ANNEX 5

REPORT OF THE WORKING GROUP ON FISH STOCK ASSESSMENT

(Hobart, Australia, 11 to 21 October 1999)

CONTENTS

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INTRODUCTION

1.1 The meeting of WG-FSA was held at CCAMLR Headquarters, Hobart, Australia, from 11 to 21 October 1999. 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:

(i) Subitem 3.3 'Status of Fisheries and Assessments' should be moved to Item 4 and be incorporated in a new Subitem 4.5 'Regulatory Framework for Fisheries Development'; and

(ii) a new Subitem 7.9 'Strategic and Policy Issues' should be added.

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. Balguerías (Spain) Dr E. Barrera-Oro (Argentina), Mr N. Brothers (Australia), Dr A. Constable (Australia), Prof. J. Croxall (UK), Dr I. Everson (UK), Dr R. Gales (Australia), 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), Ms J. Molloy (New Zealand), Ms N. Montgomery (Australia), Dr G. Parkes (UK), Dr G. Robertson (Australia) and the Secretariat.

REVIEW OF AVAILABLE INFORMATION

Data Requirements Endorsed by the Commission in 1998

Data Inventory and Developments in the CCAMLR Database

3.1 A report on the present state of the CCAMLR databases was presented by Dr D. Ramm (Data Manager).

3.2 The majority of the data from the 1998/99 split-year (1 July 1998 to 30 June 1999) and the 1998/99 fishing season (various periods) had been submitted and were available to WG-FSA.

3.3 With the exception of data from Argentina, Japan, Russia and Spain, all STATLANT data for the 1998/99 split-year had been submitted; data from Spain were submitted on

20 October 1999. Where STATLANT data were not yet available, data were temporarily constructed from catch and effort and fine-scale data. STATLANT data were summarised in SC-CAMLR-XVIII/BG/1.

3.4 With the exception of reports arising from trawling for *Champsocephalus gunnari* in Subarea 48.3, all catch and effort reports for the 1998/99 fishing season had been submitted. Data from the catch and effort reports were summarised in CCAMLR-XVIII/BG/9.

3.5 All fine-scale data from finfish fishing in the 1998/99 fishing season had been submitted, with the exception of data from three longliners targeting *Dissostichus eleginoides* in Subareas 48.3 and 48.6 (CCAMLR-XVIII/BG/9 and paragraphs 3.13 to 3.16). Fine-scale data from the krill fishery in Area 48, and the crab fishery in Subarea 48.3 in 1998/99 had not yet been submitted.

3.6 Observer data and reports on longline fishing and trawling in the 1998/99 season had been submitted. These data were summarised in WG-FSA-99/10, 99/11 and 99/12. The observer data and a report on the crab fishery in Subarea 48.3 were submitted at the meeting.

3.7 The CCAMLR research survey database underwent a major transformation in 1999, with further work to be completed during 2000. Data from trawl surveys, which had been maintained previously in the same database as the commercial trawl data, were being transferred to a new dedicated database (WG-FSA-99/14). The structure of this new database was presented and discussed at WG-FSA-98, then further developed. Data from six surveys (Argentina 1994, 1995, 1996, 1997; UK 1997; USA 1999) were available in the new format at the start of the meeting, and the transfer of other survey data was well under way.

3.8 At the four previous meetings, Dr P. Gasiukov (Russia) had found some apparent errors with the survey database. These problems had prevented him from undertaking analyses on the South Georgia trawl surveys. Arising from this, he and Dr Everson had agreed to try to resolve these difficulties during the intersessional period (SC-CAMLR-XVII, Annex 5, paragraph 3.6). Most of the difficulties that Dr Gasiukov had experienced with the UK survey database had been resolved. At the meeting it became clear that one problem remained, the specification of water depth for the 1991 UK survey. Due to an oversight, the water depths from that survey had been reported in metres when the actual measurement was made in fathoms; the appropriate transformation had not been made. The correct depths had been provided in the original tabled paper WG-FSA-91/14. Dr Everson apologised for this oversight and hoped that, with this correction, there would be no further problems. He requested that the Data Manager liaise with him whilst the remaining UK trawl survey data are loaded into the database.

3.9 Participants at WG-FSA were encouraged to update and/or correct the information listed in WG-FSA-99/14 and provide additional survey data. WG-FSA also requested that other information relevant to the surveys, such as the maturity scales reported in WG-FSA-99/55, be submitted to the Secretariat so that this may be appended to the database for reference.

3.10 The Working Group noted the greater complexity of the data resulting from research surveys compared to commercial fisheries data, and the consequent difficulties in interpretation by researchers other than the originators of the data. Those involved in submitting research data to the Secretariat were encouraged to include supplementary information on sampling protocols. Summary information to allow validation of the data should also be provided.

3.11 Data on the trade of *D. eleginoides* in 1998 and 1999 were reported to the Secretariat by Australia, Chile, USA and FAO. These data quantified imports and exports of *Dissostichus* products such as frozen fillets and headed, gutted and tailed (HAT) fish. Processed weights were converted to whole weights using the conversion factors (CFs) used by WG-FSA in 1998: a factor of 2.2 was used to convert fillet weight to whole weight; and a factor of 1.7 was used to convert HAT weight to whole weight. Available trade data were summarised in Appendix B of SC-CAMLR-XVIII/BG/1.

3.12 Some data on landings were submitted to the Secretariat during 1999. These data were circulated to Members and provided to WG-FSA's subgroup on illegal, unregulated and unreported (IUU) fishing in WG-FSA-99/51.

Data Entry and Validation

3.13 Available data from the 1998/99 split-year (STATLANT data) have been entered. In addition, data from the 1998/99 fishing season have been entered with the exception of the observer logbook data from the crab fishery in Subarea 48.3 which were submitted at the meeting. Available STATLANT data and catch and effort reports have been validated, and validation was under way for the remaining data from the 1998/99 fishing season.

3.14 The following fine-scale data were overdue at the start of the meeting:

(i) from the UK – *Argos Helena* longlining in Subarea 48.3 from 15 April to 17 July 1999 (preliminary data were submitted prior to WG-FSA, and processed during WG-FSA; the complete dataset was submitted on 18 October 1999);

(ii) from the Republic of Korea – *No. 1 Moresko* longlining in Subarea 48.3 from 15 April to 17 July 1999 (preliminary data were submitted prior to WG-FSA, and processed during WG-FSA; the complete dataset arrived by mail on 19 October 1999); and

(iii) from South Africa – *Koryo Maru 11* longlining in Subareas 48.3 and 48.6 from 15 April to 5 August 1999 and *Northern Pride* longlining in Subarea 48.3 from 1 April to 22 August 1998.

3.15 Validation of fine-scale data had identified a number of instances where it was suspected that processed weights, rather than whole weights, had been reported in the longline fisheries for *Dissostichus* spp. Currently all catches in the fine-scale data must be recorded as whole weights, and all factors used to convert processed weights to whole weights must be included in the submitted data. Two types of errors were suspected: (i) both the retained and discarded weights of *Dissostichus* spp. were reported as processed weights (e.g. HAT and offal); and (ii) the retained weight of *Dissostichus* spp. was reported as whole weight, but the discarded weight included offal.

3.16 The suspected errors were detected through reconstruction of catches using reported CFs and data from the catch and effort reports. The percentages of suspect records in the C2 dataset, by area, year, month and country, were listed in WG-FSA-99/9. Most of these suspected problems occurred in data submitted by the UK and advice had been sought from the UK. Further discussion during the meeting confirmed the use of processed weights, and WG-FSA recommended that the UK submit corrections to the Secretariat as a matter of urgency. The Secretariat would also contact other Members who had submitted data with suspected problems (see WG-FSA-99/9, Table A1) to seek confirmation, and corrections, where appropriate.

Other

3.17 Electronic data forms (eforms) were now available for reporting STATLANT data, catch and effort reports, fine-scale data (catch, effort and biological) and observer data (see WG-FSA-99/8 and 99/10). The eforms were developed in Microsoft Excel, and available from the Secretariat via email; access via the CCAMLR website will be provided in 2000. Approximately 30% of the fishery data submitted in 1999 were submitted on the Excel eforms.

In addition, a prototype Microsoft Access database had also been developed for the observer data as requested last year (SC-CAMLR-XVII, Annex 5, paragraph 3.64). This database had been available in 1999, but was yet to be evaluated.

3.18 Estimates of seabed areas within the fishable depth range and the geographic ranges of *Dissostichus* spp., both within and outside the Convention Area, were reported in WG-FSA-99/13. These estimates included those calculated at WG-FSA-98 for a number of 'small-scale' management units, and new estimates for areas north of the Convention Area to the northern limits of the geographic range of *D. eleginoides*. The release of a new dataset from Sandwell and Smith, at a spatial resolution of 1 x 1 minute, had been delayed and consequently the planned revision of seabed areas requested at WG-FSA-98 (SC-CAMLR-XVII, Annex 5, paragraph 3.12) had not been possible in 1999.

3.19 Revised estimates of seabed areas within the 500 m isobath of the South Orkney Islands were presented in WG-FSA-99/33. The estimates were derived from depth soundings and satellite altimetry data held in 16 datasets, including data from surveys conducted by the USA, Germany, Spain and the UK.

3.20 WG-FSA reviewed the available bathymetry data and differences in estimates reported in papers tabled over the past few years. The Sandwell and Smith dataset currently used by the Secretariat was known to have some limitations, including the absence of data south of 72°S due to the presence of permanent sea-ice. Mr G. Patchell (New Zealand) also identified large discrepancies between this dataset and the ETOPO5 data in Area 88. Despite these limitations, the Sandwell and Smith dataset did provide a consistent approach to the estimation of seabed areas within the Convention Area, especially in areas subject to notifications for new and exploratory fisheries where little shipboard data had been collected.

3.21 WG-FSA reaffirmed its conclusion from last year (SC-CAMLR-XVII, Annex 5, paragraph 3.11) that seabed areas within fishing depth ranges estimated from the Sandwell and Smith dataset were adequate for the purpose of estimating the amount of potentially suitable substrate available to *D. eleginoides* and *D. mawsoni* in regions where little information was available. The Working Group also continued to encourage Members to collect detailed bathymetry data, and to submit these to the Secretariat so as to develop a high resolution bathymetry dataset which could be used to further biological knowledge about key species (SC-CAMLR-XVII, Annex 5, paragraph 3.12). Detailed data could also be used to ground truth composite datasets such as Sandwell and Smith in areas where surveys had been conducted. Bathymetry data available within the Working Group are listed in Table 1.

3.22 Other data and information available to WG-FSA included (WG-FSA-99/9):

(i) notifications for new and exploratory fisheries in 1999/2000;
(ii) monitoring the longline fishery for *D. eleginoides* in Subarea 48.3 in 1998/99;
(iii) a brief history of new and exploratory fisheries;
(iv) data requirements for CCAMLR fisheries in 1997/98 and 1998/99; and
(v) catch-weighted length frequencies for *D. eleginoides* in Subarea 48.3.

