ANNEX 5

REPORT OF THE WORKING GROUP ON FISH STOCK ASSESSMENT

(Hobart, Australia, 9 to 19 October 2000)

CONTENTS

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INTRODUCTION

1.1 The meeting of WG-FSA was held at CCAMLR Headquarters, Hobart, Australia, from 9 to 19 October 2000. The Convener, Mr R. Williams (Australia), chaired the meeting.

ORGANISATION OF THE MEETING AND ADOPTION OF THE AGENDA

2.1 The Convener welcomed participants to the meeting and introduced the Provisional Agenda which had been circulated prior to the meeting. Following discussions, it was agreed that the following subitems be added:

(i) Subitem 10.3 'Impact of Budgetary Restraints; and
(ii) Subitem 11.4 'IUCN Criteria for Endangered Species'.

With these changes the Agenda was adopted.

2.2 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.

2.3 The report was prepared by Mr B. Baker (Australia), Dr E. Barrera-Oro (Argentina), Dr A. Constable (Australia), Prof. J. Croxall (UK), Dr I. Everson (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), Dr E. Marschoff (Argentina), Dr D. Miller (Chairman, Scientific Committee), Dr G. Parkes (UK), Dr G. Robertson (Australia), Mr N. Smith (New Zealand), Mr B. Watkins (South Africa) and the Secretariat.

REVIEW OF AVAILABLE INFORMATION

Data Requirements Endorsed by the Commission in 1999

Data Inventory and Developments in the CCAMLR Database

3.1 Dr D. Ramm (Data Manager) reported on the availability of data at the meeting and major developments within the CCAMLR Data Centre during the intersessional period.

3.2 Reconciliation of catch and effort reports with fine-scale data from CCAMLR fisheries in the 1999/2000 season was undertaken regularly during the year to assess the completeness of the fishery datasets. The majority of the fishery and observer data from the 1999/2000 season was available at the meeting, and details were reported in WG-FSA-00/6, 00/18 and 00/37.

3.3 At the start of the meeting, most of the fine-scale data from finfish fishing in the 1999/2000 season had been submitted. The submission of data from two longliners targeting *Dissostichus eleginoides* in Subarea 48.3 (*Lyn, Ibsa Quinto*) and one in Division 58.4.4 (*Isla Alegranza*) was overdue (data from the *Lyn* and *Isla Alegranza* were submitted and processed during the meeting). In addition, fine-scale data from the krill fishery in Area 48 in 1999/2000 had not yet been submitted.

3.4 STATLANT data from the Convention Area in the 1999/2000 split-year (1 July 1999 to 30 June 2000) were summarised in SC-CAMLR-XIX/BG/1. This paper provided an opportunity for Member countries to check their STATLANT data prior to publication in the CCAMLR *Statistical Bulletin*: four STATLANT datasets (Chile, Japan, Russia and Spain) were outstanding at the start of the meeting (data from Chile were submitted during the meeting).

3.5 Over the past two years, Data Centre staff had undertaken a major overhaul of the research survey database and the routines used for length-density analyses. This overhaul was necessary because of the increasing quantity and diversity of survey data and their importance in the assessments of WG-FSA.

3.6 As reported last year (WG-FSA-99/14), trawl survey data and commercial trawl data had been initially managed as a single dataset. While appropriate in earlier years, this procedure constrained the type of survey data that could be stored in the CCAMLR database and placed limitations on their interpretation. The overhaul of the survey database has resolved these historical difficulties. WG-FSA-00/11 described the work done during the intersessional period, the structure of the new survey database and the procedure for deriving data for the length-density analysis.

3.7 Another major task during 2000 was the implementation of the new Catch Documentation Scheme for *Dissostichus* spp. (CDS). This involved the development of a database, data-processing routine and a confidential web-based reporting system. A subset of the CDS data (landings by month and area) was made available to the Working Group, and these data were used to estimate catches of *Dissostichus* spp. taken outside the Convention Area (WG-FSA-00/6).

3.8 The implementation of the CDS and the significant budgetary constraints in 2000 had impacted on the work of the Data Centre, its computing facilities and the level of support at the meeting (see Section 10, Future Work).

Database Data Entry and Validation

3.9 Most of the data from the 1999/2000 fishing season had been submitted during August to October, and had been entered by the start of the meeting. These data would be validated by early 2001. Due mostly to the backlog of data submitted immediately prior to the meeting of WG-FSA, but also other work priorities (see above), eight submitted datasets were yet to be processed:

- *D. eleginoides* pot data from the experimental fishing in Subarea 48.3 (July–August 1999);
- *D. eleginoides* catch and effort data from Uruguay (*Isla Gorriti*) in Subarea 48.3 (May–July 2000);

- *Champsocephalus gunnari* length data from the national observer on board *Zakhar Sorokin* in Subarea 48.3 (December 1999–January 2000);

- krill biological data from Argentina (*Kasuga Maru*) in Area 48 (February–April 1999);

- krill catch and effort data from Ukraine (*Konstruktor Koshkin*) in Area 48 (May–July 1999);

- historical longline catch and effort data submitted by Russia and Ukraine (1986–1996);

- *D. eleginoides* catch and effort data from France in Division 58.5.1 and Subarea 58.6 (2000 season); and

- trawl survey data submitted from Russia (*Atlantida*, 2000).

3.10 With the exception of the data from the krill fishery and the experimental pot fishing, these datasets were processed during the first week of the meeting, and were made available to WG-FSA. In addition, Dr V. Herasymchuk (Ukraine) submitted historical data from seven trawl surveys carried out on four cruises on Ob and Lena Banks in Division 58.4.4 in 1980, 1982, 1986 and 1989; data from three other surveys would be submitted very soon. The Working Group thanked Dr Herasymchuk for these data, which will be entered into the new CCAMLR survey database.

3.11 Routine validation of the fine-scale data in 2000 detected two datasets where processed weights, rather than whole weights, may have been reported for *Dissostichus* spp. (WG-FSA-00/6); a similar situation was reported in 1999 (WG-FSA-99/9). Clarification had been sought from the data originators (Uruguay and South Africa) on 26 September 2000. In both cases, the retained weight of *Dissostichus* spp. was believed to be correctly reported as whole weight, however the discarded weight was believed to include offal and frames. If this interpretation is correct, then the weight of offal and frames will need to be subtracted from the weight of whole fish that have been discarded and that have been reported in these fine-scale datasets.

Other

3.12 The data section on the CCAMLR website has been updated, and now includes detailed information on the CCAMLR data requirements and the submission of data. Information on how to collect, record and submit data is available in portable document format (pdf), including the *Scientific Observers Manual* and the unpublished *Fishery Data Manual*.

3.13 Electronic data forms (eforms) are available for submitting catch and effort reports, fine-scale data, observer data and CEMP data. These forms are in Microsoft Excel format, and may be downloaded from the website, copied, completed and submitted to the Secretariat via email. Alternatively, the original data forms in Microsoft Word format may be downloaded, printed, completed and submitted via facsimile or airmail.

3.14 Eforms are now used by many of the Member countries to submit fishery and observer data, as well as other types of data. The amount of time required to process these eforms varies greatly and most datasets still require a significant amount of reformatting to overcome variations in formats

(e.g. reporting time as 12.35 rather than 12:35) and data type (e.g. reporting lengths in mm rather than cm); some eforms take as long to process as data submitted in paper format. However, the amount of reformatting required is being reduced as the quality of the electronic submissions continues to improve, and the eforms and data extraction routines undergo further development.

Fisheries Information

Catch, Effort, Length and Age Data Reported to CCAMLR

3.15 Fisheries prosecuted under the conservation measures in force during the 1999/2000 fishing season were reported in CCAMLR-XIX/BG/5. With the exception of the krill fisheries (1 July 1999 to 30 June 2000), all fishing seasons in 1999/2000 fell between 1 December 1999 and 30 November 2000. Catches of target species reported by the start of the meeting are summarised in Table 1.

3.16 Catches reported from the Convention Area during the 1999/2000 split-year (1 July 1999 to 30 June 2000) are summarised in Table 2 (see also paragraph 3.4). These catches, reported in STATLANT data, included catches taken within South Africa's EEZ in Subareas 58.6 and 58.7, and within France's EEZ in Subarea 58.6 and Division 58.5.1.

3.17 Most of the length-frequency data submitted during 1999/2000 were collected by scientific observers, and submitted in their logbooks and reports. Some length-frequency data were submitted as fine-scale biological data. Catch-weighted length frequencies for *D. eleginoides* caught by longline in Subarea 48.3 during the 1998/99 and 1999/2000 seasons were reported in WG-FSA-00/6. This analysis required four sets of data: length-frequency data collected by scientific observers; fine-scale length-frequency data; fine-scale catch data; and STATLANT data. Data from four longliner fleets fishing in Subarea 48.3, and from the longliners which had fished in Subarea 88.1, were available for this analysis at the start of the meeting. Data processed during the meeting allowed further analysis of catch-weighted length-frequency data, including Divisions 58.4.4 and 58.5.2.

3.18 No data on ages were submitted to the Working Group.

Estimates of Catch and Effort from IUU Fishing

Landings by all Countries

3.19 The total green-weight landings of *Dissostichus* spp. for the 1999/2000 split-year from the licensed fishery was estimated as 14 441 tonnes. The Working Group noted that this was a decrease compared to the previous split-year (17 558 tonnes). Reported catches from waters outside the Convention Area are given in Table 3 and totalled 11 553 tonnes. This gave a reported grand catch total of 25 994 tonnes.

3.20 The Working Group estimated landings of IUU-caught *D. eleginoides* by all countries (CCAMLR Members and non-Members) in Durban (South Africa), Walvis Bay (Namibia), Port Louis (Mauritius), Montevideo (Uruguay) and Vigo (Spain) for the 1999/2000 split-year and the

period July to August 2000 (Table 4). Mauritius remains the primary site for the landing of IUU-caught fish, in particular after May 2000 when the CDS came into force and landings in all ports other than Port Louis ceased.

3.21 WG-FSA used the approach adopted at its 1998 meeting (SC-CAMLR-XVII, Annex 5, paragraph 3.24) to estimate the magnitude of IUU fishing effort and catches in various subareas and divisions during the 1999/2000 split-year. The results of this analysis are presented in Tables 5 and 6. The estimated total catch for all subareas and divisions in the Convention Area in the 1999/2000 split-year was 20 987 tonnes, comprising 14 441 tonnes of reported catch and 6 546 tonnes of estimated unreported catch (Table 5). The total estimated landings of catches in Walvis Bay and Mauritius (7 942 tonnes) in 1999/2000 accounted for some 52% of the estimated 15 146 tonnes total catch in the Indian Ocean.

Estimated Trade in *Dissostichus* spp. in the 1999/2000 Split-year

3.22 Trade statistics for *D. eleginoides* in 1999/2000 were received from FAO, Japan and the USA (Table 7; WG-FSA-00/6, Tables E2 to E9) and by other countries (WG-FSA-00/6, Table E1). Product imports into Japan and the USA totalled an estimated 39 949 tonnes of whole and filleted *D. eleginoides* during the 1999 calendar year, with Argentina, Chile and Uruguay being the major sources of supply. In the first half of 2000, imports into Japan and the USA totalled 21 405 tonnes equivalent whole weight with Mauritius being a major supplier to Japan. The equivalent estimate of imports in the 1998 calendar year was 42 796 tonnes (SC-CAMLR-XVIII, Annex 5, Table 9).

3.23 The conversion factor (CF) for product to whole weight remains a problem for products other than fillets and headed and gutted, e.g. collars, in converting product weight to green weight. There is also some potential for double estimation of catch for split products as green weight is determined from product trunk weight only. The CDS reports all landed product weights per vessel and exports can be reconciled against reported landed weights (Table 8).

3.24 Although there was a decrease in the volume of imports into Japan and the USA, the price of headed and gutted product on the US market nearly trebled between July 1998 and July 1999 from US$3.80 to US$11.00 (SC-CAMLR-XVIII, Annex 5, Figure 1). From July 1999 to July 2000 this increasing trend was not evident (source from industry).

3.25 As in previous years, trade statistics should be treated with considerable caution since the export sources of a product are not necessarily responsible for the catching of fish.

Overall Estimates of IUU Catch

3.26 Table 5 provides overall estimates of the catch from IUU fishing operations. The total estimate for the 1999/2000 split-year was 6 546 tonnes. This compares to 4 913 tonnes in the 1998/99 split-year and 22 415 tonnes in 1997/98. It should be noted that estimating IUU catches has become increasingly more difficult, primarily due to transhipments on the high seas which are very difficult to track through the sources available to the Working Group (see Table 3). Consequently, estimates of IUU catches are likely to be underestimates of the true catches to an

unknown extent. The Working Group agreed that estimates of IUU catches of *Dissostichus* spp. are only minimum estimates and that the proportion of these estimates is one-third that of regulated catches. The values for 1999/2000 should be compared with previous years only with caution (see Figure 1).

Indian Ocean Sector

3.27 There is some indication that there has been a drop in illegal activity in the Prince Edward Islands EEZ. This is in part due to lower catch rates generally, and the presence of toothed cetaceans particularly in the eastern sector. Illegal activity has a year-round presence with a higher concentration of vessels during the summer months. In waters adjacent to the Crozet and Kerguelen Islands illegal fishers are also present year-round from information presented to the intersessional subgroup on IUU fisheries. During August 2000, illegal vessels moved westwards into the Prince Edward Islands EEZ from French waters during a French naval surveillance.

3.28 In summary, the IUU fishery appears to be concentrated in Area 58 (although up to four Argentinian vessels were known to fish illegally around South Georgia (Subarea 48.3)). In Area 58 the IUU fishery targets known plateaux or topographic features, in particular the Kerguelen Plateau (Kerguelen and Heard Islands) or the area around Crozet. The oceanic banks (Ob and Lena, Division 58.4.4 and Africana/Del Cano, Subarea 58.6) are also subject to IUU fishing, probably due to the isolation of these fishing grounds.

IUU Catches in Assessments

3.29 The IUU input assessments for *D. eleginoides* fisheries used the estimated unreported catches of 300 tonnes for Subarea 48.3 (South Georgia) and 800 tonnes for Division 58.5.2 (Heard Island).

IUU and the CDS

3.30 Taken with the persistence and relatively high levels of IUU fishing, it is uncertain where removals of *Dissostichus* spp. are being landed. Landed weights of *Dissostichus* product reported to the CDS by 5 October 2000 are presented in Table 8. Two clear markets are now emerging: one market for landings with a *Dissostichus* catch document (DCD) and another, cheaper market for landings without the DCD. The market for fish without the DCD is apparently very unpredictable. In August 2000 it was estimated that in excess of 1 000 tonnes was being offered for sale with non-DCD fish fetching prices US$3.00/kg lower than DCD fish, then trading at around US$8.40/kg. There is also evidence that buyers in Mauritius are willing to pay cash for their purchases.

3.31 The Secretariat, intersessionally, was tasked with reconciling estimated IUU catches with reported catches. This will serve as a preliminary assessment aimed at assisting WG-FSA in developing further analyses of CDS data to track total *Dissostichus* spp. removals and possibly IUU catches. In the interests of efficiency, the Working Group suggested that a single Secretariat staff member should be tasked with compiling IUU and comparable CDS data intersessionally, and reporting this information annually.

3.32 The Working Group noted that FAO is currently developing an International Plan of Action (IPOA) to combat IUU fishing. The Working Group agreed that the FAO–IPOA development should be kept under review, especially in relation to data and information exchange (SC-CAMLR-XIX/BG/13). It also anticipated that the IPOA is likely to impact positively on CCAMLR's efforts to address IUU fishing.

3.33 WG-FSA discussed the requirements for scientific observers to record and report sightings of vessels. It was suggested that a standard form of recordings be developed and that the Scientific Committee would prepare advice for the Commission (paragraph 3.52).

Catch and Effort Data for Fisheries for *Dissostichus* spp. in Waters adjacent to the Convention Area

3.34 Information on catches taken in fisheries operating outside the Convention Area was obtained intersessionally from WG-FSA members, FAO, and the new CDS (WG-FSA-00/6). This information indicated that the recent annual catches of *D. eleginoides* in waters outside the Convention Area were in the order of 18 000–23 000 tonnes. Details are reported in paragraphs 3.19 to 3.33.

Scientific Observer Information

3.35 Information collected by scientific observers was summarised in WG-FSA-00/18, 00/37 and 00/38. Scientific observers were deployed on all fishing vessels targeting *Dissostichus* spp. or *C. gunnari* in the Convention Area during 1999/2000. Reports and logbook data were submitted from 35 longline and 8 trawl cruises. Details are in Table 9.

3.36 The Working Group noted that on the basis of information available, the two French observers deployed in Subarea 58.6 appeared to be national observers and not CCAMLR international observers. Technically, this was inconsistent with the requirement of paragraph 7 of Conservation Measure 182/XVIII that each vessel participating in exploratory fisheries for *D. eleginoides* during the 1999/2000 season shall have at least one observer, appointed in accordance with the CCAMLR Scheme of International Observation, on board throughout all fishing activities. In the absence of a French representative, the Working Group was unable to comment further on this situation.

3.37 All but four of the logbooks and all the observer cruise reports were submitted before the start of the meeting. The quality of these reports has been good, with all logbooks presented in CCAMLR format. Seven of the 31 longline logbooks and seven of the nine trawl logbooks received were submitted using CCAMLR electronic logbooks forms (Excel spreadsheet format). This format has been highly successful, allowing faster entry into the CCAMLR database. Likewise, the standard of cruise reports submitted was high, with all the reports following the guidelines laid out in Part 1, Section 5 of the *Scientific Observers Manual*.

3.38 In relation to the work of technical coordinators, the Working Group recommended that scientific observers should be requested to use standard electronic logbooks developed in Excel format by CCAMLR for recording data.

3.39 The observer reports contain detailed information on vessel characteristics, cruise itinerary, fishing gear and fishing operations, meteorological conditions and on biological observations carried out on fish. Information on seabird incidental mortality and marine mammal observations is also fairly comprehensive (see summary in Tables 10 and 11).

3.40 A waste disposal form used by observers this year is a revised form which increased the type of information to be recorded on disposal of fishing gear, oil, organic and inorganic galley waste and plastic packaging bands (Table 11). It was reported that 85% of vessels retained or incinerated all plastic packaging bands in accordance with Conservation Measure 63/XV. Unfortunately four vessels (*Isla Sofía, Magallanes III, Aquatic Pioneer, Eldfisk*) used and/or disposed of packaging bands in contravention of this conservation measure.

3.41 Collection of biological fish samples by observers continued to be done in accordance with research priorities identified by the Scientific Committee in previous years (by-catch, length frequency, weight at length, maturity, CF, otolith/scales) (Tables 10 and 12). However, the Working Group felt that it could be necessary to revise a list of priorities. The Secretariat was requested to consult intersessionally with technical coordinators and to collect their comments and proposals for consideration at the next meeting of the Working Group.

3.42 In general, the CFs have been calculated in the reports according to the standard methodology established by WG-FSA and endorsed by the Scientific Committee. The CF used by vessels (1.6, N = 16) was lower than the value estimated by the observers (mean 1.66, SD = 0.41, N = 1 598) (paragraphs 3.60 to 3.65).

3.43 As a consequence of WG-FSA deliberations and comments received from scientific observers (SC-CAMLR-XVIII, Annex 5, paragraphs 3.53 to 3.70), the Secretariat updated the *Scientific Observers Manual* and distributed it to Members before the start of the 1999/2000 season. The revised manual included new and improved forms for the recording of data.

3.44 Distribution of the revised manual has resulted in significant improvement on the following matters/points:

(i) collection of information by scientific observers on garbage disposal (i.e. an increase from 50% in 1999 to 70% in 2000) and loss of fishing gear at sea (from 37% to 72%) (Table 11);

(ii) awareness of fishing crews of CCAMLR conservation measures and on the availability and utility of the booklet *Fish the Sea Not the Sky*.

(iii) description of longline system design. Diagrams of Spanish and autoline systems were included in Form L2(i) with data fields for recording line dimensions, weighting regimes and weighting methods;

(iv) provision for random weighting of at least 30 weights and recording distance between weights (Form L2(i));

(v) recording of offal discharge during hauling to allow accurate analysis of compliance with Conservation Measure 29/XVI;

(vi) the use of a simplified version of Form L4(vii) which facilitates recording of information required;

(vii) updated nautical dawn/dusk table which included additional areas south of 72° in Subarea 88.1;

(viii) inclusion in the section 'Summary of fishing operations' in the scientific observer report, of an item on garbage and plastic disposal, snoods, hooks in discards, bands, oil/fuel discharge;

(ix) clarification that Form L3 should be completed at the discretion of observers for a limited number of days during the cruise;

(x) clarification that Form L4 may not be completed in full at night or under low visibility conditions;

(xi) increased number of cruises with two observers on board: 8 longliners and 6 trawlers from a total of 43 cruises (Tables 9 and 13); and

(xii) inclusion of a provision for reporting fish by-catch. During the current season all observers collected and reported data on by-catch.

3.45 Information on fish identification by observers in trawl and longline fisheries are provided in Tables 14 and 15. It was recommended that fish taken as by-catch in the longline fishery in Subarea 48.3 should be identified to the level of species. It is expected that with 100% observer coverage of longline vessels, the quality of collected by-catch data would improve considerably. Reference materials which are required by observers in their work on the identification of by-catch species are defined in paragraphs 3.110 to 3.118.

3.46 There were no significant problems reported by observers on the use of the S*cientific Observers Manual* this year. Despite the required clarification to the forms made last year, some observers continued to report problems with the completion of form L3 'Daily Work Schedule of Observers' and L4(vi/vii) estimating seabird and marine mammal abundance. However, last year it was stated that the completion of these forms is not compulsory (see paragraphs 3.44(ix) and (x)). Technical coordinators should continue to bring these changes to the attention of observers.

3.47 Some observers still continued to experience difficulties with the following matters:

(i) recording the number of hooks observed during hauling, swell/height and also moon phases in the presence of cloud cover;

(ii) an absence of visual materials in the *Scientific Observers Manual* to assist identification of maturity stages of *Dissostichus* spp., e.g. colour photographs or drawings of gonads at various stages of maturity; and

(iii) determining loss of *Dissostichus* spp. to toothed cetaceans.

The Secretariat, in consultation with technical coordinators, should consult intersessionally in order to find solutions for these matters.

3.48 At the last meeting it was noted that many observers failed to apply the longline random-sampling design originally proposed by the Working Group. In general, it relates to practical aspects of collecting samples on vessels as required by the method. It was recommended that technical coordinators be encouraged to correspond intersessionally in order to identify problems and find their solutions.

3.49 The Working Group revised the number of fish per haul which need to be collected during longline exploratory fishing (Conservation Measure 182/XVIII, Annex B, paragraph 3(v)). It was recommended that while length-frequency and sex data should continue to be recorded for at least 100 fish, samples for biological studies (otoliths, scales, stomach contents) should be taken and gonad stages recorded for at least 30 fish.

3.50 In general, the Working Group felt that the size of samples and methods for their collection in other fisheries should also be reviewed and, if required, clarified at next year's meeting.

3.51 The Working Group also recognised that, particularly for vessels with only one scientific observer, the number of currently specified tasks is such that urgent attention is needed to the prioritisation of duties (see SC-CAMLR-XVIII, Annex 5, paragraph 3.76) and to reassessment of sampling requirements (see also paragraph 7.30).

3.52 The Working Group discussed the requirement for scientific observers to record and report sightings of fishing vessels in the Convention Area (CCAMLR-XVIII, paragraph 8.22). It was suggested that a standard form for recording sightings be developed. The form should provide for recording of the following information: name of the vessel; time and date of sighting, position (including CCAMLR area, subarea, division and coordinates); flag of the vessel and mode of observation/record (i.e. radar image, radio traffic, visual sighting, photographic/video). This matter will be further discussed at the upcoming meetings of the Scientific Committee and advice on the matter be prepared for the Commission.

3.53 The Working Group thanked all scientific observers for their work during the 1999/2000 fishing season and for the great deal of very useful information collected. It was noted with satisfaction that for first time an international observer was deployed on board a krill fishing vessel in Area 48 (*Chiyo Maru No. 5*). The Working Group highlighted the potential use of observers simultaneously in longline, trawl and krill fisheries under the CCAMLR Scheme of International Scientific Observation.

3.54 The Working Group congratulated the Secretariat for the excellent job they had carried out during the intersessional period on processing and analysis of information related to scientific observation programs. This assisted considerably the work of the Working Group at the meeting.

Research Survey Data

3.55 Australia conducted a random stratified survey in the Heard and McDonald Islands region (Division 58.5.2) in May 2000 to assess the abundance of *C. gunnari* and juvenile pre-recruit *D. eleginoides* (WG-FSA-00/40). A total of seven surveys have now been conducted in this region. The 2000 survey enabled a revision of the yield for managing the fishery for *C. gunnari* (WG-FSA-00/41). The data also provided an update to the recruitment series for *D. eleginoides* (WG-FSA-00/42).

3.56 The UK conducted a random stratified survey in Subarea 48.3 in January 2000 that was reported in WG-FSA-00/21. The main aims of the study were to estimate the standing stock of *C. gunnari* and also determine the population structure of *D. eleginoides* around South Georgia and Shag Rocks. Data from these studies had been reported to CCAMLR. Additional studies involved tagging of *D. eleginoides*, reported in WG-FSA-00/26, and assessments of crab density using the Aberdeen University Deep Ocean Submersible (AUDOS).

3.57 Russia conducted a random stratified survey in Subarea 48.3 in February 2000 to assess the abundance of *C. gunnari* and other species in that area (WG-FSA-00/47). Data from this survey had been submitted to the Secretariat, and were entered in the new CCAMLR survey database during the meeting. The survey adds to the existing time series of survey data collected by Russia in this area. Data from the 2000 survey provided an assessment of the *C. gunnari* stock in that region, and a review of the methods of assessment (WG-FSA-00/45, WG-FSA-00/51). A revised assessment of the *D. eleginoides* stock was also provided (WG-FSA-00/46).

3.58 The UK conducted experimental fishing for *D. eleginoides* using pots in Subarea 48.3 during March–May 2000 (WG-FSA-00/23). The major aim of this work was to develop a viable method for catching *Dissostichus* spp. which eliminates incidental catches of seabirds. During the 53 days spent fishing, a total of 38.9 tonnes of *D. eleginoides* was caught (note that the total catch reported in the catch and effort reports was 17.4 tonnes (Table 1); during the meeting it was discovered that the 17.4 tonnes referred to the processed weight). Observations indicated that the interactions of seabirds during setting and hauling of the pots was minimal, and the possibility of birds becoming entangled in the fishing gear was also very low. As a result, no bird mortality was witnessed during the trial. The experiment also provided by-catch information on crabs (WG-FSA-00/24), and data on the gut contents of *D. eleginoides* (WG-FSA-00/25).

Mesh/Hook Selectivity and related Experiments affecting Catchability

3.59 There was no information on mesh and hook selectivity presented at the meeting.

Conversion Factors

3.60 Observers continued to collect information on CFs using the methods described in the *Scientific Observer Manual* for *D. eleginoides* and *D. mawsoni*. Green and processed weights are reported in sampling units comprising various numbers of fish. The data available at the meeting are summarised in Table 16.

3.61 CFs determined on individual fish processed into headed, gutted and tailed were analysed using the same nested ANOVA applied at last year's meeting (SC-CAMLR-XVIII, Annex 5, paragraph 3.86). No replications were available for cruises. Variance components were similar to those calculated at last year's meeting (0.01312 for vessels; 0.00386 for hauls and 0.01379 for individual fish).

3.62 At its last meeting, the Scientific Committee recommended that vessel masters adopt the procedure set out in the *Scientific Observers Manual* to calculate CFs at the beginning of the season (SC-CAMLR-XVIII, Annex 5, paragraphs 5.50 and 5.51).

3.63 In Table 17 the CFs used by vessels in reporting their catches is compared with CFs obtained by observers. The differences noted in last year's report (SC-CAMLR-XVIII, Annex 5, paragraphs 3.89 and 3.90) have been largely reconciled with the exception of headed and gutted fish for which not enough observer information was available this year.

3.64 The Working Group recommended the continuation of the program using the current format and concentrating efforts on the product constituting the largest fraction of the fish being processed.

Advice to the Scientific Committee

3.65 The Working Group advised that CF data should be reported by scientific observers on a fish-by-fish basis.

Fish and Squid Biology/Demography/Ecology

3.66 A subgroup, led by Dr Everson, had been tasked with collating information on fish and squid biology/demography/ecology. Key tasks were to: review methods for age determination in *Dissostichus* spp.; review gonad maturity stages of *Dissostichus* spp.; and review the biological components of value in developing a long-term management plan for *C. gunnari*. A request for information had been circulated in April. No direct responses had been received but papers had been tabled at WG-FSA. Discussion of these topics is reported along with that on other related topics in the following paragraphs.

Dissostichus spp.

Age Determination Methods

3.67 A comparison of the effectiveness of otoliths and scales was reported in WG-FSA-00/28. Otoliths and scales from 177 individual *D. eleginoides* from South Georgia, which measured up to 180 cm total length, had been analysed. Each otolith and scale preparation was read twice in random order by two independent readers. The authors noted that:

- ages determined from scales were significantly less than those estimated using otoliths;
- for scales, bias occurred for both readers between readings; and
- for otoliths, only one reader showed a bias between readings.

3.68 The Working Group accepted the findings of the study and agreed that otoliths provided a better estimation of age and should be used for future studies on *Dissostichus* spp.

3.69 Further discussion of age determination of *D. eleginoides* is found in paragraphs 4.119 to 4.123.

3.70 Following on from the study reported in 1999 (WG-FSA-99/43), further progress in estimating the age of *D. mawsoni* was reported in WG-FSA-00/55. Otoliths had been baked at 275°C for 12 minutes prior to being sectioned. A relatively dark zone was present at age 4 (range 3–6); in some instances there was a second distinct zone. Juvenile zones with multiple banding structure were also common. Zones outside the dark growth zone were generally narrow and regular. Work was still in progress to validate age determination of this species.

3.71 It was noted that there were very few fish in the samples thus far analysed. Dr Kock noted that samples of small *D. mawsoni* had been collected in the Elephant Island/South Shetland Islands region in March 1999 and had been sent to New Zealand for further analysis. Further information on the distribution of early juveniles was contained in Russian, and possibly Polish, publications from the 1970s and 1980s. Additional information may exist in Ukraine. The Working Group recommended that if further samples were available they should be analysed as soon as possible.

Length to Mass and Natural Mortality Coefficient (*D. mawsoni*)

3.72 Parameter values to convert length to mass and estimate natural mortality were presented in WG-FSA-00/55. These were considered by the subgroup assessing *Dissostichus* spp. and revised values determined (paragraphs 4.130 to 4.142).

3.73 Estimates of growth parameters for *D. eleginoides* were provided in WG-FSA-00/44 from samples collected at South Georgia (longline fishery), Kerguelen (trawl and longline fisheries), Heard Island (trawl fishery) and the Falkland/Malvinas Islands (longline fishery). Statistical analyses (ANOVA) indicated significant differences between samples from the Kerguelen trawl and longline fisheries. At Kerguelen, South Georgia and the Falkland/ Malvinas Islands the growth parameters for females were different to those for male fish. There was no significant difference in growth rates between South Georgia and Kerguelen for either sex, although both populations were significantly different for both sexes from the population caught by longline off the Falkland/Malvinas Islands. These results were discussed further in section 4.2.

Stock Structure

3.74 Following on from the molecular study on *Dissostichus* spp. reported in 1999 as WG-FSA-99/46, further work was reported in WG-FSA-00/53. In samples from *D. eleginoides* it was noted that three regions of the mitochondrial (mt) DNA show a distinct genetic break in samples from the South American shelf as compared to the Southern Ocean. The mtDNA control region further revealed two distinct groups in the Southern Ocean. One such group includes the Ross Dependency and Macquarie Island (FAO Areas 81 and 88); the other group includes Heard and McDonald Islands, Kerguelen Islands, Prince Edward Island (Area 58) and South Georgia (Subarea 48.3).

3.75 In the same study it was noted that fillets of *D. eleginoides* and *D. mawsoni* are readily distinguished by isoelectric focusing of muscle proteins. It is also noted that the protein profiles distinguish *Dissostichus* spp. from other fillets marketed under common trade names, such as bass and hake. Three regions of mtDNA also provide diagnostic species markers.

3.76 The study on growth rates reported in WG-FSA-00/44 provided supporting evidence of a separation between *D. eleginoides* from South Georgia and the Falklands/Malvinas region.

Gonad Maturity

3.77 Further work was reported on studies on gonad maturation in *D. mawsoni* in WG-FSA-00/54. Histological preparations have been made from ovaries collected during the most recent season. Macroscopic assessments of maturity stages had been made on these samples. As in previous years (SC-CAMLR-XVIII, Annex 4, paragraph 3.111), observers had encountered difficulty in objectively assessing maturity stages. Maturity stages 1 and 2 were difficult to distinguish as gonads were in resting stage at the time when fishing took place. Staging based on a macroscopic examination of the ovary alone is at this stage unreliable. Estimates of attaining length at sexual/spawning maturity were thus biased to an unknown extent. For the time being, the Working Group used L_{m50} = 100 cm as last year.

3.78 The Working Group agreed that a histological examination of ovarian samples covering the full size range of fish taken in the fishery would provide the best indication of size at maturity. At the same time, and in the course of taking the samples, observers should be encouraged to make their own assessments of ovarian status with a view to developing a macroscopic maturity stage scale in the future.

Stomach Contents

3.79 Stomach content samples collected from longline catches are known to be biased because the fish tend to regurgitate their stomach contents between being caught and landed. The experimental pot fishery for *D. eleginoides* at South Georgia afforded an opportunity to obtain samples unaffected by this bias. The results from that study were presented in WG-FSA-00/25. The most common prey was Decapod prawns which were present in 1 116 (41%) of all stomachs. It was noted that the amounts were localised by area and depth and also that prawns were not present in stomachs of fish taken on longlines from the same location. The next most common item was fish, present in 930 (34.4%) stomachs. *Patagonotothen guntheri*, a species thought to be confined to waters of less than 350 m depth, occurred in 33 stomachs (0.8%). The third most important component was Cephalopoda present in 226 (8.3%) stomachs. Arising from these observations the authors considered *D. eleginoides* to be an opportunistic carnivore.

Tagging Studies

3.80 Information on tagging studies on *Dissostichus* spp. was provided in two papers. A UK study, described in WG-FSA-00/26, was aimed at determining:

(i) whether juvenile fish in the vicinity of Shag Rocks recruited to the South Georgia fishery;

(ii) movements of fish within the South Georgia fishery area; and

(iii) growth of individual fish.

3.81 It was noted that the fish had not been injected with tetracycline as a growth marker.

Champsocephalus gunnari

Distribution

3.82 The mesoscale distribution around South Georgia was described in WG-FSA-00/45 and 00/51. It was concluded that this species is widespread over the shelf within the depth range 100–460 m. The densest aggregations appear to be concentrated to the northwest of the island with the largest fish being found there and also at Shag Rocks. The smallest fish tended to be in the southwest and southeast of the island.

3.83 Arising from the series of trawl surveys around Heard Island, it has been noted that *C. gunnari* tend to be concentrated in the east plateau, Gunnari Ridge and Shell Bank areas. The recent survey described in WG-FSA-00/40 confirmed these ideas on distribution were correct, although abundance on Shell Bank this season was very low.

3.84 During a recent trawl survey around South Georgia undertaken by the *Atlantida*, described in WG-FSA-00/51, significant amounts of *C. gunnari* were detected acoustically in the pelagic zone. Although it has been known for some time that these fish migrate into the water column to feed at night, it has been unclear what proportion of the population is present pelagically by day and if this is a phenomenon that is present year-round and between years. Examination of daytime echocharts indicated that significant amounts might be present in that zone by day.

3.85 Observations made during commercial fishing operations in December 1999 and January 2000, and presented in WG-FSA-00/19, indicated that large schools were present pelagically by day. In addition, schools that were present on or close to the bottom often extended up to 50 m above the seabed. Such schools would be very poorly sampled by the bottom trawls used for the recent assessment surveys described in WG-FSA-00/21 and 00/51. The potential influence of these observations on the assessment of *C. gunnari* abundance is further discussed in paragraphs 4.187 and 4.203.

3.86 During the course of the *Atlantida* survey, sampling had been undertaken to determine the potential for assessing *C. gunnari* acoustically. The results were presented in WG-FSA-00/31. Theoretical estimates of target strength, based on comparisons with similar fish which lack a swimbladder, were close to *in situ* measurements. It is concluded that with current technology it should be possible to discriminate between schools of krill and fish. The Working Group agreed to investigate this development with a view to determining a revised protocol for undertaking assessment surveys for *C. gunnari*.

3.87 An analysis of a very large dataset containing information on size and age distribution of *C. gunnari* around South Georgia since the commencement of commercial fishing was presented in WG-FSA-00/32. The study highlighted the similarity between the population size structure on the western shelf and Shag Rocks regions. Few small fish are found around Shag Rocks and it appears that when 15–25 cm long they migrate from the South Georgia shelf to that region. Fish around 15–25 cm total length predominate at the eastern end of the island.

Reproduction

3.88 WG-FSA-00/51 contained information on the maturation process observed during December 1999 and January 2000. Most fish progress from stage 2 to stage 3 during this time. The only fish which had progressed to stage 4 were greater than 45 cm total length.

3.89 Analysis of information from UK research surveys presented in WG-FSA-00/27 indicated that fish in maturity stages 3 (developing) and 5 (spent) were widespread over the shelf, whereas stage 4 (ripe) fish were only present on the northeast shelf and Shag Rocks. Shore-based observations show fish appear close inshore in spawning condition in March and April. Plankton sampling transects running offshore indicate that the highest concentrations of larvae occur close inshore either in bays or within about four miles of the island. The authors infer that there is a spawning migration around the island to the northeast shelf and from there into the bays in that region.

3.90 Support for the presence of migration to the north and northeast fjords was given in WG-FSA-00/32. The same paper indicates spawning, but at much lower intensity, on the southwestern shelf area.

Feeding

3.91 WG-FSA-00/20 and 00/51 provided information on the diet of *C. gunnari* during January 2000. At that time the dominant food was krill, present in 86% of stomachs. The hyperiid amphipod *Themisto* was less frequent and present in 28% of stomachs. The feeding index was below the long-term mean. The fish were apparently feeding predominantly in the pelagic zone.

Ectoparasites

3.92 Analysis of ectoparasites present on *C. gunnari* taken by the commercial vessel *Zakhar Sorokin* fishing in Subarea 48.3 was presented in WG-FSA-00/20. A total of 1 332 fish were examined. The degree of infestation of two species of ectoparasite was: *Trulliobdella capitis* present on 11.9% of fish and *Eubrachiella antarctica* present on 37% of fish.

Crabs

3.93 Crabs had appeared in large numbers in the experimental pot fishery for *D. eleginoides* and information was provided in WG-FSA-00/24. Three species were present in the catches. *Paralomis spinosissima* were caught (20 628 – 98% discarded) mainly in water 200–800 m deep. *P. formosa* were caught (119 893 – 96% discarded) mainly in water 400–1 600 m deep. In addition, 6 740 *P. anamerae* were caught, all of which were discarded. *P. anamerae* has previously been described from the Argentine slope in water 132–135 m deep. At South Georgia this species was taken in water 530–1 210 m deep. In addition, *Neolithoides diomedeae* and *Lithodes murrayi* were present in small numbers.

Sizes

3.94 Only 3.3% of *P. spinosissima* were greater than the minimum legal size (102 mm carapace, Conservation Measure 181/XVIII) of which 0.6% were females. Similarly, only 11.1% of *P. formosa* were larger than the minimum size (90 mm). None of the *P. anamerae* were larger than the minimum size and the proportion that were mature was not reported.

3.95 The following maturity stages were recognised:

1. Eggs uneyed: eggs orange to yellow in colour, no eye spots.
2. Eggs eyed: eggs orange to yellow in colour, with distinctive eye spots.
3. Eggs dead: eggs entirely white, black or brown.
4. Empty egg cases: eggs absent but egg cases still attached to pleopods.
5. Non ovigerous: eggs absent, no reproductive tissues attached to pleopods.

3.96 The following indices of carapace age were used in the study:

1. Soft: carapace flexible and generally lightly coloured.
2. New hard: carapace hard, no fouling organisms on exterior of carapace.
3. Old: carapace hard, fouling organisms present on exterior of carapace.
4. Very old: carapace hard, fouling organisms present, tips of spines and joints discoloured (often black).

3.97 Rhizocephalan parasite load was determined and the following results given:

P. spinosissima: female 5.8%, male 2.3%,
P. formosa: female 2.3%, male 1.7%,
P. anamerae: female 14.8%, male 6.2%.

3.98 Discard mortality was investigated through two experimental studies. In the first a total of 32 *P. formosa* and 42 *P. spinosissima*, as a representative cross section of the size and sex ratio in the catches and all of which were 'lively', were tagged and placed in pots and reimmersed the next time the pots were set. Of these crabs, 76% were still 'lively' when hauled on board after reimmersion, 13% were alive but 'limp' and the remainder had died. Thirty-five crabs, none of which were tagged, were kept on board as a control. Of this sample, only 63% were 'lively' and 8% died. All the dead crabs from the reimmersion set had been attacked by amphipods and isopods leaving only the shell. The authors suggest that these taxa may have been responsible for killing the crabs, particularly where damage to the shell might have allowed access to the soft tissues of the crab. Arising from this, the authors suggest that physical damage may significantly increase discard mortality.

Skates

3.99 Information on skates taken as by-catch in the Subarea 48.3 longline fishery for *D. eleginoides* was described in WG-FSA-00/59. The authors positively identified two species, *Raja georgiana* and *Bathyraja meridionalis*, and tentatively recognised a third referred to as *Raja* species 1.

3.100 *R. georgiana* and *B. meridionalis* were found all around the South Georgia and Shag Rocks slope area whereas *Raja* species 1 appeared to be concentrated at the western end of South Georgia.

3.101 From an examination of previous catch records the authors suggest that the catches of *B. murrayi* and *B. griseocauda* may have been *B. meridionalis*. Also that previous records of *R. georgiana* may include significant quantities of *Raja* species 1 and that specimens identified as *R. taaf* may have been *R. georgiana*.

3.102 The authors noted that there is a very close similarity between *R. georgiana* and *Raja* species 1. The main differences identified in the paper are associated with the colouration; *R. georgiana* has large areas of white on the underside whereas *Raja* species 1 is dark on the underside and paler on the dorsal surface.

3.103 WG-FSA-00/22 provided information on a small collection of *R. georgiana* caught during the UK fish survey (WG-FSA-00/21). The authors noted that the taxonomic description of the species is spread through several papers and consequently drew together that information to compare with their field samples. A length to mass relationship of:

$$\text{total mass} = 0.00000646\ TL^{3.06}\ (N = 18, \text{length range: } 18–95\ cm)$$

was given in WG-FSA-00/22. This is the first length to mass relationship reported for *R. georgiana*.

3.104 Attempts at ageing skates were outlined in WG-FSA-00/59. More detailed information on the technique was given in WG-FSA-00/55 where the authors used vertebrae and the median dorsal thorns and tried several approaches to enhance annuli. The most effective method was by examination under X-ray of thorns that had been cleaned in trypsin and stained with alizarin. The Working Group noted that further work is planned on this topic.

3.105 The maturity scale for skates described by Stehman and Bürkel (1990) was used for the study reported in WG-FSA-00/59. The Working Group agreed that this description of maturity stages would be appropriate for use in the Scheme of International Scientific Observation.

3.106 Information on size at sexual maturity was given in WG-FSA-00/22 and 00/59. Based on the external morphology of the claspers in males and the size of the ovary in females, WG-FSA-00/59 gave the following L_{m50} values for the three species noted in the study:

R. georgianus:	female <88 cm TL, male <86 cm TL
Raja species 1:	female L_{m50} 100 cm, male 96 cm
B. meridionalis:	female ~140 cm, male 120 cm.

3.107 Using the clasper length relative to the pelvic fin length, WG-FSA-00/22 indicated that maturation of male fish occurs at around 80 cm total length. The only mature female in the sample was 91 cm total length.

3.108 The stomach contents of fish were described in WG-FSA-00/21. Smaller fish tended to have been feeding on krill and the mysid *Antarctomysis*. Larger skates had all been feeding on fish, principally *C. gunnari* and *Lepidonotothen larseni*.

3.109 A tagging study was initiated to investigate post-capture survival of skates taken as by-catch in the 1999 Ross Sea longline fishery (WG-FSA-00/55). A total of 2 058 skates had been tagged and released, approximately 20% of all skates caught. 90% of these fish were *Amblyraja georgiana*, the remainder were *B. eatonii* (see also paragraph 4.265).

Fish Identification

3.110 At its 1999 meeting SC-CAMLR had requested the Secretariat, in conjunction with CCAMLR technical coordinators, to prepare taxonomic keys for target and by-catch species of finfish commonly encountered in the longline fishery.

3.111 In response to a request from the Secretariat, the J.L.B. Smith Institute, Grahamstown, South Africa, had given permission for limited sections of their volume *Fishes of the Southern Ocean*, edited by O. Gon and P.C. Heemstra (1990), to be copied and used by CCAMLR scientific observers for observation programs on board longline vessels fishing in the Convention Area. This development was welcomed by the Working Group but it was recognised that the use at sea of such a volume, or even a subset as outlined above, was impracticable.

3.112 The Working Group discussed documentation available for 'at-sea' identification of fish. In addition to the extracts prepared by the Secretariat, there are the *FAO/CCAMLR Species Identification Sheets* which several members had found very useful. It was reported that the Australian Antarctic Division and AMLR Programs had prepared coloured waterproof documents giving photographs of those species most likely to be encountered in the fisheries along with key identification information. It was noted that some species, particularly Macrouridae, were very difficult to identify from photographs although the otoliths were diagnostic.

3.113 A subgroup, led by Dr Everson and including Drs Barrera-Oro, E. Fanta (Brazil), Kock, M. Vacchi (Italy), Mr Watkins and Mr Williams, met and discussed the most effective way of providing suitable information to observers.

3.114 Using the species reported by observers in their reports as a guide, the group drew up the following list of target and by-catch species likely to be taken in longline fisheries:

(i) Sharks: *Lamna nasus, Somniosus microcephalus;*

(ii) Rajiformes: *Amblyraja georgiana, Raja taaf, Bathyraja meridionalis, B. murrayi, B. eatonii, B. irrasa, B. maccaini;*

(iii) Chimaeridae;

(iv) Synaphobranchidae: *Histiobranchus bathybius;*

(v) Muraenolepidae: *Muraenolepis microps, M. orangiensis;*

(vi) Macrouridae: *Macrourus whitsoni, M. carinatus* (*M. holotrachys*);

(vii) Moridae: *Antimora rostrata, Halargyreus johnsonii*; and

(viii) Nototheniidae: *Dissostichus eleginoides, D. mawsoni*.

3.115 The following species were considered likely to be taken as target species or by-catch in current CCAMLR trawl fisheries:

(i) Myctophidae: *Electrona antarctica, E. carlsbergi, Gymnoscopelus braueri, G. bolini, G. nicholsi, G. opisthopterus*;

(ii) *Brama brama*;

(iii) Nototheniidae: *Aethotaxis mitopteryx, Dissostichus eleginoides, D. mawsoni, Gvozdarus svetovidovi, Notothenia rossii, N. coriiceps, N. neglecta, N. cyanobrancha, Paranotothenia magellinaca, Gobionotothen gibberifrons, G. acuta, Lepidonotothen squamifrons, L. mizops, L. larseni, L. kempi, Patagonotothen guntheri, Trematomus eulepidotus, T. hansoni, Pleuragramma antarcticum*;

(iv) Harpagiferidae: *Artedidraco* spp., *Pogonophryne* spp.;

(v) Channichthyidae: *Champsocephalus gunnari, Chaenocephalus aceratus, Pseudochaenichthys georgianus, Channichthys rhinoceratus, Chaenodraco wilsoni, Chionodraco hamatus, C. myersi, C. rastrospinosus, Chionobathyscus dewitti;* and

(vi) Liparidae.

3.116 The subgroup agreed, that to be of greatest practical use, the guide should be set out in the form of a field guide composed of individual sheets with two to four similar species per page. These pages might be left on display in the work area of a fishing vessel. They would contain the following information:

(i) good quality picture, either a colour photograph or line drawing with markers to indicate key diagnostic features;

(ii) illustration, where appropriate, of other key diagnostic features such as otoliths;

(iii) species name and CCAMLR species code;

(iv) brief description, in clear print, occupying no more than three lines, of obvious features, such as colour spination, position of fins etc., that make for near-certain species identification. Allometric relationships should be stated; and

(v) depth range and geographical distribution (map).

3.117 It was agreed that the preparation of this guide should be assigned a high priority and it was agreed that Drs Everson and Kock should prepare an initial draft for comment by the end of January 2001 with a view to preparing a guide for the longline fisheries before the anticipated start of the fishing season. Text would initially be in English but Members would be encouraged to provide translations into other languages. The preparation for a similar guide for use in trawl fisheries would be developed using the experience gained in drawing up the longline fishery guide. Observers should be invited to comment on the usefulness of the key at the end of their cruises. These comments would then be considered for inclusion in a final version of the key. The cost associated with the

preparation of the sheets would be born by the participants. However, funding would be required to reproduce the sheets in colour for distribution to observers. An estimated A$500 was requested for this purpose.

3.118 Recognising that these guides would not allow observers to identify all fish accurately, it was agreed that observers should be encouraged to label and store deep frozen all specimens whose identification was uncertain, and should request their technical coordinators to arrange for transmission of the specimens to appropriate taxonomists.

Other Species

3.119 Information on the ecology of nine inshore fish species sampled over a number of years at Danco Coast, Subarea 48.1, was described in WG-FSA-00/63. Two species, *G. gibberifrons* and *C. aceratus*, had been taken in significant numbers as by-catch during commercial fishing. Relative densities of *G. gibberifrons* in the South Shetland Islands, where commercial fishing has taken place, were still much lower than at Danco Coast, the site of the current observations. The authors concluded that this difference was due to slow recovery following heavy fishing in the 1970s.

3.120 Similar results were obtained in a study on the diet of the Antarctic shag (*Phalacrocorax bransfieldensis*) in the same region (WG-EMM-00/9). The agreement between both studies highlights the utility of the standard method implemented by WG-EMM, on the use of the Antarctic shag to monitor changes in the abundance of inshore demersal fish populations (paragraph 5.6).

Developments in Assessment Methods

3.121 WG-FSA-00/36 presented new software, 'Fish Heaven', for modelling the dynamics of fish stocks with spatial characteristics governed by habitat variables. It is a simple spatially explicit age-structured model, containing the basic features of the GYM with extensions to provide for different environmentally driven distributions of fish stocks. It is designed to allow environmental simulations with fishing while capturing various statistics about the status of the system. It allows fishing to be undertaken with basic fishing strategies and can be used to simulate sampling of fish stocks generally. These are intended to be extended. The software is available for distribution through the Australian Antarctic Division or the Secretariat.

3.122 The Working Group welcomed these developments and encouraged further work, noting that this model will have wider applications internationally.

3.123 WG-FSA-00/39 provided a method for integrating standardised CPUE time series into assessments using the GYM. This follows the proposal by Dr P. Gasiukov (Russia) in 1999 to undertake such an integration (WG-FSA-99/60) and the request by the Working Group to develop this work further during the intersessional period (SC-CAMLR-XVIII, Annex 5, paragraphs 3.143 to 3.145). The procedure in this paper was based on the sampling/ importance-resampling (SIR) method for estimating a likelihood of a given time series of fishable biomasses in a trial of the GYM given the time series of standardised CPUE over the same period. These likelihoods can be used to statistically weight each of the trials in the evaluation of the criteria in the GYM rather than assuming equal likelihood for all trials. This procedure is able to use all the trials in the final assessment without

giving preference to the CPUE or GYM input parameters as the primary indicators of stock abundance.

3.124 The Working Group discussed the resampling step of SIR and agreed to discuss this further intersessionally. The Working Group endorsed the use of this procedure in the assessments this year and noted that a greater number of trials may be required to improve the application of the method. An Excel spreadsheet with macros was provided with the paper to apply this method to the outputs of the GYM.

3.125 A new version of the GYM (version 3.02) was now available to the Working Group to enable the use of a recruitment time series and reporting to a user-friendly file of the status of the population each year. These modifications were required to facilitate the integration of CPUE into GY assessments. The Working Group agreed to have these minor improvements validated at this meeting in order that the latest version of the GYM could be used. Dr Gasiukov kindly agreed to undertake the validation and validated this version during the meeting prior to the assessments. The Working Group endorsed the use of the validated GYM in this year's assessments.

3.126 WG-FSA-00/43 presented an assessment undertaken by Australia of the harvested population of *D. eleginoides* at Macquarie Island based on data from a tag-recapture experiment initiated during the 1995/96 fishing season. Population models that include dynamics of tagged and untagged fish, daily releases, catches, recaptures, natural mortality and annual net recruitment are used to assess the population of one of the main fishing regions of Macquarie Island. The pre-tagging abundance is estimated by incorporating a Petersen approach in a novel semi-parametric model using maximum likelihood methods. The software provides for a number of assessment models, including a basic model that assumes the recaptures are Poisson distributed, and the recapture expectations are conditional on catch numbers and previous recaptures. A second model attempts to account for apparent decreasing availability with length.

3.127 The Working Group noted that this approach may have wider applicability in assessing stocks targeted by longline fishing for which no direct estimates of abundance may be possible. One such example could be the future assessment of tagged fish arising from the experiment begun this year at South Georgia (WG-FSA-00/26).

3.128 WG-FSA-00/46 provided another new method for assessing the status of *Dissostichus* spp. stocks. It used a dynamic age-structured production model of *Dissostichus* spp. and trends in CPUE and recruitment indices to estimate parameters of the model, including pre-exploitation biomass and the stochastic part of recruitments. The initial results of the application of this model show differences between the outputs of the GYM and this approach, as well as differences in the recruitment series estimated from surveys. These differences need to be explored further. Dr Gasiukov proposed that further development of this method could provide the foundation for short-term assessments of the status of the stock.

3.129 The Working Group welcomed these new developments of assessment methods and agreed to discuss this further in the subgroup assessing *Dissostichus* spp. It encouraged further development of this approach, including the undertaking of sensitivity trials (paragraph 4.105).

3.130 WG-FSA-00/52 used time series of estimates of cohort strength arising from mixture analyses of length-density information to estimate jointly recruitment and natural mortality. Currently, natural mortality is an input parameter to the process of estimating recruitments. However, natural

mortality has not been directly estimated for *D. eleginoides*, but instead is assumed to be about two to three times the value of the von Bertalanffy k. The paper proposes a method for the joint estimation of recruitment and M using a negative log-likelihood method. This entails first decomposing length-density distributions of a time series of trawl survey data into mixtures of different aged cohorts by means of the method of de la Mare (1994). Next, under the assumption of constant mortality for all cohorts in all years, a negative log-likelihood function was derived using a series of several cohorts from the mixtures to produce an estimate of M and the abundance of recruits at a nominated age for each cohort in the analysis. The procedure was provided on a Mathcad 2000 Professional worksheet.

3.131 The Working Group welcomed the introduction of this method, noting that mortality has not yet been directly estimated for *D. eleginoides*. It also suggested that a log-normal error function should be used in place of the error function described in the paper, in order to be consistent with the general expectation of a lognormal distribution of recruitments. With this modification, the Working Group endorsed the use of the method in the assessments this year.

ASSESSMENTS AND MANAGEMENT ADVICE

New and Exploratory Fisheries

New and Exploratory Fisheries in 1999/2000

4.1 One conservation measure relating to new fisheries and 13 conservation measures relating to exploratory fisheries were in force during 1999/2000. These are summarised in Table 18.

4.2 In only five of these 14 new or exploratory fisheries did fishing actually occur during 1999/2000. Information on these fisheries is summarised in Table 19. In most cases, the numbers of days fished and the catches reported were very small. The notable exception was the exploratory fishery for *Dissostichus* spp. in Subarea 88.1, conducted under Conservation Measure 190/XVIII, where three vessels fished for a total of 162 days, taking 745 tonnes of *D. mawsoni*.

4.3 Reviewing the information in Tables 18 and 19, the Working Group strongly reiterated its concern, expressed at previous meetings, about the number of times that new and exploratory fisheries have been notified but never actually activated. The Working Group also noted that often the same or similar notifications have been made repeatedly, but in each case no fishing had eventuated. Table 20 summarises the history of new and exploratory fishery notifications and the catches subsequently taken.

4.4 Each time a notification is made, the Working Group is required to review it and, to the extent possible, to provide advice on precautionary catch limits. Given the large number of notifications received over the last few years, an increasingly large proportion of the time available to the Working Group had to be devoted to consideration of new and exploratory fisheries. Despite this, and despite notifications having been made for a large number of subareas and divisions, once again the Working Group has essentially no new information on *Dissostichus* stocks in most of these areas. The concern is further heightened by the fact that substantial amounts of IUU fishing are believed to have occurred in these areas.

4.5 The Working Group agreed that some of these difficulties may be alleviated if changes were made to the system of notification and classification of fisheries. This is discussed further under 'Regulatory Framework' (paragraphs 4.270 to 4.274).

4.6 Conservation Measure 182/XVIII, governing exploratory fisheries, requires that once the catch in a small-scale research unit (SSRU) has exceeded a trigger level (10 tonnes or 10 hauls), research hauls must be carried out and the results reported to CCAMLR. Table 21 summarises the research data submitted in accordance with this conservation measure.

4.7 In only three of the active exploratory fisheries were the catches taken in SSRUs sufficiently large that the requirement to undertake research hauls was triggered. This occurred in SSRUs A, B and C in respect of the Uruguayan exploratory longline fishery in Division 58.4.4, in SSRUs A and B in respect of South African longline fishery in Subarea 58.6 and in SSRUs A, B, C and D in respect of the New Zealand exploratory longline fishery in Subarea 88.1.

4.8 Based on data contained in the observer report, the Working Group noted that the South African vessel undertaking exploratory fishing in Subarea 58.6 had taken some 22 tonnes of *D. eleginoides*. Mr Watkins indicated that the fine-scale catch information for this vessel had been despatched to the Secretariat, but due to the vessels late return (3 October 2000), the information had not yet arrived. For this reason, the Working Group reiterated that as indicated in Table 21, the available data were incomplete.

4.9 The Working Group noted with regret that by the start of its meeting no commercial or research catch data for this exploratory fishery had been received by the Secretariat. These data were received during the course of the meeting, but too late for the Working Group to review them. The Working Group also noted with some surprise that 55 tonnes had been taken in other grounds not covered by defined SSRUs. As such, no research requirements are mandated under Conservation Measure 182/XVIII. There may be a need to reconsider the specification of SSRUs for this division.

4.10 Last year the Working Group had concluded that it would be unable to provide reliable advice on precautionary catch limits for new or exploratory fisheries until new information directly pertaining to the subareas or divisions involved became available. Currently, the only likely source of such data is from new and exploratory fisheries carried out in these areas, especially the research data collected in accordance with the requirements of Conservation Measure 182/XVIII. It is vital that these research requirements are continued and complied with for all future new or exploratory fisheries.

4.11 The Working Group also emphasised that the research plans mandated by Conservation Measure 182/XVIII represent minimum research requirements. It is likely that these and additional research data will need to be collected for a number of years before reliable assessments will be possible. In this context, the Working Group encouraged the submission, wherever possible, of more comprehensive research plans, extending further than those required under Conservation Measure 182/XVIII.

4.12 The exploratory longline fishery in 1999/2000 by New Zealand for *D. mawsoni* in Subarea 88.1 provided a welcome and notable exception to the general lack of information about new and exploratory fisheries outlined above. A total of 745 tonnes was taken in 489 longline hauls, and research data were collected and submitted for four SSRUs. In most cases, the numbers of research hauls made exceeded the research requirements of Conservation Measure 182/XVIII.

4.13 Research activities associated with this exploratory fishery were summarised in WG-FSA-00/35, and a comprehensive analysis of data collected by this fishery from 1997/98 to 1999/2000 was given in WG-FSA-00/55. Dr Constable noted that, in addition to the considerable amounts of new biological data collected, a sufficiently large number of SSRUs may now have been fished in this subarea to allow a characterisation of the distribution of CPUEs across large parts of the subarea. If so, these data may allow a comparison of observed densities in Subarea 88.1 with those in Subarea 48.3.

4.14 The precautionary catch limit of *Dissostichus* spp. in Subarea 88.1 for the 1999/2000 season was 2 090 tonnes, comprising catch limits of 175 tonnes north of 65°S, and 478 tonnes in each of the four SSRUs to the south of 65°S (Conservation Measure 190/XVIII). Three New Zealand vessels fished during the season, with a reported catch of 745 tonnes (CCAMLR-XIX/BG/1). The majority of the catch was *D. mawsoni*, with only 0.3 tonnes of *D. eleginoides*.

4.15 The exploratory fishery has now been in operation by New Zealand vessels for three seasons with a gradual increase in catch from 41 tonnes by one vessel in 1998, to 296 tonnes by two vessels in 1999, and to 745 tonnes by three vessels in 2000. During this time there has been a widespread distribution of effort with at least four SSRUs and from 28 to 44 fine-scale rectangles fished each year, and a total of 76 fine-scale rectangles fished overall (WG-FSA-00/55). This has contributed significantly to the knowledge and distribution of both *Dissostichus* spp. and other fish fauna in this subarea.

4.16 *D. mawsoni* were caught in over 95% of all sets, and in all five SSRUs (WG-FSA-00/55). They were the dominant species in all sets apart from those made in the northern SSRU. Over 20 000 fish have been measured and sexed, and over 2 000 otoliths collected, of which 1 500 have been read. Gonad samples have also been collected and examined histologically to help identify size and age at maturity.

4.17 During the period of the exploratory fishery the impact on dependent species has been low (WG-FSA-00/35). The main by-catch species have been rat tails which have averaged about 10% (range 6–17% by weight) of the annual catch, and skates which have averaged about 8% (range 5–11%) of the annual catch. For age determination purposes, otoliths have been collected from rat tails and vertebrae from skates, and a skates tagging experiment has been initiated to determine their post-hauling survival rate. To date, 2 000 skates have been tagged, of which four have been recaptured. New Zealand has also conducted line-weighting experiments to mitigate seabird by-catch and there has been no incidental mortality of seabirds or marine mammals.

4.18 Observer length-frequency data for *D. mawsoni* were examined for variation in area, trip, and set type (commercial/research), and were then stratified and scaled up to the commercial catch for each of the past three seasons (WG-FSA-00/55). The resulting catch-weighted length frequencies are shown in Figure 2. Most fish in the catch ranged from 70–160 cm, with two broad modal peaks at 80–110 cm and 130–140 cm.

4.19 About 500 otoliths were read from *D. mawsoni* each year and the resulting ages were compiled into year-specific age–length keys. These were then applied to the scaled length-frequency distributions to produce catch-at-age distributions for each year (WG-FSA-00/55) (Figure 3). Most *D. mawsoni* in the catch were 8–16 years old

(range 3–35 years). The data suggest an increase in the size and age of fish caught over the three-year period, probably due to changes in fishing practices.

4.20 The Working Group used a similar approach to that used at last year's meeting to calculate precautionary catch limits for Subarea 88.1. Yields were estimated for Subarea 88.1 by relating the CPUE from research sets and biological parameters for *D. mawsoni* to the CPUE, biological parameters and yield estimate for *D. eleginoides* in Subarea 48.3.

4.21 A formula for estimating yield was derived from the approach used for krill where:

$$\text{Yield} = \gamma B_0$$

and that CPUE is considered to be an approximate relative estimate of biomass density. These can be combined to give the following:

$$Y_{881} = \frac{g_{881} f_{881} A_{881}}{g_{483} f_{483} A_{483}} Y_{483}$$

where γ is the precautionary pre-exploitation harvest level for each area, f is the relative density (a function of CPUE and fishing selectivity), A is the seabed area, and Y is the pre-exploitation precautionary yield. This assumes that the catchability and the relationship between CPUE and actual density is the same for both species/fisheries. A full derivation of the formula is lodged with the CCAMLR Secretariat.

4.22 While the general approach adopted was similar to last year, there were several key improvements. Firstly, several alternative approaches were used to adjust for relative seabed areas. The first two of these approaches were identical to that used last year, where the adjustment was based on relative areas of fishable seabed, and recruitment areas. The third approach involved the calculation of the area of seabed that has actually been fished in Subarea 88.1 over the past three seasons. A fourth estimate adds the area that is likely to be fished in the 2000/01 fishing year to that which has already been fished.

4.23 The Working Group agreed that, as the proportional adjustment was applied to the actual fished area, in principle the third approach should be more scientifically justifiable than the first two. However, it also noted that this should be regarded as a minimum estimate of the area of *Dissostichus* spp. habitat. The Working Group reviewed the three sets of estimated seabed areas and noted that a larger area would probably be fished in 2000/01.

4.24 The second improvement was in the estimation of relative fish density between the two areas. A total of 100 research sets were carried out in four SSRUs in Subarea 88.1 during 1999/2000 as part of Conservation Measure 190/XVIII. Relative density of recruited biomass between the two areas was estimated by comparing the CPUE from Subarea 48.3 for the 1986/87 to 1991/92 fishing seasons, with the CPUE from the research sets in Subarea 88.1. These seasons were chosen for Subarea 48.3 because these are data available from the fishery at a time when the stock was close to pre-exploitation levels. Data from 1985/86 were excluded because fishing was in very shallow water in that year (paragraph 4.109). CPUE was calculated as kg/hook for each set in each of the smaller regions in Subarea 48.3 and in each of the SSRUs fished in Subarea 88.1.

4.25 As CPUE is very variable in space and time, and is being used in this analysis as an indicator of the relative differences in abundance between the two areas, the ratio was determined by finding

the one-sided lower 95% confidence bound of this ratio using a bootstrap procedure. This is consistent with the principles applied in the short-term assessment of yield for *C. gunnari* (paragraph 4.204). Firstly, the haul-by-haul CPUE estimates were weighted by the proportion of sets and the proportion of the total area fished in that SSRU (SC-CAMLR-XVIII, Annex 5, paragraph 4.127). Then the CPUE estimates from each area were resampled with replacement, averaged and the ratio of CPUE between the areas calculated. This was repeated 10 000 times and the one-sided lower 95% confidence bound of this ratio calculated.

4.26 The aim of this second adjustment was to take explicit account of observed relative densities between the two areas. In calculating the adjustment factor in this way, the Working Group recognised that effectively it was treating CPUE data for a well-established commercial fishery as being directly comparable with CPUE data from randomly carried out research sets in fishing areas that were not well known or fully explored. It is possible that this may lead to an underestimate of the appropriate adjustment factor, but the Working Group agreed that, if this occurred, the resulting precautionary catch limit would also be underestimated. Any disadvantages this approach entailed were felt by the Working Group to be far outweighed by the advantages of taking account of relative densities on the fishing grounds. Consistent with exploratory fisheries elsewhere, the assessment of yield will be improved with more information as the fishery develops.

4.27 Because the estimate of CPUE relates only to the recruited biomass, a third adjustment was required to convert this value to total biomass. The ratio of total biomass to recruited biomass was calculated from each of the two fisheries using the appropriate biological parameters. The fishing selectivity was estimated from the left side of the length-frequency distributions for the combined commercial length-frequency data for Subarea 88.1 (Figure 4) and the earliest reliable commercial length-frequency data (from 1995) for Subarea 48.3. For Subarea 48.3, length at 50% selectivity equalled 70 cm with a range from 55 to 85 cm. The ratios for each of the two fisheries were very similar and equalled 1.10 for *D. mawsoni* and 1.13 for *D. eleginoides*.

4.28 The final adjustment was made by comparing the precautionary pre-exploitation harvest levels (γ) between the two areas. These were calculated from the biological and fishery parameters for each of the two subareas. Biological and fishery parameters for *D. eleginoides* were the same as that used for the Subarea 48.3 assessment (Table 34). However, the fishing selectivity pattern was again taken from the left side of the 1995 commercial length-frequency distribution.

4.29 Updated biological parameters for *D. mawsoni* were provided in WG-FSA-00/55. Growth parameter estimates for both sexes were updated using data from 1999/2000 and equalled L_∞ = 180.2 cm, k = 0.095 yr^{-1}, t_0 = 0.04. The length–weight relationship calculated from 1998 to 2000 data combined was $W = 4.7 \times 10^{-6} L^{3.199}$. M was estimated from the age of the oldest 1% of fish in the commercial catch and ranged from 0.15 to 0.22 yr^{-1}. Fish were assumed to be selected into the fishery at 80 cm with a range from 65 to 95 cm. The size at maturity was assumed to be 100 cm with a range from 85 to 115 cm. Biological and fishery parameters used for *D. mawsoni* in the GY calculations are shown in Table 22.

4.30 Estimates of γ from the GYM equalled 0.037 for *D. mawsoni* and 0.034 for *D. eleginoides*. This suggests that *D. mawsoni* is more productive than *D. eleginoides* which appears to be counter intuitive for a species inhabiting higher latitudes. The Working Group agreed to explore this result further taking into account uncertainties in the estimate.

