis derived from the 2002 survey.

Mean Length (mm)	Density
189	81
268	17
329	2539
372	16

Table 5.22: Mean length at age of *Champscephalus gunnari* (Division 58.5.2) at the time of the 2002 survey from an application of the von Bertalanffy growth curve.

Age	Mean Length (mm)
2	234
3	296
4	340
5	373

Table 5.23: Data inputs for short-term projections of *Champsocephalus gunnari* in Division 58.5.2 (Heard Plateau population).

Category	Parameter	<i>C. gunnari</i> Heard Plateau
Survey details	Survey date	3 June 2002
	Biomass – lower 95% bound	20 510 tonnes
Mean length at age at time of survey	Age 4	325 mm
Age structure (density n.km ⁻²)	Age 4	2 555
Biological parameters	Birthday	1 November
von Bertalanffy growth	t_0	0.358
	L_∞	457 mm
	k	0.323
Weight at age	Weight–length parameter A	2.629×10^{-10} kg
	Weight–length parameter B	3.515
Natural mortality	Mean annual M	0.4
Fishery parameters	Season	1 Dec–30 Nov
Selectivity	Age fully selected	3
	Age first selected	2.5

Table 5.24: Input parameters for GYM to assess γ of *Macrourus whitsoni* in Subarea 88.1 and *M. carinatus* in Division 58.5.2. All length parameters are given as total length in millimetres.

Input Parameters	<i>M. carinatus</i> 58.5.2	<i>M. whitsoni</i> 88.1		
		Both Sexes	Males	Females
L_8	635	857	783	870
k	0.088	0.048	0.05	0.068
t_0	-1.8	-3.89	-5.3	1.34
Maximum length	670+			
Oldest age in stock	55	80		
Last age in stock	25+	55		
Minimum age in stock	1	1		
Natural mortality range	0.09–0.17		0.05–0.12	
Length–weight				
A	2×10^{-9}	1.609×10^{-8}		
B	3.1159	2.8603		
Birthday	July			
Spawning season	May–September		May–September	
Fishing selectivity				
Minimum length 50%	320	440		
Maximum length 50%	320	470		
Range	160	160		
Maturity				
Minimum length 50%	417 (age 10)	460 (age 12)		
Maximum length 50%	512 (age 17)	500 (age 14)		
Range	150	260		
Recruitment*				
Minimum SD	0.099751	0.099751		
Maximum SD	0.312233	0.312233		
CV of B_0	0.5	1.184		
Data sources	WG-FSA-02/48 van Wijk et al., 2000 Alekseyeva et al., 1993	WG-FSA-02/32 WG-FSA-01/43 Alekseyeva et al., 1993		

* Standard deviation of lognormal recruitment (SD) calculated from recruitment coefficient of variation (CV) using equation:

$$SD = \sqrt{(\log_e(1+CV^2))}$$

Range given corresponds to CV of 0.1–0.32 from Myers et al. (1995). A sensitivity trial was also done using CV = 0.5–0.7 (equivalent to min SD = 0.472, max SD = 0.631).

Table 5.25: Total removals of macrourids and rajids by fishery from observer data (in tonnes). Data for Subarea 58.6 incorporates both South African and French catches. The ‘%’ column is the by-catch as a percentage of the total target species catch.

Species Group	88.1		58.5.1		58.5.2		58.6		58.7	
	Observer	%	Observer	%	Observer	%	Observer	%	Observer	%
Macrourids	168	12	314	9	5	< 1	162	14	17	46*
Rajids	27	2	388	11	2	< 1	42	4	0.4	1

* This high figure is due to the low catch of the target species in Subarea 58.7.

Data for Subarea 88.1 derived from WG-FSA-02/40 (Table 4), WG-FSA-02/38 (Table 2) and the Secretariat database.

Data for Division 58.5.2 derived from WG-FSA-02/56 and the Secretariat database.

Data for Division 58.5.1 and French data for Subarea 58.6 derived from data files supplied to the by-catch subgroup by G. Duhamel and the Secretariat database.

Data for Subarea 58.7 and South African data for Subarea 58.6 derived from the Secretariat database and data files supplied by B. Watkins to the by-catch subgroup.

Data for Subarea 48.3 derived from the Secretariat database.

Table 5.26: Comparison of by-catch data from different sources; observer data (as total removals), fine-scale catch and effort (C2) data and STATLANT data (in tonnes).

Species Group	88.1			58.5.1			58.5.2		58.7	
	Observer	C2	STAT	Observer	C2	STAT	Observer	STAT	Observer	STAT
Macrourids	168	158	154	314	312	190	5	0	17	11
Rajids	27	25	25	388	382	118	2	0	0.4	0.2

Refer to footnotes of Table 5.25.

Table 5.27: Breakdown of total removals from Subarea 58.6 from observer and STATLANT data (in tonnes).

Species Group	France		South Africa		Total	
	Observer	STAT	Observer	STAT	Observer	STAT
Macrourids	155	150	7	8	162	158
Rajids	41	12	1	0.5	42	12.5

Refer to footnotes of Table 5.25.

Table 5.28: Comparison of by-catch data from three different sources: observer data, fine-scale catch and effort (C2) data and STATLANT data for the complete fishing season 2001/02 and the incomplete fishing season (to 30 June 2002) in Subarea 48.3 (in tonnes).

Species Group	Fishing Season 2001/02		Fishing Season 2001/02 to 30 June 2002		
	Observer*	C2	Observer*	C2	STATLANT
Macrourids	6	51	4	23	<1
Rajids	8	25	4	9	<1

* Observer data cannot be corrected for effort, i.e. observed weights only, the data is not scaled up to reflect total captures.

Refer to footnotes of Table 5.25.

Table 5.29: Number of toothfish and skate tagged and recaptured from Subarea 88.1 (from WG-FSA-02/42 and 02/38).

Species	Number Tagged	Number Recaptured	% Recaptured
<i>Dissostichus mawsoni</i>	1052	4	0.38%
<i>Dissostichus eleginoides</i>	345	1	0.29%
<i>Amblyraja georgiana</i>	5468	14	0.26%
<i>Bathyraja eatoni</i>	546	0	0%

Refer to footnotes of Table 5.25.

Table 5.30: Estimated total catch (tonnes) by subarea and division of *Dissostichus* spp. taken inside and outside the Convention Area for the 2001/02 and 2000/01 seasons¹.

2001/02 Season*				
Area/Subarea/ Division	Reported Catch ²	Estimated IUU Catch	Total CCAMLR	Catch Limit ⁵
48.3	5 617	3	5 620	5 820
48.4	0	0	0	28
48.6	0	0	0	910
58.4.2	0	295	295	500
58.4.3a	0	0	0	250
58.4.3b	0	0	0	300
58.4.4	0	880	880	103
58.5.1	2 930	6 300	9 230	-
58.5.2	1 812	2 500	4 312	2 815
58.6	1 046	720	1 766	450
58.7	37	78	115	-
88.1	1 333	92	1 425	2 508
88.2	42	0	42	250
Total inside	12 817	10 868	23 685	
	Estimated EEZ Catch ⁴	Estimated High Seas Catch	Total Outside CCAMLR ³	
41	7 235	2 049	9 284	-
47	0	584	584	-
51	**46	***8 191	8 237	-
57	0	3 022	3 022	-
81	0	0	0	-
87	3 114	813	3 927	-
Total outside	10 395	14 659	25 054	
Global total			48 739	

(continued)

Table 5.30 (continued)

2000/01 Season				
Area/ Subarea/ Division	Reported Catch ²	Estimated IUU Catch ³	Total CCAMLR	Catch Limit ⁵
48.3	3 960	196	4156	4 500
48.4	0	0	0	28
48.6	0	0	0	910
58.4.2	0	0	0	500
58.4.3a	0	0	0	500
58.4.3b	0	0	0	300
58.4.4	9	1 247	1 256	370
58.5.1	4 747	4 550	9 297	-
58.5.2	2 987	2 004	4 991	2 995
58.6	1 127	685	1 812	450
58.7	235	120	355	-
88.1	660	0	660	2 064
88.2	0	0	0	250
Total inside	13 725	8 802	22 527	
	Estimated EEZ Catch ⁴	Estimated High Seas Catch	Total Outside CCAMLR ³	
41	8 358	2 784	11 142	
47		76	76	
51	24	14 168	14 192	
57		1 142	1 142	
81	26	1	27	
87	6 211	1 128	7 339	
Total outside	14 619	19 299	33 918	
Global total			56 445	

* To date (based on data available to the Secretariat on 7 October 2002)

** Reported from the South African EEZ (data from five-day catch and effort reports)

*** South African catch in EEZ was deducted from CDS data for Area 51

¹ Estimated IUU catches for the 2000/2001 season were recalculated by season on a monthly pro-rata basis.

² From catch and effort and STATLANT data. Division 58.5.1 estimated from CDS data.

³ From CDS data, converted to live weight.

⁴ Estimation based on CDS data and information provided to the Secretariat by Members.

⁵ Only as related to CCAMLR areas outside national jurisdiction.

Table 5.31: Reported catch (tonnes) and estimated catch from IUU fishing for *Dissostichus* spp. for the 1988/89 to 2001/02¹ seasons.

Season (Dec–Nov)	Inside Convention Area				Outside the Convention Area			Global Total Catch
	Reported Catch	Estimated IUU Catch	Total CCAMLR	Catch Limits ²	Estimated EEZ Catch	Estimated High Seas Catch	Total CDS Reported Catch	
1988/89	8 652	144	8 796					8 796
1989/90	8 936	437	9 373					9 373
1990/91	5 488	1 775	7 264	2 500				7 264
1991/92	12 174	3 066	15 240	3 500				15 240
1992/93	8 357	4 019	12 375	3 590				12 375
1993/94	8 287	4 780	13 067	1 328				13 067
1994/95	10 920	1 674	12 594	3 125				12 594
1995/96	9 471	16 667	26 138	4 525				26 138
1996/97	12 398	32 673	45 071	22 138				45 071
1997/98	13 317	15 106	28 423	15 500				28 423
1998/99	13 775	5 867	19 642	13 789				19 642
1999/2000	17 664	7 644	25 308	14 293	10 236	11 116	21 352 ³	46 660
2000/01	13 725	8 802	22 527	12 867	14 619	19 299	33 918	56 445
2001/02 ¹	12 817	10 868	23 685	13 934	10 395	14 659	25 054	48 739

¹ To date (based on data available to the Secretariat on 7 October 2002)

² Only as related to CCAMLR Convention Areas outside national jurisdiction

³ May to November 2000

Table 5.32: Seabed areas outside the CCAMLR Convention Area and within the likely geographic range of *Dissostichus eleginoides*. The geographic area covered in this table is depicted in Figure 5.7. Seabed areas in the CCAMLR Convention Area are published in the *CCAMLR Statistical Bulletin* (see Volume 14, Section E). Source: Sandwell and Smith bathymetry data (2 x 2 minute grids).

Region	Description	Boundaries				Seabed Area (km ²) within Depth Range (m)			
		North	South	West	East	0–300	300–500	500–600	600–1 800
Southeast Atlantic	in Area 41, adjacent to Subarea 48.6	47°S	50°S	20°W	30°E	71	197	178	10 703
Western Indian Ocean	in Area 51, adjacent to Area 58	40°S	45°S	30°E	80°E	2	0	12	30 007
Eastern Indian Ocean	in Area 57, adjacent Division 58.4.1	50°S	55°S	80°E	150°E	49	16	8	2 421
Southwest Pacific	in Area 81, adjacent Area 88 150–180°E	50°S	60°S	150°E	180°E	33 410	59 042	59 940	188 341
Southwest Pacific	in Area 81, adjacent Area 88 105–180°W	50°S	60°S	180°W	105°W	0	13	16	3 610
Southeast Pacific	in Area 87, adjacent Subarea 88.3 80–105°W	50°S	60°S	105°W	80°W	0	0	0	170
Southeast Pacific	in Area 87, adjacent Subarea 88.3 70–80°W	50°S	60°S	80°W	70°W	74 766	5 045	1 458	17 242
East Pacific	in Area 87, adjacent to southern Chile	35°S	50°S	80°W	coast	107 156	15 263	4 449	42 492
East Pacific	in Area 87, adjacent to Chile and Peru	20°S	35°S	80°W	coast	16 800	8 347	3 655	35 628
Southwest Atlantic	in Area 41, adjacent to Subarea 48.1	50°S	60°S	70°W	50°W	362 569	54 017	18 233	115 838
West Atlantic	in Area 41, adjacent to Argentina	35°S	50°S	coast	50°W	746 453	41 287	13 762	159 439
Total						1 341 276	183 227	101 711	605 892

Table 6.1: Incidental mortality of seabirds in longline fisheries for *Dissostichus* spp. in Subareas 48.3, 58.6, 58.7, 88.1 and 88.2 during the 2001/02 season. Sp – Spanish method; A – autoliner; N – night setting; D – daytime setting (including nautical dawn and dusk); O – opposite side to hauling.

Vessel	Dates of Fishing	Method	Sets Deployed				No. of Hooks (thousands)			Hooks Baited (%)	No. of Birds Caught						Observed Seabird Mortality (birds/1 000 hooks)			Streamer Line in Use (%)		Offal Discharge during Haul (%)
			N	D	Total	%N	Obs.	Set	% Observed		Dead		Alive		Total		N	D	Total	N	D	
											N	D	N	D	N	D						
Subarea 48.3																						
<i>Eva 1</i>	20/5–28/6/02	Sp	57	3	60	95	133.0	518.2	25	100	0	0	0	0	0	0	0	0	93	100	O (97)	
<i>Isla Camila</i>	2/5–6/7/02	Sp	142	7	149	95	153.5	792.6	19	100	0	0	0	0	0	0	0	0	93	100	O (77)	
<i>No. 1 Moresko</i>	1/5–7/7/02	Sp	112	0	112	100	226.1	968.6	23	100	0	0	0	0	0	0	0	0	99		O (83)	
<i>Isla Santa Clara</i>	1/5–25/7/02	Sp	163	0	163	100	231.1	1156.7	19	100	0	0	4	0	4	0	0	0	99		O (87)	
<i>Argos Georgia</i>	1/5–31/7/02	Sp	298	0	298	100	211.9	970.0	21	100	0	0	0	0	0	0	0	0	96		O (70)	
<i>Lyn</i>	1/5–18/7/02	Sp	176	0	176	100	292.1	1346.7	21	100	0	0	0	0	0	0	0	0	98		O (87)	
<i>Ibsa Quinto</i>	1/5–21/8/02	Sp	166	0	166	100	406.8	1723.4	23	100	0	0	5	0	5	0	0	0	88		O (100)	
<i>Polarpesca 1</i>	18/5–14/8/02	Sp	204	1	205	99.5	233.7	1020.4	22	100	0	0	4	0	4	0	0	0	100	100	O (100)	
<i>Isla Alegranza</i>	6/5–9/8/02	Sp	160	0	160	100	370.3	1531.9	24	100	0	0	7	0	7	0	0	0	96		O (93)	
<i>Viking Bay</i>	1/5–9/8/02	Sp	221	3	224	99	242.8	1152.2	21	100	0	0	4	0	4	0	0	0	100	100	O (87)	
<i>Koryo Maru No. 11</i>	1/5–2/8/02	Sp	147	0	147	100	299.9	1409.2	21	100	0	0	2	0	2	0	0	0	97		O (83)	
<i>Atlantic No. 52</i>	26/5–22/8/02	Sp	154	0	154	100	240.4	1137.8	21	100	4	0	2	0	6	0	0.017	0	82		O (98)	
<i>Jacqueline</i>	1/5–21/8/02	Sp	149	7	156	96	408.4	1713.2	23	100	2	0	3	0	5	0	0.005	0	100	100	O (86)	
<i>Argos Helena</i>	1/5–6/8/02	Sp	191	0	191	100	397.3	1275.1	31	100	0	0	6	0	6	0	0	0	100		O (100)	
<i>Eva 1</i>	2/7–11/8/02	Sp	75	0	75	100	120.7	564.5	21	98	0	0	0	0	0	0	0	0	89		O (96)	
<i>Tierra del Fuego</i>	22/5–11/8/02	Sp	134	5	139	96	168.3	740.2	22	100	0	0	0	0	0	0	0	0	96	100	O (98)	
Total						99	3968.0	17280.5	22		6	0	37	0	43	0	0.0015	0.0	0.0015			
Subareas 58.6 and 58.7																						
<i>Suidor One</i>	13/11–8/12/01	Sp	24	0	24	100	24.0	259.7	9	100	0	0	0	0	0	0	0	0	100		O (100)	
<i>Koryo Maru 11</i>	8/2–4/4/02	Sp	87	2	89	98	538.3	909.3	59	100	0	0	4	0	4	0	0	0	100	100	O (100)	
<i>Suidor One</i>	27/4–16/5/02	Sp	18	0	18	100	60.6	143.0	42	100	0	0	1	0	1	0	0	0	100		O (100)	
Total						99	622.9	1312.0	37		0	0	5	0	5	0	0	0	0			
Subareas 88.1 and 88.2																						
<i>Janas</i>	8/1–21/3/02	A	18	157	175	10	415.0	1034.7	40	94	0	0	0	0	0	0	0	0	100	100	(0)	
<i>San Aotea II</i>	17/1–19/5/02	A	33	160	193	17	463.0	1031.7	44	88	0	0	0	0	0	0	0	0	100	100	(0)	
<i>Janas</i>	4/4–2/6/02	A	49	17	66	74	159.7	354.1	45	92	0	0	0	0	0	0	0	0	100	100	(0)	
Total						33	1037.7	2420.5	43		0	0	0	0	0	0	0	0				

Table 6.2: Estimated total seabird mortality by vessel for Subarea 48.3 during the 2001/02 season.