Fisheries Information

Catch, Effort, Length and Age Data Reported to CCAMLR

3.23 Catches reported from the Convention Area during the 1998/99 split-year (1 July 1998 to 30 June 1999) are summarised in Table 2. These catches included those taken within South Africa's EEZ in Subareas 58.6 and 58.7, France's EEZ in Subarea 58.6 and Division 58.5.1, and Australia's EEZ in Division 58.5.2.

3.24 Fisheries carried out under the conservation measures in force during the fishing season of 1998/99 were reported in CCAMLR-XVIII/BG/9. Reported catches from all fisheries are summarised in Table 3.

3.25 WG-FSA briefly examined the monitoring of the longline fishery for *D. eleginoides* in Subarea 48.3 in 1998/99 (WG-FSA-99/9). The total catch reported in this fishery had exceeded the catch limit (3 500 tonnes) by 152 tonnes (4%). The Working Group concluded that the monitoring by the Secretariat had been in accordance with the agreed protocol, and that the small overshoot was the result of high catch rates during the final 10 days of the fishing season. WG-FSA also noted that 66% (56 reports) of all catch and effort reports had been submitted after their respective deadlines.

3.26 Length-frequency data have continued to be submitted during 1999. Most of the data were collected by scientific observers and reported in their logbooks and reports. Some length-frequency data were submitted on the fine-scale biological data form.

3.27 At the request of WG-FSA in 1998, the Secretariat had further developed the routine for deriving catch-weighted length frequencies for *Dissostichus* spp. and *C. gunnari* caught in commercial fisheries within the Convention Area (WG-FSA-99/15). Catch-weighted length frequencies were derived from four CCAMLR datasets: (i) length-frequency data collected by scientific observers; (ii) length-frequency data submitted by Flag States; (iii) fine-scale catch data submitted by Flag States; and (iv) STATLANT data submitted by Flag States.

3.28 Catch-weighted length frequencies were held in a new database, and were available to WG-FSA in a format which allowed graphical presentation and standardisation of data to examine trends over time. As an example, catch-weighted length frequencies for *D. eleginoides* taken by longline in Subarea 48.3 were reported in WG-FSA-99/9.

Estimates of *Dissostichus* spp. Catches from Illegal, Unregulated and Unreported Fishing

3.29 The Working Group has reviewed IUU catches of *Dissostichus* spp. in the Convention Area over the past two years (SC-CAMLR-XVI, Annex 5, paragraphs 3.18 to 3.22 and Appendix D; SC-CAMLR-XVII, Annex 5, paragraphs 3.20 to 3.41). Information for the 1998/99 season was compiled by a small task group convened by Prof. G. Duhamel (France) and presented as WG-FSA-99/51.

3.30 Reported catches of both *D. eleginoides* and *D. mawsoni*, along with estimates of unreported catches by Members and Acceding States, are presented in Table 4. Catches for the 1997/98 split-year are shown in parentheses. Information on catches in EEZs outside the Convention Area are available for most countries except Peru. Estimates of unreported catches were available for Argentina and Chile, but since these catches are derived from crude estimates of potential catch and effort in the Indian Ocean (see paragraph 3.31 below), they should be treated with caution.

3.31 Estimated landings of IUU-caught *D. eleginoides* by CCAMLR Members and non-Members alike in Cape Town/Durban (South Africa), Walvis Bay (Namibia), Port Louis (Mauritius) and Montevideo (Uruguay) are presented in Table 5 for the past three years. This information was provided by authorities in the countries concerned as well as by commercial sources. While it can be seen that landings have decreased in 1998/99 compared with the previous two years, the reasons for this decline are unclear and cannot be attributed to any obvious cause. Mauritius remains the primary site for the landing of IUU-caught fish.

3.32 Following the approach adopted at its 1998 meeting (SC-CAMLR-XVII, Annex 5, paragraph 3.24), the Working Group estimated the magnitude of IUU fishing effort and catches in various subareas and divisions during the 1998/99 split-year (Table 6).

3.33 In respect of catch estimates for Subarea 48.3, the Working Group noted that there had been a report of up to three IUU vessels from Argentina fishing in the area. Catches taken by these vessels could therefore potentially raise the total catch for Subarea 48.3 in 1998/99 by some 1 920 tonnes. However, the Working Group recognised that three CCAMLR inspections had been carried out by the UK in Subarea 48.3 during the 1998/99 fishing season and that no sightings of IUU vessels have been reported by the UK. While the presence of buoys with fishing lines attached may indicate that some IUU fishing has taken place in Subarea 48.3, this is probably relatively minimal, amounting to no more than about 300 to 400 tonnes in 1998/99. Consequently, the range of potential IUU catches in Subarea 48.3 during 1998/99 may have been between 300 and 1 920 tonnes and the Working Group was unable to narrow the range any further.

3.34 From Table 7 it can be seen that in most areas IUU catches account for between 30 and 100% of the estimated total catch. The total estimated landings of catches in Walvis Bay and Mauritius in 1998/99 (16 425 tonnes) accounted for some 86% of the estimated 18 983 tonnes total catch in the Indian Ocean. They were also similar to the estimated total reported catch by Members and Acceding States (17 041 tonnes) in the Convention Area in 1998/99, but in contrast to previous years (e.g. SC-CAMLR-XVII, Annex 5, paragraph 3.25) somewhat in excess of the range of estimated unreported catches (10 733 to 12 653 tonnes) (see Tables 4 and 6).

Estimated Unreported Catches of *D. eleginoides* for the Generalised Yield Model

3.35 As last year, estimates of total catches were obtained in order to update current assessments of *D. eleginoides* in Subareas 48.3, 58.6 and 58.7 as well as Divisions 58.5.1, 58.5.2 and 58.4.4. These catches were apportioned into reported catches and unreported catches from the Convention Area for the period November 1998 to September 1999 (Table 8).

Estimated Trade in *D. eleginoides* and *D. mawsoni* for 1998/99

3.36 Trade statistics for *D. eleginoides* in 1998/99 were received from FAO, Japan, USA, Chile and Australia (Tables 9 to 11). As last year, no market information was available for smaller markets. It can be seen that some 32 178 tonnes of *D. eleginoides* were imported into Japan and the USA during 1998/99, with Chile, Argentina, Mauritius and China being the major sources of supply. This can be compared with a total estimated import of 69 978 tonnes in the 1997 calendar year and 33 825 tonnes in the first half of 1998 (SC-CAMLR-XVII, Annex 5, Tables 9 and 10).

3.37 From a plot of the price and import quantity of *D. eleginoides* in the US market (Figure 1), it can be seen that the price of product has been steadily increasing since July 1998. The trend has continued despite obvious fluctuations in supply as shown by variable import quantities.

3.38 As noted for 1997 and 1998 (SC-CAMLR-XVII, Annex 5, paragraph 3.33), the estimated total *Dissostichus* spp. catch in 1998/99 (41 201 tonnes) was slightly in excess of the total trade (32 178 tonnes) by the USA and Japan.

3.39 As last year, the Working Group noted that trade statistics should be treated with caution since the export sources of product are not necessarily responsible for the catching of fish. In this context, the emergence of China as an export source and the fact that China could contribute to increased fishing effort in the future were noted. Other anomalies between estimated catches and trade figures may be attributable to inter-market transfers of product and stockpiling.

Working Group Commentary on Estimated Total Removals of, and IUU Fishing for, *Dissostichus* spp.

3.40 In both 1997 and 1998, WG-FSA took into account unreported catches of *D. eleginoides* in its assessment of stock yields and on the assumption that IUU catches can be brought under control (SC-CAMLR-XVI, paragraphs 2.13, 5.100, 5.108 to 5.111, 5.130 and 5.138; SC-CAMLR-XVII, paragraphs 5.85 and 5.89).

3.41 Estimated total catches for *Dissostichus* spp. over the past three split-years are given in Table 12. In keeping with similar results in 1997 and 1998, most IUU fishing for *Dissostichus* spp. during 1998/99 occurred in the Indian Ocean (Area 58) with the major focus being on Subarea 58.6 (Crozet) and Division 58.5.1 (Kerguelen) (Table 7). The emergence of Division 58.4.4 as an area of IUU fishing is noteworthy.

3.42 The Working Group reiterated its concern that the information on which its review of IUU fishing has been based over the past three years has considerable uncertainties attached to it. In the Indian Ocean, coverage of IUU activities is patchy in Subareas 58.6 and 58.7 (Prince Edward and Crozet Islands) as well as Divisions 58.5.1 (Kerguelen Islands) and 58.5.2 (Heard and McDonald Islands), and is almost absent for Division 58.4.4 (Ob and Lena Banks). This makes it difficult to directly quantify the impacts of IUU operations on the stocks concerned, despite indications that catches of *D. eleginoides* in the South African EEZ around the Prince Edward Islands have fallen to about 10% of their initial levels and biomass estimates around the Crozet Islands have declined to between 25 and 30% of their original levels.

3.43 Taking such considerations into account, the Working Group agreed that estimates of IUU catches of *Dissostichus* spp. are only minimum estimates at best and that 1998/99 values should be compared with previous years only with caution. Furthermore, information provided in WG-FSA-99/51 indicates that the transhipment of catches at sea is on the increase and that as much as 6 000 tonnes of fish may have been moved during 1998/99 in this way. Such developments only serve to raise further the uncertainty associated with estimates of total *Dissostichus* spp. removals.

3.44 Although IUU catches appear to be lower than last year, the Working Group stressed that the difficulties in estimating IUU catches have increased. The available information for 1998/99 is therefore, if anything, more uncertain than for 1997/98 and hence the Working Group reiterated the views set out in paragraphs 3.39 to 3.41 of last year's report (SC-CAMLR-XVII, Annex 5).

Catch and Effort Data for *D. eleginoides* in Waters adjacent to the Convention Area

3.45 Catches taken in fisheries operating outside the Convention Area and reported to national fisheries agencies were summarised in SC-CAMLR-XVIII/BG/1. Catches were reported by Argentina, Australia, Chile, New Zealand, South Africa, Uruguay and the UK. Data were also available from FAO. Annual catches of *D. eleginoides* taken outside the Convention Area, and reported to FAO, peaked at 36 884 tonnes in 1995 (calendar year), then decreased to 24 030 tonnes in 1996 and 18 359 tonnes in 1997. Data submitted by Members indicated that the annual catch in 1998 was approximately 23 000 tonnes.

Scientific Observer Information

3.46 The available information collected by scientific observers was summarised in WG-FSA-99/12. International and national scientific observers provided 100% coverage of

fishing operations of vessels targeting *Dissostichus* spp. or *C. gunnari* in the Convention Area during 1998/99, and reports and logbook data were submitted from 32 cruises aboard longliners and eight cruises aboard trawlers. These cruises covered longlining in Subareas 48.3, 58.6, 58.7 and 88.1, and trawling in Subarea 48.3 and Divisions 58.4.1, 58.4.3 and 58.5.2. Additionally, information from an exploratory cruise with pots for crabs carried out in Subarea 48.3 was provided by the scientific observer on board. Observers have been deployed by six Members: Argentina (1) in Subarea 48.3; Australia (7) in Divisions 58.4.1, 58.4.3 and 58.5.2; Chile (2) in Subarea 48.3; South Africa (12) in Subareas 48.3, 58.6, 58.7 and 88.1, and in Divisions 58.4.1, 58.4.3 and 58.5.2; UK (18) in Subareas 48.3 and 58.7; and Uruguay (1) in Subarea 48.3.