4.31 Total seabed area was the same as was calculated for the assessment last year (SC-CAMLR-XVIII, Annex 5, paragraphs 4.44 and 4.45). Recruited seabed area for South Georgia was taken from Everson and Campbell (1990). Estimates of fished area were taken by summing the area in the contours between 600 and 1 800 m fished by New Zealand vessels during the 1997/98 to 1999/2000 seasons. The estimate of fished area proposed for 2001 equals the area of seabed that is likely to be fished in the 2000/01 fishing season, and includes the area already fished and an estimate of the areas of new ground which will be explored by New Zealand vessels. A component of the research plan adopted by New Zealand is to continue to expand knowledge on the distribution of *D. mawsoni*. This analysis is based on projections by the New Zealand vessels to fish in deeper water (1 400–1 700 m) and further south than in previous years.

4.32 The pre-exploitation precautionary yield for Subarea 48.3 was calculated using the recruitment parameters from the results of the CMIX analyses, together with the other biological parameters used for the calculations of γ, using zero catches. This yield (4 690 tonnes) was then adjusted by the ratio of gammas, densities (a function of CPUE and fishing selectivity), and seabed areas to give estimates of yield for *D. mawsoni* in Subarea 88.1.

4.33 The resulting estimates of yield are given in Table 23. Because it is based on the known adult habitat of *D. mawsoni* in Subarea 88.1, the best available estimate of yield is based on the fished area and equals 3 616 tonnes.

4.34 The Working Group noted that whilst the current assessment provided several improvements to earlier assessments of this area, there was still considerable uncertainty present. This uncertainty stems from uncertainty in biological and fishery parameters for both *Dissostichus* spp., and the assumption of the relationship between CPUE and density.

4.35 In light of this uncertainty, the Working Group agreed that some discount still needs to be applied to the results of this assessment. The Working Group noted that in previous years a range of discount factors (from 0.25 to 0.5) has been applied to new and exploratory fisheries for *Dissostichus* spp.

4.36 The value of including a research component in Conservation Measure 182/XVIII is demonstrated by the use of the CPUE estimates from the research sets in the assessment of *D. mawsoni* in Subarea 88.1 (paragraphs 4.20 and 4.21). The Working Group agreed that further collection of data from research sets would be valuable for the assessments next year. This use of research sets was considered to be important both for Subarea 88.1 and for other new and exploratory fisheries (e.g. Division 58.4.4) generally. Members were also requested to investigate further during the intersessional period the application of research set data in assessments.

4.37 The Working Group agreed it would be desirable to develop a time series of research sets in the SSRUs to help provide indices of abundance. For example, in the second or subsequent years of the fishery, vessels which have already completed a series of research sets in a particular SSRU could be required to complete their research sets in a similar location (same fine-scale rectangle) and at a similar time to their first set. If this causes operational difficulties (e.g. ice), a new set could be undertaken instead. Alternatively, research sets could continue to be used as an effort spreading mechanism. The Working Group also agreed that tag studies initiated early in the fisheries would help in long-term assessments (paragraphs 3.126 and 3.127).

New and Exploratory Fisheries Notified for 2000/01

General Issues

4.38 A summary of new and exploratory fisheries notifications for 2000/01 is given in Table 24. As was done last year, the Working Group discussed notifications of new and exploratory fisheries together. Research survey notifications for *Dissostichus* spp. were also discussed under this item.

4.39 All notifications had been received by the Secretariat on or before the due date. Recalling the experiences of last year, the Working Group recommended that in future years neither it nor the Scientific Committee should consider any notifications received after the due date.

4.40 Dr Miller noted that some of the notifications for new or exploratory fisheries in Division 58.4.4 have neglected to specify that they applied only to areas outside national EEZs. This needs to be rectified when conservation measures are being drawn up.

4.41 The Working Group noted that the Argentinian notification (CCAMLR-XIX/12) included an intent to fish in Subareas 48.1 and 48.2, and the Brazilian notification (CCAMLR-XIX/5) included an intent to fish in Subarea 48.2. Conservation Measures 72/XVII and 73/XVII clearly state that the taking of finfish in these subareas, other than for research purposes, is prohibited until such time as a survey of stock biomass is carried out, its results reported to and analysed by the Working Group, and a decision that the fishery be reopened is made by the Commission based on the advice of the Scientific Committee. As these conditions have not yet been met, the Working Group recommended that new or exploratory fisheries for finfish should not take place in these subareas in the coming season.

4.42 The Brazilian notification (CCAMLR-XIX/5) also indicated an intent to fish for *D. eleginoides* in Subareas 48.3 and 48.4. The Working Group noted that the fisheries in these subareas are fisheries regulated under Conservation Measures 179/XVIII and 180/XVIII respectively. Thus new or exploratory fishing for this species cannot be considered in these areas.

4.43 The Working Group welcomed what it believed to be the primary intent of the Brazilian notification, which was to inform CCAMLR that Brazil intended, for the first time, to participate in fisheries in those areas. It agreed that the submission of such information was very useful. Further discussion regarding notifications may be found under 'Regulatory Framework' (paragraphs 4.270 to 4.274).

Review of Individual Notifications

4.44 Argentina submitted a notification (CCAMLR-XIX/12) for exploratory longline fisheries for *Dissostichus* spp. in Subareas 48.1, 48.2, 48.6, 58.6, 88.1, 88.2, 88.3 and Divisions 58.4.1, 58.4.2, 58.4.3, 58.4.4 and 58.5.1 outside EEZs.

4.45 Aside from the recommendation above regarding Subareas 48.1 and 48.2 (paragraph 4.41), the Working Group drew attention to the fact that the available area outside national EEZs in Division 58.5.1 was small, so appropriate precautionary catch limits for these areas should also be similarly small.

4.46 Australia submitted a notification (CCAMLR-XIX/10) for exploratory bottom trawl fisheries for *Dissostichus* spp. in Divisions 58.4.1 and 58.4.3 and a notification (CCAMLR-XIX/11) for an exploratory trawl fishery for *Dissostichus* spp., *C. wilsoni, L. kempi, T. eulepidotus, P. antarcticum* and other species in Division 58.4.2. The second notification was a resubmission of a notification made last year.

4.47 In response to a query about potential effects of trawling on the bottom substrate and benthic fauna, Dr Constable explained that in Divisions 58.4.1 and 58.4.3 most of the area contained rough ground, with only small areas suitable for trawling. In contrast, Division 58.4.2 contained large areas suitable for demersal trawling. As indicated in CCAMLR-XIX/11, the research plan for this division calls for a series of open and closed areas as required in Conservation Measure 182/XVIII. In addition, the research plan also included specific experiments to examine the effects of demersal trawling on the benthic community. Results of these experiments will be reported to the Working Group next year.

4.48 Brazil submitted a notification (CCAMLR-XIX/5) for exploratory longline fisheries for *D. eleginoides* in Subareas 48.2, 48.3, 48.4 and 48.6, and Divisions 58.4.4, 58.5.1 and 58.5.2 (outside the EEZs of South Africa, France and Australia).

4.49 As noted above (paragraph 4.41), until a survey has been completed as required in Conservation Measure 73/XVII, the Working Group recommended that no exploratory fishing should take place for finfish in Subarea 48.2. Any catches taken in Subareas 48.3 and 48.4 should be considered to be taken as part of the fisheries established in those subareas (paragraph 4.42).

4.50 With regard to exploratory fishing in Divisions 58.5.1 and 58.5.2, the Working Group drew attention to the fact that the available area outside national EEZs in these divisions is small, so appropriate precautionary catch limits for these areas should also be similarly small.

4.51 France submitted a notification (CCAMLR-XIX/13) for new and exploratory longline fisheries for *D. eleginoides* and *Raja, Bathyraja* and *Macrourus* spp. in Subareas 58.6 and 58.7 and Divisions 58.4.3, 58.4.4, 58.5.1 and 58.5.2 outside the EEZs of South Africa, Australia and France.

4.52 The notification by France indicated that *Raja, Bathyraja* and *Macrourus* spp. were not considered to be target species, but that some commercial return was to be sought from by-catches of these species. It is thus unclear whether catches of these species should be treated as by-catches, in which case Conservation Measure 182/XVIII would apply, or whether they should be treated as new fisheries. The Working Group agreed that further clarification was needed on this matter.

4.53 Fishing for *D. eleginoides* in Subarea 58.7 is governed by Conservation Measure 160/XVII, which prohibits the taking of this species until such time as a survey of stock biomass is carried out, its results reported to and analysed by the Working Group, and a decision that the fishery be reopened is made by the Commission based on the advice of the Scientific Committee. The French notification suggested that a survey will be undertaken in Subarea 58.7, but no notification of research vessel activity has been made, nor has any detailed research plan and survey design been submitted for consideration by the Working Group. The Working Group believes that clarification is needed of what is intended in Subarea 58.7.

4.54 With respect to exploratory fishing in Divisions 58.5.1 and 58.5.2, as for the Brazilian notification, the Working Group drew attention to the fact that the available area outside national EEZs in these divisions was small, so appropriate precautionary catch limits for these areas should also be similarly small.

4.55 Consideration by the Working Group of the potential effects of the intended catches was hampered by the fact that no breakdown of catches by subarea and division was given in the French notification.

4.56 Finally, the Working Group noted that it was a strict requirement of Conservation Measure 182/XVIII that exploratory fishing vessels should carry a CCAMLR scientific observer.

4.57 New Zealand submitted a notification (CCAMLR-XIX/17) for an exploratory longline fishery for *Dissostichus* spp. in Subarea 88.1. This represents a continuation of the exploratory fishing program carried out by New Zealand in previous years in this subarea, for which considerable catch and research information has been submitted (see WG-FSA-00/35 and 00/55).

4.58 Dr Hanchet emphasised the long-term commitment by New Zealand to continued exploratory fishing and research in this subarea. He also indicated that consideration was being given to extending tagging studies, currently under way for skates and rays, to *D. mawsoni*. This may provide an alternative assessment method for this species and subarea.

4.59 Dr Hanchet also indicated that fishers had found the by-catch provisions for *Macrourus* spp. in Conservation Measure 182/XVIII to be too restrictive. In the 1999/2000 season in Subarea 88.1, on 22% of the exploratory sets and 20% of the research sets the catch of *Macrourus* spp. exceeded 100 kg, triggering a requirement to move to another location. A total of 17% of all sets caught more than 200 kg of *Macrourus* spp. and 11% of all sets caught more than 300 kg of *Macrourus* spp.

4.60 The New Zealand notification for 2000/01 indicated an intended catch of up to 300 tonnes of *M. carinatus* south of 65°S. The Working Group noted that species identification for *Macrourus* spp. remains problematic, but it is apparent that they are an abundant species in these latitudes. Dr Hanchet clarified that, while New Zealand national regulations required the retention of all *Macrourus* spp. catches, they were definitely considered a by-catch species by the commercial fishers.

4.61 The Working Group noted that the way Conservation Measure 182/XVIII operated for this fishery was to require a change of location from high *Macrourus* spp. by-catch areas about 20% of the time. A valuable result of this is that it encourages fishing over a wide geographic range, as intended by paragraph 2 of Conservation Measure 182/XVIII.

4.62 Given their relatively high level, the Working Group agreed that the provisions of Conservation Measure 182/XVIII with respect to *Macrourus* spp. by-catches need to be reviewed. This will require, at least, an assessment of *Macrourus* spp. to have been carried out. Means of achieving this are discussed later (paragraph 4.100).

4.63 South Africa submitted a notification (CCAMLR-XIX/6) for exploratory longline fisheries for *Dissostichus* spp. in Subareas 48.6, 58.6, 88.1 and 88.2 and Division 58.4.4. The Working Group had no specific comments or queries about this notification.

4.64 Ukraine submitted a notification (CCAMLR-XIX/7) for an exploratory longline fishery for *Dissostichus* spp. in Division 58.4.4. The Working Group had no specific comments or queries about this notification.

4.65 Ukraine had also submitted results of seven historical research surveys conducted on four cruises on the Ob and Lena Banks in 1980, 1982, 1986 and 1989. The Working Group welcomed the submission of these valuable data and they were passed to the *Dissostichus* spp. subgroup for preliminary analysis (paragraph 4.158).

4.66 Ukraine is also currently carrying out a longline research survey in Division 58.4.4 under the provisions of Conservation Measure 64/XII, with an estimated catch of less than 50 tonnes. The Working Group noted that, for *Dissostichus* spp., there was some incompatibility between the requirements of this conservation measure and those of Conservation Measure 182/XVIII in terms of the relationship between catch levels and research requirements. This is discussed further under 'Advice to the Scientific Committee' (paragraphs 4.77 to 4.102).

4.67 Uruguay submitted a notification (CCAMLR-XIX/15) for exploratory longline fisheries for *Dissostichus* spp. in Subareas 88.1, 88.2 and 88.3 and Division 58.4.4.

4.68 Recalling that Uruguay had conducted an exploratory longline fishery in Division 58.4.4 during 1999/2000, but that data for this fishery had been received too late for consideration during this meeting, the Working Group was unable to assess the various fishery and research plans proposed in this notification. The Working Group emphasised that timely submission of data was essential for the Working Group to provide the advice required by the Scientific Committee and Commission.

4.69 Uruguay submitted a notification (CCAMLR-XIX/16) for an exploratory pot fishery for *D. eleginoides* in Subarea 48.3. It also submitted a notification (CCAMLR-XIX/16) for an exploratory pot fishery for crabs in Subarea 48.3. In accordance with Conservation Measure 64/XII, the UK submitted a notification (CCAMLR-XIX/9) of research vessel activity involving pot fishing for *D. eleginoides* with an expected catch over 50 tonnes in Subarea 48.3. The USA also notified (CCAMLR-XIX/BG/18) its intent to participate in the crab fishery in Subarea 48.3 in accordance with Conservation Measure 181/XVIII.

4.70 The Working Group recalled its discussion of UK research vessel activity involving pot fishing for *D. eleginoides* in Subarea 48.3 last year (SC-CAMLR-XVIII, Annex 5, paragraphs 4.28 to 4.31) and subsequent discussion by the Scientific Committee (SC-CAMLR-XVIII, paragraphs 8.3 to 8.5). It had been made clear that any pot catches of *D. eleginoides* should be counted against the *D. eleginoides* catch limit in Subarea 48.3. Similarly, any retained catch of crabs should be counted against the crab catch limit for Subarea 48.3. The Working Group strongly reiterated these views.

4.71 Dr Parkes drew attention to the analyses of the UK pot fishing research contained in WG-FSA-00/23. He noted that pot fishing had proved to be an effective method for catching *D. eleginoides* with no incidental mortality of seabirds. The size frequency of *D. eleginoides* taken in pots was almost identical to those for longlines. Pot fishing was, however, associated with a substantial by-catch of crabs. A very high proportion of the crab by-catch was undersized. These were discarded and nominally do not count against the crab catch limit. While evidence suggests that most discarded undersized crabs survive, there certainly is some discard mortality. Data in

WG-FSA-00/23 were used to estimate crab discard mortality (paragraph 3.98), and account should be taken of this when assessing crab stock status.

4.72 Dr Parkes further indicated that there was some evidence that large crab catches were associated with lower catches of *D. eleginoides*. The pot fishing research planned for the coming season was aimed at reducing the crab by-catch as much as possible.

4.73 The Working Group noted that both Uruguayan notifications should be treated as notifications of intended participation in established fisheries, rather than as exploratory fisheries. The Working Group regretted that it had not been possible for a Uruguayan scientist to participate in the current meeting and provide further information about the proposed pot fishing activities. However, it welcomed the fact that a CCAMLR scientific observer will be carried on board the vessel.

4.74 Further discussion of these notifications was referred to the subgroups dealing with *D. eleginoides* (paragraphs 4.108 to 4.155) and crabs in Subarea 48.3 (paragraphs 4.238 to 4.244).

4.75 The Republic of Korea and the UK submitted a notification (CCAMLR-XIX/8) for an exploratory jig fishery for *Martialia hyadesi* in Subarea 48.3.

4.76 Dr Miller noted that, in accordance with Conservation Measure 148/XVII, it was mandatory for VMS to be installed on the exploratory fishing vessel. He also noted that Conservation Measure 183/XVIII requires the presence of a CCAMLR scientific observer.

Advice to the Scientific Committee

4.77 Despite considerable efforts, last year the Working Group had found itself unable to carry out the assessments needed to provide reliable advice on precautionary catch limits for new and exploratory fisheries, using the data and assessment methods currently available. In reaching this conclusion, the Working Group had further agreed that reliable assessments would not be possible for subareas and divisions for which new or exploratory fisheries had been notified until considerable further data pertaining directly to these areas became available. For the 1999/2000 season, with the exception of Subarea 88.1 which was considered separately, very little new information was available. In consequence, the Working Group agreed that it would only attempt an assessment for the exploratory fishery notified for Subarea 88.1 at this meeting.

4.78 For each of the remaining subareas and divisions subject to notifications for new and exploratory fisheries, the Working Group was unable to provide advice on appropriate levels of precautionary yields that should apply to whole subareas or divisions. It agreed, however, that catch and effort expended in exploratory fisheries should continue to be governed by the measures contained in Conservation Measure 182/XVIII, which include, *inter alia*, that fishing in each fine-scale rectangle shall be restricted to one vessel at a time, and that fishing in each fine-scale rectangle shall cease when the reported catch reaches 100 tonnes.

4.79 The nine notifications for new or exploratory longline or trawl fisheries for *Dissostichus* spp. in the 2000/01 season pertained to 16 subareas or divisions. Table 24 summarises the numbers of vessels, gears and intended catches by country and area.

4.80 Subareas 48.1, 48.2 and 58.7 are covered by conservation measures (72/XVII, 73/XVII and 160/XVII respectively) prohibiting the taking of finfish until such time as a survey of stock biomass is carried out, its results reported to and analysed by the Working Group, and a decision that the fishery be reopened is made by the Commission based on the advice of the Scientific Committee. In the absence of such surveys, the Working Group recommended that no exploratory fishing should take place in these subareas. For Subarea 58.7, clarification is needed of precisely what activities are intended in the French notification.

4.81 Subareas 48.3 and 48.4 are the subject of established fisheries and/or catch limits. It is therefore inappropriate for exploratory fisheries for *Dissostichus* spp. to take place in those subareas. The notifications should be taken as notifications of intent to participate in these established fisheries.

4.82 For Divisions 58.5.1 and 58.5.2, the Working Group noted that last year the Scientific Committee had advised that the amount of fishable grounds in divisions that lie outside national EEZs is very small, and that new or exploratory fisheries in those areas are unlikely to be viable (SC-CAMLR-XVIII, paragraph 9.50). Based on this advice, the Commission had agreed that the proposed exploratory fisheries in these divisions would be unviable (CCAMLR-XVIII, paragraph 7.23).

4.83 As is clear from Table 25, not all notifications specified the intended catch in each subarea or division. Furthermore, even where these were specified, different notifications took different approaches to determining them. In the South African and Argentinian notifications, for example, attempts were made to specify realistic levels of intended catches, bearing in mind the expected times to be spent in the areas, the expected catch rates, and the trade-off between the needs for research and for assessing the viability of the fisheries. In other cases, the intended catch was simply stated to be less than or equal to the current precautionary catch limit for the area. While this inconsistency remains, it is difficult to assess the likely effects of several new or exploratory fisheries operating in the same area in the same season.

4.84 Similarly, very few notifications specify the number of vessels that will operate in individual subareas or divisions. Again, this impedes evaluation of the levels of effort that may be applied in subareas and divisions for which there are multiple notifications.

4.85 In all but one of the other subareas and divisions in Table 25, more than one new or exploratory fishery notification has been made, and in six subareas or divisions, three or more notifications have been made. In Division 58.4.4, six notifications have been made, involving up to a maximum of 14 vessels. If the catch limit for this division remains the same as for last season, and all notified fisheries are activated, then this would imply approximately 60 tonnes per notified fishery. Clearly there is a potential for the catch limit to be taken in a relatively short time and for the catch limit to be overshot.

4.86 A further practical problem arises when there are multiple exploratory fisheries operating in a subarea or division. Conservation Measure 182/XVIII requires that fishing in any fine-scale rectangle shall cease when the reported catch reaches 100 tonnes, and that only one vessel at a time

may fish in any fine-scale rectangle. Currently, catches within SSRUs are monitored by the Secretariat via the five-day reporting system. The Working Group agreed that this system would in principle be capable of ensuring appropriate compliance with Conservation Measure 182/XVIII, provided the five-day reporting system operates accurately and in a timely manner.

4.87 It is clear from CCAMLR-XIX/BG/5, however, that the timeliness of five-day report submissions last season was not very good. If a similar performance occurs next season, the five-day reporting system may not be sufficient to monitor accurately compliance with the requirements of Conservation Measure 182/XVIII with respect to SSRUs, when more than one exploratory fishery is operating in an area. In principle, the presence of VMS on each vessel would allow accurate monitoring of vessel positions, but without a central coordinating body it is difficult to see how this information could be used.

4.88 The Working Group also discussed the appropriateness of the 100 tonne catch limit per SSRU in light of the intent of Conservation Measure 182/XVIII to ensure that exploratory fishing occurs over as wide a geographic area as possible. Table 26 summarises the frequency distribution of catches per SSRU over the last four seasons. In most cases, the reported catches per SSRU have been less than 50 tonnes and catches over 50 tonnes have only been recorded in Subarea 88.1. Obviously, a reduction of the 100 tonne limit per SSRU would encourage a wider geographical distribution of effort. However, the Working Group believed that this issue needed further consideration, and agreed that it should be reviewed again at its next meeting.

4.89 Both longline and trawl fisheries have been notified for Divisions 58.4.1, 58.4.2 and 58.4.3. As these two fishing gears have different selectivities, last year the Working Group had recommended that precautionary catch limits should be apportioned differentially for these gears.

4.90 Recognising that different selectivities need to be taken into account, the Working Group agreed that it was also important to give priority to those exploratory fisheries which were more likely to provide information which would enhance the ability to conduct assessments in the future. Historical experience suggests that this has occurred more frequently with trawl fisheries than with longline fisheries, especially when these have involved the conducting of research surveys, though useful information has been gathered by the exploratory longline fishery in Subarea 88.1. Another factor that favours trawl over longline exploratory fisheries at the early stages of their development is that trawl fisheries take a wider size range of fish and they are thus more likely to produce information on growth and natural mortality.

4.91 Another factor that needs to be taken into account when comparing trawl and longline exploratory fisheries is the extent to which each is associated with incidental mortality and with other ecosystem effects. Generally, trawl fisheries cause lower incidental mortality than longlines, though occasional instances of substantial incidental mortality have occurred with trawls (paragraphs 8.4 and 8.6). On the other hand, trawl fisheries involving moderate to high levels of effort in restricted areas can have substantial effects on the seabed and associated benthic communities.

4.92 The potential fishing areas in Divisions 58.4.1 and 58.4.3 are largely confined to the Elan and BANZARE Banks. The Working Group agreed that separate precautionary catch limits should be set for these two banks, rather than for the two divisions. It also recommended that exploratory fishing activities in these divisions should be restricted to these banks only. The evidence from previous trawl surveys on these banks is that the abundance of fish is probably low. Accordingly,

the Working Group recommended that precautionary catch limits for these banks should be set as follows:

Elan Bank:	trawl fishing – 145 tonnes; longline fishing – 145 tonnes
BANZARE Bank:	trawl fishing – 150 tonnes; longline fishing – 150 tonnes.

4.93 For Division 58.4.2, last year a precautionary catch limit of 500 tonnes was set for the exploratory trawl fishery for *Dissostichus* spp. notified by Australia. This year, an exploratory trawl fishery and an exploratory longline fishery have been notified for this division. The Working Group recommended that the total precautionary catch limit set for *D. eleginoides* for this division should be split equally between the trawl and longline fisheries, since it is expected that they will be fishing on the same part of the stock in this division.

4.94 The best available estimate of yield for *D. mawsoni* in Subarea 88.1 is 3 616 tonnes.

4.95 The Working Group noted that there is greater uncertainty in this assessment than that for Subarea 48.3 and some level of discounting is still appropriate (paragraph 4.35).

4.96 The Working Group agreed that further collection of data from research sets would be valuable for the assessments next year (paragraph 4.36).

4.97 For Subareas 48.6, 58.6 and 88.2 and Division 58.4.4, precautionary catch limits for *Dissostichus* spp. had been set at CCAMLR-XVIII. The Working Group noted that during the 1999/2000 season, Conservation Measure 172/XVIII prohibited directed fishing for *Dissostichus* spp. in subareas and divisions, for which no specific conservation measures had been adopted.

4.98 The Working Group agreed that, until it had gained more information on areas currently fished for *Dissostichus* spp. under new and exploratory fishery regimes and more experience with the operations of SSRUs, it would be inappropriate at present to open previously unfished areas to fishing for *Dissostichus* spp., or to reopen areas that have not been fished for *Dissostichus* spp. in recent years. It therefore recommended that Subarea 48.5, the Antarctic coastal part of Division 58.4.1, and Subarea 88.3 be closed to directed fishing for *Dissostichus* spp.

4.99 In the Uruguayan exploratory fishery during 1999/2000 in Division 58.4.4, 55 tonnes of *D. eleginoides* were taken outside designated SSRUs. As catches outside SSRUs do not have the potential to trigger research activities regardless of their size, the Working Group recommended that the entire area of Division 58.4.4 currently not contained in designated SSRUs be designated as an SSRU.

4.100 The New Zealand notification for an exploratory fishery in Subarea 88.1 (CCAMLR-XIX/17) included an intended catch of *M. carinatus* of up to 300 tonnes south of 65°S. As discussed in paragraphs 4.58 to 4.62, the by-catch provisions of Conservation Measure 182/XVIII had been found to be too restrictive by the fishers. The Working Group noted that Conservation Measure 182/XVIII in fact did not specify a total by-catch limit for *Macrourus* spp., and that the appropriateness of the trigger levels in this conservation measure also needs consideration. The Working Group encouraged Members to submit an assessment of *Macrourus* spp. at its next meeting.

4.101 The 50 tonnes maximum catch specified in Conservation Measure 64/XII for scientific research activities, below which certain exemptions pertain and no detailed research plan need be submitted for review, applies regardless of the species to be taken or the gear to be used. Conservation Measure 182/XVIII, which applies to exploratory longline or trawl fisheries for *Dissostichus* spp., triggers specific research activities whenever the catch in a SSRU exceeds 10 tonnes. These two conservation measures are therefore inconsistent in their application to *Dissostichus* spp.

4.102 The Working Group recommended that the application of Conservation Measure 64/XII to research surveys for *Dissostichus* spp. should be amended so that the exemptions only apply to catches up to 10 tonnes. Research plans for research vessel activity involving catches of *Dissostichus* spp. exceeding 10 tonnes should be subject to a full review by WG-FSA and the Scientific Committee. The Working Group agreed that, as amended, Conservation Measure 64/XII should continue to apply to all gears (e.g. including pot fishing for *Dissostichus* spp.).

Assessed Fisheries

Dissostichus eleginoides

4.103 Methods for assessing *D. eleginoides* were established by WG-FSA in 1995 (SC-CAMLR-XIV, Annex 5, including Appendix E). The procedure for assessing long-term annual yields was modified this year to allow for recommendations made during the WG-FSA meeting in 1999. A method of incorporating a time series of recruitments to the GYM was introduced (WG-FSA-00/39) and an updated model made available to the Working Group. Additionally, a procedure of introducing estimated trends of standardised CPUE into results of the GYM was used during assessment (paragraphs 3.121 to 3.125). The Working Group focused primarily on determining trends in CPUE, estimating recruitment indices, natural mortality, growth parameters, and assessing long-term annual yields using the GYM. These were the primary components of the work this year.

4.104 The potential application of the Age Structured Production Model (ASPM) approach for *Dissostichus* spp. stock assessment was described in WG-FSA-00/46. WG-FSA welcomed the introduction of new quantitative assessment techniques such as the ASPM, and encouraged progress toward the testing and potential application of alternative quantitative tools for *Dissostichus* spp. assessment.

4.105 With respect to the ASPM approach, the Working Group felt that this model may have a useful role in future assessments. However, the Working Group expressed concern over several of the estimated parameters presented in WG-FSA-00/46 and the resulting effect on biomass. In particular, the estimate of the steepness parameter h that describes stock recruitment was 0.292, which is unrealistic for any fish species. For most stocks, values of h will likely fall within a range of 0.75 to 0.95. In addition, there are other parameters estimated by the ASPM model, such as the autoregressive parameter, that require further study as to the effect on *Dissostichus* spp. biomass estimates. A sensitivity analysis of ASPM model parameters was encouraged and the Working Group recommended that this analysis should be carried out prior to using this model for any assessment purposes.

4.106 Analysis of CPUE data was undertaken for Subarea 48.3 where new longline haul-by-haul data were made available. The details and extensions of the analysis are discussed under these subareas.

4.107 Assessments of long-term annual yield were reviewed for Subarea 48.3 and Division 58.5.2. Several input parameters to the GYM were reassessed, and new estimates of parameters were generated for both Subarea 48.3 and Division 58.5.2. The methods for estimating the parameters were those used in the Workshop on Methods for the Assessment of *Dissostichus eleginoides* (WS-MAD) held in 1995 (SC-CAMLR-XIV, Annex 5, Appendix E), and methods presented in WG-FSA-00/52.

South Georgia (Subarea 48.3)

4.108 The catch limit of *D. eleginoides* in Subarea 48.3 for the 1999/2000 season was 5 310 tonnes (Conservation Measure 179/XVIII) for the period 1 May to 21 July 2000. A total of 16 licensed vessels from Chile, Republic of Korea, South Africa, Spain, Ukraine, UK and Uruguay fished during the season. The fishery was closed on 21 July 2000 when the reported catch in the longline fishery reached 5 210 tonnes (CCAMLR-XIX/BG/5) and 17 tonnes had been reported in the experimental pot fishery (see also pagraph 3.58).

Standardisation of CPUE

4.109 Haul-by-haul catch and effort data for Subarea 48.3 submitted on C2 forms (fine-scale data) for the 1991/92 to 1999/2000 fishing seasons have been supplemented by historical data for Ukrainian longline vessels operating in Subarea 48.3 in the seasons 1985/86 to 1988/89 and 1990/91 (WG-FSA-00/33). GLM analyses were conducted using this extended dataset, except for data for the first season (1985/86), when fishing had been restricted to very shallow depths (mainly less than 300 m). Last year, when analysing CPUE data for the seasons 1991/92 to 1998/99, the Working Group had agreed that only data for the winter months (March to August inclusive) would be used in the analyses. This year, given the results of analyses of an extended CPUE dataset (seasons 1985/86 to 1998/99) reported in WG-FSA-00/33, data for all months were included in the analyses.

4.110 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) (SC-CAMLR-XVIII, Annex 5, Figure 5), depth and bait type were considered as predictor variables. Following the suggestion last year (SC-CAMLR-XVIII, Annex 5, paragraph 4.113), depth was coded as a factor with four levels (0–500 m, 500–1 000 m, 1 000–1 500 m, 1 500 m and above), in order to allow interactions of other predictor variables and depth to be investigated. GLM analyses were conducted on positive CPUE data only, with an adjustment for zero catches being made afterwards. This year, because of the frequency of hauls for which catch numbers were not reported, no analyses were conducted using CPUE in numbers/hook as the response variable.

4.111 The basic approach used to fit the GLMs was the same as that used last year, with a square root transformation being applied and a robust form of GLM fitted. In addition to fitting models with

each of the listed predictor variables as main effects, models incorporating season–nationality, season–month, season–depth, nationality–depth and nationality–month interactions were also fitted. In contrast to the analyses conducted last year, the only statistically significant effects were nationality, season and depth. None of the remaining main effects or interactions even approached significance. A QQ-plot of residuals from the fitted model (Figure 5) revealed some departures from the assumed error model, but these were not sufficient to reject the fit. However, the Working Group noted that the extended dataset remained very unbalanced, with fishing in the early seasons (1986/87 to 1992/93) being carried out primarily in summer months by eastern European vessels, and in the later seasons (after 1993/94) mainly in winter months by fleets of different nationalities (largely South American). This implies that some doubt must still remain about how well the relative levels of standardised CPUEs in early and later seasons have been estimated.

4.112 The standardised time series of CPUEs in kg/hook is plotted in Figure 6 and given in Table 27. The standardisation is with respect to Chilean vessels fishing at depths of 1 000–1 500 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 given in Table 28. Adjusted, standardised catch rates have fluctuated around a relatively constant level between 1986/87 and 1994/95. As was seen last year, the adjusted standardised catch rates declined substantially between 1994/95 and 1996/97, but they have increased each season since then.

4.113 Examination of the distributions of depths fished in Subarea 48.3 by season and area revealed that the trend in recent seasons towards increased longline fishing at shallow depths (300–700 m) has continued in the 1999/2000 season, particularly to the north of Shag Rocks. Histograms of depths fished by season are shown in Figure 7, and by area around South Georgia for the 1998/99 and 1999/2000 seasons in Figures 8 and 9. When these distributions are grouped by different levels of CPUE, it is clear that the shallow-depth fishing contributed substantially to the overall CPUEs (Figure 10).

4.114 The Working Group examined the (full-season) catch-weighted length frequencies by season and area (Figures 11 to 13). These figures indicate that in the last three seasons the modal length around South Georgia was lower than in previous seasons. Around Shag Rocks, there was a notable decline in modal length in the last three seasons and also a notable reduction in the spread of the length-frequency distributions. However, the length frequencies for depths above and below 900 m at Shag Rocks were very similar.

4.115 The Working Group updated the weighted length-frequency plots for *D. eleginoides* caught in the longline fishery in Subarea 48.3. The plots are split into three series: for South Georgia (Figure 11), for Shag Rocks <900 m (Figure 12), and for Shag Rocks >900 m (Figure 13). The length frequencies for Shag Rocks <900 m show that the mean length in the catches was 87 cm in 1996 and 1997, but dropped to 77 cm in 1998. In 1999 and 2000 the mean lengths in the catches increased slightly to 79 cm and 81 cm respectively.

4.116 A change in the mean length in catches like this is consistent with the recruitment of a new large year class to the fishery. According to the von Bertalanffy length–age relationship for this stock presented during 1999 (SC-CAMLR-XVIII, Annex 5, Figure 21), 7-, 8- and 9-year-old fish would be about 75, 82 and 90 cm respectively. It is, however, possible that a large year class may have

slower growth than average due to competition for food, and the year class that has recruited to the fishery in 1998 may be from 1991 or one of the preceding year classes.

4.117 WG-FSA in 1999 (SC-CAMLR-XVIII, Annex 5, paragraph 4.119) noted that smaller fish were contributing more to the catches than in the past, and that the selectivity of fish was likely to be changing. A change in the size composition of the catches may be due to a change in the size composition of the stock, to a change in the fishing pattern, or both. A change in the size composition of the stock is possible or even likely, as indicated above. As the smaller fish tend to be found in shallower water than the older fish (Agnew et al., 1999), it is possible that the fishery may have moved into shallower depths in order to target the newly recruited and smaller fish, which may have given higher catches.

Determination of Long-term Annual Yields using the GYM

4.118 The analysis of long-term annual yield was updated with recent catches taken from Subarea 48.3, including the new recruitment estimates from the 2000 UK survey, the use of the recruitment time series and standardised CPUE estimates into the GYM analysis.

Growth, Mortality and Fishing Selectivity

4.119 Estimates of the von Bertalanffy parameters were obtained from a reanalysis conducted in 1999 (SC-CAMLR-XVIII, Annex 5, paragraph 4.116) of length-at-age data first used in 1995. The values of L_∞, k and t_0 were estimated by combining the lengths at age from two sources: otoliths collected in the UK survey around South Georgia in January and February 1991; and an age–length key compiled by Aguayo (1992) from readings of scales taken from the commercial longline fishery during February to May 1991. The estimated parameters used were L_∞ = 194.6 cm, k = 0.066.yr^{-1} and t_0 = -0.56 years.

4.120 The Working Group discussed the findings of WG-FSA-00/28 which concluded that scale readings likely provide underestimates of age. The Working Group noted that estimates of growth parameters based on otoliths from longline catches were provided in WG-FSA-00/44. However, researchers and custodians of the raw data felt that the information was not ready for release until full review and documentation. Thus, the Working Group had no access to the data and felt that it was premature to incorporate this information for analysis. Therefore, the values of L_∞, k and t_0 used during the 1999 assessment were considered the best available estimates for assessment purposes.

4.121 Although the estimates of growth parameters were carried forward from the previous assessment, the uncertainties contained within these growth parameters greatly concerned the Working Group, as the underlying foundation of the modelling approaches used are greatly affected by these parameters. This led to the examination of alternative approaches regarding growth. These approaches are described in paragraphs 4.130 to 4.142. The Working Group stressed that work to refine and validate age-determination methods, including the validation of annual formation of rings in otoliths, is of the highest priority for future assessments.

4.122 The Working Group expressed concern that *D. eleginoides* exhibits considerable difference in size between the sexes. Female fish grow to a larger maximum size and mature at a greater length than males. The growth curve used as one of the basic inputs to the assessment is based on data from 1991, combined for both sexes. The difference in growth pattern between the sexes is thus not taken into account in the assessment.

4.123 With the present selection pattern showing 50% recruitment to the fishery at 67 cm length, female *D. eleginoides* may be subject to fishing for several years before first spawning (length at 50% maturity is 93 cm). As recruitment depends on the number and size of mature females, the current fishing pattern may present a threat to the stock that is not reflected in the current assessment. The Working Group considers that high priority should be given to the construction of separate growth curves for males and females of *D. eleginoides* in Subarea 48.3, and integration of these data into the assessment model.

Trends in Selectivity

4.124 There was new information on longline selectivity patterns presented to the Working Group. An updated analysis of selectivity in size to the fishery for *D. eleginoides* in Subarea 48.3 was conducted with the purpose of obtaining a more accurate estimate of the retention at 50%, the size at the beginning of exploitation and the size at which the species is totally recruited to the fishery. The available information for the analysis was the length densities of captures (combined sexes) for the years 1995, 1997, 1998, 1999 and 2000, and the parameters of growth and natural mortality used by WG-FSA in 1999.

4.125 The methodology was based on analysis of the capture curve. Catch curves are informative in that their right side in relation to the applied levels of total mortality follow the same exponential decline to that in the population (totally recruited individuals). The right side of the catch curve, assuming exponential decline, provides information regarding the levels of partial recruitment to size, since the capture probability changes as a function of size due to fishing selectivity, as well as depth, spatial and temporal distribution of the resources.

4.126 The methodological procedure (Pauly, 1984) consisted of extrapolating the catch levels to the sizes that should have been present if those sizes or ages have been totally recruited, under the hypothesis of the exponential decline of cohorts. The ratio between the observed capture and the estimated capture as fully recruited gives an estimate of the pattern of exploitation or selective effect on size. The estimated selectivity was then adjusted to the classic ogive curve, where the size at 50% of recruitment and the size at the beginning of exploitation were estimated.

4.127 The patterns of selectivity based on this approach are shown in Figure 14 and the resulting selectivity estimates by season in Table 29. These results show that the size at 50% selectivity for the year 2000 was 74 cm, the 5% selectivity was 66 cm and the 95% selectivity was 83 cm. The Working Group noted that the selectivity of fish was likely to be changing such that smaller fish were contributing more to the catches than in the past. Evidence that supports this contention is demonstrated in Table 29, where the size at 50% selectivity was 91.8 cm in 1995, and has decreased each year to the current 50% level of 74 cm.

4.128 The Working Group thought this approach was useful in detecting changes in selectivity between years. However, at this stage selectivity patterns between years cannot be fitted in the GYM. The Working Group encouraged further examination of this approach for next year's assessment, and agreed to retain values used in previous years (SC-CAMLR-XVIII, Annex 5, paragraph 4.118). These estimates indicated a size at 50% selectivity of 67 cm, with selection of fish into the fishery occurring greater than 55 cm and full selection at greater than 79 cm.

4.129 Selectivity patterns of *D. eleginoides* captured in pots were considered by the Working Group. Based on a comparison of the length-frequency distributions of *D. eleginoides* from the experimental pot fishery and longline fishery presented in WG-FSA-00/23, it was concluded that the selectivity of the longline and pot gear types does not appear substantially different. Therefore, for assessment purposes, catches from both methods were combined.

Recruitment and Natural Mortality

4.130 As for previous meetings (1995, 1997 and 1999), the Working Group analysed length-frequency data from trawl surveys expressed in terms of density (numbers/km^2) using the CMIX program (de la Mare, 1994) (termed 'length-density' or 'mixtures') (SC-CAMLR-XVIII, Annex 5, paragraphs 4.121 to 4.135), in order to generate estimates of recruitment to the population of *D. eleginoides* in Subarea 48.3. An important element of decomposing length-density data into densities of cohorts is to identify how many cohorts are likely to be present in the sample and to set length ranges in which the mean length of each cohort would be expected to be found. To this end, length-at-age relationships are used as a guide for setting these initial conditions in an analysis. The quality of the results is judged according to how well the expected densities from the analysis compares to the observed length densities.

4.131 Last year a reanalysis of the length densities was undertaken to help reconcile the existing length-at-age growth model with the length-density data from surveys (SC-CAMLR-XVIII, Annex 5, paragraphs 4.116 and 4.122). This analysis is referred hereafter as 'high k analysis'. The growth parameters used last year were derived from a reanalysis of length-at-age information used in 1995, which had been based on age readings from both otoliths and scales (SC-CAMLR-XVIII, Annex 5, paragraphs 4.116 and 4.117). While many cohorts appeared well resolved by these analyses, some of the expected lengths at age arising from the mixtures did not coincide well with the length-at-age curve (Figure 15) and some peaks in the observed length densities were not accommodated in the analysis. Also, the lengths at age may have been underestimated because scale readings were used to determine age for older fish and these are known to provide underestimates of age (SC-CAMLR-XVIII, Annex 5, paragraph 4.117 and WG-FSA-00/44). As a result, more cohorts may be present in the range of length densities than expected previously at the workshop in 1995.

4.132 The length-density data were reanalysed at this meeting allowing for the presence of more cohorts in the dataset. The expected mean length of cohorts was determined by using the growth rate, k, from the Heard Island length-at-age relationship estimated last year ($k = 0.041$) but keeping the other von Bertalanffy parameters the same as those used previously ($L_8 = 1\,946$ mm, $t_0 = -0.21$), hereafter called the 'low k analysis'. The results of the new fits to the survey data are shown in Figure 16.

4.133 Length-density distributions were extracted from a total of 14 trawl surveys in Subarea 48.3 (Table 30). However, data from only 12 surveys were used in the final analyses. Two new surveys were conducted during 2000 in Subarea 48.3, one by the UK in January–February and another by Russia in February.

4.134 Analysis of the survey data showed that in some cases, whilst catches of *D. eleginoides* were recorded, very few fish had been measured. In the case of the *Anchar* survey in 1990, the total catch was 3.7 tonnes, but only 210 fish had been measured throughout the survey. A large proportion of the catch (2.7 tonnes) was taken at two stations where only 34 fish were measured in total. The Working Group considered that due to the small sample sizes relative to the size of the catch, the length-density estimates might not provide a good representation of the size distribution of young fish in that year, particularly in view of the extent of the extrapolation required. It was therefore decided to omit this survey from the analysis. This was also the case for the most recent Russian survey where a total of 118 kg of *D. eleginoides* was caught and only 62 fish measured. A mixture analysis was attempted on this dataset but the sample size was too small and the mixtures could not be resolved. Thus, this survey was also excluded from the analysis.

4.135 There were also several hauls in some surveys where catches of *D. eleginoides* were recorded, but no fish were measured. Because length densities measure absolute numbers of fish in a given area, the Working Group agreed that even though length distributions for these catches were not available, it was necessary to include these fish in the analysis, in order that the estimates of recruitment would reflect the total abundance of fish in the survey catches. This was achieved using the same methodology as last year (SC-CAMLR-XVIII, Annex 5, paragraph 4.126).

4.136 The densities of fish up to age 10 were estimated for each survey following the procedure used at last year's meeting (SC-CAMLR-XVIII, Annex 5, paragraphs 4.127). Similarly, length densities for separate strata were pooled according to the method described in paragraph 4.127 of SC-CAMLR-XVIII, Annex 5. The area under each fitted distribution component is assumed to estimate the density of the corresponding age class. The assignment of nominal ages to mixtures assumed a birthday of 1 November.

4.137 The densities derived from the 1999 mixture analyses are given in Table 31, including results from the 2000 UK survey. For the 'low k analysis', the results of the fitting process are illustrated in Table 32 and Figure 16. The graphs in Figure 16 illustrate the observed length densities, the fitted mixtures and the age of the cohort. The resulting densities for each age are given in Table 32. In all cases, the positions of the modes of the fitted mixtures were consistent with the growth rate expected from the new value of k. Differences between sums of observed expected densities were generally small and the fits to the data were considered to be good. The only survey for which the fit to the data was poor was the UK survey in January 1991. Although the expected densities were much less than the observed densities, the respective modes seemed to coincide. In all cases, the sum of the expected densities at age were adjusted so that the sum of the densities across ages equalled the sum of the observed densities (SC-CAMLR-XVIII, Annex 5, paragraph 4.130). These were then scaled up to give estimates of total abundance using the total seabed area for 50–500 m of 40 993.3 km^2 (Everson and Campbell, 1990).

4.138 The Working Group noted some consistency in the patterns of age modes moving through the population sampled by the survey, but also noted that in some cases, apparently strong year

classes in one year did not appear in the samples the following year. This was a problem highlighted last year (SC-CAMLR-XVIII, Annex 5, paragraph 4.129).

4.139 In 1999 a range of estimates of M had been used based on M = 2k (0.13 yr^{-1}) to M = 3k (0.20 yr^{-1}) (SC-CAMLR-XVIII, Annex 5, paragraph 4.120). As no direct estimates of M had been obtained prior to this meeting, the Working Group agreed to use the method in WG-FSA-00/52 (paragraphs 3.130 and 3.131) to estimate M along with estimates of recruitment.

4.140 The estimates of abundance at age were then grouped into year classes. Cohorts with two or more estimates of abundance were used for assessing recruitment strength at age 4 (the first age in the assessments) and natural mortality. The value of M estimated using this procedure was used to project cohorts to age 4 for which only one estimate was available.

4.141 The Working Group considered the two time series of recruitments estimated from mixture analyses (paragraphs 4.131 and 4.132). The estimate of natural mortality using either series of cohorts were higher than expected for *D. eleginoides*, between M = 0.25 yr^{-1} and M = 0.35 yr^{-1}. The Working Group agreed that some of the estimates of cohort strength were much higher than the expected magnitude for the given cohorts. As a result, it was agreed to exclude these observations from the respective series for the purpose of estimating natural mortality. This resulted in one of the eight cohorts being excluded from the 'high k analysis', and two of the remaining seven had one less observation. For the 'low k analysis', three out of the 10 cohorts had one less observation and one had two less. The estimates of recruitment from this analysis remained largely unaltered after exclusion of the respective observations. Thus, the estimates of recruitment from the full analysis were used in the recruitment series.

4.142 The resulting estimates of natural mortality were M = 0.196 for the 'high k analysis' and M = 0.082 for the 'low k analysis'. These estimates are in the same ranges used in the South Georgia and Heard Island assessments last year. The Working Group agreed to use these estimates in determining the age-4 recruitment of cohorts for which only one observation was available. The respective series of age-4 recruits are presented in Table 33, along with the mean and standard deviations used for determining the parameters of a lognormal recruitment function for use in stock projections using the GYM.

Assessment

4.143 In light of the new mixture analyses available and various assumptions regarding growth, recruitment and natural mortality, the Working Group conducted five alternative approaches for using this information as inputs for assessment of long-term yield in Subarea 48.3. The alternatives were:

(i) recruitment estimates and growth parameters from the 'low k analysis' (2000 mixture analysis) with mortality ranging from M = 0.082–0.196;

(ii) recruitments estimates and growth parameters from the 'high k analysis' (1999 mixture analysis) with mortality ranging from M = 0.082–0.196;

(iii) the 'high k analysis' using an internally consistent fixed M of 0.196;

(iv) the 'low k analysis' using an internally consistent fixed M of 0.082; and

(v) the 'high k analysis' with the range of M values used in last year's assessment (M = 0.132–0.198).

4.144 The Working Group considered that option (v) was the best approach because the upper bound of M was almost identical to that predicted by the 'high k analysis', and the lower bound of M was more consistent with the estimate of k from the 1999 growth parameters. Option (i) was rejected because the upper bound of M was incompatible with the low value of k. Option (ii) was rejected because the lower bound of M was inconsistent with the high value of k. Options (iii) and (iv), while having internally consistent parameters, did not allow for uncertainty in the estimate of natural mortality.

4.145 The Working Group therefore agreed to use option (v) for the final assessment of long-term yield. The other options were examined by the Working Group as an analysis of the sensitivity of the GYM to different estimates of growth, M and recruitment.

4.146 The Working Group noted that the results of yield from these assessments are sensitive to the estimates of natural mortality used in the projections, notably that lower estimates of M would result in an increase in yield. Given this and the need for growth parameters (k) and M to be approximately consistent, the Working Group agreed that option (v) was appropriate to use as the basis of this year's assessment until uncertainties in growth parameters are considered during the intersessional period. The range of M applied is consistent with a range of 2 to 3 times k. This range coincided with the greater estimate of M from the 'high k analysis'. The Working Group noted that the estimate of yield was at the lower end of the range considered in these options.

4.147 The input parameters for the GYM are shown in Table 34, giving the updated parameters as derived above. As in previous years, the decision rule concerning the probability of depletion was binding. The yield at which there is a probability of 0.1 of falling below 0.2 of the median pre-exploitation spawning biomass level over 35 years was 4 120 tonnes. The median escapement for this level of catch was 0.546.

Integration of CPUE into Assessment

4.148 The Working Group agreed that the procedure described in WG-FSA-00/39 for integrating the time series of standardised CPUE for Subarea 48.3 into the long-term yield assessment should be used this year (see paragraphs 3.123 and 3.124). This procedure involved weighting each of the 1 001 trajectories simulated by the GYM by their likelihood with respect to the standardised CPUE time series, rather than giving them equal weights as was done in past assessments.

4.149 A histogram of weights assigned to each of the 1 001 trajectories is shown in Figure 17. Figures 18 and 19 illustrate the effects of the weighting procedure by showing the 50 simulated trajectories accorded the greatest weight and least weight respectively, along with the scaled standardised CPUE series. In each figure, the standardised CPUE has been scaled using the average estimated catchability coefficient for the respective sets of 50 simulations.

4.150 The effect of using this procedure was to increase the estimate of the long-term yield marginally to 4 180 tonnes, with an adjusted median escapement of 0.54.

4.151 This was an increase in yield on the unadjusted estimate because the trials given least weight are those with a generally upwards trajectory (in contrast to the CPUE) and are most likely to have started near to or below 0.2 of the pre-exploitation median spawning biomass (Figure 19). Given their reduced weight in the assessment, the probability of depletion for the unadjusted estimate is reduced, thereby allowing a slight increase in yield.

4.152 The estimated long-term annual yield is lower than in previous years primarily as a result of reduced recruitment in Subarea 48.3 estimated from the most recent survey and incorporation of the recruitment series in the GYM analysis.

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

4.153 The Working Group welcomed the considerable progress made at this year's meeting in refining the data inputs into the GYM, particularly with respect to incorporating a time series of recruitments and integrating the CPUE series into the assessment model. The Working Group reiterated its advice from last year that the development of methods to integrate different indicators of stock status into assessments is a high priority.

4.154 The Working Group agreed that the catch limit for the 2000/01 season should be 4 180 tonnes. Other management measures for *D. eleginoides* in Subarea 48.3 in the 2000/01 season should be similar to the 1999/2000 season.

4.155 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.

South Sandwich Islands (Subarea 48.4)

4.156 Despite a catch limit of 28 tonnes for *D. eleginoides* (Conservation Measure 156/XVII), no fishing in this subarea was reported to the Commission during the 1999/2000 season. No new information was made available to the Working Group on which to base an update of the assessment. The Working Group was also unable at this year's meeting to consider the period of validity of the existing assessment.

Management Advice for *D. eleginoides* and *D. mawsoni* (Subarea 48.4)

4.157 The Working Group recommended that Conservation Measure 156/XVII be carried forward for the 2000/01 season. As last year, it was also recommended that the situation in this subarea be reviewed at next year's meeting with a view to considering the period of validity of the existing assessment.

Ob and Lena Banks (Division 58.4.4)

4.158 Ukraine has submitted data on three bottom trawl surveys of Ob Bank (Subdivision 58.4.4a) from 1980, 1986 and 1989, and four surveys of Lena Bank (Subdivision 58.4.4b) from 1980,

1982, 1986 and 1989. The target species of these surveys was *L. squamifrons*. By-catch species included *D. eleginoides*, *N. rossii* and *Nototheniops tchizh*. Along with the target species, measurements of all by-catch species were taken. A limited number of *D. eleginoides* were measured at Ob Bank, with a much larger quantity measured at Lena Bank.

4.159 Initial exploratory analysis suggests that there may be a sufficient data series from Lena Bank that could be used to estimate the level of recruitment of fish in Subdivision 58.4.4b. The available data do not appear to confirm any distinguishing characteristics between *D. eleginoides* captured at Ob and Lena Banks. Thus, it may be appropriate to combine the data series in future analysis. Because these data were presented to the Working Group at the time of the meeting, there was insufficient time to conduct any rigorous analysis of the survey data. The Working Group recommended that these data be analysed at the next WG-FSA meeting as this represents potentially valuable information for *Dissostichus* spp. stock status and assessment in Division 58.4.4.

Kerguelen Islands (Division 58.5.1)

4.160 According to STATLANT data reporting, the total catch in the fishery in Division 58.5.1 during the period 1 September 1999 to 31 August 2000 was 4 876 tonnes. Of this, about 2 615 tonnes were taken by longline, and 2 261 tonnes were taken by trawl. No assessments of long-term annual yields were undertaken this year.

Standardisation of CPUE in the Longline Fishery

4.161 Haul-by-haul catch and effort data for longline fisheries in Division 58.5.1 were made available to the Working Group this year. Using this information, a standardisation of CPUE was performed for the first time.

4.162 For the standardisation of CPUE at the Kerguelen Islands (Division 58.5.1), GLM analyses were performed using catch and effort data from longliners for the 1996/97 to 1999/2000 fishing seasons. Since this is the first time that longline CPUEs have been standardised in Division 58.5.1, CPUEs for all months (January–April and October–December inclusive) were used in the analyses. However, because of the experimental nature of this analysis, only the CPUEs in numbers/hook were analysed. Therefore, CPUE in numbers of fish per hook was defined as a response variable and fishing season, month, vessel, bait and mean depth of each haul were considered as predictor variables. For nationality, only the Ukrainian vessels were considered since the vessels of other nationalities did not provide sufficient information for this analysis. The analyses were conducted both on positive and zero values of CPUE.

4.163 The basic approach used to fit the GLMs was the same as that used for *D. eleginoides* in Subarea 48.3. Details of the methodology are provided in SC-CAMLR-XIV, Annex 5, Appendix G. However, some modifications were made in the CPUE data transformation and type of GLM analysis. These modifications were made to have a satisfactory distribution of residuals produced by the GLM functioning in S-plus software. A square root transformation of the response variable and a robust form of GLM analysis were carried out. The model used was GLM ((cpue) ~ fishing season + month + vessel + bait + mean depth), family = robust (quasi (link = sqrt, variance =

constant)). This resulted in a much more satisfactory distribution of residuals than any other transformations and probability functions searched over during this analysis (Figure 20). All predictive variables used in the model were highly statistically significant.

4.164 The time series of standardised CPUE indices (numbers/hook) from longliners in the Kerguelen Islands area is plotted in Figure 21 and given in Table 35. Results show that the adjusted and standardised catch rates appear to have increased between the 1996/97 and 1998/99 fishing seasons, while they decreased during the last season, from 1998/99 to 1999/2000.

Standardisation of CPUE in the Trawl Fishery

4.165 The total catch in the trawl fishery in Division 58.5.1 during the 1999/2000 season was about 2 261 tonnes. It was not possible to undertake an analysis of trawl CPUE data at this year's meeting because haul-by-haul data were not available for analysis.

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

4.166 The Working Group has no information from the French authorities on whether there will be trawling and longlining in their EEZ within this division in the 2000/01 season (1 September 2000 to 31 August 2001).

4.167 The Working Group discussed the role of WG-FSA in assessment and management decisions regarding Kerguelen. At present, WG-FSA is not able to conduct assessments or give advice concerning *D. eleginoides* population status or exploitation in Division 58.5.1. There is currently no capacity to revise the stock assessment because recent haul-by-haul data were not provided by France. The Working Group recommended that these data should be made available for assessment purposes, as well as any other information that would help determine the current stock status. In addition, the Working Group felt that the presence of a French scientist would be beneficial, and would greatly add to the understanding of the state of *Dissostichus* spp. stocks in Division 58.5.1.

Heard and McDonald Islands (Division 58.5.2)

4.168 The catch limit of *D. eleginoides* in Division 58.5.2 for the 1999/2000 season was 3585 tonnes (Conservation Measure 176/XVIII) for the period 1 December 1999 to the end of the Commission meeting in 2000. The catch reported for this division at the time of the WG-FSA-2000 meeting was 3 008 tonnes. Two Australian vessels participated in the fishery.

Length Frequency

4.169 The Working Group examined the available catch-weighted length frequencies by season (Figure 22) for the Division 58.5.2 trawl fishery. These figures demonstrate that little change in

modal length and spread of the distribution has taken place in the four seasons of available data.

Determination of Long-term Annual Yields using the GYM

4.170 The analysis of long-term annual yield was updated with the recent catches taken from Division 58.5.2, the new recruitment estimates from the 2000 Australian survey and the use of the recruitment time series in the GYM. Parameters for growth, maturity and fishing selectivity were carried forward from the 1999 assessment as no new information was made available to the Working Group.

4.171 Estimates of the von Bertalanffy growth parameters were carried over from the 1999 assessment of Heard Island. The Working Group noted that there is a continuing problem with the samples from Heard Island being comprised primarily of small fish. Because of this, the Working Group agreed to continue the use of the L_8 estimated for South Georgia (194.6 cm). The estimates of k and t_0 were generated during the 1999 assessment by non-linear regression, and were 0.0414 yr^{-1} and -1.80 years respectively. The Working Group requested that further work be undertaken to clarify the growth model for this area.

4.172 The method for jointly estimating recruitment and natural mortality (paragraphs 3.130 and 3.131) was attempted for the survey series (four surveys in all) but only two cohorts had two observations, the rest had only single observations. Natural mortality was estimated to be less than 0. Consequently, the Working Group decided to apply the values for natural mortality from last year. The lower bound was consistent with the estimate of M for the slower growth rate determined in the assessment of Subarea 48.3 (paragraph 4.116). The Working Group agreed to use a range of M as for last year because of the uncertainty remaining in this parameter.

4.173 The recruitment series from 1999 was updated using the results of the 2000 survey described in WG-FSA-00/42. As fish greater than 450 mm are expected to be more widely distributed than the survey area, only the abundance of ages 3- and 4-year-old fish from this survey were used. The method for combining repeat estimates of cohorts was applied as for last year and the time series of recruitments is presented in Table 36. This resulted in an increase in the estimated abundance of the 1995 year class and the addition of the 1996 and 1997 year classes.

Assessment

4.174 The input parameters for the GYM are shown in Table 34, giving the updated parameters as derived above. As in previous years, the decision rule concerning the probability of depletion was binding. The yield at which there is a probability of 0.1 of falling below 0.2 of the median pre-exploitation spawning biomass level over 35 years was 2 995 tonnes. The median escapement for this level of catch was 0.547.

Management Advice for *D. eleginoides* (Division 58.5.2)

4.175 The Working Group recommended that the catch limit by trawling for Division 58.5.2 in the 2000/01 season be revised to 2 995 tonnes, representing the long-term annual yield estimate from the GYM.

General Advice

4.176 In addition to the advice pertaining to specific fisheries, the Working Group noted that many of the parameters used in the assessments, such as growth and natural mortality, remain uncertain. In some cases, the results are sensitive to changes in M (paragraph 4.146). These uncertainties have been taken account of, where possible, in the assessment procedures, such as having ranges of natural mortality in the assessments of long-term annual yield. However, some decisions need to be made at different stages in the work of the Working Group. For example, the assessment of *D. eleginoides* in Subarea 48.3 required choosing between different options as a result of compiling new information (paragraph 4.143). In this case, the Working Group chose the option that had the greatest internal consistency amongst estimates of parameters while allowing for uncertainty in M. The resulting estimate of yield was lower than most of the other options.

4.177 The Working Group recognised that taking full account of such uncertainties in the assessment process will require further work and sensitivity analyses during the intersessional period. It considered this to be an urgent priority.

4.178 The Working Group noted that adjustment of the recruitment parameters in *D. eleginoides* assessments in Subarea 48.3 and Division 58.5.2 is expected from one year to the next in the early years of estimating strengths of recruitment from surveys. This is illustrated in Figure 23 which shows, for increasing numbers of observed year classes, the departure of estimates of mean recruitment from the true mean given a recruitment CV of 1.0. Only after estimates of abundance for 15 to 20 cohorts have been obtained can it be expected that recruitment parameters would not alter appreciably given the addition of new cohorts to the assessments. Even then, the estimate may be biased and result in some adjustments over time.

Champsocephalus gunnari

South Georgia (Subarea 48.3)

4.179 The 1999/2000 season for the commercial fishery for *C. gunnari* around South Georgia (Subarea 48.3) was split into two periods: the first from 1 December 1999 to 29 February 2000 and the second from 1 June 2000 to 30 November 2000. There was a closed season from 1 March to 31 May to protect spawning concentrations. The catch limit agreed by the Commission for the 1999/2000 season was 4 036 tonnes (Conservation Measure 175/XVIII). Several other conditions applied to this fishery, including overall by-catch limits (Conservation Measure 95/XIV), 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 CCAMLR scientific observer on every vessel.

4.180 Two vessels took part in the commercial fishery in 1999/2000. WG-FSA-00/20 provided summary information on the activities of the Russian-registered stern trawler *Zakhar Sorokin*. The other vessel involved in the fishery was the Chilean-registered trawler *Betanzos*. Fishing took place between 11 December 1999 and 31 January 2000 when the catch limit was expected to be taken. The total reported catch was 4 110 tonnes. This was 74 tonnes over the catch limit set by the Commission, due to late submission of five-day catch reports in the period leading to the closure of the fishery.

4.181 The main by-catch species was *G. nicholsi* with a total catch of 67.7 tonnes. Other by-catch included *G. bolini* (120 kg), *P. guntheri* (210 kg), Loliginidae (310 kg) and Elasmobranchii (100 kg).

4.182 Both vessels carried observers designated by the UK in accordance with the CCAMLR Scheme of International Scientific Observation, and observer reports were submitted to the Secretariat. The *Zakhar Sorokin* also carried a national observer from Russia.

Past Assessment

4.183 The catch limit for the 1999/2000 season was derived from a short-term cohort projection first performed at the 1997 meeting of WG-FSA (SC-CAMLR-XVI, Annex 5, paragraphs 4.179 to 4.182). This was based on a one-sided lower 95% confidence bound of the biomass estimate from the UK trawl survey in September 1997, calculated using a bootstrap procedure during the 1997 meeting (SC-CAMLR-XVI, Annex 5, paragraphs 4.199 to 4.208). The projection was used to calculate catch limits for a period of two years: 1999/2000 and 2000/01. The estimated catch limit for 2000/01 was 2 774 tonnes.

New Information Available in 2000

4.184 Although the assessment at last year's meeting had calculated a catch limit for the forthcoming season, the Working Group considered the range of new information available at this year's meeting that could be used to reassess the status of the *C. gunnari* stock in Subarea 48.3 and make recommendations for catch limits in 2000/01. The new information comprised catch/effort and biological data from the commercial fishery, which represented the first substantial fishing for this species since the 1989/90 season. The Working Group also received reports and data from two bottom trawl surveys in January and February 2000 by the UK and Russia respectively (see also paragraphs 6.5 and 6.6).

Commercial Fishing

4.185 Fishing was concentrated primarily in one area of very high catch rates on the shelf to the west of South Georgia, located in stratum SGNW (Figure 24). WG-FSA-00/19 reported on acoustic observations in this area by the *Zakhar Sorokin* that indicated the presence of dense aggregations of fish with a vertical range of between 10–20 m and 30–40 m, and a horizontal range of 0.2–1.2 n miles.

4.186 Average daily catch rates (catch/hour fishing) from the two vessels operating in the fishery are plotted in Figure 25. Both vessels undertook two trips. Catch rates during the first trip were highly variable, ranging between 2 tonnes/hour and nearly 25 tonnes/hour. Catch rates during the second trip were less variable being in the range of 1–6 tonnes/hour. The report of the CCAMLR observer on the *Zakhar Sorokin* noted that the catch rates were so high that the processing capacity of the vessel was sometimes insufficient to keep pace with the supply of fish. At these times, the net was left in the water, but moved away from the area where fish were indicated on the fishfinder, so that the backlog of catch could be processed before the next catch was brought on board. The observer therefore cautioned that calculation of catch rates on the basis of the period during which the net was in the water might be misleading because the net would not have been actively fishing for all of this period.

4.187 Catch-weighted length distributions for the two vessels by month are provided in Figure 26, along with length distributions for previous years where available. Length distributions from the two vessels fishing in 1999/2000 appear to be different. Both vessels fished mainly in the same area, suggesting that the differences resulted from the fishing gear and the way in which it was fished. Both vessels used pelagic otter trawls but the size of the Russian trawl was substantially greater than the Chilean trawl (horizontal openings 90 m and 40 m respectively). Also codend mesh sizes differed; these were 92 mm for the Russian trawl and 110 mm for the Chilean trawl.

4.188 On the basis of age estimates from previous analyses and the age–length key in WG-FSA-00/51, the length distributions indicate that the bulk of the catch was composed of fish aged 2 to 5.

Research Surveys

4.189 The results of the two surveys undertaken in the 1999/2000 season were reported in WG-FSA-00/21 (UK), and 00/47 and 00/51 (Russia).

4.190 Figure 24 shows the locations of stations sampled during the two surveys and the catch rates (densities) at each station. The Russian survey sampled 81 stations (67 at South Georgia and 14 at Shag Rocks). The UK survey sampled only 41 stations (30 at South Georgia and 11 at Shag Rocks). The number of stations fished by the UK survey was less than on previous surveys, due to time constraints and difficulties in fishing at predetermined locations due to icebergs and fog.

4.191 A combined ranking of the catch densities resulting from the two surveys indicated that the densities of fish encountered over the shelf were broadly similar with the exception of a few large catches. The *Atlantida* (Russia) had several large catches to the north and west of South Georgia, with two particularly large catches (one of 1.6 tonnes and the other of just over 3 tonnes per half hour tow) taken in the vicinity of the area fished by the commercial fishery. The UK survey had no large catches around South Georgia and did not sample in the area fished by the commercial fishery in the 1999/2000 season. The UK survey had a single large catch on the shelf to the east of Shag Rocks (2.6 tonnes per half hour tow), while the Russian survey had no large catches on the Shag Rocks shelf.

4.192 Both surveys used random stratified designs and provided estimates of standing stock (Table 37). Standing stock estimates were calculated using the swept area (Saville, 1977) and TRAWLCI (de la Mare, 1994) methods. For the South Georgia shelf, the standing stock estimated by the

Russian survey was considerably higher than that estimated by the UK survey. On the Shag Rocks shelf, the situation was reversed.

Assessment at this Year's Meeting

4.193 In considering options for the assessment of catch limits for *C. gunnari* in the 2000/01 season, the Working Group again recalled its discussions from previous years regarding variability in M between years in relation to the availability of krill and predation by fur seals, and the need to consider appropriate decision rules for application of the GYM to assessing precautionary yield for this fishery (e.g. SC-CAMLR-XVI, paragraphs 4.171 to 4.178).

4.194 WG-FSA-00/51 provided an alternative explanation for the fluctuations in biomass observed by the bottom trawl surveys. Based on acoustic observations during the *Atlantida* survey in January–February 2000, the paper suggested that the observed fluctuations could be explained by changes in the vertical distribution of fish in the water column. Low biomass may be recorded by the bottom trawl at times when the fish are distributed in the water column above the range sampled by the bottom trawl, and conversely high biomass may be recorded when the fish are present in high concentrations that are distributed closer to the seabed. The Working Group noted this alternative hypothesis and discussed the effects of the vertical distribution of fish under the heading of catchability (paragraphs 4.199 to 4.201).

4.195 As last year, there was no new information available to the Working Group on the properties of possible decision criteria for applications of the GYM to fisheries for *C. gunnari*. There was, however, new information regarding standing stock and there was evidence from the commercial fishery that there were commercial concentrations of *C. gunnari* in Subarea 48.3 during the 1999/2000 season.

4.196 The Working Group therefore agreed that the short-term projection used at the last two meetings of the Working Group, updated with new information on biomass and age structure, was the best available method for assessing catch limits for the 2000/01 season. The Working Group reiterated, however, that this is an interim approach used to ensure there is a low probability of depleting the stock in the short term, and increased efforts should be made to address the issue of a longer term management approach of *C. gunnari* fisheries in the Convention Area (paragraphs 10.1 to 10.6).