Vessel	Hooks Observed (thousands)	Hooks Set (thousands)	% Hooks Observed	% Night Sets	Estimated Number of Birds Caught Dead		
					Night	Day	Total
<i>Eva 1</i>	133.0	518.2	25	95	0	0	0
<i>Isla Camila</i>	153.5	792.6	19	95	0	0	0
<i>No. 1 Moresko</i>	226.1	968.6	23	100	0	0	0
<i>Isla Santa Clara</i>	231.1	1156.7	19	100	0	0	0
<i>Argos Georgia</i>	211.9	970.0	21	100	0	0	0
<i>Lyn</i>	292.1	1346.7	21	100	0	0	0
<i>Ibsa Quinto</i>	406.8	1723.4	23	100	0	0	0
<i>Polarpesca 1</i>	233.7	1020.4	22	99.5	0	0	0
<i>Isla Alegranza</i>	370.3	1531.9	24	100	0	0	0
<i>Viking Bay</i>	242.8	1152.2	21	99	0	0	0
<i>Koryo Maru No. 11</i>	299.9	1409.2	21	100	0	0	0
<i>Atlantic No. 52</i>	240.4	1137.8	21	100	19	0	19
<i>Jacqueline</i>	408.4	1713.2	23	96	8	0	8
<i>Argos Helena</i>	397.3	1275.1	31	100	0	0	0
<i>Eva 1</i>	120.7	564.5	21	100	0	0	0
<i>Tierra del Fuego</i>	168.3	740.2	22	96	0	0	0
Total					27	0	27

Table 6.3: Total estimated seabird by-catch and by-catch rate (birds/thousand hooks) in longline fisheries in Subareas 48.3, 58.6 and 58.7 from 1997 to 2002.

Subarea	Year					
	1997	1998	1999	2000	2001	2002
48.3						
Estimated by-catch	5 755	640	210*	21	30	27
By-catch rate	0.23	0.032	0.013*	0.002	0.002	0.0015
58.6, 58.7						
Estimated by-catch	834	528	156	516	199	0
By-catch rate	0.52	0.194	0.034	0.046	0.018	0

* Excluding *Argos Helena* line-weighting experiment cruise.

Table 6.4: Species composition of birds killed in longline fisheries in Subareas 48.3 during the 2001/02 season. N – night setting; D – daylight setting (including nautical dawn and dusk); MAI – southern giant petrel; PRO – white-chinned petrel; DAC – Cape petrel; MAH – giant petrel; () – % composition.

Vessel	Dates of Fishing	No. Birds Killed by Group						Species Composition (%)			
		Albatross		Petrels		Total		MAI	PRO	DAC	MAH
		N	D	N	D	N	D				
<i>Eva 1</i>	20/5–28/6/02	0	0	0	0	0	0				
<i>Isla Camila</i>	2/5–6/7/02	0	0	0	0	0	0				
<i>No. 1 Moresko</i>	1/5–7/7/02	0	0	0	0	0	0				
<i>Isla Santa Clara</i>	1/5–25/7/02	0	0	0	0	0	0				
<i>Argos Georgia</i>	1/5–31/7/02	0	0	0	0	0	0				
<i>Lyn</i>	1/5–18/7/02	0	0	0	0	0	0				
<i>Ibsa Quinto</i>	1/5–21/8/02	0	0	0	0	0	0				
<i>Polarpesca 1</i>	18/5–14/8/02	0	0	0	0	0	0				
<i>Isla Alegranza</i>	6/5–9/8/02	0	0	0	0	0	0				
<i>Viking Bay</i>	1/5–9/8/02	0	0	0	0	0	0				
<i>Koryo Maru No. 11</i>	1/5–2/8/02	0	0	0	0	0	0				
<i>Atlantic No. 52</i>	26/5–22/8/02	0	0	4	0	4	0	2 (50)		1 (25)	1 (25)
<i>Jacqueline</i>	1/5–21/8/02	0	0	2	0	2	0	2 (100)			
<i>Argos Helena</i>	1/5–6/8/02	0	0	0	0	0	0				
<i>Eva 1</i>	2/7–11/8/02	0	0	0	0	0	0				
<i>Tierra del Fuego</i>	22/5–11/8/02	0	0	0	0	0	0				
Total %		0	0	6	0	6	0	4 (66)		1 (17)	1 (17)

Table 6.5: Vessel compliance (%) with Conservation Measure 29/XIX during the 2001/02 season based on data from scientific observers. Those vessels that reached 95% of the minimum requirement of all elements of the conservation measure are in bold. Values for night setting and streamer line setting are absolute proportions for all sets by each vessel. Values for offal discharge and streamer line design are averages across all cruises by each vessel; line weighting is expressed as a percentage of the minimum requirement (6 kg every 20 m or 8.5 kg every 40 m). CHL – Chile; ESP – Spain; GBR – United Kingdom; KOR – Republic of Korea; NZL – New Zealand; RUS – Russia; URY – Uruguay; ZAF – South Africa.

Area/Vessel	Number of Cruises	Night Setting	Offal Discharge	Line Weighting		Streamer Line	
				Distance	Weight	Setting	Design
Subarea 48.3							
<i>Eva I</i> (RUS)	2	98	100	100	90	91	0
<i>Isla Camila</i> (CHL)	1	95	100	100	100	93	100
<i>No. 1 Moresko</i> (KOR)	1	100	100	100	99	99	100
<i>Isla Santa Clara</i> (CHL)	1	100	100	100	100	99	100
<i>Argos Georgia</i> (GBR)	1	100	100	100	100	96	100
<i>Lyn</i> (GBR)	1	100	100	100	100	98	100
<i>Ibsa Quinto</i> (ESP)	1	100	100	100	96	88	100
<i>Polarpesca I</i> (CHL)	1	99.5	100	100	100	100	100
<i>Isla Alegranza</i> (URY)	1	100	100	100	92	96	100
<i>Viking Bay</i> (ESP)	1	99	100	100	76	100	100
<i>Koryo Maru No. 11</i> (ZAF)	1	100	100	100	100	97	0
<i>Atlantic No. 52</i> (URY)	1	100	100	100	65	82	100
<i>Jacqueline</i> (GBR)	1	96	100	100	100	100	100
<i>Argos Helena</i> (GBR)	1	100	100	100	100	100	100
<i>Tierra del Fuego</i> (CHL)	1	100	100	100	100	96	100
Subareas 58.6 and 58.7							
<i>Suidor One</i> (ZAF)	2	100	100	100	71	100	100
<i>Koryo Maru No. 11</i> (ZAF)	1	98	100	100	100	100	100
Subareas 88.1 and 88.2							
<i>Janas</i> (NZL)*	2	28	100	Autoline		100	100
<i>San Aotea II</i> (NZL)*	1	17	100	Autoline		100	100

* Conservation Measure 216/XX allows fishing in Subarea 88.1 during daylight periods if the vessel can demonstrate a minimum sink rate of 0.3 m/s.

Table 6.6: Compliance, as reported by scientific observers, of streamer lines with the minimum specifications set out in Conservation Measure 29/XIX during the 2001/02 season. Y: yes; N: no; -: no information; A: autoliner; Sp: Spanish; CHL – Chile; ESP – Spain; GBR – United Kingdom; KOR – Republic of Korea; NZL – New Zealand; RUS – Russia; URY – Uruguay; ZAF – South Africa.

Vessel Name (Nationality)	Dates of Fishing	Fishing Method	Compliance with CCAMLR Specifications	Compliance with Details of Streamer Line Specifications				Length of Streamers (m)	Streamer Line in Use (%)	
				Attachment, Height above Water (m)	Total Length (m)	No. Streamers per Line	Spacing of Streamers per Line (m)		Night	Day
Subarea 48.3										
<i>Eva I</i> (RUS)	20/5–28/6/02	Sp	N	Y (7)	N (125)	Y (5)	Y (5)	-	93	100
<i>Isla Camila</i> (CHL)	2/5–6/7/02	Sp	Y	Y (5.5)	Y (150)	Y (5)	Y (5)	Y (3–1.5)	93	100
<i>No. 1 Moresko</i> (KOR)	1/5–7/7/02	Sp	Y	Y (6)	Y (165)	Y (5)	Y (5)	Y (4–2)	99	
<i>Isla Santa Clara</i> (CHL)	1/5–25/7/02	Sp	Y	Y (5)	Y (150)	Y (5)	Y (5)	Y (3.5–1.5)	99	
<i>Argos Georgia</i> (GBR)	1/5–31/7/02	Sp	Y	Y (6.3)	Y (150)	Y (30)	Y (5)	Y (3.5–1.5)	96	
<i>Lyn</i> (GBR)	1/5–18/7/02	Sp	Y	Y (10)	Y (155)	Y (7)	Y (5)	Y (3)	98	
<i>Ibsa Quinto</i> (ESP)	1/5–21/8/02	Sp	Y	Y (8)	Y (162)	Y (6)	Y (5)	-	88	
<i>Polarpesca 1</i> (CHL)	18/5–14/8/02	Sp	Y	Y (5.7)	Y (150)	Y (5)	Y (5)	Y (3.7–1.4)	100	100
<i>Isla Alegranza</i> (URY)	6/5–9/8/02	Sp	Y	Y (6.5)	Y (163)	Y (5)	Y (5)	-	96	
<i>Viking Bay</i> (ESP)	1/5–9/8/02	Sp	Y	Y (8)	Y (162)	Y (5)	Y (5)	Y (3.8–1.4)	100	100
<i>Koryo Maru No. 11</i> (ZAF)	1/5–2/8/02	Sp	N	N (4)	Y (155)	Y (10)	Y (5)	Y (5–2.5)	97	
<i>Atlantic No. 52</i> (URY)	26/5–22/8/02	Sp	Y	Y (5)	Y (154)	Y (10)	Y (5)	Y (3.5–1.3)	82	
<i>Jacqueline</i> (GBR)	1/5–22/8/02	Sp	Y	Y (7)	Y (150)	Y (5)	Y (5)	Y (3.9–2)	100	100
<i>Argos Helena</i> (GBR)	1/5–6/8/02	Sp	Y	Y (5)	Y (150)	Y (5)	Y (5)	Y (3.5–1.5)	100	
<i>Tierra del Fuego</i> (CHL)	15/5–19/8/02	Sp	Y	Y (5)	Y (153)	Y (30)	Y (5)	Y (5–1)	89	
<i>Eva I</i> (RUS)	30/6–31/8/02	Sp	N	Y (6.9)	N (110)	Y (7)	Y (5)	Y (4–1.2)	96	100
Subareas 58.6 and 58.7										
<i>Suidor One</i> (ZAF)	13/11–8/12/01	Sp	Y	Y (4.5)	Y (150)	Y (5)	Y (5)	Y (3.5–1.2)	100	
<i>Koryo Maru No. 11</i> (ZAF)	8/2–4/4/02	Sp	Y	Y (6)	Y (155)	Y (5)	Y (5)	Y (5.5–3.5)	100	100
<i>Suidor One</i> (ZAF)	27/4–16/5/02	Sp	Y	Y (5.3)	Y (160)	Y (7)	Y (5)	Y (3.0–.4)	100	
Subarea 88.1										
<i>Janas</i> (NZL)	8/1–21/3/02	A	Y	Y (6)	Y (170)	Y (21)	Y (5)	Y (5–1.5)	100	100
<i>San Aotea II</i> (NZL)	17/1–19/5/02	A	Y	Y (4.5)	Y (155)	Y (12)	Y (4)	Y (9–1.6)	100	100
<i>Janas</i> (NZL)	4/4–2/6/02	A	Y	Y (6)	Y (200)	Y (21)	Y (25)	Y (3.8–1)	100	100

Table 6.7: Summary of compliance with Conservation Measure 29/XIX, based on data from scientific observers from 1996/97 to 2001/02 season. Values in parentheses are % of observer records that were complete. na – not applicable.

Subarea/ Time	Line Weighting (Spanish System Only)			Night Setting (% Night)	Offal Discharge (%) Opposite Haul	Streamer Line Compliance (%)					Total Catch Rate (birds/1 000 hooks)							
	Compliance %	Median Weight (kg)	Median Spacing (m)			Overall	Attached Height	Total Length	No. Streamers	Distance Apart	Night	Day						
Subarea 48.3																		
1996/97	0 (91)	5	45	81	0 (91)	6 (94)	47 (83)	24 (94)	76 (94)	100 (78)	0.18	0.93						
1997/98	0 (100)	6	42.5	90	31 (100)	13 (100)	64 (93)	33 (100)	100 (93)	100 (93)	0.03	0.04						
1998/99	5 (100)	6	43.2	80 ¹	71 (100)	0 (95)	84 (90)	26 (90)	76 (81)	94 (86)	0.01	0.08 ¹						
1999/00	1 (91)	6	44	92	76 (100)	31 (94)	100 (65)	25 (71)	100 (65)	85 (76)	<0.01	<0.01						
2000/01	21 (95)	6.8	41	95	95 (95)	50 (85)	88 (90)	53 (94)	94 (94)	82 (94)	<0.01	<0.01						
2001/02	63 (100)	8.6	40	99	100 (100)	87 (100)	94 (100)	93 (100)	100 (100)	100 (100)	0.002	0						
Division 58.4.4																		
1999/00	0 (100)	5	45	50	0 (100)	0 (100)	100 (100)	0 (100)	Y (100)	100 (100)	0	0						
Subareas 58.6 and 58.7																		
1996/97	0 (60)	6	35	52	69 (87)	10 (66)	100 (60)	10 (66)	90 (66)	60 (66)	0.52	0.39						
1997/98	0 (100)	6	55	93	87 (94)	9 (92)	91 (92)	11 (75)	100 (75)	90 (83)	0.08	0.11						
1998/99	0 (100)	8	50	84 ²	100 (89)	0 (100)	100 (90)	10 (100)	100 (90)	100 (90)	0.05	0						
1999/00	0 (83)	6	88	72	100 (93)	8 (100)	91 (92)	0 (92)	100 (92)	91 (92)	0.03	0.01						
2000/01	18 (100)	5.8	40	78	100 (100)	64 (100)	100 (100)	64 (100)	100 (100)	100 (100)	0.01	0.04						
2001/02	66 (100)	6.6	40	99	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0						
Subarea 88.1																		
1996/97	Auto only	na	na	50	0 (100)	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0						
1997/98	Auto only	na	na	71	0 (100)	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0						
1998/99	Auto only	na	na	1 ³	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0						
1999/00	Auto only	na	na	6 ⁴	No discharge	67 (100)	100 (100)	67 (100)	100 (100)	100 (100)	0	0						
2000/01	1 (100)	12	40	18 ⁴	No discharge	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0						
2001/02	Auto only	na	na	33 ⁴	No discharge	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0						

- ¹ Includes daytime setting – and associated seabird by-catch – as part of line-weighting experiments on *Argos Helena* (WG-FSA-99/5).
² Includes some daytime setting in conjunction with use of an underwater-setting funnel on *Eldfisk* (WG-FSA-99/42).
³ Conservation Measure 169/XVII allowed New Zealand vessels to undertake daytime setting south of 65°S in Subarea 88.1 to conduct a line-weighting experiment.
⁴ Conservation Measures 210/XIX and 216/XX allowed vessels to undertake daytime setting south of 65°S in Subarea 88.1 if they could demonstrate a sink rate of 0.3 m/s.