3.47 The Working Group noted the high quality of logbooks and the remarkable improvement of the reports submitted in 1999. Also, problems in previous years related to delays in the arrival of some logbooks and reports at the Secretariat have been solved satisfactorily. Most of the logbooks and reports have been submitted within six weeks of the observer's return to port. This has permitted the Secretariat to enter the corresponding data into the database, begin validation (paragraph 3.13) and to prepare preliminary analyses in time for the meeting of WG-FSA.

3.48 At last year's meeting the Secretariat was tasked with the development of a stand-alone database containing the essential elements of the CCAMLR observer database, to be used on laptop computers commonly carried by scientific observers (SC-CAMLR-XVII, Annex 5, paragraphs 3.62 to 3.64). The requested database should include the observer data forms and instructions, CCAMLR codes and basic validation routines.

3.49 These electronic forms were prepared in spreadsheet format (Excel 97) and distributed among scientific observers who have had the opportunity of testing them during the 1998/99 field season (paragraph 3.17). As a result, three complete electronic observer logbooks were submitted, two from Chilean observers and one from an Argentinian observer. This has greatly facilitated the input of data into the CCAMLR general database. However, the Working Group has noted that further refinements were needed, especially relating to the development of basic validation routines.

3.50 The Working Group reviewed the contents of Tables 1 to 3 in WG-FSA-99/12 (Tables 13 to 15 in this report). These tables were found to contain important information on the types of data available. An evaluation of the vessels' compliance with Conservation Measure 29/XVI and other measures in force related to the incidental mortality arising from longline fishing, is given in paragraphs 7.48 to 7.54 and Table 16.

3.51 All the observers' reports contain very detailed information on the vessels' characteristics, the cruise itinerary, the gear and the fishing operations, the meteorological conditions and on the biological observations carried out on fish (see summary in Table 13). Information on the work conducted in relation to the seabird incidental mortality and the marine mammal observations is also fairly comprehensive. However, in general the reports lack sufficient description on the offal discharge practices, on the details of streamer lines and on mitigation measures used to avoid marine mammal interactions with the fishing gear.

3.52 Work on biological sampling of fish has been undertaken according to the current research priorities identified by the Scientific Committee for conducting scientific observations on commercial fishing vessels. The collection of biological samples has been extended significantly to the scales of *Dissostichus* spp., and the collection of new samples and data. The continuation of specific experiments (i.e. stomach contents, tissues for genetic studies, tagging) has been reported by several observers. Also, a good response has been noted for sampling directed to the estimation of independent CFs following the standard methodology established at last year's meeting of WG-FSA (SC-CAMLR-XVII, Annex 5, Appendix D) and endorsed by the Scientific Committee (SC-CAMLR-XVII, paragraph 3.6).

3.53 Currently scientific observers are not required to collect information on the disposal of garbage and the loss of fishing gear at sea. However, in accordance with actions agreed by the Commission on monitoring marine debris, this information is being collected by Members from their flag vessels and submitted to the Commission in Members' activities reports. A small number of observers also collected and reported this information in 1998/99 (Table 14). Several vessels were reported as returning all non-biodegradable garbage to their home ports. One vessel had plastic bands aboard, although it has not been reported to have dumped them at sea. The loss of portions of fishing gear such as hooks, floaters, doors, bobbins and other, seems to be rather frequent. Also one vessel was reported to have lost a complete longline. Only one report of an incidental oil spillage was reported.

3.54 The Working Group felt that the collection of this information by scientific observers is required taking into account a lack of precise information by vessels on the disposal of garbage and the loss of fishing gear at sea. This information would be useful for the Scientific Committee in preparing its advice to the Commission on the matter. The Working Group recommended that the collection of the abovementioned information be added to the list of tasks of scientific observers and specific forms be developed by the Secretariat for its recording and reporting.

3.55 Reports of interactions of marine mammals with fishing gear have been increasing over the years. They are mostly restricted to longlines involving Odontoceti such as killer whales and sperm whales and Otariidae such as fur seals, although there is an increasing number of records of other species (e.g. leopard seals, elephant seals) in the proximity of longlines. Also, several fur seals have been reported to interact with trawls during fishing operations. One Antarctic fur seal was recovered dead in a trawl (*Southern Champion*, Division 58.5.2) and one undetermined dolphin was reported to have been hooked but released itself (*Isla Sofía*, Subarea 48.3) (Table 15). France reported that killer whales predated heavily on *D. eleginoides* caught on longlines during fishing at the Crozet Islands in 1998/99 (CCAMLR-XVIII/MA/9).

3.56 Detailed information on streamer lines is rather scarce in the observer reports, but has been adequately recorded in the corresponding logbook forms. From them, it has been established that only one vessel complied in full with the streamer-line specifications (Table 17), and only one vessel using the Spanish longline system applied the recommended line-weighting regime of 6 kg/20 m (Figure 30). Further details and discussion are provided in paragraphs 7.49 to 7.52.

3.57 Last year it was observed that some vessels were still unaware of CCAMLR regulations and measures to prevent incidental mortality of seabirds. The Working Group therefore decided that in addition to the distribution of the booklet *Fish the Sea Not the Sky* to CCAMLR Members and directly to fishing companies, sufficient copies (including in languages appropriate for vessels being observed) had to be provided to technical coordinators for passing them on, via scientific observers, to crews of observed vessels (SC-CAMLR-XVII, Annex 5, paragraph 3.78). The Secretariat acted as requested, but despite these efforts some of the observers have commented on the lack of awareness of fishing crews of CCAMLR conservation measures and on the availability and utility of the abovementioned booklet.

3.58 At last year's meeting, comments of scientific observers on the *Scientific Observers Manual* and, in particular, on its data collection logbooks, were reviewed and a number of recommendations were made on their improvement (SC-CAMLR-XVII, Annex 5, paragraph 3.48). The revised sections of the manual were prepared by the Secretariat and circulated in January 1999.

3.59 During 1998/99 the task group on the *Scientific Observers Manual*, comprising technical coordinators of national observation programs, has continued its work. Only a limited number of comments were received from technical coordinators by the time of the WG-FSA meeting.

Therefore, the Working Group reviewed the reports submitted by scientific observers in 1998/99 and made a number of recommendations which are described in the following paragraphs.

3.60 Direct comments by scientific observers on the *Scientific Observers Manual* are rare, but some information can be extracted indirectly from their reports. Most of the reported problems are similar to previous years. The Working Group reviewed these comments and other matters raised by meeting participants and requested the Secretariat to modify the related forms as appropriate, in time for being tested during the next fishing season.

3.61 The need for observers to accurately record the weights used on longlines and the weight spacings is increasing as the potential of this mitigation measure for both autoliners and vessels using the Spanish system gains recognition.

3.62 Form L2(i) and the accompanying instructions in the manual could be changed slightly to increase the reliability of the data observers' record. It is recommended that a diagram of both the Spanish system and the autoline system are included in this section with boxes for observers to fill in relevant line dimensions, weighting regimes and weighting methods.

3.63 A related issue that requires refinement is the method of determining the mass of weights and the distance between weights. To address this, it is recommended that observers weigh 30 weights at random and provide this information in a new form which could be included in Form L2(i).

3.64 Instructions on these new requirements would be needed for the manual.

3.65 Conservation Measure 29/XVI requires vessels to discharge offal on the opposite side to hauling, if discharge of offal during hauling is unavoidable. The logbook form allows observers to record whether offal is discharged on the same or opposite side to hauling but does not allow a record of whether offal is discharged during hauling. The Working Group recommended that a new data field be added that records whether offal was never, occasionally, or always discharged during hauling, to allow more accurate analysis of compliance with Conservation Measure 29/XVI.

3.66 Form L4(vi): Preferably, at least two counts/set and minimum number of each seabird species should be recorded.

3.67 Form L4(vii): It is virtually impossible to determine if bait is taken and/or birds hooked when large numbers of birds are present. The time column is irrelevant unless recording continually 10-minute observations/set or the whole set. This part of the table could possibly be reduced to:

Species Code	Distance Astern	Method of Foraging

Other details (e.g. birds observed hooked, interactions, unusual foraging etc.) could be recorded in the comments section.

3.68 The nautical dawn/dusk table should be updated/improved, including south of 72°S in Subarea 88.1.

3.69 The outline of information to be included in scientific observer summaries to CCAMLR (reports), under '4: Summary of Fishing Operations' should include garbage and plastic disposal, snoods, hooks in discards, bands, oil/fuel discharge.

3.70 Following a recommendation of WG-FSA in 1998, the Secretariat changed instructions related to the form L3 'Daily Work Schedule of Observers' by adding a note that this form

should be completed at the discretion of observers for a limited number of days during the cruise. However, there are still some comments of scientific observers on this particular form. Therefore, WG-FSA asked technical coordinators to make sure that the amendment is drawn to the attention of scientific observers.

3.71 Many observers felt that it was difficult to accurately record seabird and marine mammal abundance as well as seabird activity at night or when visibility was poor (form L4 'Daily Setting Observation'). The Working Group noted that changes have been introduced in this form during the intersessional period, according to its recommendations at last year's meeting (SC-CAMLR-XVII, Annex 5, paragraph 3.53), to reflect the fact that there is no need to complete this form in full when visibility is low or at night, but that the form should remain in use for research trips. Even at night, however, information on the presence, and, if possible, relative abundance of seabirds was required. WG-FSA requested technical coordinators to draw the attention of scientific observers to these changes.

3.72 Another frequent problem mentioned by observers is the difficulty of assessing the gonadal maturity stages in *D. eleginoides*. It was suggested that the *Scientific Observers Manual* should include visual guidance (drawings/photographs) of the stages (i.e. similar to that of krill). The Working Group discussed this question and concluded that more studies and feedback from observers were needed in order to make an accurate macroscopical description of the different maturity stages. It requested that a questionnaire be prepared and distributed among a number of experienced observers to gather the necessary material and information.

3.73 Many observers expressed their inability to comply with the longline random-sampling design originally proposed by the Working Group. Also the alternative methodology established at last year's meeting (SC-CAMLR-XVII, Annex 5, paragraph 3.66) has proved impractical, especially for those observers working on board vessels with limited space availability at their factories. The Working Group stated that some analyses should be undertaken intersessionally to evaluate the quality of the collected data and their potential effect on the stock assessments. It was agreed that, in the meantime, some flexibility would be required with the established systems as fishing operations are not identical on all vessels.

3.74 WG-IMALF also noted apparent inconsistencies between data in observers' reports (and papers derived therefrom, e.g. WG-FSA-98/60 and 99/42 Rev. 1) and in the summaries prepared by the Secretariat, in respect of estimates of the amount of setting in daytime. It is important to resolve these discrepancies and to ensure that everyone is calculating this in identical fashion.

3.75 The need for a comprehensive and easy to interpret key for identification of the most common fish species caught in the longline fishery, similar to that recently prepared for the seabirds of the Southern Ocean, was stressed by several observers.