4.197 The data inputs required for the short-term assessment are listed in Table 42 of last year's report of the Working Group (SC-CAMLR-XVIII, Annex 5). In summary, these are a 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.

4.198 The Working Group agreed to use the results of the surveys in January and February 2000 to update the estimates of biomass and the distribution of numbers at age.

4.199 The Working Group discussed whether the catch densities from the surveys should be adjusted for catchability. The bottom trawl surveys are generally considered to provide indices of abundance rather than estimates of absolute biomass. One of the main factors affecting catchability

is the distribution of the fish in the water column above the level sampled by the bottom trawls routinely used during the surveys. The pattern of diurnal vertical migration shown by *C. gunnari* has been reported in the past and was again described in WG-FSA-00/19, using observations from the *Zakhar Sorokin* in 1999/2000.

4.200 Past surveys have attempted to take this phenomenon into account by taking bottom trawl samples for biomass estimation only during the hours of daylight when the fish are assumed to be distributed close to the seabed within that range sampled by the net (the average headline height of the trawls used during the surveys in 1999/2000 were approximately 6 m and 8 m for the UK and Russian surveys respectively). Evidence presented in WG-FSA-00/19, however, suggests that the behaviour of the fish is variable. During January 2000, some dense pelagic schools with a vertical development of 10 to 20 m were observed acoustically during the day and caught using a pelagic trawl. However, observations during other surveys have also shown that dense concentrations of fish may stay close to the bottom during the day, within the vertical range of the bottom trawl.

4.201 The Working Group agreed that evidence presented in WG-FSA-00/19 suggested that there may be a substantial amount of fish distributed in the water column above the level sampled by survey bottom trawls during the day. This effect would tend to make the catchability of these trawls less than 1. The Working Group noted that catchability can be estimated in the assessment process, as has been done in the past when VPAs were used to assess the absolute abundance of the stock. However, the extent of vertical distribution during the day, and hence the effect on the biomass estimates, appears to be variable. The presence of significant quantities of fish above the level sampled by bottom trawls may be a phenomenon associated with particular conditions and fish behaviour, such as aggregations feeding on krill, which may not be typical at other times and locations. Nevertheless, in years when the fish aggregate, a substantial part of the biomass is present in patches of high concentration and using a bottom trawl to estimate the abundance of fish in these patches may lead to a disproportionately low estimate compared to areas outside the patches.

4.202 The Working Group agreed that there was an urgent need to assess patterns of vertical distribution and movements of *C. gunnari* under different circumstances. This could be achieved through the combined use of bottom trawls, pelagic trawls and acoustic observations. The possible design and use of a bottom trawl with a very high opening (up to 30 m) might also be considered, although the Working Group noted that such a net would be difficult to operate and require a very powerful survey vessel to be used effectively.

4.203 Two specific proposals were put before the Working Group. The first was a preliminary acoustic survey aimed at assessing the distribution and movements of fish in the water column (WG-FSA-00/31; see also paragraph 3.86), and the second was that bottom trawl surveys should be undertaken during the winter season when previous observations suggest that the vertical migration of fish is much less pronounced. The Working Group recommended that these proposals be given more detailed consideration as part of a Workshop on Assessment Methods for Icefish (WAMI) (paragraphs 10.1 to 10.6).

4.204 The one-sided lower 95% confidence bounds of the biomass estimates from the two trawl surveys were calculated using the same bootstrap procedure as used during the last three meetings of the Working Group (SC-CAMLR-XVI, Annex 5, paragraphs 4.199 to 4.208). The results of this analysis are presented in Table 38.

4.205 Numbers at age from the Russian survey were provided in WG-FSA-00/51, based on a new age–length key from readings of otoliths taken during that survey. No age–length data were available for the UK survey. To estimate numbers at age from this survey, the CMIX program (de la Mare, 1994) was used to analyse length densities of *C. gunnari* applying the same methodology as used in the estimation of numbers at age for *D. eleginoides* in Subarea 48.3 and Division 58.5.2 (paragraph 4.130). This method was also used to analyse length densities from the Russian survey to compare the resulting age distribution with that obtained from the age–length key. The age distributions from the CMIX analyses and the Russian age–length key are presented in Table 39. The observed and expected length densities are plotted in Figure 27.

4.206 There was a much greater proportion of age-1 fish in the catches of the UK survey compared to the Russian survey, which estimated that 80% of the stock was composed of fish aged 2 and 3. The UK survey also detected a greater proportion of fish aged 4 and above.

4.207 In comparing the results provided by the two approaches used to analyse the Russian survey data, the Working Group noted that the CMIX analysis allocated fish more evenly between ages 2 and 3, compared to the age–length key, which estimated that 55% of the stock comprised fish of age 2.

4.208 The Working Group considered the results of the two surveys and noted differences in both the age distribution and the estimated biomass. Concern was expressed over the small number of stations sampled by the UK survey on the South Georgia shelf, and whether it was possible to obtain a reliable estimate of stock status from such a small number of hauls.

4.209 In order to achieve a single best estimate of standing stock and age structure in the 1999/2000 season, the Working Group decided to combine the two sets of density-at-length data from the two surveys into a single dataset. The stratification, number of stations in each stratum and the results of the bootstrap analysis to estimate the one-sided lower 95% confidence bound are presented in Table 40. The geographic distribution of the strata is illustrated in Figure 24.

4.210 The bootstrap on the combined dataset was performed using the same method as used to analyse the UK and Russian surveys separately. The Working Group noted that the single-sided lower 95% confidence bound of the combined dataset (35 085 tonnes) was higher than the values calculated independently for UK and Russian surveys (Table 38). This is consistent with the higher number of stations in the combined dataset and the consequently greater precision of the biomass estimate.

4.211 The combined dataset was analysed using the CMIX program to estimate numbers of fish at age for the short-term projection. The results are presented in Table 41 and Figure 28. The means of the mixture components from Table 41 are compared with the growth curve in Figure 29.

4.212 The data inputs for the short-term projection are presented in Table 42. The one-sided lower 95% confidence bounds of the biomass estimate and the distribution of numbers at age were derived from the combined survey dataset. Based on the catch-weighted length distributions from the commercial fishery, the age when fish first recruit to the fishery was fixed at 2 years, with full selection at age 3. The von Bertalanffy growth and weight–length parameters were the same as those used at last year's meeting.

4.213 With a projected fishing mortality of 0.14 for 2000/01 and 2001/02, the catch limit satisfying the agreed criteria is 11 895 tonnes over two years. This is made up of 6 760 tonnes in the first year (1 December 2000 to 30 November 2001) and 5 135 tonnes in the second year (1 December 2001 to 30 November 2002).

Closed Season

4.214 At last year's meeting the Working Group recommended, and the Commission adopted, a change in the closed season for the *C. gunnari* fishery in Subarea 48.3, based on a review of information regarding the timing of the spawning season. The Working Group also recommended that a more detailed analysis of the distribution of young fish from surveys and the exploitation pattern of the fishery operating under existing measures to protect young fish be undertaken, in order to provide advice on the possible benefits of the use of refuges for protecting young fish as part of the management procedure for *C. gunnari* (SC-CAMLR-XVIII, Annex 5, paragraph 4.183). WG-FSA-00/27 and 00/32 presented information on the location of spawning in Subarea 48.3 (paragraphs 3.89 and 3.90). The Working Group considered this new information and concluded there was no reason to recommend a change to the closed season adopted by the Commission last year (Conservation Measure 175/XVIII).

4.215 The Working Group also discussed the need to consider predator requirements and whether a closed season might be appropriate during peak periods of foraging activity. The Working Group agreed that this was an important issue, and it was recommended that the topic be considered more fully during WAMI (paragraphs 10.1 to 10.6).

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

4.216 The Working Group agreed that the management measures for *C. gunnari* in Subarea 48.3 should be similar to those of the 1999/2000 season.

4.217 The Working Group agreed that the total catch limit should be revised to 6 760 tonnes for the period from 1 December 2000 to 30 November 2001, with a closed season between 1 March and 31 May 2001.

Kerguelen Islands (Division 58.5.1)

4.218 No commercial fishing for *C. gunnari* took place in this division during the 1999/2000 season and no surveys were reported.

4.219 The Working Group recalled that the most recent data available remain from a brief survey conducted in February 1998 which indicated that the previous strong cohort (4+ years old) had almost disappeared, but that a new year 1+ cohort (~170 mm long fish) was present in 1997/98. In addition, according to information provided to the Working Group last year, a survey in 1998/99 revealed practically zero biomass on the traditional northeastern fishing ground. Only a few mature specimens (36 cm cohort) and some immature fish (22 cm cohort) were caught from late April to early May.

4.220 The Working Group has no information on whether a resumption of fishing is being contemplated at this time or whether a survey will be conducted in the 2000/01 season.

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

4.221 In the absence of recent data from this division, the Working Group is unable to offer any new management advice. It is strongly recommended that a survey of *C. gunnari* abundance is conducted and the results analysed by the Working Group before commercial fishing is recommenced.

Heard and McDonald Islands (Division 58.5.2)

Commercial Catch

4.222 The commercial fishery for *C. gunnari* around Heard Island (Division 58.5.2) was open from the end of the Commission meeting in November 1999 to 30 November 2000. The catch limit agreed by the Commission for this period was 916 tonnes to be taken on the Heard Island Plateau area only (Conservation Measure 177/XVIII). This conservation measure included several other conditions to be 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 178/XVII).

4.223 The commercial catch in the 1999/2000 fishing season was 39 tonnes. This was because the strong cohort, now aged 4, that was detected in a survey in 1998 had almost disappeared.

4.224 A survey was conducted on the Heard Island Plateau and Shell Bank in May 2000 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 and 1998 and detected a high abundance of principally 2-year-old fish on the Heard Plateau, but very few fish on Shell Bank (WG-FSA-00/40). As in previous years, fish were concentrated on the southeast part of the plateau in the Gunnari Ridge and Plateau East strata (Table 43), and these areas seem to be a region of consistent high abundance of *C. gunnari* whenever a strong cohort is present.

4.225 An assessment of short-term yield over the next two years was presented to the Working Group in WG-FSA-00/41. This assessment used the same methodology as used in previous assessments at the 1998 meeting, as adopted during the 1997 meeting (SC-CAMLR-XVI, Annex 5, paragraph 4.181) and described in de la Mare et al. (1998) and as used in the assessments for Subarea 48.3 described in paragraphs 4.212 and 4.213. Results of the survey conducted in 2000 were used as input. Estimates of yield for Shell Bank were not made because of the very low abundance of this population. Data inputs for the short-term projection are provided in Table 44.

4.226 With a projected fishing mortality of 0.14 for 2000/01 and 2001/02, the catch limit satisfying the agreed criteria is 2 150 tonnes over two years. This is made up of 1 150 tonnes in the first year and 1 000 tonnes in the second year.

4.227 The Working Group reviewed WG-FSA-00/41 and agreed with its findings. Consequently, no other assessment was performed at the meeting.

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

4.228 The Working Group agreed that the management of the fishery for *C. gunnari* on the Heard Island Plateau part of Division 58.5.2 during the 2000/01 season should be similar to that in force last season, as detailed in Conservation Measure 177/XVIII. The total catch limit should be revised to 1 150 tonnes in accordance with this year's short-term yield calculations. The fishery on Shell Bank should remain closed.

Other Fisheries

Other Finfish Fisheries

4.229 Other fisheries considered by the Working Group were those in Subareas 48.1, 48.2, 48.4, 88.2, 88.3, and Divisions 58.4.1 and 58.4.2.

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

4.230 No commercial fishing has taken place in Subareas 48.1 and 48.2 in the 50–500 m depth range since the 1989/90 season when CCAMLR introduced conservation measures for these two areas (currently Conservation Measures 72/XVII and 73/XVII). An extensive review of the fishery, status and biology of fish stocks in these two subareas was provided in WG-FSA-00/14. The authors concluded that there is currently little scope for a viable commercial fishery and suggested that the two subareas should remain closed.

4.231 There are two new bottom trawl surveys planned around Elephant Island and the lower South Shetland Islands for March and November–December 2001 by Germany and the USA, with participation by scientists from a number of other CCAMLR Members.

Management Advice

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

South Sandwich Islands (Subarea 48.4)

4.233 A catch limit of 28 tonnes for *D. eleginoides* is in force in Subarea 48.4 (Conservation Measure 180/XVIII). No fishing was reported to the Commission in the 1999/2000 season. No new information was made available to the Working Group on which an update of the assessment could be based.

Management Advice

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

Antarctic Coastal Areas of Divisions 58.4.1 and 58.4.2

4.235 A notification for an exploratory fishery was submitted to CCAMLR by Australia for Division 58.4.2 for the fishing season 1999/2000, while no trawl fishing was planned for Division 58.4.1. Because of ice, little exploratory fishing was possible. A new notification for the 2000/01 season was submitted for Division 58.4.2 by Australia. Details of the plan can be found in paragraph 4.46. Again, no fishing is planned for the Antarctic coastal area of Division 58.4.1.

Pacific Ocean Sector (Subareas 88.2 and 88.3)

4.236 No fishing occurred in these two subareas in 1999/2000. Notifications for conducting a longline fishery in the 2000/01 season primarily on *Dissostichus* spp. in Subareas 88.2 and 88.3 were lodged by Argentina, South Africa (Subarea 88.2 only) and Uruguay. Details on the proposed development of the fisheries were provided in paragraphs 4.44, 4.63, 4.67 and 4.68.

Management Advice

4.237 The Working Group envisaged assessing at its meeting in 2001, Division 58.4.2 and Subareas 88.2 and 88.3, after the completion of the exploratory fisheries.

Crabs

4.238 Five species of crabs currently occur in catches around South Georgia: *P. spinosissima*, *P. formosa*, *P. anemerae*, *N. diomedeae* and *L. murrayi*. Only the three species of the genus *Paralomis* are of interest to the crab fishery. *P. formosa* has been the predominant species in the crab fishery conducted in 1997/98, while *P. spinosissima* prevailed in the experimental pot fishery on *D. eleginoides* in 1999/2000. The difference is mostly due to the different depth range covered by the two fisheries.

4.239 Conservation measures in force in the crab fishery are Conservation Measure 150/XVIII which regulates the experimental harvest regime on crabs, and 181/XVIII which sets limits on the catch at 1 600 tonnes green weight per season of all species combined and limits the number of vessels to one per country.

4.240 Two countries have notified crab fishing in the 2000/01 season: USA and Uruguay. The USA has already fulfilled the requirement of an experimental harvest regime as set out in Conservation Measure 150/XVIII, whereas Uruguay has not.

4.241 WG-FSA-00/23 presented CPUE data on the by-catch of crabs and fish from the experimental pot fishery on *D. eleginoides* in Subarea 48.3. However, WG-FSA-00/24 presented a more extensive analysis of the same dataset. Crabs formed 45.5% of the total weight of all species and 96.1% of all numbers caught. Few crabs were males above the legal size that could be retained. Soak time of the pots was positively correlated with the numbers of crabs being taken. Biological data on crabs are presented in paragraphs 3.93 to 3.98. Preliminary results from reimmersion experiments on crabs suggested that about 10% of apparently lively discarded crabs would die subsequently. Attempts are currently under way to reduce the by-catch of crabs by making changes to the design of pots.

4.242 CFs of crab products to green weight are insufficiently known. The Working Group recommended that investigations into CFs be carried out in the near future.

Management Advice

4.243 The Working Group recommended that the Uruguayan vessel applying for a permit should conduct Phase 1 of the experimental harvest regime specified in Conservation Measure 150/XVIII. The US vessel has already fulfilled these requirements.

4.244 The Working Group agreed that the high by-catch of undersized crabs in the directed fishery on crabs and the by-catch of crabs in the directed fishery on *D. eleginoides* using pots is of concern in both fisheries. Mortality rates of crabs discarded by these fisheries are insufficiently known and need further consideration by the Working Group in forthcoming years. The Working Group encouraged further experiments on mortality rates of undersized crabs to be conducted in the near future.

Squid

4.245 Conservation Measure 183/XVIII is currently in force to regulate this fishery. No fishing took place in the 1999/2000 season. The UK and the Republic of Korea have submitted a joint proposal to conduct an exploratory fishery on *M. hyadesi* in waters north of South Georgia (Subarea 48.3) in the 2000/01 season (paragraph 4.75).

4.246 The scientific basis on which the current precautionary conservation measure was based has not changed. Discussion on this matter can be found in SC-CAMLR-XVI, paragraphs 9.15 to 9.18; SC-CAMLR-XVI, Annex 4, paragraphs 6.83 to 6.87; and SC-CAMLR-XVI, Annex 5, paragraphs 4.2 to 4.6. The catch limit is considered to be precautionary (SC-CAMLR-XV, paragraph 8.3).

Management Advice

4.247 The Working Group recommended that a conservative management scheme as contained in Conservation Measure 183/XVIII is still considered to be appropriate for this fishery.

General By-catch Provisions

4.248 During the last two meetings, WG-FSA reviewed the need to study elasmobranch by-catch in fisheries in the Convention Area (SC-CAMLR-XVII, Annex 5, paragraphs 4.201 to 4.209; SC-CAMLR-XVIII, Annex 5, paragraphs 4.88 to 4.98). During last year's meeting, several papers were presented which provided rates of by-catch experienced in the Convention Area fisheries; an assessment of yield and status of the by-catch species *M. carinatus* on BANZARE Bank in Divisions 58.4.1/58.4.3; and a definition of a research program to assess the impact of the exploratory fishery for *Dissostichus* spp. for Subarea 88.1.

4.249 The amount of by-catch reported from longline fisheries targeting *Dissostichus* spp. during the 1998/99 season was estimated from data reported in the five-day catch and effort reports, in scientific observer data and in the fine-scale data (SC-CAMLR-XVIII, Annex 5, Table 30). Finally, overall species composition of the by-catch reported in the observer data from longline fisheries in the 1998/99 season was also reported (SC-CAMLR-XVIII, Annex 5, Table 31).

4.250 The precise identification of by-catch species was found to be problematic for some groups and the need for better keys to be made available for observers on board the vessel was recognised (SC-CAMLR-XVIII, Annex 5, paragraph 4.97). In response, WG-FSA-00/15 was submitted. A discussion on this paper can be found in paragraphs 3.110 to 3.118.

4.251 This year, the Secretariat again calculated the amount of by-catch reported from the longline fisheries (Table 45) and determined the overall species composition of the by-catch reported in the observer data (Table 46). In addition, both tables were expanded to include by-catch data reported from the trawl fisheries in the Convention Area.

4.252 The largest by-catch (255 tonnes) was reported for the *D. eleginoides* longline fishery in Division 58.5.1 from fine-scale data; however, no catch and effort reports or observer data were available for this fishery (Table 45). Other large by-catches, for fine-scale data, occurred in the longline fisheries for *Dissostichus* spp. in Subareas 88.1 (118 tonnes) and 58.6 (81 tonnes). In general, comparisons among the three data sources were difficult because of missing data, pooling effects etc.

4.253 For the reasons discussed above, comparisons of by-catch amounts in the longline fisheries during the 1999/2000 season with those reported during the 1998/99 season (SC-CAMLR-XVIII, Annex 5, Table 30) were also difficult. Therefore, the Working Group requested the Secretariat to intersessionally investigate the feasibility of expanding Table 45 to include the previous year's data.

4.254 Although data presented in Table 46 are those recorded by observers and are therefore a subset of the total by-catch, it does illustrate that a wide variety of species are taken in fisheries in the Convention Area. Most are taken in small amounts by weight.

4.255 Several papers presented data associated with by-catch in CCAMLR fisheries in 1999/2000. These include: SC-CAMLR-XIX/BG/1 (catches in the Convention Area for split-year 1999/2000); WG-FSA-00/18 (summary of trawl observations); WG-FSA-00/59 (skate by-catch in Subarea 48.3 observed from one vessel); WG-FSA-00/55 (Ross Sea Antarctic toothfish fishery from 1997/98 to 1999/2000); WG-FSA-00/23 (fishing for toothfish using pots); WG-FSA-00/24 (crab by-catch in experimental toothfish pot fishery); and Annex 4, paragraphs 2.29 to 2.31 (fish by-catch in the krill fishery).

4.256 SC-CAMLR-XIX/BG/1 presented catches from STATLANT data for the 1999/2000 split-year (both trawl and longline) for the purpose of allowing Members to check their data prior to publication in the *CCAMLR Statistical Bulletin*. However, it also provided some useful information relative to by-catch species caught by trawl and longline fisheries combined. Table 1 of the paper provided catches in the 1999/2000 split-year for seven species which were at least 5 tonnes. Of the by-catch species, *Macrourus* spp. had the largest take (334 tonnes). Catch is also provided by species by region (Table 2 of the paper), species by month by region (Table 5 of the paper) and by country by species by region (Tables 3 and 4 of the paper).

4.257 WG-FSA-00/18 presented a summary of scientific observations of trawl operations completed under Conservation Measures 175/XVIII, 177/XVIII and 186/XVIII during the 1999/2000 season. Table 3 of the paper provided a listing of all species caught. Observations were made from four vessels which conducted eight trawl operations targeting finfish in the Convention Area.

4.258 In Subarea 48.3, one Russian and one Chilean trawler conducted 266 trawls of which 189 were observed. Five by-catch species were observed in catches which amounted to only 1.6% of total catch. *G. nicholsi* represented 1.5% of the by-catch.

4.259 Two Australian-flagged vessels conducted six cruises in Division 58.5.2 and one Australian vessel conducted part of a trip in Division 58.4.2. In Division 58.5.2, 810 trawls were undertaken targeting *D. eleginoides* of which 761 trawls were observed and 29 trawls were undertaken targeting *C. gunnari* of which 26 were observed. In Division 58.5.2, by-catch species in trawls targeting *D. eleginoides* and *C. gunnari* comprised 2.9% and 6.6% of the total catch respectively.

4.260 In Division 58.4.2, one trawl targeting *D. eleginoides* was observed and all eight trawls targeting *C. wilsoni* were observed. In the first case, Octopodidae comprised 13.4% of the catch while in the second case the target species only comprised 1.1% of the catch. Ten species groups, including *M. whitsoni* (45.3% of catch) and Medusae (21.4%) comprised by-catch of the *C. wilsoni* trawls.

4.261 WG-FSA-00/59 presented an examination of skate by-catch from one longline vessel in Subarea 48.3 during the 1999/2000 longline *Dissostichus* spp. season and is a follow-up to the skate research program initiated in 1999 (Agnew et al., 1999). This year a detailed study of skate caught on one vessel was designed to establish the total number of skates caught. Anatomical features (colour, spination etc.) were discussed to aid in improving field identifications of skates. Information is also provided relative to skate size and maturity, distribution, discard mortality, growth and age determination, and morphology.

4.262 During the cruise, 336 skates were caught with a rate of 0.236 (numbers/thousand hooks) (Table 1 of report). Three rajid species were caught as by-catch. No small skates were caught, most were estimated between 10 and 25 years of age, although many appeared to be sexually

immature. Results of discard mortality experiments indicated that of 44 skates observed only seven (16%) were found to be alive after a period of 12 hours from hauling. There seems to be a clear relationship between depth from which skates are hauled and their survival. No skate survived which had been hauled from a depth greater than 1 550 m. Only one of eight animals tested was found to survive after being hauled from a depth of 1 450 m. Because longlines catch larger specimens of skate which are at or nearing maturity, this may represent a threat to the population levels of all three species found in the study.

4.263 The Working Group noted that the mortality of by-catch species caught on longlines may be affected by the manner in which they are removed from the hooks. If specimens are removed in a manner causing injury to the mouth, head etc., then mortality will be much greater.

4.264 WG-FSA-00/55 presented an analysis of the New Zealand Ross Sea Antarctic toothfish fishery from 1997/98 to 1999/2000. The main by-catch species were rat tails which averaged about 10% (range 6–17%) of the annual catch and skate which averaged about 8% (range 5–11%) of the annual catch. Species misidentification and grouping of the species by observers made it difficult to ascertain actual percentage by-catch by individual species. Other by-catch species (including icefish and moray cods) each contributed less than 1% of the catch overall. A summary of catches is given in Table 2 of the paper.

4.265 WG-FSA-00/55 also presented results of a tag and release program to assess post-capture survival of skate. A total of 2 058 skates were tagged (approximately 20% of all skates caught), some in all of the four SSRUs fished. Specimens of both *A. georgiana* (90%) and *B. eatonii* were tagged. Four skates were recaptured during the 1999/2000 season, despite the vessels not fishing over the same grounds again. The mean time at liberty was 14.5 days, with two skates caught 22 days after release, and mean distance travelled was 7.3 n miles. Further recaptures are expected in the 2001 season as vessels undertake exploratory voyages in the area again. However, the within-season results provide evidence that at least some of the skates released survived after being caught.

4.266 WG-FSA-00/23 presented CPUE of by-catch of crabs and fish in the experimental pot *Dissostichus* spp. fishery around South Georgia in 2000 (Figure 2 of the paper). However, WG-FSA-00/24 presented a fuller analysis of the crab by-catch in the experimental fishery. Results are discussed in paragraph 4.241.

4.267 The by-catch of fish in the krill fishery was presented to WG-EMM (Annex 4, paragraphs 2.29 to 2.31). A CCAMLR-designated observer from the USA on board a Japanese krill vessel reported five small fish from 22 hauls but the observer did not have free access to sample catches. This was found to be regrettable by the Working Group.

4.268 A national observer working on the Ukrainian vessel reported several hauls taken to the west of the South Orkney Islands were found to contain *C. gunnari* (length range 5–7 cm, maximum 12 cm). The largest catch was 200 *C. gunnari* per tonne of krill. WG-EMM noted that these catch rates did not appear to be large and, in the case of the Ukrainian information, were confined to a limited area.

Advice to the Scientific Committee

4.269 The Working Group agreed that substantial information regarding the amount of by-catch in various fisheries had been presented. However, there is still an urgent need for the calculation and

presentation of by-catch rates in both longline and trawl fisheries. An intersessional subgroup has been tasked with collating these data (paragraph 10.9(vi)).

Regulatory Framework

4.270 Over the past two years, the Scientific Committee and Commission have discussed the need for a unified framework for providing management advice on all fisheries in the Convention Area (CCAMLR-XVII, paragraphs 10.3 to 10.7). In the 1998/99 intersessional period, the Chairman of the Scientific Committee convened a task group to explore the scientific basis for a regulatory framework. A draft of the latest report of the task group, prepared during the 1999/2000 intersessional period, was circulated at the meeting and discussed in detail by the Working Group. It was agreed that any changes to the document required as a result of these discussions would be made and the revised report presented as a background paper to the 2000 meeting of the Scientific Committee.

4.271 The Working Group noted the substantial progress made by the task group since last year's meeting. The new report proposed a move away from a rigid framework of defined stages of fishery development towards a more generalised structure that would allow individual fisheries to be developed at a pace commensurate with the acquisition of information required by the Scientific Committee to develop management advice. This would remove the need to define stages of fishery development (e.g. new, exploratory, established). The Working Group welcomed proposals in the report to streamline the process of annual review and assessment of fisheries by the Scientific Committee and its working groups, in the face of a mounting workload created by the increasing number of fisheries in the Convention Area.

4.272 The report summarises the regulatory requirements currently stipulated for new and exploratory fisheries under Conservation Measures 31/X and 65/XII, and notes that these requirements are often also highly desirable features of the management of fisheries other than those classified as new and exploratory. The report makes proposals for how application of these requirements could be generalised to apply to all fisheries in the Convention Area.

4.273 An important component of the proposed framework is the development of a new reference document called a *Fishery Plan* for each fishery that has ever been prosecuted in the Convention Area. This document would be a compilation of information from the conservation measures and other sources, providing a standardised point of reference to support the application of regulatory requirements to all fisheries and track developments and changes in individual fisheries over time. The task group has developed a proposed structure for the *Fishery Plan* that could be used as a replacement for the assessment summaries which have been appended to the Working Group's report. The structure also provides a list of the standard harvest controls and reporting requirements routinely included in conservation measures that could be used to standardise the structure of the conservation measures.

4.274 The Working Group welcomed the proposal to prepare *Fishery Plans* for all fisheries and recommended that this be regarded as a high priority. The Working Group requested the Scientific Committee to consider how this task could be undertaken.

CONSIDERATION OF ECOSYSTEM MANAGEMENT

Interaction with WG-EMM

By-catch of Young Fish in the Krill Fishery

5.1 WG-EMM had considered a single submission (WG-EMM-00/12) documenting the incidental catch of fish during krill fishing (Annex 4, paragraphs 2.29 to 2.31).

5.2 WG-FSA welcomed the additional information provided and encouraged future submissions detailing fish by-catch by the krill fishery. It was again emphasised that such information may provide further information on the distribution of juvenile fish. Every effort should be taken to ensure that sampling program(s) are stratified to take account of geographical differences in juvenile fish density.

Other Information arising from WG-EMM's Deliberations of relevance to WG-FSA

5.3 WG-FSA noted the growing importance which WG-EMM is attaching to interactions between components of the ecosystem other than krill (Annex 4, paragraphs 4.45 and 4.46).

5.4 Key areas of focus to be noted include the interactions of *C. gunnari* with both krill as well as land-based predators at South Georgia (Annex 4, paragraph 4.45). Ongoing work demonstrated that an index of *C. gunnari* condition appears to respond rapidly to changes in krill availability (Annex 4, paragraphs 4.38 to 4.40).

5.5 Other work within WG-EMM noted that myctophids are an important food source for some bird species, with south polar skuas in the Antarctic Peninsula region (Annex 4, paragraph 4.58), snow petrels on Laurie Island (Annex 4, paragraph 3.25) and king penguins (Annex 4, paragraph 4.57) among them.

5.6 WG-FSA also supported the ongoing study of fish prey taken by South Georgia shags and Antarctic shags from the South Orkney Islands and the Antarctic Peninsula respectively (Annex 4, paragraphs 4.48 to 4.50). The ongoing submission of such data was endorsed as a means to improve knowledge of potential changes in the interactions between certain ecosystem components. It was recognised that there may be merit in broadening regional case studies to examine the food-web interactions of all predators, including those on fish.

Ecosystem Assessment

5.7 WG-EMM made ongoing efforts to provide and improve approaches to ecosystem assessment (Annex 4, paragraphs 4.86 to 4.117). It was noted that the approach being developed by WG-EMM for krill could also be adapted to fish. WG-FSA recognised that the use of ecological information is relevant for the formulation of management advice on fish since the characterisation of specific ecosystems could take account of the expected dynamics of different system components. This would not only improve insights into the variability of certain ecosystem

components but would also serve to relate 'extreme events' to long-term population trends as well as the application of management measures (Annex 4, paragraphs 4.106 to 4.109). Good examples include the documentation of *C. gunnari* condition as well as some of the topics identified within the terms of reference of the forthcoming *C. gunnari* workshop.

Marine Protected Areas

5.8 WG-EMM embarked on the development of criteria for the designation of marine protected areas relevant to CCAMLR's perceived needs (Annex 4, paragraphs 5.54 to 5.61). A key consideration in the development of such areas requires that due account be taken of existing, and potential, fisheries subject to the provisions of Article II. In this context, CCAMLR's practice of closing specific areas to fishing (e.g. as contained in Conservation Measures 72/XVII and 73/XVII for Subareas 48.1 and 48.2 respectively) could be viewed as a means to protect fish populations in areas where exploitation has been perceived to compromise the future of the stocks concerned.

5.9 WG-FSA encouraged the further development of criteria for protected/closed areas relevant to CCAMLR and appreciated that the Working Group is likely to be involved in such a development.

Ecological Interactions

Interactions between Marine Mammals and Fishing Operations

5.10 Two papers were submitted to WG-FSA on this topic (WG-FSA-00/56 and 00/60). These are considered in paragraphs 7.47, 7.88 and 8.3.

Effects of Bottom Trawling

5.11 The issue of potential damage by bottom trawling on benthos has been considered by WG-FSA over a number of years. Therefore, the Working Group recognised with appreciation the intentions of Australia to study the potential effects of bottom trawling on benthic communities during the forthcoming fishing season (see also paragraph 4.91). Further research on this matter is planned for the forthcoming AMLR survey in March 2001 in the Elephant Island–Lower South Shetland region.

RESEARCH SURVEYS

Simulation Studies

6.1 There were no simulation studies conducted during 1999/2000. Developments in survey methods included the use of hydroacoustics in surveys for *C. gunnari* in Subarea 48.3 (WG-FSA-00/19).

Recent and Proposed Surveys

6.2 Studies were undertaken by Australia, New Zealand, Russia and the UK. Three research surveys were undertaken in the Convention Area in 1999/2000, covering Subarea 48.3 and Division 58.5.2. Additionally, tagging studies on *Dissostichus* spp. have been conducted in Subareas 48.3 and 88.1 and Division 58.5.2.

6.3 The Australian bottom trawl survey in Division 58.5.2 on board the *Southern Champion* studied the abundance and length distribution of *C. gunnari, L. squamifrons* and pre-recruit *Dissostichus* spp. (WG-FSA-00/40).

6.4 The exploratory fishery of New Zealand in Subarea 88.1 conducted tagging studies of skates from its three vessels (paragraphs 3.109 and 4.265).

6.5 The Russian bottom trawl survey on board the *Atlantida* conducted in Subarea 48.3 covered shelf areas down to 500 m around Shag Rocks and South Georgia. The aim of the survey was to estimate the standing stock of *C. gunnari*. Hydroacoustic equipment was in use during the cruise (WG-FSA-00/31, 00/47 and 00/51).

6.6 The UK survey on board the *Argos Galicia* also covered the shelf areas in Subareas 48.3 and was aimed at estimation of the standing stock of *C. gunnari* and other bottom species (WG-FSA-00/40). Tagging of *D. eleginoides* was conducted during the cruise (WG-FSA-00/26).

Proposed Surveys

6.7 Argentina indicated that a bottom trawl survey of Subarea 48.3 during May–June 2001 is being planned.

6.8 Australia plans to repeat the *C. gunnari* and *D. eleginoides* pre-recruit survey in Division 58.5.2 during the coming season.

6.9 New Zealand intends to continue with its skate tagging program, and to start tagging experiments on *D. mawsoni*.

6.10 The USA plans to conduct a bottom trawl survey using a random survey design in Subarea 48.1 on board the *Yuzhmorgeologiya*.

INCIDENTAL MORTALITY ARISING FROM LONGLINE FISHING

Intersessional Work of Ad Hoc WG-IMALF

7.1 The Secretariat reported on the intersessional activities of ad hoc WG-IMALF (WG-FSA-00/5 Rev. 1) according to the agreed plan of intersessional activities for 1999/2000 (SC-CAMLR-XVIII, Annex 5, Appendix D). The report contained records of all activities planned and their results. These were reviewed and appropriate details appear in the 2000/01 plan of intersessional activities of WG-IMALF (Appendix D).

7.2 The Working Group noted the extensive work accomplished intersessionally by ad hoc WG-IMALF, details of which were presented in a number of WG-FSA papers. In general, the group concluded that most tasks planned for 1999/2000 had been successfully implemented. The Working Group thanked the Science Officer for his work on the coordination of IMALF activities. 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 1999/2000 fishing season.

7.3 Of concern was the limited feedback received this year from some technical coordinators on IMALF-related matters. All technical coordinators are urged to respond to requests from WG-IMALF, even if they are unable to report progress.

7.4 The membership of WG-IMALF was reviewed and a number of modifications and additions suggested; the group noted that some CCAMLR Member countries which are involved in longline fishing and/or seabird research in the Convention Area (e.g. European Community, Ukraine, Uruguay and the USA) are not represented on ad hoc WG-IMALF. The Working Group indicated that Dr A. Stagi (Uruguay) and Dr K. Rivera (USA) would be welcome additions to its membership. The attendance at this year's meeting of a representative from Brazil was particularly appreciated; the absence of a representative from France was particularly regretted. Members were asked to review their representation on ad hoc WG-IMALF intersessionally and to facilitate attendance of as many representatives as possible at the meeting.

Research into the Status of Seabirds at Risk

7.5 In response to requests for updates on information summarising national research on seabirds (albatrosses and *Macronectes* and *Procellaria* petrels) vulnerable to longline fisheries interactions, papers were presented by the UK (WG-FSA-00/8), France (WG-FSA-00/9), New Zealand (WG-FSA-00/10) and Australia (WG-FSA-00/49). Reference to research on albatrosses in Chile is included in both WG-FSA-00/8 and 00/49. Of the countries known to be conducting relevant research on these species, no reports to IMALF were received from Argentina, South Africa and the USA. These Members were requested to table information on the current status of these research programs for next year's meeting of WG-FSA. All Members were requested to update regularly information relating to their programs.

7.6 The reports provided were summarised in Table 47, which updates Table 45 in SC-CAMLR-XVIII, Annex 5.

7.7 Essentially, no research programs focusing on relevant seabird populations have been initiated since 1999. Consequently the deficiencies resulting from the lack of relevant research on population dynamics and foraging ecology of most populations remain (SC-CAMLR-XVIII, Annex V, paragraph 7.10). Specifically the urgent requirement for research on the species and populations described in SC-CAMLR-XVIII, Annex V, paragraphs 7.11 to 7.15 remains.

7.8 Prof. Croxall reported that although the directed research program on white-chinned petrels at South Georgia had concluded, the population assessment project had demonstrated a 28% decline in the breeding population over the last 20 years and concluded that, as this could not be attributed to habit modification caused by fur seal activities on land, the likely causes were in the

marine environment (Berrow et al., 2000). Full details of this work, which provide a sound baseline for future population monitoring, would be presented at next year's meeting.

7.9 The Working Group recollected that the main reasons for requesting the data summarised in Table 47 were to enable assessment of the availability of data on:

(i) size and trends of populations of albatross species and of *Macronectes* and *Procellaria* petrel species vulnerable to interactions with longline fisheries; and

(ii) the foraging ranges of populations of these species, at different times of year and stages of the breeding cycle, adequate to assess overlap with areas used by longline fisheries and, ideally, to compare at-sea distributions with data on fishing effort.

7.10 From the information summarising current population research provided in Table 47, it remains impossible to determine the adequacy of these data for assessing population trends and providing critical data on population dynamics. Therefore, Members are requested to report in more detail on their seabird research programs, specifically to provide information on the years in which population estimates have been obtained and in which demographic variables (productivity, adult survival and recruitment) have been measured. A similar request should be made to the SCAR Secretariat to obtain relevant information from SCAR members.

7.11 Similarly, Members are requested to provide more detail on their studies to determine foraging range by indicating the year of study, the number of individuals tracked, the breeding stage of study birds and the CCAMLR statistical subareas and divisions frequented by these birds. This information will assist in delineating foraging ranges as well as assisting the assessments of regional risk of seabird by-catch.

7.12 Last year the Working Group had requested information from Members on genetic research relevant to determining the provenance of birds killed in longline fisheries.

7.13 The UK had briefly summarised in WG-FSA-00/7 the species and sites studied in some recent research. Prof. Croxall indicated that this work revealed a limited ability to determine the source populations of black-browed and wandering albatrosses but, at present, no ability to achieve any discrimination between grey-headed albatross populations. More details of this work should be available for presentation at next year's meeting.

7.14 Complementary studies of other species and populations are known to be previously or currently undertaken by Australia, New Zealand, USA and South Africa. Members are requested to provide and update information on the current status of these research programs for next year's meeting of WG-FSA. Additional information detailing the number of samples analysed from each population, as well as the agency responsible for the curation of samples, would be sought.

7.15 The requests outlined in paragraphs 7.10, 7.11 and 7.14 should also be made to the SCAR Secretariat to solicit relevant information from their members.

7.16 The Working Group drew attention to WG-FSA-00/34 which summarised the global status of albatrosses and *Macronectes* and *Procellaria* petrels, as assessed using the IUCN threatened species criteria. The latest IUCN Red List, which contains these assessments, was published in September 2000; the full texts of all these assessments are in BirdLife International (2000), published in October 2000.

7.17 These new category assessments have been incorporated into Table 47, replacing the earlier assessments in Croxall and Gales (1998).

7.18 Of particular concern, in relation to CCAMLR, are those species, identified in WG-FSA-00/34, where the categorisation is based on criteria involving population decline, either solely, or in combination with small range and/or small population size. In most, if not all, such cases, the main cause of decline is known, or inferred, to be incidental mortality associated with longline fishing (BirdLife International, 2000).

7.19 The Working Group noted that WG-EMM-00/16 contained analyses of time-series data of breeding population counts of various albatross and petrel species and populations, viz:

Wandering albatross	*Diomedea exulans*	South Georgia Kerguelen Marion (Prince Edward Islands) Possession (Crozet Islands)
Amsterdam albatross	*Diomedea amsterdamensis*	Amsterdam
Black-browed albatross	*Diomedea melanophrys*	South Georgia Kerguelen
Indian yellow-nosed albatross	*Diomedea chlororhynchos*	Amsterdam Gough
Grey-headed albatross	*Diomedea chrysostoma*	South Georgia Marion
Sooty albatross	*Phoebetria fusca*	Possession
Light-mantled albatross	*Phoebetria palpebrata*	Possession
Southern giant petrel	*Macronectes giganteus*	Marion Possession Mawson Davis Casey
Northern giant petrel	*Macronectes halli*	Marion Possession

These data, and analyses, are of considerable potential relevance to the investigations of the Working Group referred to in paragraphs 7.5 to 7.9.

7.20 The Working Group noted that the report of the Workshop on Albatross and Petrel Mortality from Longline Fishing held in Hawaii, USA, in May 2000 (SC-CAMLR-XIX/BG/12), called for enhanced effective monitoring of seabird population trends (including structure and dynamics) and enhanced research into foraging ecology. The workshop also concluded that it was vital to maintain and sustain existing long-term population studies since these are unique sources from which to identify problems, disentangle potentially confounding causal effects and monitor progress towards management targets, including success of remedial measures. Wherever possible, these studies should be designed so as to accompany estimates of population

size and trends with other demographic data, especially annual adult survival and recruitment rates. The Working Group endorsed these conclusions.

7.21 The Working Group noted a comment from the Scientific Committee (SC-CAMLR-XVIII, paragraph 4.76(iv)(d)), apparently requesting advice from WG-IMALF on 'appropriate levels of by-catch, on an area-specific basis'.

7.22 Given the lack of detail accompanying this request, and the complexity, both philosophical and practical, of undertaking relevant analyses, the Working Group deferred consideration of this topic.

7.23 It noted, however, that this subject would be extensively discussed at the forthcoming International Fishers' Forum meeting (see paragraphs 7.179 to 7.181). Several members of WG-IMALF would be attending and it was hoped that WG-IMALF would be in a position to discuss this topic next year.

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

2000 Data

7.24 Data were available from 35 longline cruises conducted within the Convention Area during the 1999/2000 season (for details see WG-FSA-00/37 and paragraphs 3.35 to 3.38 and Table 9).

7.25 The Working Group expressed concern, as they did last year (SC-CAMLR-XVIII, Annex 5, paragraph 7.31), that the proportion of hooks being observed to provide overall estimates of seabird mortality was still rather low (WG-FSA-00/37 and Table 48). The Working Group was concerned to note that on seven trips the proportion of hooks observed was less than 20%. A desirable level of observation would be about 40–50% (SC-CAMLR-XVII, Annex 5, paragraphs 3.60 and 7.124 to 7.130); levels below 20% may introduce potentially serious errors into estimates (SC-CAMLR-XVIII, Annex 5, paragraph 7.31; paragraph 3.48).

7.26 The Working Group noted, however, that for vessels with single observers it could be very difficult to achieve observation of a higher proportion of hooks without potentially compromising other duties (paragraph 3.51).

7.27 This problem was compounded this year by the fact that a disproportionate amount of the observed seabird by-catch was reported on vessel cruises with low proportions of hooks observed (e.g. Subareas 58.6/58.7: *Aquatic Pioneer* cruise 3 (10%); *Eldfisk* Cruise 3 (17%); *Koryo Maru 11* cruise 2 (27%)).

7.28 The average proportion of hooks observed (percentages with ranges in parenthesis) over the last four years, for Subareas 48.3, 58.6/58.7 and 88.1 has been as follows:

1997: 48.3 – 34 (5–100); 58.6/58.7 – 60 (15–100);
1998: 48.3 – 24 (1–57); 58.6/58.7 – 43 (14–100);
1999: 48.3 – 25 (10–91); 58.6/58.7 – 34 (13–62); 88.1 – 31 (29–32); and
2000: 48.3 – 24 (11-39); 58.6/58.7 – 42 (10–91); 88.1 – 33 (29–58).

The Working Group understood that the consistently higher values for Subareas 58.6 and 58.7 reflected, at least in part, the use of two observers. The Working Group commended this practice.

7.29 The Working Group expressed disappointment at the continued incorrect reporting of the proportion of hooks observed for seabird by-catch. It was apparent from the data presented that some observers continue to record the number of hooks hauled while they are undertaking biological work, rather than the number of hooks directly observed. For example, in the 2000 data for Subareas 58.6/58.7, the reported value of 91% was found actually to have been 3.7% (Technical Coordinator, South Africa). This problem with the data means that many estimates of seabird by-catch provided to the Working Group are likely to be underestimates.

7.30 The Working Group reiterated (see SC-CAMLR-XVIII, Annex 5, paragraph 7.33) that the level of sampling effort required to estimate seabird mortality should be investigated using existing data and simulation models. This work, which should be undertaken in the intersessional period, should consider the resolution and accuracy of estimates of seabird by-catch rates under various levels of observed by-catch rates.

7.31 The total catch rates were calculated using the total numbers of hooks observed and the total seabird mortality observed (Table 48). No incidental mortality was observed for Subarea 88.1 or Division 58.4.4. The estimated total catch of seabirds by vessel was calculated using the vessel's catch rate multiplied by the total number of hooks set. For those vessels where logbook data for calculating catch rates were unavailable, the catch rate was calculated using the information contained in the observer cruise reports.

Subarea 48.3

7.32 The overall catch rate of birds killed in Subarea 48.3 was 0.0004 birds/thousand hooks; during daylight setting the rate (0.002 birds/thousand hooks) was higher than that for night setting (0.0002 birds/thousand hooks).

7.33 The total estimated seabird mortality in Subarea 48.3 for this season was 21 birds (Table 49), compared with 210 for the previous season. Of the six birds observed killed, half were southern giant petrels (*Macronectes giganteus*); the remainder were equally divided between black-browed albatrosses (*Diomedea melanophrys*), northern giant petrels (*Macronectes halli*) and cape petrels (*Daption capense*) (Table 50).

Subareas 58.6 and 58.7

7.34 For Subareas 58.6 and 58.7, the overall catch rate of birds killed was 0.022 birds/thousand hooks; during daylight setting the rate (0.013 birds/thousand hooks) was significantly lower than that for night setting (0.027 birds/thousand hooks) (Table 51) (see also paragraph 7.41).

7.35 The total estimated seabird mortality in Subareas 58.6 and 58.7 for this season was 516 birds, a three-fold increase compared with the previous season. The white-chinned petrel (*Procellaria aequinoctialis*) was the most commonly observed species killed, comprising 90% of the total seabird mortality (Table 50).

7.36 Further analysis of seabird by-catch in the South African EEZ around the Prince Edward Islands was presented in WG-FSA-00/30. This paper reports on the observer data from 11 fishing trips involving a fishing effort of 7.4 million hooks, up 45% from the 1998/99 season. During 1999/2000, 268 seabirds from six species were reported killed. White-chinned petrels comprised 92% of the total, with smaller numbers of Indian yellow-nosed albatross (*Diomedea chlororhynchos*) and grey-headed albatross (*Diomedea chrysostoma*), grey petrels (*Procellaria cinerea*) and giant petrels.

7.37 The average catch rate was 0.036 birds/thousand hooks, more than double that in 1998/99 (0.016), but considerably lower than the values recorded in either 1997/98 (0.117) or 1996/97 (0.289). By-catch rate varied greatly among trips, but only one trip had a by-catch rate exceeding 0.1 birds/thousand hooks. Just over 2 million hooks were set through the Mustad funnel fitted to the *Eldfisk*, significantly reducing by-catch rates in comparison with daytime sets when the funnel was not in use (see paragraph 7.117). Excluding these sets, the mean by-catch rate was 0.043 birds/thousand hooks (233 birds killed on 5.36 million hooks).

7.38 Seabirds were killed during 134 of 1 748 sets (7.7%), with 68% of birds killed on only 49 sets (2.8%) that had multiple casualties. With the exception of grey petrels (all killed June–September), most birds were caught in summer. The highest by-catch rate was in early summer (October–November) during the pre-laying and early incubation period of white-chinned petrels.

7.39 Time of setting was another important determinant of seabird by-catch. Thus, 21.2% of sets (20.3% of hooks) were set during the day or spanned nautical dawn or dusk. Excluding all underwater sets, the by-catch rate for day sets (0.065 birds/thousand hooks) was almost twice that of night sets (0.038). As was the case in previous years, the seabird by-catch rate showed peaks around dusk and dawn.

7.40 Most fishing effort took place >200 km from the islands. Bird by-catch was greatest between 100 and 200 km from the island due to a peak in white-chinned petrel mortality in this region. Four of the five grey petrels were killed >200 km from the islands, but other species were mostly caught close to the islands (<100 km). The by-catch rate also varied as a function of wind strength. Most birds were killed during sets made at moderate wind speeds (force 4–5). However, the by-catch rate was greatest in calm conditions at night, and at stronger wind speeds during the day.

7.41 The Working Group noted differences between WG-FSA-00/30 and 00/37 in respect of data from Subareas 58.6 and 58.7, which reflected that:

(i) WG-FSA-00/30 included reports of dead birds not directly recorded by the observer, resulting in higher by-catch totals and rates; and

(ii) different definitions of day and night with respect to time of line setting (in WG-FSA-00/37 dusk and dawn was included in daylight, whereas in WG-FSA-00/30 most dusk and dawn periods were included in night time) resulting in different conclusions on by-catch rates in day and night periods.

7.42 Both analyses, however, indicated that:

(i) by-catch levels had increased (over 1999 values) to values similar to those in 1997 and 1998, presumably due to the increased fishing effort;

(ii) by-catch rates had shown no reduction – and possibly even an increase – compared to 1999 values; and

(iii) by-catch rates were still consistently higher than those in Subarea 48.3.

7.43 The differences in by-catch rates between Subarea 48.3 and Subareas 58.6 and 58.7 were clearly attributable to:

(i) vessels in the latter subareas fishing in close proximity to major breeding sites of albatrosses and petrels during their breeding season; and

(ii) poor compliance with night-time setting requirements.

7.44 The Working Group reaffirmed its recommendations from last year (SC-CAMLR-XVIII, Annex 5, paragraph 7.46) that:

(i) reduction in the by-catch rate would likely be achieved by elimination of daytime setting and by line-weighting regimes that comply with Conservation Measure 29/XVI; and

(ii) fishing within 200 n miles of the Prince Edward Islands should be prohibited from January to March inclusive.

7.45 The Working Group expressed regret that, once again, no data on seabird by-catch from fishing operations within the French EEZ in Subarea 58.6 had been submitted to the meeting. It reiterated its request to France to submit such data in order to assist the Working Group in conducting comprehensive evaluations.

Division 58.5.1

7.46 The Working Group expressed regret that, once again, no data on seabird by-catch from fishing operations within the French EEZ in Division 58.5.1 had been submitted to the meeting. It reiterated its request to France to submit such data in order to assist the Working Group in conducting comprehensive evaluations.

Subarea 88.1

7.47 For the third successive season, observers reported no seabird by-catch in association with longline fishing carried out in this subarea by New Zealand (WG-FSA-00/56). The data on seabird species and numbers associated with the fishing vessels, however, emphasised that potential for by-catch exists if mitigating measure requirements were less stringent. This year, in addition to continuing to use streamer lines that met all specifications in Conservation Measure 29/XVI, no offal

discharge was made at any time during the cruise, in full compliance with Conservation Measure 190/XVIII. In previous years some offal and by-catch had been stored and discharged only when the vessel was not engaged in fishing activities.

General

7.48 Table 52 summarises data on seabird by-catch and by-catch rates for the last four years (1997–2000) for the best-documented subareas.

7.49 In Subarea 48.3 the total estimated seabird by-catch in 2000 was 10% of that in 1999 and 4% of that in 1997. By-catch rates in 2000 were 0.05% of those in 1997. These changes, achieved in large part by restricting fishing to winter months, but also by improved compliance with Conservation Measure 29/XVI, particularly night setting, have culminated in reducing seabird by-catch in the regulated fishery to negligible levels.

7.50 In Subareas 58.6 and 58.7 the total estimated seabird by-catch in 2000 increased three-fold compared to 1999, reverting to values similar to 1998; the by-catch rate, however, was 27% lower than the 1999 value. The increased by-catch in 2000 is likely due to increased fishing effort, although compliance with Conservation Measure 29/XVI was slightly worse in 2000 than in 1999. By-catch rates in these subareas are unlikely to be reduced further either:

(i) as long as fishing is undertaken during the breeding seasons of the seabird species mainly at risk; or

(ii) until more effective mitigation measures (e.g. fully effective underwater setting and/or line weighting) can be developed and used.

Compliance with Conservation Measure 29/XVI

7.51 Compliance with this conservation measure this year, as set out in WG-FSA-00/38, is summarised in Table 53, in comparison with similar data from previous years.

Streamer Lines

7.52 Compliance with the streamer-line design was poor and only 33% of the streamer lines deployed complied fully with the specifications in Conservation Measure 29/XVI (Table 54). The length of most of the streamer lines was less than 150 m and this continues to be the main reason for the low compliance. All of the streamer lines deployed in Subareas 58.6 and 58.7 and Division 58.4.4 were less than 150 m in length, and only 25% of the lines used in Subarea 48.3 and 67% of the lines in Subarea 88.1 were greater than 150 m in length (but see footnote to Table 53). Some vessels have persistently poor compliance with this element of the conservation measure (e.g. *Aquatic Pioneer, Argos Helena, Eldfisk, Illa de Rua, Isla Gorriti, Lyn, Jacqueline, Magallanes III, No. 1 Moresko* and *Tierra del Fuego*). Compliance with other elements such as the attached height of the line and the number and spacing of streamers per line remains high (85–100%). Nineteen observers indicated that spare streamer-line material was present on board.

Offal Discharge

7.53 In Subareas 58.6, 58.7 and 88.1 there was 100% compliance with the requirement either to hold offal on board, or to discharge on the opposite side to where the line was hauled. In Subarea 48.3, 76% of the vessels discharged offal on the opposite side to hauling (compared with 71% in 1999); of these vessels 50% did not discharge offal during hauling operations.

7.54 In Subarea 48.3 four vessels (*Faro de Hercules, Isla Sofía*, *Isla Camila* and *Jacqueline*) are still operating with offal discharge on the same side as the haul, in contravention of Conservation Measure 29/XVI.

Night Setting

7.55 Compliance with night setting has improved in Subarea 48.3 from 80% last season to 92% this season. In Subareas 58.6 and 58.7 compliance fell slightly from 84% to 72% this season. Night setting for the new fishery in Division 58.4.4 was only 50%.

7.56 Vessels which have fished for at least three cruises in two years and consistently failed to comply with this element of the conservation measure include the *Eldfisk*, *Isla Camila*, *Isla Gorriti* and *Tierra del Fuego*.

7.57 Fishing in Subarea 88.1 (where only 6% of lines were set at night) operated under Conservation Measure 190/XVIII which contained an exemption from night-setting requirements for vessels south of 65°S in order to conduct line-weighting trials.

Line Weighting

7.58 As in previous years, no vessels complied with line weighting for Spanish longline systems (6 kg every 20 m). The median weight and line spacing for Subareas 48.3, 58.6, 58.7 and Division 58.4.4 was 6 kg every 44 m, 6 kg every 88 m and 5 kg every 45 m respectively.

Thawed Bait

7.59 This year two vessels were reported to have used frozen bait regularly; up to 68% of the lines on the *Aquatic Pioneer* and 34% of the lines on the *RK-1* were set with frozen bait. The Working Group noted that there are technical problems for autoline vessels using fully thawed baits, and that the use of partially thawed baits on autoline vessels was unlikely to adversely affect autoline sink rate.

General

7.60 Details of compliance with streamer line, offal discharge and night-setting requirements of Conservation Measure 29/XVI are summarised on a vessel-specific basis in Table 55. In addition to the persistent compliance failures summarised in paragraphs 7.52, 7.54 and 7.56, this also reveals that several vessels which first entered longline fisheries in the Convention Area in 2000 failed to

comply with one (*Faro de Hercules*) or two (*Isla Alegranza* and *Isla Santa Clara*) of these three elements of the conservation measure.

Fishing Seasons

7.61 Last year the Commission decided that the timing of the fishing season for longlining in Divisions 58.4.3, 58.4.4, 58.5.1, 58.5.2 and Subareas 48.3, 48.4 and 58.6 should be changed from 15 April–31 August to 1 May–31 August (CCAMLR-XVIII, paragraph 9.3).

7.62 Only for Subarea 48.3 are sufficient data available to the Working Group to assess the impact this change might have had on seabird by-catch.

7.63 If, in previous years, the fishing season in Subarea 48.3 had opened on 1 May rather than 15 April, then the proportion of mortality occurring at or after the latter date, that would have been avoided, is as follows:

1996 – 71% (58 of 82 birds)
1997 – 43% (103 of 239 birds)
1998 – 23% (18 of 80 birds)
1999 – 36% (21 of 59 birds).

This suggests that the delay in starting the fishing season for longlining in 2000 had a significant beneficial effect on seabird by-catch.

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

Unregulated Seabird By-catch

7.64 As no information is available on seabird by-catch rates from the unregulated fishery, estimates have been made using both the average by-catch rate for all cruises from the appropriate period of the regulated fishery and the highest by-catch rate for any cruise in the regulated fishery for that period. Justification for using the worst by-catch rate from the regulated fishery is that unregulated vessels accept no obligation to set at night, to use streamer lines or to use any other mitigation measure. Therefore by-catch rates, on average, are likely to be considerably higher than in the regulated fishery. For Subarea 48.3, the worst-case by-catch rate was nearly four times the average value and applies only to a single cruise in the regulated fishery. Using this by-catch rate to estimate the seabird by-catch rate of the whole unregulated fishery may produce a considerable overestimate.

7.65 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 this assessment last year. The assessment this year, therefore, followed the identical procedure to that used last year (SC-CAMLR-XVIII, Annex 5, paragraphs 7.60 to 7.62).

Unregulated Effort

7.66 To estimate the number of hooks deployed by the unregulated fishery, it is assumed that the fish catch rate in the regulated and unregulated fisheries is the same. Estimates of fish catch rate from the regulated fishery and estimated total catch from the unregulated fishery can then be used to obtain an estimate for the total number of hooks using the following formula:

$$\text{Effort}(U) = \text{Catch}(U)/\text{CPUE}(R),$$

where U = unregulated and R = regulated.

Catch rates for Divisions 58.4.4 and 58.5.2 were assumed to be identical to those for Division 58.5.1.

7.67 The fishing year was divided into two seasons, a summer season (S: September–April) and a winter season (W: May–August), corresponding to periods with substantially different seabird by-catch rates. There is no empirical basis on which to split the unregulated catch into summer and winter components. Three alternative splits (80:20, 70:30 and 60:40) were used.

7.68 The seabird by-catch rates used were:

Subarea 48.3 –
summer: mean 2.608 birds/thousand hooks; maximum 9.31 birds/thousand hooks;
winter: mean 0.07 birds/thousand hooks; maximum 0.51 birds/thousand hooks.

Subareas 58.6, 58.7, Divisions 58.5.1 and 58.5.2 –
summer: mean 1.049 birds/thousand hooks; maximum 1.88 birds/thousand hooks;
winter: mean 0.017 birds/thousand hooks; maximum 0.07 birds/thousand hooks.

Division 58.4.4 –
summer: mean 0.629 birds/thousand hooks; maximum 1.128 birds/thousand hooks;
winter: mean 0.010 birds/thousand hooks; maximum 0.042 birds/thousand hooks.

Results

7.69 The results of these estimations are shown in Tables 56 and 57.

7.70 For Subarea 48.3, depending on the proportionate split of catches into summer and winter, estimates of the seabird by-catch in the unregulated fishery range from a lower level (based on the mean by-catch rate of regulated vessels) of 1 800–2 400 birds in summer (and 20–30 in winter) to a

potentially higher level (based on the maximum by-catch rate of regulated vessels) of 6 400–8 600 birds in summer (and 120–230 in winter).

7.71 For Subareas 58.6 and 58.7 combined, depending on the proportionate split of catches into summer and winter, estimates of the seabird by-catch in the unregulated fishery range from a lower level (based on the mean by-catch rate of regulated vessels) of 15 300–20 500 birds in summer (and 80–140 in winter) to a potentially higher level (based on the maximum by-catch rate of regulated vessels) of 27 600–37 100 birds in summer (and 340–680 in winter).

7.72 Subarea 58.7, mainly due to low levels of fishing and catch rates of fish, makes rather little contribution to this year's total.

7.73 For Divisions 58.5.1 and 58.5.2, depending on the proportionate split of catches into summer and winter, estimates of the seabird by-catch in the unregulated fishery range from a lower level (based on the mean by-catch rate of regulated vessels) of 7 600–10 200 birds in summer (and 40–80 in winter) to a potentially higher level (based on the maximum by-catch rate of regulated vessels) of 13 900–18 600 birds in summer (and 170–340 in winter).

7.74 For Division 58.4.4, depending on the proportionate split of catches into summer and winter, estimates of the seabird by-catch in the unregulated fishery range from a lower level (based on the mean by-catch rate of regulated vessels) of 1 700–3 000 birds in summer (and 10–20 in winter) to a potentially higher level (based on the maximum by-catch rate of regulated vessels) of 2 200–4 000 birds in summer (and 40–70 in winter).

7.75 The overall estimated totals for the whole Convention Area (Tables 56 and 57) indicate a potential seabird by-catch in the unregulated fishery of 26 400–35 300 (lower level) to 50 900–68 300 birds (higher level) in 1999/2000.

7.76 This compares with totals of 17 000–27 000 (lower level) to 66 000–107 000 (higher level) in 1996/97; 43 000–54 000 (lower level) to 76 000–101 000 (higher level) in 1997/98; and 21 000–29 000 (lower level) to 44 000–59 000 birds (higher level) in 1998/99. Attempts to draw inferences regarding changes in by-catch levels in the IUU fishery should be viewed with caution, given the uncertainties and assumptions involved in these calculations.

7.77 Note that the lower level value for 1998/99 in paragraph 7.76 has been corrected (from 18 000–24 000) because an incorrect seabird by-catch rate (0.049 instead of 1.049) was inadvertently used last year in the estimation of mean values for Subareas 58.6 and 58.7 and Divisions 58.5.1 and 58.5.2.

7.78 The composition of the estimated potential seabird by-catch based on data from 1997 is set out in Table 58. This indicates a potential by-catch in 1999/2000 of 7 000–15 000 albatrosses, 1 000–2 000 giant petrels and 19 000–37 000 white-chinned petrels in the unregulated fishery in the Convention Area.

7.79 As in the last three years, it was emphasised that the values in Tables 56 to 58 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.

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

Summary Conclusion

7.81 WG-IMALF 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. In the last four years, an estimated total of 237 000 to 333 000 seabirds have been killed by these vessels. Of these:

(i) 21 900–68 000 were albatrosses, including individuals of four species listed as globally threatened (vulnerable) using the IUCN threat classification criteria (BirdLife International, 2000);

(ii) 5 000–11 000 were giant petrels, including one globally threatened (vulnerable) species; and

(iii) 79 000–178 000 were white-chinned petrels, a globally threatened (vulnerable) species.

7.82 These levels of loss of birds from the populations of these species and species-groups is 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.

7.83 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 take action to prevent further seabird mortality by unregulated vessels in the forthcoming fishing season.

Incidental Mortality of Seabirds in relation
to New and Exploratory Fisheries

New and Exploratory Longline Fisheries Proposed in 2000

7.84 As in previous years concerns were raised relating to the numerous proposals for new fisheries and the potential for these new and exploratory fisheries to lead to substantial increases in seabird incidental mortality.

7.85 In order to address these concerns, the Working Group prepared 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.

7.86 The Working Group again noted that the need for such assessments would be largely unnecessary if all vessels were to adhere to all elements of Conservation Measure 29/XVI. It is considered that these measures, if fully employed, and if appropriate line-weighting regimes could be devised for autoliners, should permit longline fishing activities to be carried out in any season and area with negligible seabird by-catch.

7.87 In 1999 the Working Group carried out comprehensive assessments on the potential risk of interaction between seabirds, especially albatrosses, and longline fisheries for all statistical areas in the Convention Area. These assessments were combined into a background document for use by the Scientific Committee and Commission (SC-CAMLR-XVIII/BG/23). It was agreed in 1999 that this document should be tabled and updated annually for the Scientific Committee.

7.88 This year new data on at-sea distribution of albatrosses and petrels were provided in WG-FSA-00/56. New data on at-sea distribution from satellite-tracking studies were also obtained from Terauds (2000). This information was used to update the assessment of potential risk of interaction between seabirds and longline fisheries for Subareas 88.1 and 88.2. The revised assessments for these areas are set out below (with changes/additions underlined):

(i) Subarea 88.1:

Breeding species in this area: none.

Breeding species known to visit this area: Antipodean albatross from Antipodes Island, <u>black-browed albatross, grey-headed albatross</u> and light-mantled albatross from Macquarie Island.

Breeding species inferred to visit this area: light-mantled albatross from Auckland, Campbell and Antipodes Islands; <u>sooty albatross from Indian Ocean populations</u>; grey-headed albatross and Campbell albatross from Campbell Island; wandering albatross from Macquarie Island; Chatham albatross from Chatham Islands; <u>northern giant petrel from Macquarie, Auckland and Campbell Islands</u>; <u>southern giant petrel from Macquarie Island</u>; and <u>grey petrel from Macquarie Island and New Zealand populations.</u>

Other species: short-tailed shearwater, sooty shearwater.

Assessment: the northern part of this area lies within the foraging range of eight albatross species (seven threatened) and is probably used by other albatrosses and petrels to a greater extent than the limited available data indicate. The southern part of this subarea has potentially fewer seabirds at risk.

Advice: average risk overall. Average risk in northern sector (*D. eleginoides* fishery), average to low risk in southern sector (*D. mawsoni* fishery); longline fishing season limits of uncertain advantage; the provisions of Conservation Measure 29/XVI should be strictly adhered to.

(ii) Subarea 88.2

Breeding species in this area: none.

Breeding species known to visit this area: grey-headed albatross and light-mantled albatross from Macquarie Island.

Breeding species inferred to visit this area: light-mantled albatross from Auckland, Campbell and Antipodes Islands; Antipodean albatross from Antipodes Island; grey-headed albatross and Campbell albatross from Campbell Island; wandering albatross and black-browed albatross from Macquarie Island; grey petrel and white-chinned petrel from New Zealand populations.

Other species: sooty shearwater.

Assessment: although there are few observational data from this area, the northern part of this area lies within the suspected foraging range of six albatross species (five threatened) and is probably used by other albatrosses and petrels to a greater extent than the limited available data indicate. The southern part of this subarea has potentially fewer seabirds at risk.

Advice: low risk. No obvious need for restriction of longline fishing season; apply Conservation Measure 29/XVI as a seabird by-catch precautionary measure.

7.89 Because the revisions to the assessments are not extensive, the Working Group did not feel there was a need to produce a revised version of SC-CAMLR-XVIII/BG/23 this year. However, it drew to the attention of the Scientific Committee and Commission that in Figure 1 of SC-CAMLR-XVIII-BG/23 the codes for potential risk of interaction with seabirds for Subareas 48.1 and 48.4 should be 1 and 3 respectively (not 2 as depicted).

New and Exploratory Longline Fisheries Operational in 1999/2000

7.90 Of the 22 proposals last year for new and exploratory longline fisheries, only four were actually undertaken: by Uruguay in Division 58.4.4, by France and by South Africa in Subarea 58.6 and by New Zealand in Subarea 88.1.

7.91 No seabird by-catch was reported to have been observed in any of these fisheries. Those in Division 58.4.4 and Subarea 58.6 were undertaken in winter. That in Subarea 88.1 followed the specific requirements set out in Conservation Measure 190/XVIII, the results being described in detail in CCAMLR-XIX/17 and WG-FSA-00/37.

New and Exploratory Longline Fisheries for 2000/01

7.92 The areas for which proposals for new and exploratory longline fisheries were received by CCAMLR in 2000 were:

Subarea 48.1	Argentina
Subarea 48.2	Argentina
Subarea 48.6	Argentina, Brazil, South Africa
Division 58.4.1	Argentina
Division 58.4.2	Argentina
Division 58.4.3	Argentina, France
Division 58.4.4	Argentina, Brazil, France, South Africa, Ukraine, Uruguay
Division 58.5.1	Argentina, Brazil, France
Division 58.5.2	Brazil, France
Subarea 58.6	Argentina, France, South Africa
Subarea 58.7	France
Subarea 88.1	Argentina, New Zealand, South Africa, Uruguay
Subarea 88.2	Argentina, South Africa, Uruguay
Subarea 88.3	Argentina, Uruguay.