Table 6.8: Bird by-catch (death rate) calculated from 1997 data from the *Dissostichus* spp. fishery in Subarea 48.3, assuming a summer end date of 1 April, used to bootstrap the model in WG-FSA-02/04 (taken from WG-FSA-02/05, Table 5).

Season	Vessel Name	Cruise ID	Hooks Set (thousand)	Hooks Observed (thousand)	Number of Birds Dead	Death Rate (n/1 000 hooks)
Summer	<i>Argos Helena</i>	9	303.49	91.91	142	1.545
Summer	<i>Cisne Verde</i>	6	99.84	10.244	4	0.390
	<i>Elqui</i>	7	183.6	73.2	36	0.492
	<i>Isla Camila</i>	17	322.72	58.055	43	0.741
	<i>Isla Isabel</i>	11	186.56	21.648	252	11.641
Winter	<i>Argos Helena</i>	9	949.35	189.3	14	0.074
	<i>Cisne Verde</i>	6	366.34	89.329	4	0.045
	<i>Cisne Verde</i>	8	951.88	411.41		0.000
	<i>Elqui</i>	7	324	152	15	0.099
	<i>Elqui</i>	29	695.42	639.17		0.000
	<i>Elqui</i>	10	456.94	326.08		0.000
	<i>Ercilla</i>	14	512.35	316.91	24	0.076
	<i>Ercilla</i>	15	343.98	157.94		0.000
	<i>Ercilla</i>	16	243.74	152.42		0.000
	<i>Ibsa Quinto</i>	25	1178.1	353.05	34	0.096
	<i>In Sung 66</i>	28	1345.8	328.26		0.000
	<i>Isla Camila</i>	18	489.29	93.45	9	0.096
	<i>Isla Camila</i>	19	459.84	44.268		0.000
	<i>Isla Isabel</i>	12	537.1	289.8	4	0.014
	<i>Isla Isabel</i>	13	431.21	199.7		0.000
	<i>Jacqueline</i>	20	380.93	19.84	10	0.504
	<i>Jacqueline</i>	21	683.03	41.71	6	0.144
	<i>Koryo Maru No. 11</i>	39	820.4	820.4	1	0.001
	<i>Pescarosa Primero</i>	26	288.52	236.04	2	0.008
	<i>Pescarosa Primero</i>	27	163.2	137.73		0.000

Table 6.9: Summary of IMAF risk level and assessment in relation to proposed new and exploratory longline fisheries in 2002/03. Risk scales are as follows: 1 – Low; 2 – Average-to-Low; 3 – Average; 4 – Average-to-High; 5 – High. Text in bold indicates issues needing resolution.

Area	Risk Scale	IMAF Risk Assessment	Notes
48.6 north of 60°S	2	Average-to-low risk – southern part of area (south of c. 55°S) of low risk; no obvious need for restriction of longline fishing season. Ensure strict compliance with Conservation Measure 29/XIX as a seabird by-catch precautionary measure. Fishing during daytime only permitted under the provisions currently prescribed under Conservation Measure 216/XX. In addition, vessels that catch a total of three (3) birds shall revert to night setting.	<ul style="list-style-type: none"> • South Africa (CCAMLR-XXI/6) proposes to fish during a season to be established at CCAMLR-XXI. State their acceptance of IMAF assessments and intent to comply with Conservation Measure 29/XIX. Proposal does not conflict with advice provided.
48.6	2	Average-to-low risk – southern part of area (south of c.55°S) of low risk; no obvious need for restriction of longline fishing season. Ensure strict compliance with Conservation Measure 29/XIX as a seabird by-catch precautionary measure. Fishing during daytime only permitted under the provisions currently prescribed under Conservation Measure 216/XX. In addition, vessels that catch a total of three (3) birds shall revert to night setting.	<ul style="list-style-type: none"> • Japan (CCAMLR-XXI/9) proposes to fish during a season to be established at CCAMLR-XXI. Intend to comply with Conservation Measure 29/XIX noting that ‘some variation to application of paragraph 3 within Subareas 88.1 and 88.2 has been allowed by the Commission.’ Proposal does not conflict with advice provided by IMAF, subject to acceptance of provisions of Conservation Measure 216/XX. A maximum limit of three birds caught should be applied to daylight setting as required for fishing in other lower risk areas (Conservation Measures 235/XX and 236/XX). • New Zealand (CCAMLR-XXI/8) proposes to fish north of 60°S from 1 March 2003 to 31 August 2003, and south of 60°S from 15 February 2003 to 15 October 2003. Two scientific observers, 24-hour observer coverage proposed. Intend to comply fully with Conservation Measure 29/XIX north of 60°S. For fishing south of 60°S, a variation to Conservation Measure 29/XIX is sought consistent with the approaches approved by CCAMLR in Conservation Measures 216/XX (line-weighting trials) and 229/XX (three-bird limit for daylight setting). Proposal does not conflict with advice provided.

(continued)

Table 6.9 (continued)

Area	Risk Scale	IMAF Risk Assessment	Notes
58.4.2	2	Average-to-low risk. Ensure strict compliance with Conservation Measure 29/XIX. Prohibit longline fishing during the breeding season of giant petrels (October to March). Fishing at other times only permitted under the provisions currently prescribed under Conservation Measure 216/XX. In addition, vessels that catch a total of three (3) birds shall revert to night setting.	<ul style="list-style-type: none"> Australia (CCAMLR-XXI/12) proposes to fish from 1 January to 31 March 2003. Intend to 'comply with or exceed Conservation Measure 29/XIX', specifically through offal retention and use of twin streamer lines. Seek exemption to night-setting requirements through achieving a sink rate of at least 0.3 m/s to a depth of 15 m as specified in Conservation Measure 216/XX. Proposal does not conflict with advice provided. A maximum limit of three birds caught should be applied to daylight setting as required for fishing in other lower risk areas (Conservation Measures 235/XX and 236/XX).
58.4.3a	3	Average risk. Ensure strict compliance with Conservation Measure 29/XIX. Prohibit longline fishing during the breeding season of albatrosses, giant petrels and white-chinned petrels (September to April). Fishing at other times only permitted under the provisions currently prescribed under Conservation Measure 216/XX. In addition, vessels that catch a total of three (3) birds shall revert to night setting.	<ul style="list-style-type: none"> Japan (CCAMLR-XXI/9) proposes to fish during a season to be established at CCAMLR-XXI. Intend to comply with Conservation Measure 29/XIX noting that 'some variation to application of paragraph 3 within Subareas 88.1 and 88.2 has been allowed by the Commission.' Proposal does not conflict with advice provided by IMAF, subject to acceptance of provisions of Conservation Measure 216/XX. A maximum limit of three birds caught should be applied to daylight setting as required for fishing in other lower risk areas (Conservation Measures 235/XX and 236/XX). Australia (CCAMLR-XXI/11) proposes to fish from 1 May to 31 August 2003. Intend to 'comply with or exceed Conservation Measure 29/XIX', specifically through offal retention, use of twin streamer lines, and achieving a sink rate of at least 0.3m/s to a depth of 15 m as specified in Conservation Measure 216/XX. Proposal does not conflict with advice provided.
58.4.3b	3	Average risk. Ensure strict compliance with Conservation Measure 29/XIX. Prohibit longline fishing during the breeding season of albatrosses, giant petrels and white-chinned petrels (September to April). Fishing at other times only permitted under the provisions currently prescribed under Conservation Measure 216/XX. In addition, vessels that catch a total of three (3) birds shall revert to night setting.	<ul style="list-style-type: none"> Japan (CCAMLR-XXI/9) proposes to fish during a season to be established at CCAMLR-XXI. Intend to comply with Conservation Measure 29/XIX noting that 'some variation to application of paragraph 3 within Subareas 88.1 and 88.2 has been allowed by the Commission.' Proposal does not conflict with advice provided by IMAF, subject to acceptance of provisions of Conservation Measure 216/XX. A maximum limit of three birds caught should be applied to daylight setting as required for fishing in other lower risk areas (Conservation Measures 235/XX and 236/XX).

(continued)

Table 6.9 (continued)

Area	Risk Scale	IMAF Risk Assessment	Notes
58.4.4	3	Average risk. Ensure strict compliance with Conservation Measure 29/XIX. Prohibit longline fishing during the breeding season of albatrosses and petrels (September to April). Fishing at other times only permitted under the provisions currently prescribed under Conservation Measure 216/XX. In addition, vessels that catch a total of three (3) birds shall revert to night setting.	<ul style="list-style-type: none"> • Japan (CCAMLR-XXI/9) proposes to fish during a season to be established at CCAMLR-XXI. Intend to comply with Conservation Measure 29/XIX noting that ‘some variation to application of paragraph 3 within Subareas 88.1 and 88.2 has been allowed by the Commission.’ Proposal does not conflict with advice provided by IMAF, subject to acceptance of provisions of Conservation Measure 216/XX. A maximum limit of three birds caught should be applied to daylight setting as required for fishing in other lower risk areas (Conservation Measures 235/XX and 236/XX). • South Africa (CCAMLR-XXI/6) proposes to fish during a season to be established at CCAMLR-XXI. State their acceptance of IMAF assessments and intent to comply with Conservation Measure 29/XIX. Proposal does not conflict with advice provided. A maximum limit of three birds caught should be applied to daylight setting as required for fishing in other lower risk areas (e.g. Conservation Measures 235/XX and 236/XX).
58.5.2	4	Average-to-high risk. Prohibit longline fishing within the breeding season of the main albatross and petrel species (September to April). Ensure strict compliance with Conservation Measure 29/XIX.	<ul style="list-style-type: none"> • Australia (CCAMLR-XXI/11) proposes to fish from 1 May to 31 August 2003. Intend to ‘comply with or exceed Conservation Measure 29/XIX’, specifically through offal retention, use of twin streamer lines, and achieving a sink rate of at least 0.3 m/s to a depth of 15 m as specified in Conservation Measure 216/XX. Proposal does not conflict with advice provided.
58.6	5	High risk. Prohibit longline fishing during the main albatross and petrel breeding season (September to April); ensure strict compliance with Conservation Measure 29/XIX.	<ul style="list-style-type: none"> • Japan (CCAMLR-XXI/9) proposes to fish during a season to be established at CCAMLR-XXI. Intend to comply with Conservation Measure 29/XIX noting that ‘some variation to application of paragraph 3 within Subareas 88.1 and 88.2 has been allowed by the Commission.’ Proposal does not conflict with advice provided. • South Africa (CCAMLR-XXI/6) proposes to fish during a season to be established at CCAMLR-XXI. State their acceptance of IMAF assessments and intent to comply with Conservation Measure 29/XIX. Proposal does not conflict with advice provided.

(continued)

Table 6.9 (continued)

Area	Risk Scale	IMAF Risk Assessment	Notes
88.1	3	<p>Average risk overall. Average risk in northern sector (<i>D. eleginoides</i> fishery), average-to-low risk in southern sector (<i>D. mawsoni</i> fishery). Longline fishing season limits of uncertain advantage.</p> <p>Ensure strict compliance with Conservation Measure 29/XIX as a seabird by-catch precautionary measure. Fishing during daytime only permitted under the provisions currently prescribed under Conservation Measure 216/XX. In addition, vessels that catch a total of three (3) birds shall revert to night setting.</p>	<ul style="list-style-type: none"> <li> <p>• Japan (CCAMLR-XXI/9) proposes to fish during a season to be established at CCAMLR-XXI. Intend to comply with Conservation Measure 29/XIX noting that ‘some variation to application of paragraph 3 within Subareas 88.1 and 88.2 has been allowed by the Commission.’</p> <p>Proposal does not conflict with advice provided by IMAF, subject to acceptance of provisions of Conservation Measure 216/XX.</p> <p>A maximum limit of three birds caught should be applied to daylight setting as required for fishing in other lower risk areas (Conservation Measures 235/XX and 236/XX).</p> <li> <p>• New Zealand (CCAMLR-XXI/7) proposes to fish from 1 December 2002 to 31 August 2003. State their intent to comply with Conservation Measures 29/XIX and 10/XIX. Intend to comply fully with Conservation Measure 29/XIX north of 65°S. For fishing south of 65°S, a variation to Conservation Measure 29/XIX is sought to allow daytime setting consistent with the approaches approved by CCAMLR in Conservation Measures 235/XX and 236/XX (three-bird limit for daylight setting). New Zealand also proposes that all vessels fishing are subject to Conservation Measure 216/XX (line-weighting trials).</p> <p>New Zealand also proposes fishing be prohibited within 10 n miles of 23 significant seabird and marine mammal breeding sites, and within 10 n miles of the Antarctic coastline on a precautionary basis.</p> <p>Proposal does not conflict with advice provided by IMAF, but IMAF has no data to assess the utility of the 10 n miles exclusion zones.</p> <li> <p>• Russia (CCAMLR-XXI/16) proposes to fish from 1 December 2002 to 31 August 2003. State their intent to comply with Conservation Measure 29/XIX. Compliance with Conservation Measure 235/XX (three-bird limit for daylight setting) uncertain.</p> <p>Proposal does not conflict with advice provided by IMAF, subject to acceptance of provisions of Conservation Measure 216/XX. A maximum limit of three birds caught should be applied to daylight setting as required for fishing in other lower risk areas (Conservation Measures 235/XX and 236/XX).</p>

(continued)

Table 6.9 (continued)

Area	Risk Scale	IMAF Risk Assessment	Notes
88.1 (continued)			<ul style="list-style-type: none"> • South Africa (CCAMLR-XXI/6) proposes to fish during a season to be established at CCAMLR-XXI. State their acceptance of IMAF assessments and note some relaxation of daytime setting has been accepted by CCAMLR in Conservation Measure 235/XX. State intent to comply with Conservation Measure 29/XIX. Proposal does not conflict with advice provided by IMAF, subject to acceptance of provisions of Conservation Measure 216/XX. A maximum limit of three birds caught should be applied to daylight setting as required for fishing in other lower risk areas (Conservation Measures 235/XX and 236/XX). • Spain (CCAMLR-XXI/6) proposes to fish from 1 December 2002 to 31 August 2003, subject to changes imposed by CCAMLR. State their acceptance of all conservation measures developed for this fishery, and in particular Conservation Measures 29/XIX, 216/XX (line weighting trials) and 235/XX (three-bird limit for daylight setting). Proposal does not conflict with advice provided.
88.2	<p>Low risk. No obvious need for restriction of longline fishing season. Ensure strict compliance with Conservation Measure 29/XIX as a seabird by-catch precautionary measure. Fishing during daytime only permitted under the provisions currently prescribed under Conservation Measure 216/XX. In addition, vessels that catch a total of three (3) birds shall revert to night setting.</p>		<ul style="list-style-type: none"> • Japan (CCAMLR-XXI/9) proposes to fish during a season to be established at CCAMLR-XXI. Intend to comply with Conservation Measure 29/XIX noting that ‘some variation to application of paragraph 3 within Subareas 88.1 and 88.2 has been allowed by the Commission.’ Proposal does not conflict with advice provided by IMAF, subject to acceptance of provisions of Conservation Measure 216/XX. A maximum limit of three birds caught should be applied to daylight setting as required for fishing in other lower risk areas (Conservation Measures 235/XX and 236/XX). • New Zealand (CCAMLR-XXI/7) proposes to fish from 1 December 2002 to 31 August 2003. State their intent to comply with Conservation Measures 29/XIX and 210/XIX. Intend to comply fully with Conservation Measure 29/XIX north of 65°S. For fishing south of 65°S, a variation to Conservation Measure 29/XIX is sought to allow daytime setting consistent with the approach approved by CCAMLR in Conservation Measure 236/XX (3-bird limit for daylight setting). New Zealand also proposes that all vessels fishing are subject to Conservation Measure 216/XX (line-weighting trials).