3.76 The Working Group re-emphasised the earlier advice of WG-FSA and the Scientific Committee that, wherever possible, two scientific observers should be used, one expert in fish work, the other experienced with seabirds. When only one scientific observer could be used, there would need to be some clear instructions on work priorities and/or how to subsample within and between the main fish and seabird tasks. In this respect, the Working Group discussed the existing work tasks and although it recognised that many of these tasks were performed in some areas, further improvement in data and material collection is needed.

3.77 The Working Group thanked all scientific observers involved in monitoring fisheries in 1998/99 for the great deal of very good work which they have done under difficult conditions. The data and reports have contributed substantially to the analyses of the Working Group.

Research Survey Data

3.78 Longline weighting trials were conducted by the UK in Subarea 48.3 in February 1999 (WG-FSA-99/5). Fine-scale catch and effort data and data collected by the scientific observer were available to the Working Group.

3.79 Australia conducted a random stratified survey in Division 58.5.2 in March and April 1999 which provided new data on density and abundance of *D. eleginoides*, as well as fishing selectivity and stock structure, age and growth, maturity and recruitment (WG-FSA-99/68). A second survey, based on a grid design, was conducted on BANZARE Bank. This survey was a requirement of the exploratory fishery for *D. eleginoides* in Divisions 58.4.1 and 58.4.3 in 1998/99. Only two individuals of *D. eleginoides* were caught. However, the survey provided new information on abundance of *Macrourus carinatus* (WG-FSA-99/69).

3.80 The USA conducted a random stratified survey in Subarea 48.2 in March 1999, and new findings on the biology of demersal fish stocks in the southern Scotia Arc were reported (WG-FSA-99/16). This included new information on the species assemblage, length composition, length–weight relationships, sexual dimorphism, sexual maturity and gonadosomatic indices. Estimates of biomass for eight species were reported in WG-FSA-99/32, including trends since 1985. Revised estimates of seabed areas in waters off the South Orkney Islands were also available (WG-FSA-99/33).

3.81 Other research surveys notified for 1999 (CCAMLR-XVIII/BG/9) had either been postponed or were not aimed to acquire data in support of fish stock assessments.

Mesh/Hook Selectivity and related Experiments affecting Catchability

3.82 Dr Everson reminded WG-FSA of the continued need to collect data on mesh and hook selectivity, and to determine catchability. The need for such research had been recognised as early as 1906 (WG-FSA-99/66); no new data were presented to WG-FSA this year.

Conversion Factors

3.83 At last year's meeting of WG-FSA, it was noted that existing differences between the CFs calculated by observers and those used by the fishing vessels to report their catches might cause a significant error in estimates of catches (SC-CAMLR-XVII, Annex 5, paragraphs 3.74 to 3.76 and Table 13).

3.84 A draft protocol for collecting observer data on CFs was prepared at that meeting (SC-CAMLR-XVII, Annex 5, Appendix D). The Scientific Committee endorsed this proposal and the procedure was evaluated during the 1998/99 season (SC-CAMLR-XVII, paragraph 3.6).

3.85 The 1998/99 season was the first year that observers had made consistent observations of CFs using a standard protocol. At this meeting, the information on CFs from observer reports was collated by the Secretariat. Table 18 presents a summary of available data.

3.86 Data from individual fish were analysed using a nested ANOVA design to provide estimates of the variance components in the CF of fish headed, gutted and tailed arising from vessels (0.0147), cruises (0.00653), hauls (0.00529) and individual fish (0.01973). Equivalent estimates of CF in headed and gutted fish was not possible since this product was obtained on only one of the cruises where individual fish were sampled.

3.87 Mean CFs were 1.672 (s^2 = 0.000112) for headed and gutted fish and 1.6565 (s^2 = 0.000097) for headed, gutted and tailed. There were no significant differences in CFs between male and female. Similarly, there were no significant differences in CFs between headed and gutted product and headed, gutted and tailed product.

3.88 Observers on several other cruises also provided valuable information on CFs from aggregated samples of fish which were compared with the CFs used by the vessel reports (Table 19).

3.89 These observations confirm the views expressed by WG-FSA in 1998 (SC-CAMLR-XVII, Annex 5, Table 13) that catches from some fisheries, particularly in Subarea 48.3, are being underestimated because inappropriate CFs are being used by most vessels when reporting their catches.

3.90 The large differences observed in Subarea 48.3 might also result from differences in the products considered by vessel skippers as opposed to scientific observers. For example, collars and cheeks may be included in the CFs used by vessels, but not used when determining total catch. Furthermore, the CFs determined by observers may or may not include collars and cheeks with the added complication that collars and cheeks undergo secondary processing in some vessels. It is not always clear from observer reports whether CFs have been calculated using different product forms and how the factors relate to standard product cuts such as illustrated in the *Scientific Observers Manual*.

3.91 The Working Group agreed that observers should continue to use the current format for determining CFs set out in the *Scientific Observer Manual*. However, the fish being sampled should be subject to the same processing methods as used during commercial processing of the catch. It was recognised that the strict application of the scientific observer guidelines for determining CFs may result in a reduction of the number of individual fish sampled. The Working Group urged theoretical studies to be undertaken in an effort to derive better estimates of the sampling precision of procedures to be applied in CF estimation.

3.92 The Working Group recognised the potential difficulties inherent in inconsistent CFs and the implications of this problem for the calculation of real catch levels. For example, catches reported for the past three seasons in Subarea 48.3 are calculated using the observer-derived CFs in Table 20.

3.93 The Working Group recommended that the Scientific Committee consider steps to ensure that appropriate CFs are used when reporting catches to CCAMLR. The possibility of directly recording the green weight of all catches should be considered in this regard.

Fish and Squid Biology/Demography/Ecology

Dissostichus eleginoides and *D. mawsoni*

Identification to Species Level of Fish Products

3.94 The Working Group noted that there had been reports of *Dissostichus* spp. being landed under other species' names. Such activities would contribute to the unaccounted illegal catch. WG-FSA-99/46 indicated that protein fingerprints can be readily obtained from fillet samples by isoelectric focusing on the muscle proteins. This process cannot be undertaken in the field, but could be undertaken in a few hours, or at most a day, in a basic laboratory ashore.

3.95 It was noted that CSIRO (Australia) had recently published a book (Yearsley et al., 1999) which contained information on the description of the appearance of fillets and the protein fingerprint for *D. eleginoides* as well as other fish species.

Stock Separation

3.96 Two papers were concerned with stock separation. WG-FSA-99/48 gave a brief summary of electrophoretic analysis of water-soluble muscle protein which indicated that there was no genetic difference between fish caught within the Argentine–Uruguayan zone in comparison with other locations of the southwest Atlantic.

3.97 An analysis of preliminary results with allozyme markers reported in WG-FSA-99/46 indicated that there was evidence for population subdivision among Pacific and Indian Ocean samples at three out of 11 loci in muscle tissue, although the population subdivision is not consistent among loci.

3.98 It was noted that samples of *D. eleginoides* had been provided to Dr P. Rodhouse (UK) as part of a 'geneflow' study. Also, the Working Group recalled that last year an additional approach had been described which was based on otolith microchemistry (WG-FSA-98/40). No further progress was reported on either of these studies.

3.99 The Working Group encouraged further work on these topics and recommended that experimental designs incorporate double-blind and inter-laboratory tests.

Age Determination

3.100 Analyses of 730 otoliths from *D. mawsoni* were reported in WG-FSA-99/43. This was a much more extensive analysis than had been possible previously. The estimates of von Bertalanffy parameters with 95% confidence limits from *D. mawsoni* caught on longlines in Subarea 88.1 were as follows:

Male L_∞ = 171.2 (162.5–180.0); k = 0.098 (0.084–0.113) and t_0 = 0.06 (-0.54–0.66)
Female L_∞ = 189.5 (179.5–199.5); k = 0.086 (0.073–0.098) and t_0 = 0.01 (-0.60–0.62).

The Working Group agreed that these should be used for current analyses.

3.101 A description was given in WG-FSA-99/43 of a study using otoliths from *D. eleginoides* for age determination. The material came from several months during the period from 1995 to 1999 and had come from three localities. All the otoliths were read by at least two of a total of four readers and their estimates compared. The results from three of the readers were in good agreement. The fourth reader gave results that were consistently higher by a constant amount relative to the other three.

3.102 The reasons for this difference are described in WG-FSA-99/56 and were suggested to be due to the criteria used to identify the first few annuli as had been described in WG-FSA-98/52. After about age 4 the annuli appear regular, a transition that is not thought to be related to the onset of sexual maturity. In WG-FSA-99/56 it is also noted that there are difficulties in determining whether the edge of the otolith was opaque or hyaline. These studies highlight the difficulties that are present in estimating the age of *Dissostichus* spp.

3.103 The estimates of von Bertalanffy growth parameters for *D. eleginoides* presented in WG-FSA-99/43 were somewhat different to earlier studies with L_∞ for males being 134.3 cm and females 158.7 cm.

3.104 Additional results on biological and population parameters for *D. eleginoides* were presented in WG-FSA-99/68. The samples for this study were obtained from a trawl survey in April 1999 and by observers on commercial trawlers operating around Heard Island (Division 58.5.2) since 1997. There were significant differences in the age composition from the sampling methods. Selectivity by longlines is known to be significant and result in catches

within a narrow size range. Trawls are thought to undersample fish larger than about 1 m in length. Neither method catches large numbers of fish greater than about 130 cm. Thus the larger and older fish are poorly represented in the samples which could lead to an underestimation of L_∞.

3.105 Various alternative analytical procedures were discussed and it was concluded that different approaches were needed depending on whether a population age composition, or age composition of the commercial catches or an age–length key was the aim of the particular study. Age composition of the commercial catches can be obtained by direct sampling but sampling for the other two objectives needs to take account of the various biases.

3.106 Pending the availability of further information, it was decided that for the time being it was probably best to fix L_∞ at some arbitrary realistic value and estimate k from the data appropriate to the stock in question. The value of t_0 appears to be close to zero for all the sets of available parameter values.

3.107 It was agreed that the effects of this approach on results from the GYM and other procedures should be examined carefully.

3.108 The Working Group welcomed the collaboration between workers in trying to standardise methodology. Such a process had been very successful in the 1980s for age determination studies on other Antarctic fish species.

3.109 Analysis of length-density data from the Heard Island area presented in WG-FSA-99/68 indicated that the fish were not randomly distributed over the Heard Island shelf, but migrated between different zones. Small fish, 30 to 40 cm long, were present in the shallow part of the shelf plateau while the commercial catches in restricted parts of the upper slope zone were of fish 50 to 75 cm length. Larger fish appeared to be present in deeper waters.

3.110 A sexual maturity/length function from the samples described in WG-FSA-99/68 indicated that L_{m50} for these fish is around 970 mm, close to the values for other localities, but using the von Bertalanffy growth parameters from the study indicated that this size is reached only when the fish are about 15.5 years old. The Working Group agreed that the age at L_{m50} should be revised in the light of reconsideration of the von Bertalanffy growth parameters already mentioned.