7.93 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 paragraph 7.85, SC-CAMLR-XVIII/BG/23 and paragraph 7.88. A summary of risk level, risk assessment, WG-IMALF recommendations relating to fishing season and any inconsistencies between these and the proposals for new and exploratory longline fisheries in 2000, is set out in Table 59.

New Zealand Proposal in respect of Subarea 88.1

7.94 The Working Group noted New Zealand's request for a continuation of the variation to Conservation Measure 29/XVI for Subarea 88.1, as provided for previously by Conservation Measures 169/XVII and 190/XVIII. The variation is to allow line-weighting experiments to continue south of 65°S in Subarea 88.1 (CCAMLR-XVIII/10 and CCAMLR-XIX/17). Conservation Measures 169/XVII and 190/XVIII allowed New Zealand vessels to set lines during the daytime south of 65°S in Subarea 88.1 if vessels weighted their lines and achieved a minimum sink rate of 0.3 m/s for all parts of the longline. The variation was sought because during austral summer (December to March) there are insufficient periods of darkness at these latitudes for exploratory fishing to occur.

7.95 In 1998 the Working Group noted that line weighting has the best potential as an alternative mitigation measure, and noted the need to urgently gain information on longline sink rates. Accordingly, the Working Group supported the New Zealand proposal. In 1999 the Working Group noted that the experiment had been conducted successfully in the 1998/99 season, no seabird mortality had occurred and that valuable data had been collected on autoline sink rates. However, the Working Group noted that operational issues needed to be further investigated and more data collected. The Working Group again supported the proposal to allow a variation to Conservation Measure 29/XVI for this experiment.

7.96 The Working Group assessed the current proposal (CCAMLR-XIX/17) on the basis of data provided in WG-FSA-00/58. The model presented is now well developed, but requires further data on variation in weight-spacing regimes to be useful for monitoring line sink rates without mechanical verification.

7.97 The Working Group noted that, with this further experimentation, it should be possible to specify line-weighting regimes for autoline vessels which, in conjunction with all other mitigating measures, should enable these vessels to fish during daylight with zero, or insignificant, by-catch of seabirds, at least in areas of average (or lower) risk (see also paragraph 7.148).

7.98 The Working Group, therefore, strongly supported the New Zealand proposal for a variation to Conservation Measure 29/XVI for those New Zealand flagged vessels prepared to undergo line sink-rate certification and comply with all experimental protocols.

7.99 The Working Group noted that the proposals for longline fishing in Subarea 88.1 by Argentina, South Africa and Uruguay did not contain any proposal for line-weighting (or other) experiments in support of any potential exemption from the night-setting provision contained in paragraph 3 of Conservation Measure 29/XVI.

7.100 The Working Group recommended that any other vessels allowed to conduct longline fishing in Subarea 88.1 should meet the same requirements as set out in paragraph 7.98.

7.101 The Working Group also noted the proposal by New Zealand to place a limit on any potential seabird by-catch during the daylight setting variation to Conservation Measure 29/XVI on a per-vessel basis. Any vessel catching three seabirds would have to revert immediately to Conservation Measure 29/XVI.

7.102 The Working Group endorsed this proposal, noting that placing a limit on a per-vessel basis was a commendable way of encouraging greater responsibility at the level of individual vessels. Further, the Working Group agreed with the limit of three seabirds per vessel proposed by New Zealand, whilst noting this number was not a scientific estimation of an appropriate level of seabird by-catch, but a precautionary small number.

7.103 The Working Group recommended that any other vessels allowed to conduct longline fishing in Subarea 88.1 should be subject to the same seabird by-catch limit, and consequential requirements, as set out in paragraph 7.101.

Incidental Mortality of Seabirds during Longline Fishing outside the Convention Area

7.104 WG-FSA-00/13 evaluated interactions between seabirds and longline fisheries operating around Tristan da Cunha and Gough Islands. The demersal fisheries for bluefish and alfoncino, despite setting in daytime and attracting many birds (including albatrosses), had an observed by-catch rate of 0.001 birds/thousand hooks. In contrast, limited observations on board a Japanese autoliner longline fishing in winter for tuna, suggested that by-catch rates may exceed 1 bird/thousand hooks. Black-browed albatross (probably from the South Georgia population) was the only species observed caught. However at other times of year, the globally endangered Tristan albatross

(*Diomedea dabbenena*) and the globally critically endangered spectacled petrel (*Procellaria conspicillata*) would be potentially at high risk.

7.105 The Working Group endorsed the recommendations in WG-FSA-00/13 that tuna longliners operating in these waters should be required to apply mitigating measures, preferably identical to those required for high-risk areas within the Convention Area.

7.106 It was disturbing to note the lack of any measures to reduce seabird by-catch on Japanese longliners, as the Working Group understood, from previous reports by Japan to ICCAT and CCSBT, that these vessels were required to use at least streamer lines wherever and whenever fishing.

7.107 Mr Smith reported that New Zealand continued to undertake observations of both pelagic and demersal longline fisheries. Records of actual by-catch numbers observed and, where possible, estimates of total seabird by-catch continue to be made annually and are available in Baird (2000).

7.108 Mr Baker reported that no Australian longline observer program had been in operation last year. Previous years' experiences had been reported in detail in SC-CAMLR-XVIII, Annex 5, paragraphs 7.96 to 7.100.

7.109 The Working Group regretted the absence of other data from Members on incidental mortality of seabirds, especially for regions adjacent to the Convention Area, such as southern South America and the Falkland/Malvinas Islands.

7.110 Prof. Croxall indicated that some relevant data, particularly from Argentina and Brazil, had been presented at the Albatross Conference in Hawaii, USA (paragraph 7.20), and at a recent Marine Science Congress in Argentina. He would try to arrange the circulation of such information intersessionally.

7.111 The Working Group regretted that so little information had been forthcoming from areas adjacent to the Convention Area on topics of considerable significance, viz:

(i) longline fishing effort;
(ii) incidental mortality of seabirds breeding within the Convention Area; and
(iii) implementation of the provisions of Conservation Measure 29/XVI in adjacent fisheries.

7.112 The Working Group reiterated the request to Members to provide such data to the next meeting of WG-IMALF.

Research into and Experience with Mitigating Measures

Offal Discharge

7.113 In Subarea 48.3 four vessels were discharging offal on the same side as the haul, in contravention of Conservation Measure 29/XVI (paragraph 7.56). Three of these vessels (*Isla Sofía*, *Isla Camila* and *Jacqueline*) have persisted with the practice for the last three years.

7.114 Offal discharge should be on the opposite side of the haul irrespective of whether or not offal is stored during line hauling. On long cruises, vessels may not have the freezer capacity to freeze and store offal for discharge at the end of the cruise (200 tonnes of toothfish might accrue 80 tonnes of offal). The retention of offal on a daily basis might also present problems, particularly during periods of high fish catch rates and production of offal. Unless under strict observation, the incentive will be great to jettison offal as it is accrued during the fishing operation. This problem can be rectified if vessels re-engineer offal dumping facilities to discharge offal on the opposite side to the line-hauling site of vessels. Re-engineering offal discharge facilities will also result in vessels discharging offal in a seabird-safe manner when vessels leave the Convention Area for other fishing grounds.

7.115 Offal discharge sites should be re-engineered according to the engineering diagrams of the *Koryo Maru 11* (SC-CAMLR-XVIII, Annex 5, paragraph 7.110).

7.116 In Subarea 88.1 the three New Zealand vessels achieved full compliance with the conservation measure by processing offal into fish meal on board, or returning all offal to port for onshore processing into fish meal. This includes all baits returned on board and removed from hooks. Other vessels should be encouraged to adopt the same solution to the problem.

Underwater Funnel

7.117 WG-FSA-00/29 reported that in Subareas 58.6 and 58.7, the *Eldfisk* used a Mustad underwater funnel (setting the line 1–2 m underwater). It set 5.12 million hooks over a two-year period, the results of the first year being reported in WG-FSA-00/42 Rev. 1 (SC-CAMLR-XVIII, Annex 5, paragraph 7.122). Bait loss and fish catch rates were not affected by the use of the funnel. At night in summer, by-catch rates were 0.013 birds/thousand hooks when the funnel was not in use and 0.009 birds/thousand hooks when the funnel was in use. Comparable rates for summer daytime sets were 0.05 and 0.02 birds/thousand hooks for control and underwater setting respectively. Birds caught were white-chinned petrels (88% of the 114 birds killed).

7.118 The Working Group noted that this three-fold reduction in seabird by-catch rates when the funnel was in use is encouraging. However, the Mustad funnel is short, deploys bait above the propeller turbulence (forces baited hooks to the surface) and setting depth is affected by both swell height and the load status of the vessel (sits lower in the water if fully fuelled and has full freezers). To avoid these problems, underwater setting tubes should deploy baits beneath the propeller turbulence so that the turbulence forces the baits down.

7.119 WG-FSA-00/64 reported the results of preliminary trials (12 260 hooks) of an underwater setting tube in the Australian domestic tuna fishery. The tube set the line 6 m under water. A total of eight birds was caught during the development trials but none were caught once design and operational deficiencies were corrected. The results to date look promising. Potentially, for tuna fishing at least, setting lines deep under water (beneath propeller turbulence) could be the most effective measure to date to reduce seabird mortality.

7.120 WG-FSA-00/61 reported on several years of experimentation to reduce seabird by-catch (principally northern fulmars) in Norwegian longline fisheries. The results of trials with bird-scaring lines, an underwater setting tube and a line shooter were reported. Catches were 0–0.40 birds/thousand hooks when mitigation measures were tested and 0.55–1.75 birds/thousand hooks when no measures were employed. The setting funnel reduced by-

catch by 72% (126 900 hooks in total) and the line shooter reduced by-catch by 59% (58 420 hooks in total).

7.121 It should be noted, however, that in the Norwegian fishery the dominant seabird species, the northern fulmar (*Fulmarus glacialis*), although very abundant, is not a proficient diver and is unable to ingest baited hooks whole. Most captures occur by birds getting hooked in the wing or body; the North Sea does not have albatross species or proficient divers like white-chinned petrels and grey petrels, whose interaction with fishing vessels is more difficult to mitigate. Nonetheless, the results of WG-FSA-00/61 are encouraging and if adopted in Norwegian longline fisheries, reduction of seabird by-catch would be expected to reach levels where potential threats to populations are eliminated.

Streamer Lines

7.122 In Norwegian trials (186 132 hooks in total) (WG-FSA-00/61), the most effective measure was the streamer line which reduced seabird by-catch by 98–100%. Significantly, the use of the bird-scaring line gave a 32% increase in fish catch compared to control sets, because fewer baits were lost to seabirds.

7.123 Because streamer lines may lose their effectiveness when line setting in crosswinds, the use of paired streamers lines, which should increase longline protection in this type of weather condition, should be investigated, particularly for vessels which fish in summer in Subareas 58.6 and 58.7. The USA recommends the use of paired streamer lines in the Gulf of Alaska halibut fishery.

7.124 To address this problem, New Zealand vessels in Subarea 88.1 use a boom and bridle system to allow the streamer line to be deployed directly over the longline being set, irrespective of the wind direction.

7.125 More attention is still needed to the correct design and deployment of streamer lines. As a minimum requirement, vessels must use streamer lines to CCAMLR specifications in regard to length, attachment height on vessels, number of streamers, length of streamers and distance between streamers. All these characteristics of streamer lines will have an important influence on the effectiveness of streamer lines in reducing seabird by-catch. Better provision should be made for observers to report on these characteristics of streamer lines.

Line Shooter

7.126 Norwegian trials (WG-FSA-00/61) also examined the effect of a line shooter on seabird by-catch rates. The line shooter reduced seabird by-catch by 59% (58 420 hooks), less than for streamer lines and the underwater funnel. Nevertheless, this device may have considerable utility as an auxiliary mitigating measure for autoline vessels.

Artificial Bait

7.127 WG-FSA-00/50 reported that no experiments testing the performance of natural and artificial baits regards attraction to seabirds have been conducted.

Line Weighting

7.128 WG-FSA-00/58 reported on the effect on longline sink rate of a range of environmental and operational issues of autoline vessels fishing in Subarea 88.1. Of the effects tested, added weight explained 72% of the variance in the sink rate of longlines to 15 m depth. Swell height and setting speed explained an additional 4% and 2% respectively. The results to date are preliminary, but when the work is completed the ensuing model will, potentially, eliminate the need to use time-depth recorders to estimate longline sink rates on autoline vessels.

Toothfish Pots

7.129 WG-FSA-00/23 reported on the use of pots to catch toothfish, as a method to avoid seabird by-catch, in Subarea 48.3. A total of 11 088 pots was deployed between 16 March and 11 May 2000. No seabirds were caught during the trial, although plenty of seabirds were available to interact with vessels. This suggests that the use of pots will eliminate seabird by-catch. However, present catch rates of toothfish were not commercially viable and there was a significant catch of crabs. Technological refinements are necessary before the feasibility of this fishing practice can be verified and further trials are planned.

Other Measures

7.130 Mr Smith reported that initial trials had been undertaken with a laser gun and aircraft spotlights within the New Zealand EEZ. The results were such that full trials were considered inappropriate as the measures appeared totally ineffective.

General

7.131 The Working Group considered a New Zealand report on the technical feasibility of video monitoring of seabird interactions on fishing vessels (WG-FSA-00/62). The study concluded that the technology is now available to go forward with this method, that the costs are still moderately high and that without suitable software the issue of viewing all footage onshore remains. However, the study suggests that the method is technically feasible and that a pilot trial should go ahead.

7.132 The Working Group cautioned that when considering the substitution of observers with video surveillance of fishing operations, there is enhanced potential for fishers to disguise by-catch events. For example, the practice in some fisheries of line-cutting prior to landing of a by-catch species (WG-FSA-98/31) could mean that the identity of by-catch could go unrecorded by video.

7.133 Nevertheless, the Working Group concluded that video monitoring of seabird interactions on fishing vessels could be very useful and possibly one way of increasing the proportion of hooks observed for seabird by-catch.

Policy Considerations in relation to Mitigating Measures and Conservation Measure 29/XVI

7.134 Conservation Measure 29/XVI is the key element in minimisation of incidental mortality of seabirds during longlining in the Convention Area.

7.135 Last year WG-FSA and the Scientific Committee advised the Commission (SC-CAMLR-XVIII, Annex 5, paragraph 7.150) that:

(i) sustained development of underwater setting offers the most likely medium- to long-term solution to the problem;

(ii) work to develop line-weighting regimes to ensure sink rates that will preclude seabirds accessing bait offers the best short-term solution, as well as the likelihood of permitting exemption from several other mitigating measures currently in use in the Convention Area; and

(iii) in the meantime, improved compliance with the existing suite of mitigation measures in Conservation Measure 29/XVI is essential.

7.136 Although there is still some continuing improvement in compliance with Conservation Measure 29/XVI – and simple means exist to improve this further – three important problems remain:

(i) how to get fishers to comply with the straightforward elements of the conservation measure, in respect of offal discharge, streamer lines and night setting;

(ii) how to tackle the consistent inability of vessels to comply with the element of the conservation measure that specifies the line-weighting regime for Spanish system longliners; and

(iii) how to develop the requirements for an appropriate line-weighting regime for autoliners.

7.137 Some suggestions on the way forward on these topics, including the potential for revision of elements of Conservation Measure 29/XVI, are set out below.

Offal Discharge

7.138 The Working Group noted the reluctance of some vessels fishing in the Convention Area to implement easy-to-achieve conservation measures such as discharging offal on the opposite side of the haul. Three vessels (*Isla Sofia*, *Isla Camila* and *Jacqueline*) continued to discharge offal on the same side as the haul, in direct contravention of Conservation Measure 29/XVI. Attention was drawn to this situation involving these three vessels last year (SC-CAMLR-XVIII, Annex 5, paragraph 7.110). This year the *Faro de Hercules* also discharged offal in a manner in contravention of the conservation measure. Reconfiguring vessels to comply with this measure is clearly feasible, as demonstrated by the compliance achieved by most vessels currently fishing in the Convention Area (i.e. in Subarea 48.3 no compliance in 1997; 76% compliance in 2000). The fact

that the vessels mentioned above continue to be licensed each year is contrary to the expressed views of the Commission on this topic (CCAMLR-XVII, paragraph 6.42(i)). The Working Group reiterated that vessels which have proven unable or unwilling to comply with this provision of Conservation Measure 29/XVI should not be allowed to fish in the Convention Area.

Streamer Lines

7.139 Paragraph 7.125 indicates the importance of adhering strictly to the provisions of Conservation Measure 29/XVI in this regard, as a minimum requirement. Paragraphs 7.123 (use of paired streamer lines) and 7.124 (device to centre a streamer line over the longline) indicate potential improvements to the nature and operation of streamer lines which could be reflected in some future revision of the conservation measure. Members are urged to test these potential improvements and report to the Working Group on their efficacy.

Night Setting

7.140 The Working Group reiterated the importance of avoiding setting during daylight, and in particular during dusk and dawn, as many species, particularly white-chinned petrels, are very active at these times.

7.141 It is possible that part of the failure to comply with this measure reflects uncertainty over the definition of the light levels that constitute the beginning and end of night. It was suggested that some simple device (e.g. light meter, Secchi disk) might be provided to give fishing masters and observers unambiguous empirical guidance as to when line setting should commence. Members were encouraged to investigate this further.

7.142 Even without such assistance, compliance with this element of the conservation measure – which is of particular importance – is very straightforward. Vessels which are unable or unwilling to comply should not be allowed to fish in the Convention Area.

Line Weighting – Spanish System

7.143 The current prescription for Spanish system longlining of a minimum of a 6 kg weight spaced every 20 m has proven consistently unattainable by any vessel since its introduction. Dr Robertson reported that correspondence with fishing masters indicated that 20 m weight spacing was insufficient to bridge undulations in bottom topography, causes line tangles during setting and hauling, and requires slower setting speeds and heavier mother lines.

7.144 Although none of these problems are incapable of solution, albeit at extra cost and effort to the fisher, the Working Group felt that there was a strong case for an interim relaxation of the current requirements of this element of Conservation Measure 29/XVI.

7.145 The Working Group recollected the line-weighting experiment carried out last year (SC-CAMLR-XVIII, Annex 5, paragraphs 7.111 to 7.115) which showed that increasing line

weighting from 4.25 kg at 40 m to 8.5 kg at 40 m reduced bird mortality from 3.98 birds/thousand hooks to <1.0 birds/thousand hooks when setting during daylight in the breeding season of susceptible albatross and petrel species in Subarea 48.3.

7.146 In circumstances where all other elements of Conservation Measure 29/XVI apply (e.g. in respect of night setting, streamer lines and offal discharge) and with appropriate closed seasons, the Working Group recommended that the line-weighting regime for the Spanish system of longlining should be set at weights of a minimum of 8.5 kg spaced at no more than 40 m intervals.

7.147 Members, technical coordinators and observers were encouraged to report in detail on the use of, and compliance with, this requirement. Further experiments on line weighting were encouraged to try to develop a regime that might be appropriate for use at times of year other than winter and for times of day other than night time.

Line Weighting – Autoline System

7.148 Currently, Conservation Measure 29/XVI does not include a line-weighting requirement for autoline vessels. The Working Group noted New Zealand's proposed experimental work in Subarea 88.1 to complete a predictive model for autoline sink rates taking into account line weight and environmental variables. The Working Group strongly supported this initiative. It encouraged Members to conduct similar trials in areas where the interaction between albatrosses and diving species of petrels and longlines will be more difficult to mitigate. At the completion of such trials the Working Group should be in a good position to recommend a line weighting for autoline vessels that will have utility for all subareas of the Convention Area.

General Observations

7.149 The Working Group recommended that seabird by-catch in the Convention Area should be managed by measures adopted in Subarea 48.3, where in the 1999/2000 season with over 14 million hooks set only 21 seabirds were estimated to have been caught. In Subarea 48.3 the combination of a closed season in summer, night setting, the use of streamer lines and proper offal discharge practices has effectively solved the seabird by-catch problem.

7.150 The Working Group recognised that the ultimate aim in managing seabird by-catch in the Convention Area will be to allow fishing at any time of day without seasonal closure of fishing grounds. However, 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 (current practice for Spanish system vessels) will still result in unacceptably high mortality of seabirds. Clearly, more time is required to allow experimentation into the effectiveness of line-weighting concepts and underwater setting devices with the Spanish system that will reduce seabird by-catch and be more acceptable to the fishing industry. In the meantime, the Working Group believed that seabird by-catch in the Convention Area should be managed in accordance with practices adopted in Subarea 48.3.

Vessel Accreditation

7.151 In spite of the successes in Subarea 48.3, best practice regarding the use of streamer lines, night setting and offal discharge procedures has not been achieved and should be, especially since these mitigating measures are simple and easy to use.

7.152 The Working Group therefore recommended that vessels should not be allowed to fish in the Convention Area unless they comply completely with all the elements of Conservation Measure 29/XVI relating to streamer lines, night setting and offal discharge.

7.153 The Working Group recommended that these requirements should be brought to the attention of technical coordinators (and through these to fishing companies and fishers) at the earliest opportunity after the conclusion of the Commission meeting this year. It should be made absolutely clear that vessels unable to comply with the elements of Conservation Measure 29/XVI relating to night setting, offal discharge and streamer lines should not expect to be allowed or licensed to fish in the Convention Area in 2000/01.

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

Workshop on Albatross and Petrel Mortality from Longline Fishing

7.154 This workshop, held in Hawaii, USA, in May 2000 and attended by approximately 75 biologists, resource managers and conservationists from many countries (including eight members of WG-IMALF), reviewed the effects of longlining on albatrosses and petrels on a global scale (SC-CAMLR-XIX/BG/12). The workshop made recommendations, relating to albatross research and conservation, in respect of:

(i) the use of appropriate multilateral, intergovernmental instruments, mechanisms and fora;

(ii) improved practical means to reduce seabird by-catch and promote their wide and effective use; and

(iii) enhanced monitoring of seabird by-catch and population trends, complemented by relevant research into population structure, dynamics and foraging ecology.

7.155 The workshop indicated that priorities for sustaining existing research and monitoring work, and developing new studies were:

(i) monitoring of status and trends of albatross populations, complemented by demographic research;

(ii) undertaking genetic studies to understand structure and stock identity within albatross species and populations;

(iii) collecting comprehensive data on by-catch rates and fishing effort; and

(iv) defining foraging ranges by age, sex and season, using new technologies, devices and analytical approaches.

7.156 In order to facilitate cooperation and information exchange throughout the international seabird research and conservation communities, the workshop recommended that the issue of seabird mortality in longline fisheries should be addressed by means of further national and international workshops and conferences. BirdLife International was invited, in the context of its 'Save the Albatross Campaign', to sponsor a workshop in 2001 among Latin-American states to address the issue of seabird by-catch in longline fisheries in that region.

7.157 The Working Group was informed that this workshop is to be held in Montevideo, Uruguay, and will be co-convened by Uruguayan and Brazilian scientists. Dates will be advised to CCAMLR as soon as they are available.

7.158 In respect of training scientific observers for longline fisheries, the Hawaiian workshop attempted to facilitate collaboration between New Zealand and South American countries. New Zealand funding for such initiative is understood to be available and it is hoped that a way to utilise this will be arranged at the Montevideo workshop.

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

7.159 Last year Members were invited to report on progress in developing NPOA–Seabirds under the FAO–IPOA initiative (SC-CAMLR-XVIII, paragraph 4.75(i) and Annex 5, paragraph 7.131).

7.160 Mr Smith reported that New Zealand has completed its review of seabird interactions with longline fisheries as required by FAO. The review has resulted in the development of a draft NPOA–Seabirds. The draft has been circulated within New Zealand for consultation, and implementation is planned for early 2001. Copies are available from New Zealand and requests can be forwarded to <smithn@fish.govt.nz>.

7.161 Mr Baker reported that Australia's responsibilities in meeting the requirements of an NPOA are largely met by the implementation of the Threat Abatement Plan (TAP) for the incidental catch (or by-catch) of seabirds during oceanic longline fishing operations. This plan was prepared by the Australian Government following the listing in 1995 of longline fishing as a key threatening process under the *Endangered Species Protection Act 1992*.

7.162 The objective of the TAP is to reduce seabird by-catch in all fishing areas, seasons and fisheries to below 0.05 birds/thousand hooks, based on 1998 fishing levels. This represents a reduction of up to 90% of seabird by-catch within the Australian Fishing Zone (AFZ), and should be achievable within the five-year life of the plan. The TAP prescribes the actions necessary to achieve this objective.

7.163 Australia is still intending to prepare an NPOA. The main contribution of the NPOA will be to outline an approach by which the issue of seabird by-catch can be promoted through regional fisheries fora, including the facilitation of information exchange and mitigation technologies. It is expected that a draft document will be prepared by the end of the year.

7.164 For Brazil, Dr Fanta indicated that, as part of the initiatives being generated by new national committees responsible for fisheries and environmental matters, scientists with experience of longline fisheries and seabird interactions had been invited to collaborate in the preparation of a draft NPOA.

7.165 Prof. C. Moreno (Chile) indicated that he was responsible for coordinating the preparation of a draft NPOA for Chile.

7.166 Prof. Croxall reported that the European Community had recently decided to embark on an assessment of Community longline fisheries. A questionnaire had been circulated to members requesting information on the nature and extent of longline fishing (and associated incidental catches of seabirds) in the waters of European Community Member States and on the high seas, and what, if any, actions are being taken to address by-catch issues. It was hoped that the European Community would agree to produce a Community-based plan to ensure harmonisation among fleets operating in different European Community EEZs and regional seas. Some issues relating to operations regarding overseas territories may still need to be clarified.

7.167 Dr Holt reported that the USA draft NPOA would be completed by the end of 2000. Further details can be obtained from www.nmfs.noaa.gov or from <kim.rivera@noaa.gov>.

7.168 Norway was understood to be developing an NPOA but no details were available to the meeting.

7.169 No information on progress towards NPOAs was available for other CCAMLR Members. All Members were requested to provide WG-IMALF with information on the progress of their NPOAs, making copies as widely available as appropriate.

Convention on the Conservation of Migratory Species

7.170 The 6th Conference of Parties (COP) to the Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention), was held in South Africa in November 1997. Dr J. Cooper (South Africa) attended as an observer of the CCAMLR Scientific Committee. SC-CAMLR-XIX/BG/7 reports on discussions and outcomes of this conference which may be of interest to CCAMLR.

7.171 A proposal by South Africa to add five species of *Procellaria* and two species of *Macronectes* petrels to Appendix II of the CMS was accepted. This listing opens the way for the development of a Range-State Agreement to further their protection. At earlier meetings of the CMS Scientific Council the need for a Southern Hemisphere Albatross Agreement had been recognised. As albatrosses, *Procellaria* petrels and *Macronectes* petrels are all subject to incidental mortality arising from longline fishing, the moves by CMS to further the conservation and protection of these birds were welcomed by the Working Group.

Regional Agreement for the Conservation of Albatrosses

7.172 The WG-IMALF meeting in 1999 was informed of the efforts by the Group of Temperate Southern Hemisphere Countries (known as the Valdivia Group) to develop an agreement for the

conservation of albatrosses in cooperation with other southern hemisphere albatross Range States. Members of the Valdivia Group are Argentina, Australia, Brazil, Chile, New Zealand, South Africa and Uruguay. The Working Group was advised of further actions to progress this initiative which have taken place over the last 12 months (CCAMLR-XIX/BG/10 and BG/15).

7.173 Following Resolution 6.3 at the 6th COP to the CMS in South Africa, Australia held a number of informal consultations with relevant Range States to discuss the development of an international Agreement on albatross conservation.

7.174 The positive outcomes of these consultations resulted in Australia hosting the first international meeting to which all southern hemisphere albatross and petrel Range States were invited. This meeting was held in Hobart, Australia, from 10 to 14 July 2000, and aimed to facilitate the development of an Agreement on the Conservation of Albatrosses and Petrels of the Southern Hemisphere. The meeting was a significant step towards effective global cooperation in albatross and petrel conservation. A total of 28 parties was invited to attend the meeting, including Range States and international organisations. Twelve Range States of southern hemisphere albatrosses and petrels and five international organisations attended the meeting. CCAMLR was represented by its Science Officer.

7.175 The meeting unanimously supported the fundamental principle of developing an international agreement focused on the conservation of albatrosses and petrels. The purpose of the agreement is to establish a cooperative and comprehensive framework and process to restore southern hemisphere albatrosses and petrels to a favourable conservation status. The agreement aims to stop or reverse population declines by coordinating action to mitigate known threats to albatross and petrel populations.

7.176 The general structure and format for an Action Plan (Annex 2 of the Agreement) was developed. The details of this Action Plan were subject to further consideration by participating parties, who were requested to provide comments to the Chair of the CMS Scientific Council by the end of September 2000. The Convener of WG-IMALF coordinated responses on the Action Plan from Working Group members.

7.177 All participants at the Hobart meeting (paragraph 7.174) agreed that a formal negotiation towards a legally binding agreement to promote albatross conservation should be the next step, and that this should occur as soon as practicable. South Africa has offered to host the next meeting, provisionally early next year. It is hoped that a technical meeting to further develop the content of the draft Action Plan could be held immediately prior to the proposed negotiation session.

7.178 The Working Group welcomed the progress made towards an agreement which had very substantial implications for the conservation of seabirds in marine and terrestrial ecosystems. It recommended that all Members of CCAMLR should participate actively in these meetings, especially by facilitating the attendance of appropriate technical and scientific experts.

International Fishers' Forum

7.179 The Working Group noted that New Zealand's International Fishers' Forum (IFF) on Solving the Incidental Capture of Seabirds in Longline Fisheries is to be held the week after the CCAMLR Commission meeting.

7.180 The forum will be an opportunity for fishers, gear technologists and researchers to meet and discuss mitigation measures used in longline fisheries around the world, and to learn about new measures currently under development. A second objective for the forum will be to address the use of modelling tools to predict the impact of fisheries on seabird species. Seabird modelling experts will report on projects undertaken to date and will consider questions posed by workshop participants.

7.181 The Working Group encouraged Member countries longlining in the Convention Area to facilitate the participation of other scientists, fishery managers and fishers in the IFF. It noted that several members of the Working Group would participate in the IFF.

Commission for the Conservation of Southern Bluefin Tuna (CCSBT)

7.182 No information was available this year to the Working Group from this Commission or from its Ecologically Related Species Working Group (ERSWG). It was understood that the ERSWG had not met in 2000.

Indian Ocean Tuna Commission (IOTC)

7.183 No information was available this year to the Working Group from this Commission.

General

7.184 Prof. Moreno summarised recent initiatives in Chile, under the auspices of WG-IMALF, which had arisen from the tri-nation collaborative project (involving Australia, Chile and the UK) of research on albatrosses at Islas Diego Ramirez.

7.185 Prof. Moreno, Drs J. Valencia (INACH) and Robertson held discussions with Mr D. Albarran Ruiz-Clavijo, Undersecretary of Fisheries and Chair of the Chilean CCAMLR Committee, to discuss potential Chilean activities to address incidental mortality of seabirds in longline fisheries.

7.186 The meeting had recollected the importance of Chilean waters and activities by Chilean fisheries with respect to albatrosses breeding at Chilean sites and to those visiting from elsewhere, particularly New Zealand.

7.187 It was agreed that:

(i) relevant data could be collected from Chilean artisanal longline fisheries and from the longline fisheries for hake in the southern channels (which are believed to have very low seabird by-catch rates due to using droplines);

(ii) future discussions and actions relating to incidental mortality should involve collaboration with the major commercial fishery interests;

(iii) a meeting would be held, before the end of 2000, with companies involved in southern demersal longline fisheries, to discuss how to reduce incidental mortality; and

(iv) legislation would be prepared to provide an appropriate basis, along the lines of the CCAMLR scheme, for the operation of scientific observers on board Chilean longline vessels operating in national waters.

7.188 The Working Group congratulated Prof. Moreno and Dr Robertson for facilitating these important developments and offered whatever assistance would be appropriate to develop these and other initiatives (e.g. FAO–NPOA).

7.189 The Working Group noted with appreciation the efforts of the World Bird Federation of Taiwan (in association with BirdLife International) to provide information for fishers on the avoidance of incidental mortality in longline fisheries. Copies of the two leaflets, widely circulated within Taiwanese fishing industries, are provided in SC-CAMLR-XIX/BG/21.

Advice to the Scientific Committee

Research into the Status of Seabirds at Risk

7.190 The review of availability of data on:

(i) size and trends of populations of albatross species and of *Macronectes* and *Procellaria* petrel species vulnerable to interactions with longline fisheries (paragraph 7.9(i));

(ii) the foraging ranges of populations of these species adequate to assess overlap with areas used by longline fisheries (paragraph 7.9(ii)); and

(iii) genetic research relevant to determining the provenance of birds killed in longline fisheries (paragraph 7.12);

revealed that considerable further detail is necessary for which Members will be requested during the coming year (paragraphs 7.10, 7.11 and 7.14).

Incidental Mortality of Seabirds during Regulated
Longline Fishing in the Convention Area in 2000

7.191 (i) Timely data submission ensured comprehensive analysis of this year's data (Tables 48 to 51).

(ii) Accuracy of seabird by-catch estimation is still affected by the low proportion of hooks being observed on some cruises, particularly in Subarea 48.3 (paragraphs 7.25 to 7.29); intersessional work to address this issue is required (paragraph 7.30).

(iii) For Subarea 48.3 the total estimated seabird by-catch was only 21 birds at a rate of 0.0004 birds/thousand hooks (paragraphs 7.32 and 7.33) (compared with 210 at a rate of 0.01 birds/thousand hooks last year); fishing season restrictions and improved compliance with Conservation Measure 29/XVI have reduced by-catch in the regulated fishery in this subarea to negligible levels (paragraph 7.49).

(iv) For Subareas 58.6 and 58.7 the total estimated seabird by-catch was 516 birds (a three-fold increase over last year) at a rate of 0.02 birds/thousand hooks (compared with 0.03 birds/thousand hooks last year) (paragraphs 7.34 and 7.35). Increased by-catch this year was mainly due to greater fishing effort, but poorer compliance with Conservation Measure 29/XVI also contributed (paragraph 7.50).

(v) Differences in by-catch rates between Subarea 48.3 and Subareas 58.6 and 58.7 were clearly attributable to:

(a) vessels in the latter subareas fishing in close proximity to major breeding sites of albatrosses and petrels during their breeding season; and

(b) poor compliance with night-time setting requirements (paragraph 7.43).

The Working Group reiterated its recommendation of last year that fishing within 200 n miles of the Prince Edward Islands should be prohibited from January to March inclusive (paragraph 7.44).

(vi) Once again, the data for the French EEZs in Subarea 58.6 and Division 58.5.1 were not available for analysis; their submission was requested (paragraphs 7.45 and 7.46).

(vii) For Subarea 88.1 there had been no seabird by-catch for the third successive year due to strict compliance with Conservation Measure 29/XVI (including the exemption from night setting) and Conservation Measure 190/XVIII (paragraph 7.47). No seabird by-catch was reported for fishing in Division 58.4.4 (paragraph 7.31).

Compliance with Conservation Measure 29/XVI

7.192 (i) Overall compliance with this conservation measure this year, compared to last year, was slightly improved in Subarea 48.3, slightly poorer in Subareas 58.6 and 58.7, poor in Division 58.4.4 and complete in Subarea 88.1.

(ii) Streamer lines – compliance with the streamer-line design was poor; only 33% of the streamer lines deployed complied fully, mainly because their length was less than 150 m. Vessels which have not complied with this element of the conservation measure over at least the last two years include *Argos Helena*, *Eldfisk*, *Illa de Rua*, *Isla Gorriti*, *Lyn*, *Jacqueline*, *Magallanes III*, *No. 1 Moresko* and *Tierra del Fuego* (Table 55 and paragraph 7.52).

(iii) Offal discharge – in Subareas 58.6, 58.7 and 88.1 there was 100% compliance with the requirement either to hold offal on board, or to discharge on the opposite side to where the line was hauled. In Subarea 48.3, 76% of the vessels discharged offal on the opposite side to hauling (compared with 71% in 1999); of these vessels 50% did not discharge offal during hauling operations. Three vessels (*Isla Sofía*, *Isla Camila* and *Jacqueline*) have never complied with this element of Conservation Measure 29/XVI (Table 55 and paragraphs 7.53 and 7.54).

(iv) Night setting – compliance improved in Subarea 48.3 from 80% last season to 92% this season, has reduced in Subareas 58.6 and 58.7 from 84% to 72%, and for the new fishery in Division 58.4.4 was only 50% (paragraph 7.55). Several vessels (*Eldfisk*, *Isla Camila*, *Isla Gorriti, Magallanes III, No. 1 Moresko* and *Tierra del Fuego*) have fished for at least the last two seasons and consistently failed to comply with this element of the conservation measure (Table 55 and paragraph 7.56).

(v) Line weighting – as in previous years, no vessels complied with line-weighting requirements for Spanish longline systems (6 kg every 20 m) (paragraph 7.58).

(vi) Three vessels which first entered longline fisheries in the Convention Area in 2000, failed to comply with two or more elements of the conservation measure (Table 55 and paragraph 7.60).

Fishing Seasons

7.193 The Commission decision last year to delay the start of longline fishing in Divisions 58.4.3, 58.4.4, 58.5.1, 58.5.2 and Subareas 48.3, 48.4 and 58.6 from 15 April to 1 May probably contributed significantly to the reduction in seabird by-catch in Subarea 48.3 (paragraph 7.63).

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

7.194 (i) The estimates of potential seabird by-catch by area for 2000 (paragraphs 7.70 to 7.74, Tables 56 and 57) were:

Subarea 48.3:	1 800–2 400 to 6 500–8 800 seabirds;
Subareas 58.6 and 58.7:	15 400–20 600 to 27 900–37 800 seabirds;
Divisions 58.5.1 and 58.5.2:	7 000–10 300 to 14 100–18 900 seabirds; and
Division 58.4.4:	1 700–3 000 to 2 200–4 100 seabirds.

(ii) The overall estimated totals for the whole Convention Area (paragraph 7.75 and Table 57) indicate a potential seabird by-catch in the unregulated fishery of 26 400–35

300 (lower level) to 50 900–68 300 birds (higher level) in 1999/2000. This compares with totals of 17 000–27 000 (lower level) to 66 000–107 000 (higher level) in 1996/97 and 43 000–54 000 (lower level) to 76 000–101 000 (higher level) in 1997/98 and 21 000–29 000 (lower level) to 44 000–59 000 (higher level) in 1998/99.

(iii) The species composition of the estimated potential seabird by-catch (Table 58) indicates a potential by-catch of 21 900–68 000 albatrosses, 5 000–11 000 giant petrels and 79 000–178 000 white-chinned petrels in the unregulated fishery in the Convention Area over the last four years (paragraph 7.81).

(iv) The Working Group endorsed its conclusion of last year that such levels of mortality are entirely unsustainable for the populations of albatrosses, giant petrels and white-chinned petrels breeding in the Convention Area (paragraph 7.80).

(v) The Scientific Committee was asked to recommend that the Commission take the most stringent measures possible to combat unregulated fishing in the Convention Area (paragraph 7.83).

Incidental Mortality of Seabirds in relation to
New and Exploratory Fisheries

7.195 (i) Of the 22 new and exploratory fisheries approved for 1999, only four were operational in 1999/2000; no seabird by-catch was reported for any of these fisheries (in Subareas 58.6 and 88.1, and Division 58.4.4) (paragraphs 7.90 and 7.91).

(ii) The assessment of potential risk of interactions between seabirds and longline fisheries for all statistical areas in the Convention Area was reviewed, revised for Subareas 88.1 and 88.2, and provided as advice to the Scientific Committee and Commission in SC-CAMLR-XVIII/BG/23 (paragraph 7.89).

(iii) The 33 proposals by six Members for new and exploratory longline fisheries in 14 subareas/divisions of the Convention Area in 2000/01 were addressed, in relation to advice in SC-CAMLR-XVIII/BG/23 and Table 59.

(iv) The potential problems identified were:

(a) in proposals by Argentina for Subareas 48.1 and 48.2 and Divisions 58.4.2, 58.5.1 and 58.5.2, the desired fishing season has substantial overlap with the recommended season closure to protect seabirds;

(b) proposals by France (for Divisions 58.4.3, 58.4.4, 58.5.1, 58.5.2 and Subareas 58.6 and 58.7) do not specify a fishing season so cannot be assessed in this important regard; and

(c) in Subarea 88.1 there are important issues relating to exemptions from the night-setting requirements of Conservation Measure 29/XVI (paragraphs 7.94 to 7.103).

Incidental Mortality of Seabirds during Longline
Fishing outside the Convention Area

7.196 (i) The only formal report received related to potential by-catch of black-browed albatrosses (probably from South Georgia) in the Japanese autoliner longline fishery around Tristan da Cunha and Gough Islands (paragraphs 7.104 and 7.105).

(ii) The Working Group again requested reports from Members, for regions adjacent to the Convention Area, on longline fishing effort, on incidental mortality of seabirds and on implementation of mitigating measures (paragraphs 7.111 and 7.112). It also regretted the absence of any feedback to the meeting from CCAMLR observers at meetings of tuna commissions (paragraphs 7.182 and 7.183).

Research into and Experience with Mitigating Measures

7.197 (i) Offal discharge – all vessels operating in the Convention Area should be encouraged either to process offal into fish meal on board, or return all offal to port for onshore processing into fish meal as is the practice by New Zealand (paragraph 7.116); any vessels still discharging offal on the same side as the haul, in contravention of Conservation Measure 29/XVI, should be re-engineered, according to the engineering diagrams of the *Koryo Maru 11* (see SC-CAMLR-XVIII, Annex 5, paragraph 7.110), or prohibited from fishing in the Convention Area.

(ii) Underwater setting – promising results were obtained from trials:

(a) by South Africa, of the Mustad funnel in Subareas 58.6 and 58.7 where, on night-time and daytime sets in summer, seabird by-catch was reduced from 0.013–0.009 and 0.03–0.02 birds/thousand hooks respectively;

(b) by Australia, using a funnel setting at 6 m depth, in its domestic tuna longline fishery, eventually resulting in zero seabird by-catch (paragraph 7.119); and

(c) by Norway, in domestic longline fisheries, where setting funnels reduced the by-catch of northern fulmars by 72% (paragraphs 7.120 and 7.121).

(iii) Streamer lines – the importance of adhering, as a minimum, to the specifications set out in Conservation Measure 29/XVI was re-emphasised; some potential modifications, to enhance performance, were recommended for testing (paragraphs 7.123 to 7.125).

(iv) Line weighting – New Zealand vessels operating in Subarea 88.1 successfully achieved the required experimental line sink rates (WG-FSA-00/58 and paragraph 7.128); some further trials, however, are required before a weighting regime for autoliners can be incorporated into Conservation Measure 29/XVI (paragraph 7.148).

(v) Pots – no seabird by-catch had been reported in association with the experimental use of pots to catch toothfish (WG-FSA-00/23 and paragraph 7.129).

(vi) Other – trials by New Zealand of a laser gun and aircraft spotlights had been unsuccessful.

Policy Considerations in relation to Mitigating Measures and Conservation Measure 29/XVI

7.198 Conservation Measure 29/XVI is the key element in minimisation of incidental mortality of seabirds during longlining in the Convention Area. Compliance is still substantially deficient, particularly in some key elements. Improving the current situation requires:

(i) further development of underwater setting, which offers the most likely medium- to long-term solution to the problem;

(ii) work to develop line-weighting regimes to ensure sink rates that will preclude seabirds accessing bait. This offers the best short-term solution, as well as the likelihood of permitting exemption from several other mitigating measures currently in use in the Convention Area; and

(iii) in the meantime, better compliance with the existing suite of mitigation measures in Conservation Measure 29/XVI is essential (paragraphs 7.134 and 7.135).

7.199 The main issues relating to compliance with Conservation Measure 29/XVI are:

(i) how to get fishers to comply with the straightforward elements of the conservation measure, in respect of offal discharge, streamer lines and night setting;

(ii) how to tackle the consistent inability of vessels to comply with the element of the conservation measure that specifies the line-weighting regime for Spanish system longliners; and

(iii) how to develop the requirements for an appropriate line-weighting regime for autoliners (paragraph 7.136).

7.200 To address these problems, the Working Group provided some detailed comments and practical suggestions (paragraphs 7.138 to 7.150) and advises that:

(i) given the simplicity of complying with the elements of Conservation Measure 29/XVI relating to offal discharge, night setting and streamer lines, vessels unable, or failing, to comply with these elements should be prohibited from fishing in the Convention Area; this should be emphasised to technical coordinators, fishing companies and national authorities at the earliest opportunity (paragraphs 7.151 to 7.153);

(ii) in circumstances where all other elements of Conservation Measure 29/XVI apply (e.g. in respect of night setting, streamer lines and offal discharge) and with appropriate closed seasons, the line-weighting regime for the Spanish system of longlining should be set at weights of a minimum of 8.5 kg spaced at no more than 40 m intervals (paragraph 7.146);

(iii) once experimental trials of autoline weighting are completed in Subarea 88.1 and similar trials have been carried out in areas of higher risk to seabirds, the Working Group should be able to recommend a line weighting for autoline vessels that will have utility for all subareas of the Convention Area (paragraph 7.148);

(iv) the ultimate aim in managing seabird by-catch in the Convention Area will be to allow fishing at any time of day without seasonal closure of fishing grounds. However, 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. Clearly, more time is required to allow experimentation into the effectiveness of line-weighting concepts and underwater setting devices with the Spanish system that will reduce seabird by-catch and be more acceptable to the fishing industry. In the meantime, seabird by-catch in the Convention Area should be managed in accordance with practices adopted in Subarea 48.3, where a combination of a closed season in summer, night setting, the use of streamer lines and proper offal discharge practices has effectively solved the seabird by-catch problem (paragraphs 7.149 and 7.150).

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

7.201 (i) FAO–NPOAs – New Zealand and USA had draft plans available for consultation; Australia's TAP contained the essence of its NPOA (which would be prepared in due course); Brazil and Chile were commencing to prepare plans; the European Community had started the assessment process (paragraphs 7.160 to 7.169).

(ii) Regional Agreement for the Conservation of Albatrosses under the CMS – considerable progress had been made at an initial meeting in Hobart, Australia, in July 2000; the details of the Action Plan are under consultation; a second meeting is planned in South Africa in early 2001. This agreement has very substantial implications for the conservation of seabirds in marine and terrestrial ecosystems; all Members of CCAMLR should participate actively in the meetings, especially by facilitating the attendance of appropriate technical and scientific experts (paragraphs 7.170 to 7.178).

(iii) New Zealand's International Fishers' Forum on Solving the Incidental Capture of Seabirds in Longline Fisheries is to be held the week after the CCAMLR Commission meeting; Members longlining in the Convention Area were encouraged to facilitate the participation of other scientists, fishery managers and fishers (paragraphs 7.179 to 7.181).

(iv) Uruguayan and Brazilian scientists will convene a BirdLife International workshop in Montevideo, Uruguay, in 2001 to address issues relating to seabird by-catch in South America (paragraphs 7.156 and 7.157).

OTHER INCIDENTAL MORTALITY

Longline Vessels – Marine Mammals

8.1 One Antarctic fur seal was hooked and drowned in Subarea 58.6 (WG-FSA-00/38, Table 3). No entanglements were reported this year (Table 60).

8.2 Interactions with marine mammals resulting in a potential loss of fish were reported in Subareas 48.3, 58.6 and 58.7 and Division 58.4.4 (WG-FSA-00/38, Table 3):

> Subarea 48.3: 13 of 17 cruises; killer whale (12), sperm whale (1), fur seal (5);
> Subareas 58.6/58.7: 9 of 12 cruises; killer whale (6), sperm whale (4), unknown (3);
> Division 58.4.4: 1 of 1 cruise; killer whale.

No such interactions were reported for Subarea 88.1 despite sightings of killer whales from the fishing vessels.

8.3 WG-FSA-00/60 reported interactions between killer whales, sperm whales and a longline vessel fishing around the Falkland/Malvinas Islands. The interactions reported were complex and restricted to the time of line hauling. Nevertheless, all available evidence indicated that the whales were not taking fish from the line.

Trawl Fishing

8.4 In the Report of Member's Activities by Australia, in respect of trawl fisheries in Division 58.5.2, one dead Antarctic prion (*Pachyptila desolata*), the remains of one dead white-chinned petrel and one injured common diving petrel (*Pelecanoides urinatrix*) were reported found on trawl decks in circumstances and at times suggesting interactions with fishing gear.

8.5 Two Antarctic fur seals were caught and killed in trawl nets in Subarea 48.3 (WG-FSA-00/38).

8.6 In Subarea 48.3 the same trawler, targeting *C. gunnari*, reported that 19 black-browed albatrosses were killed while attempting to feed on fish as the net was being hauled. This level of mortality by a single vessel is almost the same as the total estimated seabird by-catch (21 birds killed) for all 16 vessels longlining in Subarea 48.3 in 1999/2000.

8.7 Considerable concern was expressed at this. Mr Smith indicated that there were some reports of similar interactions in New Zealand domestic fisheries. Last year extensive observations from vessels trawling for *Dissostichus* spp. in Division 58.5.2 and around Macquarie Island (WG-FSA-99/72) reported numerous interactions with seabirds but very low levels of mortality.

8.8 Further details on the circumstances of incidents such as that reported in paragraph 8.6 were required in order to establish if anything could be done to prevent them. Observers were encouraged to make full reports in such circumstances.

CCAMLR WEBSITE

9.1 The Working Group reviewed the recent development of the CCAMLR website (WG-FSA-00/12). Most sections of the website are now available in the four official languages of CCAMLR. General information about CCAMLR is presented on public webpages. Secure webpages are used to communicate information to CCAMLR Members only (accessible via 'MEMBERS' menu options).

9.2 Secure webpages are accessed via user names and passwords. The Secretariat has provided each Scientific Committee contact (nominated by the Commissioners) with the user names and passwords required to access the secure webpages of the Scientific Committee, and it is the responsibility of each Scientific Committee contact to provide access to members of their scientific team. Similarly, Members who need access to the secure webpages of the Commission should contact their Commissioners for the user names and passwords.

9.3 Intersessional developments in support of WG-FSA have included:

(i) updating the data section on the CCAMLR website to include detailed information on the CCAMLR data requirements and the submission of data (paragraphs 3.12 to 3.14);

(ii) dissemination of meeting documents via the website; and

(iii) loading available WG-FSA meeting documents on the server used by the Working Group at the meeting to provide easy access to the electronic documents during the meeting (SC-CAMLR-XVIII, Annex 5, paragraph 10.6).

9.4 Many WG-FSA participants who had accessed the website reported problems in downloading documents prior to the meeting. The most common problem encountered was the long download time required to view (or print) individual documents. Download times of 30–60 minutes/document were reported, making access to documents via the website an impractical option.

9.5 Where possible, these difficulties will be addressed by the Secretariat during the intersessional period. The long download times are due to the 'slow' 64 Kbps connection between the Secretariat and the Internet. Under optimum condition (i.e. only one user at any time), the average-sized document at WG-FSA-2000 (900 Kb) would take approximately two to three minutes to download. These conditions are infrequent as there is generally a number of users at any one time using the Secretariat's Internet connection, either internally or external website users. This connection also carries the fairly constant email traffic between the Secretariat and external recipients. A two-fold increase of the connection speed would require a two-fold increase in the Secretariat's cost of the connection; the current connection costs approximately A$1 200 per month.

9.6 The Working Group recommended that the connection speed be increased by 10-fold during the month leading up to major CCAMLR meetings. This would allow meeting participants to efficiently access documents on the website and prepare for the meetings. The present long download times had prevented the widespread dissemination of WG-FSA documents via the website.

FUTURE WORK

Workshop on Assessment Methods for Icefish

10.1 The Working Group discussed the need to undertake a workshop on the development of management procedures for *C. gunnari*, as first recommended in 1997 (SC-CAMLR-XVI, paragraphs 5.58 to 5.65). The Working Group agreed that the requirement for the types of analyses listed in the provisional terms of reference for this workshop remained high. The Working Group also recalled its discussion from last year regarding the urgent need to undertake analyses required under the major biological components of the terms of reference (SC-CAMLR-XVIII Annex 5, paragraph 9.10).

10.2 At this year's meeting a number of specific issues arose during discussions of the assessment of *C. gunnari* that would benefit from detailed consideration at such a workshop. These included:

(i) the development of longer term approaches to the management of *C. gunnari* fisheries in the Convention Area;

(ii) methods for assessing standing stock of *C. gunnari*, including the use of acoustic survey techniques; and

(iii) causes and effects of changes in the vertical and horizontal distribution of *C. gunnari*.

10.3 The Working Group agreed that these issues would be addressed by the existing terms of reference (SC-CAMLR-XVI, paragraph 5.62). Two additional issues were identified for attention at the workshop:

- the exploration of the potential to predict changes in M should be extended to explore the manner in which changes in M might be managed; and

- determine, as necessary for the development of a management procedure, whether the ecosystem in Subarea 48.3 could support, in the future, a *C. gunnari* fishery at the scale experienced at the beginning of that fishery.

This would provide a comparative basis for consideration of *C. gunnari* fisheries in other areas (e.g. Division 58.5.1).

10.4 The Working Group recommended that the workshop, as proposed previously, should be held in association with the next meeting of WG-FSA. Planning for the workshop should proceed in accordance with the previous proposal, and a deadline of 1 August 2001 should be set for the submission of data and appropriate papers. At that time, a final decision to hold the workshop could be taken by the Convener of WG-FSA, in consultation with the Chair of the Scientific Committee and the Data Manager.

10.5 The Working Group formed a subgroup (see paragraph 10.9 below) to assist with the preparation of information for the workshop and to refine the workshop terms of reference should it go ahead. This subgroup would also liaise with WG-EMM on matters concerning ecosystem interactions involving *C. gunnari*.

10.6 The Working Group also noted that the requirements identified in last year's report (SC-CAMLR-XVIII, Annex 5, paragraph 9.10) and in paragraph 10.3 apply equally to *D. eleginoides*, and the further development of knowledge on that species.

Intersessional Work of Subgroups

10.7 The Working Group reviewed the activities of subgroups which had worked during the intersessional period. These subgroups, with the support of the Secretariat, had provided essential information to the meeting. WG-FSA agreed that the tasks assigned to the subgroups had generally far exceeded the time available to each subgroup. However, each subgroup had produced valuable work and information which had contributed to the assessments and review of information available at the meeting. WG-FSA agreed that the activities of each group should be extended during the 2000/01 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.

10.8 The Working Group reminded participants that the membership to the subgroups was open, and that the reason for nominating coordinators and others at the meeting was to facilitate the establishment of subgroups.

10.9 WG-FSA assigned some of the major tasks arising from the 2000 meeting to the following groups:

(i) A subgroup to plan the *C. gunnari* workshop, coordinated by the WG-FSA Convener with the assistance of the Chair of the Scientific Committee and the Data Manager. This task should include the preparation of information and the development of the terms of reference, should the workshop go ahead (paragraph 10.5).

(ii) Failing the hiring of new Secretariat staff to assist with the CDS (paragraph 3.31) and the collation of information on IUU fishing, a subgroup to determine total removals of *Dissostichus* spp., including landings reported under the new CDS and information on IUU fishing activities. The subgroup would be coordinated by Mr Watkins, and assisted by Profs Moreno and G. Duhamel (France), and others.

(iii) A subgroup to review observer reports and information, coordinated by Dr Barrera-Oro with assistance from Dr E. Balguerías (Spain) and Ms J. Molloy (IMALF, New Zealand).

(iv) A subgroup to continue developing assessment methods coordinated by Dr Constable, and assisted by Drs D. Agnew (UK) and Gasiukov, Mr Jones and Drs Kirkwood and Parkes.

(v) A subgroup to review, and where necessary assess, the biology and demography of species considered by the Working Group, coordinated by Dr Everson. The subgroup was tasked with:

- standardising methods for age determination of *D. eleginoides* using otoliths: Drs J. Ashford (UK), P. Horn (New Zealand) and I. Knuckey (Australia);

- developing guidelines for determining maturity stage in *D. mawsoni* (paragraph 3.78): Mr G. Patchell (New Zealand); and

- developing fish identification guides for scientific observers: Drs Barrera-Oro, Fanta, Herasymchuk, Kock and Vacchi amd Mr Watkins and Mr Williams (paragraphs 3.113 to 3.117).

(vi) A subgroup to document the extent of by-catch in CCAMLR fisheries, coordinated by Dr Everson with the assistance of Ms E. van Wijk (Australia), Drs Agnew and Hanchet and Mr Williams.

(vii) A subgroup to revise the method used by scientific observers to subsample catches from longlines, coordinated by Dr Agnew, and assisted by Ms van Wijk, Mr Watkins and Dr Ashford. Problems encountered using the current method are outlined in paragraph 3.48.

(viii) The Secretariat was tasked with the review of notifications for new and exploratory fisheries in 2001/02, and obtaining information on catches of *D. eleginoides* taken outside the Convention Area and trade statistics for *Dissostichus* spp. in 2000/01.

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

Other Intersessional Work

10.11 The Working Group identified a number of tasks which should be carried out by participants and the Secretariat during the intersessional period. The main tasks are listed below with reference to paragraphs in the report which contain details of these tasks; routine tasks are not included.

10.12 The following tasks were identified as part of the development of the scientific observer program:

Secretariat:

(i) Consult with technical coordinators and seek their comments and proposals on research priorities (paragraph 3.41), and solutions to difficulties experienced in the completion of the observer duties (paragraph 3.47), including the longline random-sampling design (paragraph 3.48; also see paragraph 10.9(vii)).

Members:

(ii) Request that scientific observers submit data on electronic logbooks developed in Microsoft Excel format by CCAMLR (paragraph 3.38).

(iii) Encourage technical coordinators to continue to bring changes and updates of the *Scientific Observers Manual* to the attention of the scientific observers (paragraph 3.46).

(iv) Encourage scientific observers to make their own assessments of ovarian status of *D. mawsoni* with a view to developing a scale for macroscopic maturity stages (paragraph 3.78).

(v) Encourage scientific observers to label and store, deep frozen, all specimens whose identification was uncertain, for subsequent forwarding to appropriate taxonomists (paragraph 3.118).

(vi) Encourage scientific observers and fishing masters to continue collecting information on CFs using the CCAMLR format and concentrating on product which constitutes the largest fraction of the fish processed (paragraph 3.64).

(vii) Remind scientific observers that data on CFs should be collected on a fish-by-fish basis (paragraph 3.65).

10.13 Various other tasks were identified as follows:

Secretariat:

(i) Maintain a watching brief on IUCN, CITES and FAO in relation to developments on the Red List (paragraph 11.12), and report any new development to the Working Group during the intersessional period.

Members:

(ii) Consider options for reorganising the work of the Working Group during its meetings (paragraph 13.1).

(iii) Encourage further work and sensitivity analyses to take full account of uncertainties in the assessment process (paragraphs 4.176 and 4.177).

(iv) Consider further applications of research sets from new and exploratory fisheries (paragraph 4.36).

(v) Encourage the development of an assessment of *Macrourus* spp. in Subarea 88.1 (paragraph 4.100).

(vi) Where possible, submit documents electronically to the Secretariat at least two weeks prior to the start of the 2001 meeting of WG-FSA (paragraphs 11.7 and 11.8).

(vii) Encourage further development of criteria for protected/closed areas relevant to CCAMLR (paragraph 5.9).

(viii) Submit data on by-catch which can be used to estimate catch rates in terms of both numbers and weight per unit of effort (paragraph 4.269).

Secretariat Support at Future Meetings

10.14 The Working Group found that the level of hardware and software support provided by the Secretariat at the meeting was inadequate. As a result, it was not possible for the Working Group to complete all planned analyses within the time available at the meeting. This led to inefficiencies in the work of WG-FSA, and created tension which was both unnecessary and counter-productive.

10.15 While the Working Group understood the financial difficulties under which the Secretariat was operating, the group concluded that it could not undertake future assessments using the outdated hardware and software facilities of the Secretariat.

10.16 The following facilities were available to the Working Group during its meeting (WG-FSA-00/4):

- a network hub providing 32 connections for laptops using 10BaseT Ethernet;
- one computer (Alpha XL 266 MHz) with a shared hard disk containing files used previously by WG-FSA;
- a laser printer;
- Microsoft Office 97 applications;
- Visual FORTRAN (5.0);
- MapInfo Professional (version 4.5);
- S-Plus 2000 (release 2); and
- MathCad (version 6.0 for Windows 95).

10.17 The length-density analyses using CMIX could not be run on the Alpha computer because CMIX required a faster and more compatible computer. The graphic interface in CMIX was also found to be unstable on certain laptops, including the Secretariat's laptop. In addition, the short-term assessment model developed in MathCad could not be run on the Secretariat's version because it was outdated.

10.18 In addition, access to the Internet and email which had been provided to participants in previous years was not available at the start of the meeting. Participants personally contributed A$400 (the connection cost at WG-FSA-99) so that Internet and email access could be provided during the meeting.

10.19 Finally, through necessity, the Secretariat had placed a restriction on the amount of overtime which support staff could work during the meeting. This had limited some of the analyses which could be undertaken during the meeting.

10.20 As a minimum requirement at the 2001 meeting of WG-FSA, the Working Group would require:

- a network hub providing 32 connections for laptops using 10BaseT Ethernet;

- Internet access enabling web and email services;
- two high-powered computers (at least 1 GHz) each capable of running all routine assessment tools used at the meeting;
- a Microsoft Windows compatible desktop computer for word processing;
- a Microsoft Windows compatible laser printer accessible via the network; and
- latest versions (2000 releases or more recent) of all software required for analyses.

10.21 In addition, the Secretariat should ensure that the WG-FSA network and provided services are compatible with Microsoft Windows 95 and Microsoft Windows 98 (and future versions) since these are more commonly used by WG-FSA participants than the Windows NT/2000 deployed within the Secretariat.

10.22 The Scientific Committee was urged to ensure that sufficient funds were available to the Secretariat in 2001 to support the work of WG-FSA.

OTHER BUSINESS

CCAMLR Science and the *Science Citation Index*

11.1 The Working Group welcomed news that *CCAMLR Science* has now been selected by the Institute for Scientific Information (ISI) for coverage in Current Contents/Agriculture, Biology and Environmental Sciences (CC/AB&ES). Coverage of *CCAMLR Science* will begin with the 2000 issue of the journal, which is currently being printed and will be distributed in November 2000.

Fishery Data Manual

11.2 The Working Group reviewed the options for publishing the *Fishery Data Manual*. This manual describes the CCAMLR requirements for the collection and submission of catch and effort reports, fine-scale data and STATLANT data. The manual was developed with the aim of promoting the standard methods for collecting data across all CCAMLR fisheries.

11.3 An edited version of the manual was considered by the Working Group last year (WG-FSA-99/8), and a recommendation to publish this manual in loose-leaf format in the four languages of the Commission had been forwarded to the Scientific Committee (SC-CAMLR-XVIII, Annex 5, paragraph 10.13). Subsequently, the Scientific Committee decided to postpone translation and publication until 2000, pending developments in the data requirements for new and exploratory fisheries (SC-CAMLR-XVIII, paragraph 12.5).

11.4 As an interim measure, the Secretariat placed the *Fishery Data Manual* in English only on the data section of the CCAMLR website (paragraph 3.12).

11.5 The Working Group identified three options for consideration by the Scientific Committee at its forthcoming meeting:

(i) postpone translation and publication until the data requirements for new and exploratory fisheries are further developed;

(ii) translate the manual and disseminate in all four languages via the website; and

(iii) translate the manual and publish in loose-leaf format (i.e. the original proposal).

11.6 Dr Ramm stated that, as a minimum, it would be desirable to translate the manual so as to enhance the collection of quality data in CCAMLR fisheries, and align the documentation for these data with that available for data collected by the scientific observers (*Scientific Observer Manual*) and under CEMP (*CEMP Standard Methods*). The total costs for the translation and publication of the *Fishery Data Manual* would be A$7 500 in 2001.

Deadline for the Submission of Meeting Papers

11.7 The Working Group considered WG-EMM's decision that papers submitted at its 2001 meeting must be lodged electronically with the Secretariat at least two weeks prior to the start of that meeting. Further, papers for WG-EMM-2001 which did not comply with this principle would not be accepted at the 2001 meeting (Annex 4, paragraph 9.5).

11.8 The Working Group encouraged all participants at future meetings of WG-FSA to strive towards the new deadline set by WG-EMM. However, the Working Group felt that it would not be possible for all documents to be submitted to Secretariat two weeks prior to the start of the meetings of WG-FSA.

11.9 The Working Group reaffirmed that the current deadline for the submission of papers (0900 h of the first day of the meeting) was not negotiable.

IUCN Criteria for Globally Threatened Species

11.10 Last year, WG-EMM requested the Secretariat to obtain information on the criteria and process applied in the preparation of IUCN's new Red List of endangered and vulnerable species. WG-EMM asked that this information be relayed to WG-FSA because some Antarctic fish species may be candidates for globally threatened status under the new criteria (Annex 4, paragraphs 7.77 and 7.78).

11.11 The information obtained by the Secretariat was listed in WG-FSA-00/48, and the material was available at the meeting. The IUCN database may be searched online at www.redlist.cymbiont.ca/search.asp.

11.12 There is presently little overlap between the fish species listed in the Red List and those considered by WG-FSA. However, the Working Group agreed that it should review the criteria used, and the species listed in the Red List, in relation to CCAMLR matters. The Working Group also noted current initiatives within CITES aimed at developing criteria for CITES designation of marine species, including fish. The Secretariat was requested, as these may affect the matters of interest to the Working Group, to maintain a watching brief on IUCN and CITES, as well as related

developments within FAO. Any new development should be brought to the attention of the Working Group during the intersessional periods.

Fish and Fish Resources of Antarctica

11.13 Last year, the Scientific Committee supported the Working Group's recommendation to translate, from Russian to English, the headings, figure and table captions, and the references to Dr Shust's book *Fish and Fish Resources of Antarctica* (SC-CAMLR-XVIII, paragraphs 12.11 and 12.12).

11.14 As requested, the translation was completed during the intersessional period and forwarded to the Editorial Board of *CCAMLR Science* for advice on further translation of the book. This matter was considered at the last meeting of the Board, and the advice will be reported to the Scientific Committee.

Bibliography on Antarctic Fish

11.15 Last year, the Scientific Committee considered the request of the Working Group to update and distribute a bibliography on Antarctic fish which is being compiled by Dr Kock. Dr Miller was tasked to explore the possibility of SCAR sponsoring the completion of the bibliography in CD-ROM format (SC-CAMLR-XVIII, paragraph 12.13).

11.16 Dr Miller advised the Working Group that SCAR was unable to fund this work. Based on this advice, Dr Kock agreed to continue to develop the bibliography as a low priority task. Once completed, the bibliography would be available via a website.

ADOPTION OF THE REPORT

12.1 The report of the meeting was adopted.

CLOSE OF THE MEETING

13.1 The Working Group noted that, as in previous years, it had been hard pressed to complete its work and to validate fully the assessments which it had undertaken. It agreed that the meeting should not be extended beyond the current duration and that members should give some thought on how to structure WG-FSA's work. The Working Group agreed that an item to this effect should be included in the agenda for the Working Group's 2001 meeting and a proposed structure circulated with the draft agenda. Items which warrant consideration include:

(i) undertaking sensitivity analyses intersessionally in an attempt to identify and bind key parameters to be used in assessments;

(ii) identifying stocks for which annual assessments are mandatory;

(iii) identifying stocks for which revised assessments are not required or not possible; and

(iv) improving organisation of the meeting schedule including reducing downtime on the first day, attempting to clear less difficult items from the agenda at the beginning of the meeting and initiating subgroup work on the first day.

13.2 Dr Miller advised the Working Group that this was the last time he was participating in the meeting in the capacity of Chair of the Scientific Committee. He thanked the Convener, Mr Williams, Working Group participants and the Secretariat for another very successful meeting. All had worked long hours and made major contributions to the discussions and the drafting of the report. The Scientific Committee appreciated the level of commitment of WG-FSA, and the Committee was grateful for the major contribution which the Working Group makes to the work of CCAMLR.

13.3 In closing the meeting, the Convener thanked the Working Group, once again, for their excellent work, and members of the Secretariat for their support. He also thanked the rapporteurs for their efforts. On behalf of WG-FSA, Mr Williams thanked Dr Miller for his long-standing contribution to the debates and analyses of the Working Group; the Working Group looked forward to his continued participation at future meetings.

13.4 The meeting was closed.

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Table 1: Catches (tonnes) of target species by region and gear reported for the 1999/2000 fishing season. Source: catch and effort reports submitted by 7 October 2000.