(continued)

Table 6.9 (continued)

Area	Risk Scale	IMAF Risk Assessment	Notes
88.2 (continued)			<p>New Zealand also proposes fishing be prohibited within 10 n miles of the Antarctic coastline on a precautionary basis.</p> <p>Proposal does not conflict with advice provided by IMAF, but IMAF has no data to assess the utility of the 10 n miles exclusion zones.</p> <ul style="list-style-type: none"> • Russia (CCAMLR-XXI/16) proposes to fish from 1 December 2002 to 31 August 2003. State their intent to comply with Conservation Measure 29/XIX. Compliance with Conservation Measure 236/XX (three-bird limit for daylight setting) uncertain. <p>Proposal does not conflict with advice provided by IMAF, subject to acceptance of provisions of Conservation Measure 216/XX. A maximum limit of three birds caught should be applied to daylight setting as required for fishing in other lower risk areas (Conservation Measures 235/XX and 236/XX).</p>

Table 6.10: Interactions between marine mammals and longline vessels fishing for toothfish, taken from WG-FSA-02/12 Rev. 1 and reports of scientific observers.

Subarea	Year	Cruises where Interaction Occurred	Killer Whale	Sperm Whale	Fur Seal	Unknown
Subarea 48.3	1999	13 of 17	12	1	5	0
	2000	9 of 26	6	3	3	1
	2001	11 of 15	5	4	4	0
Subareas 58.6/58.7	1999	9 of 12	6	4	0	3
	2000	9 of 11	7	6	0	2
	2001	1 of 3	1	0	0	0

Table 6.11: Details of the number of seabirds captured in trawl fisheries in Subarea 48.3, taken from WG-FSA-02/12 Rev. 1 and reports of scientific observers. DIM – black-browed albatross, PRO – white-chinned petrel, PAC – Antarctic prion; nr – not recorded.

Vessel	Dates	Days Fishing	No. of Trawls	% Trawls Observed	Birds Dead	DIM	PRO	PAC	Birds Released	DIM	PRO
<i>Zakhar Sorokin</i>	20/12–05/02	48	185	94	7	3	4		nr		
<i>In Sung Ho</i>	31/12–18/02	37	87	100	21	3	17	1	18	1	17
<i>Robin M. Lee</i>	23/12–15/02	32	85	94	19	4	15		25	7	18
<i>Bonito</i>	15/12–09/02	40	68	100	5	2	3		1	1	
<i>Argos Vigo</i>	15/12–16/02	29	60	100	21	8*	13*		8	4	4
Total					73	20	52	1	52	13	39

* Includes two birds observed killed but not brought on board

Table 6.12: Nature and timing of offal discharge (proportion of total sets/hauls) and status of deck lighting of vessels involved in trawl fisheries for icefish in Subarea 48.3, taken from reports of scientific observers.

Vessel	Offal Discharged Setting/Hauling	Deck Lighting
<i>Zakhar Sorokin</i>	0 / 0	No information
<i>In Sung Ho</i>	No information	Details provided
<i>Robin M. Lee</i>	0 / 0	Details provided
<i>Bonito</i>	9% / 7%	Details provided
<i>Argos Vigo</i>	7% / 0	No information

Table 9.1: Draft timetable for the Subgroup on Assessment Methods to prepare for WG-FSA in October 2003.

December 2002	Circular on the workplan of the subgroup.
1 June	<p>Receive papers for consideration at an August meeting, including papers on:</p> <ul style="list-style-type: none"> (i) new and existing assessment methods and, where possible, evaluations of the methods; (ii) new data and/or estimates of parameters; and (iii) proposed timetable for providing new data and/or estimates of parameters with details as to the methods being used to obtain/develop them. <p>These could be used for preparing for WG-FSA in October 2003.</p>
Early August	<p>Four-day meeting of Subgroup on Assessment Methods prior to WG-EMM (a host will be needed).</p> <p>Report will be available following WG-EMM.</p>
Early September	<p>Receive updates on progress to provide methods and estimates of parameters for use at WG-FSA.</p>
Beginning of WG-FSA	<p>Report of the subgroup (not including the report of the meeting), including:</p> <ul style="list-style-type: none"> (i) available methods and parameters estimates for use at WG-FSA; and (ii) a provisional work plan for assessments to be undertaken at WG-FSA in October 2003.

Table 12.1: List of tasks identified by WG-FSA for the 2002/03 intersessional period. The paragraph numbers (Ref.) refer to this report unless stated otherwise. Tasks identified by ad hoc WG-IMAF are listed in Appendix D. Priority: high priority (1); general request (2). Subgroups: Subgroup on assessment methods (SGassessment), Subgroup on biology, ecology and demography (SGbiology); Subgroup on sampling catches from longlines (SGsampling); Subgroup on fisheries acoustics (SGacoustic); CCAMLR Otolith Network (CON).

Task	Ref.	Priority	Action Required	
			Members/Subgroups	Secretariat
Organisation of the meeting				
1. For this year only, collate background papers arising from the meeting into a bound companion volume to the report of WG-FSA.	2.2	1		Coordinate and implement
2. Submit papers to WG-FSA-03 one week before meeting.	2.6	1	Members to implement	Coordinate and implement
Review of available information				
3. Complete loading of all fishery surveys reported to CCAMLR.	3.2	1		Implement
4. Create database shell for submission of survey data.	3.3	1	Data originators to use	Coordinate and implement
5. Develop protocol for updating and correcting data in the survey database.	3.4–3.8	1	Data originators to collaborate	Coordinate and implement
6. Provide data files with password protection during meetings, and then archive these files.	3.9	1	Participants to be aware of the Rules of Access and Use of CCAMLR Data	Coordinate and implement
7. Retain some older versions of operating systems to allow use of older software.	3.10	2		Implement
8. Update information on catches of target species.	3.13	1		Implement
9. Update estimates of reported catches, catches from IUU fishing and total removals by season and area within the Convention Area.	3.16	1	Members to provide information on IUU fishing	Coordinate and implement
10. Update estimates of catches reported in CDS data by season and area outside the Convention Area.	3.16	1		Implement
11. Update information on scientific observations.	3.26	1		Implement
12. Provide a program to calculate times of nautical dawn and dusk.	10.3	1	Technical coordinators to distribute to observers	Coordinate and implement

(continued)

Table 12.1 (continued)

	Task	Ref.	Priority	Action Required	
				Members/Subgroups	Secretariat
13.	Development of acoustic techniques for assessing fish stocks.	3.43	2	SGassessment to implement	
14.	Provide accurate reporting of by-catch by vessels and Flag States.	5.184, 13.9	1	Members to implement	Remind
Preparation of assessments					
15.	Prepare catch-weighted length-frequency plots for the fishery for <i>D. eleginoides</i> in Subarea 48.3.	5.73	1		Implement
16.	Develop species profiles.	2.1, 4.9	1	SGbiology to implement	
17.	Develop assessment manual.	2.1, 4.9, 9.2	1	SGassessment to implement	
Assessments and management advice					
18.	Further examine survey design and how variability in survey catchability may be incorporated in assessments.	5.69	2	Members to implement	Remind
19.	Re-examine acoustic data for <i>C. gunnari</i> and provide robust estimate of biomass.	3.43	1	SGacoustic to coordinate and implement	
20.	Conduct experiments on crab survival.	5.144	2	Members and Technical coordinators to implement	Remind
21.	Submit data on male cheliped height and length for <i>Paralomis</i> spp. in Subarea 48.3.	5.146	1	Data originator to implement	Coordinate and implement
22.	Conduct a more comprehensive analysis of size of male maturity of <i>Paralomis</i> spp. in Subarea 48.3.	5.146	2	Members to implement	Remind
23.	Transfer all relevant national data on by-catch to the CCAMLR database.	5.171	2	Members to implement	Remind
24.	Conduct further studies of survivorship of discarded rajids.	5.195, 10.20	2	Members to implement	Remind
25.	Conduct further studies on issues surrounding the by-catch of rajids.	5.196	2	Members to implement	Remind

(continued)

Table 12.1 (continued)

	Task	Ref.	Priority	Action Required	
				Members/Subgroups	Secretariat
26.	Designate more appropriate boundaries for SSRUs in Subarea 88.1.	5.31, 5.44	2	Members to implement	Remind
27.	Reanalyse the CPUE data from the fishery for <i>D. mawsoni</i> in Subarea 88.1, including consideration of depth fished and revised boundaries for SSRUs.	5.27, 5.28	2	Members to implement	Remind
28.	Amend the CDS to include requirement to report data by smallest appropriate FAO subarea or division, both inside and outside the CCAMLR Convention Area.	5.227	1	Members to implement	Coordinate and implement
Biology, ecology and demography of target and by-catch species					
29.	Continue to collect biological data on by-catch species, including invertebrate species, and in particular information on biomass of the important species.	5.165, 5.171, 5.192, 7.2, 7.3	2	Members to implement	Remind
30.	Conduct further validation of ageing of <i>Dissostichus</i> spp.	7.4–7.6	1	CON to implement	
31.	Conduct further work on ageing of <i>C. gunnari</i> .	7.7	2	CON to implement	
32.	Collect observer information on the condition of <i>Dissostichus</i> spp. during the period leading up to spawning.	7.8	2	Technical coordinators to implement	Coordinate and implement
33.	Allocate separate species codes for <i>A. georgiana</i> and <i>A. sp. anon.</i>	BG/27 7.20	1	Technical coordinators to implement	Implement
Consideration of ecosystem management					
34.	Provide information on <i>C. gunnari</i> of relevance to the CEMP Review.	8.2	2	Members to implement	Remind
35.	Publicise the World Fisheries Congress session on 'Reconciling Fisheries with Conservation in the Antarctic' and submit abstracts by April 2003.	8.7	2	Members to implement	Remind
Future assessments					
36.	Evaluate alternative methods of assessment.	9.5, 9.6	1	SGassessment to implement	Provide support

(continued)

Table 12.1 (continued)

	Task	Ref.	Priority	Action Required	
				Members/Subgroups	Secretariat
37.	Develop a list of data extractions which could be undertaken prior to the next meeting.	9.10	1	SGassessment to advise	Coordinate and implement
38.	Consider holding an intersessional meeting to further the development of assessment methods.	9.3, 9.4	1	SGassessment to coordinate and implement	
Scheme of International Scientific Observation					
39.	Updates and additions to the <i>Scientific Observers Manual</i> .	10.20	1		Coordinate and implement
40.	Review the codes used to describe processing of fish.	3.34	1	Technical coordinators to implement	Coordinate and implement
41.	Use latest forms for nautical twilight.	10.3	1	Technical Coordinators to implement	Remind
42.	Complete part of observer logbook and report dealing with deck lighting.	10.5	1	Technical Coordinators to implement	Remind
43.	Update the <i>Species Identification Sheets</i> .	10.9	1	Dr Collins to coordinate, Technical Coordinators to implement	Implement
44.	Revisions to the format of the <i>Scientific Observers Manual</i> .	10.10	2	Technical Coordinators to coordinate	Implement
45.	Implement agreed sampling procedure for the 2002/03 season.	10.14	1	Technical coordinators to implement	Remind
46.	Collect tissue samples and measure pre-anal lengths from macrourids.	10.17, 5.154, 5.166	1	Technical coordinators to implement	Remind

(continued)

Table 12.1 (continued)

Task	Ref.	Priority	Action Required	
			Members/Subgroups	Secretariat
CCAMLR website				
47. Further develop the bibliography of CCAMLR working documents and make available online.	11.2	1		Coordinate and implement
Other business				
48. Further develop electronic access to STATLANT data, including online queries.	13.8	2		Coordinate and implement

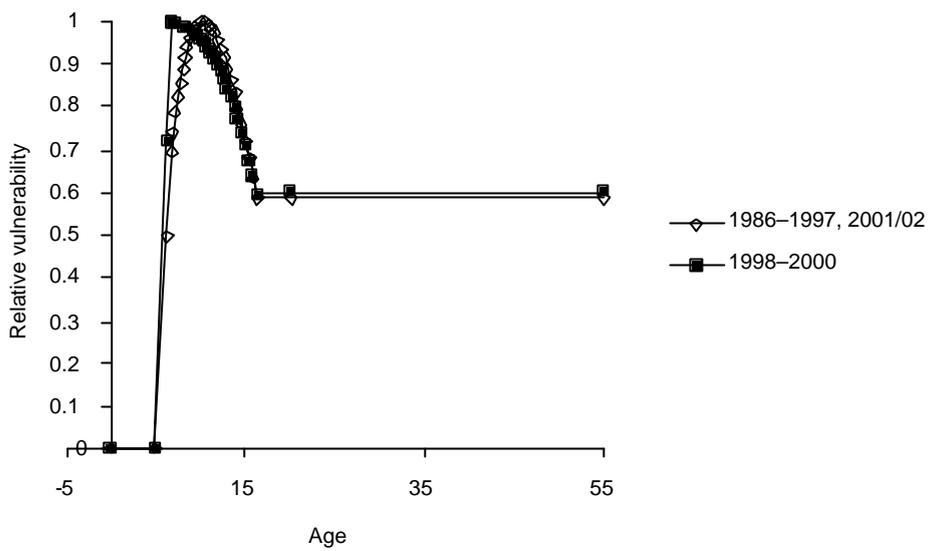


Figure 5.1: Estimated relative age-specific vulnerabilities for longline-caught *Dissostichus eleginoides* in Subarea 48.3.

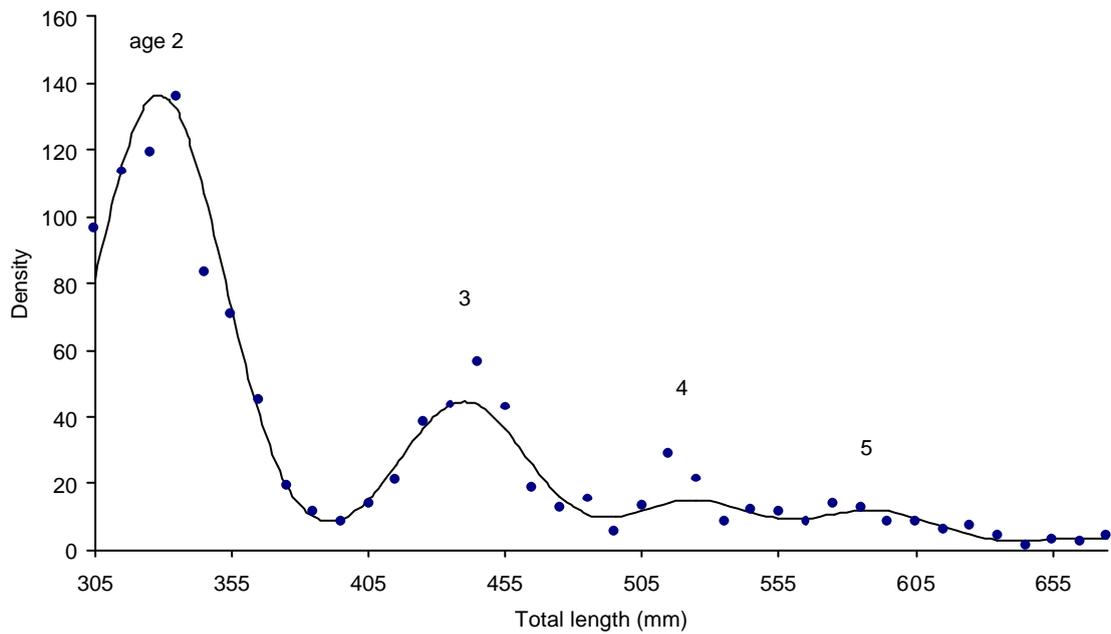


Figure 5.2: Length-density plot for *Dissostichus eleginoides* in Subarea 48.3 from the UK trawl survey in 2002. Peaks corresponding to ages 2–5 are indicated.