3.111 It was noted that there was some confusion over the descriptions of the maturity stages used to describe the reproductive cycle of *Dissostichus* spp. The problem appears to be greatest for *D. mawsoni* in the Ross Sea area because that fishery is restricted to about two months during the summer, a period several months away from the assumed spawning season as noted in last year's report (SC-CAMLR-XVII, Annex 5, paragraph 3.122). In the absence of further information, it was agreed that the L_{m50} value of 100 cm (range 95–105 cm) agreed at last year's meeting should continue to be used. In the Atlantic sector, where the fishery is currently restricted to the winter months, the ripening of the gonads prior to spawning is more easily recognisable. It was agreed that development of good descriptions, including photographs of the various stages and based on samples from as much of the season as possible, should be undertaken as part of the Scheme of International Scientific Observation.

3.112 The Working Group considered the depth range over which it would be most appropriate to integrate the recruitment estimates. Taking into account survey results from different regions it was agreed that the depth range from 0 to 500 m should be used.

Champsocephalus gunnari

Length to Mass Relationship

3.113 The following general relationships using several seasons' data from South Georgia (Subarea 48.3) were given in WG-FSA-99/50:

Total mass = $0.001285\ L_t^{3.46}$
Gutted mass = $0.001136\ L_t^{3.46}$.

These relationships had been used to calculate condition indices, presented in the same paper.

3.114 In addition, the following relationships were given in WG-FSA-99/16:

Lower South Shetlands:	total mass = $0.0006\ L_t^{3.7045}$
Elephant Island:	total mass = $0.0008\ L_t^{3.581}$
South Orkneys:	total mass = $0.0017\ L_t^{3.421}$.

Size Distribution

3.115 The length distributions from two localities (Elephant Island and lower South Shetlands shelf) in Subarea 48.1 were given in WG-FSA-99/16. These indicated that different modes were present at the different localities. At Elephant Island, modes were at 24 and 35 cm, whereas on the lower South Shetlands shelf they were at 27 and 33 cm. There was a greater difference when compared with the South Orkneys at the same period where the modal values were at 23 and 43 cm, with the larger size being by far the dominant group.

3.116 The size distribution from a series of 85 hauls in Subarea 48.3 using a commercial midwater trawl in February and March 1999 described in WG-FSA-99/57, gave a length range from 13 to 46 cm with peaks at 16–17, 24–25 and 30 cm corresponding to 1+, 2+ and 3+ age classes respectively. It was suggested that the large numbers of 1+ fish at some localities probably indicated a strong recruiting year class.

Diurnal Migrations

3.117 In WG-FSA-99/64 it is noted that fry (9–10 cm) undertook a diurnal vertical migration, ascending into the water column before dawn and returning to the seabed before sunset. Juveniles and adults were present in the water column at night where catches were approximately three times those obtained by day.

3.118 WG-FSA-99/65 contained an analysis of data on the distribution of *C. gunnari* around South Georgia over a 20-year period. The annual cycle of the fish is divided into three periods: feeding (October to March), spawning (April to June) and wintering (July to September). During the feeding period, immature and large fish were present on the northern part of the South Georgia and Shag Rocks shelves. Juvenile fish at this time tended to be concentrated on the southern shelf. As the fish develop, they appear to migrate northwards through the eastern and western parts of the shelf while the bulk of small fish migrate northeastwards along the eastern part of the shelf. Most immature fish are found in the eastern shelf area.

3.119 Pre-spawning migrations are directed eastwards from the northeast part of the shelf towards the coastal zone. Off the western part of the north coast the fish migrate west and south to spawn in coastal areas on the south side of the island. Post-spawning migrations occur in the opposite directions. The fish overwinter at depths of 200 to 250 m at some distance from the coast mainly on the north side of the island.

Standing Stock

3.120 In WG-FSA-99/63 an explanation was sought for some very large reductions in standing stock between successive seasons. These reductions were coincident with seasons of low krill abundance. It is suggested that the reduction in standing stock is due to predation by fur seals which at that time were unable to obtain sufficient krill, their favoured food item.

3.121 Dr Gasiukov noted that the increase in standing stock from 1988/89 to 1989/90 was of equal interest and suggested that, even though the 95% confidence limits for the surveys overlapped, the increase could also in part be due to immigration. It was agreed that this might be investigated further in developing models of the South Georgia ecosystem. Dr Constable had noted some similar changes in *C. gunnari* at Heard Island.

Reproduction

3.122 Over the period of the *C. gunnari* fishery a number of different descriptions of maturity stages have been used by workers from different laboratories. These descriptions have much commonality but divide the annual gonad cycle into different numbers of stages. WG-FSA-99/55 described the different systems used and provided an indication of the degree of compatibility. It was agreed that Members inform the Secretariat of any errors in the descriptions. The Secretariat was requested to find out which series should be applied to each of the datasets in the CCAMLR database.

3.123 Estimates of gonadosomatic indices in March of the 1997/98 and 1998/99 seasons were presented in WG-FSA-99/16. These were 15.0 (range 9.74–22.27) for females in the South Shetlands (Subarea 48.1) and 6.52 (range 0.93–11.29) for females and 2.29 (range 0.28–6.45) for males from the South Orkneys (Subarea 48.2). The length at sexual maturity and length at first spawning appear to be reached one year later than at South Georgia (Subarea 48.3). During the period from 16 February to 10 March 1999 the majority of fish were at or close to maturity stage III. Gonad maturation appeared to be more advanced in Subareas 48.1 and 48.2 than had been reported at Shag Rocks or the South Georgia shelf as reported in WG-FSA-99/57.

3.124 Information from commercial fishing around South Georgia presented in WG-FSA-99/65 indicated that most fish would be coming into spawning condition during April.

3.125 Data from research cruises and commercial fishing were analysed to provide within-season indications of the gonad maturation process and the results presented in WG-FSA-99/54. In most seasons nearly all sexually mature fish were coming into spawning condition by April. However, the timescale of the maturation process appears to vary greatly from season to season and this is attributed to feeding conditions during the preceding winter. The analysis demonstrates that, even though in November the maturation may be several months behind a 'normal' schedule, the process is sufficiently plastic for fish to come into spawning condition in April.

3.126 WG-FSA-99/52 reviewed the development of conservation measures for *C. gunnari* around South Georgia and questioned the need for an extended closure of the fishery to protect juvenile and spawning fish. The paper was seen as a useful compilation of the sequence of events leading to each change in the conservation measures. The Working Group discussed the implications of the paper further under Agenda Item 4.

Feeding

3.127 Data from commercial fishing during February and March 1999 reported in WG-FSA-99/57 indicated that the fish were feeding predominantly on krill. These were present in 88% of the stomachs examined. The second most important prey item was the amphipod *Themisto gaudichaudii* which was present in 16.2% of stomachs examined. The mean index of stomach fullness was 1.72.

Condition

3.128 Results from an analysis of condition indices were reported in WG-FSA-99/50. The condition index is the ratio of the measured total mass to the expected total mass. The index is thought to be related to the amount of food available and, on the South Georgia shelf, is closely correlated to the density of krill observed from acoustic surveys. The paper presented results from an analysis of data from commercial fishing and research trawl surveys around South Georgia (Subarea 48.3) between 1972 and 1997. Periods of low condition index are linked to indicators of poor krill seasons identified during CEMP. Short-term changes in condition, of the order of a month, were found to occur. It was agreed that condition indices and variability in reproductive status should be discussed further with respect to interactions with WG-EMM.

Parasites

3.129 During commercial fishing for *C. gunnari* in March 1999 in Subarea 48.3, a large sample of fish was examined for ectoparasites. These results are reported in WG-FSA-99/58. Of the 3 000 fish examined, 24.4% were infested by the copepod *Eubrachiellantarctica* and 18.5% with the leech *Trulliobdella capitis.* It was noted that studies such as that reported in the paper might provide useful information on the degree of mixing between fish from different localities and the proposal by the authors to consider further work on the topic was welcomed.

Rajidae

3.130 At its meeting in 1998 the Working Group had identified a need for more information on elasmobranch by-catch and specifically on rays (SC-CAMLR-XVII, Annex 5, paragraphs 9.1 and 9.2). Three papers relevant to the topic were tabled.

3.131 A report on the fish species caught during exploratory longline fishing in Subarea 88.1 was presented in WG-FSA-99/44. Three species, *Raja georgiana, Bathyraja eatonii* and *Bathyraja* spp. nov. were reported from catches and specimens registered in the National Fish Collection at the Museum of New Zealand.

3.132 Information on rays as by-catch can be found in WG-FSA-99/40 and 99/45, and in paragraph 4.90.

Comparative and Absolute Estimates of Standing Stock

3.133 Standing stock estimates for eight species of fish encountered in bottom trawl surveys which had been undertaken in 1985, 1991 and 1999 in Subarea 48.2 were compared and the results presented in WG-FSA-99/32. Although there is substantial variability in point estimates, biomass levels of most of the species appear to be unchanged or may have declined

slightly since 1991. The exceptions were in the stock of *C. gunnari*, which is currently extremely low in spite of there being no commercial fishing on this species for a number of years, and *Lepidonotothen squamifrons* and *Notothenia rossii* where there appears to be a signal of recovery. It is noted that the overall levels of biomass indicate very little potential for commercial exploitation.

3.134 Studies on *Notothenia coriiceps* at Potter Cove, presented in WG-FSA-99/24, indicated that the sampling program, which had been concentrated within a small area, had caused a decrease in mean size of fish in the population. This study is part of a monitoring program on fish species of commercial/potential commercial interest in the inshore waters of the lower South Shetland Islands area.

3.135 Monitoring of *N. rossii, Gobionotothen gibberifrons* and *N. coriiceps* mainly over a much larger area of Potter Cove over a period of nine years, presented in WG-FSA-99/30, indicated that relative to *N. coriiceps*, the other two species are still at low levels. This decline was thought to be due to commercial fishing in the region in the late 1970s. In spite of this it is reported that there are some signs of a recovery in recruitment of *N. rossii* in the last two years.

3.136 The information in WG-FSA-99/30 was compared with that from a larger scale trawl survey in the South Shetlands area in WG-FSA-99/31 (see also paragraph 4.201). It is hoped that future surveys will allow a more detailed comparison to be made so that the more frequent sampling that is possible at Potter Cove and other inshore sites of the lower South Shetland Islands area can be viewed in a wider context.

3.137 In considering these papers, the Working Group was concerned that even 20 years after the end of large-scale commercial fishing on *N. rossii*, it was still showing so little sign of significant recovery. Whilst accepting that the CCAMLR Convention had not been agreed at the time during which this fishing activity was taking place, the Working Group noted that the impact was such as to be contrary to the requirements of Article II.3(c).

3.138 Comparisons were drawn between the level of reported fishing on *N. rossii* with the total level of fishing on *D. eleginoides* from reported and IUU catches and the biological similarity of the two species. Serious concern was expressed that the levels of fishing thought to have taken place on *D. eleginoides* were similar to those which had taken place on *N. rossii* and which might lead to the imminent collapse of the stock. With *N. rossii* as the only comparison, it was felt that if such a collapse did take place, any recovery would almost certainly last for longer than the timescale specified in Article II.3(c).

Developments in Assessment Methods

3.139 WG-FSA-99/71 provided an outline of intersessional activities on the development of assessment methods for use at WG-FSA. A small workshop was held at the Renewable Resource Assessment Group (UK) to further develop the mixture analyses for estimating recruitments at South Georgia and to examine ways of integrating the CPUE analyses and the yield assessments of the GYM. Other research has made progress on developing methods for determining the age of *Dissostichus* spp. in the UK, New Zealand and Australia.