Fishery and Target Species	Conservation Measure	Region	Gear	Catch Limit (tonnes)	Reported Catch (tonnes)
Euphausia superba					
	32/X	48	Trawl	1 500 000	101 742
	106/XV	58.4.1	Trawl	775 000	0
	45/XIV	58.4.2	Trawl	450 000	0
Dissostichus spp. (established fisheries)					
	179/XVIII	48.3	Longline	5 310	5 210[1]
	180/XVIII	48.4	Longline	28	0
	176/XVIII	58.5.2	Trawl	3 585	3 008
	-	58.6 (in the South African EEZ)	Longline	-	67
	-	58.6 (in the French EEZ)	Longline	-	59[2]
	-	58.7 (in the South African EEZ)	Longline	-	844
	-	58.5.1 (in the French EEZ)	Longline	-	2 102[2]
	-	58.5.1 (in the French EEZ)	Trawl	-	1 368[2]
Dissostichus spp. (exploratory fisheries)					
	188/XVIII	58.4.4 North of 60°S (outside EEZs)	Longline	370	99
	189/XVIII	58.6 (outside EEZs)	Longline	450	14
	187/XVIII	58.4.3 (outside Australian EEZ)	Longline	250	0
	187/XVIII	58.4.3 and 58.4.1 (outside Australian EEZ)	Longline	300	0
	184/XVIII	48.6 north of 60°S	Longline	455	0
	184/XVIII	48.6 south of 60°S	Longline	455	0
	190/XVIII	88.1 north of 65°S	Longline	175	0
	190/XVIII	88.1 south of 65°S	Longline	1 915	745
	191/XVIII	88.2 south of 65°S	Longline	250	0
	186/XVIII	58.4.2	Trawl	500	<1
	185/XVIII	58.4.3 (Elan Bank)	Trawl	145	0
	185/XVIII	58.4.1 and 58.4.3 (BANZARE Bank)	Trawl	150	0
Champsocephalus gunnari					
	177/XVIII	58.5.2	Trawl	916	39
	175/XVIII	48.3	Trawl	4 036	4 110
Electrona carlsbergi					
	174/XVIII	48.3	Trawl	109 000	0
Chaenodraco wilsoni (new fishery)					
	186/XVIII	58.4.2	Trawl	500	<1
Martialia hyadesi					
	183/XVIII	48.3	Jig	2 500	0
Crab					
	181/XVIII	48.3	Pot	1 600	0

[1] An additional 39 tonnes of *Dissostichus* were taken during research on pot fishing (paragraph 3.58).
[2] 1 December 1999 to 30 June 2000, reported in STATLANT data.

Table 2: Catches (tonnes) by species and region reported for the 1999/2000 split-year (1 July 1999 to 30 June 2000). Source: STATLANT data submitted by 7 October 2000.

Species Name	All Areas	Area/Subarea/Division									
		48	48.1	48.2	48.3	58.4.2	58.5.1	58.5.2	58.6	58.7	88.1
Amblyraja georgiana	36				<1						36
Antimora rostrata	10								6	4	<1
Bathyraja eatonii	5										5
Bathyraja meridionalis	<1				<1						
Bathyraja murrayi	<1								<1	<1	
Bathyraja spp.	<1								<1	<1	
Benthos	<1				<1						
Bothidae	<1				<1						
Chaenocephalus aceratus	<1				<1						<1
Champsocephalus gunnari	4 195				4 114			81			
Channichthyidae	<1										<1
Channichthys rhinoceratus	2							2			
Dissostichus eleginoides	13 689				4 694		5 009	2 579	688	720	<1
Dissostichus mawsoni	751										751
Euphausia superba	101 147	68 034	27 064	6 049							
Gobionotothen gibberifrons	1				1						
Gymnoscopelus nicholsi	<1				<1						
Lithodes murrayi	<1									<1	
Lithodidae	3				<1				<1	3	
Macrourus carinatus	65										65
Macrourus spp.	335				5	<1	116	3	86	125	<1
Macrourus whitsoni	9				<1	<1				3	5
Medusae	5				5						
Muraenolepis microps	5				<1						5
Muraenolepis spp.	2				<1						2
Myctophidae	67				67						
Notothenia rossii	<1				<1						
Notothenia squamifrons	5				5						
Nototheniidae	<1										<1
Nototheniops larseni	<1				<1						
Nototheniops nudifrons	<1				<1						
Osteichthyes spp.	<1					<1		<1			
Parachaenichthys georgianus	<1				<1						
Paralithodes spp.	<1				<1						
Paralomis aculeata	<1									<1	
Paralomis formosa	3				3						
Paralomis spinosissima	<1				<1						
Patagonotothen brevicauda	1				1						
Pogonophryne permitini	<1										<1
Pseudochaenichthys georgianus	<1				<1						
Rajiformes spp.	103				4		88		9	1	<1
Unknown	<1				<1						
Total	120 442	68 034	27 064	6 049	8 901	<1	5 214	2 665	789	857	869

Table 3: Reported catches (tonnes) of *Dissostichus eleginoides* and *Dissostichus mawsoni* by Members and Acceding States in EEZs and in the Convention Area, and estimates of unreported catches from the Convention Area by Members and Acceding States in the 1999/2000 split-year. Catches for the 1998/99 split-year are given in parentheses. The information in this table may be incomplete.

Member/ Acceding State	Outside CCAMLR Area Catch in EEZs		CCAMLR Area Reported Catch		CCAMLR Area Estimates of Unreported Catches by Members		Estimated Total Catch All Areas	
Chile	2 704[1]	(9 093)[2]	1 609	(1 668)	0	(3 280)	4 313	(14 120)
Argentina	4 667	(8 297)	0	(10)	0	(800)	4 667	(9 107)
France	0	(0)	5 503	(6 260)	0	(0)	5 503	(6 260)
Australia	82	(100)	2 579	(5 451)	0	(0)	2 661	(5 551)
South Africa	180	(75)	1 239	(948)	0	(0)	1 419	(957)
UK	3 919[3]	(>1 416)[3]	1 221	(1 238)	0	(0)	5 140	(2 654)
Uruguay	0	(1 059)	767	(517)	0	(0)	767	(1 576)
Ukraine	0	(0)	128	(760)	0	(0)	128	(760)
Spain	0	(0)	264	(154)	0	(0)	264	(154)
Rep. of Korea	0	(0)	380	(255)	0	(0)	380	(255)
Peru	0	(0)	0	(0)	0	(0)	0	(0)
Japan	0	(0)	0	(0)	0	(0)	0	(0)
New Zealand	<1	(<1)	751	(296)	0	(0)	751	(323)
USA	0	(0)	0	(<1)	0	(0)	0	(<1)
All countries	11 553	(20 041)	14 441	(17 558)	0	(4 080)	25 993	(41 718)

[1] Based on reports from CDS to August 2000
[2] 1998 calendar year
[3] From Falkland/Malvinas Islands

Table 4: Estimated landings (tonnes) of IUU-caught *Dissostichus eleginoides* in African, South American and European ports in the 1999/2000 split-year and the beginning of the 2000/01 split-year. Landed green weight + estimated green weight add up to estimates of total IUU catches.

Port	July 1999–June 2000		July–August 2000		July 1999–June 2000		July–August 2000	
	Landed Product Weight	Landed Green Weight	Landed Product Weight	Landed Green Weight	Estimated Product Weight	Estimated Green Weight	Estimated Product Weight	Estimated Green Weight
Walvis Bay	932	1 584						
Durban	21	36						
Mauritius	3 740	6 358	2 074	3 526	1 840	3 128	600	1 020
Montevideo	149	253						
Vigo	110	187						

[1] Catches/landings conversion factor of product to green weight 1.7. [2] Landings from confidential sources, estimates from Prof. G. Duhamel (France) on additional catches.

Table 5: Estimated effort, mean catch rates/day and total catches by subarea/division in the unregulated fishery on *Dissostichus eleginoides* in the 1999/2000 split-year. Estimates for the 1998/99 split-year are given in parentheses. The total estimated unreported catch for 1999/2000 is 6 546 tonnes. The reported catch for 1999/2000 is given in Table 3. The estimated total catch for 1999/2000 is 19 937 tonnes.

Area/ Subarea/ Division	Estimated Start of Unregulated Fishery	No. of Vessels Sighted in Unregulated Fishery[1,7]		No. of Fishing Vessels		Estimated No. of Vessels Fishing Illegally		No. of Days Fishing per Fishing Trip	No. of Trips/Year	Estimated Effort in Days Fishing[6] (1)		Mean Catch Rate per Day[3] (tonnes) (2)	Estimated Unreported Catch (1) x (2)		Estimated Total Catch	
48.6	No info															
48.3	1991	5	(1)[2]	18		5	(1)[4]	30	1.2	180	-	2.2	396	(300–400)	5 090	(4 931)
58.7	Apr/May 1996	1	(1)	3	(6)	2	(2)	40	2.5	200	(100)	1.1	220	(140)	940	(345)
58.6	Apr/May 1996	7	(4)	5	(4)	11[5]	(6)	40	2.5	1 100	(920)	1.8	1 980	(1 748)	2 668	(3 660)
58.5.1	Dec 1996	7	(11)	0	(6)	7	(15)	40	2.5	700	(310)	3.0	2 100	(620)	7 109	(6 022)
58.5.2	Feb/Mar 1997	2[1]	(2)	2	(2)	4	(4)	40	2.5	400	(80)	2.0	800	(160)	3 379	(5 611)
58.4.4	Sep 1996	1	(2)	1	(0)	7	(7)	40	2.5	700	(1 230)	1.5	1 050	(1 845)	1 050	(1 845)
58			(3)				(5)				(1 000)	1.5				(1 500)
88.1															751	(297)
Total													6 546	(4 813–4 913)[8]	20 987	(24 211)

[1] Two vessels sighted; one with 125 tonnes on board and the other estimated to have 346 tonnes on board.
[2] Double sightings in one zone not counted.
[3] Data from Secretariat.
[4] Report of additional three vessels in 1998/99 in this subarea.
[5] Estimated number of vessels not in area throughout period, but moving between areas.
[6] Calculated as no. of vessels fishing illegally x no. fishing days/trip x no. trips/year.
[7] Vessel sightings (sources): AFMA, MRAG, Prof. G. Duhamel (France), observers (South Africa).
[8] The estimate of additional 1 920 tonnes of catch from three vessels reported in Subarea 48.3 is not included.

Table 6: Estimated total catch (tonnes) by subarea/division of *Dissostichus eleginoides* and *D. mawsoni* in the Convention Area for the 1999/2000 split-year. Estimates for the 1998/99 split-year are in parentheses.

Subarea/ Division	Estimated Total Catch		Reported Catch 1999/2000		Estimated Unreported Catch		Unreported Catch as % of the Estimated Total Catch
48.1	–	(<1)		(0)	probably low		
48.2	–	(<1)		(0)	probably low		
48.3	5 090	(4 931)[1]	4 694	(4 291)	396	(300–400)[1]	8
58.4.4	1 050	(1 845)	-	(0)	1 050	(1 845)	no data
58.5.1	7 109	(6 022)	5 009	(5 402)	2 100	(620)	30
58.5.2	3 379	(5 611)	2 579	(5 451)	800	(160)	24
58.6	2 668	(3 660)	688	(1 912)[3]	1 980	(1 748)	74
58.7	940	(345)	720	(205)[3]	220	(140)	23
88.1	751	(297)	751	(297)	probably low		
88.3	-	(<1)	0	(0)	probably low		
All subareas	20 987	(24 211)[2]	14 441	(17 558)	6 546	(4 813–4 913)[1]	32

[1] Not included is estimate of additional 1 920 tonnes of catch from three vessels reported in Subarea 48.3.
[2] Includes 1 500 tonnes of unreported catch for Area 58 as a whole.
[3] From South African EEZ

Table 7: Imports (tonnes) of frozen whole and filleted *Dissostichus eleginoides* to the USA and Japan 1999 (January–December) and 2000 (Japan: January–June; USA: January–July). Trade data supplied by the USA and by FAO for Japan. Green weights were estimated by the Secretariat using a factor of 2.2 to convert fillet weight to green weight.

Country	1999 (January–December)	2000 (January–July)	2000 (January–June)
USA (green weights)	11 545	7 597	
Japan (whole weights)	20 203		8 105
Japan (other products)	8 201		5 703

Table 8: Landed weights (tonnes) of *Dissostichus* spp. product reported in the CDS by 5 October 2000, and estimated whole weights (tonnes). Whole weights were estimated by the Secretariat using the following CFs: whole weight = 1.0 x WHO; whole weight = 1.6 x HAG; whole weight = 1.7 x HAT; whole weight = 1.7 x HGT; whole weight = 2.3 x FLT; OTH was not used to estimate whole weights because that product may be included in the conversion from other types of cuts. FLT – fillet; HAG – headed and gutted; HAT – headed and tailed; HGT – headed, gutted and tailed; OTH – other; WHO – whole.

Year	Month	Estimated Whole Weight (tonnes)	Product Weight (tonnes)					
			FLT	HAG	HAT	HGT	OTH	WHO
Area ?								
2000	?	30				18		
2000	April	103				61		
2000	May	31		<1		18		
2000	June	116				68	13	
2000	July	48	<1			28	2	
Area 41								
?	?	41				24	3	
1999	Nov	68				40		
2000	Feb	281				165	73	
2000	Jan	465				274	83	
2000	April	635		36		340	91	
2000	May	418		13		229	72	9
2000	June	557		3		320	94	9
2000	July	156				92	38	
2000	Aug	606				357	56	
2000	Sept	155		1		91	40	
Area 47								
2000	April	251				148	38	
2000	June	30				18	4	
Area 48								
1999	Oct	10				6	<1	
2000	May	36				21	1	
2000	June	2 068		154		1 072	225	
2000	July	2 266		454	112	793	260	
2000	Aug	297				175	44	
Area 51								
2000	April	<1					36	
2000	June	657				387	93	
2000	July	560				329	75	
2000	Aug	341				201	31	
Area 56								
– no information available –								
Area 57								
2000	April	7	<1			4	2	
2000	July	83				49	26	

(continued)

Table 8 (continued)

Year	Month	Estimated Whole Weight (tonnes)	Product Weight (tonnes)					
			FLT	HAG	HAT	HGT	OTH	WHO
Area 58								
2000	Jan	532	1			286	192	45
2000	March	764	62			344	225	38
2000	April	580	2			332	225	10
2000	May	1 259				740	90	
2000	June	2 724	2			1 589	444	18
2000	July	734	123			265	21	
2000	Aug	98				57	13	
Area 84								
2000	Aug	7						7
Area 86								
2000	June	4		2		1		
Area 87								
1999	April	16				10	<1	
1999	Nov	9	2			3	<1	
1999	Dec	90	18			29	9	
2000	Jan	351	42			149	8	
2000	Feb	578	1			339	16	1
2000	March	215	<1			122	7	7
2000	April	150	2			75	11	17
2000	May	87	1			6	13	74
2000	June	132		3		2	5	123
2000	July	156						156
2000	Aug	238		<1		<1		236
2000	Sept	34		1				32
Area 88								
2000	March	533	1	332			47	<1
Total		19 608	260	1 001	112	9 678	2 729	783

Table 9: Summary of observations on longline fisheries conducted in the 1999/2000 season by scientific observers.

Flag State	Vessel	Fishing Method	Observer	Subarea / Fishery	Period of Observation	Report / Date Submitted	Data Reported
Chile	*Faro de Hercules*	LLS Spanish	P. Wright UK	48.3 *D. eleginoides*	18/5–27/7/00	Scientific Observer Logbook 18/9/00 Cruise Report 12/9/00	Cruise, vessel, and IMALF details
Chile	*Isla Camila*	LLS Spanish	A. Williams UK	48.3 *D. eleginoides*	15/4–27/7/00	Scientific Observer Logbook 18/9/00 Cruise Report 12/9/00	Cruise, vessel, and IMALF details
Chile	*Isla Santa Clara*	LLS Spanish	R. Gater UK	48.3 *D. eleginoides*	12/4–27/7/00	Scientific Observer Logbook 31/8/00 Cruise Report 12/9/00	Cruise, vessel, and IMALF details
Chile	*Isla Sofía*	LLS Spanish	C. Herrera Argentina	48.3 *D. eleginoides*	20/6–21/7/00	Scientific Observer Logbook 28/8/00 Cruise Report 29/8/00	Cruise, vessel, and IMALF details
Chile	*Magallanes III*	LLS Spanish	P. Wright UK	48.3 *D. eleginoides*	23/4–18/5/00	Scientific Observer Logbook 18/9/00 Cruise Report 12/5/00	Cruise, vessel, and IMALF details
Chile	*Magallanes III*	LLS Spanish	M. Lozano Uruguay	48.3 *D. eleginoides*	10/7–21/7/00	Cruise Report 12/9/00	Cruise details
Chile	*Tierra del Fuego*	LLS Spanish	M. Murphy UK	48.3 *D. eleginoides*	1/5–21/7/00	Scientific Observer Logbook 13/8/00 Cruise Report 28/9/00	Cruise, vessel, and IMALF details
France	*Cap Kersaint*	LLS Spanish	D. Capdeville France	58.6 *D. eleginoides*	9/7–19/7/00	Scientific Observer Logbook 19/9/00	Cruise, vessel, and IMALF details
France	*Croix de Sud I*	LLS Auto	N. Gasco France	58.6 *D. eleginoides*	28/7–31/7/00	Scientific Observer Logbook 19/9/00	Cruise, vessel, and IMALF details
UK	*Argos Georgia*	LLS Spanish	M. Purves South Africa	48.3 *D. eleginoides*	18/5–28/7/00	Scientific Observer Logbook 18/9/00 Cruise report 12/9/00	Cruise, vessel, and IMALF details
UK	*Argos Helena*	LLS Spanish	Y. Marín Uruguay	48.3 *D. eleginoides*	1/5–21/7/00	Cruise report 2/10/00	Cruise details
UK	*Jacqueline*	LLS Spanish	C. Vera Cárdenas Chile	48.3 *D. eleginoides*	1/5–21/7/00	Scientific Observer Logbook 13/9/00 Cruise Report 25/9/00	Cruise, vessel, and IMALF details
UK	*Lyn*	LLS Spanish	P. Casas–Cordero Chile	48.3 *D. eleginoides*	1/5–21/7/00	Scientific Observer Logbook 13/9/00 Cruise Report 25/9/00	Cruise, vessel, and IMALF details
New Zealand	*Janas*	LLS Auto	J. Wium South Africa	88.1 *Dissostichus* spp.	4/1–24/3/00	Scientific Observer Logbook 6/7/00 Cruise Report 3/7/00	Cruise, vessel, and IMALF details

(continued)

Table 9 (continued)

Flag State	Vessel	Fishing Method	Observer	Subarea / Fishery	Period of Observation	Report / Date Submitted	Data Reported
New Zealand	*San Aotea II*	LLS Auto	F. Stoffberg South Africa	88.1 *Dissostichus* spp.	3/1–18/3/00	Scientific Observer Logbook 6/7/00 Cruise Report 3/7/00	Cruise, vessel, and IMALF details
New Zealand	*Sonrisa*	LLS Auto	B. Fairhead South Africa	88.1 *Dissostichus* spp.	21/1–7/3/00	Scientific Observer Logbook 6/7/00 Cruise Report 27/4/00	Cruise, vessel, and IMALF details
Republic of Korea	*No. 1 Moresko*	LLS Spanish	S. Hutton UK	48.3 *D. eleginoides*	26/4–21/7/00	Scientific Observer Logbook 18/7/00 Cruise Report 12/7/00	Cruise, vessel, and IMALF details
South Africa	*Aquatic Pioneer*	LLS Spanish	P. Nel* South Africa	58.7 *D. eleginoides*	23/8–5/10/99	Scientific Observer Logbook 6/11/99 Cruise Report 20/12/99	Cruise, vessel, and IMALF details
South Africa	*Aquatic Pioneer*	LLS Spanish	M. Davies* South Africa	58.6 *D. eleginoides*	9/10–10/12/99	Scientific Observer Logbook 1/2/00 Cruise Report 1/2/00	Cruise, vessel, and IMALF details
South Africa	*Aquatic Pioneer*	LLS Spanish	E. Simpson* South Africa	58.6, 58.7 *D. eleginoides*	17/1–15/3/00	Scientific Observer Logbook 27/4/00 Cruise Report 27/4/00	Cruise, vessel, and IMALF details
South Africa	*Aquatic Pioneer*	LLS Spanish	H. Crous* South Africa	58.6, 58.7 *D. eleginoides*	29/3–11/5/00	Scientific Observer Logbook 3/7/00 Cruise Report 3/7/00	Cruise, vessel, and IMALF details
South Africa	*Aquatic Pioneer*	LLS Spanish	R. Pienaar* South Africa	58.6, 58.7 *D. eleginoides*	13/7–8/9/00	Cruise Report 28/9/00	Cruise details
South Africa	*Eldfisk*	LLS Auto	B. Fairhead* South Africa	58.7 *D. eleginoides*	26/7–1/10/99	Scientific Observer Logbook 27/4/00 Cruise Report 26/11/99	Cruise, vessel, and IMALF details
South Africa	*Eldfisk*	LLS Auto	Crous, Enticott* South Africa	58.6, 58.7 *D. eleginoides*	8/10–17/12/99	Scientific Observer Logbook 1/2/00 Cruise Report 1/2/00	Cruise, vessel, and IMALF details
South Africa	*Eldfisk*	LLS Auto	Davies, Dyer* South Africa	58.6, 58.7 *D. eleginoides*	5/1–17/3/00	Scientific Observer Logbook 27/4/00 Cruise Report 27/4/00	Cruise, vessel, and IMALF details
South Africa	*Eldfisk*	LLS Auto	Fairhead, Koen* South Africa	58.6, 58.7 *D. eleginoides*	23/3–2/6/00	Scientific Observer Logbook 3/7/00 Cruise Report 3/7/00	Cruise, vessel, and IMALF details
South Africa	*Eldfisk*	LLS Auto	Stoffberg, Davies* South Africa	58.6, 58.7 *D. eleginoides*	16/6–23/8/00	Cruise Report 28/9/00	Cruise details
South Africa	*Koryo Maru 11*	LLS Spanish	G. Westhuizen* South Africa	58.6, 58.7 *D. eleginoides*	16/10–10/11/99	Scientific Observer Logbook 1/2/00 Cruise Report 1/2/00	Cruise, vessel, and IMALF details

(continued)

Table 9 (continued)

Flag State	Vessel	Fishing Method	Observer	Subarea / Fishery	Period of Observation	Report / Date Submitted	Data Reported
South Africa	*Koryo Maru 11*	LLS Spanish	B. Stander* South Africa	58.6, 58.7 *D. eleginoides*	16/1–7/4/00	Scientific Observer Logbook 3/7/00 Cruise Report 3/7/00	Cruise, vessel, and IMALF details
South Africa	*Koryo Maru 11*	LLS Spanish	P. Usher UK	48.3 *D. eleginoides*	18/4–2/7/00	Scientific Observer Logbook 18/9/00 Cruise Report 18/9/00	Cruise, vessel, and IMALF details
Spain	*Ibsa Quinto*	LLS Spanish	M. Endicott UK	48.3 *D. eleginoides*	23/4–21/7/00	Scientific Observer Logbook 18/9/00 Cruise Report 12/9/00	Cruise, vessel, and IMALF details
Ukraine	*RK-1*	LLS Auto	L. Fearnhough UK	48.3 *D. eleginoides*	25/4–24/7/00	Scientific Observer Logbook 31/8/00 Cruise Report 12/9/00	Cruise, vessel, and IMALF details
Uruguay	*Illa de Rua*	LLS Spanish	J. Bailey UK	48.3 *D. eleginoides*	14/4–25/7/00	Scientific Observer Logbook 31/8/00 Cruise Report 12/9/00	Cruise, vessel, and IMALF details
Uruguay	*Isla Alegranza*	LLS Spanish	H. Pavez Chile	58.4.4 *D. eleginoides*	26/6–30/8/00	Scientific Observer Logbook 30/9/00 Cruise Report 2/10/00	Cruise, vessel, and IMALF details
Uruguay	*Isla Gorriti*	LLS Auto	M. Keen UK	48.3 *D. eleginoides*	18/4–22/7/00	Scientific Observer Logbook 31/8/00 Cruise Report 12/9/00	Cruise, vessel, and IMALF details

* National observers, deployed within national EEZs

Table 10: Summary of information contained in the observer cruise reports for the 1999/2000 fishing season. Nationality: AUS – Australia, CHL – Chile, ESP – Spain, GBR – United Kingdom, JPN – Japan, KOR – Republic of Korea, NZL – New Zealand, RUS – Russia, UKR – Ukraine, URY – Uruguay, ZAF – South Africa; Fishing method: A – autoliner, Sp – Spanish, OTM – midwater trawl, OTB – bottom trawl; Information on: LF – length frequency, CF – conversion factor; Y – yes, N – no.

Vessel Name (Nationality)	Dates of Trip	Fishing Method	IMALF Data	Mammal Interactions	Debris Information	Information on					Samples		Observer Manual Comments
						By-catch	LF	Weight	Maturity	CF	Otoliths	Scales	
Subarea 48.3													
Argos Helena (GBR)	18/5–28/7/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Argos Helena (GBR)	1/5–27/7/00	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N
Betanzos (CHL)	10/12/99–2/2/00	OTM	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
Faro de Hercules CHL)	18/5–27/7/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Ibsa Quinto (ESP)	23/4–25/7/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
Illa de Rua (URY)	18/4–25/7/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Isla Camila (CHL)	15/4–22/7/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Isla Gorriti (URY)	18/4–25/7/00	A	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
Isla Santa Clara (CHL)	12/4–27/7/00	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N
Isla Sofia (CHL)	20/6–28/7/00	Sp	Y	Y	N	Y	Y	N	Y	Y	Y	Y	N
Jacqueline (GBR)	30/4–25/7/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Koryo Maru 11 (ZAF)	1/5–21/7/00	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
Lyn (GBR)	24/4–25/7/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Magallanes III (CHL)	23/4–9/5/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Magallanes III (CHL)	3/7–5/8/00	Sp	Y	Y	N	Y	Y	N	Y	N	Y	N	N
No.1 Moresko (KOR)	26/4–25/7/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
RK-1 (UKR)	25/4–24/7/00	A	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y
Tierra del Fuego (CHL)	1/5–21/7/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Zakhar Sorokin (RUS)	27/11/99–22/2/00	OTM	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Subareas 58.6 and 58.7													
Aquatic Pioneer (ZAF)	23/8–5/10/99	Sp	Y	Y	N	Y	Y	Y	N	Y	N	N	N
Aquatic Pioneer (ZAF)	9/10–10/12/99	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Aquatic Pioneer (ZAF)	17/1–18/3/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Aquatic Pioneer (ZAF)	29/3–11/5/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N

(continued)

Table 10 (continued)

Vessel Name (Nationality)	Dates of Trip	Fishing Method	IMALF Data	Mammal Interactions	Debris Information	Information on By-catch	LF	Weight	Maturity	CF	Samples Otoliths	Scales	Observer Manual Comments
Aquatic Pioneer (ZAF)	13/7–8/9/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N
Eldfisk (ZAF)	26/7–1/10/99	A	Y	Y	N	Y	Y	Y	Y	N	Y	N	N
Eldfisk (ZAF)	8/10–17/12/99	A	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
Eldfisk (ZAF)	5/1–17/3/00	A	Y	Y	Y	Y	Y	Y	Y	N	N	N	N
Eldfisk (ZAF)	23/3–2/6/00	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Eldfisk (ZAF)	16/6–18/8/00	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Koryo Maru 11 (ZAF)	20/8–12/12/99	Sp	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Koryo Maru 11 (ZAF)	11/1–7/4/00	Sp	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Subarea 88.1													
Janas (NZL)	3/1–24/3/00	A	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
San Aotea II (NZL)	8/1–18/3/00	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Sonrisa (NZL)	21/1–7/3/00	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Division 58.5.2													
Austral Leader (AUS)	20/10–20/12/99	OTB	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Austral Leader (AUS)	19/4–7/6/00	OTB	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Southern Champion (AUS)	3/12–25/1/00	OTB	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Southern Champion (AUS)	31/1–3/4/00	OTB	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Southern Champion (AUS)	20/4–27/6/00	OTB	Y	Y	N	Y	Y	Y	N	N	Y	N	Y
Divisions 58.4.1, 58.4.3 and 58.5.2													
Austral Leader (AUS)	17/2–14/4/00	OTB	Y	Y	N	Y	Y	Y	N	Y	Y	N	N
Area 48													
Chiyo Maru No.5 (JPN)	31/1–1/3/00	OTM	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y
Division 58.4.4													
Isla Alegranza (CHL)	14/7–31/8/00	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N

Table 11: Disposal of wastes and oil reported by observers during the 1999/2000 season. Nationality: AUS – Australia, CHL – Chile, ESP – Spain, GBR – United Kingdom, JPN – Japan, KOR – Republic of Korea, NZL – New Zealand, RUS – Russia, UKR – Ukraine, URY – Uruguay, ZAF – South Africa; Fishing method: A – autoliner, Sp – Spanish, OTM – midwater trawl, OTB – bottom trawl; Y – disposed of over board, N – waste retained or burnt at sea, - no information.

Vessel Name (Nationality)	Dates of Trip	Fishing Method	Bands (bait etc.)	Oil	Gear Debris	Garbage (galley, other)	Hooks in Discards
Subarea 48.3							
Argos Georgia (GBR)	18/5–28/7/00	Sp	N	-	N	Y	-
Argos Helena (GBR)	1/5–27/7/00	Sp	N	-	N	N	-
Betanzos (CHL)	10/12–2/2/00	OTM	-	-	-	-	-
Faro de Hercules (CHL)	18/5–27/7/00	Sp	N	N	N	N	N
Ibsa Quinto (ESP)	23/4–25/7/00	Sp	-	-	Y	-	Y
Illa de Rua (URY)	18/4–25/7/00	Sp	N	-	N	Y	Y
Isla Camila (CHL)	15/4–22/7/00	Sp	-	-	Y	-	Y
Isla Gorriti (URY)	18/4–25/7/00	A	-	-	N	-	-
Isla Santa Clara (CHL)	12/4–27/7/00	Sp	-	-	Y	Y	-
Isla Sofía (CHL)	20/6–28/7/00	Sp	Y	Y	N	Y	-
Jacqueline (GBR)	30/4–25/7/00	Sp	N	N	N	N	Y
Koryo Maru 11 (ZAF)	1/5–21/7/00	Sp	N	N	Y	N	-
Lyn (GBR)	24/4–25/7/00	Sp	N	-	Y	N	Y
Magallanes III (CHL)	23/4–9/5/00	Sp	Y	Y	Y	Y	-
Magallanes III (GBR)	3/7–5/8/00	Sp	-	-	-	-	-
No.1 Moresko (KOR)	26/4–25/7/00	Sp	N	-	Y	N	-
RK-1 (UKR)	25/4–24/7/00	A	-	-	-	-	-
Tierra del Fuego (CHL)	1/5–21/7/00	Sp	N	-	Y	Y	Y
Zakhar Sorokin (RUS)	27/11/99–22/2/00	OTM	-	-	-	-	-
Subareas 58.6, 58.7							
Aquatic Pioneer (ZAF)	23/8–5/10/99	Sp	-	-	-	-	-
Aquatic Pioneer (ZAF)	9/10–10/12/99	Sp	Y	-	Y	N	-
Aquatic Pioneer (ZAF)	17/1–18/3/00	Sp	N	N	N	N	N
Aquatic Pioneer (ZAF)	29/3–11/5/00	Sp	-	N	N	N	N
Aquatic Pioneer (ZAF)	13/7–8/9/00	Sp	N	N	N	N	Y
Cap Kersaint (FRA)	8/7–15/7/00	Sp	-	-	-	-	-
Croix du Sud I (FRA)	28/7–31/7/00	Sp	-	-	-	-	-
Eldfisk (ZAF)	26/7–1/10/99	A	-	-	-	-	-
Eldfisk (ZAF)	8/10–17/12/99	A	-	N	N	Y	-
Eldfisk (ZAF)	5/1–17/3/00	A	-	Y	-	Y	-
Eldfisk (ZAF)	23/3–2/6/00	A	N	N	N	N	N
Eldfisk (ZAF)	16/6–18/8/00	A	Y	N	Y	Y	N
Koryo Maru 11 (ZAF)	20/8–12/12/99	Sp	N	N	Y	N	Y
Koryo Maru 11 (ZAF)	11/1–7/4/00	Sp	N	N	Y	Y	N
Subarea 88.1							
Janas (NZL)	3/1–24/3/00	A	-	-	-	-	-
San Aotea II (NZL)	8/1–18/3/00	A	N	N	N	Y	N
Sonrisa (NZL)	21/1–7/3/00	A	N	N	N	N	N
Division 58.5.2							
Austral Leader (AUS)	20/10–20/12/99	OTB	N	N	N	N	
Austral Leader (AUS)	19/4–7/6/00	OTB	N	N	N	N	
Southern Champion (AUS)	20/4–27/6/00	OTB	N	N	N	N	
Southern Champion (AUS)	31/1–3/4/00	OTB	N	N	N	N	
Southern Champion (AUS)	3/12–25/1/00	OTB	N	N	N	N	
Divisions 58.5.2, 58.4.3, 58.4.1							
Austral Leader (AUS)	17/2–14/4/00	OTB	N	N	N	N	
Area 48							
Chiyo Maru No.5 (JPN)	31/1–1/3/00	OTM	-	-	-	-	
Division 58.4.4							
Isla Alegranza (CHL)	14/7–31/8/00	Sp	N	-	N	N	-

Table 12: Summary of biological data collected by observers in trawl fisheries during the 1999/2000 season.

Area/Subarea/Division	Number of Measurements			
	Length	Weight	Sex	Maturity
48.1				
Euphausia superba	13 102	4 743	13 102	4 743
48.3				
Champsocephalus gunnari	5 894	5 893	5 894	5 894
Gobionotothen gibberifrons	9	9	9	8
58.4.2, 58.5.2				
Champsocephalus gunnari	4 230	1 921	1 906	1 885
Pleuragramma antarcticum	3	3	3	3
Bathyraja eatonii	376	374	374	7
B. irrasa	22	22	22	2
B. murrayi	103	101	99	4
Neopagetopsis ionah	13	13	13	13
Channichthys rhinoceratus	1 394	1 315	677	660
Notothenia squamifrons	1 340	1 339	1 301	1 176
Chionodraco hamatus	11	11	11	11
Dissostichus mawsoni	3	3	3	3
Dissostichus eleginoides	11 072	11 047	9 076	9 063
Trematomus eulepidotus	59	59	59	59
Macrourus whitsoni	50	50	50	50
Chaenodraco wilsoni	43	43	43	43

Table 13: Scientific observations conducted on board trawl vessels within the Convention Area for the 1999/2000 season. Flag/Nationality: AUS – Australia, CHL – Chile, GBR – United Kingdom, JPN – Japan, RUS – Russia, UKR – Ukraine; Target species: TOP – *Dissostichus eleginoides*; ANI – *Champsocephalus gunnari*, KRI – *Euphausia superba*, WIC – *Chaenodraco wilsoni*.

Vessel	Flag	Observer (Nationality)	Observation Dates	Area	Target Species	Number of Trawls		
						Total	Observed	(%)
Austral Leader	AUS	J. Parkinson (AUS)	20/10–20/12/99	58.5.2	TOP	75	75	(100)
Austral Leader	AUS	L. Pschenichnov (UKR)	17/2–14/4/00	58.4.2	WIC	8	8	(100)
					TOP	1	1	(100)
				58.5.2	ANI	4	4	(100)
					TOP	125	125	(100)
Austral Leader	AUS	J. Hamill (AUS)	19/4–7/6/00	58.5.2	TOP	185	172	(93)
					ANI	8	8	(100)
Betanzos	CHL	G. Fulton (GBR)	10/12/99–2/2/00	48.3	ANI	94	75	(80)
Chiyo Maru No. 5	JPN	W. Rain (USA)	28/1–29/2/00	48.1	KRI	252	82	(33)
Southern Champion	AUS	M. Tucker (AUS)	3/12/99–25/1/00	58.5.2	TOP	76	76	(100)
					ANI	3	3	(100)
Southern Champion	AUS	J. Parkinson (AUS)	31/1–3/4/00	58.5.2	TOP	158	122	(77)
					ANI	9	6	(67)
Southern Champion	AUS	L. Pschenichnov (UKR)	3/5–29/5/00	58.5.2	TOP	191	191	(100)
					ANI	5	5	(100)
Zakhar Sorokin	RUS	R. Hartnell (GBR)	27/11/99–31/1/00	48.3	ANI	172	114	(66)

Table 14: Overall species composition of catches reported by scientific observers in trawl and longline fisheries in the 1999/2000 season. The relative abundance of each taxon is expressed as the percentage, by weight, of the total catch observed. Data limited to those where weight provided. Target species: ANI – *Champsocephalus gunnari;* KRI – *Euphausia superba*; TOA – *Dissostichus mawsoni*; TOP – *Dissostichus eleginoides*; WIC – *Chaenodraco wilsoni*.

Gear	Trawl						Longline			
Target species	KRI	ANI	ANI	TOA	TOP	WIC	TOP	TOP	TOP	TOA
Subarea/Division	48.1	48.3	58.5.2	58.4.2	58.5.2	58.4.2	48.3	58.4.4	58.6/7	88.1
Elasmobranchs		<0.1								
Callorhinchidae										
Callorhinchus capensis									<0.1	
Laminidae										
Lamna nasus			0.5							
Rajidae			<0.1		<0.1		2.3	0. 9	0.7	<0.1
Amblyraja georgiana							<0.1		0.6	5.7
Bathyraja eatonii			0.2		0.2		<0.1			0.9
Bathyraja irrasa			<0.1		<0.1					
Bathyraja maccaini					<0.1	0.7			<0.1	
Bathyraja meridionalis							<0.1			
Bathyraja murrayi			<0.1		<0.1				<0.1	
Bathyraja spp.									<0.1	
Raja spp.							0.3			
Squalidae										
Etmopterus granulosus									<0.1	
Somniosus microcephalus									0.1	
Somniosus pacificus					0.2					
Bony Fishes										
Achiropsettidae										
Mancopsetta maculata					<0.1					
Artedidraconidae										
Artedidraco mirus										<0.1
Bathylagidae										
Bathylagus antarcticus					<0.1					
Bothidae					<0.1					
Bramidae										
Brama brama									<0.1	
Carapidae										
Echiodon cryomargarites									<0.1	
Ceratiidae										
Ceratias tentaculatus					<0.1					
Channichthyidae					<0.1		<0.1			<0.1
Chaenocephalus aceratus										<0.1
Chaenodraco wilsoni						1.1				
Champsocephalus gunnari		98.5	93.4		1.9		<0.1			
Channichthys rhinoceratus			4.0		<0.1					
Chionodraco hamatus						0.4				
Neopagetopsis ionah						1.4				
Pagetopsis macropterus										<0.1
Pseudochaenichthys georgianus					<0.1		<0.1			

(continued)

Table 14 (continued)

Gear	Trawl						Longline			
Target species	KRI	ANI	ANI	TOA	TOP	WIC	TOP	TOP	TOP	TOA
Subarea/Division	48.1	48.3	58.5.2	58.4.2	58.5.2	58.4.2	48.3	58.4.4	58.6/7	88.1
Congiopodidae										
Zanclorhynchus spinifer					<0.1					
Gempylidae										
Paradiplospinus antarcticus					<0.1					
Paradiplospinus gracilis					<0.1					
Harpagiferidae										
Pogonophryne permitini										<0.1
Pogonophryne spp.										<0.1
Lampridae										
Lampris immaculatus					<0.1					
Macrouridae										
Macrourus carinatus			<0.1		<0.1		<0.1			7.9
Macrourus holotrachys					<0.1		0.1			
Macrourus spp.			<0.1		<0.1		0.9	18.2	19.4	<0.1
Macrourus whitsoni					<0.1	45.3	0.6		<0.1	0.5
Merlucciidae										
Macruronus novaezelandiae			<0.1		<0.1					
Moridae			<0.1		<0.1					
Antimora rostrata					<0.1		0.1	0.6	2.7	<0.1
Muraenolepididae										
Muraenolepis microps									<0.1	0.6
Muraenolepis orangiensis										<0.1
Muraenolepis spp.					<0.1				<0.1	0.2
Myctophidae					<0.1					
Electrona carlsbergi					<0.1					
Gymnoscopelus bolini		<0.1			<0.1					
Gymnoscopelus nicholsi		1.5			<0.1					
Notacanthidae										
Notacanthus chemnitzii					<0.1					
Nototheniidae							<0.1			<0.1
Dissostichus eleginoides			1.3		97.2		95.6	80.2	76.3	<0.1
Dissostichus mawsoni				86.6						84.1
Notothenia acuta			<0.1		<0.1					
Notothenia coriiceps			<0.1		<0.1					
Notothenia neglecta							<0.1			
Notothenia rossii					<0.1		<0.1			
Notothenia squamifrons			<0.1		0.2		<0.1			
Nototheniops mizops			<0.01		<0.1					
Nototheniops nudifrons							<0.1			
Pagothenia hansoni										
Patagonotothen brevicauda		<0.1					<0.1			
Pleuragramma antarcticum						2.0				
Trematomus eulepidotus						5.2				
Paralepididae										
Notolepis coatsi					<0.1					
Scorpaenidae							<0.1			

(continued)

Table 14 (continued)

Gear	Trawl						Longline			
Target species	KRI	ANI	ANI	TOA	TOP	WIC	TOP	TOP	TOP	TOA
Subarea/Division	48.1	48.3	58.5.2	58.4.2	58.5.2	58.4.2	48.3	58.4.4	58.6/7	88.1
Stomiidae										
Stomias boa boa					<0.1					
Zoarcidae										
Melanostigma spp.					<0.1					
Other					<0.01		<0.1		<0.1	
Invertebrates										
Euphausia spp.			<0.1							
Euphausia superba	100									
Lithodidae							<0.1		<0.1	
Lithodes murrayi							<0.1		<0.1	
Lithodes spp.								0.2		
Loliginidae		<0.1	<0.1		<0.1					
Moroteuthis ingens			<0.1		<0.1	4.9				
Octopodidae				13.4	<0.1	1.2				
Paralithodes spp.							<0.1			
Paralomis anamerae							<0.1		<0.1	
Paralomis formosa							<0.1			
Paralomis spinosissima							<0.1			
Paralomis spp.							<0.1			
Other			0.4		0.1	38.0	<0.1		<0.1	

Table 15: Frequency of occurrence (%) of longline hauls where at least one example of a particular taxon was taken as reported by observers for the 1999/2000 season. N – number of hauls.

Species Name	Subarea/Division			
	48.3 (N = 1987)	58.4.4 (N = 68)	58.6, 58.7 (N = 1 617)	88.1 (N = 485)
Amblyraja georgiana	1.3		1.5	61.0
Antimora rostrata	17.9	77.9	21.6	6.6
Artedidraco mirus				3.1
Bathyraja eatonii	1.0		0.1	52.8
Bathyraja maccaini			0.1	
Bathyraja meridionalis	0.8			
Bathyraja murrayi			2.4	
Bathyraja spp.	0.2		1.0	
Brama brama			0.6	
Callorhinchus capensis			0.2	
Chaenocephalus aceratus				1.0
Champsocephalus gunnari	<0.1			
Channichthyidae	0.2			35.3
Crustacea			0.2	
Dissostichus eleginoides	80.3	100.0	89.5	1.4
Dissostichus mawsoni				98.4
Echinodermata	0.6		0.1	
Echiodon cryomargarites			0.3	
Elasmobranchii			0.2	
Electrona spp.			0.2	
Etmopterus granulosus			0.3	
Lithodes murrayi	2.9	0.0	3.4	
Lithodes spp.	2.3	47.1		
Lithodidae	5.6		2.4	
Macrourus carinatus				81.6
Macrourus holotrachys	4.8			
Macrourus spp.	40.4	97.1	85.3	1.0
Macrourus whitsoni	12.2		0.4	37.7
Muraenolepis microps			0.1	39.6
Muraenolepis orangiensis				5.8
Muraenolepis spp.			0.8	34.0
Notothenia neglecta	0.2			
Notothenia rossii	0.7			
Notothenia squamifrons	0.2			
Nototheniidae	0.5			1.6
Nototheniops nudifrons	0.3			
Osteichthyes spp.	0.2		1.1	
Pagetopsis macropterus				0.2
Paralithodes spp.	0.1			
Paralomis anamerae	17.2		0.6	
Paralomis formosa	0.2			
Paralomis spinosissima	0.7			
Paralomis spp.	0.2			
Patagonotothen brevicauda	0.4			
Pogonophryne permitini				2.3
Pogonophryne spp.				0.2
Porifera			0.1	
Pseudochaenichthys georgianus	0.2			
Raja spp.	5			
Rajiformes spp.	30	31	6	1
Unknown			1	

Table 16: Summary of observer data on CFs for headed, gutted and tailed fish (HAT).

Area	No. of Vessels	No. of Cruises	No. of Hauls	No. of Fish in Sample Unit[1]	No. of Sample Units
Dissostichus eleginoides					
48.3	10	10	317	1	1 350
48.3	3	3	7	(2–5)	83
48.3	5	5	31	(6–15)	31
48.3	3	3	17	(16–29)	17
48.3	2	2	4	(>30)	4
58.4.4	1	1	1	5	1
58.4.4	1	1	12	(6–15)	12
58.6, 58.7	1	1	3	1	52
58.6, 58.7	1	1	1	4	1
58.6, 58.7	2	3	20	(16–29)	20
58.6, 58.7	2	3	5	(>30)	13
58.7	1	1	1	1	2
58.7	1	1	1	13	1
58.7	1	1	2	(16–29)	2
58.7	1	1	4	(>30)	4
Dissostichus mawsoni					
88.1	1	1	5	1	5
88.1	2	2	4	(2–5)	6
88.1	2	2	7	(6–15)	7
88.1	1	1	4	(16–29)	4

[1] The number of fish used in bins used in the analysis.

Table 17: CFs from different sources and products. Observer data for fillet (FLT), and headed and gutted (HAG) were not available in sufficient quantities.

Area	Product	Vessel[1]	Observer[2]	Observer[3]
Dissostichus eleginoides				
48.3	HAG	1.587	NA	NA
48.3	HAT	1.625	1.665	1.651
58.4.4	HAG	1.73	NA	NA
58.4.4	HAT	1.73	1.737	1.768
58.4.4	FLT	NA	2.777	2.781
58.7	HAG	NA	1.292	1.284
58.7	HAT	NA	1.612	1.574
58.6, 58.7	HAT	NA	1.670	1.752
Dissostichus mawsoni				
88.1	HAG	1.72	1.565	1.581
88.1	HAT	1.72	1.691	1.703

[1] Weighted by the number of data submission.
[2] Weighted by the green weight of the fish observed.
[3] Weighted by the number of fish observed.

Table 18: New and exploratory fisheries managed under conservation measures in force in 1999/2000. Source of data: 5-day catch and effort reports submitted by 7 October 2000.

Conservation Measure	Fishery	Season		Area Fished	Catch Limit (tonnes)	Total Catch (tonnes)	% Catch Limit
		Start	End				
183/XVIII	Exploratory jig fishery for *Martialia hyadesi* in Subarea 48.3	01-Dec-99	30-Nov-00	48.3	2 500	0	0
188/XVIII	Exploratory longline fishery for *Dissostichus eleginoides* in Division 58.4.4	01-May-00	31-Aug-00	58.4.4 North of 60°S	370	99	27
189/XVIII	Exploratory longline fishery for *Dissostichus eleginoides* in Subarea 58.6	01-May-00	31-Aug-00	58.6	450	14	3
187/XVIII	Exploratory longline fishery for *Dissostichus* spp. in Division 58.4.3	01-May-00	31-Aug-00	Elan Bank	250	0	0
187/XVIII	Exploratory longline fishery for *Dissostichus* spp. in Divisions 58.4.3/58.4.1	01-May-00	31-Aug-00	BANZARE Bank	300	0	0
184/XVIII	Exploratory longline fishery for *Dissostichus* spp. in Subarea 48.6	01-Mar-00	31-Aug-00	48.6 north of 60°S	455	0	0
184/XVIII	Exploratory longline fishery for *Dissostichus* spp. in Subarea 48.6	15-Feb-00	15-Oct-00	48.6 south of 60°S	455	0	0
190/XVIII	Exploratory longline fishery for *Dissostichus* spp. in Subarea 88.1	01-Dec-99	31-Aug-00	88.1 north of 65°S	175	0	0
190/XVIII	Exploratory longline fishery for *Dissostichus* spp. in Subarea 88.1	01-Dec-99	31-Aug-00	88.1 south of 65°S	1 915	745	39
191/XVIII	Exploratory longline fishery for *Dissostichus* spp. in Subarea 88.2	15-Dec-99	31-Aug-00	88.2 south of 65°S	250	0	0
186/XVIII	Exploratory trawl fishery for *Dissostichus* spp. in Division 58.4.2	01-Dec-99	30-Nov-00	58.4.2	500	<1	0
185/XVIII	Exploratory trawl fishery for *Dissostichus* spp. in Division 58.4.3	01-Dec-99	30-Nov-00	Elan Bank	145	0	0
185/XVIII	Exploratory trawl fishery for *Dissostichus* spp. in Divisions 58.4.1/58.4.3	01-Dec-99	30-Nov-00	BANZARE Bank	150	0	0
186/XVIII	New trawl fishery for *Chaenodraco wilsoni* in Division 58.4.2	01-Dec-99	30-Nov-00	58.4.2	500	<1	0

Table 19: CCAMLR fisheries operating in Areas 58 and 88 in the 1999/2000 season. Source of data: 5-day, 10-day or monthly catch and effort reports submitted by 7 October 2000.

Exploratory longline fishery for *Dissostichus eleginoides* in Division 58.4.4 (188/XVIII)			
Season			1 May–31 Aug 2000
Catch limit (tonnes) for target species			370
Reported catch (tonnes) of target species			99
Total effort (vessel.day)			45
Number of vessels fishing			1
	by country	Uruguay	1
Exploratory longline fishery for *Dissostichus eleginoides* in Subarea 58.6 (189/XVIII)			
Season			1 May–31 Aug 2000
Catch limit (tonnes) for target species			450
Reported catch (tonnes) of target species			4
Total effort (vessel.day)			17
Number of vessels fishing			3
	by country	France	2
		South Africa	1
Exploratory trawl fishery for *Dissostichus* spp. in Division 58.4.2 (186/XVIII)			
Season			1 Dec 1999–30 Nov 2000
Catch limit (tonnes) for target species			500
Reported catch (tonnes) of target species			0
Total effort (vessel.day)			2
Number of vessels fishing			1
	by country	Australia	1
New trawl fishery for *Chaenodraco wilsoni* in Division 58.4.2 (186/XVIII)			
Season			1 Dec 1999–30 Nov 2000
Catch limit (tonnes) for target species			500
Reported catch (tonnes) of target species			0
Total effort (vessel.day)			4
Number of vessels fishing			1
	by country	Australia	1
Exploratory longline fishery for *Dissostichus* spp. in Subarea 88.1 (south of 65°S) (190/XVIII)			
Season			1 Dec 1999–31 Aug 2000
Catch limit (tonnes) for target species			1 915
Reported catch (tonnes) of target species			745
Total effort (vessel.day)			162
Number of vessels fishing			3
	by country	New Zealand	3

Table 20: History of new and exploratory fisheries. Catch – target species; x – notified but did not fish; N – notification for 2000/01.

Fishery	Season	Total Reported Catch (tonnes)	Chile	Korea/ UK	South Africa	Norway	Australia	France	Uruguay	Ukraine	Spain	Russia	New Zealand	EC (Portugal)	Argentina	Brazil
Longline fishery for *Dissostichus* spp. in Subarea 48.1																
	1997/98	1	1													
	2000/01	N													N	
Longline fishery for *Dissostichus* spp. in Subarea 48.2																
	1997/98	<1	<1													
	2000/01	N													N	
Jig fishery for *Martialia hyadesi* in Subarea 48.3																
	1995/96	52		52												
	1996/97	81		81												
	1997/98	0		x												
	1998/99	0														
	1999/00	0														
	2000/01	N		N												
Longline fishery for *Dissostichus* spp. in Subarea 48.6																
	1996/97	0			x											
	1997/98	0			x	x										
	1998/99	<1			<1											
	1999/00	0			x									x		
	2000/01	N			N										N	N
Longline fishery for *Dissostichus* spp. in Division 58.4.1																
	2000/01	N													N	
Trawl fishery for *Dissostichus* spp. in Division 58.4.1																
	1998/99	<1					<1									
Trawl fishery for *Dissostichus* spp. in Division 58.4.3																
	1995/96	0					x									
	1996/97	<1					<1									
	1997/98	0					x									
	1998/99	<1					<1									

(continued)

Table 20 (continued)

Fishery	Season	Total Reported Catch (tonnes)	Chile	Korea/ UK	South Africa	Norway	Australia	France	Uruguay	Ukraine	Spain	Russia	New Zealand	EC (Portugal)	Argentina	Brazil
Trawl fishery for *Dissostichus* spp. in Division 58.4.1/58.4.3 (BANZARE and Elan Banks)																
	1999/00	<1					<1									
	2000/01	N					N									
Trawl fishery for *Chaenodraco wilsoni* and other species in Division 58.4.2																
	1999/00	<1					<1									
	2000/01	N					N									
Longline fishery for *Dissostichus* spp. in Division 58.4.2																
	2000/01	N													x	
Longline fishery for *Dissostichus* spp. in Division 58.4.3																
	1996/97	0			x		x									
	1997/98	0			x											
	1998/99	0						x								
	1999/00	0						x						x		
	2000/01	N						N							N	
Longline fishery for *Dissostichus eleginoides* in Division 58.4.4																
	1997/98	0			x					x						
	1998/99	0			x			x	x		x					
	1999/00	99	x		x			x	99					x		
	2000/01	N			N			N	N	N					N	N
Longline fishery for *Dissostichus eleginoides* in Division 58.5.1																
	2000/01	N						N							N	N
Longline fishery for *Dissostichus eleginoides* in Division 58.5.2																
	2000/01	N						N								N
Trawl fishery for deep-water species in Division 58.5.2																
	1995/96	<1					<1									
	1996/97	0					x									

(continued)

Table 20 (continued)

Fishery	Season	Total Reported Catch (tonnes)	Chile	Korea/ UK	South Africa	Norway	Australia	France	Uruguay	Ukraine	Spain	Russia	New Zealand	EC (Portugal)	Argentina	Brazil
Longline fishery for *Dissostichus eleginoides* in Subarea 58.6																
	1996/97	0			x											
	1997/98	1			1					x		x				
	1998/99	0			<1			x								
	1999/00	14	x		11			3						x		
	2000/01	N			N			N							N	
Longline fishery for *Dissostichus eleginoides* in Subarea 58.7																
	1995/96	0			x											
	1996/97	0			x											
	1997/98	<1			<1					x		x				
	1998/99	0			x											
	2000/01	N						N								
Longline fishery for *Dissostichus* spp. in Subarea 88.1																
	1996/97	<1											<1			
	1997/98	39											39			
	1998/99	298											298			
	1999/00	745	x										745	x		
	2000/01	N			N				N				N		N	
Longline fishery for *Dissostichus* spp. in Subarea 88.2																
	1996/97	<1											<1			
	1997/98	0											x			
	1999/00	0	x											x		
	2000/01	N			N				N						N	
Longline fishery for *Dissostichus* spp. in Subarea 88.3																
	1997/98	<1	<1													
	2000/01	N							N						N	

Table 21: Catch of *Dissostichus* spp. and number of hauls undertaken in each small-scale research unit (see Table 1 and Figure 1 of Conservation Measure 182/XVIII, Annex B). Source of data: 5-day catch and effort reports and fine-scale data submitted by 7 October 2000.

SSRU	Catch (tonnes)		Number of Hauls Reported	
			Total	Research
Exploratory longline fishery for *Dissostichus eleginoides* in Division 58.4.4				
A (51–54°S, 40–42°E)	17	catch >10 tonnes, research required	20	no data
C (51–54°S, 46–50°E)	16	catch >10 tonnes, research required	10	no data
B (51–54°S, 42–46°E)	12	catch >10 tonnes, research required	3	no data
Other grounds	55	no research requirements	35	no data
Exploratory longline fishery for *Dissostichus eleginoides* in Subarea 58.6				
A (45–48S, 40–44°E)	9.9	catch <10 tonnes and hauls <10?	8[1]	0
B (45–48S, 44–48°E)	1	catch <10 tonnes and hauls <10?	1[1]	0
Exploratory longline fishery for *Dissostichus* spp. in Subarea 88.1 (south of 65°S)				
A (72–84°S, 170°W–180)	310	catch >10 tonnes, research required	200	26
B (72–84°S, 171°E–180)	159	catch >10 tonnes, research required	136	52
C (65–72°S, 170°W–180)	230	catch >10 tonnes, research required	135	20
D (65–72°S, 150°E–180)	47	catch >10 tonnes, research required	18	2
Exploratory trawl fishery for *Dissostichus* spp. in Division 58.4.2				
C (>62°S, 60–70°E)	0	catch <10 tonnes and hauls <10	1	0

[1] Dataset incomplete

Table 22: Parameters input to the GYM for evaluation of γ for the exploratory fishery for *Dissostichus mawsoni* in Subarea 88.1.

Category	Parameter	*D. mawsoni* Subarea 88.1 Longline
Age structure	Recruitment age	4
	Plus class accumulation	35
	Oldest age in initial structure	55
Recruitment	SD $\log_e$(recruits)	0.803
Natural mortality	Mean annual M	0.15–0.22
von Bertalanffy growth	Time 0	0.37
	L_∞	180.26
	k	0.095
Weight at age	Weight–length parameter – A	0.000005
	Weight–length parameter – B	3.199
Maturity	L_{m50}	100.0
	Range: 0 to full maturity	30.0
Spawning season		01/08
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	1997
	Reference start date in year	01/12
	Increments in year	180
	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	Length, 50% recruited	80.0
	Range over which recruitment occurs	30.0

Table 23: Assessment of long-term annual yield for the exploratory fishery for the *Dissostichus mawsoni* in Subarea 88.1 based on four different estimates of seabed area. Ratios are the ratio of seabed area between Subareas 88.1 and 48.3 based on the appropriate depth range.

	Subarea 48.3		Subarea 88.1			
	Total (600–1 800 m)	Recruited (0–500 m)	Total (600–1 800 m)	Recruited (0–500 m	Fished (600–1 800 m)	Proposed Fished (600–1 800 m)
Seabed areas (km^2)	32 035	42 753	236 391	202 022	49 692	77 158
Seabed area ratios (88.1/48.3)	-	-	7 382	4 725	1 552	2 409
Yields			17 204	11 013	3 616	5 615

Table 24: Summary of notifications of new and exploratory fisheries in 2000/01.

Member	Subarea or Division	Target Species	Gear	Summary (WG-FSA-00/6)
Argentina	48.1[1], 48.2[1], 48.6, 58.4.1, 58.4.2, 58.4.3, 58.4.4, 58.5.1, 58.6, 88.1, 88.2, 88.3	*Dissostichus* spp.	Longline	Table C2
Australia	58.4.1, 58.4.3	*Dissostichus* spp.	Trawl	Table C3
Australia	58.4.2	Mixed species	Trawl	Table C4
Brazil	48.6, 58.5.1, 58.5.2, 58.4.4	*Dissostichus eleginoides*	Longline	Table C5
France	58.6, 58.7[2], 58.4.3, 58.4.4, 58.5.1, 58.5.2	*Dissostichus eleginoides*	Longline	Table C6
New Zealand	88.1	*Dissostichus* spp.	Longline	Table C7
South Africa	48.6, 58.4.4, 58.6, 88.1, 88.2	*Dissostichus* spp.	Longline	Table C8
Ukraine	58.4.4	*Dissostichus eleginoides*	Longline	Table C9
Uruguay	48.3	*Dissostichus* spp.	Pots	Table C10
Uruguay	58.4.4, 88.1, 88.2, 88.3	*Dissostichus* spp.	Longline	Table C11
Uruguay	48.3	Crab	Pots	Table C12
UK, Republic of Korea	48.3	*Martialia hyadesi*	Jig	Table C13

[1] In accordance with Conservation Measure 73/XVII, directed fishing for finfish in Subarea 48.2 is prohibited until such time as a survey of stock biomass is carried out and a decision to reopen the fishery is made by the Commission based on advice of the Scientific Committee.

[2] In accordance with Conservation Measure 160/XVII, taking of *Dissostichus eleginoides* in Subarea 58.7 is prohibited other than for scientific research purposes. The prohibition shall apply until at least such time that a survey of the *D. eleginoides* stock in this subarea is carried out and a decision to reopen the fishery is made by the Commission based on advice of the Scientific Committee.

Table 25: Summary of intended catches and number of vessels per area in new/exploratory fisheries notifications for *Dissostichus* spp. in the 2000/01 season. In each cell: top figure – number of vessels nominated; middle letter L – longline, T – trawl; bottom figure – intended catch.

Country	48.1	48.2	48.3	48.4	48.6	58.4.2	58.4.1/58.4.3	58.4.4	58.5.1	58.5.2	58.6	58.7	88.1	88.2	88.3	No. Vessels	Intended Catch
Argentina	L	L			L	L	L	L	L*		L*		L	L	L	3	CCAMLR-XIX
Australia						2 T 500 t	2 T 145 t Elan 150 t BANZARE									2	
Brazil		L	L	L	L			L	L*	L*						2	Not stated
France							L**	L	L*	L*	L*	L				3	500 t per vessel
New Zealand													3 L 2 090 t			3	
South Africa					Up to 3 L <500 t			Up to 3 L <60 t			Up to 3 L* <100 t		Up to 2 L <560 t	Up to 2 L <60 t		3	
Ukraine								1 L <500 t								1	
Uruguay								L					L	L	L	2	CCAMLR-XIX
Total notifications	1	2	1	1	3	2	3	6	3	2	3	1	4	3	2		
Maximum no. of vessels	3	5	2	2	8	5	8	14	8	5	9	3	10	7	5		
Catch limit set at CCAMLR-XVIII	0	0	5 310 t	28 t	455 t	Trawl 500 t	Trawl: 145 t Elan 150 t BANZARE Longline: 250 t Elan 300 t BANZARE	370 t (N of 60˚S)	0[a]	0[a]	450 t	0	175 t (N of 65˚S) 1 915 t (S of 65˚S)	250 t (S of 65˚S)	0		

* Outside EEZs
** French proposal is for Division 58.4.3 only

[a] Based on Scientific Committee advice that these fisheries are unlikely to be viable.

Table 26: Frequency of catches of *Dissostichus* spp. by fine-scale rectangles for new and exploratory fisheries.

Fishery	Catch (tonnes)	Fishing Season				
		All	1996/97	1997/98	1998/99	1999/00
Exploratory longline fishery for *Dissostichus eleginoides* in Division 58.4.4	0–10	3				3
	10–20	2				2
	20–30	1				1
	30–40	1				1
Exploratory longline fishery for *Dissostichus eleginoides* in Subarea 58.6 (outside EEZs)	0–10	4		1		3
Exploratory longline fishery for *Dissostichus eleginoides* in Subarea 58.7 (outside EEZ)	0–10	1		1		
Exploratory longline fishery for *Dissostichus* spp. in Subarea 88.1 (south of 65°S)	0–10	76		25	29	22
	10–20	15		1	3	11
	20–30	6			1	5
	30–40	5			4	1
	50–60	2				2
	60–70	2				2
	80–90	1				1
Exploratory trawl fishery for *Dissostichus* spp. in Division 58.4.3	0–10	2			2	
New longline fishery for *Dissostichus* spp. in Subarea 88.1	0–10	1	1			
New longline fishery for *Dissostichus* spp. in Subarea 88.3 (south of 65°S)	0–10	9		9		
New trawl fishery for *Dissostichus* spp. in Division 58.4.3	0–10	1	1			

Table 27: Standardised series of CPUEs in kg/hook for *Dissostichus eleginoides* in Subarea 48.3.

Season	Std. CPUE	SE
1986/87	0.551	0.025
1987/88	0.693	0.029
1988/89	0.517	0.027
1989/90	-	-
1990/91	0.504	0.022
1991/92	0.719	0.015
1992/93	0.712	0.016
1993/94	0.559	0.022
1994/95	0.606	0.012
1995/96	0.355	0.007
1996/97	0.267	0.006
1997/98	0.273	0.007
1998/99	0.309	0.007
1999/00	0.348	0.007

Table 28: Proportions of non-zero catches by season in the haul-by-haul data for *Dissostichus eleginoides* in Subarea 48.3.

Season	Proportion
1985/86	0.977
1986/87	0.976
1987/88	0.975
1988/89	1.000
1989/90	-
1990/91	0.960
1991/92	0.965
1992/93	0.972
1993/94	0.946
1994/95	0.993
1995/96	0.978
1996/97	0.977
1997/98	0.981
1998/99	0.988
1999/00	0.984

Table 29: Estimates of lengths from the analysis of changes in selectivity by season for *Dissostichus eleginoides* in Subarea 48.3.

	1995	1997	1998	1999	2000	1992–2000	1998–2000
L5%	77.2	68.0	64.8	67.0	65.7	67.9	64.4
L10%	80.9	71.2	67.6	69.2	67.9	71.0	67.6
L25%	86.4	75.7	71.8	72.4	71.2	75.6	72.2
L50%	91.8	80.3	75.9	75.7	74.4	80.2	76.8
L75%	97.3	84.9	80.0	78.9	77.6	84.7	81.5
L90%	102.8	89.5	84.1	82.2	80.8	89.3	86.1
L95%	106.5	92.7	86.9	84.4	83.0	92.4	89.3
Range 10–90	21.9	18.4	16.4	13.0	12.9	18.3	18.5
Range 25–75	10.9	9.2	8.2	6.5	6.4	9.2	9.3

Table 30: Trawl surveys from which length-density data were generated at this meeting.

Split-year	Survey	Vessel	Timing
1986/87	US/Polish	*Profesor Siedlecki*	November–December 1986
1987/88	US/Polish	*Profesor Siedlecki*	December 1987–January 1988
1989/90	UK	*Hill Cove*	January 1990
1989/90	USSR	*Anchar*	April–June 1990
1990/91	UK	*Falklands Protector*	January 1991
1991/92	UK	*Falklands Protector*	January 1992
1993/94	UK	*Cordella*	January–February 1994
1993/94	Argentina	*Dr Eduardo L. Holmberg*	February–March 1994
1994/95	Argentina	*Dr Eduardo L. Holmberg*	February–March 1995
1995/96	Argentina	*Dr Eduardo L. Holmberg*	March–April 1996
1996/97	Argentina	*Dr Eduardo L. Holmberg*	March–April 1997
1996/97	UK	*Argos Galicia*	September 1997
1999/00	UK	*Argos Galicia*	January–February 2000
1999/00	USSR	*Atlantida*	February 2000

Table 31: Results of mixture analyses from 1999 including the 2000 UK survey, analysed with the parameters used in 1999. Densities are in numbers of fish per km^2 derived from surveys covering the period 1986/87 to 1999/2000 (assuming a split-year of 1 December to 1 November). The mean lengths at age are specified in SC-CAMLR-XVIII, Annex 5, Table 36.

Survey	Age	Density	SD	Observed Density	Expected Density
1987 US/Polish survey Nov–Dec 86	3.12	20.4784	7.08769	49.7674	47.2886
	4.12	26.9235	4.42636		
1988 US/Polish survey Dec 87–Jan 88	4.21	14.4966	11.2833	21.3409	22.0951
	5.21	8.66871	12.5805		
1990 UK survey Jan 90	3.21	165.111	116.813	468.472	473.282
	4.21	195.885	105.115		
	5.21	85.0901	42.0315		
	6.21	32.3369	19.7487		
1991 UK survey Jan 91	2.21	199.169	121.561	578.823	199.007
1992 UK survey Jan 92	3.21	281.373	174.354	287.62	281.167
1994 Argentine survey Feb–Mar 94	3.33	2.61879	2.65314	48.029	49.578
	4.33	47.3539	9.32859		
1994 UK survey Feb–Mar 94	3.21	36.2709	20.0802	122.462	125.88
	4.21	89.8471	32.6139		
1995 Argentine survey Feb–Mar 95	3.33	8.25306	5.16069	60.5409	65.5784
	4.33	21.9359	9.22319		
	5.33	35.7098	8.83209		
1996 Argentine survey Mar–Apr 96	3.41	114.138	39.7255	167.895	167.867
	4.41	18.0444	5.33346		
	5.41	22.2229	6.7232		
	6.41	17.4433	5.76246		
1997 UK survey Sep 97	3.88	52.9244	32.2021	100.425	111.622
	4.88	45.7511	33.2331		
	5.88	13.6754	16.6639		
1997 Argentine survey Mar–Apr 97	2.41	13.0348	6.78435	122.912	124.561
	3.41	26.3148	8.31875		
	4.41	46.2928	13.4333		
	5.41	16.3421	6.77879		
	6.41	14.8633	4.56242		
	7.41	8.15623	4.48682		
2000 UK survey Jan/Feb 00	1.21	28.0208	17.1977	140.284	125.958
	2.21	59.9535	25.1203		
	3.21	38.2432	11.58		

Table 32: Results of mixture analyses for 2000 using k = 0.041 as a guide (see text for details). Densities are in numbers of fish per km^2 derived from surveys covering the period 1986/87 to 1999/2000 (assuming a split-year of 1 December to 1 November).