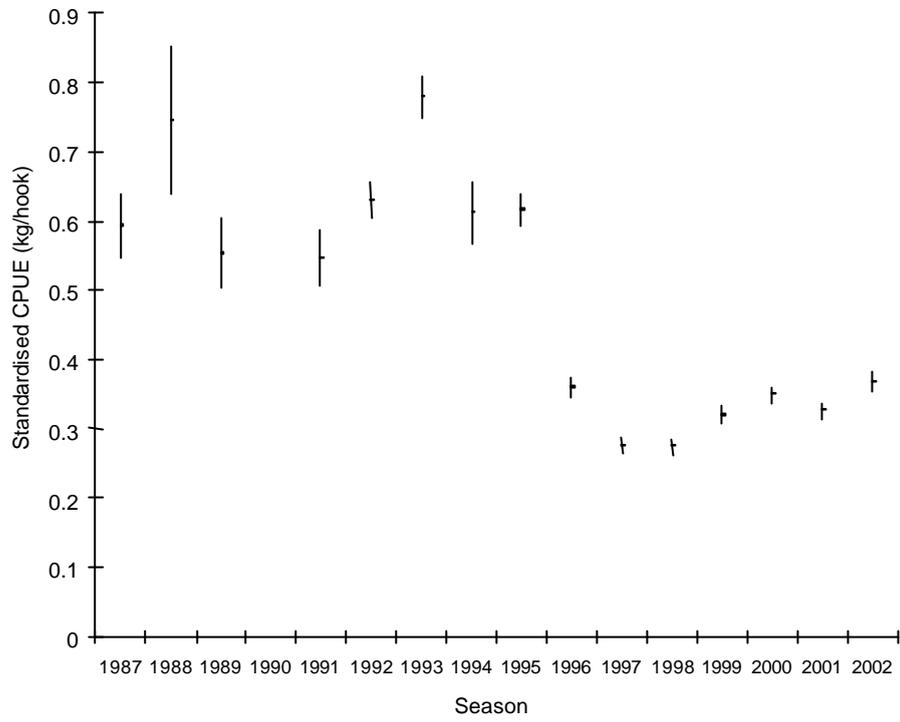


Figure 5.3: Standardised CPUEs and 95% confidence intervals in kg/hook for *Dissostichus eginoides* in Subarea 48.3.

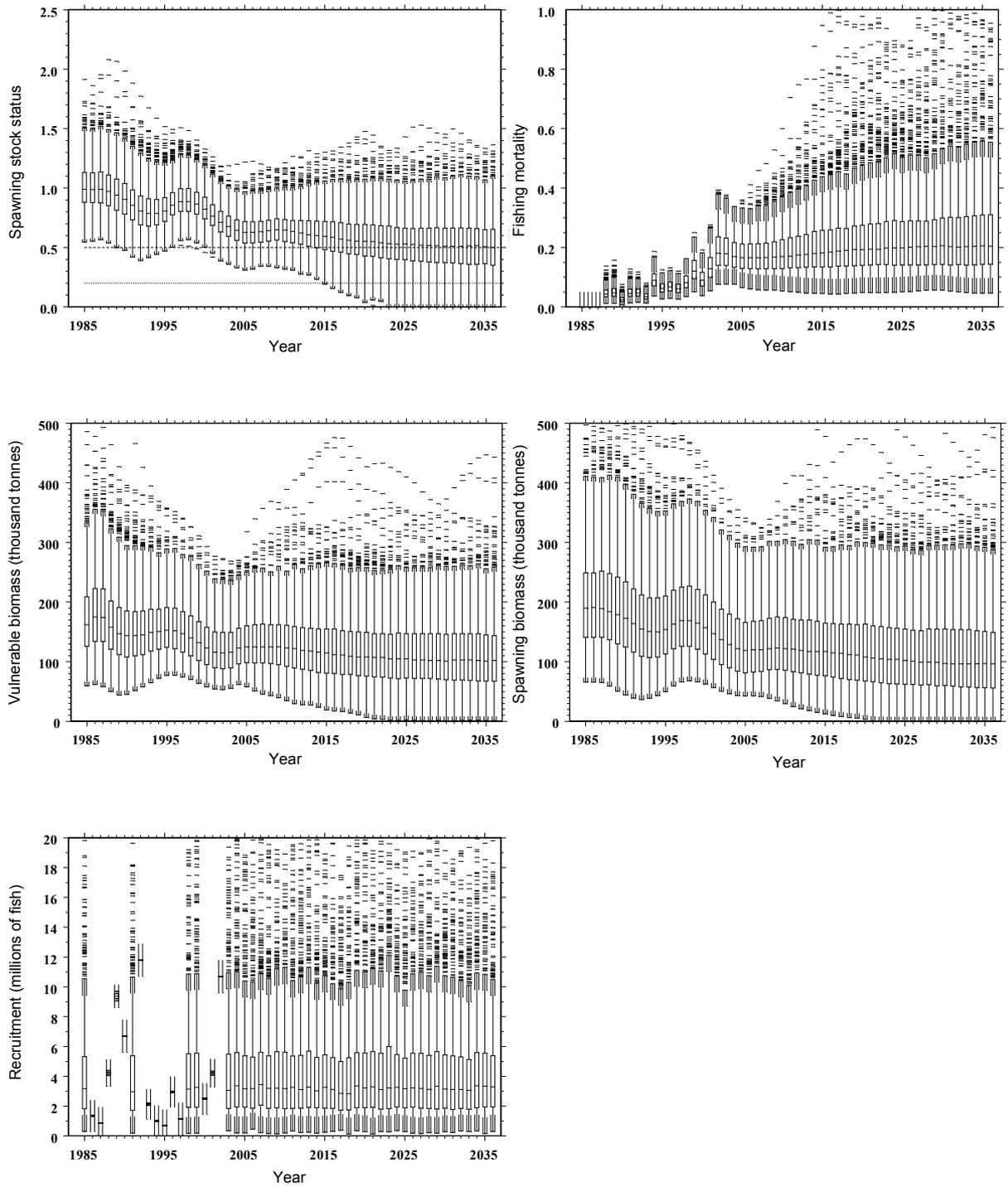


Figure 5.4: Historical and projected trajectories for the final GYM run for *Dissostichus eleginoides* in Subarea 48.3 using shallow water future vulnerabilities (giving a precautionary yield of 7 810 tonnes).

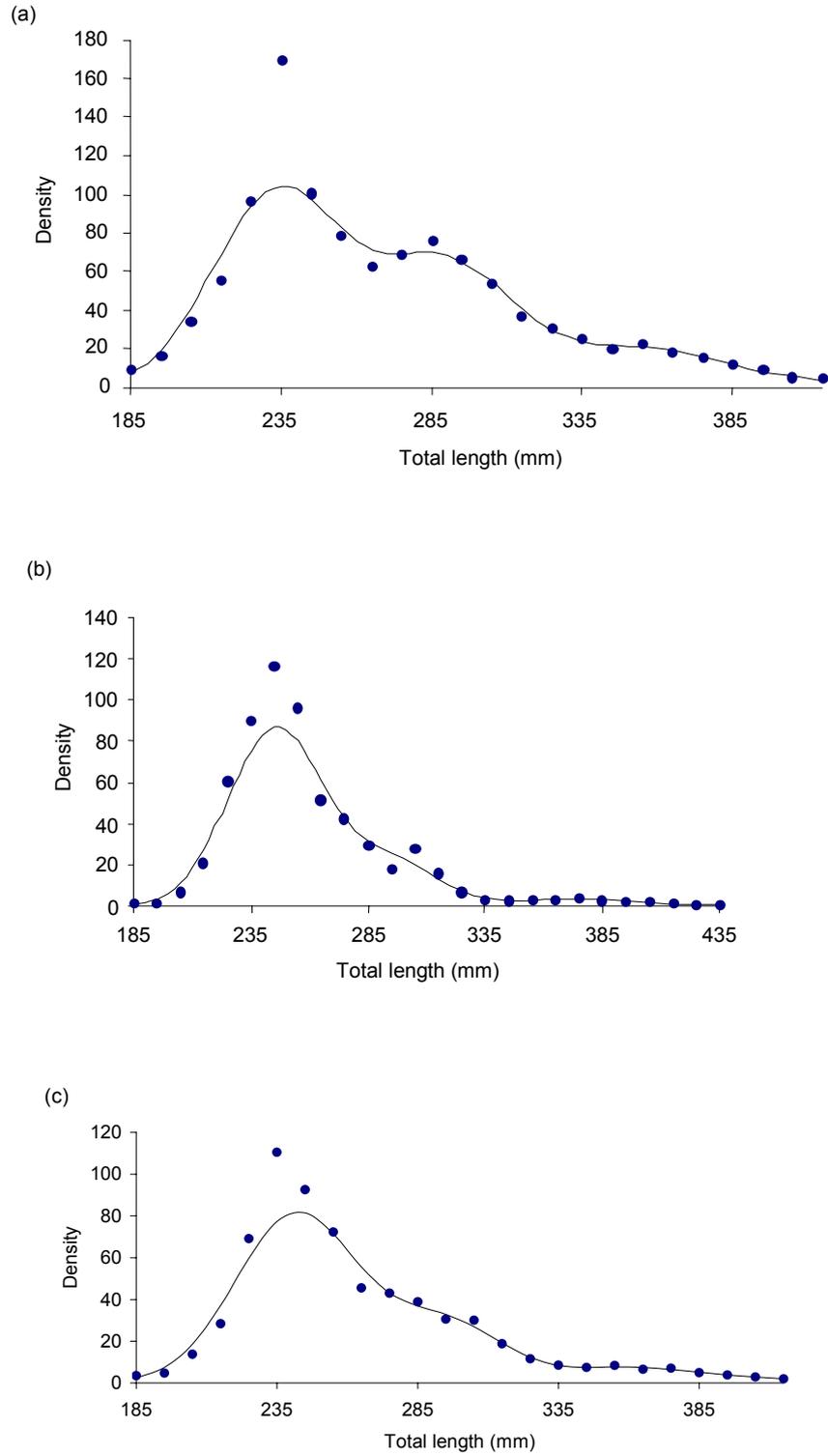


Figure 5.5: Output from the mixture analyses of *Champsocephalus gunnari* length at age in Subarea 48.3 in 2002 from (a) UK survey (*Dorada*), (b) Russian survey (*Atlantida*), and (c) combined (UK and Russian) datasets.

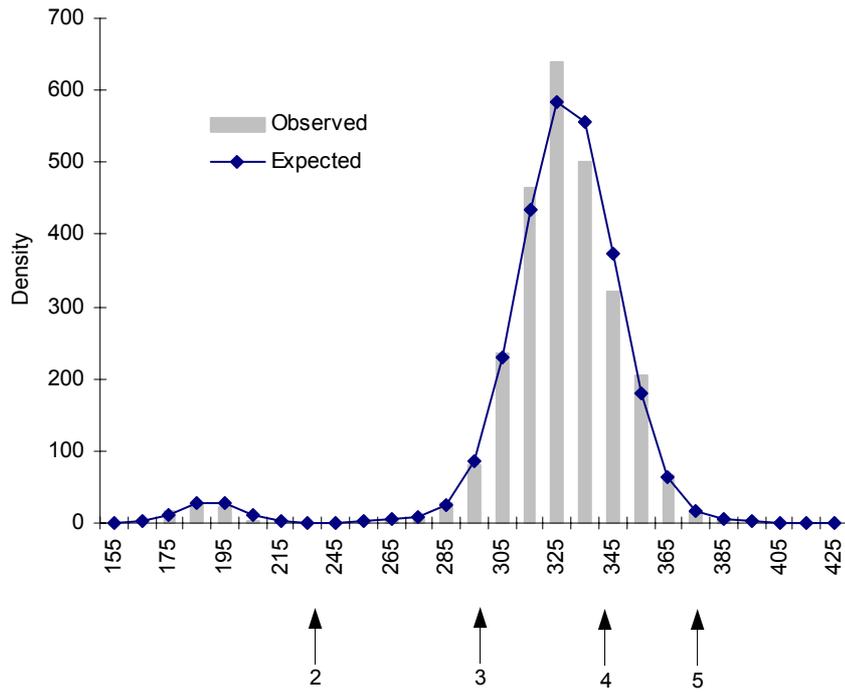


Figure 5.6: Observed densities at length for *Champsocephalus gunnari* with fitted mixtures of distributions for the Australian survey in Division 58.5.2 in 2002. Also shown are the approximate positions of the mean length at age from the von Bertalanffy growth curve.

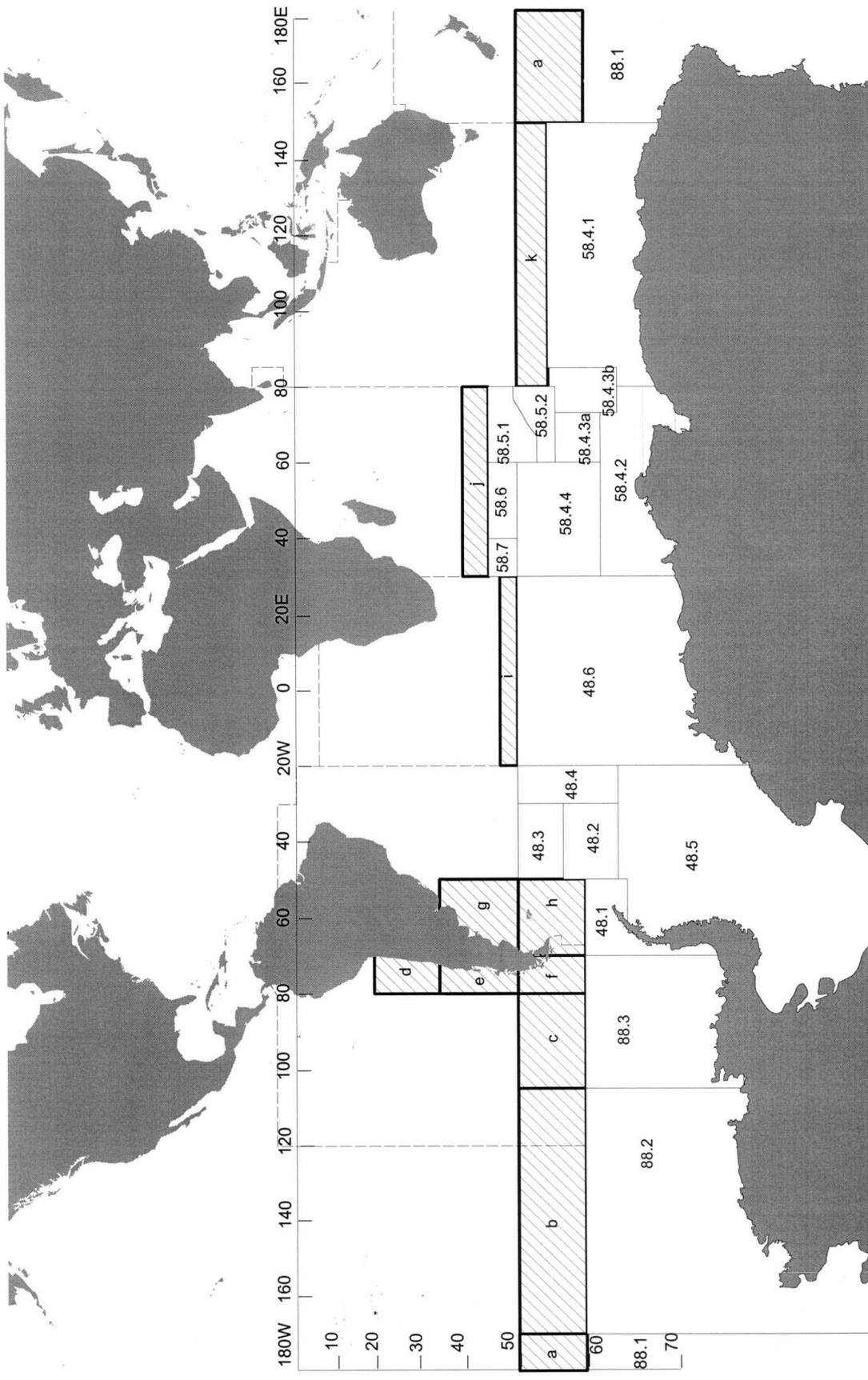


Figure 5.7: Regions outside the CCAMLR Convention Area and within the likely geographic range of *Dissostichus eleginoides*. (a) Southwest Pacific 150–180°E; (b) Southwest Pacific 105–180°W; (c) Southeast Pacific 80–105°W; (d) East Pacific 20–35°S; (e) East Pacific 35–50°S; (f) Southeast Pacific 70–80°W; (g) West Atlantic 35–50°S; (h) Southwest Atlantic 50–70°W; (i) Southeast Atlantic; (j) Western Indian Ocean; (k) Eastern Indian Ocean. Seabed areas for these regions within the depth range 0–1 800m are reported in Table 5.32.