3.140 Apart from a recent survey at Heard Island and BANZARE Bank, no new information has become available to assist with estimating recent recruitment levels in the Convention Area as requested for assisting in the assessments of new and exploratory fisheries. The Working Group expressed great concern at the continuing lack of information on stocks of *Dissostichus* spp. subject to applications for new and exploratory fisheries, especially given that many of these stocks appear to have been targeted already by IUU fishers. Importantly, the Working Group noted that, in the absence of research voyages into these areas, longliners entering these fisheries need to contribute to some form of research program to help develop assessments of stock status and long-term yield.

3.141 Dr Gasiukov presented WG-FSA-99/60 in which a method is described for enhancing the application of the GYM when CPUE or some other index of abundance is available. The method uses estimates of uncertainty in the CPUE time series combined with the relationship between catch and fishing mortality in the period of known catches during the projections to ascertain whether individual projections in the simulations are plausible, given the apparent trends in CPUE in reality. The paper details the methodology required to process outputs from the GYM. This approach results in a subset of possible projections being used in the final assessment of long-term annual yield according to the CCAMLR decision rules. In the example developed in the paper based on the CPUE and GYM assessments for *D. eleginoides* at South Georgia, 10 000 projections were used to obtain a sample (approximately 10% of plausible projections) to include in the assessment. A smaller sample may be possible but 1 000 projections are likely to be too few in this procedure. The paper indicates that the current catch levels may be higher than would result from the application of this new approach (2 500 tonnes compared with 3 500 tonnes).

3.142 The Working Group noted that the results of this paper were based on last year's assessment results. The workplan for assessing yield in *D. eleginoides* at this meeting was to involve a review and, where necessary, revision of the input parameters to the GYM as well as updating the CPUE time series with the recent fishing activities. Consequently, the Working Group noted that the results of the paper provided an example of the workings of the proposed procedure but that they could not be used to infer the outcomes of such a procedure in this year's analysis.

3.143 The Working Group welcomed these developments, particularly as this had been an area of priority indicated last year. It noted that analyses that utilise and refine the outputs of the GYM will be very helpful in progressing the assessments of the Working Group.

3.144 Dr Kirkwood indicated that another approach to the same problem is to use a SIR (Sampling/Importance Resampling) Algorithm (see McAllister et al., 1994) to help tune the GYM to CPUE trajectories. This would assign probabilities to individual projections according to how compatible the observed CPUE was with those projected abundances. This would avoid the problems of rejecting large numbers of projections before an assessment could be undertaken.

3.145 The Working Group recommended that these types of analyses be developed over the intersessional period in order that some post-hoc analyses of the outputs of the GYM can be undertaken next year.

ASSESSMENTS AND MANAGEMENT ADVICE

New and Exploratory Fisheries

New and Exploratory Fisheries in 1998/99

4.1 Three conservation measures relating to new fisheries were in force during 1998/99, but only in respect of one of these was fishing carried out (Conservation Measure 162/XVII). Seven conservation measures relating to exploratory fisheries were in force during 1998/99, but only in respect of four of these was fishing carried out (Conservation Measures 151/XVII, 166/XVII, 167/XVII, 169/XVII).

4.2 For those new and exploratory fisheries where fishing occurred in 1998/99, in all but one case, the numbers of days fished and the catches reported were very small. The exception was the exploratory fishery for *Dissostichus* spp. in Subarea 88.1 conducted under Conservation Measure 169/XVII, where two vessels fished for a total of 76 days in 38 grids, taking 298 tonnes of *D. mawsoni*.

4.3 The Working Group noted that for each active new or exploratory fishery in 1998/99, all data required under Conservation Measure 65/XII were submitted by the due date.

4.4 A summary of the history of new and exploratory fisheries that have been notified since 1992/93 is given in Table 21, and a summary of the data requirements for CCAMLR fisheries in 1998/99, as defined in conservation measures, is given in Table 22.

4.5 Reviewing the information in Table 21, the Working Group noted that in all but a few cases, either no fishing or at most a very small amount of fishing had actually been carried out for the new or exploratory fisheries that had been notified. The Working Group further noted that increasing amounts of time are spent each year developing advice on precautionary catch limits for such fisheries. Particular concern was expressed that the Working Group has essentially no new information on *Dissostichus* spp. stocks in a number of subareas and divisions, despite new or exploratory fisheries having been notified for these areas, in some cases for up to four seasons in a row. The concern is further heightened by the fact that substantial amounts of IUU fishing are believed to have occurred in these areas.

4.6 The exploratory fishery for *D. mawsoni* in Subarea 88.1 provided an exception to this general pattern in 1998/99. The Working Group welcomed the new information on age and growth in WG-FSA-99/43. These data were used when calculating precautionary catch levels for Subarea 88.1 (see paragraph 4.55).

New and Exploratory Fisheries Notified for 1999/2000

4.7 A summary of new and exploratory fisheries notifications for 1999/2000 is given in Table 23.

4.8 Before discussing the individual notifications, several members noted that, especially in relation to fisheries for *Dissostichus* spp., the distinction between new and exploratory fisheries was somewhat blurred. This is particularly true for new or exploratory fisheries notified for areas that have been subjected to extensive amounts of IUU fishing.

4.9 One issue raised was that, since the closing date for notifications of new and exploratory fisheries occurs before the end of the fishing season, it is difficult to know whether an existing new fishery notified for the current season should be classified as a new or exploratory fishery in the next season. This can cause problems, since currently the two types of fisheries have different requirements for data collection.

4.10 The Working Group agreed that these classifications needed further consideration. This is taken up under Agenda Item 4.5 (paragraphs 4.227 to 4.229).

4.11 In view of the similarity between new and exploratory fisheries, the Working Group agreed to discuss the notifications together. The research vessel activity involving trap fishing for *D. eleginoides* in Subarea 48.3 notified by the UK was also considered to have similar characteristics to an exploratory fishery, and it was also discussed along with the new and exploratory fisheries notifications.

4.12 The Working Group noted that the USA had submitted a notification (CCAMLR-XVIII/BG/30) of plans to fish for crab in Subarea 48.3 in accordance with Conservation Measures 150/XVII and 151/XVII; FV *Pro Surveyor* intends to catch 1 600 tonnes of crabs, and approximately 60 tonnes of finfish as by-catch.

New Trawl Fishery for *Chaenodraco wilsoni, Lepidonotothen kempi, Trematomus eulepidotus, Pleuragramma antarcticum* and *Dissostichus* spp. in Division 58.4.2

4.13 Australia submitted a notification (CCAMLR-XVIII/11) for a new fishery for *Chaenodraco wilsoni, Lepidonotothen kempi, Trematomus eulepidotus, Pleuragramma antarcticum,* and *Dissostichus* spp. in Division 58.4.2. A summary is given in the following table.

Information required	Information supplied
Type of fishery	New
Member	Australia
Reference	CCAMLR-XVIII/11
Area	Division 58.4.2
Relevant conservation measures	31/X
Species	*C. wilsoni, L. kempi, T. eulepidotus, P. antarcticum, Dissostichus* spp.
1999/2000 notification by 28 July 1999	Yes
Catch level (tonnes) for a viable fishery	Overall catch of 1 500 tonnes.
Fishery plan	Mostly pelagic trawl; demersal trawl prohibited in depths of <550 m except in designated 'open' strips for research purposes. Fishing operations will comply with Conservation Measures 2/III and 30/X.
Biological information	Provided in CCAMLR-XVIII/11.
Effect on dependent species	Provided in CCAMLR-XVIII/11.
Information for calculation of yield	
Data collection plan	In accordance with Conservation Measures 51/XII, 121/XVI and 122/XVI.
Observer coverage	One international and one other scientific observer on each vessel.
Position verification	VMS in accordance with Conservation Measure 148/XVII.

New Longline Fisheries for *D. eleginoides* in Subarea 48.6 and Division 58.4.4 outside the South African EEZ

4.14 South Africa submitted a notification (CCAMLR-XVIII/9) for new fisheries for *D. eleginoides* in Subarea 48.6 and Division 58.4.4 outside the South African EEZ. A summary is given in the following table.

Information required	Information supplied
Type of fishery	New
Member	South Africa

Table (continued)

Information required	Information supplied
Reference	CCAMLR-XVIII/9
Area	Subarea 48.6 and Division 58.4.4 outside the South African EEZ
Relevant conservation measures	31/X, 161/XVII, 162/XVII and 164/XVII
Species	*Dissostichus* spp.
1999/2000 notification by 28 July 1999	Yes
Catch level (tonnes) for a viable fishery	To be determined based on 100 tonnes/fine-scale rectangle.
Fishery plan	Longlines; set grid catch limit for target species at 100 tonnes/ fine-scale rectangle; confine fishery to South African-flagged vessels; fishing seasons as defined in Conservation Measures 162/XVII and 164/XVII; vessels to comply with Conservation Measures 29/XVI, 31/X, 51/XII, 63/XV, 65/XII, 121/XVI, 122/XVI, 161/XVII, 162/XVII and 164/XVII.
Biological information	In accordance with Conservation Measures 121/XVI and 122/XVI.
Effect on dependent species	
Information for calculation of yield	
Data collection plan	As defined in Conservation Measures 51/XII, 121/XVI, 122/XVI and Annex 161/A of 161/XVII.
Observer coverage	International scientific observer on each vessel.
Position verification	VMS in accordance with Conservation Measure 148/XVII.

4.15 Dr Miller noted that the South African notification for new fisheries in Subarea 48.6 and Division 58.4.4 submitted last year contained a description of a 'sliding scale' for biological sampling (SC-CAMLR-XVII, Annex 5, paragraph 4.20). This was not instituted last year. He advised that this year it was intended that the feasibility of this form of sampling would be examined, but it has not been made a formal part of the notification.

New Longline Fishery for *Dissostichus* spp. in Division 58.4.4 outside the South African EEZ

4.16 Uruguay submitted a notification (CCAMLR-XVIII/14) for a new fishery for *Dissostichus* spp. in Division 58.4.4 outside the South African EEZ. A summary is given in the following table.

Information required	Information supplied
Type of fishery	New
Member	Uruguay
Reference	CCAMLR-XVIII/14

Table (continued)

Information required	Information supplied
Area	Division 58.4.4 outside the South African EEZ
Relevant conservation measures	31/X, 161/XVII and 164/XVII
Species	*Dissostichus* spp.
1999/2000 notification by 28 July 1999	Yes*
Catch level (tonnes) for a viable fishery	Proposed total catch limit of 580 tonnes as outlined in Conservation Measure 138/XVI (current total catch limit 572 tonnes – Conservation Measure 164/XVII).
Fishery plan	Maximum of two longliners.
Biological information	
Effect on dependent species	
Information for calculation of yield	
Data collection plan	In accordance with conservation measures.
Observer coverage	One international and one national scientific observer on board each vessel.
Position verification	VMS in accordance with Conservation Measure 148/XVII.

* Notification dated 26 July 1999, received 31 July 1999.