Survey	Age	Density	SD	Observed Density	Expected Density
1987 US/Polish survey Nov–Dec 86	5.12	16.4201	7.51189	49.7674	50.7646
	6.12	6.55312	5.04633		
	7.12	25.5005	4.44284		
	8.12	2.34475	1.78873		
1988 US/Polish survey Dec 87–Jan 88	6.21	10.2775	5.2341	21.3409	22.3224
	7.21	9.35829	5.08739		
	8.21	2.79209	3.79403		
1990 UK survey Jan 90	6.21	157.113	101.632	468.472	469.398
	7.21	211.168	100.404		
	8.21	20.0624	25.4541		
	9.21	42.0502	27.522		
	10.21	40.7181	19.3791		
1991 UK survey Jan 91	4.21	134.026	70.4781	578.823	159.452
	5.21	25.503	34.8016		
1992 UK survey Jan 92	5.21	261.338	74.614	287.62	273.139
	6.21	12.022	26.2761		
1994 Argentine survey Feb–Mar 94	6.33	7.35597	3.19371	48.029	45.5537
	7.33	21.4435	9.91993		
	8.33	16.7597	9.89185		
1994 UK survey Feb–Mar 94	6.25	36.2737	20.0839	122.462	125.894
	7.25	89.8582	32.6145		
1995 Argentine survey Feb–Mar 95	5.33	13.8755	12.2588	60.5409	65.8605
	6.33	0.000103	0.003585		
	7.33	25.1863	8.16832		
	8.33	31.8978	8.09693		
1996 Argentine survey Mar–Apr 96	4.41	28.4174	9.9149	202.119	193.396
	5.41	108.184	36.6056		
	6.41	2.21E-06	6.06E-06		
	7.41	15.9357	7.25606		
	8.41	16.3485	8.20869		
	9.41	24.6925	8.10416		
1997 UK survey Sep 97	5.88	7.6774	15.9115	101.464	102.653
	6.88	42.5386	33.1305		
	7.88	30.0979	30.1309		
	8.88	10.4395	13.8247		
	9.88	12.0209	14.4493		
1997 Argentine survey Mar–Apr 97	4.41	14.0384	10.017	122.912	125.534
	5.41	25.1256	9.80466		
	6.41	1.1E-05	5.27E-05		
	7.41	57.7507	20.3484		
	8.41	4.81903	13.0498		
	9.41	24.4348	9.33683		
2000 UK survey Jan/Feb 00	2.21	26.8968	15.3732	140.284	127.461
	3.21	0.674774	0		
	4.21	61.5829	28.4046		
	5.21	17.8197	13.9575		
	6.21	21.6946	15.7049		

Table 33: Time series of recruitments (millions of fish) from the 1999 assessment and for the revised assessments this year guided by the growth parameters from 1999 (k = 0.066) and by k = 0.041 from Heard Island. See text for details about how recruitments were adjusted.

Year Class	Year Age 4	1999 Assessment	k = 0.066	k = 0.041
1979	1983			2.153
1980	1984			1.011
1981	1985			0.776
1982	1986	1.146	1.108	11.241
1983	1987	0.722	0.747	7.705
1984	1988	4.106	4.377	no obs
1985	1989	8.055	8.282	1.332
1986	1990	5.786	5.739	5.039
1987	1991	no obs	no obs	1.587
1988	1992	10.190	5.815	0.072
1989	1993	2.061	2.053	1.503
1990	1994	0.961	1.006	3.310
1991	1995	0.701	0.718	1.183
1992	1996	2.649	2.405	0.583
1993	1997	1.119	0.962	1.173
1994	1998		0.386	0.888
1995	1999		no obs	2.827
1996	2000		1.496	0.003
1997	2001		1.927	1.048
1998	2002		- [1]	
	Mean	3.185	2.517	2.413
	SD	3.219	2.395	2.901
	CV	1.011	0.951	1.202
	n	11	15	18

[1] See SC-CAMLR-XIX, paragraphs 5.45 and 5.46.

Table 34: Input parameters for the GYM to assess the long-term annual yield of *D. eleginoides* taken by longline in Subarea 48.3 and trawl in Division 58.5.2.

Category	Parameter	Subarea 48.3 Longlining	Division 58.5.2 Trawling
Age structure	Recruitment age	4	4
	Plus class accumulation	35	35
	Oldest age in initial structure	55	55
Recruitment	Mean $\log_e$(recruits)	14.481[1]	14.744
	SE of mean $\log_e$(recruits)	0.209[1]	0.256
	SD $\log_e$(recruits)	0.783[1]	0.993
Natural mortality	Mean annual M	0.132–0.198	0.083–0.124
von Bertalanffy growth	Time 0	-0.21	-1.80
	L_∞	194.6	1946.0
	k	0.066	0.04114
Weight at age	Weight-length parameter – A	0.000025	2.59E-09
	Weight-length parameter – B	2.8	3.2064
Maturity	L_{m50}	93.0	
	Range: 0 to full maturity	78–108	
	Maturity at age		0(0), 4.6(0), 5.4(0.005), 6.2(0.009), 7.1(0.025), 8.0(0.048), 9.0(0.066), 10.0(0.129), 11.0(0.150), 12.1(0.202), 13.2(0.296), 14.4(0.389), 15.6(0.677), 16.9(0.8), 18.3(0.909), 19.8(0.923), 23.0(1.0)
	Length, 50% are mature		
	Range over which maturity occurs	30.0	
Spawning season		1 Aug–1 Aug	1 Jul–1 July
Simulation characteristics	Number of runs in simulation	1001	1001
	Depletion level	0.2	0.2
	Seed for random number generator	-24189	-24189
Characteristics of a trial	Years to remove initial age structure	1	1
	Observations to use in median SB_0	1001	1001
	Year prior to projection	1988	1996
	Reference start date in year	01/12	01/12
	Increments in year	365	365
	Vector of known catches	8.501e6 4.206e6 7.309e6 5.589e6 6.605e6 6.171e6 4.362e6 2.619e6 3.201e6 4.3e6 5.5e6	18.96e6 3.913e6 3.628e6 4.385e6
	Years to project stock in simulation	35	35
	Reasonable upper bound for annual F	5.0	5.0
	Tolerance for finding F in each year	0.000001	0.000001

[1] See SC-CAMLR-XIX, paragraphs 5.45 and 5.46.

(continued)

Table 34 (continued)

Category	Parameter	Subarea 48.3 Longlining	Division 58.5.2 Trawling
Fishing mortality	Length, 50% recruited	67.0 cm	
	Range over which recruitment occurs	55–79 cm	
	Fishing selectivity with age		0(0.), 3(0), 3.92(0.016), 4.88(0.207), 5.54(0.473), 5.88(0.512), 6.57(0.708), 7.29(0.886), 7.65(0.909), 8.02(0.745), 8.40(0.691), 8.78(0.642), 9.56(0.485), 9.96(0.325), 10.37(0.222), 11.2(0.099), 11.63(0.066), 12.07(0.049), 12.51(0.033), 13.43(0.014), 14.87(0.011), 16.40(0.008), 21.04(0.005), 25.21(0.002), 31.0(0.0)

Table 35: Standardised CPUE values (number/hook) for longliners in the Kerguelen Islands.

Season	Standard CPUE	SE Standard CPUE
1996	0.0624	0.0055
1997	0.2029	0.0102
1998	0.2565	0.0090
1999	0.1946	0.0093

Table 36: Abundances of fish (millions) at age 4 (birthday 1 November of the year indicated).

Year Class	Year at Age 4	Abundance (millions of fish)
1983	1987	1.550
1984	1988	1.590
1985	1989	3.649
1986	1990	1.956
1987	1991	1.793
1988	1992	4.575
1989	1993	2.435
1990	1994	2.944
1991	1995	5.674
1992	1996	9.548
1993	1997	21.557
1994	1998	3.440
1995	1999	1.059
1996	2000	0.241
1997	2001	0.152
	Mean	4.144
	SD	5.374
	CV	1.297
	N	15

Table 37: Summary of standing stock estimates (tonnes) from bottom trawl surveys in Subarea 48.3 undertaken during the 1999/2000 season.

Shelf	Method	*Argos Galicia* Survey (UK)			*Atlantida* Survey (Russia)		
		Biomass (CV%)	Lower 95%CI	Upper 95% CI	Biomass	Lower 95%CI	Upper 95% CI
South Georgia	Swept Area	10 925 (33%)			45 633.3		
	Trawl CI	9 667	6 551	19 421	85 075		
Shag Rocks	Swept Area	13 859 (87%)			2 192.48		
	Trawl CI	11 540	3 039	2.19E+12	2 231		
Subarea 48.3 (total)	Swept Area	24 784			47 811 (27.2%)		
	Trawl CI	21 027			87 308.5	22 885.3	2.241E+12

Table 38: Lower one-sided 95% confidence bound of biomass from the UK and Russian surveys in 1999/2000.

Survey	Lower One-sided 95% Confidence Bound (tonnes)
UK Survey, Subarea 48.3	8 916.0
Russian Survey, Subarea 48.3	28 098.1

Table 39: Distribution of numbers of fish at age (%) from the UK and Russian surveys based on length densities analysed using CMIX and an age-length key (ALK) from the Russian survey.

Survey		UK Survey	Russian Survey	Russian Survey
Subarea		48.3	48.3	48.3
Method		Length Density + CMIX	Swept Area + ALK	Length Density + CMIX
Numbers at age	1	17	1	0
	2	28	55	48
	3	15	25	36
	4	36	9	8
	5	4	6	8
	6	0	4	0

Table 40: Lower one-sided 95% confidence bound of biomass from the combined survey dataset.

Stratum		No. of Valid Hauls	Mean Biomass	SE	Two-sided Lower 95% CI	Two-sided Upper 95% CI	One-sided Lower 95% Confidence Bound
S1	SGNW <150 m	6	94.7	33.4	37.5	159.2	46.5
S2	SGNW 150–<250 m	8	23 895.7	12 724.0	5 380.7	49 395.2	6 981.4
S3	SGNE <150 m	2	3 903.5	1 773.2	2 130.3	5 676.6	2 130.3
S4	SGNE 150–<250 m	17	3 308.6	1 699.6	665.8	6 982.2	805.4
S5	SGSE <150 m	9	3 380.0	2 632.7	341.4	8 759.9	436.1
S6	SGSE 150–<250 m	9	2 144.2	1 570.3	465.3	5 334.6	490.9
S7	SGSW <150 m	0					
S8	SGSE 150–<250 m	19	13 272.9	3 515.0	6 851.2	20 304.7	7 782.5
S9	SR <150 m	10	5 709.3	4 802.3	154.4	15 457.1	245.5
S10	SR 150–<250 m	9	1 431.3	787.4	174.4	3114.3	238.4
S11	all 250–<500 m	33	1 046.8	314.6	498.6	1 695.8	572.5
All strata combined		122	58 186.9	15 999.2	31 712.0	94 072.9	35 084.6

Table 41: Results of the CMIX analysis for the combined survey dataset.

Sum of the observed densities =	15 465.8			
Sum of the expected densities =	14 603			
ANI00AL4	Component 1	Component 2	Component 3	Component 4
Means of mixture components (mm)	222.42	275.484	325.88	378.969
Standard deviations of mixture components	14.3441	15.4643	16.5282	17.6489
Total density of each mixture component	8 904.77	3476.48	1 568.87	673.445
SD of each mixture component density	2 992.47	1 100.89	535.958	316.301
Parameters of linear standard deviations				
Intercept = 9.64883				
Slope = 0.211101E-01				
Cohorts not fitted in the analysis:	Length Range	Sum of Observed Densities		
Age 1:	115–175 mm	233.8241		
Plus class	415–595 mm	137.466		

Table 42: Inputs for the short term assessment.

Lower single sided 95% CI		35 085
Numbers at age	1	9 585 221
	2	365 035 908
	3	142 512 388
	4	64 313 159
	5	27 606 733
	6	0
Method		Length Density + CMIX
Natural mortality		0.42
Age when fully selected		3
Age when selection begins		2
Birthday (days since start of year)		245
Von Bertalanffy growth parameters		
	Time 0	0
	L_∞[1]	455
	K[1]	0.332
Weight length	a (kg)	6.17E-10
	b	3.388
Survey timing: days since start of year		32
Catch since survey (between survey and first year of projection)		0

[1] These values were chosen as 98% of the population had vanished by the time fish reached lengths of 42–44 cm. The true values of K were lower (0.15–0.2) and of L_∞ were higher (64–70 cm) for this population.

Table 43: Estimates of abundance (kg) of *Champsocephalus gunnari* at Heard Island and McDonald Islands in 2000 (from WG-FSA-00/40).

Stratum	No. of hauls	Value	SE	Lower CI	Upper CI
Plateau West	5	294 603	274 135	26 812	164 131 000
Plateau North	10	56 914	42 546	9 356	443 593
Gunnari Ridge	20	81 481 100	73 856 600	6 084 970	9 332 850 000
Plateau East	25	1 818 310	1 115 970	527 771	15 169 400
Shell Bank	15	722	722	0	0.176×10^{39}
All strata combined		83 594 000	73 865 500	7 958 670	9 334 950 000

Table 44: Parameters for the short-term assessment of yield from the Heard Plateau population of *Champsocephalus gunnari* (from WG-FSA-00/41).

Category	Parameter	*C. gunnari* Heard Plateau	Subarea 48.3
Survey details:	Survey date	20 May 2000	
	Biomass – lower 95% bound	6 522 tonnes	
Mean length at age at time of survey	Age 2	245	
	Age 3	324	
Age structure (density n.km^2)	Age 2	18 361	
	Age 3	48	
Biological parameters:	Birthday	1 November	
Von Bertalanffy growth	Time 0	0.234	
	L_∞	411 mm	
	k	0.41	
Weight at age	Weight-length parameter A	2.6 x 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 45: By-catch (tonnes) reported in the fine-scale data (FS), catch and effort reports (CE) and observer data (OBS) for fisheries in the 1999/2000 season.

Fishery	By-catch (tonnes)		
	FS	CE	OBS
Chaenodraco wilsoni			
Trawl fishery in Division 58.4.2	0	0	e
Champsocephalus gunnari			
Trawl fishery in Division 58.5.1	4	no data	no data
Trawl fishery in Division 58.5.2	3	17[a]	25[d]
Trawl fishery in Subarea 48.3	0	68	68
Dissostichus mawsoni			
Trawl fishery in Division 58.4.2	0	0	[e]
Dissostichus eleginoides			
Longline fishery in Division 58.4.4	14	0	6
Longline fishery in Division 58.5.1	255	no data	no data
Longline fishery in Subarea 48.3	18	4	85
Longline fishery in Subarea 58.6	81[b]	10[c]	200[c]
Longline fishery in Subarea 88.1	118	115	143
Trawl fishery in Division 58.5.1	8	no data	no data
Trawl fishery in Division 58.5.2	10	49[a]	25[d]
Euphausia superba			
Trawl fishery in Area 48	0	0	0

a Incomplete
b From French EEZ
c Excluding French EEZ
d Both fisheries
e Combined data with Division 58.5.2

Table 46: Overall species composition of catches reported by scientific observers in trawl and longline fisheries in the 1999/2000 season. The relative abundance of each taxon is expressed as the percentage, by weight, of the total catch observed. Data limited to those where weight provided. Target species: ANI – *Champsocephalus gunnari*; KRI – *Euphausia superba*; TOA – *Dissostichus mawsoni*; TOP – *Dissostichus eleginoides*; WIC – *Chaenodraco wilsoni*.

Gear	Trawl						Longline			
Target species	KRI	ANI	ANI	TOA	TOP	WIC	TOP	TOP	TOP	TOA
Subarea/Division	48.1	48.3	58.5.2	58.4.2	58.5.2	58.4.2	48.3	58.4.4	58.6/7	88.1
Elasmobranchs		<0.1								
Callorhinchidae										
Callorhinchus capensis									<0.1	
Laminidae										
Lamna nasus			0.5							
Rajidae			<0.1		<0.1		2.3	0. 9	0.7	<0.1
Amblyraja georgiana							<0.1		0.6	5.7
Bathyraja eatonii			0.2		0.2		<0.1			0.9
Bathyraja irrasa			<0.1		<0.1					
Bathyraja maccaini					<0.1	0.7			<0.1	
Bathyraja meridionalis							<0.1			
Bathyraja murrayi			<0.1		<0.1				<0.1	
Bathyraja spp.									<0.1	
Raja spp.							0.3			
Squalidae										
Etmopterus granulosus									<0.1	
Somniosus microcephalus									0.1	
Somniosus pacificus					0.2					
Bony Fishes										
Achiropsettidae										
Mancopsetta maculata					<0.1					
Artedidraconidae										
Artedidraco mirus										<0.1
Bathylagidae										
Bathylagus antarcticus					<0.1					
Bothidae					<0.1					
Bramidae										
Brama brama									<0.1	
Carapidae										
Echiodon cryomargarites									<0.1	
Ceratiidae										
Ceratias tentaculatus					<0.1					
Channichthyidae					<0.1		<0.1			<0.1
Chaenocephalus aceratus										<0.1
Chaenodraco wilsoni						1.1				
Champsocephalus gunnari		98.5	93.4		1.9		<0.1			
Channichthys rhinoceratus			4.0		<0.1					
Chionodraco hamatus						0.4				
Neopagetopsis ionah						1.4				
Pagetopsis macropterus										<0.1
Pseudochaenichthys georgianus					<0.1		<0.1			

(continued)

Table 46 (continued)

Gear	Trawl						Longline			
Target species	KRI	ANI	ANI	TOA	TOP	WIC	TOP	TOP	TOP	TOA
Subarea/Division	48.1	48.3	58.5.2	58.4.2	58.5.2	58.4.2	48.3	58.4.4	58.6/7	88.1
Congiopodidae										
Zanclorhynchus spinifer					<0.1					
Gempylidae										
Paradiplospinus antarcticus					<0.1					
Paradiplospinus gracilis					<0.1					
Harpagiferidae										
Pogonophryne permitini										<0.1
Pogonophryne spp.										<0.1
Lampridae										
Lampris immaculatus					<0.1					
Macrouridae										
Macrourus carinatus			<0.1		<0.1		<0.1			7.9
Macrourus holotrachys					<0.1		0.1			
Macrourus spp.			<0.1		<0.1		0.9	18.2	19.4	<0.1
Macrourus whitsoni					<0.1	45.3	0.6		<0.1	0.5
Merlucciidae										
Macruronus novaezelandiae			<0.1		<0.1					
Moridae			<0.1		<0.1					
Antimora rostrata					<0.1		0.1	0.6	2.7	<0.1
Muraenolepididae										
Muraenolepis microps									<0.1	0.6
Muraenolepis orangiensis										<0.1
Muraenolepis spp.					<0.1				<0.1	0.2
Myctophidae					<0.1					
Electrona carlsbergi					<0.1					
Gymnoscopelus bolini		<0.1			<0.1					
Gymnoscopelus nicholsi		1.5			<0.1					
Notacanthidae										
Notacanthus chemnitzii					<0.1					
Nototheniidae							<0.1			<0.1
Dissostichus eleginoides			1.3		97.2		95.6	80.2	76.3	<0.1
Dissostichus mawsoni				86.6						84.1
Notothenia acuta			<0.1		<0.1					
Notothenia coriiceps			<0.1		<0.1					
Notothenia neglecta							<0.1			
Notothenia rossii					<0.1		<0.1			
Notothenia squamifrons			<0.1		0.2		<0.1			
Nototheniops mizops			<0.01		<0.1					
Nototheniops nudifrons							<0.1			
Pagothenia hansoni										
Patagonotothen brevicauda		<0.1					<0.1			
Pleuragramma antarcticum						2.0				
Trematomus eulepidotus						5.2				
Paralepididae										
Notolepis coatsi					<0.1					
Scorpaenidae							<0.1			

(continued)

Table 46 (continued)

Gear	Trawl						Longline			
Target species	KRI	ANI	ANI	TOA	TOP	WIC	TOP	TOP	TOP	TOA
Subarea/Division	48.1	48.3	58.5.2	58.4.2	58.5.2	58.4.2	48.3	58.4.4	58.6/7	88.1
Stomiidae										
Stomias boa boa					<0.1					
Zoarcidae										
Melanostigma spp.					<0.1					
Other					<0.01		<0.1		<0.1	
Invertebrates										
Euphausia spp.			<0.1							
Euphausia superba	100									
Lithodidae							<0.1		<0.1	
Lithodes murrayi							<0.1		<0.1	
Lithodes spp.								0.2		
Loliginidae		<0.1	<0.1		<0.1					
Moroteuthis ingens			<0.1		<0.1	4.9				
Octopodidae				13.4	<0.1	1.2				
Paralithodes spp.							<0.1			
Paralomis anamerae							<0.1		<0.1	
Paralomis formosa							<0.1			
Paralomis spinosissima							<0.1			
Paralomis spp.							<0.1			
Other			0.4		0.1	38.0	<0.1		<0.1	

Table 47: Summary of seabirds at risk from longline fisheries in the Convention Area indicating the populations where population monitoring (PM) and foraging ecology (FE) studies are currently being undertaken (information extracted from documents cited in SC-CAMLR-XVIII, Annex 5, paragraph 7.7; also Gales, 1998; Marchant and Higgins, 1990).

Species	Species Status[1]	Study Location	Annual Pairs	Year Commenced	Objectives PM	Objectives FE
Wandering albatross	Vulnerable	South Georgia	2 178	1972	√	√
Diomedea exulans		Crozet	1 734	1966	√	√
		Kerguelen	1 455	1973	√	√
		Macquarie	10	1994	√	
				1998		√
		Marion	1 794	1979	√	√
		Prince Edward	1 277			
Antipodean albatross	Vulnerable	Auckland	65	1991	√	√
Diomedea antipodensis		Adams	5 762			
		Antipodes	5 148	1994	√	√
Amsterdam albatross	Critically	Amsterdam	13	1983	√	√
Diomedea amsterdamensis	Endangered					
Southern royal albatross	Vulnerable	Campbell	7 800	1995	√	√
Diomedea epomophora						
Northern royal albatross	Endangered	Chatham	5 200	1990s	√	√
Diomedea sanfordi		Taiaroa	18	1950s	√	√
				1993		√
Grey-headed albatross	Vulnerable	South Georgia	54 218	1976	√	√
Diomedea chrysostoma		Diego Ramirez	10 000	1999	√	√
		Macquarie	84	1994	√	
				1999		√
		Campbell	6 400	1987	√	
				1995		√
		Marion	6 217	1984	√	√
		Prince Edward	1 500			
		Kerguelen	7 900			
Black-browed albatross	Near	South Georgia	96 252	1976	√	√
Diomedea melanophrys	Threatened	Falklands/Malvinas	550 000	1990	√	
				1998		√
		Diego Ramirez	32 000	1999	√	√
		Kerguelen	3 115	1978	√	√
		Macquarie	38	1994	√	
				1999		√
		Antipodes	100	1995	√	
		Heard, McDonald	750			
		Crozet	980			
Campbell albatross	Vulnerable	Campbell	26 000	1987	√	
Diomedea impavida				1995		√
Indian yellow-nosed albatross	Vulnerable	Amsterdam	25 000	1978	√	√
Diomedea chlororhynchos		Prince Edward	7 000			
		Crozet	4 430			

(continued)

Table 47 (continued)

Species	Species Status[1]	Study Location	Annual Pairs	Year Commenced	Objectives PM	Objectives FE
Buller's albatross	Vulnerable	Snares	8 460	1992	√	√
Thalassarche bulleri		Solander	4 000–5 000	1992	√	√
Chatham albatross	Critically	Chatham	4 000	1998		√
Thalassarche eremita	Endangered					
Salvin's albatross	Vulnerable	Bounty	76 000	1998	√	
Thalassarche salvini		Snares	650			
White-capped albatross	Vulnerable	Antipodes	75	1995	√	
Thalassarche steadi		Disappointment	72 000			
		Adams	100			
		Auckland	3 000			
Light-mantled albatross	Near	Macquarie	1 100	1993	√	
Phoebetria palpebrata	Threatened			1998		√
		Crozet	2 151	1966	√	√
		South Georgia	6 500			
		Marion	201			
		Kerguelen	3 000–5 000	1994	√	
		Heard, McDonald	500-700			
		Auckland	5 000			
		Campbell	>1 500	1995	√	
		Antipodes	<1 000			
Sooty albatross	Vulnerable	Crozet	2 298	1968	√	√
Phoebetria fusca		Amsterdam	300-400	1992	√	√
		Tristan da Cunha	2 750			
		Gough	5 000–10 000	2 000	√	√
		Prince Edward	700			
		Marion	2 055			
Southern giant petrel	Vulnerable	South Georgia	5 000	1980	√	
Macronectes giganteus				1998		√
		Macquarie	2 300	1994	√	
		Crozet	1 017	1981	√	
		Marion		1984	√	√
		Adélie Land	9–11	1964	√	
		South Sandwich	800			
		Gough				
		Prince Edward	3 000			
		Kerguelen	3–5			
		Heard	2 350			
		South Orkney	8 755	1976	√	
		South Shetland	7 185			
		Enderby Land	no estimate			
		Frazier	250			
		Antarctic Peninsula	1 125			
		Falklands/Malvinas	5 000			

(continued)

Table 47 (continued)

Species	Species Status[1]	Study Location	Annual Pairs	Year Commenced	Objectives PM	Objectives FE
Northern giant petrel	Near	South Georgia	3 000	1980	√	
Macronectes halli	Threatened		1 280	1998		√
		Macquarie	1 313	1994	√	
		Crozet		1981	√	
		Marion	500	1984	√	√
		Prince Edward				
		Kerguelen	1 450–1 800	1986	√	
		Auckland	no estimate			
		Campbell	230+			
		Antipodes	320			
		Chatham	no estimate			
White-chinned petrel	Vulnerable	South Georgia	2 000 000	1995–98	√	√
Procellaria aequinoctialis		Crozet	10 000s	1968	√	√
		Prince Edward	10 000s	1996	√	√
		Falklands/Malvinas	1 000–5 000			
		Kerguelen	100 000s			
		Auckland, Campbell, Antipodes	10 000–50 000			
Grey petrel	Near	Gough	100 000s			
Procellaria cinerea	Threatened	Tristan da Cunha	1 000s			
		Prince Edward	1 000s			
		Crozet	1 000s			
		Kerguelen	1 000s			
		Campbell	10 000s			
		Antipodes	10 000s			
		Macquarie	<100			

[1] As classified using IUCN criteria for threatened species. (Birdlife International. 2000. *Threatened Birds of the World.* BirdLife International/Lynx-Edicions, Barcelona; see WG-FSA-00/34).

Table 48: Incidental mortality of seabirds in the longline fisheries for *Dissostichus eleginoides* in Subareas 48.3, 58.6, 58.7 and 88.1 during the 1998/99 season. Sp – Spanish method; Auto – autoliner; N – night-time setting; D – daytime setting (including nautical dawn and dusk); O – opposite side to hauling; S – same side as hauling. * – Data obtained from observer cruise reports.

Vessel	Dates of Fishing	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 (%)
									%	%	Dead		Alive		Total					%		
			N	D	Total	%N	Obs.	Set	Observed		N	D	N	D	N	D	N	D	Total	N	D	
Subarea 48.3																						
Argos Georgia	1/6–20/7/00	Sp	153	4	157	97	234.1	586.5	39	100	0	0	0	0	0	0	0	0	0	83	100	O (100)
*Argos Helena**	1/5-21/7/00	Sp									0	0	0	0	0	0	0	0	0			
Faro de Hercules	18/5–21/7/00	Sp	114	5	119	96	163.0	784.8	20	100	0	0	4	0	4	0	0	0	0	90	100	S (0)
Ibsa Quinto	2/5–21/7/00	Sp	117	9	126	93	149.7	1360.0	11	99	0	0	0	0	0	0	0	0	0	89	88	O (94)
Illa de Rua	1/5–20/7/00	Sp	163	4	167	97	357.2	1725.2	20	100	0	0	16	0	16	0	0	0	0	97	100	O (59)
Isla Camila	1/5–15/6/00	Sp	141	23	164	86	293.7	1072.4	27	100	0	0	5	0	5	0	0	0	0	98	100	S (100)
Isla Gorriti	1/5–19/7/00	Auto	129	27	156	83	371.9	1362.6	27	98	0	1	0	0	0	1	0	0.019	0.003	96	100	O (100)
Isla Santa Clara	1/5–20/7/00	Sp	148	20	168	88	381.4	1330.2	28	96	2	2	0	0	2	2	0.006	0.044	0.01	53	100	O (95)
Isla Sofía	20/6–18/7/00	Sp	50	0	50	100	111.4	367.8	30	100	0	0	6	0	6	0	0	0	0	100		S (0)
Jacqueline	6/5–20/7/00	Sp	88	12	100	88	347.8	1101.8	31	100	1	0	0	0	1	0	0.003	0	0.003	62	100	S (100)
Koryo Maru 11	1/5–21/7/00	Sp	91	2	93	98	174.7	1118.1	15	99	0	0	0	0	0	0	0	0	0	100	100	O (88)
Lyn	2/5–20/7/00	Sp	115	0	115	100	144.2	1140.3	12	100	0	0	8	0	8	0	0	0	0	100		O (0)
Magallanes III	2/5–9/5/00	Sp	13	2	15	87	23.8	110.3	21	100	0	0	0	0	0	0	0	0	0	92	100	O (0)
*Magallanes III**	7/7–14/7/00	Sp									0	0	0	0	0	0	0	0	0			
No. 1 Moresko	2/5–21/7/00	Sp	100	27	127	79	301.2	1120.8	26	100	0	0	0	0	0	0	0	0	0	99	96	O (98)
RK-1	1/5–20/7/00	Auto	251	20	271	92	210.6	860.0	24	85	0	0	0	0	0	0	0	0	0	14	25	O (98)
Tierra del Fuego	1/5–21/7/00	Sp	131	28	159	82	192.9	668.3	28	95	0	0	0	1	0	1	0	0	0	87	85	O (92)
Total						87	3457.6	14709.1	24								0.0002	0.002	0.0004			
Division 58.4.4																						
Isla Alegranza	26/6–30/8/00	Sp	34	34	68	50	178.8	704.9	25	100	0		0		0		0	0	0	20	85	S (100)
Subareas 58.6, 58. 7																						
Aquatic Pioneer	30/8–28/9/99	Sp	33	0	33	100	129.4	215.0	60	63	3	0	0	0	3	0	0.023	0	0.023	93		O (80)
Aquatic Pioneer	15/10– 3/12/99	Sp	29	22	51	57	380.0	585.3	64	64	19	9	10	1	29	10	0.098	0.048	0.074	93	90	O (96)
Aquatic Pioneer	24/1–11/3/00	Sp	44	0	44	100	54.6	506.0	10	79	17	0	2	0	19	0	0.311	0	0.311	97		O (98)
Aquatic Pioneer	3/4–4/5/00	Sp	31	0	31	100	98.5	356.2	27	75	12	0	1	0	13	0	0.122	0	0.122	100		O (100)
*Aquatic Pioneer**	18/7–1/9/00	Sp					63.7	528.1	12		0	0	0	0	0	0	1	0	0			
Cap Kersaint	8/7–15/7/00	Sp	5	0	5	100	4.2	41.0	10	100	0	0	0	0	0	0	0	0	0	60		O (100)
Croix du Sud I	28/7–31/7/00	Auto	2	0	2	100	19.9	23.1	85	90	0	0	0	0	0	0	0	0	0	0		
Eldfisk	1/8–27/9/99	Auto	245	75	320	77	301.7	968.3	31	90	2	0	0	0	2	0	0.008	0	0.007	100	100	O (100)
Eldfisk	13/10–12/12/99	Auto	128	165	293	44	786.0	858.9	91	90	34	5	1	0	35	5	0.101	0.011	0.050	98	100	O (80)
Eldfisk	10/1–12/3/00	Auto	81	228	309	26	160.9	935.3	17	83	14	9	3	6	17	15	0.262	0.084	0.143	100	99	O (70)

(continued)

Table 48 (continued)

Vessel	Dates of Fishing	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 (%)
									%	%	Dead		Alive		Total					%		
			N	D	Total	%N	Obs.	Set	Observed		N	D	N	D	N	D	N	D	Total	N	D	
Subareas 58.6, 58. 7 continued																						
Eldfisk	28/3–27/5/00	Auto	95	211	306	31	530.0	915.4	57	86	0	3	0	0	0	3	0	0.008	0.006	98	99	O (100)
*Eldfisk**	16/6–16/8/00	Auto					324.8	676.8	48		4		3		7				0.012			
Koryo Maru 11	25/8–28/9/00	Sp	99	1	100	99	366.0	806.5	45	100	2	0	3	0	5	0	0.005	0	0.005	98	100	O (100)
Koryo Maru 11	16/1– 31/3/00	Sp	108	15	123	88	223.0	844.8	26	99	20	6	11	3	31	9	0.104	0	0.117	99	93	O (100)
Total						77	3442.1	8260.7	42								0.027	0.013	0.022			
Subarea 88.1																						
Janus	13/1–15/3/00	Auto	6	184	190	3	302.2	952.5	31	91	0	0	0	0	0	0	0	0	0	100	100	(0)
San Aotea II	13/1–14/3/00	Auto	32	177	209	15	293.4	997.0	29	88	0	0	0	0	0	0	0	0	0	87	100	S (0)
Sonrisa	30/1–27/2/00	Auto	0	86	86	0	108.6	184.3	58	87	0	0	0	0	0	0	0	0	0		97	(0)
Total						6	704.2	2133.8	33								0	0	0			

Table 49: Estimated seabird mortality by vessel for Subarea 48.3 during the 1999/2000 season. * – Data obtained from observer cruise report.

Vessel	Hooks Observed (thousands)	Hooks Set (thousands)	Percentage of Hooks Observed	% Night Sets	Estimated Number of Birds Caught Dead		
					Night	Day	Total
Argos Georgia	234.1	586.5	39	97	0	0	0
*Argos Helena**					0	0	0
Faro de Hercules	163.0	784.8	20	96	0	0	0
Ibsa Quinto	149.7	1 360.0	11	11	0	0	0
Illa de Rua	357.2	1 725.2	20	97	0	0	0
Isla Camila	293.7	1 072.4	27	86	0	0	0
Isla Gorriti	371.9	1 362.6	27	83	0	4	4
Isla Santa Clara	381.4	1 330.2	28	88	7	7	14
Isla Sofía	111.4	367.8	30	100	0	0	0
Jacqueline	347.8	1 101.8	31	88	3	0	3
Koryo Maru 11	174.7	1 118.1	15	98	0	0	0
Lyn	144.2	1 140.3	12	100	0	0	0
Magallanes III	23.8	110.3	21	21	0	0	0
*Magallanes III**					0	0	0
No. 1 Moresko	301.2	1 120.8	26	26	0	0	0
RK-1	210.6	860.0	24	92	0	0	0
Tierra del Fuego	192.9	668.3	28	82	0	0	0
Total	3 156.4	13 588.3	24	87	10	11	21

Table 50: Species composition of birds killed in longline fisheries in Subareas 48.3, 58.6 and 58.7 during the 1999/2000 season. N – night setting; D – daylight setting (including nautical dawn and dusk); DIM – black-browed albatross; DIC – grey-headed albatross; MAI – southern giant petrel; PRO – white-chinned petrel; MAH – northern giant petrel; DAC – cape petrel; DCR – yellow-nosed albatross; PCI – grey petrel; ( ) – % composition; * – Data obtained from observer cruise report.

Vessel	Dates of Fishing	No. Birds Killed by Group						Species Composition (%)							
		Albatross		Petrels		Total									
		N	D	N	D	N	D	DIM	DIC	MAI	PRO	MAH	DAC	DCR	PCI
Subarea 48.3															
Argos Georgia	1/6–20/7/00	0	0	0	0	0	0								
*Argos Helena**	1/5–21/7/00	0	0	0	0	0	0								
Faro de Hercules	18/5– 21/7/00	0	0	0	0	0	0								
Ibsa Quinto	2/5–21/7/00	0	0	0	0	0	0								
Illa de Rua	1/5–20/7/00	0	0	0	0	0	0								
Isla Camila	1/5–15/6/00	0	0	0	0	0	0								
Isla Gorriti	1/5–19/7/00	0	1	0	0	0	1	1 (100)							
Isla Santa Clara	1/5–20/7/00	0	0	2	2	2	2			2 (50)		1 (25)	1 (25)		
Isla Sofía	20/6–18/7/00	0	0	0	0	0	0								
Jacqueline	6/5–20/7/00	0	0	1	0	1	0			1 (100)					
Koryo Maru 11	1/5–21/7/00	0	0	0	0	0	0								
Lyn	2/5–20/7/00	0	0	0	0	0	0								
Magallanes III	2/5–9/5/00	0	0	0	0	0	0								
*Magallanes III**	7/7–14/7/00	0	0	0	0	0	0								
No. 1 Moresko	2/5–21/7/00	0	0	0	0	0	0								
RK-1	1/5–20/7/00	0	0	0	0	0	0								
Tierra del Fuego	1/5–21/7/00	0	0	0	0	0	0								
Total %								1 (16.5)		3 (50)		1 (16.5)	1 (16.5)		
Subareas 58.6, 58.7															
Aquatic Pioneer	30/8–28/9/99	0	0	3	0	3	0			1 (33.3)		1 (33.3)			1 (33.3)
Aquatic Pioneer	15/10–3/12/99	0	0	19	9	19	9				28 (100)				
Aquatic Pioneer	24/1–11/3/00	0	0	17	0	17	0				17 (100)				
Aquatic Pioneer	3/4–4/5/00	0	0	12	0	0	0				12 (100)				
*Aquatic Pioneer**	18/7–1/9/00	0	0	0	0	0	0								
Cap Kersaint	8/7–15/7/00	0	0	0	0	0	0								
Croix du Sud I	28/7–31/7/00	0	0	0	0	0	0								
Eldfisk	1/8–27/9/99	0	0	2	0	2	0								2 (100)
Eldfisk	13/10–12/12/99	0	0	34	5	34	5				39 (100)				
Eldfisk	10/1–12/3/00	0	6	14	3	14	9		1 (4)		17 (74)			5 (22)	
Eldfisk	28/3–27/5/00	0	1	0	2	0	3		1 (33.3)		2 (66.6)				
*Eldfisk**	16/6–16/8/00	2		2		4			2 (50)	1 (25)					1 (25)
Koryo Maru 11	25/8–28/9/00	0	0	2	0	2	0				2 (100)				
Koryo Maru 11	16/1–31/3/00	0	0	20	6	20	6				26 (100)				
Total %									4 (2.5)	2 (1)	143 (90)	1 (1)		5 (3)	4 (2.5)

Table 51: Estimated seabird mortality by vessel for Subareas 58.6 and 58.7 during the 1999/2000 season. * – Data obtained from observer cruise report.

Vessel	Hooks Observed (thousands)	Hooks Set (thousands)	Percentage of Hooks Observed	% Night Sets	Estimated Number of Birds Caught Dead		
					Night	Day	Total
Aquatic Pioneer	129.4	215.0	60	100	5	0	5
Aquatic Pioneer	380.0	585.3	64	57	33	12	45
Aquatic Pioneer	54.6	506.0	10	100	157	0	157
Aquatic Pioneer	98.5	356.2	27	100	43	0	43
*Aquatic Pioneer**	63.7	528.1	12		0	0	0
Cap Kersaint	4.2	41.0	10	100	0	0	0
Croix du Sud I	19.9	23.1	85	100	0	0	0
Eldfisk	301.7	968.3	31	77	6	0	6
Eldfisk	786.0	858.9	91	44	38	5	43
Eldfisk	160.9	935.3	17	26	64	58	122
Eldfisk	530.0	915.4	57	31	0	5	5
*Eldfisk**	324.8	676.8	48		6	2	8
Koryo Maru 11	366.0	806.5	45	99	4	0	4
Koryo Maru 11	223.0	844.8	26	88	77	0	77
Total	3 030.1	6 991.7	42	72.20	434	83	516

Table 52: 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 2000.

Subarea	Year			
	1997	1998	1999	2000
48.3				
Estimated by-catch	5 755	640	210*	21
By-catch rate	0.23	0.03	0.01*	0.0004
58.6, 58.7				
Estimated by-catch	834	528	156	516
By-catch rate	0.52	0.19	0.03	0.022

* Excluding *Argos Helena* line-weighting experiment cruise.

Table 53: Summary of compliance with Conservation Measure 29/XVI, based on data from scientific observers, for 1996/97, 1997/98, 1998/99 and 1999/2000. Values in parentheses are % of observer records that were complete.

Subarea/ Time	Line Weighting (Spanish System Only)			Night Setting	Offal Discharge		Streamer Line Compliance (%)										Total Catch Rate (birds/1 000 hooks)	
	Compliance %		Median Weight (kg)	Median Spacing (m)	(% Night)	(% Opposite Haul)	Overall		Attached Height		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]
1999/2000	1	(91)	6	44	92	76	(100)	31	(94)	100	(65)	25	(71	100	(65)	85	(76)	<0.01	<0.01
Division 58.4.4																		
1999/2000	0	(100)	5	45	50	0	(100)	0	(100)	100	(100)	0	(100)	Y	(100)	100	(100)	0	0
Subareas 58.6, 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
1999/2000	0	(83)	6	88	72	100	(93)	8	(100)	91	(92)	0	(92)	100	(92)	91	(92)	0.03	0.01
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
1999/2000	Auto only		na	na	6[4]	No discharge		67[5]	(100)	100	(100)	67[5]	(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 Measure 190/XVIII allowed New Zealand vessels to undertake daytime setting south of 65°S in Subarea 88.1 to conduct a line-weighting experiment.
[5] In electronic form only; the written report to CCAMLR and the report of the New Zealand national observer both gave a value of 150 m.

Table 54: Compliance, as reported by scientific observers, with streamer line minimum specifications set out in Conservation Measure 29/XVI during the 1999/2000 season. Nationality: CHL – Chile, ESP – Spain, GBR – United Kingdom, KOR – Republic of Korea, NZL – New Zealand, UKR – Ukraine, URY – Uruguay, ZAF – South Africa; Fishing method: A – autoliner, Sp – Spanish system; Y – yes, N – no, - no information.

Vessel Name (Nationality)	Dates of Trip	Fishing Method	Compliance with CCAMLR Specifications	Compliance with Details of Streamer Line Specifications										Spare Streamers on Board
				Attachment Height above Water (m)		Total Length (m)		Streamers per Line (No.)		Spacing of Streamers per Line (m)		Length of Streamers (m)		
Subarea 48.3														
Argos Georgia (GBR)	18/5–28/7/00	Sp	N	Y	(6)	N	(120)	Y	(7)	Y	(5)	Y	(1.5–3)	Y
Argos Helena (GBR)	1/5–27/7/00	Sp	N		-		-		-		-		-	Y
Faro de Hercules (CHL)	18/5–27/7/00	Sp	Y		-		-	Y	(15)	Y	(2.5)		-	-
Ibsa Quinto (ESP)	23/4–25/7/00	Sp	N		-	N	(100)		-	Y	(5)		-	-
Illa de Rua (URY)	18/4–25/7/00	Sp	N	Y	(11)	N	(103)	Y	(5)	N	(8)		-	Y
Isla Camila (CHL)	15/4–22/7/00	Sp	Y	Y	(5)	Y	(157)	Y	(6)	Y	(5)		-	-
Isla Gorriti (URY)	18/4–25/7/00	A	N	Y	(11)	N	(125)	Y	(5)	N	(8)		-	Y
Isla Santa Clara (CHL)	12/4–27/7/00	Sp	N	Y	(5)	N	(92)	Y	(42)	Y	(1.06)		-	-
Isla Sofía (CHL)	20/6–28/7/00	Sp	Y	Y	(6)		-		-		-		-	-
Jacqueline (GBR)	30/4–25/7/00	Sp	N	Y	(4.5)	N	(80)	Y	(52)	Y	(1.5)		-	Y
Koryo Maru 11 (ZAF)	1/5–21/7/00	Sp	Y	Y	(8)	Y	(170)	Y	(12)	Y	(5)		-	-
Lyn (GBR)	24/4–25/7/00	Sp	N	Y	(5)	N	(120)		-	y	(3)	Y	(6)	Y
Magallanes III (CHL)	23/4–9/5/00	Sp	N		-		-		-		-		-	-
Magallanes III (CHL)	3/7–5/8/00	Sp	-		-		-		-		-		-	-
No. 1 Moresko (KOR)	26/4–25/7/00	Sp	N	Y	(4.5)	N	(78)	Y	(11)	Y	(2)		-	-
RK-1 (UKR)	25/4–24/7/00	A	Y		-	Y	(250)	Y	(50)	Y	(1.5)		-	-
Tierra del Fuego (CHL)	1/5–21/7/00	Sp	N	Y	(5.5)	N	(70)	Y	(26)	Y	(2.7)		-	-
Subareas 58.6 and 58.7														
Aquatic Pioneer (ZAF)	23/8–5/10/99	Sp	Y		-		-		-		-		-	-
Aquatic Pioneer (ZAF)	9/10–10/12/99	Sp	N	Y	(7)	N	(75)	Y	(6)	Y	(5)		-	Y
Aquatic Pioneer (ZAF)	17/1–18/3/00	Sp	N	Y	(10)	N	(100)	Y	(5)	Y	(5)	Y	(3)	Y
Aquatic Pioneer (ZAF)	29/3–11/5/00	Sp	N	N	(4)	N	(120)	Y	(5)	Y	(5)		-	Y
Aquatic Pioneer (ZAF)	13/7–8/9/00	Sp	N	Y	(7.5)	N	(117)	Y	(6)	Y	(5)	Y	(3)	Y
Eldfisk (ZAF)	26/7–1/10/99	A	N	Y	(5.5)	N	(100)	Y	(9)	Y	(5)		-	Y
Eldfisk (ZAF)	8/10–17/12/99	A	N	Y	(5.5)	N	(80)	Y	(5)	Y	(3)	Y	(1–4)	Y
Eldfisk (ZAF)	5/1–17/300	A	N	Y	(6)	N	(100)	Y	(7)	N	(6)		-	Y
Eldfisk (ZAF)	23/3–2/6/00	A	N	Y	(6)	N	(100)	Y	(7)	Y	(5)		-	Y
Eldfisk (ZAF)	16/6–18/800	A	N	Y	(6)	N	(70)	Y	(9)	Y	(4.8)		-	Y
Koryo Maru 11 (ZAF)	20/8–12/12/99	Sp	N	Y	(5)	N	(100)	Y	(10)	Y	(5)	Y	(2–5)	Y
Koryo Maru 11 (ZAF)	11/17/4/00	Sp	N	Y	(10)	N	(70)	Y	(8)	Y	(4)	Y	(2–5)	Y
Subarea 88.1														
Janas (NZL)	3/1–24/3/00	A	Y	Y	(8)	Y	(200)	Y	(5)	Y	(2)	Y	(4)	Y
San Aotea II (NZL)	8/1–18/3/00	A	Y	Y	(4.5)	Y	(200)	Y	(6)	Y	(5)		-	Y
Sonrisa (NZL)	21/1–7/3/00	A	N	Y	(6)	N	(125)[1]	Y	(5)	Y	(5)	Y	(3.5)	Y
Division 58.4.4														
Isla Alegranza (CHL)	14/7–31/8/00	Sp	N	Y	(4.5)	N	(80)	Y	(7)	Y	(3)		-	-

[1] From electronic forms; the written report to CCAMLR and the New Zealand national observer's report both gave a value of 150 m.

Table 55: Summary of compliance with Conservation Measure 29/XVI regarding night setting, correct configuration and use of streamer lines and offal discharge practices in the Convention Area, from 1998 to 2000. Vessels with a history of non-compliance (at least two consecutive years of non-compliance, including the current year) with a conservation measure are indicated in bold. Vessels in their first year in the fishery that failed to comply with a conservation measure are indicated in italics. Nationality: CHL – Chile, ESP – Spain, GBR – United Kingdom, KOR – Republic of Korea, NZL – New Zealand, PAN – Panama, UKR – Ukraine, URY – Uruguay, ZAF – South Africa; Y – complied, N – did not comply, - did not fish, n/a – not applicable.

Vessel (Nationality)	Subarea/ Division	Night Setting			Streamer Line			Offal Discharge		
		1998	1999	2000	1998	1999	2000	1998	1999	2000
Aquatic Pioneer (ZAF)	58.6, 58.7	Y	N	Y	N	N	**N**	Y	Y	Y
Argos Georgia (GBR)	48.3	-	-	Y	-	-	*N*	-	-	Y
Argos Helena (GBR)	48.3	Y	Y	Y	Y	N	**N**	Y	Y	Y
Cap Kersaint (FRA)	58.6	-	-	Y	-	-	Y	-	-	Y
Croix du Sud I (FRA)	58.6	-	-	Y	-	-	no data	-	-	Y
Eldfisk (PAN)	58.6, 58.7	N	-	-	N	-	-	Y	-	-
Eldfisk (ZAF)	58.6, 58.7	-	N	**N**	-	N	**N**	-	Y	Y
Faro de Hercules (CHL)	48.3	-	-	Y	-	-	Y	-	-	*N*
Ibsa Quinto (ESP)	48.3	-	Y	Y	-	Y	N	-	Y	Y
Illa de Rua (URY)	48.3	N	Y	Y	N	N	**N**	Y	Y	Y
Isla Alegranza (URY)	58.4.4	-	-	**N**	-	-	*N*	-	-	*N*
Isla Camila (CHL)	48.3	Y	N	**N**	N	N	Y	N	N	**N**
Isla Gorriti (URY)	48.3	-	N	**N**	-	N	**N**	-	Y	Y
Isla Santa Clara (CHL)	48.3	-	-	*N*	-	-	*N*	-	-	Y
Isla Sofía (CHL)	48.3	Y	N	Y	N	N	Y	N	N	**N**
Jacqueline (GBR)	48.3	Y	Y	N	N	N	**N**	N	N	**N**
Lyn (GBR)	48.3	-	N	Y	-	N	**N**	Y	Y	Y
Magallanes III (CHL)	48.3	N	N	**N**	N	N	**N**	Y	Y	Y
No. 1 Moresko (KOR)	48.3	-	N	**N**	-	N	**N**	-	Y	Y
RK-1 (UKR)	48.3	-	-	Y	-	-	Y	-	-	Y
Tierra del Fuego (CHL)	48.3	N	N	**N**	N	N	**N**	Y	Y	Y
Janas (NZL)	88.1	-	na	na	-	Y	Y	-	Y	Y
San Aotea (NZL)	88.1	-	na	na	-	Y	Y	-	Y	Y
Sonrisa (NZL)	88.1	-	-	na	-	-	N	-	-	Y
Koryo Maru (ZAF)	58.6, 58.7	Y	Y (Y; 48.3)	N (Y; 48.3)	N	N (Y; 48.3)	N (Y; 48.3)	Y	Y	Y

Table 56: Estimate of seabird by-catch in the unregulated *Dissostichus* spp. fishery in Subareas 48.3, 58.6 and 58.7 and Divisions 58.4.4, 58.5.1 and 58.5.2 in 1999/2000. S – summer, W – winter.

Subarea/ Division	Total Unregulated Catch (tonnes)	Split S:W		Unregulated Catch (tonnes)		*Dissostichus* spp. Regulated By-catch Rate (kg/hooks)	Unregulated Effort (1 000 hooks)		Seabird By-catch Rate (birds/1 000 hooks)				Estimated Total Unregulated Seabird By-catch			
									Mean		Max		Mean		Max	
		S	W	S	W		S	W	S	W	S	W	S	W	S	W
48.3	350	80	20	280	70	0.31	903	226	2.608	0.07	9.31	0.51	2 356	16	8 409	115
	350	70	30	245	105	0.31	790	339	2.608	0.07	9.31	0.51	2 061	24	7 358	173
	350	60	40	210	140	0.31	677	452	2.608	0.07	9.31	0.51	1 767	32	6 307	230
58.6	1 980	80	20	1 584	396	0.09	17 600	4 400	1.049	0.017	1.88	0.07	18 462	75	33 088	308
	1 980	70	30	1 386	594	0.09	15 400	6 600	1.049	0.017	1.88	0.07	16 155	112	28 952	462
	1 980	60	40	1 188	792	0.09	13 200	8 800	1.049	0.017	1.88	0.07	13 847	150	24 816	616
58.7	220	80	20	176	44	0.1	1 760	440	1.049	0.017	1.88	0.07	1 846	7	3 309	31
	220	70	30	154	66	0.1	1 540	660	1.049	0.017	1.88	0.07	1 615	11	2 895	46
	220	60	40	132	88	0.1	1 320	880	1.049	0.017	1.88	0.07	1 385	15	2 482	62
58.4.4	1 050	80	20	840	210	0.24	3 500	875	0.629	0.01	1.128	0.042	2 202	9	3 948	37
	1 050	70	30	735	315	0.24	3 063	1 313	0.629	0.01	1.128	0.042	1 926	13	3 455	55
	1 050	60	40	630	420	0.24	2 625	1 750	0.629	0.01	1.128	0.042	1 651	18	2 961	74
58.5.1	2 100	80	20	1680	420	0.24	7 000	1 750	1.049	0.017	1.88	0.07	7 343	30	13 160	123
	2 100	70	30	1470	630	0.24	6 125	2 625	1.049	0.017	1.88	0.07	6 425	45	11 515	184
	2 100	60	40	1260	840	0.24	5 250	3 500	1.049	0.017	1.88	0.07	5 507	60	9 870	245
58.5.2	800	80	20	640	160	0.24	2 667	667	1.049	0.017	1.88	0.07	2 797	11	5 013	47
	800	70	30	560	240	0.24	2 333	1 000	1.049	0.017	1.88	0.07	2 448	17	4 387	70
	800	60	40	480	320	0.24	2 000	1 333	1.049	0.017	1.88	0.07	2 098	23	3 760	93

Table 57: Estimates of potential seabird by-catch in unregulated longline fishing in the Convention Area in 1999/2000.

Subarea/ Division	Potential By-catch Level	Summer	Winter	Total[1]
48.3	Lower	1 800–2 400	30–30	1 800–2 400
	Higher	6 300–8 400	120–230	6 400–8 600
58.6	Lower	13 800–18 500	70–150	13 900–18 700
	Higher	24 800–33 100	270–540	52 100–33 700
58.7	Lower	1 400–1 800	10–10	1 400–1 800
	Higher	2 500–3 300	30–60	2 500–3 400
58.4.4	Lower	1 700–2 200	10–20	1 700–2 200
	Higher	3 000–3 900	40–70	3 000–4 000
58.5.1	Lower	5 500–7 300	30–60	5 500-7 400
	Higher	9 900–13 200	120–250	10 000–13 500
58.5.2	Lower	2 100–2 800	10–20	2 100–2 800
	Higher	3 800–5 000	50–90	3 900–5 100
Total	Lower	26 300–35 000[1]	150–290[1]	26 000–35 000[2]
	Higher	50 300–66 900[1]	670–1 320[1]	51 000–68 000[2]

[1] Rounded to nearest hundred birds
[2] Rounded to nearest thousand birds

Table 58: Composition of estimated potential by-catch in unregulated longline fisheries in the Convention Area from 1997 to 2000.

Area/Year	Estimated Total Potential Seabird By-catch[1] (lower level above, higher level below)	Composition of Potential Seabird By-catch[2]		
		Albatrosses	Giant Petrels	White-chinned Petrels
Subarea 48.3[3]				
1996/97	-	-	-	-
1997/98	-	-	-	-
1998/99	3 000–4 000	1 505	70	1 680
	12 000–16 000	6 020	280	6 720
1999/2000	1 800–2 400	903	42	1 008
	6 400–8 600	3 225	150	3 600
Subareas 58.6, 58.7[4]				
1996/97	17 000–27 000	4 840	880	13 860
	66 000–107 000	19 030	3 460	54 495
1997/98	9 000–11 000	2 200	400	6 300
	15 000–20 000	3 850	700	11 025
1998/99	13 000–17 000	3 300	600	9 450
	24 000–32 000	6 160	1 120	17 640
1999/2000	15 000–21 000	3 960	720	11 340
	28 000–37 000	7 150	1 300	20 475
Divisions 58.5.1, 58.5.2[4]				
1996/97	-	-	-	-
1997/98	34 000–45 000	8 690	1 580	24 885
	61 000–81 000	15 620	2 840	44 730
1998/99	2 000–3 000	550	100	1 575
	4 000–5 000	990	180	2 835
1999/2000	8 000–10 000	1 980	360	5 670
	14 000–19 000	3 630	660	10 395
Division 58.4.4[4]				
1996/97	-			
1997/98	-			
1998/99	3 000–5 000	880	160	2 520
	4 000–7 000	1 210	220	3 465
1999/2000	2 000	440	80	1 260
	3 000–4 000	770	140	2 205
Total 1996/97	17 000–27 000	4 840	880	13 860
	66 000–107 000	19 030	3 460	54 495
1997/98	43 000–54 000	10 890	1 980	30 185
	76 000–101 000	19 470	3 540	55 755
1998/99	21 000–29 000	6 235	930	15 225
	44 000–59 000	14 380	1 800	30 660
1999/2000	26 000–35 000	7 283	1 202	19 278
	52 000–68 000	14 775	2 250	36 675
Overall Total	104 000–140 000	29 248	4 992	78 548
	237 000–333 000	67 655	11 050	177 585

1 Rounded to nearest thousand birds.
2 Based on averages for lower (above) and higher (below) level values.
3 Based on 43% albatrosses, 2% giant petrels, 48% white-chinned petrels (7% unidentified petrels) (see SC-CAMLR-XVI, Annex 5, Table 44).
4 Based on 22% albatrosses, 4% giant petrels, 63% white-chinned petrels (10% unidentified petrels) (see SC-CAMLR-XVI, Annex 5, Table 42).

Table 59: Summary of IMALF risk level and assessment in relation to proposed new and exploratory longline fisheries in 2000/01.

Area	Risk Scale	IMALF Risk Assessment	Notes
48.1	3	Average risk: Prohibit longline fishing during the breeding season of black-browed and grey-headed albatrosses, southern giant petrel and white-chinned petrel (i.e. September to April). Maintain all elements of Conservation Measure 29/XVI.	• Argentina (CCAMLR-XIX/12) proposes to fish from 1 December to 30 November. This will substantially overlap the recommended season closure. • Directed fishing for finfish in this subarea is currently prohibited under Conservation Measure 72/XVII.
48.2	2	Average-to-low risk: Avoid longline fishing during the breeding season of southern giant petrel (October to March). Maintain all elements of Conservation Measure 29/XVI.	• Argentina (CCAMLR-XIX/12) proposes to fish from 1 December to 30 November. This will substantially overlap the recommended season closure. • Directed fishing for finfish in this subarea is currently prohibited under Conservation Measure 73/XVII.
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. Apply Conservation Measure 29/XVI as a seabird by-catch precautionary measure.	• Argentina (CCAMLR-XIX/12) proposes to fish from 1 March to 31 August north of 60°S and from 15 February to 15 October south of 60°S. This does not conflict with advice provided. • Brazil (CCAMLR-XIX/5) – proposal does not conflict with advice provided. Fishing season to be as established at CCAMLR-XIX. • South Africa (CCAMLR-XIX/6) – proposal does not conflict with advice provided. Fishing season to be as established at CCAMLR-XIX. • Conservation Measure 184/XVIII applied in 1999/2000.
58.4.1	3	Average risk: No specific advice on restriction of fishing season. Apply all elements of Conservation Measure 29/XVI. Much of the risk to seabirds in this area arises in the region of the BANZARE Rise in the west of the region, adjacent to Division 58.4.3.	• Argentina (CCAMLR-XIX/12) proposes to fish from 1 December to 30 November. This does not conflict with advice provided.
58.4.2	2	Average-to-low risk: Prohibit longline fishing during the breeding season of giant petrels (October to March). Maintain all elements of Conservation Measure 29/XVI.	• Argentina (CCAMLR-XIX/12) proposes to fish from 1 December to 30 November. This will substantially overlap the recommended season closure.

(continued)

Table 59 (continued)

Area	Risk Scale	IMALF Risk Assessment	Notes
58.4.3	3	Average risk: Prohibit longline fishing during the breeding season of albatrosses, giant petrels and white-chinned petrels (September to April). Maintain all elements of Conservation Measure 29/XVI.	• Argentina (CCAMLR-XIX/12) proposes to fish from 1 May to 31 August. This does not conflict with advice provided. • France (CCAMLR-XIX/13) – fishing season not specified. • Conservation Measure 187/XVIII applied in 1999/2000.
58.4.4	3	Average risk: Prohibit longline fishing during the main breeding season of albatrosses and petrels (September to April). Maintain all elements of Conservation Measure 29/XVI.	• Argentina (CCAMLR-XIX/12) proposes to fish from 1 May to 31 August. This does not conflict with advice provided. • Brazil (CCAMLR-XIX/5) – proposal does not conflict with advice provide. Fishing season to be as established at CCAMLR-XIX. • France (CCAMLR-XIX/13) – fishing season not specified. • South Africa (CCAMLR-XIX/6) – proposal does not conflict with advice provided. Fishing season to be as established at CCAMLR-XIX. • Ukraine (CCAMLR-XIX/7) proposes to fish from 1 May to 31 August. This does not conflict with advice provided. • Uruguay (CCAMLR-XIX/15) proposes to fish from 1 May to 31 August and comply with Conservation Measure 29/XVI. This does not conflict with advice provided. • Conservation Measure 188/XVIII applied in 1999/2000.
58.5.1	5	High risk: Prohibit longline fishing during the main albatross and petrel breeding season (i.e. September to April). Ensure strict compliance with Conservation Measure 29/XVI.	• Argentina (CCAMLR-XIX/12) proposes to fish from 1 December to 30 November. This will substantially overlap the recommended season closure. • Brazil (CCAMLR-XIX/5) – proposal does not conflict with advice provided. Fishing season to be as established at CCAMLR-XIX. • France (CCAMLR-XIX/13) – fishing season not specified. • Fishing for *Dissostichus* outside EEZs in this division was adjudged unlikely to be viable due to the small amount of fishable ground (SC-CAMLR-XVIII, paragraph 9.50; CCAMLR-XVIII, paragraph 7.23(ii)).
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/XVI.	• Brazil (CCAMLR-XIX/5) – proposal does not conflict with advice provided. Fishing season to be as established at CCAMLR-XIX. • France (CCAMLR-XIX/13) – fishing season not specified. • Longline fishing is currently prohibited within the EEZ around Heard/McDonald Islands. • Fishing for *Dissostichus* outside EEZs in this division was adjudged unlikely to be viable due to the small amount of fishable ground (SC-CAMLR-XVIII, paragraph 9.50; CCAMLR-XVIII, paragraph 7.23(ii)).

(continued)

Table 59 (continued)

Area	Risk Scale	IMALF Risk Assessment	Notes
58.6	5	High risk: Prohibit longline fishing during the main albatross and petrel breeding season (i.e. September to April). Ensure strict compliance with Conservation Measure 29/XVI.	• Argentina (CCAMLR-XIX/12) proposes to fish from 1 May to 31 August. This does not conflict with advice provided. • France (CCAMLR-XIX/13) – fishing season not specified. • South Africa (CCAMLR-XIX/6) – proposal does not conflict with advice provided. Fishing season to be as established at CCAMLR-XIX. • Conservation Measure 189/XVIII applied in 1999/2000.
58.7	5	High risk: Prohibit longline fishing during the main albatross and petrel breeding season (September to April). Ensure strict compliance with Conservation Measure 29/XVI.	• France (CCAMLR-XIX/13) – fishing season not specified. • Directed fishing for *Dissostichus eleginoides* in this subarea is currently prohibited under Conservation Measure 160/XVII.
88.1	3	Average risk overall. Average risk in northern sector (*D. eleginoides* fishery), average to low risk in southern sector (*D. mawsoni* fishery): Longline fishing season limits of uncertain advantage. The provisions of Conservation Measure 29/XVI should be strictly adhered to.	• Argentina (CCAMLR-XIX/12) proposes to fish from 1 December to 31 August and comply with Conservation Measure 29/XVI. This does not conflict with advice provided. • New Zealand (CCAMLR-XIX/17) proposes to fish from 1 December to 31 May, and similarly in the 2001/02 season subject to CCAMLR-XX. Intends to comply with Conservation Measure 29/XVI. Proposes that prohibition on fishing within 10 n miles of Balleny Is, enacted in Conservation Measure 190/XVIII, paragraph 8, should be extended to 50 n miles. Proposes that elsewhere in Subarea 88.1 fishing be prohibited within 10 n miles of coastlines. • New Zealand intends to conduct line-weighting experiments, a condition for an exemption from the application of paragraph 3 (night setting) of Conservation Measure 29/XVI in 1999. • South Africa (CCAMLR-XIX/6) – proposal does not conflict with advice provided. Fishing season to be as established at CCAMLR-XIX. Intends to comply with Conservation Measure 29/XVI, taking into consideration paragraph 9.40 of CCAMLR-XVIII, which defines a fishing season in this subarea from 1 December to 31 August, and gives exemption from the application of paragraph 3 of Conservation Measure 29/XVI. • Uruguay (CCAMLR-XIX/15) proposes to fish from 1 December to 31 August and comply with Conservation Measure 29/XVI. This does not conflict with advice provided. • Conservation Measure 190/XVIII applied in 1999/2000.

(continued)

Table 59 (continued)

Area	Risk Scale	IMALF Risk Assessment	Notes
88.2	1	Low risk: No obvious need for restriction of longline fishing season. Apply Conservation Measure 29/XVI as a seabird by-catch precautionary measure.	• Argentina (CCAMLR-XIX/12) proposes to fish from 15 December to 31 August. This does not conflict with advice provided. • South Africa (CCAMLR-XIX/6) – proposal does not conflict with advice provided. Fishing season to be as established at CCAMLR-XIX. • Uruguay (CCAMLR-XIX/15) proposes to fish from 1 December to 31 August and comply with Conservation Measure 29/XVI. This does not conflict with advice provided. • Conservation Measure 191/XVIII applied in 1999/2000.
88.3	1	Low risk: Restrictions on timing of longline fishery probably inappropriate. Apply Conservation Measure 29/XVI, at least until further data on seabird–fishery interactions are available.	• Argentina (CCAMLR-XIX/12) proposes to fish from 1 December to 31 August. This does not conflict with advice provided. • Uruguay (CCAMLR-XIX/15) proposes to fish from 1 December to 31 August and comply with Conservation Measure 29/XVI. This does not conflict with advice provided.

Table 60: Marine mammal incidental mortality and interactions with fishing operations reported by observers during the 1999/2000 season. Nationality: AUS – Australia, CHL – Chile, ESP – Spain, GBR – United Kingdom, KOR – Republic of Korea, NZL – New Zealand, RUS – Russia, URY – Uruguay, ZAF – South Africa; Y – yes, N – No, DLP – dolphin, KIW – killer whale, SEA – Antarctic fur seal, SPW – sperm whale.