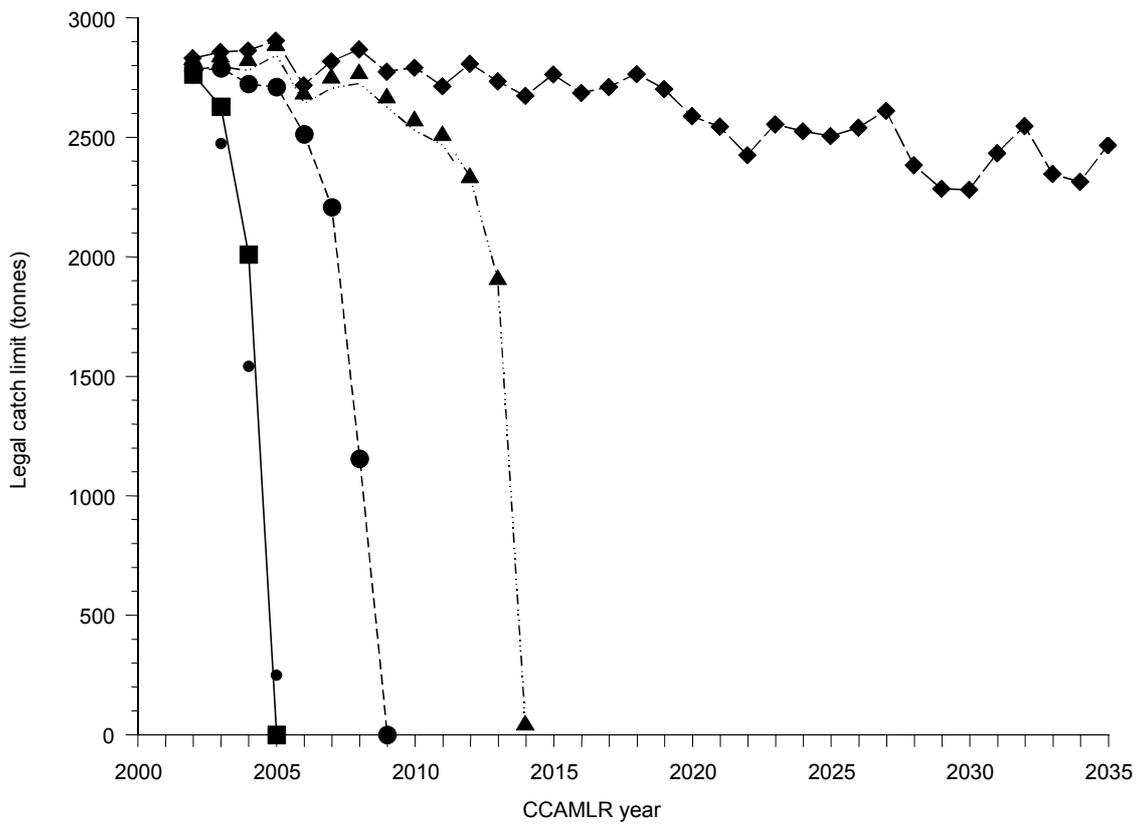


Figure 5.8: Projections of the legal catch limit for *Dissostichus eleginoides*, using the CCAMLR assessment process under the following scenarios of IUU fishing in which the annual IUU catch is: (◆) approximately 0.33x the legal catch limit for 2001, (▲) approximately 1x the legal catch limit for 2001, (●) approximately 2x the legal catch limit for 2001, and (■) approximately 4x the legal catch limit for 2001.

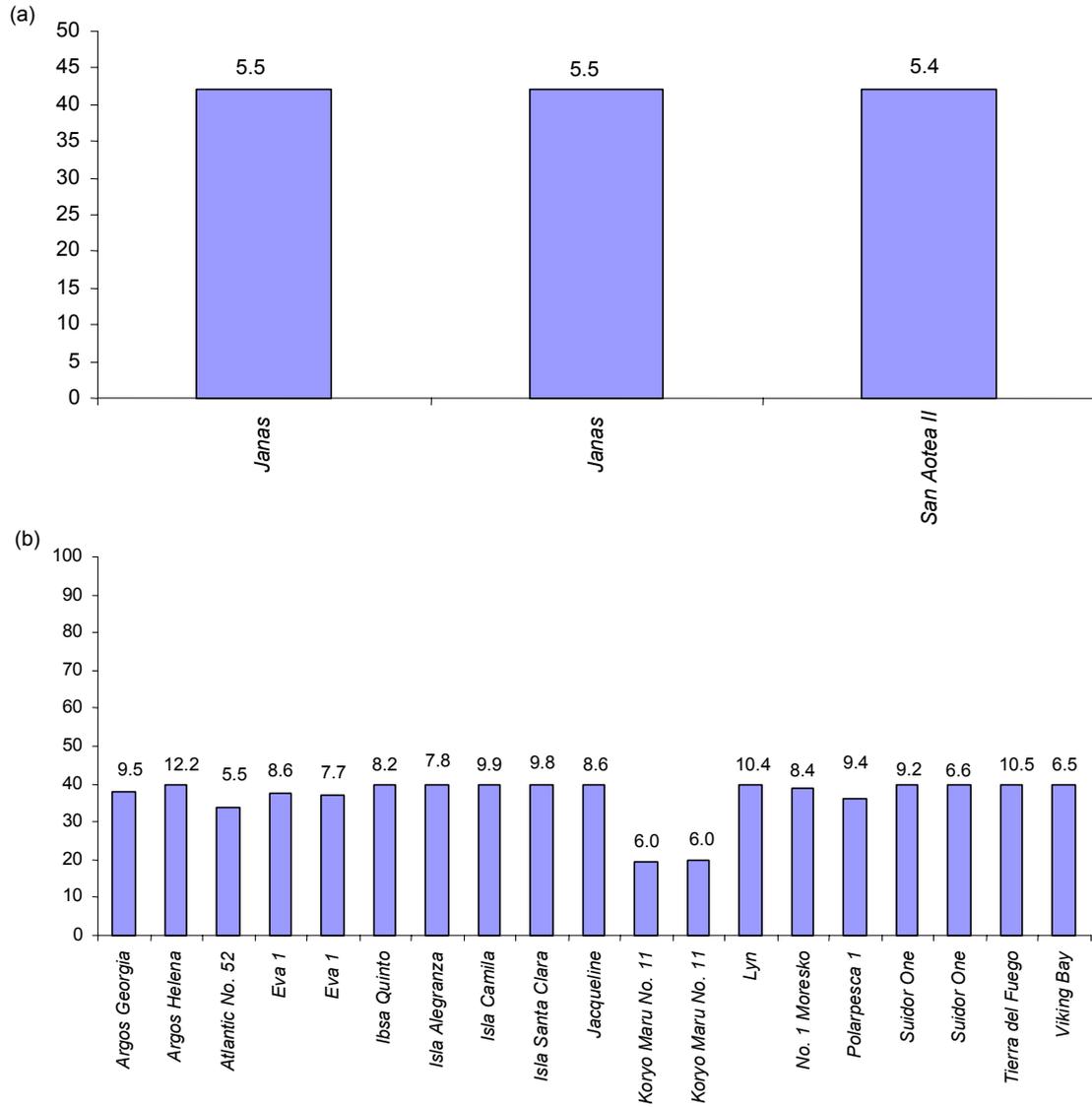


Figure 6.1: Longline weight spacing (y-axis in metres) and weights used (kilograms) by (a) auto and (b) Spanish systems during the 2002 season.

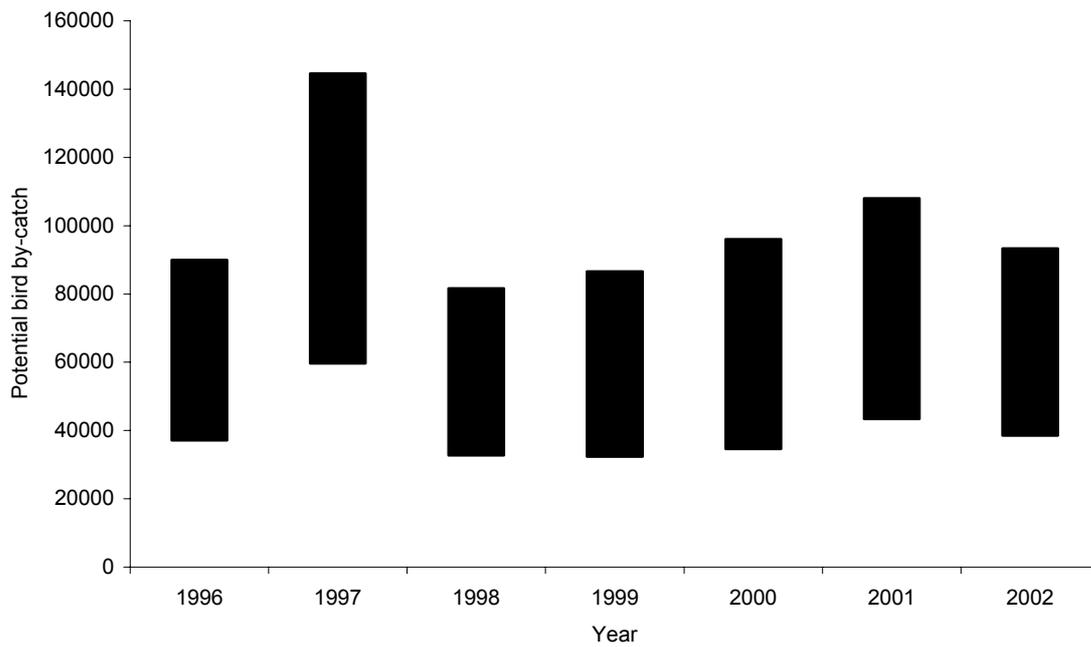


Figure 6.2: The range of estimated potential by-catch of birds in IUU longline fisheries in the Convention Area from 1996 to 2002. The solid bars represent the range from the lower limit of the lower estimate to the upper limit of the upper estimate (see paragraph 6.96).

AGENDA

Working Group on Fish Stock Assessment
(Hobart, Australia, 7 to 17 October 2002)

1. Opening of the meeting
2. Organisation of the meeting and adoption of the agenda
3. Review of available information
 - 3.1 Data requirements specified in 2001
 - 3.1.1 Development of the CCAMLR database
 - 3.1.2 Data processing
 - 3.1.3 Data access
 - 3.1.4 Other
 - 3.2 Fisheries information
 - 3.2.1 Catch, effort, length and age data reported to CCAMLR
 - 3.2.2 Estimates of catch and effort from IUU fishing
 - 3.2.3 Catch and effort data for toothfish fisheries in waters adjacent to the Convention Area
 - 3.2.4 Scientific observer information
 - 3.2.5 Research surveys
 - 3.2.6 Mesh/hook selectivity and related experiments affecting catchability
4. Preparation for assessments
 - 4.1 New information extending time series
 - 4.1.1 Estimation of total removals
 - 4.1.2 Standing stock
 - 4.1.3 Recruitment series
 - 4.1.4 CPUE
 - 4.2 Other parameters
 - 4.3 Status of current assessment methods

5. Assessments and management advice
 - 5.1 New and exploratory fisheries in 2001/02 and for 2002/03
 - 5.1.1 New and exploratory fisheries in 2001/02
 - 5.1.2 New fisheries notified for 2002/03
 - 5.1.3 Exploratory fisheries notified for 2002/03
 - 5.1.4 Progress towards assessments of new and exploratory fisheries
 - 5.2 Assessed fisheries
 - 5.2.1 *Dissostichus eleginoides* South Georgia (Subarea 48.3)
 - 5.2.2 *Dissostichus eleginoides* Kerguelen Islands (Division 58.5.1)
 - 5.2.3 *Dissostichus eleginoides* Heard Island (Division 58.5.2)
 - 5.2.4 *Champtocephalus gunnari* South Georgia (Subarea 48.3)
 - 5.2.5 *Champtocephalus gunnari* Heard Island (Division 58.5.2)
 - 5.3 Other fisheries
 - 5.3.1 *Dissostichus eleginoides* Prince Edward and Marion Islands (Subarea 58.7) and Crozet Islands (Subarea 58.6)
 - 5.3.2 *Champtocephalus gunnari* South Shetlands (Subarea 48.1)
 - 5.3.3 Myctophids South Georgia (Subarea 48.3)
 - 5.3.4 Crabs South Georgia (Subarea 48.3)
 - 5.3.5 Squid South Georgia (Subarea 48.3)
 - 5.3.6 Other fisheries
 - 5.4 By-catch
 - 5.4.1 Assessments of the status of by-catch species or groups
 - 5.4.2 Assessments of the expected impact of target species fisheries on the by-catch species or groups
 - 5.4.3 Consideration of mitigation measures
 - 5.4.4 Advice to the Scientific Committee
 - 5.5 Regulatory framework
 - 5.6 Evaluation of the threats arising from IUU activities
 - 5.6.1 Review of historical trends in IUU activity
 - 5.6.2 Evaluation of future threats of IUU activity
 - 5.6.3 Advice to the Scientific Committee
6. Incidental mortality of mammals and seabirds arising from fishing (ad hoc WG-IMAF Report)
 - 6.1 Intersessional work of ad hoc WG-IMAF

- 6.2 Incidental mortality of seabirds during regulated longline fishing in the Convention Area
 - 6.2.1 Data submitted for the 2001/02 and the beginning of the 2002/03 seasons
 - 6.2.2 Evaluation of levels of incidental mortality
 - 6.2.3 Implementation of Conservation Measure 29/XIX
 - 6.2.4 Research into and experience with mitigating measures
 - 6.2.5 Revision of Conservation Measure 29/XIX
- 6.3 Incidental mortality of seabirds during unregulated longline fishing in the Convention Area
- 6.4 Incidental mortality of seabirds during longline fishing outside the Convention Area
- 6.5 Research into the status of seabirds
- 6.6 International and national initiatives relating to incidental mortality of seabirds in relation to longline fishing
- 6.7 Incidental mortality of seabirds in relation to new and exploratory fisheries
 - 6.7.1 Assessments of risk in CCAMLR subareas and divisions
 - 6.7.2 New and exploratory fisheries operational in 2001/02
 - 6.7.3 New and exploratory fisheries proposed for 2002/03
- 6.8 Other incidental mortality
 - 6.8.1 Interactions involving marine mammals with longline fishing operations
 - 6.8.2 Interactions involving marine mammals and seabirds with trawl or pot fishing operations
- 6.9 Advice to the Scientific Committee
- 7. Biology, ecology and demography of target and by-catch species
 - 7.1 Information available to the meeting
 - 7.2 Update species profiles
 - 7.3 Identify gaps in the knowledge
- 8. Considerations of ecosystem management
 - 8.1 Interactions with WG-EMM
 - 8.2 Ecological interactions (e.g. multi-species, benthos etc.)