New and Exploratory Longline Fisheries for *Dissostichus eleginoides* 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

4.17 France submitted a notification (CCAMLR-XVIII/20) for new and exploratory fisheries for *D. eleginoides* 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. A summary is given in the following table.

Information required	Information supplied
Type of fishery	New and exploratory
Member	France
Reference	CCAMLR-XVIII/20
Area	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.
Relevant conservation measures	31/X, 65/XII, 160/XVII, 161/XVII, 163/XVII, 164/XVII and 168/XVII

Table (continued)

Information required	Information supplied
Species	*D. eleginoides*
1999/2000 notification by 28 July 1999	Yes*
Catch level (tonnes) for a viable fishery	Total of 2 500 tonnes for all vessels in all regions.
Fishery plan	Four longliners; fishing depth 500–2 000 m; minimum length of fish retained 60 cm.
Biological information	
Effect on dependent species	
Information for calculation of yield	
Data collection plan	Data in accordance with Conservation Measures 51/XII, 121/XVI and 122/XVI.
Observer coverage	One national observer, and eventually one international scientific observer on each vessel.
Position verification	VMS in accordance with Conservation Measure 148/XVII.

* A preliminary notification was submitted on 25 July 1999, CCAMLR-XVIII/20 was submitted on 17 September 1999.

4.18 The Working Group noted that, while the original notification was submitted on time, full details were not available until considerably later.

4.19 The Working Group also noted that the distribution of fishing effort amongst fine-scale rectangles within an area will presumably be covered by Conservation Measure 161/XVII. However, no information was given on the planned distribution of effort or catches amongst subareas and divisions in this notification. Since this notification covers subareas and divisions subject to other notifications of new or exploratory fisheries, provision of management advice in relation to precautionary catch levels for those areas may be made more difficult.

New and Exploratory Fisheries for *Dissostichus* spp. in Subareas 48.6, 58.6, 88.1 and 88.2, and Divisions 58.4.3 and 58.4.4 outside the Australian, French and South African EEZs

4.20 The European Community submitted a notification (CCAMLR-XVIII/21) on behalf of Portugal for new and exploratory fisheries for *Dissostichus* spp. in Subareas 48.6, 58.6, 88.1 and 88.2, and Divisions 58.4.3 and 58.4.4 outside the Australian, French and South African EEZs. A summary is given in the following table.

Information required	Information supplied
Type of fishery	New and exploratory[1]
Member	European Community (Portugal)
Reference	CCAMLR-XVIII/21

Table (continued)

Information required	Information supplied
Area	Subareas 48.6, 58.6, 88.1 and 88.2 and Divisions 58.4.3 and 58.4.4 outside Australian French and South African EEZs, and Division 58.5.1[2].
Relevant conservation measures	31/X, 65/XII, 162/XVII, 163/XVII, 164/XVII, 168/XVII and 169/XVII
Species	*Dissostichus* spp.
1999/2000 notification by 28 July 1999	Received 1 October 1999.
Catch level (tonnes) for a viable fishery	900 tonnes
Fishery plan	One longliner; fishing depth 500–2 500 m.
Biological information	
Effect on dependent species	By-catch of *Macrourus* spp. and *Bathyraja* spp.
Information for calculation of yield	
Data collection plan	In accordance with conservation measures.
Observer coverage	International scientific observer on board.
Position verification	VMS in accordance with Conservation Measure 148/XVII.

[1] This notification also covers longlining in Subarea 48.3 (550 tonnes of *D. eleginoides*)
[2] Not stated whether inside or outside French EEZ

4.21 The Working Group noted that this proposal had been submitted very late.

4.22 It also noted that this is the first time that a proposal had been received on behalf of a non-Contracting Flag State. In this context, it agreed that submission of information on previous fishing activities within the Convention Area by Portuguese-flagged vessels, if any, would be welcomed.

4.23 The notification also included longlining in Subarea 48.3. The Working Group agreed that this could not be considered a new or exploratory fishery. Rather, any longline fishing in Subarea 48.3 should be subject to the catch limit and any related conservation measures adopted for that subarea.

Exploratory Trawl Fishery for *Dissostichus* spp. in Divisions 58.4.1 and 58.4.3

4.24 Australia submitted a notification (CCAMLR-XVIII/12) for an exploratory fishery for *Dissostichus* spp. in Divisions 58.4.1 and 58.4.3. A summary is given in the following table.

Information required	Information supplied
Type of fishery	Exploratory
Member	Australia

Table (continued)

Information required	Information supplied
Reference	CCAMLR-XVIII/12
Area	Divisions 58.4.1 and 58.4.3
Relevant Conservation Measures	65/XII, 166/XVII and 167/XVII
Species	*Dissostichus* spp.
1999/2000 notification by 28 July 1999	Yes
Catch level (tonnes) for a viable fishery	Similar to 1998/99 catch limit in 58.4.3; possibly around 150 tonnes in Division 58.4.1.
Fishery plan	Two Australian-flagged trawlers.
Biological information	Provided in CCAMLR-XVIII/12.
Effect on dependent species	Escapement from the trawl fishery in Division 58.5.2 >85%.
Information for calculation of yield	See CCAMLR-XVIII/12.
Data collection plan	Random stratified trawl survey and data in accordance with Conservation Measures 51/XII, 121/XVI and 122/XVI.
Observer coverage	International scientific observer on each vessel.
Position verification	VMS in accordance with Conservation Measure 148/XVII.

Exploratory Longline Fisheries for *Dissostichus* spp. in Subareas 58.6, 88.1 and 88.2, and Divisions 58.4.4 and 58.5.1 outside the EEZs of South Africa and France

4.25 Chile submitted a notification (CCAMLR-XVIII/8) for exploratory fisheries for *Dissostichus* spp. in Subareas 58.6, 88.1 and 88.2, and Divisions 58.4.4 and 58.5.1 outside the EEZs of South Africa and France. A summary is given in the following table.

Information required	Information supplied
Type of fishery	Exploratory
Member	Chile
Reference	CCAMLR-XVIII/13
Area	Subareas 58.6, 88.1 and 88.2 (outside South African and French EEZs), Divisions 58.4.4 (outside South African EEZ) and 58.5.1 (outside French EEZ).
Relevant conservation measures	65/XII, 139/XVI, 161/XVII, 164/XVII, 168/XVII and 169/XVII
Species	*D. eleginoides*, *D. mawsoni*
1999/2000 notification by 28 July 1999	Yes

Table (continued)

Information required	Information supplied
Catch level (tonnes) for a viable fishery	To be determined based on 100 tonnes/fine-scale rectangle.
Fishery plan	Bottom longlines; maximum of three vessels; catch limits of 100 tonnes in each fine-scale rectangle.
Biological information	
Effect on dependent species	
Information for calculation of yield	
Data collection plan	In accordance with Conservation Measures 51/XII, 121/XVI and 122/XVI.
Observer coverage	International scientific observer on each vessel.
Position verification	VMS in accordance with Conservation Measure 148/XVII.

Exploratory Longline Fishery for *Dissostichus* spp. in Subarea 88.1

4.26 New Zealand submitted a notification (CCAMLR-XVIII/10) for an exploratory fishery for *Dissostichus* spp. in Subarea 88.1. A summary is given in the following table.

Information required	Information supplied
Type of fishery	Exploratory
Member	New Zealand
Reference	CCAMLR-XVIII/10
Area	Subarea 88.1
Relevant conservation measures	65/XII, 161/XVII and 169/XVII
Species	*D. eleginoides*, *D. mawsoni*
1999/2000 notification by 28 July 1999	Yes
Catch level (tonnes) for a viable fishery	As determined by CCAMLR.
Fishery plan	Longliners; fishing season from 1 December 1999 to 31 August 2000; New Zealand-flagged vessels only.
Biological information	
Effect on dependent species	New by-catch provisions proposed.
Information for calculation of yield	
Data collection plan	Line-weighting experiment (see paper) and data in accordance with Conservation Measures 51/XII, 121/XVI and 122/XVI.

Table (continued)

Information required	Information supplied
Observer coverage	International scientific observer and New Zealand Ministry of Fisheries scientific observer on each vessel.
Position verification	VMS in accordance with Conservation Measure 148/XVII.

Exploratory Longline Fishery for *D. eleginoides* in Subarea 58.6 outside the EEZs of South Africa and France

4.27 South Africa submitted a notification (CCAMLR-XVIII/8) for an exploratory fishery for *D. eleginoides* in Subarea 58.6 outside the EEZs of South Africa and France. A summary is given in the following table.

Information required	Information supplied
Type of fishery	Exploratory
Member	South Africa
Reference	CCAMLR-XVIII/8
Area	Subarea 58.6 (outside South African and French EEZs)
Relevant conservation measures	65/XII, 161/XVII and 168/XVII
Species	*D. eleginoides*
1999/2000 notification by 28 July 1999	Yes
Catch level (tonnes) for a viable fishery	
Fishery plan	South African-flagged vessels; fishing season to be determined by CCAMLR, but note that the existence of a closed season may serve to encourage high levels of unregulated fishing which in turn may exert substantive impact on seabirds.
Biological information	
Effect on dependent species	
Information for calculation of yield	
Data collection plan	Trawl survey in Subarea 58.6 and data in accordance with Conservation Measures 51/XII, 121/XVI, 122/XVI and Annex 161/A of 161/XVII.
Observer coverage	International scientific observer on each vessel.
Position verification	VMS in accordance with Conservation Measure 148/XVII.

Experimental Trap Fishing for *D. eleginoides* in Subarea 48.3

4.28 The UK submitted a notification (WG-FSA-99/41) of research vessel activity for which the total catch is expected to be >50 tonnes. This involved experimental fishing for *D. eleginoides* using pots. A summary is given in the following table.

Member	Gear	Target Species	Subarea and Time
UK[1]	Trap	*Dissostichus eleginoides*	48.3, January–July 2000

[1] Estimated total catch of target species is 400 to 600 tonnes

4.29 There was considerable discussion on whether this notification should be considered as one for research vessel activity with a total catch exceeding 50 tonnes, or as a new or exploratory fishery, and also on the size of the anticipated catch in relation to the catch needed to determine the rate of incidental mortality.

4.30 Dr Parkes explained that in Subarea 48.3 there already exists a well-established longline fishery for *D. eleginoides*, but that the longline fishing gear is subject to a significant bird by-catch problem. Experience from a similar pot fishery for *D. eleginoides* within the Uruguayan EEZ suggested that pots can take *D. eleginoides* successfully and that there is no associated bird mortality, but the fishing method has not been tried for *D. eleginoides* in Subarea 48.3.

4.31 The aim of the fishing trials proposed is to test the commercial viability of an alternative method of catching *D. eleginoides* that has a high potential to avoid or eliminate incidental mortality of seabirds. It is intended that the experiment will start in mid-January and to continue until mid-July. Pots will be set both during the day and at night. The expected catch is based on typical Uruguayan catch rates of 2 to 3 tonnes per day. All catches would be counted as part of the catch limit set for Subarea 48.3.