Vessel Name (Nationality)	Dates of Trip	Observation Reported	Mammal Killed	(Species) Entangled	Fish Loss Observed (Species)
Subarea 48.3					
Argos Georgia (GBR)	18/5–28/7/00	Y	N	N	Y (KIW)
Argos Helena (GBR)	1/5–27/700	Y	N	N	Y (KIW, SPW)
Betanzos (CHL)	10/12–2/2/00	Y	Y (SEA)	N	N
Faro de Hercules (CHL)	18/5–27/7/00	Y	N	N	Y (KIW)
Ibsa Quinto (ESP)	23/4–25/7/00	Y	N	N	Y (KIW)
Illa de Rua (URY)	18/4–25/7/00	Y	N	N	Y (KIW, SEA)
Isla Camila (CHL)	15/4–22/7/00	Y	N	N	Y (KIW, SEA)
Isla Gorriti (URY)	18/4–25/7/00	Y	N	N	Y (KIW, SEA)
Isla Santa Clara (CHL)	12/4–27/7/00	Y	N	N	Y (KIW)
Isla Sofía (CHL)	20/6–28/7/00	Y	N	N	N
Jacqueline (GBR)	30/4–25/7/00	Y	N	N	Y (KIW)
Koryo Maru 11 (ZAF)	1/5–21/7/00	Y	N	N	Y (KIW)
Lyn (GBR)	24/4–25/7/00	Y	N	N	N
Magallanes III (CHL)	23/4–9/5/00	Y	N	N	N
Magallanes III (CHL)	3/7–5/8/00	Y	N	N	N
No. 1 Moresko (KOR)	26/4–25/7/00	Y	N	N	Y (SEA)
RK-1 (UKR)	25/4–24/7/00	Y	N	N	Y (KIW)
Tierra del Fuego (CHL)	1/5–21/700	Y	N	N	Y (KIW, SEA)
Zakhar Sorokin (RUS)	27/11–22/2/00	Y	Y (SEA)	N	Y
Subareas 58.6 and 58.7					
Aquatic Pioneer (ZAF)	23/8–5/10/99	Y	N	N	Y
Aquatic Pioneer (ZAF)	9/10–10/12/99	Y	N	N	Y (KIW, SPW)
Aquatic Pioneer (ZAF)	17/1–18/3/00	Y	N	N	N
Aquatic Pioneer (ZAF)	29/3–11/5/00	Y	N	N	Y
Aquatic Pioneer (ZAF)	13/7–8/9/00	Y	N	N	N
Eldfisk (ZAF)	26/7–1/10/99	Y	N	N	N
Eldfisk (ZAF)	8/10–17/12/99	Y	N	N	Y (KIW, SPW)
Eldfisk (ZAF)	5/1–17/3/00	Y	Y (SEA)	N	Y (KIW, SPW)
Eldfisk (ZAF)	23/3–2/6/00	Y	N	N	Y (KIW)
Eldfisk (ZAF)	16/6–18/8/00	Y	N	N	Y (KIW, SPW)
*Koryo Maru 11 (*ZAF)	20/8–12/12/99	Y	N	N	Y (KIW)
Koryo Maru 11 (ZAF)	11/1–7/4/00	Y	N	N	Y
Subarea 88.1					
Janas (NZL)	3/1–24/3/00	Y	N	N	N
San Aotea II (NZL)	8/1–18/3/00	Y	N	N	N
Sonrisa (NZL)	21/1–7/3/00	Y	N	N	N
Division 58.5.2					
Austral Leader (AUS)	20/10–20/12/99	Y	N	N	N
Austral Leader (AUS)	19/4–7/6/00	Y	N	N	N
Southern Champion (AUS)	20/4–27/6/00	Y	N	N	N
Southern Champion (AUS)	31/1–3/4/00	Y	N	N	N
Southern Champion (AUS)	3/12–25/1/00	Y	N	N	N
Divisions 58.4.1, 58.4.3 and 58.5.2					
Austral Leader (AUS)	17/2–14/4/00	Y	N	N	N
Area 48					
Chiyo Maru No. 5 (JPN)	31/1–1/3/00	Y	N	N	N
Division 58.4.4					
Isla Alegranza (CHL)	14/7–31/8/00	Y	N	N	Y (KIW)

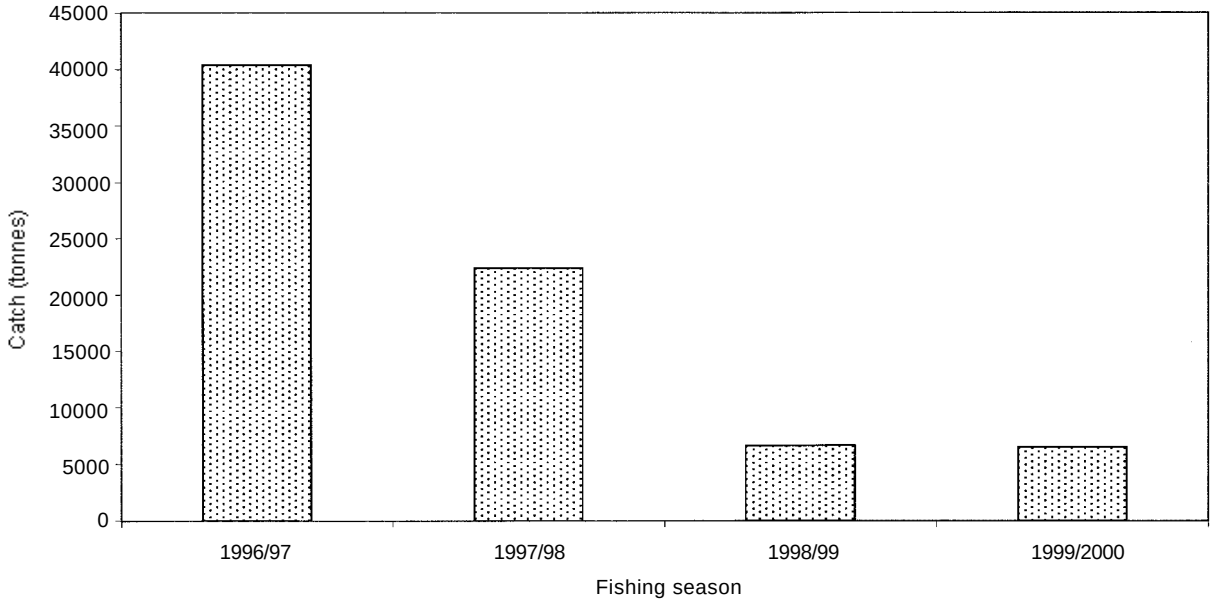


Figure 1: Estimated unreported catches (in tonnes) of *Dissostichus* spp. in the CCAMLR Convention Area for split-years 1996/97 to 1999/2000.

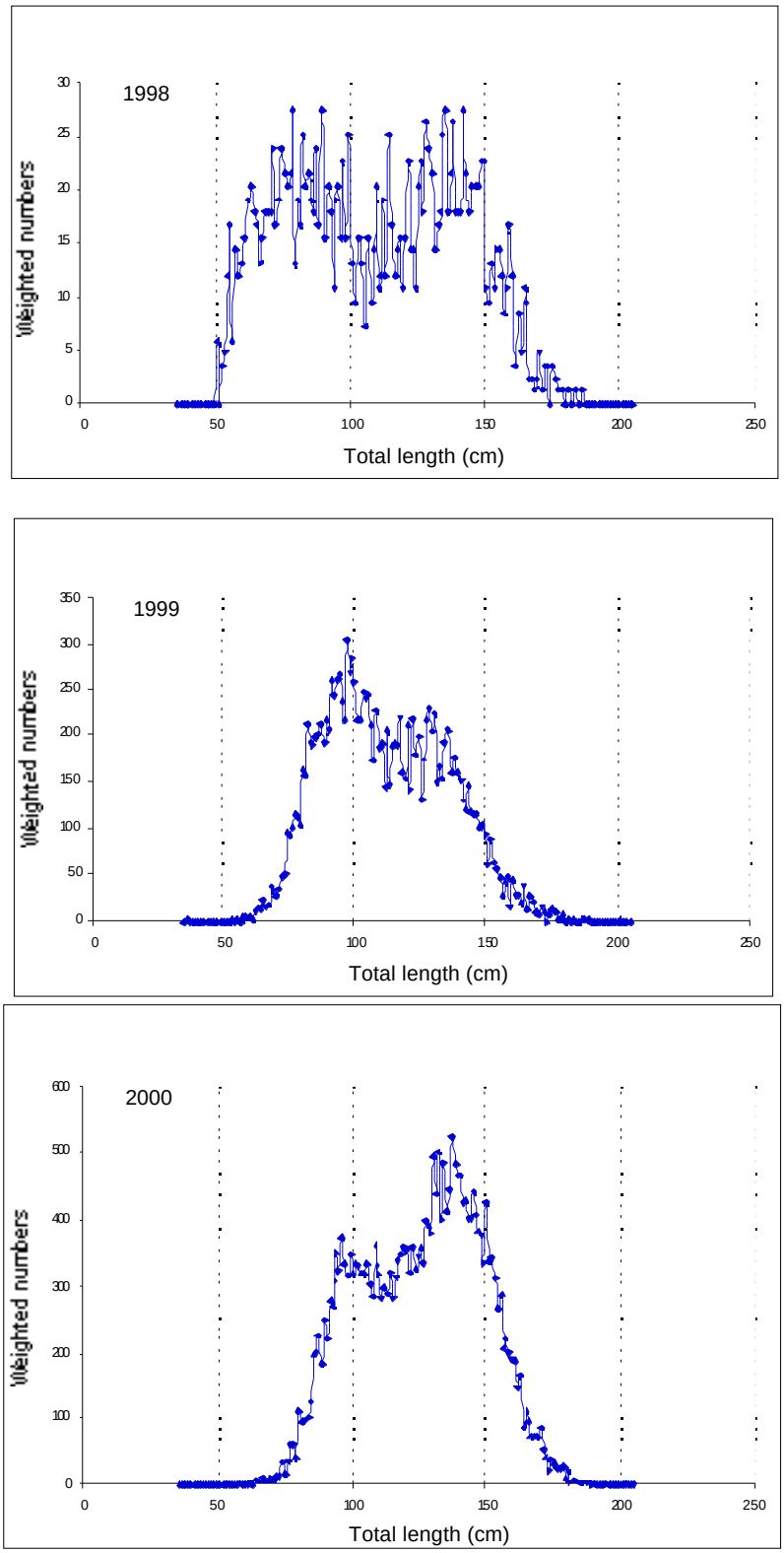


Figure 2: Catch-weighted length frequencies of *Dissostichus mawsoni* by year in the exploratory longline fishery in Subarea 88.1.

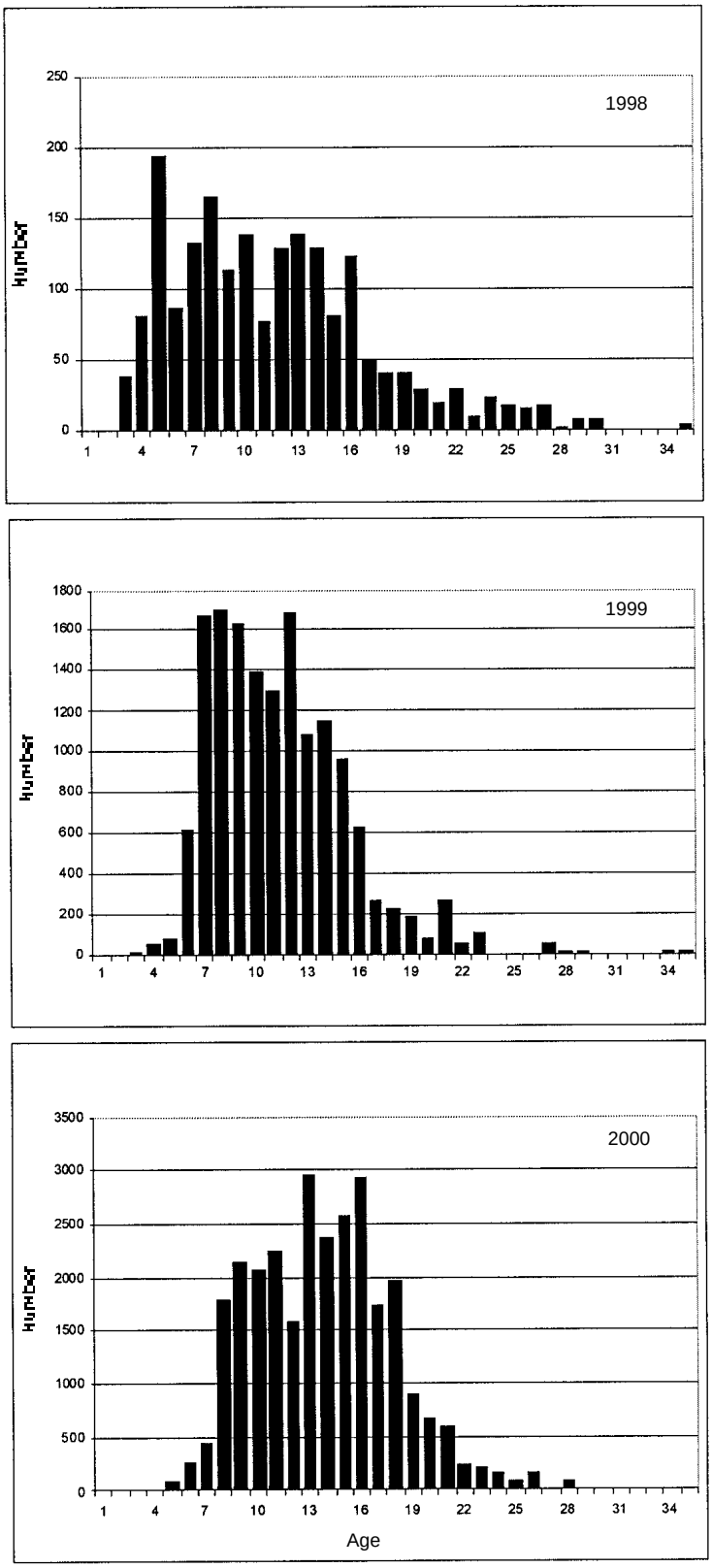


Figure 3: Estimated numbers at age of *Dissostichus mawsoni* by year in the exploratory longline fishery in Subarea 88.1.

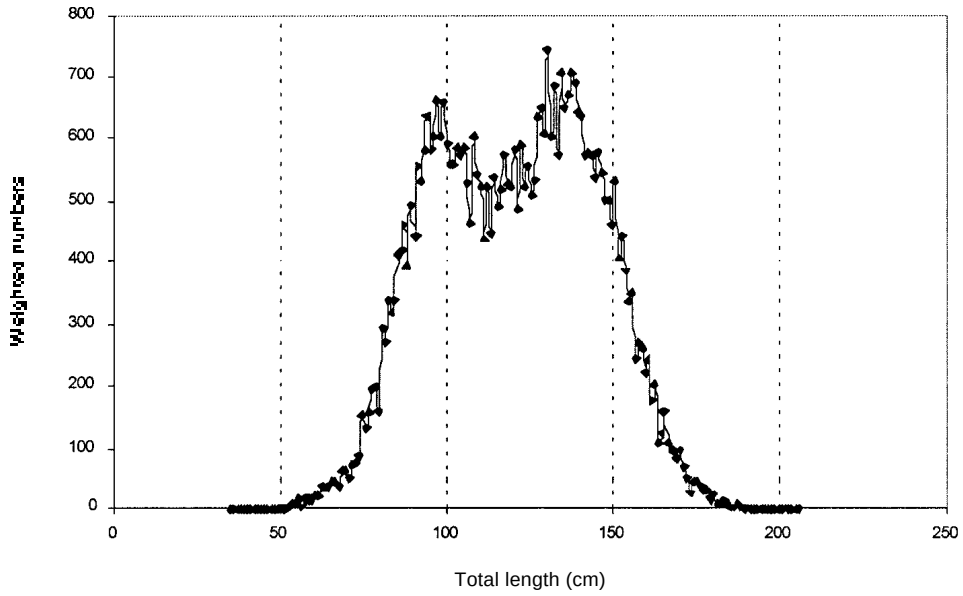


Figure 4: Catch-weighted length frequencies of *D. mawsoni* in the exploratory longline fishery in Subarea 88.1 for 1998–2000.

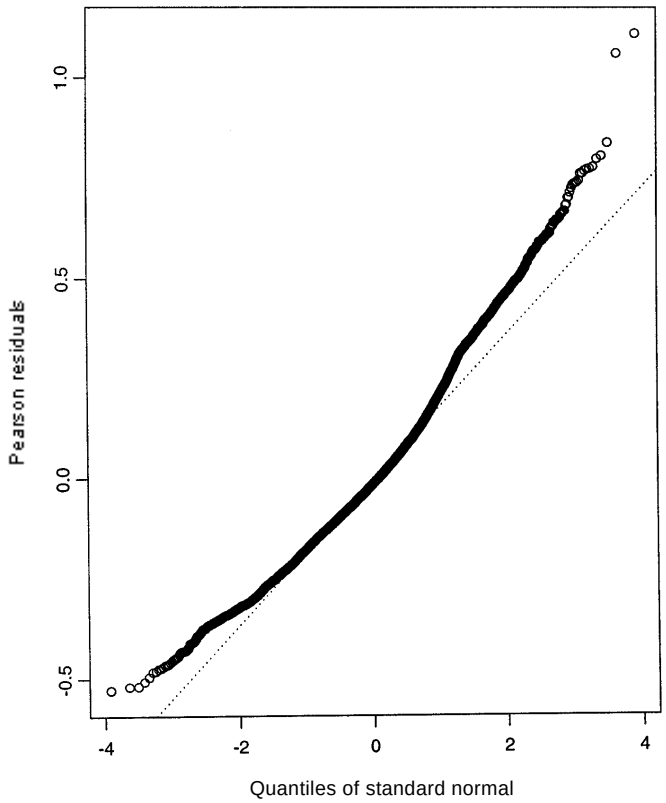


Figure 5: QQ plot of standardised residuals for the GLM fitted to CPUEs in kg/hook, using a robust GLM with the quasi distribution family and a square root link.

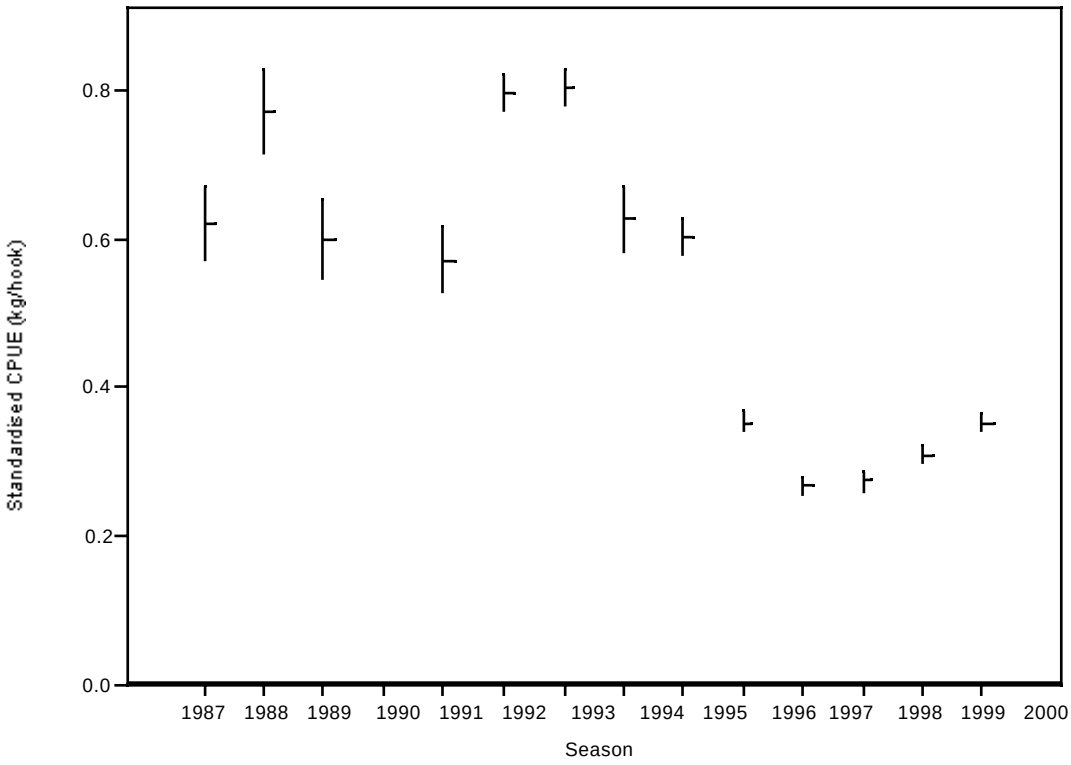
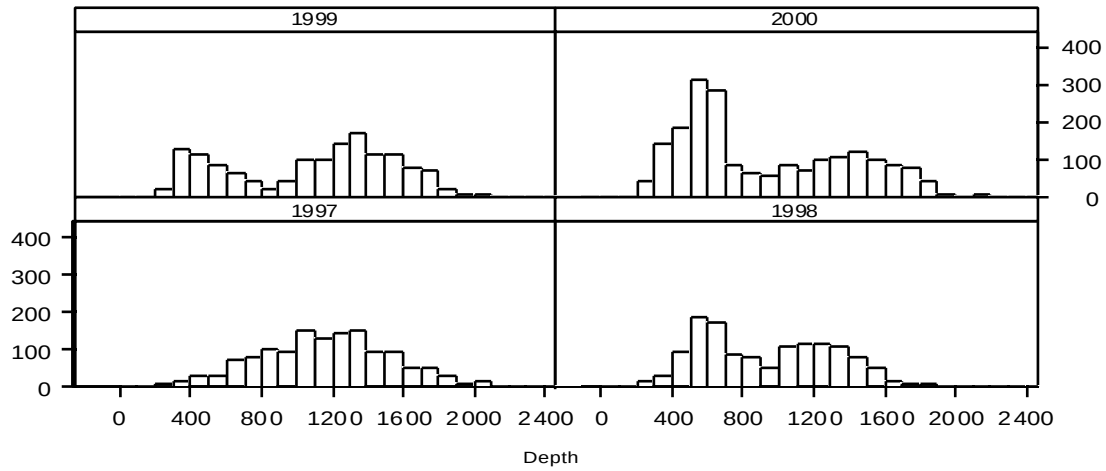


Figure 6: Standardised CPUEs and 95% confidence intervals in kg/hook for Subarea 48.3.



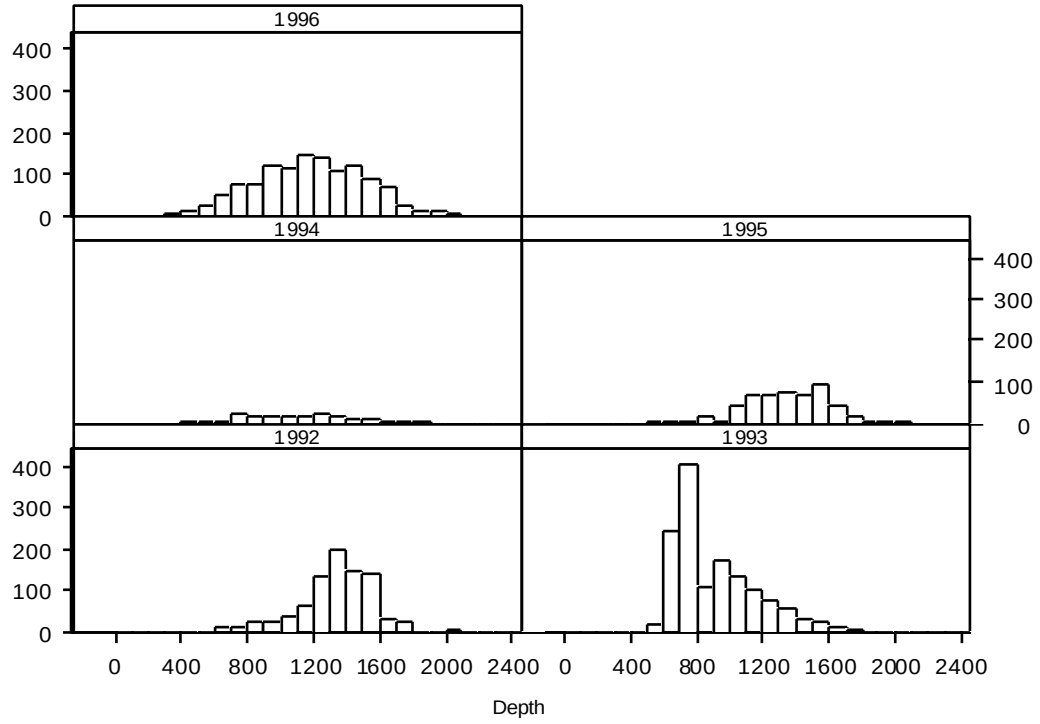


Figure 7: Histograms of depths fished by season in Subarea 48.3.

(continued)

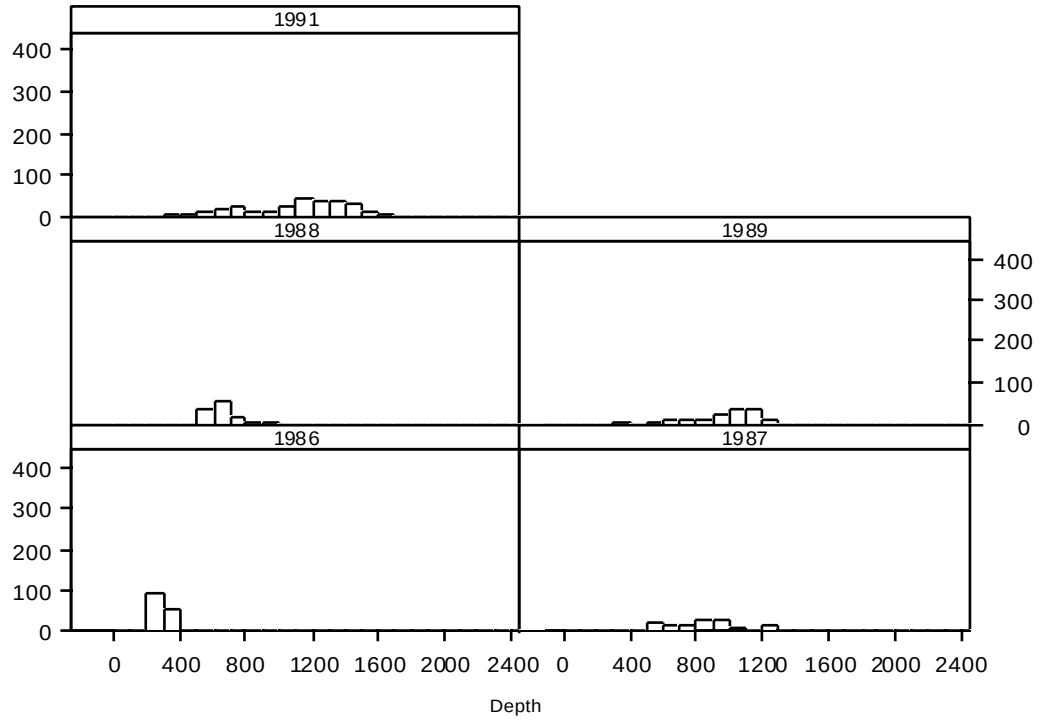


Figure 7 (continued)

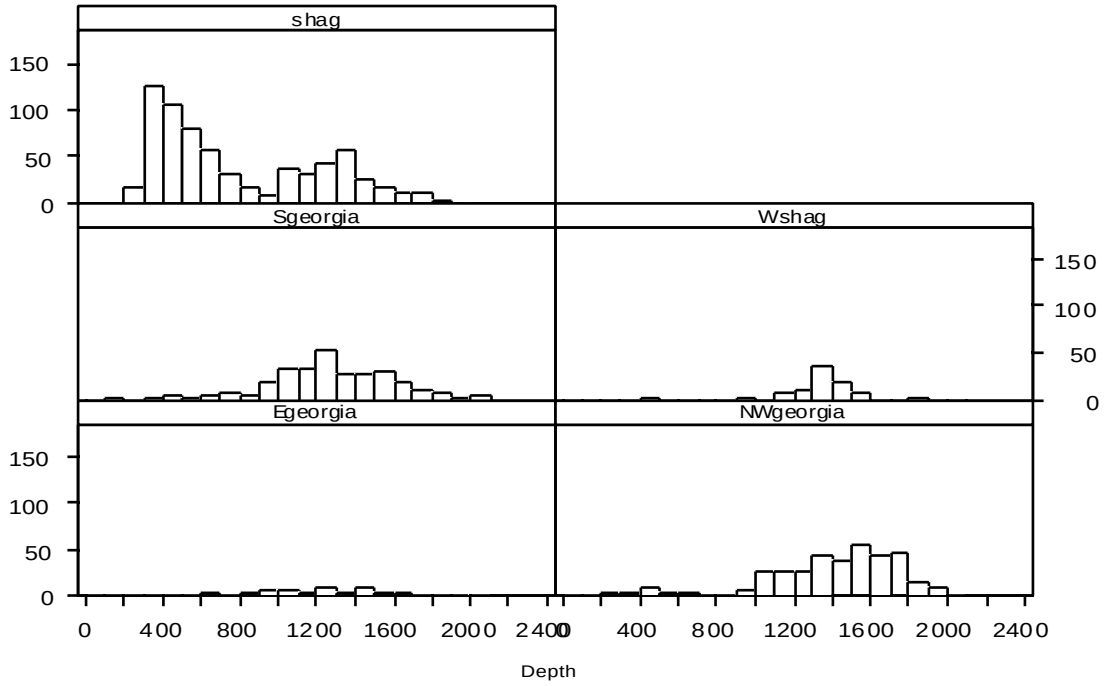


Figure 8: Histograms of depths fished during the 1998/99 season by area in Subarea 48.3.

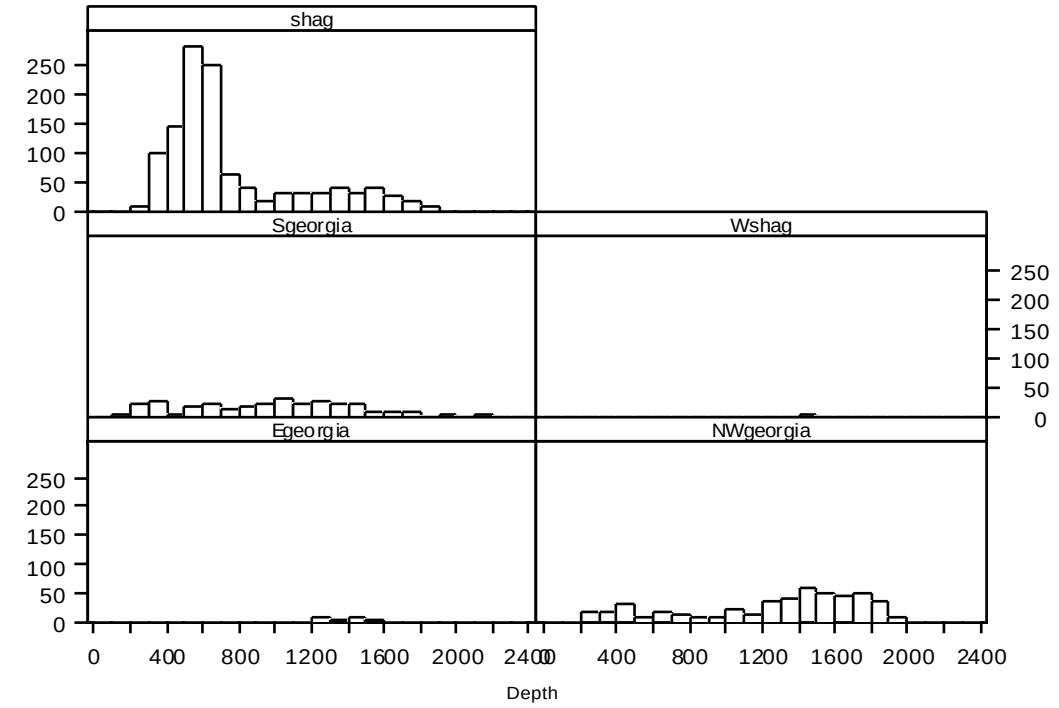


Figure 9: Histograms of depths fished during the 1999/2000 season by area in Subarea 48.3.

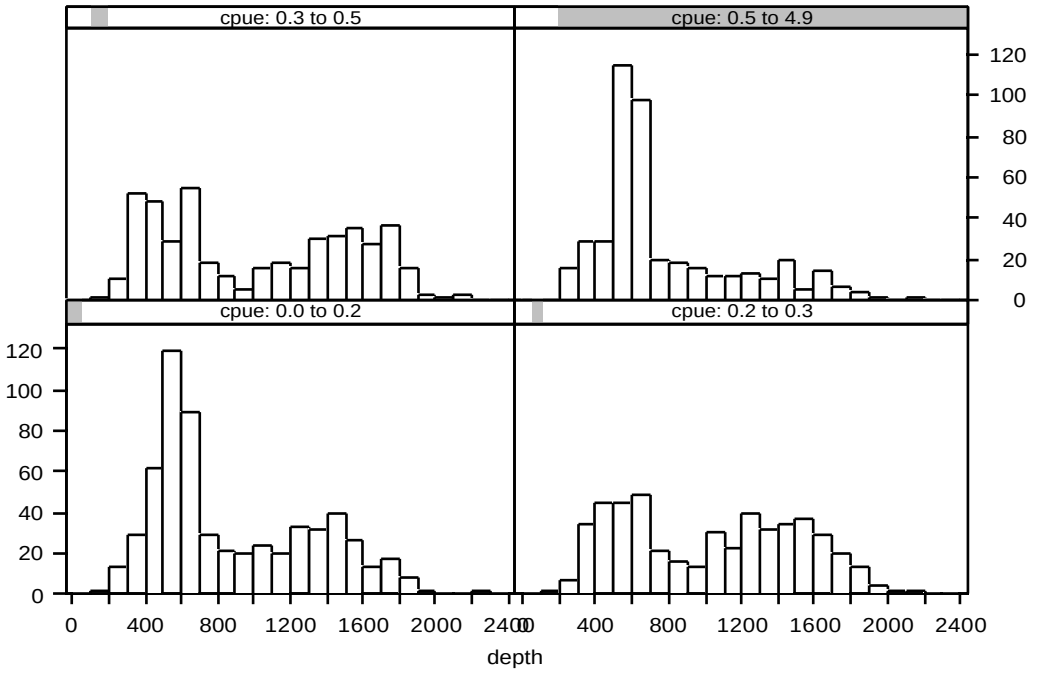


Figure 10: Histograms of depths fished during the 1999/2000 season in Subarea 48.3 for different levels of CPUE in kg/hook.

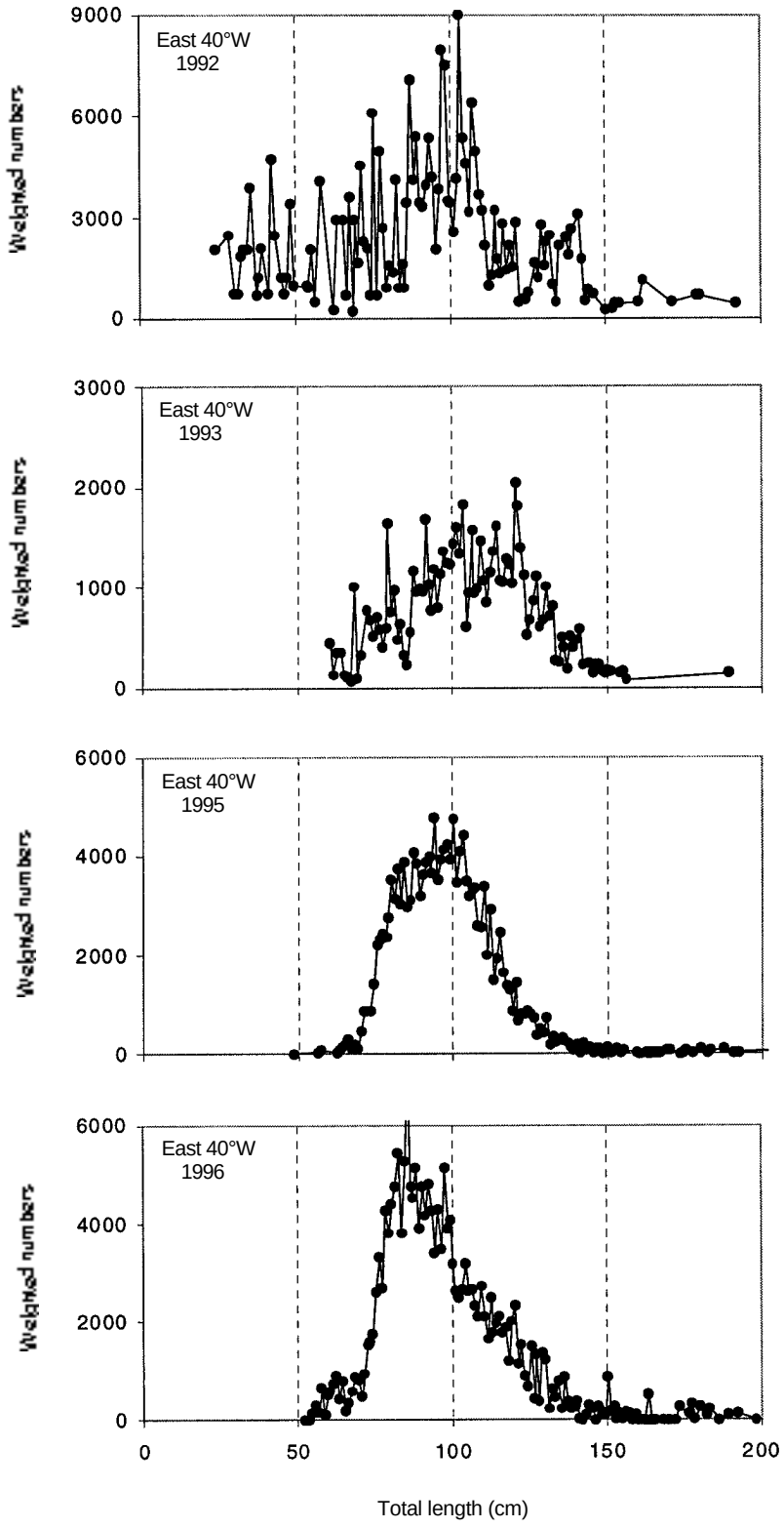


Figure 11: Catch-weighted length frequencies by season for fish taken around South Georgia.

(continued)

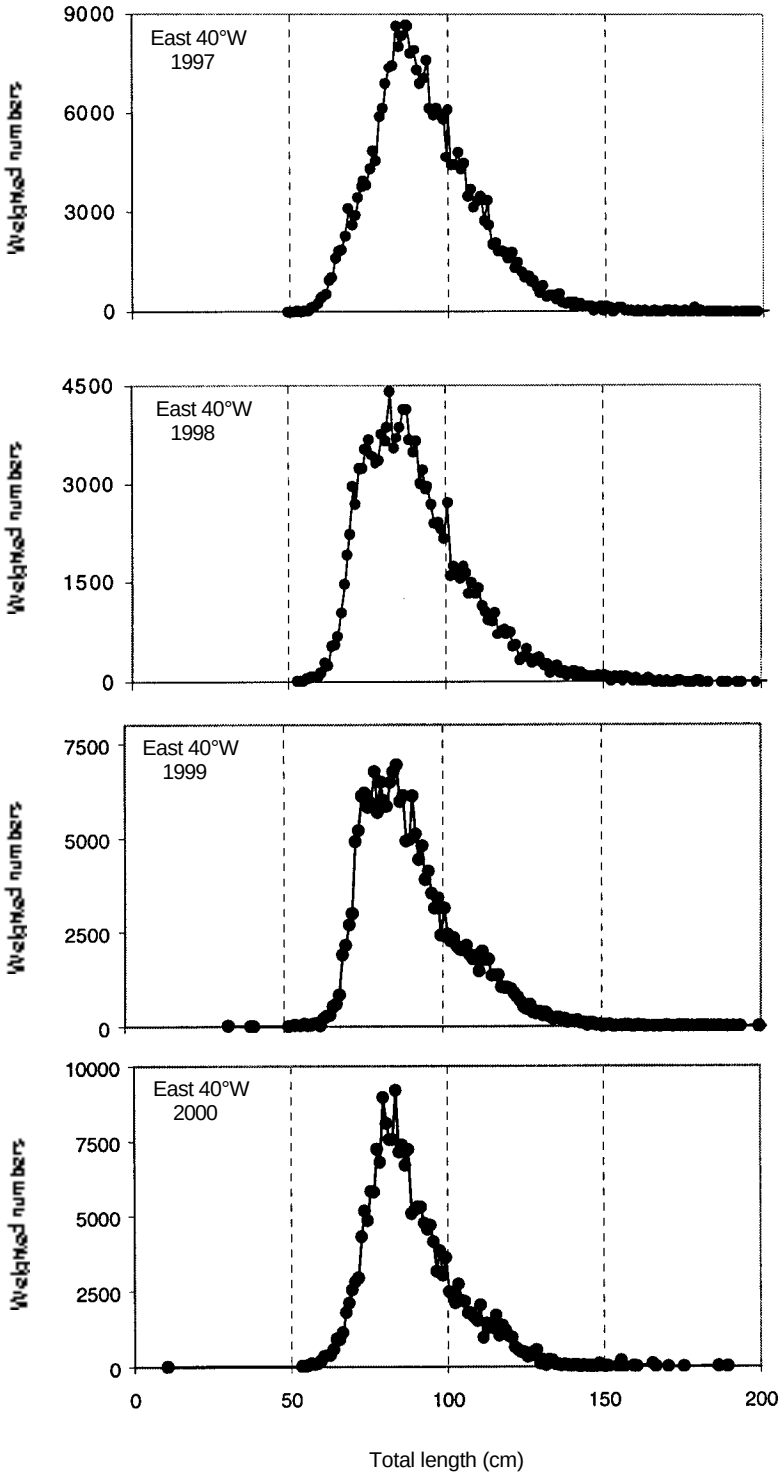


Figure 11 (continued)

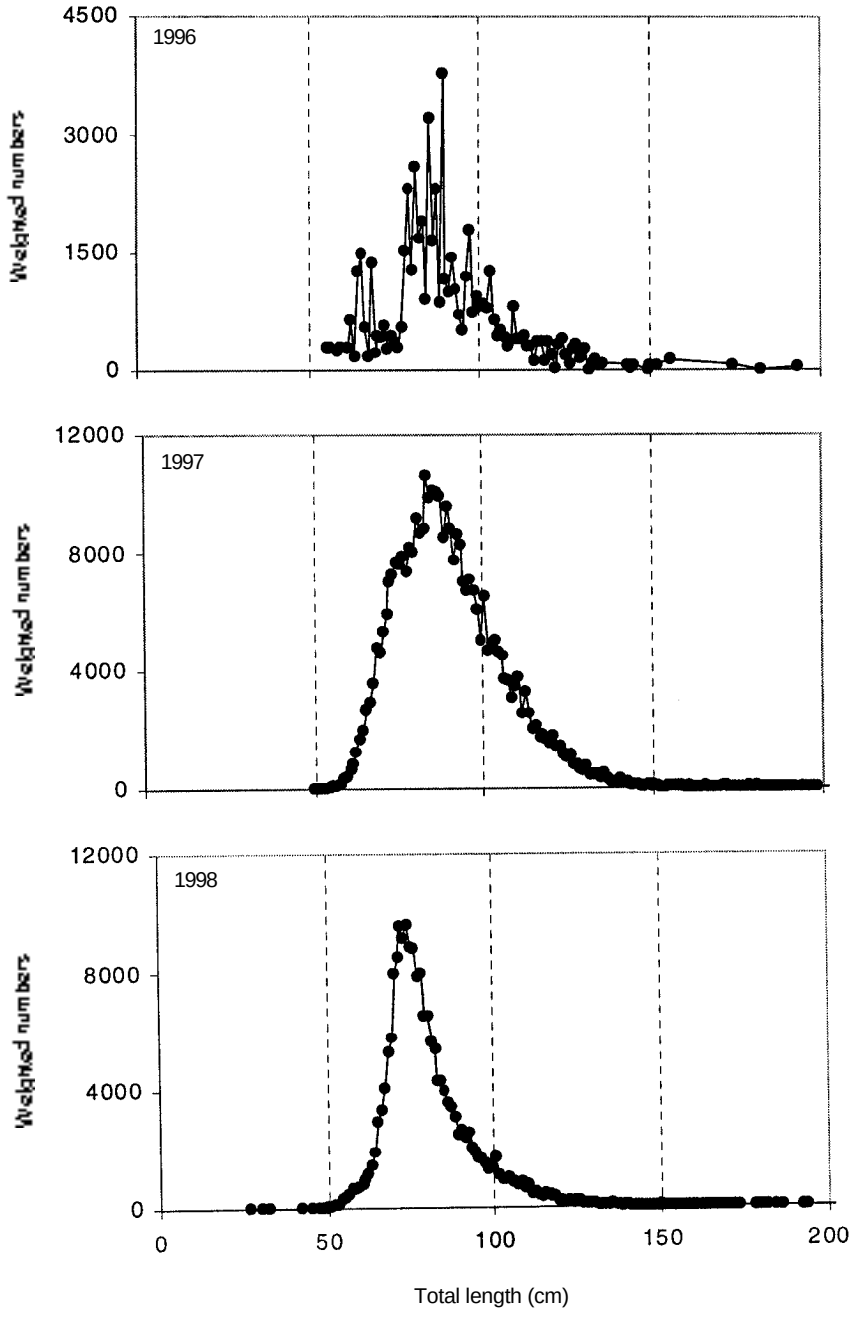


Figure 12: Catch-weighted length frequencies by season for fish taken around Shag Rocks for catches <900 m.

(continued)

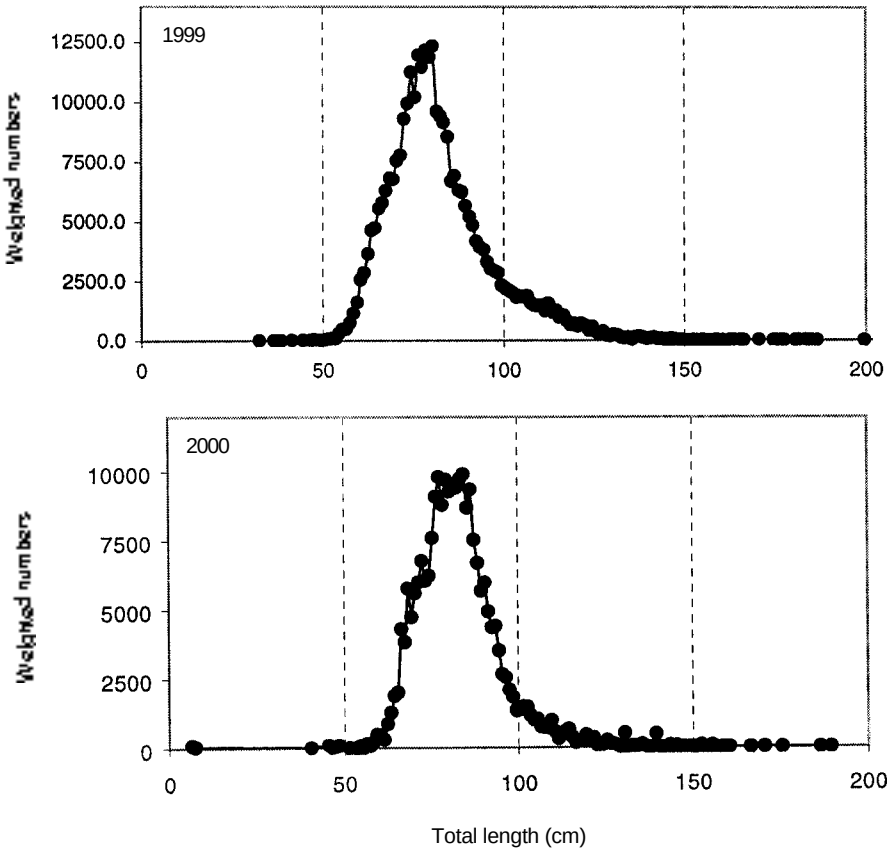


Figure 12 (continued)

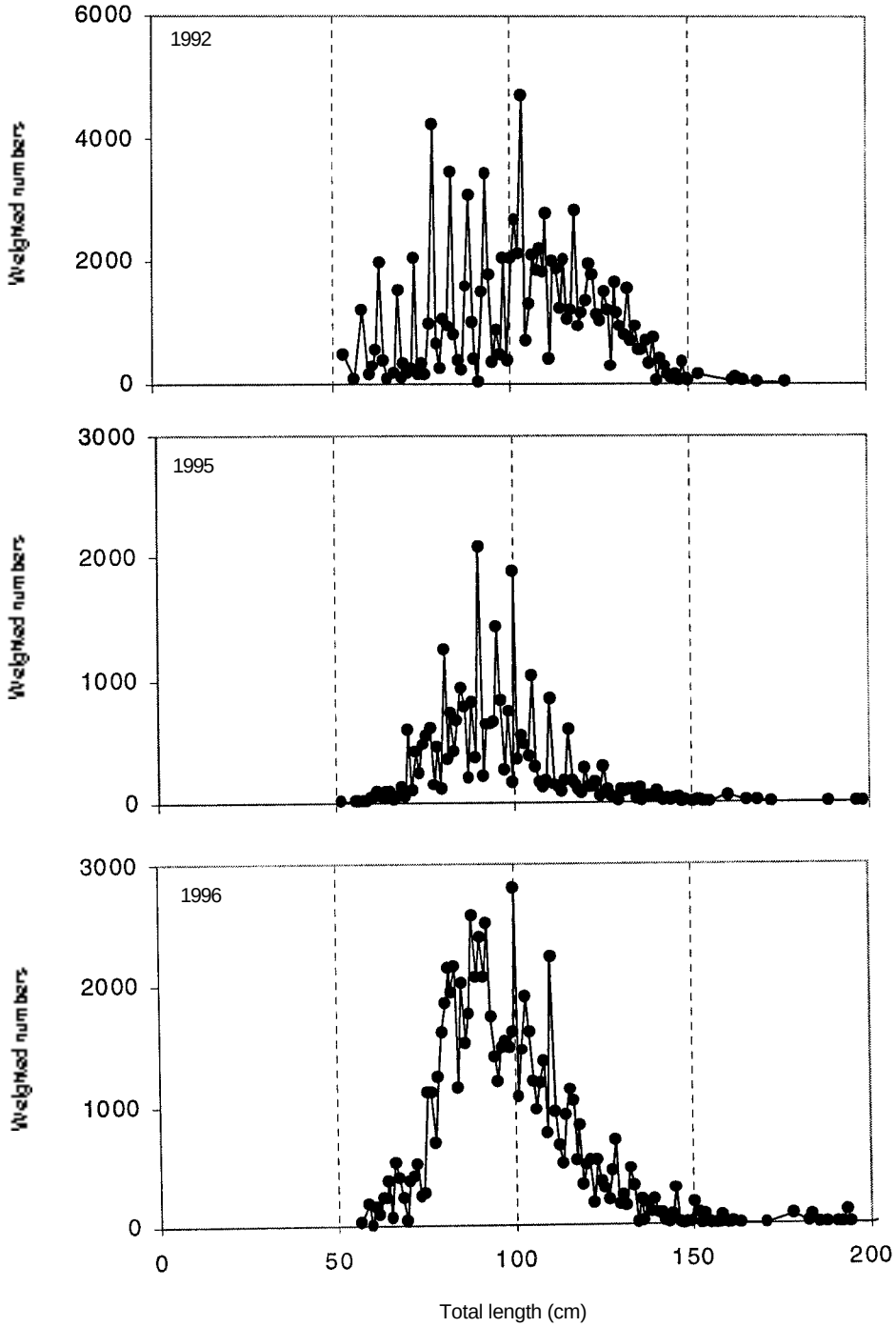


Figure 13: Catch-weighted length frequencies by season for fish taken around Shag Rocks for catches >900 m.

(continued)

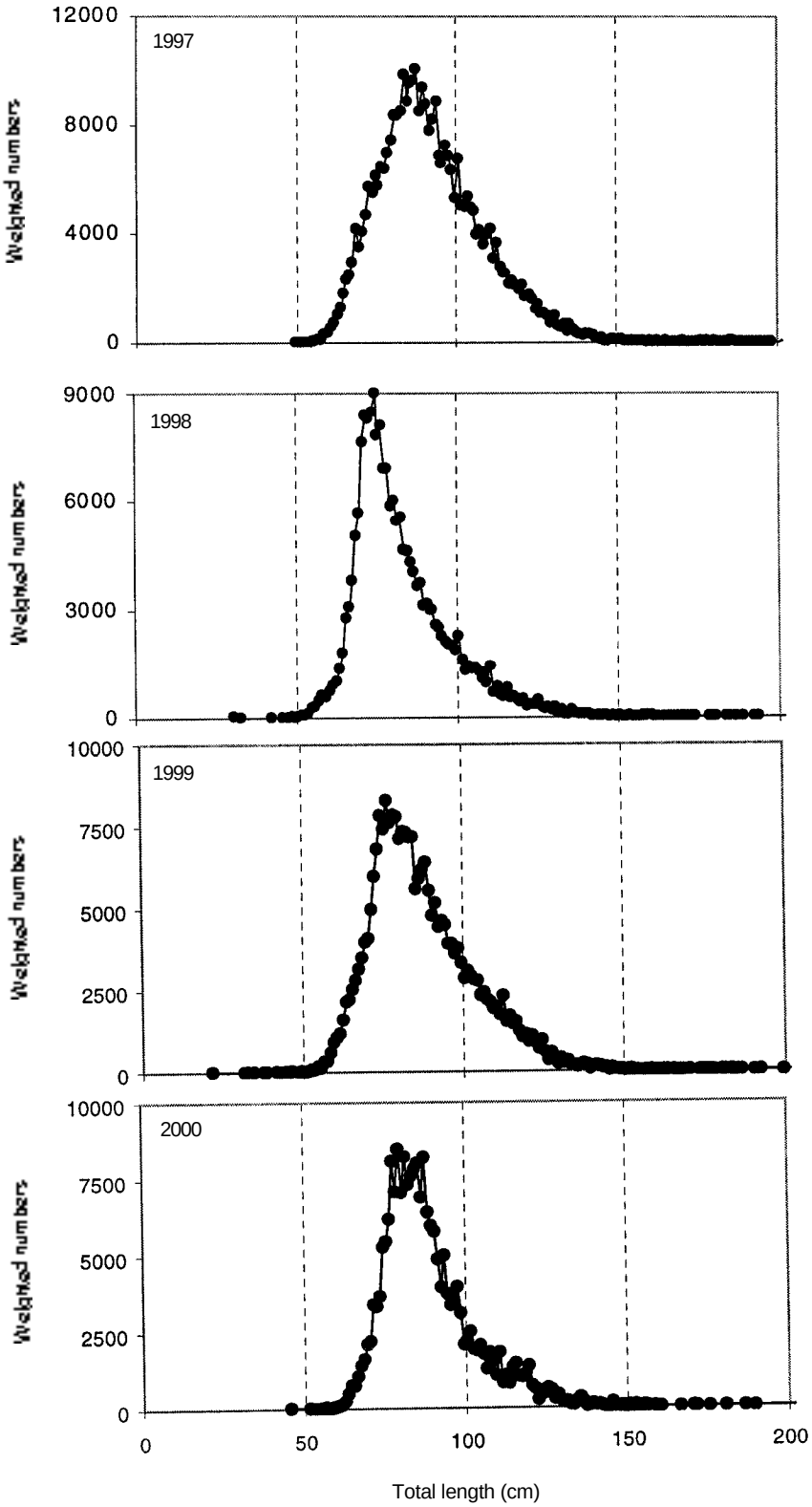


Figure 13 (continued)

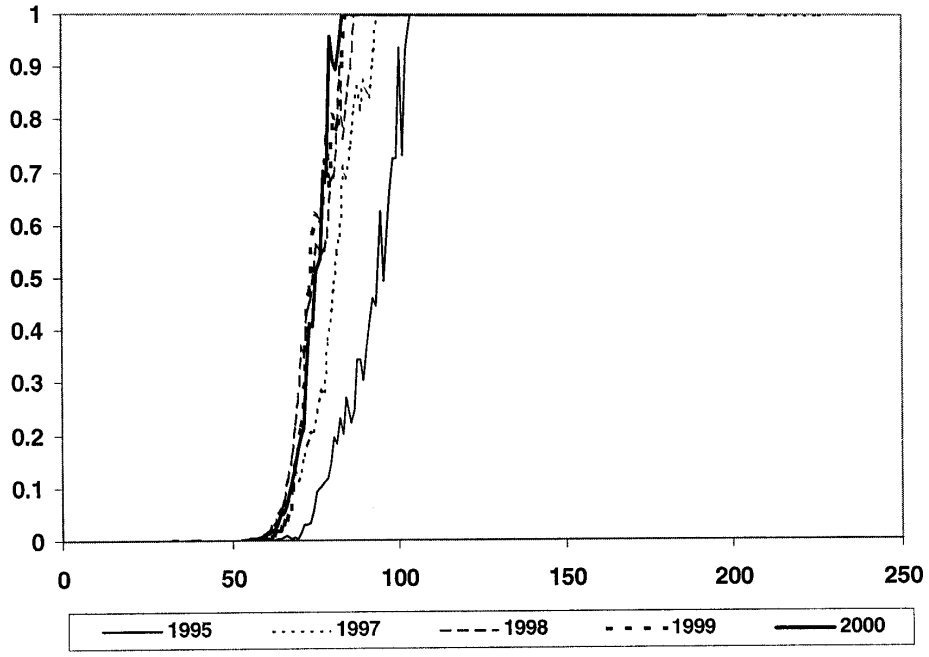


Figure 14: Selectivity curves by year for *Dissostichus eleginoides* in South Georgia (Subarea 48.3).

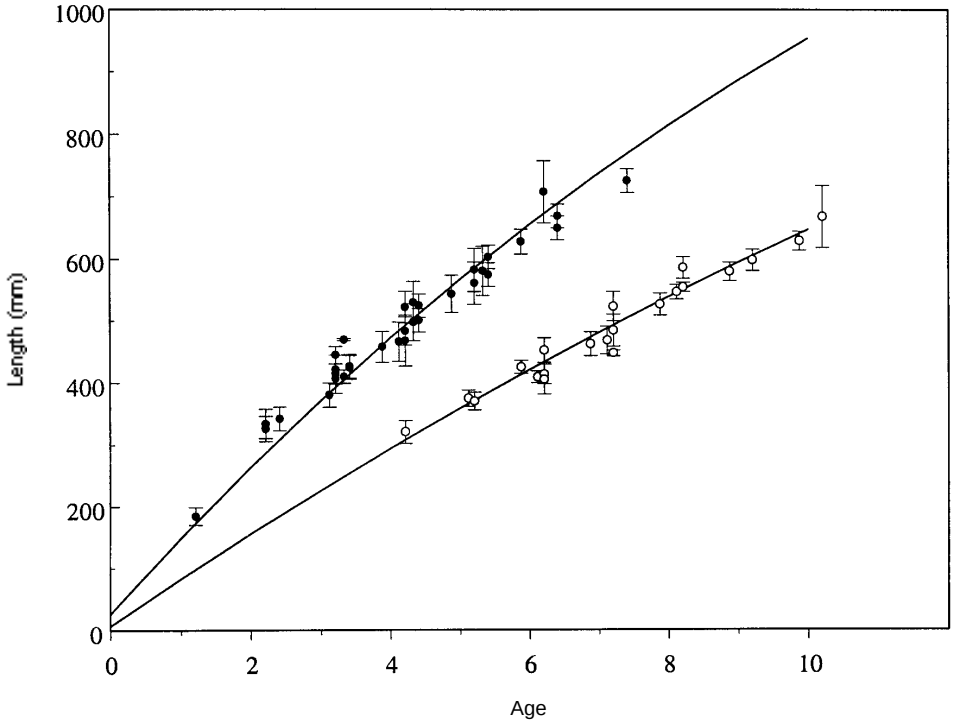
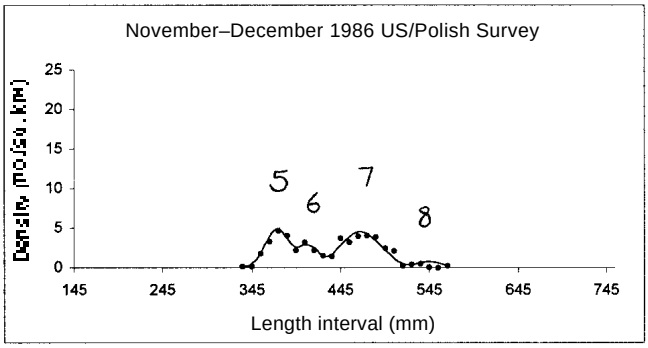
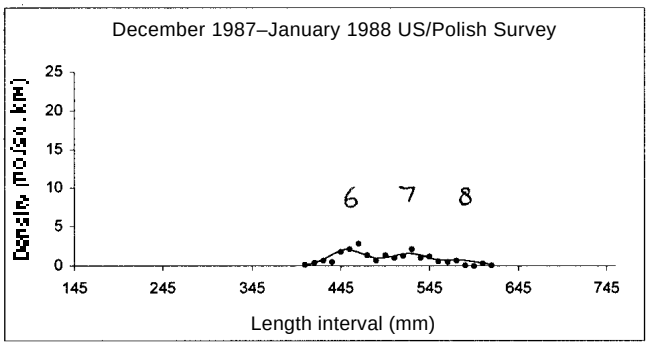
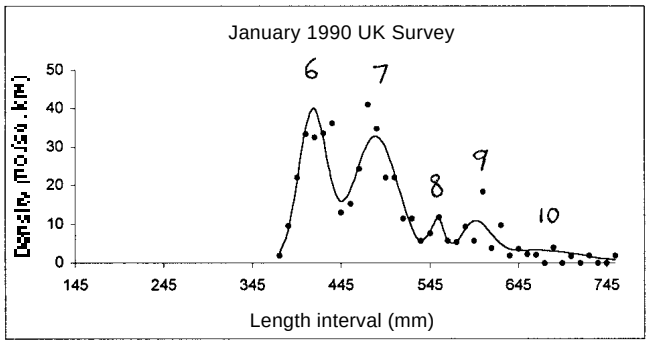


Figure 15: Mean length (± standard deviation) for cohorts from mixture analyses with the growth curves used as a guide to fit the mixture. Filled circles are results from WG-FSA-99 including the 2000 survey results analysed based on growth parameters from 1999 (top line). Open circles are from the revised mixture analyses based on von Bertalanffy k = 0.041 (bottom line).







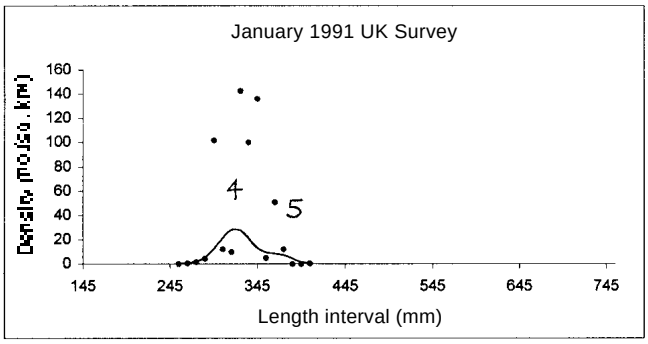
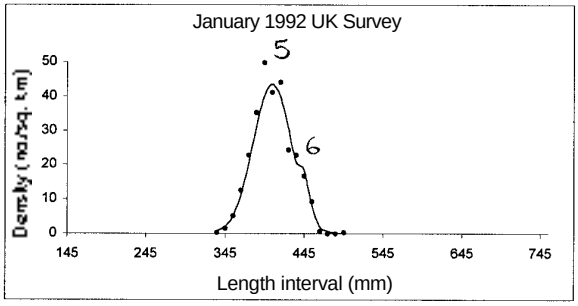
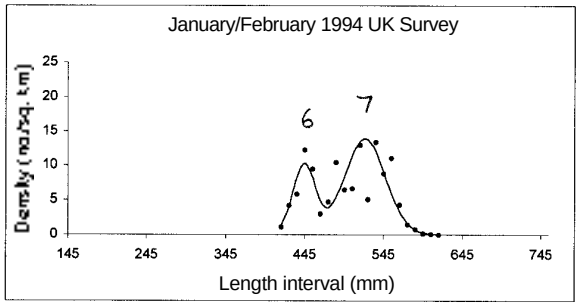
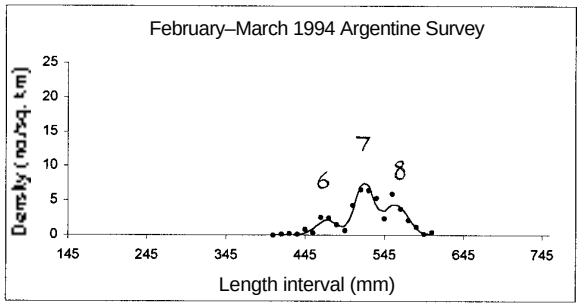


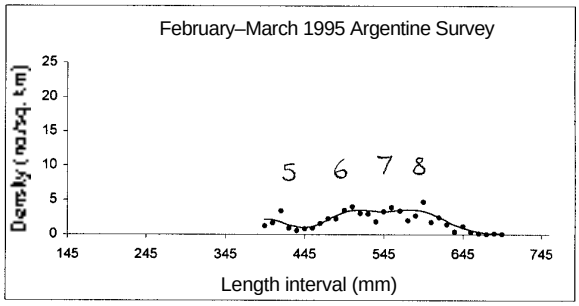
Figure 16: Plots of the observed and expected length-density data produced during the mixture analysis, using the growth rate from Heard Island (paragraph 4.132). Numbers superimposed on the plots indicate nominal ages assigned to each mixture component.

(continued)









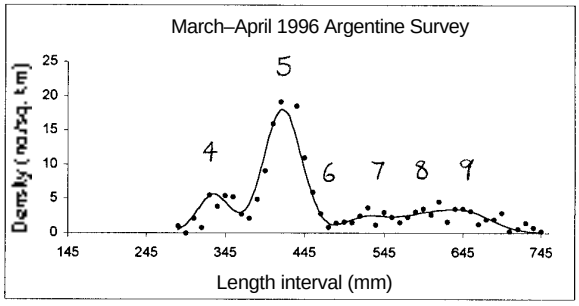


Figure 16 (continued)

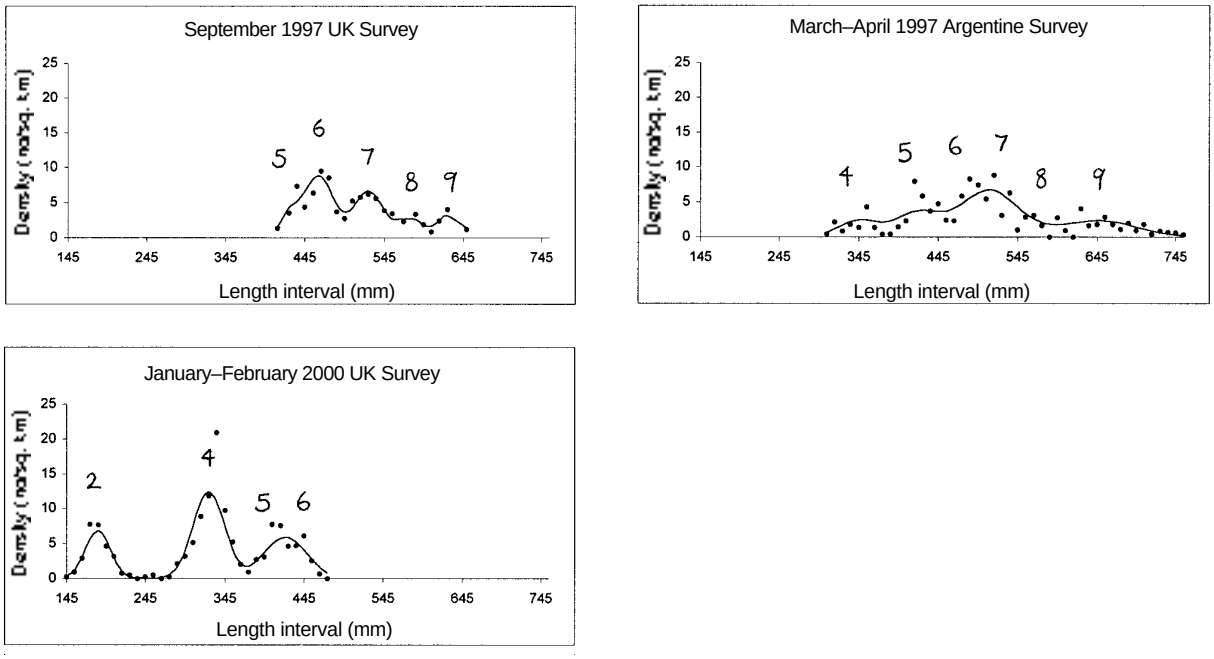


Figure 16 (continued)

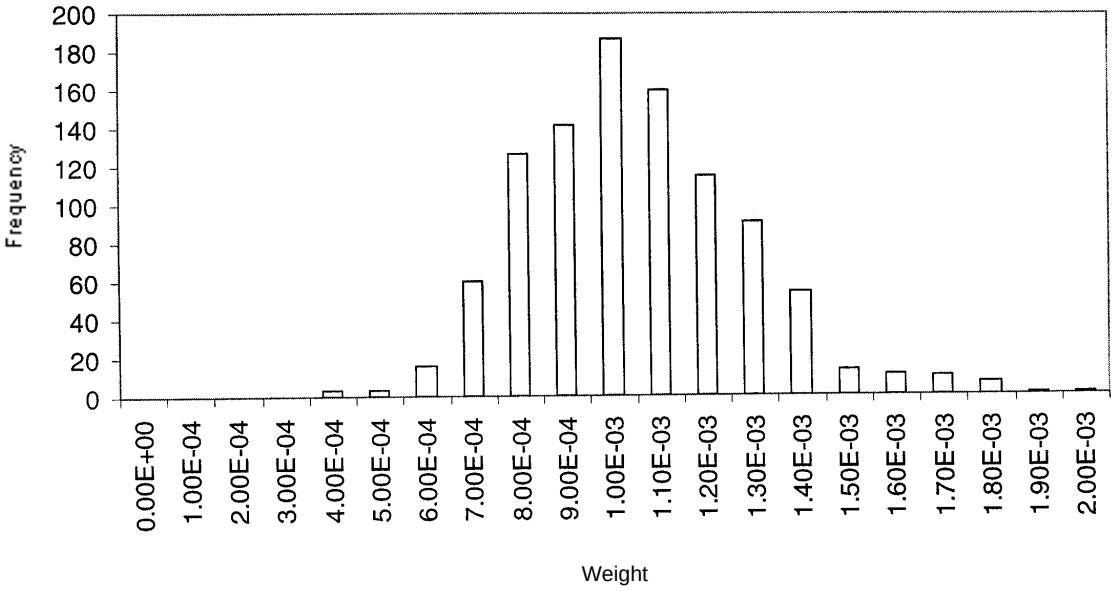


Figure 17: Histogram of estimated weights for Subarea 48.3 GYM trajectories.