9. Future Assessments
 - 9.1 New and planned assessment methods

10. Scheme of International Scientific Observation
 - 10.1 Summary of information extracted from observer reports and/or provided by technical coordinators

 - 10.2 Implementation of the observer program
 - 10.2.1 Scientific Observers Manual
 - 10.2.2 Sampling strategies
 - 10.2.3 Priorities

 - 10.3 Information relevant to SCOI

 - 10.4 Advice to the Scientific Committee

11. CCAMLR website

12. Future work
 - 12.1 Data requirements
 - 12.2 Organisation of intersessional activities in subgroups
 - 12.3 Plans for WG-FSA-2003

13. Other business
 - 13.1 Consideration of a proposal to list toothfish under CITES Appendix II
 - 13.2 FAO's Fisheries Global Information System (FIGIS)
 - 13.3 Publication matters
 - 13.4 Other matters

14. Adoption of the report

15. Close of the meeting.

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(Hobart, Australia, 7 to 17 October 2002)

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Philippa McCulloch

Information Technology

Information Technology Manager

Fernando Cariaga

Information Technology Support Specialist

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LIST OF DOCUMENTS

Working Group on Fish Stock Assessment
(Hobart, Australia, 7 to 17 October 2002)

WG-FSA-02/1	Provisional and Annotated Provisional Agenda for the 2002 Meeting of the Working Group on Fish Stock Assessment (WG-FSA)
WG-FSA-02/2	List of participants
WG-FSA-02/3	List of documents
WG-FSA-02/4	A statistical method for analysing the extent of IUU fishing in CCAMLR waters: application to Subarea 48.3 D.J. Agnew and G.P. Kirkwood (United Kingdom) (<i>CCAMLR Science</i> , submitted)
WG-FSA-02/5	The rate of incidental mortality of birds in the IUU longline fishery in Subarea 48.3 D.J. Agnew and G.P. Kirkwood (United Kingdom) (<i>CCAMLR Science</i> , submitted)
WG-FSA-02/6	The role of fish in the Antarctic marine food web: differences between inshore and offshore waters in the southern Scotia Arc and west Antarctic Peninsula E. Barrera-Oro (Argentina)
WG-FSA-02/7	Fish species profiles – mackerel icefish I. Everson (United Kingdom)
WG-FSA-02/8	Fish species profiles – toothfish I. Everson (United Kingdom)
WG-FSA-02/9	Fishery Information for WG-FSA-02 Secretariat
WG-FSA-02/10	CCAMLR Survey Database: development during 2002 Secretariat
WG-FSA-02/11 Rev. 1	A summary of observations on board longline vessels operating within the CCAMLR Convention Area Secretariat

- WG-FSA-02/12 Rev. 1 Summary of observations aboard trawlers operating in the Convention Area during the 2001/02 season
Secretariat
- WG-FSA-02/13 Rev. 2 A summary of scientific observations related to Conservation Measures 29/XIX, 63/XV and 173/VIII
Secretariat
- WG-FSA-02/14 Summary of an observation aboard a pot vessel operating in the Convention Area during the 2001/02 season
Secretariat
- WG-FSA-02/15 Observations on the diet of Antarctic toothfish (*Dissostichus mawsoni*) from the Ross Sea, Antarctica (CCAMLR Statistical Subarea 88.1)
J.M. Fenaughty, D.W. Stevens and S.M. Hanchet (New Zealand) (CCAMLR Science, submitted)
- WG-FSA-02/16 Population dynamics of wandering albatrosses *Diomedea exulans* at sub-Antarctic Marion Island: longline fishing and environmental influences
D.C. Nel, P.G. Ryan and J. Cooper (South Africa)
- WG-FSA-02/17 Seabird by-catch in the Patagonian toothfish longline fishery at the Prince Edward Islands: 2001–2002
B.P. Watkins (South Africa)
- WG-FSA-02/18 Progress report of Chilean research on albatross ecology and conservation
J. Arata and C.A. Moreno (Chile)
- WG-FSA-02/19 Brief information on the results of the bottom trawl and trawl–acoustic surveys carried out by STM *Atlantida* in the South Georgia subarea (48.3) during January to March 2002
V.N. Shnar, V.A. Khvichia and A.P. Malyshko (Russia)
- WG-FSA-02/20 Some biological characteristics of Antarctic fish stocks in the Elephant Island–South Shetland Island region in January–February 2002
K.-H. Kock (Germany), C.D. Jones (USA), J. Appel (Germany), G. von Bertouch (CCAMLR Secretariat), D.F. Doolittle (USA), M. la Mesa (Italy), L. Psenichnov (Ukraine), R. Riehl (Germany), T. Romeo (Italy), S. Schöling (Germany) and L. Zane (Italy)

- WG-FSA-02/21 Mesoscale abundance of fish in a 'box' west of Elephant Island
K.-H. Kock (Germany), C.D. Jones (USA), J. Appel (Germany),
G. von Bertouch (CCAMLR Secretariat), D.F. Doolittle (USA),
M. la Mesa (Italy), L. Psenichnov (Ukraine), R. Riehl (Germany), T.
Romeo (Italy), S. Schöling (Germany) and
L. Zane (Italy)
- WG-FSA-02/22 Demersal longlines with integrated weight: a preliminary assessment
of sink rates, fish catch success and operational effects
G. Robertson (Australia), M. McNeill, B. King (New Zealand) and
R. Kristensen (Norway)
- WG-FSA-02/23 The status of black-browed albatrosses *Thalassarche melanophrys*
at Diego de Almagro Island, Chile
K. Lawton, G. Robertson (Australia), J. Valencia (Chile),
B. Wienecke and R. Kirkwood (Australia)
- WG-FSA-02/24 Standing stock estimates of finfish biomass from the 2002 *Polarstern*
bottom trawl survey around Elephant Island and the South Shetland
Islands (Subarea 48.1) with some notes on the composition of
catches taken north of Joinville Island – D'Urville Island
K.-H. Kock (Germany), C.D. Jones (USA), J. Appel (Germany),
G. von Bertouch (CCAMLR Secretariat), D.F. Doolittle (USA),
M. la Mesa (Italy), L. Psenichnov (Ukraine), R. Riehl (Germany), T.
Romeo (Italy), S. Schöling (Germany) and
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- WG-FSA-02/25 How fast do demersal longlines sink?
G. Robertson (Australia), E. Moe, R. Haugen (Norway) and
B. Wienecke (Australia)
- WG-FSA-02/26 Fecundity and size at sexual maturity of the bigeye grenadier
(*Macrourus holotrachys*) at South Georgia (CCAMLR
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T. Mulvey, S.A. Morley, M. Belchier and J. Dickson (United
Kingdom)
- WG-FSA-02/27 Fecundity and egg size of Lithodid crabs from CCAMLR
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S.A. Morley, M. Belchier, J.D. Dickson and T.M. Mulvey (United
Kingdom)
- WG-FSA-02/28 Movement and growth of tagged toothfish around South Georgia and
Shag Rocks (Subarea 48.3)
T.R. Marlow, D.J. Agnew and I. Everson (United Kingdom)
(*CCAMLR Science*, submitted)

- WG-FSA-02/29 Notes for identifying the three macrourid species, *M. holotrachys*, *M. whitsoni* and *M. carinatus* in CCAMLR Subarea 48.3
S.A. Morley, M. Belchier, M.G. Purves, T. Mulvey and J. Dickson (United Kingdom)
- WG-FSA-02/30 Progress report on attempts to conduct an experiment on the effectiveness of mitigation measures used with the double-line system of longline fishing
G. Robertson and P. Virtue (Australia)
- WG-FSA-02/31 Information on the spawning season and gonadosomatic indices of *Dissostichus mawsoni* from Subarea 88.1 in the 2001/02 season
G.J. Patchell (New Zealand)
- WG-FSA-02/32 Review of identity and biology of species of the family Macrouridae, from the CCAMLR fishery in the Ross Sea, Antarctica
P.M. Marriott and P. McMillan (New Zealand)
(*CCAMLR Science*, submitted)
- WG-FSA-02/33 Evidence to support the annual formation of growth zones in otoliths of Antarctic toothfish (*Dissostichus mawsoni*)
P.L. Horn, C.P. Sutton (New Zealand) and A.L. DeVries (USA)
(*CCAMLR Science*, submitted)
- WG-FSA-02/34 Fish stock assessment survey in Subarea 48.3
E. Everson, T. Marlow, M. Belchier, R. Forster, S. Morley, A. North, J. Szlakowski and S. Wilhelms (United Kingdom)
- WG-FSA-02/35 Bottom trawls used in UK fish surveys in Subarea 48.3
I. Everson, P. Hicken, T. Marlow, T. North, M. Belchier, C. Jones and T. Daw (United Kingdom)
- WG-FSA-02/36 Seabird interactions/mortality with longliners and trawlers in the Falkland/Malvinas Island waters
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- WG-FSA-02/37 Research under way in New Zealand on seabirds vulnerable to fisheries interactions
S. Moore and J. Molloy (New Zealand)
- WG-FSA-02/38 The New Zealand toothfish fishery in Subareas 88.1 and 88.2 from 1997/98 to 2001/02
S.M. Hanchet, P.L. Horn, M.L. Stevenson and N.W. McL. Smith (New Zealand)

- WG-FSA-02/39 Information on incidental mortality of seabirds and other protected species in the US west coast pelagic longline fishery
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- WG-FSA-02/40 Review of rattail and skate by-catch and analysis of rattail standardised CPUE from the Ross Sea toothfish fishery in Subarea 88.1 from 1997/98 to 2001/02
R.G. Blackwell and S.M. Hanchet (New Zealand)
- WG-FSA-02/41 Preliminary standardised CPUE analysis of the New Zealand toothfish fishery in Subarea 88.1 from 1997/98 to 2001/02
R.G. Blackwell and S.M. Hanchet (New Zealand)
- WG-FSA-02/42 Morphometrics, maturity and movement of the Antarctic skates *Amblyraja georgiana* and *Bathyraja eatonii* in the Ross Sea
M.P. Francis and N.W. McL. Smith (New Zealand)
- WG-FSA-02/43 Spatio-temporal trends of longline fishing effort in the Southern Ocean and implications for seabird by-catch
G.N. Tuck, T. Polacheck and C.M. Bulman (Australia)
- WG-FSA-02/44 Mackerel icefish biomass and distribution on the results of acoustic survey carried out in February–March 2002
S.M. Kasatkina, V.Yu. Sunkovich, A.P. Malysenko and Zh.A. Frolkina
(*CCAMLR Science*, submitted)
- WG-FSA-02/45 Methods of comparative tests of bottom trawls (trawls systems)
A.S. Myskov, Zh.A. Frolkina, S.M. Kasatkina and P.S. Gasyukov (Russia)
- WG-FSA-02/46 Review of fish and invertebrate by-catch in trawl fisheries in Division 58.5.2
E.M. van Wijk and R. Williams (Australia)
- WG-FSA-02/47 Preliminary assessment of *Champscephalus gunnari* on the Heard Island Plateau (Division 58.5.2) based on a survey in May 2002
A.J. Constable, R. Williams and T. Lamb (Australia)
- WG-FSA-02/48 Age, growth and size at sexual maturity of *Macrourus carinatus* from the CCAMLR fisheries in division 58.5.2
E.M. van Wijk, R. Williams and A.J. Constable (Australia)
(*CCAMLR Science*, submitted)
- WG-FSA-02/49 CCAMLR Working Group on Fish Stock Assessment –
Report of the Intersessional Subgroup on By-catch

- WG-FSA-02/50 Implementation of the United States National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries (NPOA-Seabirds)
K.S. Rivera (USA)
- WG-FSA-02/51 First Annual Report of the CCAMLR Otolith Network, 2002
- WG-FSA-02/52 Report of the WG-FSA Intersessional Subgroup on Sampling Catches from Longlines
- WG-FSA-02/53 Changes to seabird avoidance regulations in Alaska demersal longline fisheries based on scientific research on effectiveness of mitigation measures
K.S. Rivera (USA)
- WG-FSA-02/54 Identification of *Amblyraja* species in the longline fishery in Subarea 48.3 – CCAMLR
M. Endicott (United Kingdom), L.J.V. Compagno (South Africa) and D.J. Agnew (United Kingdom)
- WG-FSA-02/55 Preliminary estimation of ray by-catch in the longline fishery in Subarea 48.3
D.J. Agnew, J. Pearce and M. Endicott (United Kingdom)
- WG-FSA-02/56 A study of UK and Russian surveys using acoustics to augment trawling methods in shelf waters off South Georgia (Subarea 48.3)
S. Kasatkina, P. Gasiukov (Russia), C. Goss, I. Everson, M. Belchier, T. Marlow, A. North and M. Collins (United Kingdom) (*CCAMLR Science*, submitted)
- WG-FSA-02/57 Progress report on age determination of mackerel icefish using otoliths
P. Gasiukov, K. Shust (Russia) and I. Everson (United Kingdom)
- WG-FSA-02/58 Workshop on austral summer 2002 fish surveys at South Georgia carried out by Russia and the UK
- WG-FSA-02/59 Standing stock estimates of mackerel icefish (*Champsocephalus gunnari*) from the UK and Russian bottom trawl survey in the 2001/02 season within Subarea 48.3
- WG-FSA-02/60 Behaviour of *Dissostichus eleginoides* fitted with archival tags at Heard Island: preliminary results
R. Williams and T. Lamb (Australia)

- WG-FSA-02/61 CMIX: User's Manual and Specifications
W. de la Mare, A. Constable, E. van Wijk, T. Lamb and B. Ronai (Australia)
- WG-FSA-02/62 Generalised Yield Model: User's Manual and Specifications
A.J. Constable, A.T. Williamson and W.K. de la Mare (Australia)
- WG-FSA-02/63 Fish Heaven Manual
I. Ball and A.T. Williamson (Australia)
- WG-FSA-02/64 Revised selectivities for *Dissostichus eleginoides* taken by longliners in Subarea 48.3
G.P. Kirkwood (United Kingdom)
- WG-FSA-02/65 Preliminary analysis on the Kerguelen shelf icefish *Champsocephalus gunnari* stock from 1996/97 to 2001/02: no evidence in the recovery!
G. Duhamel and J. Claudet (France)
- WG-FSA-02/66 Informe sobre la operación del B/P naseo Viking Sky durante Setiembre–Octubre del 2001: Atlántico sudoccidental (latitudes 37°–38° sur y 42° sur) Área estadística 41
O.D. Pin y H. Nión (Uruguay)
- WG-FSA-02/67 Informe preliminar sobre un viaje de pesca de merluza negra (*Dissostichus eleginoides*) del B/P Viarsa I, en el Océano Indico oriental (Área Estadística 57) – Abril–junio 2002
H. Nion y O.D. Pin (Uruguay)
- WG-FSA-02/68 Short note: some software developments within the Australian Antarctic Division
I. Ball and A. Constable (Australia)
- WG-FSA-02/69 Evaluation of the effects of illegal, unregulated and unreported (IUU) fishing on the legal catch of fisheries for *Dissostichus eleginoides*
A.J. Constable (Australia)
- WG-FSA-02/70 Preliminary assessment of *Dissostichus eleginoides* on the Heard Island Plateau (Division 58.5.2) based on a survey in May 2002
A.J. Constable, R. Williams and T. Lamb (Australia)
- WG-FSA-02/71 An update on conversion factors for toothfish in the Ross Sea (Subareas 88.1 and 88.2)
J.M. Fenaughty and N.W. McL. Smith (New Zealand)

WG-FSA-02/72	United States research under way on seabirds vulnerable to fisheries interactions K.S. Rivera (USA)
WG-FSA-02/73 Rev. 1	Food and feeding of two Channichthyids, <i>Champscephalus gunnari</i> and <i>Chaenocephalus aceratus</i> , around Elephant Island and in the South Shetland Islands (Subarea 48.1) in 2001 and 2002 H. Flores, K.-H. Kock, S. Wilhelms (Germany) and C.D. Jones (USA)
WG-FSA-02/74	Age-at-length of Patagonian toothfish from the Falkland/Malvinas Islands J. Ashford, A. Arkhipkin, C. Jones and S. Bobko
WG-FSA-02/75	Age-at-length of Patagonian toothfish from South Georgia J. Ashford, M. Belchier, C. Jones and S. Bobko
WG-FSA-02/76	An updated assessment of the toothfish (<i>Dissostichus eleginoides</i>) resource in the Prince Edward Islands vicinity and extension taking commercial catch-at-length data into account A. Brandão, D.S. Butterworth, B.P. Watkins and L. Staveres (South Africa)
WG-FSA-02/77	Age and growth of Scotia Sea icefish <i>Chaenocephalus aceratus</i> (Lönnberg, 1906), from the South Shetland Islands M. La Mesa, J. Ashford, E. Larson and M. Vacchi (CCAMLR Science, submitted)
WG-FSA-02/78	Stock assessment of <i>D. eleginoides</i> in Subarea 48.3 using dynamic production models P.S. Gasiukov and R.S. Dorovskich (Russia) (CCAMLR Science, submitted)
WG-FSA-02/79	Distribution, biological characteristic and biomass of icefish from the results of inventory trawling survey carried out by STM-8390 <i>Atlantida</i> in January–March 2002 Zh.A. Frolkina and P.S. Gasiukov (Russia)
WG-FSA-02/80	Subgroup on Assessment Methods: Report to the Working Group on Fish Stock Assessment 2002 A.J. Constable (Subgroup Coordinator)
WG-FSA-02/81 Rev. 1	Estimates of the total removal of <i>Dissostichus</i> spp. from inside and outside the Convention Area for the 2001/02 fishing season Secretariat

WG-FSA-02/82	Preliminary data on seabird by-catch along the Patagonian shelf by Argentine longline fishing vessels: period 1999–2001 Delegation of Argentina
Other Documents	
WG-EMM-02/8	Database of CCAMLR working documents CCAMLR Secretariat
WG-EMM-02/24	World Fisheries Congress J.P. Croxall (United Kingdom)
CCAMLR-XXI/5	Notification of Spain's intention to initiate an exploratory fishery in Subarea 88.1 for <i>Dissostichus</i> spp. in the 2002/03 season Delegation of Spain
CCAMLR-XXI/6	Notification of exploratory fisheries for <i>Dissostichus</i> spp. in the 2002/2003 season Delegation of South Africa
CCAMLR-XXI/7	Notification by New Zealand of its intention to continue an exploratory fishery for <i>Dissostichus</i> spp. in CCAMLR Subareas 88.1 and 88.2 for the 2002/03 season Delegation of New Zealand
CCAMLR-XXI/8	Notification by New Zealand of its intention to continue an exploratory fishery for <i>Dissostichus</i> spp. in CCAMLR Subarea 48.6 for the 2002/03 season Delegation of New Zealand
CCAMLR-XXI/9	Notification of exploratory fisheries for <i>Dissostichus</i> spp. in the 2002/03 season Delegation of Japan
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CCAMLR-XXI/11	Notification of Australia's intention to conduct an exploratory longline fishery in Division 58.4.3a and 58.4.3b for <i>Dissostichus</i> spp. Delegation of Australia
CCAMLR-XXI/12	Notification of Australia's intention to conduct an exploratory longline fishery in Division 58.4.2 for <i>Dissostichus</i> spp. Delegation of Australia

CCAMLR-XXI/16	Notification of Russia's intention to conduct an exploratory longline fishery in 2002/03 in Subareas 88.1 and 88.2 Delegation of Russia
CCAMLR-XXI/BG/4	Rapport de la Dix-Septieme Reunion Annuelle de L'iccat (Murcia, Espagne, novembre 2001) Observateur de la CCAMLR (Communauté européenne)
SC-CAMLR-XXI/6	Proposed partnership between CCAMLR and FIGIS-FIRMS Secretariat
SC-CAMLR-XXI/7	A proposal to modify the boundaries of Statistical Division 58.5.2 to define William's Ridge Delegation of Australia
SC-CAMLR-XXI/BG/7	Fishing gear, marine debris and oil associated with seabirds at Bird Island, South Georgia, 2001/02 Delegation of the United Kingdom
SC-CAMLR-XXI/BG/9	Summary of notifications of new and exploratory fisheries in 2002/03 Secretariat
SC-CAMLR-XXI/BG/18	Conservation of marine areas in the Australian EEZ around the territory of Heard Island and McDonald Islands: notice of intent by Australia to declare a HIMI Marine Reserve and conservation zone Delegation of Australia
SC-CAMLR-XXI/BG/19 Rev.1	Information on the crab fishery in Subarea 48.3 in 2001/02 and notification for 2002/03 Delegation of Japan
SC-CAMLR-XXI/BG/20	Progress toward an agreement on the conservation of albatrosses and petrels Delegation of Australia

**INTERSESSIONAL WORK PLAN FOR
AD HOC WG-IMAF FOR 2002/03**

INTERSESSIONAL WORK PLAN FOR AD HOC WG-IMAF FOR 2002/03

The Secretariat will coordinate the intersessional work of the IMAF group. An interim review of work will be conducted in June 2003 and advised to ad hoc WG-IMAF at the time of WG-EMM (August 2003). The outcome of the intersessional work will be reviewed in September 2003 and reported as a tabled paper to WG-IMAF in October 2003.

¹ In addition to work coordinated by the Science Officer (Secretariat) * SODA: Scientific Observer Data Analyst

Task/Topic	Paragraphs of WG-FSA Report	Members' Assistance ¹	Start/ Completion Deadlines	Action	
1. Planning and coordination of work:					
1.1	Circulate materials on IMAF matters as contained in reports of current meetings of CCAMLR.	Standing request	Dec 2002	Circulate all relevant sections of CCAMLR-XXI to IMAF group members, and technical coordinators and (via them) to scientific observers.	
1.2	Circulate papers submitted to WG-FSA on IMAF matters.	Standing request	Dec 2002	Circulate the list of papers submitted to WG-FSA on IMAF matters and advise that copies of papers may be provided on request. Circulate the papers requested.	
1.3	Acknowledge work of technical coordinators and scientific observers.	Standing request	Dec 2002	Commend technical coordinators and all observers for their efforts in the 2001/02 fishing season.	
1.4	Review new and exploratory fishery notifications.	Standing request	B. Baker (Australia)	At submission deadline	Transmit hard copies of notifications to Mr Baker to prepare initial draft of IMAF table.
1.5	Membership of WG-IMAF.	Standing request 6.4	Members	Nov 2002/ as required	Request nomination of new members to IMAF. Request all Members to send their representatives to the next IMAF meeting.
2. Members' research and development activities:					
2.1	Update information on national research programs on albatrosses, giant petrels and white-chinned petrels, in relation to:	Standing request 6.113	Members, IMAF members, technical coordinators, nominated scientists	Nov 2002/ Sep 2003	Use existing standard formats for this submission, where available. Secretariat to develop new formats as appropriate.
	(i) status and trends of populations;				
	(ii) foraging range and distribution;				
	(iii) genetic profiles of albatrosses, giant petrels and white-chinned petrels; and				
	(iv) number and nature of by-catch specimens and samples.	6.116			

	Task/Topic	Paragraphs of WG-FSA Report	Members' Assistance ¹	Start/Completion Deadlines	Action
2.2	Risk assessment of seabird by-catch in the Convention Area.	Standing request	IMAF members	Nov 2002/ Sep 2003	Further work as appropriate to update SC-CAMLR-XXI/BG/21 for the Scientific Committee. Circulate any new tabled papers relating to seabird at-sea distributions to Mr Baker, Prof. Croxall and Dr Gales – and to other WG-IMAF members as requested. Liaise with BirdLife International (Dr Nel) in respect of outputs from seabird range workshop.
2.3	Information on the development and use of fisheries-related methods of the avoidance of incidental mortality of seabirds. In particular, information is sought on the following: <ul style="list-style-type: none"> • seabird capture rates in relation to artificial bait, snoodline and mainline colour, bait depth and sink rates; • optimum configuration of line-weighting regimes and equipment; • automated methods for adding and removing weights to and from the line; • line-setting devices for autoline vessels; • underwater longline setting devices; • feasibility of using video recording of line hauling operations for observations on seabird incidental catch; • tests of/experiences with paired streamer lines and boom-and-bridle arrangements; and • experiences with revised requirements for line weighting for Spanish system vessels. 	Standing request 6.111	Members, IMAF members, technical coordinators	Nov 2002/ Sep 2003	Request information, collate responses for IMAF-2003.
		6.64	Ms Molloy		Report to IMAF-2003.
		6.161	USA (Ms Rivera)		Report to IMAF-2003.
		6.75			
2.4	Experimental research to test effectiveness of mitigation measures in Spanish system vessels.	6.35	Appropriate IMAF scientists, Members	By Oct 2003, if possible	Report to IMAF-2003.
2.5	Information on measures for mitigating incidental seabird mortality in trawl fisheries, especially for icefish in Subarea 48.3.		Members as appropriate	Nov 2002/ Sep 2003	Collate responses for IMAF-2003.
2.6	Information on new vessel design.	6.85	France	By Oct 2003	

Task/Topic	Paragraphs of WG-FSA Report	Members' Assistance ¹	Start/ Completion Deadlines	Action
3. Information from outside the Convention Area:				
3.1 Information on longline fishing effort in the Southern Ocean to the north of the Convention Area.	Standing request	Members, non-Contracting Parties, international organisations	Sep 2003	Request information intersessionally from those Members known to be licensing fishing vessels in areas adjacent to CCAMLR (e.g. Argentina, Brazil, Chile, UK [in respect of Falkland/Malvinas Islands and Tristan da Cunha], South Africa, Uruguay, New Zealand, Australia); review situation at IMAF-2003. Request information from other parties (Members and non-Contracting Parties, e.g. Republic of Korea, Taiwan, Japan, China; international organisations, e.g. CCSBT, ICCAT, IOTC) known to be fishing, or collecting data on fishing in areas adjacent to the Convention Area.
3.2 Information on incidental mortality outside the Convention Area of seabirds breeding within the area.	Standing request 6.109	Members, IMAF members	Sep 2003	Repeat request to all IMAF members, especially to those relevant to item 3.1 above; review at IMAF 2003.
3.3 Reports on use and effectiveness of mitigating measures outside the Convention Area.	Standing request 6.111	Members, non-Contracting Parties, international organisations	Sep 2003	Request information on use/implementation of mitigating measures, especially provisions in Conservation Measure 29/XIX, as under item 3.1 above; review responses at IMAF-2003.
3.4 Reports on nature of observer programs, including observer coverage.	Standing request	Members, non-Contracting Parties, international organisations	Sep 2003	Request information intersessionally from those Members known to be licensing fishing vessels in areas adjacent to CCAMLR (e.g. Argentina, Brazil, Chile, UK [in respect of Falkland/Malvinas Islands and Tristan da Cunha], South Africa, Uruguay, New Zealand, Australia); review situation at IMAF-2003. Request information from other parties (Members and non-Contracting Parties, e.g. Republic of Korea, Taiwan, Japan, China; international organisations, e.g. CCSBT, ICCAT, IOTC) known to be fishing, or collecting data on fishing in areas adjacent to the Convention Area.
3.5 Request information on the current requirements for the use of measures to mitigate by-catch of seabirds on Japanese longline fishing vessels.	SC-XIX 4.35		Sep 2003	Request again specific information from Japan.

Task/Topic	Paragraphs of WG-FSA Report	Members' Assistance ¹	Start/Completion Deadlines	Action
4. Cooperation with international organisations:				
4.1 Participation at the 2003 meeting of CCSBT-ERSWG; invite CCSBT to attend WG-IMAF.	Standing request	CCSBT Secretariat	As required	Invite and nominate observers as decided by the Scientific Committee.
4.2 Cooperation with ICCAT, IATTC and IOTC on specific issues regarding incidental mortality of seabirds.	Standing request 6.143, 6.146, 6.148	CCAMLR observers	Nov 2002/ Sep 2003	Brief CCAMLR observers on desired feedback on IMAF matters (seabird by-catch levels and mitigating measures).
4.3 Input to ICCAT agenda, especially in relation to seabird resolutions and issues.	6.143	Relevant Members, IMAF members, EC	Nov 2002/ May 2003	
4.4 Collaboration and interaction with all tuna commissions and regional fishery management organisations with responsibility for fisheries in areas where Convention Area seabirds are killed.	6.153, 6.154	Relevant Members, CCAMLR observers	Nov 2002 and at specific meetings	Request information on: (i) existing data on levels of seabird by-catch; (ii) mitigating measures currently in use and whether voluntary or mandatory; and (iii) nature and coverage of observer program. Support regulations for use of mitigating measures at least as effective as Conservation Measure 29/XIX.
4.5 Progress with National Plans of Action in respect of FAO IPOA–Seabirds.	Standing request 6.138	Relevant Members, IMAF members	By Oct 2003	Solicit reports to CCAMLR on progress for information and make review.
4.6 Input to CWP agenda, concerning coordination of fishery reporting on seabird by-catch.	SC-XXI 9.13	Data Manager	At CWP meeting	Place item on agenda; table appropriate CCAMLR/IMAF papers; report back to IMAF.
4.7 Assist Japan in improving its NPOA and use of mitigating measures.	SC-XX 4.58, 4.66, CC-XX 6.29, 6.137(iv)	Members, IMAF	As feasible	Discuss progress at IMAF-2003.
4.8 Second International Fishers' Forum	6.127–6.129	Members, IMAF members	As feasible	Disseminate information on forum outputs to fishers, IMAF etc.
4.9 IUCN Red List: Seabirds	Standing request	Secretariat	Jan 2003 onwards	Obtain from BirdLife International, circulate to IMAF members and table for SC-CAMLR-XXII, any proposals for revision to the conservation status of albatross, <i>Macronectes</i> and <i>Procellaria</i> species.

	Task/Topic	Paragraphs of WG-FSA Report	Members' Assistance ¹	Start/ Completion Deadlines	Action
4.10	BirdLife International	Standing request		Nov 2002/ Sep 2003	Request information from BirdLife International about its activities of relevance to IMAF, in particular its Seabird Program and 'Save the Albatross Campaign'.
4.11	Southern Seabird Solutions	6.156–6.157	Ms Molloy	Oct 2003	Report to IMAF-2003.
5.	Data acquisition and analysis:				
5.1	Preliminary analyses of data from the current fishing season.	Standing request	Technical coordinators	Sep–Oct 2003	Standing request: summarise and analyse current year data at a level adequate to undertake a preliminary assessment at IMAF-2003.
5.2	Acquisition from EEZs and elsewhere as appropriate, of seabird incidental mortality data for trawl fisheries.	Standing request	Members, especially France	Nov 2002/ Sep 2003	Request Members for appropriate data.
5.3	Acquisition of original data on seabird incidental mortality for French EEZs in Subarea 58.6 and Division 58.5.1 for 2001 and 2002.	6.14	France	Sep 2003	Request France to submit reports and data logbooks prepared by national observers for the current and past fishing seasons, preferably using CCAMLR reporting formats.
5.4	Provision by France of details of mitigation measures in use in their EEZs, details of by-catch statistics for white-chinned petrels, for intersessional evaluation.	SC-XXI 5.6	France, IMAF	as soon as possible	
5.5	Analysis of seabird incidental mortality data for EEZ in Subareas 58.6/58.7.	Standing request	South Africa	Nov 2002/ Sep 2003	Request South Africa to undertake analysis and report to IMAF-2003.
5.6	Estimation of IUU seabird by-catch.	6.92	Dr Agnew, Secretariat, Members	For Oct 2003	Report to IMAF-2003.
5.7	Data on seabird densities and by-catch rates in trawl fisheries.	6.205	Members	For Oct 2003	Report to IMAF-2003.
6.	Scientific observer issues:				
6.1	Preliminary analysis of data from 2002/03 fisheries.	Standing request	SODA*	IMAF meeting	Produce draft tables equivalent to Tables 6.1 to 6.8 of the FSA-2002 report.

Task/Topic	Paragraphs of WG-FSA Report	Members' Assistance ¹	Start/ Completion Deadlines	Action
6.2 Review and revise instructions in <i>Scientific Observers Manual</i> and address identified issues: (i) distinguish status of birds released alive; (ii) reporting of hook loss; (iii) streamer line areal coverage; (iv) levels of observation; (v) improved reporting from trawl fishing; and (vi) more/better data on seabird densities associated with trawl fishing.	6.16, 6.208 6.26, 6.27 6.76 6.177, 6.178 6.195, 6.196 6.205	IMAF/FSA observer subgroup, technical coordinator	Nov 2002	Report, as necessary, to IMAF-2003.
7. Revision of Conservation Measure 29/XIX		IMAF		Review at IMAF-2003. Prepare draft text in advance, if possible.