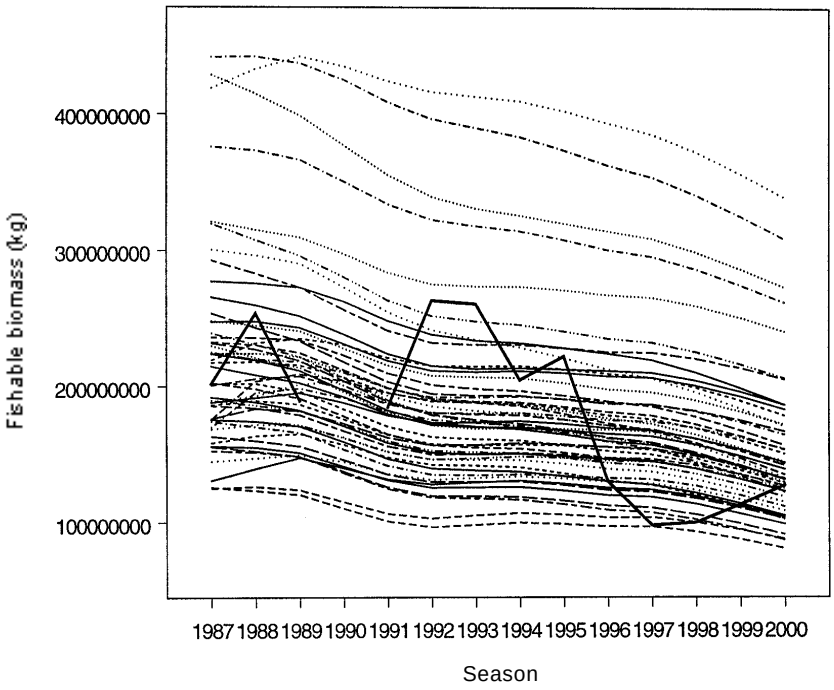


Figure 18: The 50 highest weighted trajectories of fishable biomass and scaled CPUE in Subarea 48.3 GYM analysis.

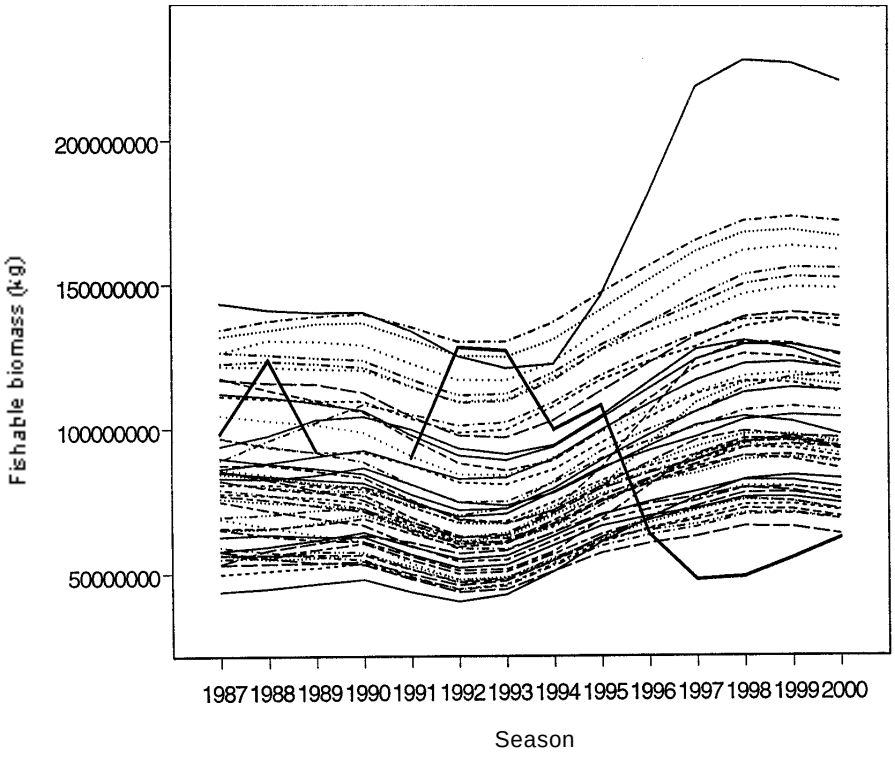


Figure 19: The 50 lowest weighted trajectories of fishable biomass and scaled CPUE in Subarea 48.3 GYM analysis.

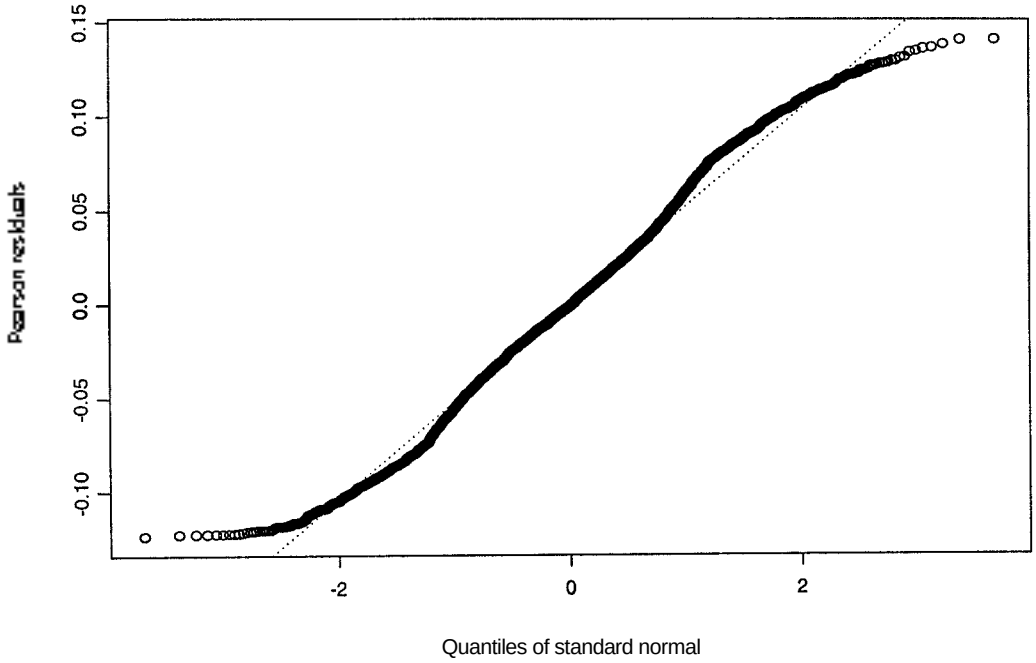


Figure 20: QQ plot of standardised residuals for the GLM fitted to CPUE values in numbers of fish/hook using data from longliners in the Kerguelen Islands.

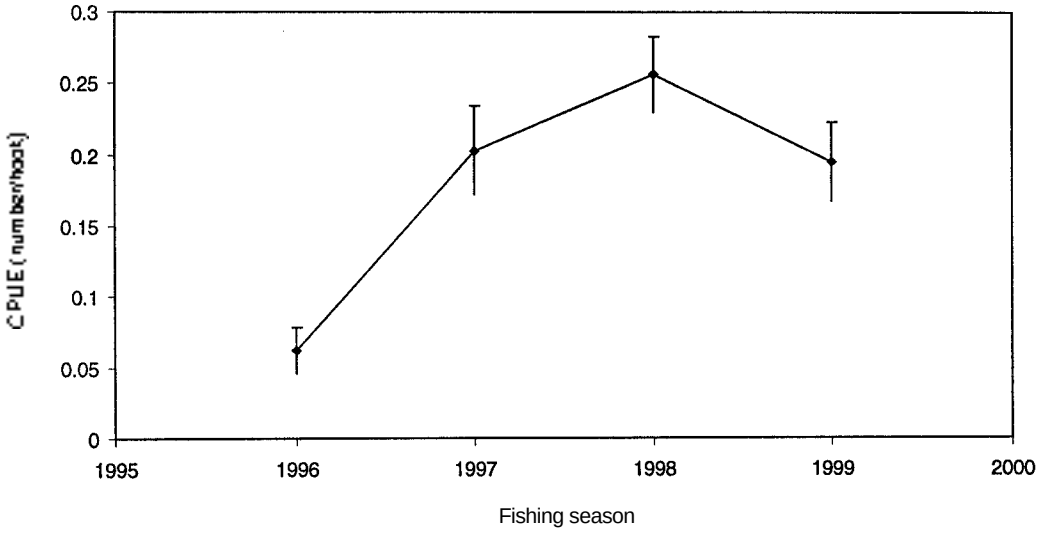


Figure 21: Standardised series of CPUE in number of fish/hook for longliners in Division 58.5.1.

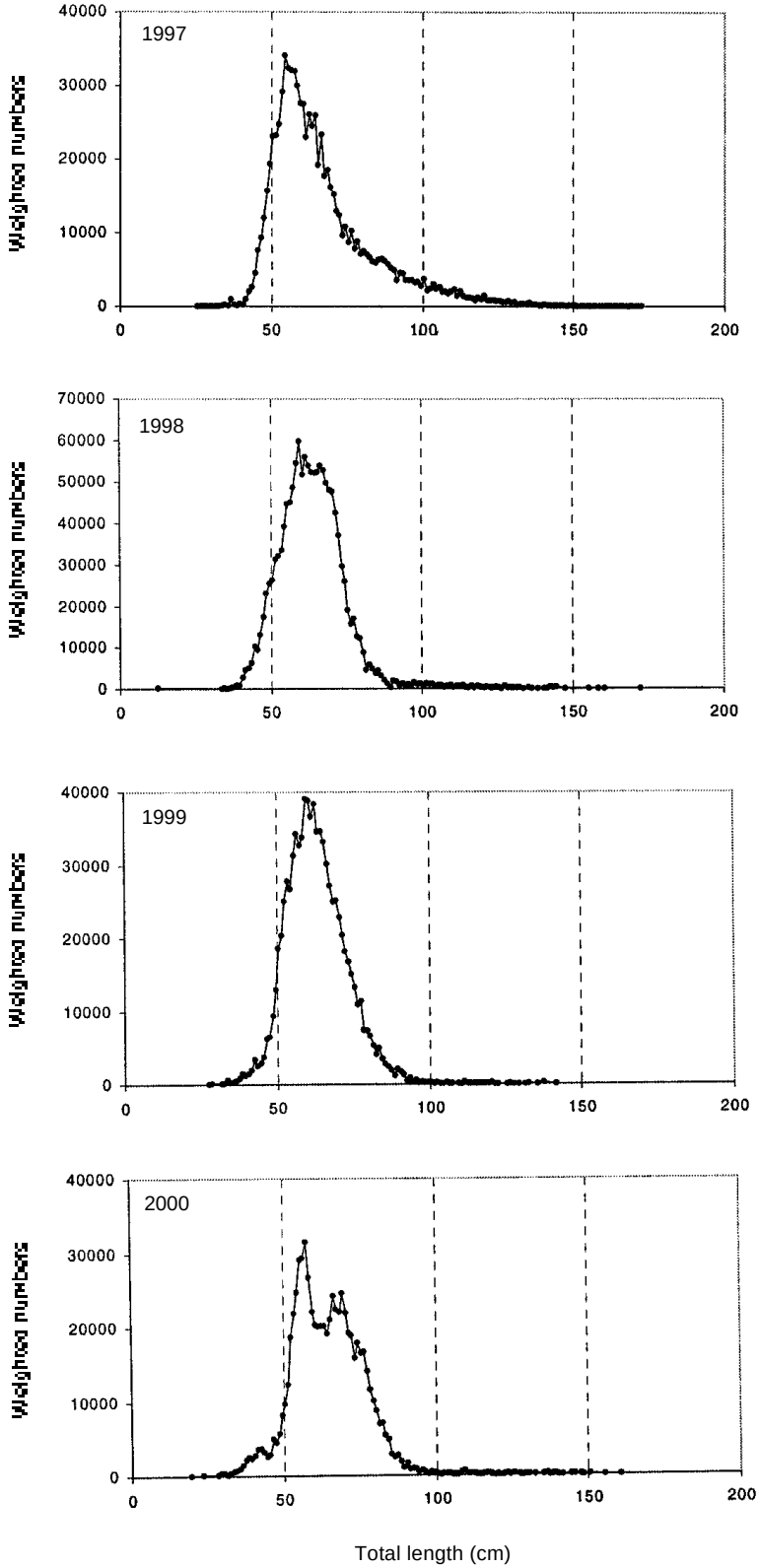


Figure 22: Catch-weighted length frequencies for *Dissostichus eleginoides* by season for fish taken around Heard Island (Division 58.5.2).

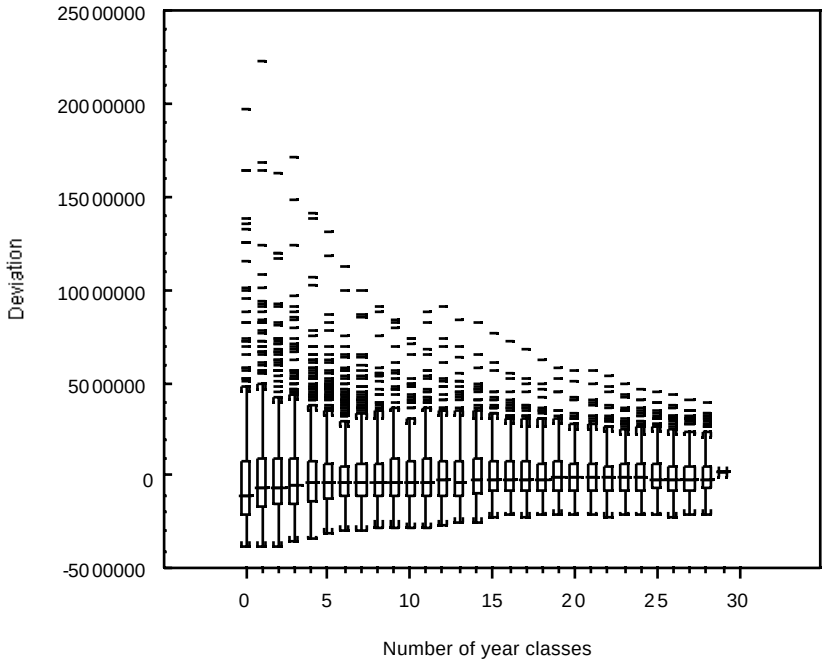


Figure 23: Box plots showing, for the number of observed year classes, the distribution of estimated mean recruitments as deviations from the population mean for 500 repeated samples from a log-normal distribution with a CV of 1.

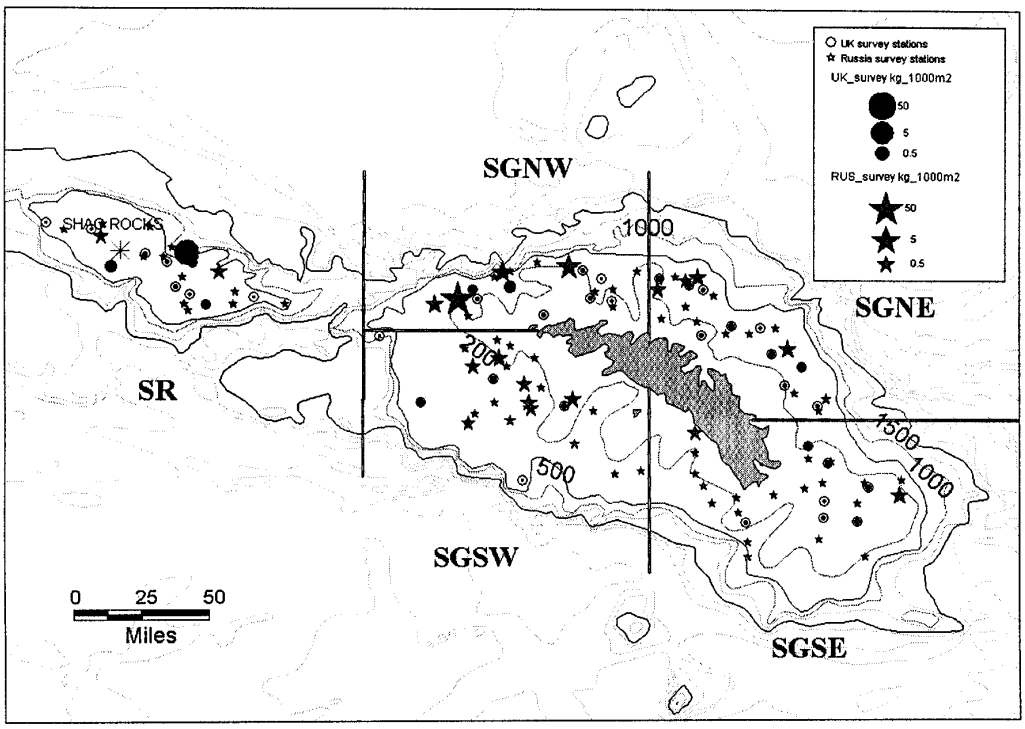
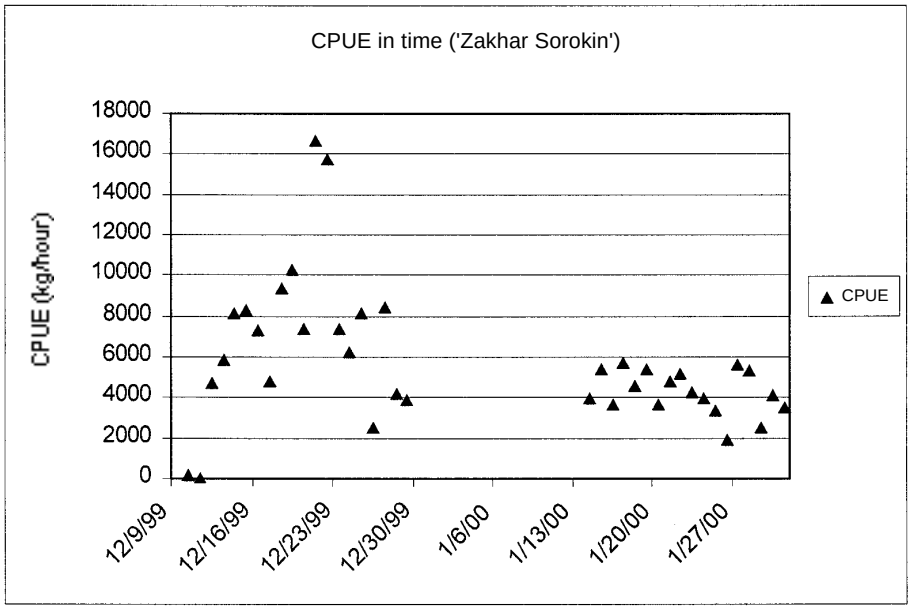


Figure 24: Location of stations sampled during the surveys conducted by Russia and the UK in Subarea 48.3 in January–February 2000.



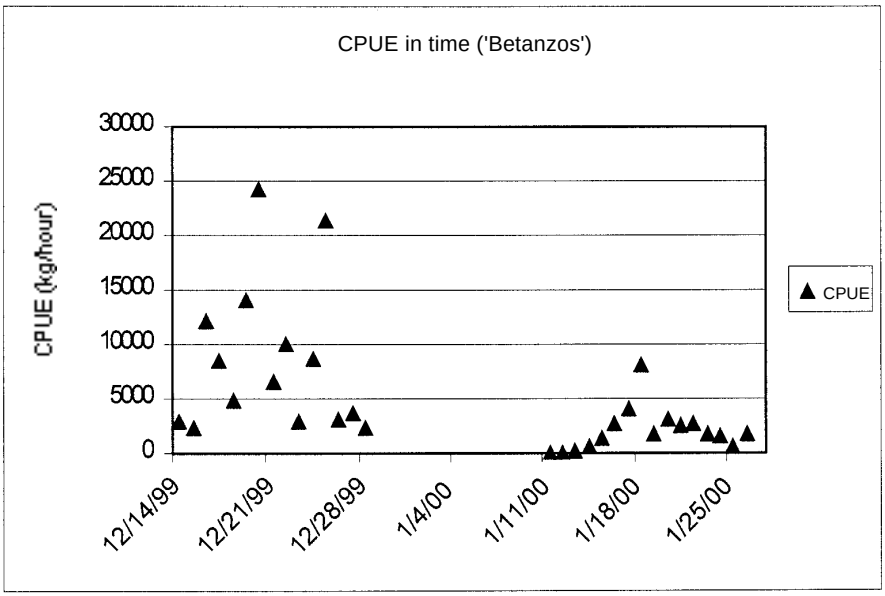


Figure 25: Graph of catch rates per hour over time for the two vessels.

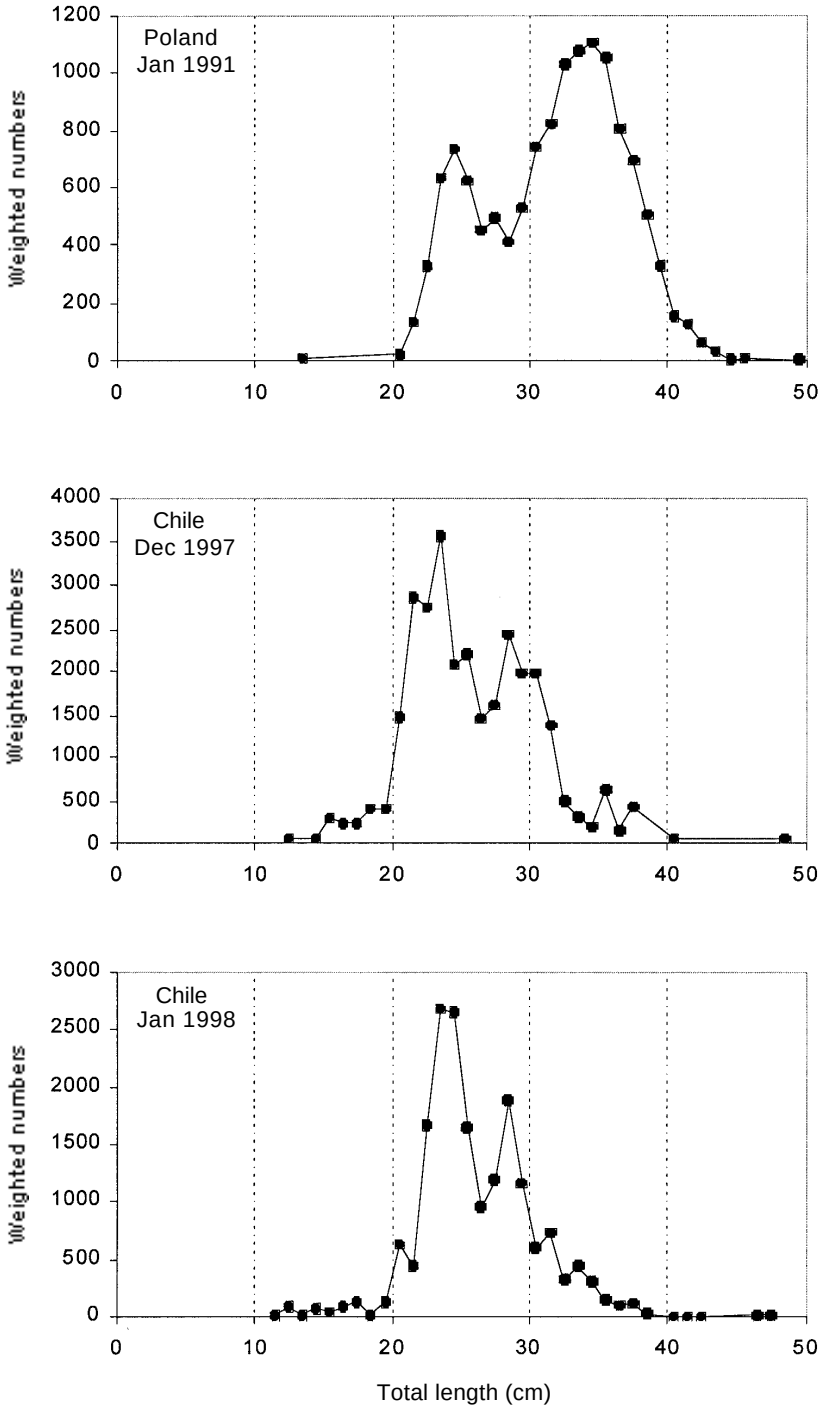


Figure 26: Catch-weighted length distributions from the commercial fishery for *C. gunnari* in the 1990/91 to 1999/2000 fishing seasons.

(continued)

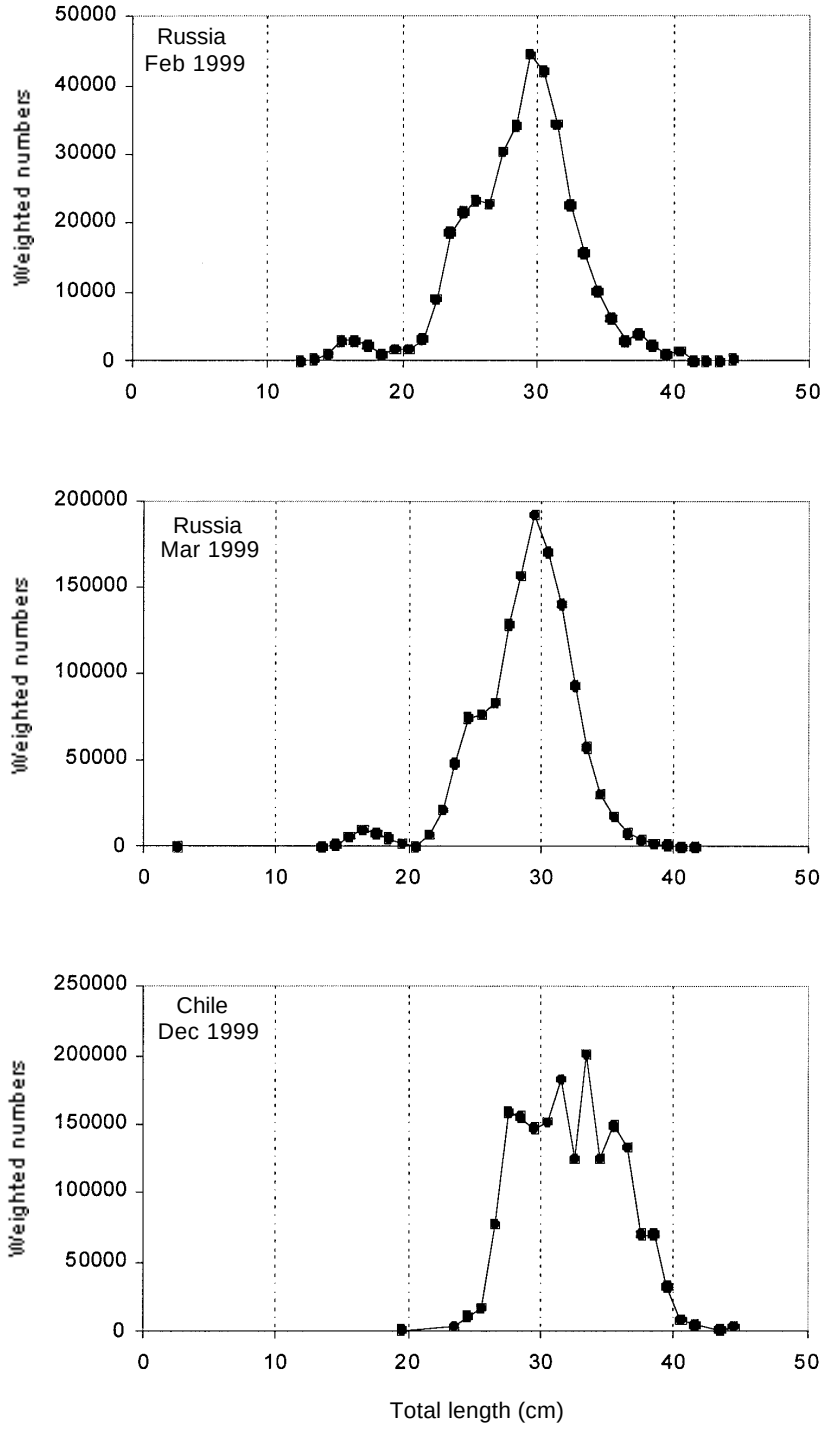


Figure 26 (continued)

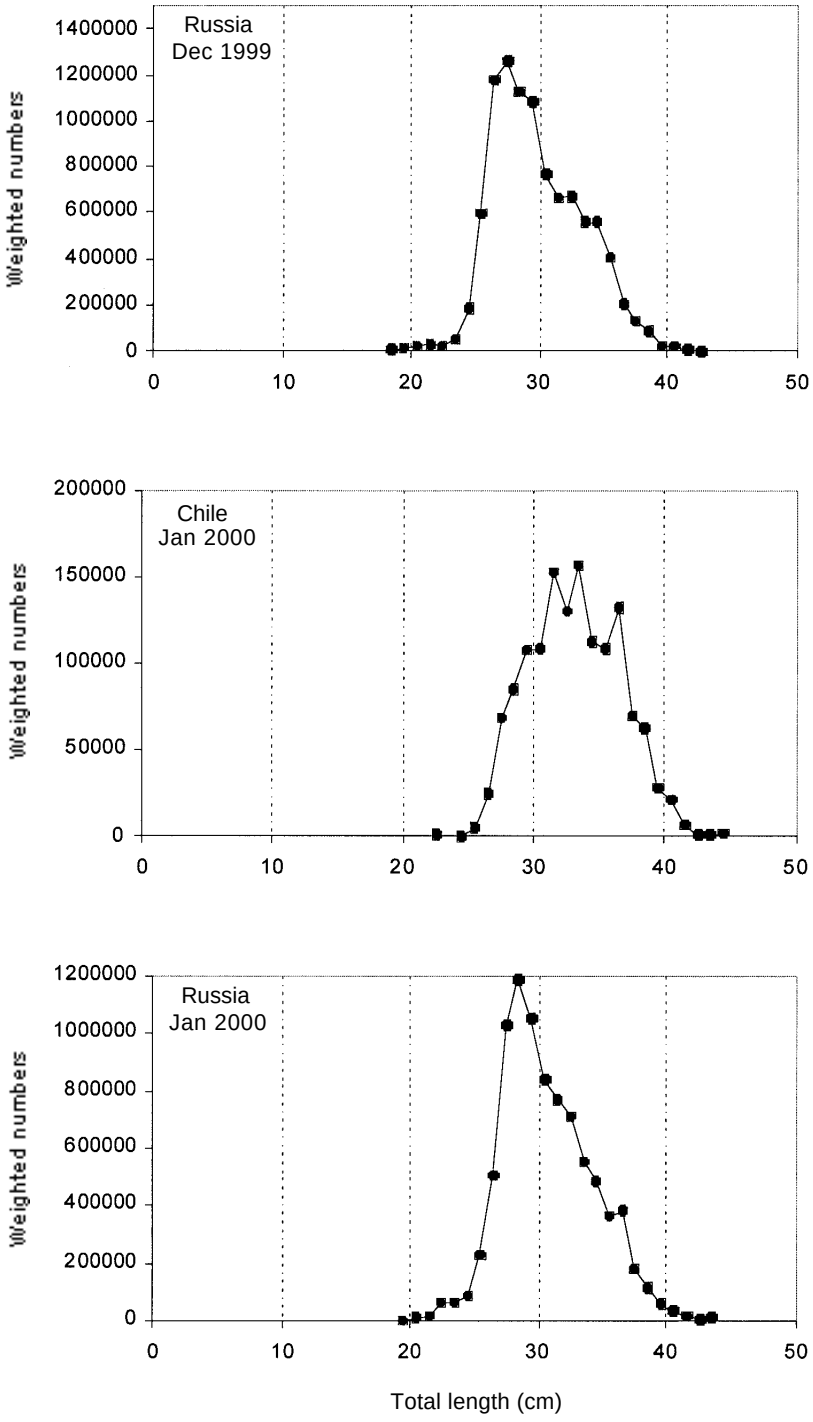
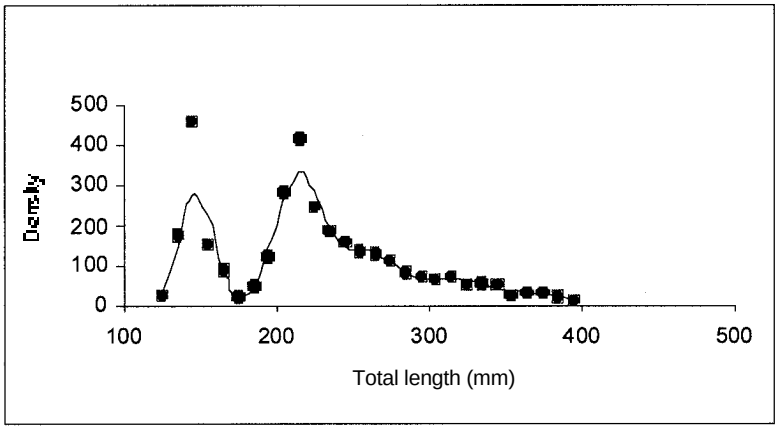
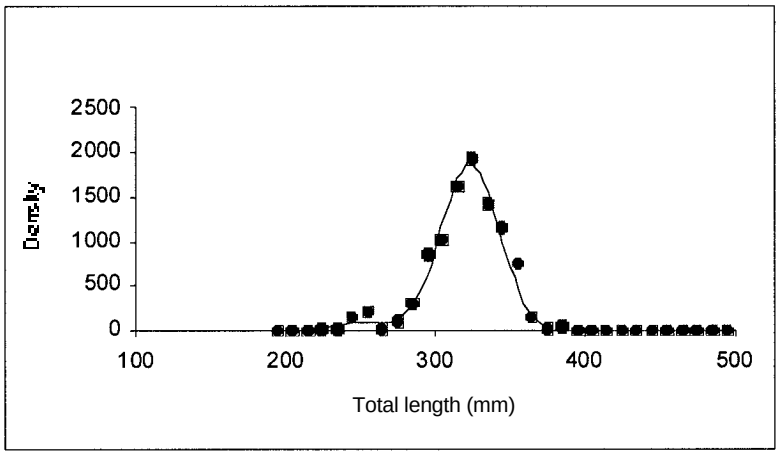


Figure 26 (continued)

(a) UK survey, South Georgia



(b) UK survey, Shag Rocks



(c) Russian survey, Subarea 48.3

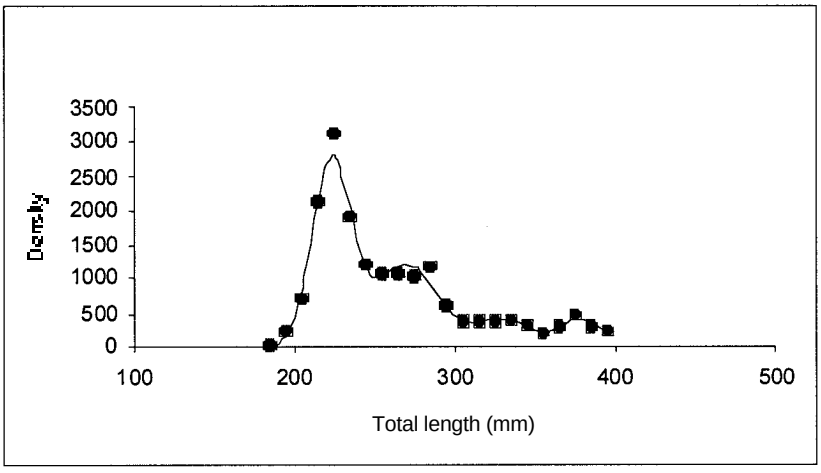


Figure 27: Observed densities at length and fitted mixtures of distributions for UK and Russian surveys during the 1999/2000 season.

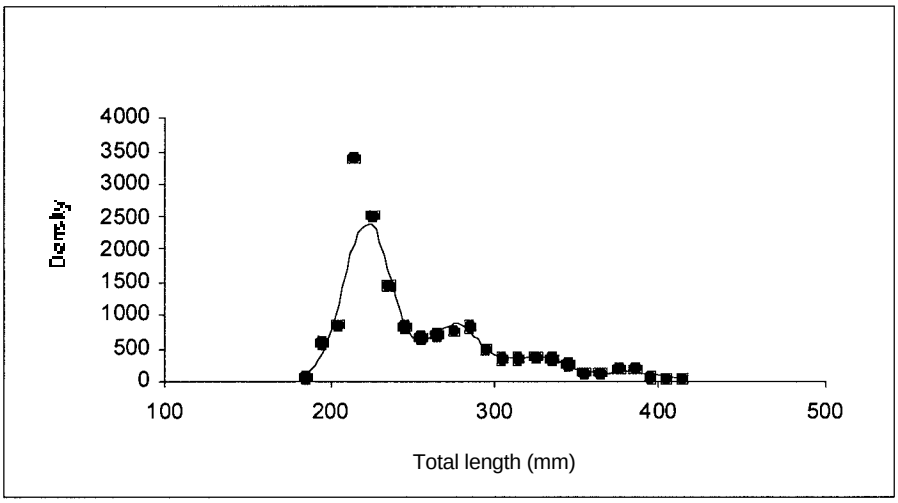


Figure 28: Observed densities at length and fitted mixtures of distributions for the combined survey dataset, Subarea 48.3.

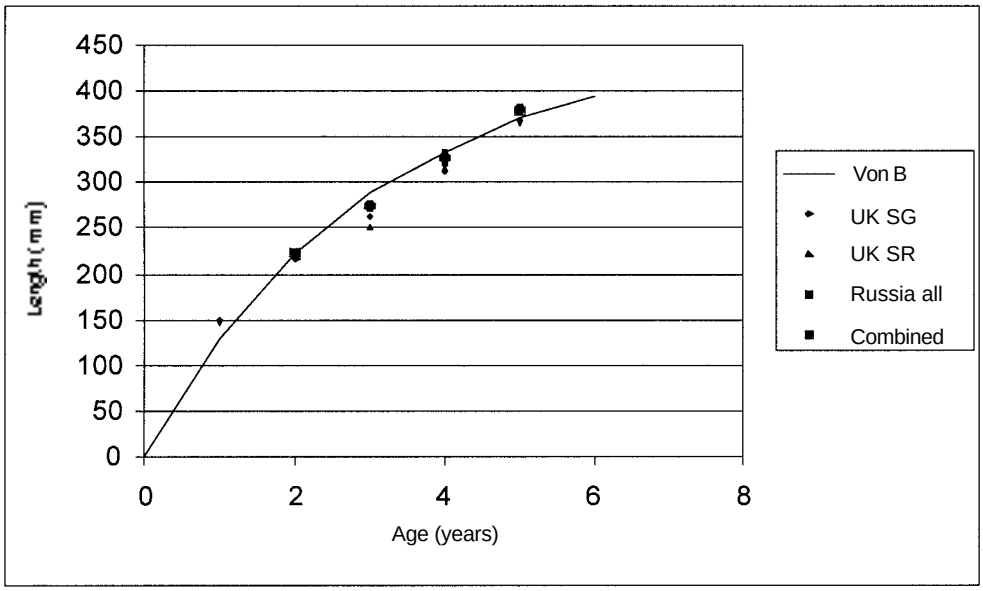


Figure 29: Comparison of means of mixture components from the CMIX analysis and the von Bertalanffy growth curve used in the short-term projection.

APPENDIX A

AGENDA

Working Group on Fish Stock Assessment
(Hobart, Australia, 9 to 19 October 2000)

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 1999
      3.1.1 Data Inventory and Developments in the CCAMLR Database
      3.1.2 Data Entry and Validation
      3.1.3 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 Illegal, Unregulated and Unreported (IUU) Fishing (Subgroup report)
      3.2.3 Catch and Effort Data for Fisheries for *Dissostichus* spp. in Waters Adjacent to the Convention Area
      3.2.4 Scientific Observer Information (Subgroup report)
      3.2.5 Research Surveys
      3.2.6 Mesh/Hook Selectivity and related Experiments affecting Catchability
      3.2.7 Conversion Factors

   3.3 Fish and Squid Biology/Demography/Ecology (Subgroup report)

   3.4 Developments in Assessment Methods (Subgroup report)

4. Assessments and Management Advice

   4.1 New and Exploratory Fisheries
      4.1.1 New Fisheries in 1999/2000
      4.1.2 Exploratory Fisheries in 1999/2000
      4.1.3 New Fisheries Notified for 2000/2001
      4.1.4 Exploratory Fisheries Notified for 2000/2001
      4.1.5 Progress Towards Assessments in New and Exploratory Fisheries
      4.1.6 Apportioning Catch Limits between Trawl and Longline Fisheries

   4.2 Assessed Fisheries
      4.2.1 *Dissostichus eleginoides* South Georgia (Subarea 48.3)
      4.2.2 *Dissostichus eleginoides* Kerguelen Islands (Division 58.5.1)
      4.2.3 *Dissostichus eleginoides* Heard Island (Division 58.5.2)
      4.2.4 *Champsocephalus gunnari* South Georgia (Subarea 48.3)
      4.2.5 *Champsocephalus gunnari* Heard Island (Division 58.5.2)

   4.3 Other Fisheries
      4.3.1 Other Finfish Fisheries
      4.3.2 Crabs
      4.3.3 Squid

4.4 General By-catch Provisions (Subgroup report)
4.5 Regulatory Framework

5. Considerations of Ecosystem Management

5.1 Interactions with WG-EMM
5.2 Ecological Interactions (e.g. multi-species, benthos, etc.)

6. Research Surveys

6.1 Simulation Studies
6.2 Recent and Proposed Surveys

7. Incidental Mortality Arising from Longline Fishing

7.1 Intersessional Work of ad hoc WG-IMALF

7.2 Research into the Status of Seabirds

7.3 Incidental Mortality of Seabirds during Regulated Longline Fishing in the Convention Area
7.3.1 Data Submitted for the 1999/2000 and the Beginning of the 2000/2001 Seasons
7.3.2 Evaluation of Levels of Incidental Mortality
7.3.3 Compliance with Conservation Measure 29/XVI

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

7.5 Incidental Mortality of Seabirds in relation to New and Exploratory Fisheries
7.5.1 Assessments of Risk in CCAMLR Subareas and Divisions
7.5.2 New and Exploratory Fisheries Operational in 1999/2000
7.5.3 New and Exploratory Fisheries Proposed for 2000/2001

7.6 Incidental Mortality of Seabirds during Longline Fishing outside the Convention Area

7.7 Research into and Experience with Mitigating Measures

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

7.9 Advice to the Scientific Committee

8. Other Incidental Mortality

8.1 Interactions involving Marine Mammals with Longline Fishing Operations
8.2 Trawl Fishing

9. CCAMLR Website

10. Future Work

10.1 Data Requirements
10.2 Software and Analyses to be Prepared or Developed Prior to the Next Meeting
10.3 Impact of Budgetary Restraints

11. Other Business

11.1 *CCAMLR Science* and the *Science Citation Index*
11.2 *Fishery Data Manual*
11.3 Deadline for Submission of Meeting Papers
11.4 IUCN Criteria for Endangered Species

12. Adoption of the Report

13. Close of the Meeting.

APPENDIX B

LIST OF PARTICIPANTS

Working Group on Fish Stock Assessment
(Hobart, Australia, 9 to 19 October 2000)

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APPENDIX C

LIST OF DOCUMENTS

Working Group on Fish Stock Assessment
(Hobart, Australia, 9 to 19 October 2000)

WG-FSA-00/1	Provisional and Annotated Provisional Agenda for the 2000 Meeting of the Working Group on Fish Stock Assessment (WG-FSA)
WG-FSA-00/2	List of participants
WG-FSA-00/3	List of documents
WG-FSA-00/4	Data and resources available to WG-FSA 2000 Secretariat
WG-FSA-00/5	Secretariat work in support of WG-FSA Secretariat
WG-FSA-00/6	Fishery information for WG-FSA-00 Secretariat
WG-FSA-00/7	United Kingdom genetic research relevant to Southern Ocean seabirds vulnerable to fisheries interactions J.P. Croxall (United Kingdom)
WG-FSA-00/8	United Kingdom research under way on Southern Ocean seabirds vulnerable to fisheries interactions J.P. Croxall (United Kingdom)
WG-FSA-00/9	France research under way on Southern Ocean seabirds vulnerable to fisheries interactions H. Weimerskirch (France)
WG-FSA-00/10	Research under way on New Zealand seabirds vulnerable to fisheries interactions J. Molloy (New Zealand)
WG-FSA-00/11	Documentation for the CCAMLR survey database and length-density analysis Secretariat
WG-FSA-00/12	Update on the CCAMLR Website Secretariat
WG-FSA-00/13	Longline fishing at Tristan da Cunha: impact on seabirds N. Glass, I. Lavarello, J.P. Glass and P.G. Ryan (South Africa) (In: *Atlantic Seabirds,* 2 (2), in press).
WG-FSA-00/14	What do we know about fish stocks in the Southern Scotia region? A review and prospects for future research K.-H. Kock (Germany) and C. Jones (USA)

WG-FSA-00/15	Preparation of identification keys for by-catch fish species Secretariat
WG-FSA-00/16	Restoration of retrospective data on *Dissostichus eleginoides* catches in Subarea 48.3 Delegations of Ukraine and Russia
WG-FSA-00/17	Brief report of national scientific observer aboard longliner *RK1* Delegation of Ukraine
WG-FSA-00/18	Summary of observations aboard trawlers operating in the Convention Area during the 1999/2000 season Secretariat
WG-FSA-00/19	Hydroacoustic observations of the vertical distribution of icefish *Champsocephalus gunnari* in the western part of the slope of the South Georgia Island in December 1999–January 2000 V.L. Senioukov (Russia)
WG-FSA-00/20	Biological features of the icefish *Champsocephalusgunnari* from commercial catches in Subarea 48.3 during the period from 8 December 1999 until 31 January 2000 V.L. Senioukov (Russia)
WG-FSA-00/21	UK groundfish survey in Subarea 48.3 (South Georgia and Shag Rocks), January 2000 I. Everson, D. Agnew, P. Bagley, M. Collins, T. Daw, R. Forster, T. Marlow, A. North (United Kingdom), J. Szlakowski (Poland), E. Van Wijk (Australia), S. Wilhelms (Germany) and C. Yau (United Kingdom)
WG-FSA-00/22	Notes on the biology of the South Georgia ray, *Raja georgiana* I. Everson, J. Kerr, C. Yau and A. Williams (United Kingdom)
WG-FSA-00/23	Fishing for toothfish using pots: results of trials undertaken around South Georgia, March–May 2000 D. Agnew, T. Daw, M. Purves and G. Pilling (United Kingdom) (*CCAMLR Science*, 8: submitted)
WG-FSA-00/24	Crab by-catch in the experimental toothfish pot fishery around South Georgia, 2000 T. Daw, D. Agnew, M. Purves, G. Pilling and C. Yau (United Kingdom) (*CCAMLR Science*, 8: submitted)
WG-FSA-00/25	Examination of the gut contents of Patagonian toothfish (*Dissostichus eleginoides*) from the toothfish pot fishery trials around South Georgia G. Pilling, T. Daw, M. Purves, D. Agnew and J. Xavier (United Kingdom)
WG-FSA-00/26	Toothfish tagging programme around South Georgia, 2000 G. Pilling, I. Everson, D. Agnew, T. Daw, R. Forster, A. North and M. Purves (United Kingdom)

WG-FSA-00/27	Spawning activity of mackerel icefish at South Georgia I. Everson, A. North (United Kingdom) and K.-H. Kock (*CCAMLR Science*, 8: submitted) (Germany)
WG-FSA-00/28	A comparison between otoliths and scales for use in estimating the age of *Dissostichus eleginoides* from South Georgia J. Ashford, C. Jones, S. Wischniowski, S. Bobko (USA) and I. Everson (United Kingdom) (*CCAMLR Science*, 8: submitted)
WG-FSA-00/29	Reducing seabird by-catch with an underwater longline setting funnel P. Ryan and B. Watkins (South Africa)
WG-FSA-00/30	Seabird by-catch in the Patagonian toothfish longline fishery at the Prince Edward Islands: 1999–2000 P. Ryan and B. Watkins (South Africa)
WG-FSA-00/31	On possibility of using acoustic method to improve quality of *Champsocephalus gunnari* biomass estimates in Subarea 48.3 S. Kasatkina (Russia) (*CCAMLR Science*, 8: submitted)
WG-FSA-00/32	Length-age composition of icefish (*Champsocephalus gunnari*, perciformes, notothenioidei, Channichthyidae) from different locations of South Georgia Island subarea Zh.A. Frolkina (Russia) (*CCAMLR Science*, 8: submitted)
WG-FSA-00/33	Standardised estimates of *D. eleginoides* catches per effort in Subarea 48.3 using information for 1985/86–1990/91 seasons P. Gasiukov (Russia) and V. Bibik (Ukraine) (*CCAMLR Science*, 8: submitted)
WG-FSA-00/34	Global status of albatrosses and Macronectes and Procellaria petrels (Source: BirdLife International. 2000. *Threatened Birds of the World*. BirdLife International/Lynx-Edicions, Barcelona.)
WG-FSA-00/35	Fishery dependent research (Extract from the Report of New Zealand on Member's Activities in the Convention Area in 1999/2000)
WG-FSA-00/36	Fish Heaven: a Monte Carlo, spatially explicit single species fishery model for the testing of parameter estimation methods I. Ball and A. Constable (Australia)
WG-FSA-00/37	A summary of observations on board longline vessels operating within the CCAMLR Convention Area Secretariat
WG-FSA-00/38	A summary of observations on compliance with Conservation Measures 29/XVI and 63/XV Secretariat

WG-FSA-00/39	Integration of CPUE data into assessments using the generalised yield model G. Kirkwood (United Kingdom) and A. Constable (Australia) (*CCAMLR Science*, 8: submitted)
WG-FSA-00/40	A survey of fish stocks in the Heard Island and McDonald Islands region in the 1999/2000 season and a comparison of the abundances of selected species with those obtained in previous surveys R. Williams, A. Constable, T. Lamb and E. van Wijk (Australia)
WG-FSA-00/41	A revision of yield and catch controls for managing the mackerel icefish (*Champsocephalus gunnari*) fishery in the vicinity of Heard Island and McDonald Islands A. Constable, R. Williams, T. Lamb and E. van Wijk (Australia)
WG-FSA-00/42	Update to recruitment series for Patagonian toothfish in the Heard Island region A. Constable, R. Williams, T. Lamb and E. van Wijk (Australia)
WG-FSA-00/43	An exact time of release and recapture stock assessment model applied to Macquarie Island Patagonian toothfish (*Dissostichus eleginoides*) G. Tuck, W. de la Mare, W. Hearn, R. Williams, A. Smith, X. He and A. Constable (Australia)
WG-FSA-00/44	Stock structure and growth in Patagonian toothfish (*Dissostichus eleginoides*) in the Southern Ocean J. Ashford, C. Jones (USA) and I. Everson (United Kingdom)
WG-FSA-00/45	On the state of *Champsocephalusgunnari* stock in Subarea 48.3 and methods of its assessment K. Shust, V. Senioukov, P. Gasiukov and A. Kozlov (Russia)
WG-FSA-00/46	Results of *D. eleginoides* stock assessment for Subarea 48.3 using a dynamic age structured production model P. Gasiukov and R. Dorovskikh (Russia)
WG-FSA-00/47	Brief information on the results of the bottom trawling survey at RV *Atlantida* in February 2000 in South Georgia subarea (48.3) P. Chernyshkov, P. Bukatin and V. Khvichya (Russia)
WG-FSA-00/48 Rev. 1	IUCN/CITES criteria for critically endangered, endangered and vulnerable species Secretariat
WG-FSA-00/49	Australian research underway on seabirds vulnerable to fisheries interactions B. Baker and R. Gales (Australia)
WG-FSA-00/50	Information received from Norway on research related to the development of artificial bait and setting devices for longlines Secretariat

WG-FSA-00/51	Distribution, biological characteristics and biomass of mackerel icefish based on the results of the trawling survey carried out at RV *Atlantida* in February 2000 Zh.A. Frolkina and P.S. Gasiukov (Russia)
WG-FSA-00/52	A method for estimating recruitment and mortality from time series of length-density data A. Constable and I. Ball (Australia) (*CCAMLR Science*, 8: submitted)
WG-FSA-00/53	Population genetics of Patagonian toothfish *Dissostichus eleginoides* and fillet identification of Patagonian toothfish and Antarctic toothfish *D. mawsoni* P. Smith and P. Gaffney (New Zealand)
WG-FSA-00/54	New information on size at maturity of *Dissostichus mawsoni* in Subarea 88.1 G. Patchell (New Zealand)
WG-FSA-00/55	The Ross Sea Antarctic toothfish (*Dissostichus mawsoni*) fishery from 1997/98 to 1999/2000 S. Hanchet and P. Horn (New Zealand)
WG-FSA-00/56	Summary of seabird and marine mammal observations during observed toothfish (*Dissostichus* spp.) longline fishing operations in CCAMLR Subareas 88.1, 1998–2000 S. Baird (New Zealand)
WG-FSA-00/57	Fishes collected during the 1999/00 exploratory fishery by New Zealand in CCAMLR Subarea 88.1 and registered in the National Fish Collection at the Museum of New Zealand Te Papa Tongarewa
WG-FSA-00/58	Factors affecting the sink rate of autoline longline fishing gear R. Blackwell, B. Bull, S. Hanchet and N. Smith (New Zealand) (*New Zealand Fisheries Assessment Report 2000/xx*)
WG-FSA-00/59	Examination of the skate by-catch from around South Georgia from one vessel in the 2000 longline toothfish season M. Endicott, D. Agnew and C. Nolan (United Kingdom)
WG-FSA-00/60	Interactions between killer whales (*Orcinus orca*) and sperms whales (*Physeter macrocephalus*) with a longline fishing vessel C.P. Nolan, G.M. Liddle and J. Elliot (United Kingdom) (*Marine Mammal Science*, 16(3): 658–664, July 2000)
WG-FSA-00/61	Review and evaluation of three mitigation measures – bird-scaring line, underwater setting and line shooter – to reduce seabird by-catch in the Norwegian longline fishery S. Løkkeborg (Norway) (ICES CM 2000/J: 10)

WG-FSA-00/62	Feasibility of video monitoring seabird interactions on small domestic tuna longliners. Delegation of New Zealand (*Conservation Advisory Science Notes*: 303, Department of Conservation, Te Papa Atawhai, New Zealand)
WG-FSA-00/63	Preliminary information on inshore demersal fish from the Danco Coast, Antarctic Peninsula, in the 1999/00 summer season R. Casaux, E. Barrera-Oro, A. Baroni and A. Ramón (Argentina)
WG-FSA-00/64	Performance assessment and performance improvement of two underwater line setting devices for avoidance of seabird interactions in pelagic longline fisheries. N. Brothers, D. Chaffey and T. Reid (Australia) (Published by the Australian Fisheries Management Authority (AFMA) through the AFMA Research Fund and Environment Australia)

Other Documents

CCAMLR-XIX/5	Notification of an exploratory longline fishery for *Dissostichus eleginoides* in CCAMLR areas Delegation of Brazil
CCAMLR-XIX/6	Notification of exploratory fisheries for *Dissostichus* spp. in the 2000/2001 season Delegation of South Africa
CCAMLR-XIX/7	Notification of Ukraine's intention to initiate exploratory fisheries for *Dissostichus eleginoides* in Division 58.4.4 Delegation of Ukraine
CCAMLR-XIX/8	Proposal for an exploratory jig fishery for squid in Subarea 48.3 in the 2000/2001 fishing seasons Delegations of the United Kingdom and the Republic of Korea
CCAMLR-XIX/9	Proposal for an extension of the CCAMLR pot fishing trial for 2000/2001 Delegation of the United Kingdom
CCAMLR-XIX/10	Notification of an exploratory fishery for *Dissostichus* spp. on Elan and BANZARE Banks (Divisions 58.4.3 and 58.4.1) and a proposed research plan Delegation of Australia
CCAMLR-XIX/11	Notification of Australia's intention to continue an exploratory fishery in Division 58.4.2 Delegation of Australia
CCAMLR-XIX/12	Notification of Argentina's intention to initiate exploratory longline fisheries for *Dissostichus* spp. in CCAMLR areas Delegation of Argentina

CCAMLR-XIX/13	Notification by France of new and exploratory fisheries in CCAMLR Statistical Area 58 during the 2000/2001 season Delegation of France
CCAMLR-XIX/14	Notification of an exploratory pot fishery for crabs in Subarea 48.3 Delegation of Uruguay
CCAMLR-XIX/15	Notification of exploratory fisheries in Subareas 88.1, 88.2, 88.3 and Division 58.4.4 Delegation of Uruguay
CCAMLR-XIX/16	Notification of an exploratory pot fishery for *Dissostichus eleginoides* in Subarea 48.3 Delegation of Uruguay
CCAMLR-XIX/17	Notification by New Zealand of its intention to continue an exploratory fishery for *Dissostichus* spp. in CCAMLR Subarea 88.1 Delegation of New Zealand
CCAMLR-XIX/19	Deadlines set by CCAMLR for the submission of information by Member countries Delegation of Chile
CCAMLR-XIX/BG/5	Implementation of conservation measures in 1999/2000 Secretariat
CCAMLR-XIX/BG/10	Report on a meeting to discuss an agreement on the conservation of southern hemisphere albatrosses and petrels Delegation of Australia
CCAMLR-XIX/BG/15	Report of the CCAMLR Observer at the Meeting on the Development of a Regional Agreement for Southern Hemisphere Albatross and Petrels under the Convention on the Conservation of Migratory Species of Wild Animals (CMS) Secretariat
CCAMLR-XIX/BG/18	US plans for fishing for crab in Subarea 48.3 in accordance with Conservation Measures 150/XVIII and 181/XVIII Delegation of the USA
CCAMLR-XIX/BG/19	Évaluation de la pêche illicite dans les eaux françaises adjacentes aux îles Kerguelen et Crozet pour la saison 1999/2000 (1er juillet 1999–30 juin 2000) – informations générales sur la zone CCAMLR 58 et tendances 2000/2001 Délégation française
SC-CAMLR-XIX/BG/1	Catches in the Convention Area in the 1999/2000 split-year Secretariat
SC-CAMLR-XIX/BG/7	Sixth conference of parties to the Convention on the Conservation of Migratory Species of Wild Animals (Somerset West, South Africa, November 1999) CCAMLR Observer (J. Cooper, South Africa)

SC-CAMLR-XIX/BG/11	The direct impact of fishing and fishery-related activities on marine life in the CCAMLR Convention Area with particular emphasis on longline fishing and its impact on albatrosses and petrels – a review Delegation of Germany
SC-CAMLR-XIX/BG/12	Albatross and petrel mortality from longline fishing: report on an international workshop held in Honolulu, Hawaii, USA, 11 and 12 May 2000 CCAMLR Observer (J. Cooper, South Africa)
SC-CAMLR-XIX/BG/13	Report to SC-CAMLR on the expert consultation on illegal, unreported and unregulated fishing Sydney, Australia, 15–19 May 2000 Presented by the Chairman of the Scientific Committee
WG-EMM-00/8	Changes in the diet of the South Georgia shag *Phalacrocorax georgianus* at the South Orkney Islands along four consecutive years R. Casaux and A. Ramón (Argentina)
WG-EMM-00/9	Fish in the diet of breeding Antarctic shags *Phalacrocorax bransfieldensis* at four colonies in the Danco Coast, Antarctic Peninsula R. Casaux, A. Baroni and E. Barrera-Oro (Argentina)
WG-EMM-00/16	A statistical assessment of the status and trends of Antarctic and sub-Antarctic seabirds Prepared for the SCAR Bird Biology Subcommittee and SC-CAMLR Working draft as of June 2000 E.J. Woehler (Australia), J. Cooper (South Africa), J.P. Croxall (United Kingdom), W.R. Fraser (USA), G.L. Kooyman (USA), G.D. Miller (South Africa), D.C. Nel (South Africa), D.L Patterson (USA), H.-U. Peter (Germany), C.A. Ribic (USA), K. Salwicka (USA), W.Z. Trivelpiece (USA) and H. Weimerskirch (France)

APPENDIX D

INTERSESSIONAL WORK PLAN FOR AD HOC WG-IMALF

INTERSESSIONAL WORK PLAN FOR AD HOC WG-IMALF FOR 2000/01

The Secretariat will coordinate the intersessional work of the IMALF group. An interim review of work will be conducted in June 2001 and advised to ad hoc WG-IMALF at the time of WG-EMM (July 2001). The outcome of the intersessional work will be reviewed in August/September 2001 and reported to WG-FSA in October 2001.

	Task/Topic	Paragraphs of WG-FSA Report	Action[1]	Start/ Completion Deadlines	Action
1.	**Planning and coordination of work:**				
1.1	Circulation of materials on IMALF matters as contained in reports of current meetings of CCAMLR.	Standing request		Dec 2000	Circulate all relevant sections of CCAMLR-XIX to IMALF group members, and technical coordinators and (via them) to scientific observers.
1.2	Circulation of papers submitted to WG-FSA on IMALF matters.	Standing request		Dec 2000	Circulate the list of papers submitted to WG-FSA on IMALF matters and advise that copies of papers may be provided on request. Circulate the papers requested.
1.3	Acknowledgement of work of technical coordinators and scientific observers.	Standing request		Dec 2000	Commend technical coordinators and all observers for their effort in the 1999/2000 fishing season.
1.4	Review observer reports (seabird interactions).	Standing request	J. Molloy (NZ)	As available	Provide on receipt copies of required section of reports for review to a member nominated by IMALF.
1.5	Review of new and exploratory fishery proposals.	New request	B. Baker	At submission deadline	Transmit hard copies of applications to Baker to prepare initial draft of IMALF table.
1.6	Membership of WG-IMALF.	7.4	Members	Nov 2000/ as required	Request to nominate new members to IMALF as required. Request all Members to send their representatives to the WG-FSA meeting.
1.7	Education and training of fishing companies and fishermen on issues of incidental mortality of seabirds.	Standing request	Technical coordinators	Dec 2000/ Aug 2001	Urge Members to improve education and training of fishers on issues of incidental mortality of seabirds via technical coordinator; report to IMALF-2001.

[1] In addition to Science officer.

(continued)

	Task/Topic	Paragraphs of WG-FSA Report	Action[1]	Start/ Completion Deadlines	Action
1.8	Protection for observers on board against adverse weather conditions.	Standing request	Technical coordinators	Dec 2000	Request technical coordinators to ask vessel owners and captains to provide as much protection as possible for observers against adverse weather conditions.
1.9	Awareness of CCAMLR conservation measures in force.	Standing request	Technical coordinators	Dec 2000/ Aug 2001	Request feedback information from technical coordinators.
1.10	The use by scientific observers of the book *Identification of Seabirds of the Southern Ocean.*	New request	Technical coordinators	Nov 2000/ Sep 2001	Request reports, collate responses for IMALF-2001.
1.11	Submission of scientific observers data from the 2000/2001 fisheries.	Standing request	Technical coordinators	Dec 2000/ as required	Liaise with technical coordinators, as necessary, on data submission for the 2000/2001 season.
2.	**Members' research and development activities:**				
2.1	Update information on national research programs into status and foraging ecology of albatrosses, giant petrels and white-chinned petrels including, in particular, research on foraging ranges.	7.10, 7.11	Members, IMALF members, R. Gales (Australia)	Jul–Sep 2001	Develop a standard format for the submission of information and request, as appropriate, for consideration at IMALF-2001. Dr Gales/Science officer to coordinate and report to IMALF-2001. Request to SCAR members via its Secretariat.
2.2	Acquire reports on research on genetic profiles of albatrosses, giant petrels and white-chinned petrels.	7.14, 7.15	Members, IMALF members	Sep 2001	Request IMALF members in Australia, New Zealand, South Africa, France, UK to assist in provision of information. Need to get response from USA. Request to SCAR members via its Secretariat.
2.3	Risk assessment of seabird by-catch in the Convention Area.	Standing request	IMALF members	Nov 2000/ Sep 2001	Further work as appropriate to update the BG for the Scientific Committee. Circulate any new tabled papers relating to seabird-at-sea distributions to Mr Baker, Dr Croxall and Dr Gales – and to other WG-IMALF members as requested.

(continued)

	Task/Topic	Paragraphs of WG-FSA Report	Action[1]	Start/ Completion Deadlines	Action
2.4	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: • seabird capture rates in relation to artificial bait, snood line 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; and • underwater longline setting devices.	Standing request	Members, IMALF members, Technical coordinators	Nov 2000/ Sep 2001	Request information, collate responses for IMALF-2001.
2.5	Feasibility of using video recording of line-hauling operations for observations on seabird incidental catch.	Standing request (see 7.132, 7.133)	Technical coordinators	Nov 2000/ Sep 2001	Request reports, collate responses for IMALF-2001. Circulate New Zealand document.
2.6	Tests of/experiences with paired streamer lines and boom-and-bridle arrangements.	7.124, 7.139	USA; New Zealand; Members	Sep 2001	Report to IMALF 2001.
2.7	Investigate light-level definition devices.	7.141	Members	Sep 2001	Report to IMALF/FSA 2001.
2.8	Line-weighting experiments on autoliners.	7.95–7.98, 7.148	New Zealand; other Members as appropriate	Sep 2001	Report to IMALF 2001.
2.9	Experiences with revised requirements for line weighting for Spanish system vessels.	7.147	Members	Sep 2001	Report to IMALF 2001.
2.10	Information/paper relevant to assessment of appropriate seabird by-catch levels for longline fisheries.	7.21–7.23	Members, especially attendees at IFF	Sep 2001	Report to IMALF 2001.

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	Task/Topic	Paragraphs of WG-FSA Report	Action[1]	Start/ Completion Deadlines	Action
2.11	Collation of demographic data on relevant albatross and petrel species; transmission of summary data to WG-EMM-2001.	SC-CAMLR-XIX, 4.14	Members	Complete by 30 June 2001	Report to WG-EMM 2001
2.12	Relationship of IUU seabird by-catch rates to sizes and trends of relevant populations; additional monitoring requirements.	SC-CAMLR-XIX, 4.29	Members	Sep 2001	Report to IMALF 2001
3.	**Information from outside the Convention Area:**				
3.1	Information on longline fishing effort in the Southern Ocean to the north of the Convention waters.	Standing request	Members, non-Contracting Parties, international organisations	Sep 2001	Request information intersessionally from those Members known to be licensing fishing 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 IMALF-2001. Request information from other parties (Members and Non-contracting Parties; international organisations) 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	IMALF members	Sep 2001	Repeat request to all IMALF members, especially to those mentioned under item 3.1 above; review at IMALF 2001.
3.3	Implementation of provisions of Conservation Measure 29/XVI in fisheries adjacent to the CCAMLR Convention Area.	Standing request	Members, non-Contracting Parties, int. organisations	Sep 2001/ as required	Request information on use/implementation of provisions of Conservation Measure 29/XVI, as under item 3.1 above; review responses at IMALF-2001.
3.4	Reports on effectiveness of use of mitigating measures outside Convention Area.	Standing request	IMALF members	Sep 2001	
3.5	Request information on the current requirements for the use of measures to mitigate by-catch of seabirds on Japanese longline fishing vessels.	7.106 and SC-CAMLR-XIX, 4.35		Sep 2001	Request information from Japan.

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	Task/Topic	Paragraphs of WG-FSA Report	Action[1]	Start/ Completion Deadlines	Action
4.	**Cooperation with international organisations:**				
4.1	Participation at the 2001 meeting of CCSBT ERSWG; invite CCSBT to attend WG-FSA.	Standing request	CCSBT Secretariat	As required	Invite and nominate observers as decided by the Scientific Committee.
4.2	Cooperation with ICCAT and IOTC on specific issues regarding incidental mortality of seabirds.	Standing request	CCAMLR observers	Sep 2001	Remind CCAMLR observers of desired feedback on IMALF matters.
4.3	Develop National Plan of Action in respect of FAO IPOA–Seabirds.	7.169	Members	Sep 2001/ as required	Provide report on progress to IMALF for information and consideration.
4.4	Albatross and petrel agreement under CMS.	7.177	South Africa	Mar–Apr 2001	Feedback to IMALF on outcome of forthcoming meeting.
4.5	International Fishers' Forum.	7.179–7.181	New Zealand	Jan 2001	Feedback to IMALF on outcome of meeting.
4.6	IUCN Red List: Seabirds.	7.16		Jan 2001	Obtain BirdLife International (2000), circulate to IMALF members and table for Scientific Committee 2001 results of assessments of threatened and near-threatened albatross, *Macronectes* and *Procellaria* species.
5.	**Data acquisition and analysis:**				
5.1	Preliminary analyses of data from the current fishing season.	Standing request	Technical coordinators	Sep–Oct 2001	Standing request: summarise and analyse current year data at a level adequate to undertake a preliminary assessment at IMALF-2001.
5.2	Acquisition of EEZ data.	Standing request (see 7.45, 7.46) (see also SC-CAMLR-XIX, 4.21, 4.22)	France	Nov 2000/ Sep 2001	Request France to submit reports and data logbooks prepared by national observers for the current and past fishing seasons.
5.3	Analysis of seabird incidental mortality data for EEZ in Subareas 58.6/58.7.	Standing request	South Africa	Nov 2000/ Sep 2001	Request South Africa to undertake analysis and report to IMALF-2001.

(continued)

	Task/Topic	Paragraphs of WG-FSA Report	Action[1]	Start/ Completion Deadlines	Action
6.	**Scientific Observers Manual:**				
6.1	Preliminary analysis of data from 2000/2001 fisheries.	Standing request	SODA	IMALF meeting	Produce draft tables equivalent to Tables 48 to 55 and 60 of WG-FSA 2000 report.
6.2	Review codes for seabird species.	?	IMALF Members	Apr 2001	Secretariat to provide revised list, using updated FAO codes and indicate any anomalies and/or species requiring codes.
6.3	Analysis of hook observation data to provide advice on minimum requirements for scientific observers.	7.30		Sep 2001	Report to IMALF 2001.

[1] In addition to Science officer.