Working Group Comments on New and Exploratory Fisheries

4.32 The Working Group noted that the conservation measures on new (31/X) and exploratory (65/XII) fisheries clearly specify the type of information to be provided and then considered by the Scientific Committee in the formulation of its advice to the Commission. Apart from the proposed new fishery in Division 58.5.2 and the proposed exploratory trawl fishery in Divisions 58.4.3 and 58.4.1, the information provided in the notifications submitted for 1999/2000 was deficient in terms of the requirements set out in paragraphs 3 and 2 respectively of the conservation measures concerned. The Scientific Committee's attention was drawn to this situation which WG-FSA agreed had serious implications for its ability to fully advise the Scientific Committee on the likely consequences of the notified fisheries entering into force as well as their subsequent management and ability to provide essential scientific information.

Calculation of Precautionary Catch Levels

4.33 The Working Group agreed to continue to use the same general approach it adopted at its last meeting and calculated precautionary catch limits for new and exploratory fisheries by extrapolating from estimated long-term yields for *D. eleginoides* in Subarea 48.3 and Division 58.5.2. This involved two types of calculation. Firstly, yields estimated for Subarea 48.3 or Division 58.5.2 were extrapolated to other areas using the GYM, making

adjustments for the relative seabed areas and for the estimated relative densities. Following this, the extrapolated yields were discounted to take implicit account of incomplete knowledge of previously unexploited or lightly exploited areas.

4.34 While the general approach adopted was similar to last year, there were two key changes. Firstly, two alternative approaches were used to adjust for relative seabed areas. The first of these approaches was identical to that used last year, where the adjustment was based on relative areas of fishable seabed. The second approach involved adjustment based on relative areas of seabed which may be classified as recruitment areas.

4.35 The Working Group agreed that, as the proportional adjustment was actually applied to mean recruitment in each area under consideration, in principle the second approach may be more scientifically justifiable than the first, however it agreed to review the two sets of estimated seabed areas before reaching any final conclusion on this.

4.36 Secondly, the mean recruitment that had been adjusted proportionally by seabed area was multiplied by a further factor, equal to the estimated relative density on the fishing grounds of the area under consideration for new or exploratory longline fisheries, compared with that in South Georgia. This factor was calculated as the ratio of the average longline CPUE (kg/hook) available for the area under consideration to the average longline CPUE (kg/hook) for Subarea 48.3 in the 1991/92 season, the first season when haul-by-haul CPUE data were available for Subarea 48.3.

4.37 The aim of this second adjustment was to take explicit account of observed relative densities in Subarea 48.3 and the various subareas and divisions under consideration for new or exploratory fisheries. 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 for fishing areas that were not well known or 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.

4.38 In the absence of CPUE data for an area notified for a new or exploratory fishery, the assessments were undertaken using the relative CPUE from adjacent areas. This meant using CPUE data from Subarea 88.1 for Subarea 88.2, and CPUE data from Division 58.4.4 for Division 58.4.3.

4.39 The Working Group noted that in assessments for the trawl fishery in Division 58.4.2, the estimated recruitment should be prorated from that observed at Heard and Macquarie Islands. A survey conducted in Division 58.4.3 found only very low abundances of *Dissostichus* spp. There is a need for the Scientific Committee to consider how this information could be used in the assessment of appropriate catch levels for this division.

4.40 The calculations using the GYM involved three main components:

(i) Estimates of mean recruitment in each area under consideration were obtained by proportional adjustments for either fishable or recruitment seabed areas. For longline fisheries, the adjustments based on fishable seabed areas used the relative areas of seabed between 600 and 1 800 m in Subarea 48.3 and in the areas under consideration. For trawl fisheries, the depth range used was 500 to 1 500 m. For adjustments based on recruitment seabed areas, the relative areas of seabed used were between 0 and 500 m in Subarea 48.3 and in the areas under consideration.

(ii) Other biological and fishery parameters were set equal to the values most appropriate for the area under consideration. Where reliable estimates of

biological parameters were available for the area under consideration, these were used. For other areas, available parameter estimates from the same ocean sector were used, except the Indian Ocean sector parameters were used for areas in the Pacific Ocean sector. When calculating precautionary catch limits in those areas where *D. mawsoni* would be the predominant target species, available estimates of biological parameters for that species were used.

(iii) The recent catch history for each area under consideration was updated to include the most recent information on regulated (Tables 2 and 3) and IUU (Tables 7 and 8) catches.

4.41 For *D. mawsoni,* new data on age and growth were provided in WG-FSA-99/43. These data were used to estimate a von Bertalanffy growth curve for combined sexes. Parameter estimates were L_∞ = 182.89 cm, k = 0.089 yr^{-1} and t_0 = -0.015 yr. For *D. eleginoides*, growth parameters estimated using data from Subarea 48.3 were used (paragraph 4.116). It was noted that *D. mawsoni* appears to grow faster and reach a lower maximum length than *D. eleginoides*.

4.42 For *D. eleginoides*, the Working Group agreed to use the same range of M values estimated for Subarea 48.3 (0.13–0.2 yr^{-1}, see paragraph 4.120). For *D. mawsoni,* the Working Group agreed to use a range of M values from twice to two and a half times the estimated k for that species. That resulted in a range of M of 0.18 to 0.22 yr^{-1}.

4.43 For *D. mawsoni*, the size at maturity was assumed to be 100 cm TL with a range of 95 to 105 cm. The length–weight relationship calculated from 1998 and 1999 data combined (WG-FSA-98/43) was $W = 6 \times 10^{-6} L^{3.1509}$.

4.44 Estimated seabed areas are shown in Table 24. The seabed areas cover depths between 500–600, 600–1 500 and 1 500–1 800 m, and within the fishable depth ranges for trawling (500–1 500 m) and longlining (600–1 800 m) in Subareas 48.1, 48.6, 58.6, 58.7, 88.1 and 88.2, and Divisions 58.4.1, 58.4.2, 58.4.3, 58.4.4, 58.5.1 and 58.5.2. The methods used for the estimations are outlined in WG-FSA-98/6 and 98/50. For all regions except Subarea 88.1, the Sandwell and Smith bathymetric data were used. In Subarea 88.1, WG-FSA-98/50 used additional data sources to account for the areas in the Ross Sea excluded from the Sandwell and Smith database. More detailed data are available for calculating the seabed area between 0 and 500 m in Subarea 48.3 than in other areas, but these are not used, in order to provide consistency between areas.

4.45 In calculating seabed areas, all regions of permanent ice have been omitted, including the Ross Sea ice shelf in Subarea 88.1 and the Amery ice shelf in Division 58.4.2. No data are available from the Sandwell and Smith database for seabed areas south of 72°S in Subarea 88.2. The southeastern side of the Ross Sea in this subarea is sometimes free of fast-ice during summer.

4.46 The Working Group noted that, as was done last year, the adult habitat on the Maurice Ewing Bank was included in the calculations of fishable seabed area in Subarea 48.3. No new information was available to the Working Group on the effects on estimates of precautionary yield for new and exploratory fisheries of removing Maurice Ewing Bank from seabed area calculations (SC-CAMLR-XVII, Annex 5, paragraph 4.64).

4.47 Similarly, the Delcano Rise was included in the calculation of fishable seabed area for Subarea 58.6 this year, although, as recognised last year, this is another area where adult *D. eleginoides* are captured on banks that are not immediately adjacent to juvenile habitat (the shelf around Crozet Islands). No new information was available to the Working Group on whether adult fish on the Delcano Rise contribute to recruitment of juvenile fish around Crozet Islands (SC-CAMLR-XVII, Annex 5, paragraph 4.64).

4.48 Average catch rates by species in kg/hook, weighted by the number of hooks set in each region, are given in Table 25 by subarea and division, along with the proportions these averages represent of the 1991/92 weighted average catch rate in Subarea 48.3.

4.49 For Division 58.5.1, CPUE data were available from 1995/96 to 1998/99, but the first season had a very low catch rate (0.06 kg/hook) with a very large number of hooks set, and only the second two years were used to calculate weighted average catch rates. In Subarea 58.6, CPUE data were available from 1996/97 to 1998/99, but only the first two seasons were used in calculating weighted average catch rates, as a high average catch rate occurred (0.78 kg/hook) in the most recent season. Results from a Spanish longline research cruise in Subarea 48.6 and Division 58.4.4 (Ob and Lena Banks) in 1997 (WG-FSA-98/48) provided the only source of CPUE information for these areas.

4.50 The input parameters for the GYM for areas where there are notifications for new and exploratory fisheries are given in Table 26.

4.51 The precautionary catch limit calculations were done separately for those parts of each subarea or division that were believed to be occupied by *D. mawsoni* and *D. eleginoides.* As already indicated, different growth parameters were used for each species.

4.52 The Working Group recalled that last year it had identified a number of intrinsic uncertainties in the calculation of precautionary yields. On the basis of these, the Commission had decided to apply further discount factors to the estimated precautionary yields. These were 0.45 for *D. eleginoides* fisheries and 0.3 for *D. mawsoni* fisheries.

4.53 This year, when calculating precautionary yield levels for areas notified for new or exploratory longline fisheries, the mean recruitment levels have been scaled by the estimated stock densities in the area under consideration relative to those in Subarea 48.3, as measured by CPUE ratios. The Working Group agreed that, by adopting this approach, some of the additional uncertainties involved in extrapolating recruitment have been taken into account and there may not be a need to apply the same discount factor as last year for longline fisheries.

4.54 For trawl fisheries, however, it has not yet been possible to use a correction factor for relative densities, so the Working Group agreed that a discount factor of 0.45 should continue to be applied for both *Dissostichus* species. It noted that there remained no scientific basis for selecting a particular value for this discount factor.

4.55 The Working Group also noted that this year it had substantial new information on biological parameters for *D. mawsoni* based on data collected during exploratory fishing in Subarea 88.1. At least for that area, it may no longer be necessary to apply as low a discount factor for uncertainty for *D. mawsoni* as was done last year. The Working Group agreed, however, that the available information about *D. mawsoni* was still considerably less than for *D. eleginoides.*

4.56 The results of the projections using the GYM are given in Table 27.

4.57 In calculating these projections, given the shortness of time available, some approximations were made. The actual assessments conducted using the GYM were only undertaken for a single run within each of the different sets of fishery models. A fishery model is defined by the combination of:

(i) the biological parameters (taken either from South Georgia or Heard Island for *D. eleginoides* depending on the ocean in which the proposed fishery was to be undertaken, and from the Ross Sea for *D. mawsoni*);

(ii) the recruitment variability derived from the recruitment function applied to the model (taken from South Georgia for proposed fisheries using longlining,

including *D. mawsoni*, and for which CPUE was available from the proposed fishing area, or from Heard Island for Indian Ocean fisheries in which no CPUE adjustment could be applied); and

(iii) the fishing selectivity function, which differed between trawl and longline fisheries.

4.58 The resulting yield from a model run can be scaled to a different mean level of recruitment by determining the long-term annual yield per mean recruit from the model run and multiplying this by the new mean level of recruitment, which has been scaled by seabed area and, in some areas, relative levels of CPUE. The Working Group agreed that this approach was appropriate under the circumstances because the differences between approximations and some GYM trials to test the method were very small.

4.59 When reviewing the results of the GYM calculations, all members of the Working Group agreed that in a number of cases, the calculated yield levels were far in excess of any possible precautionary catch levels appropriate for those subareas or divisions. This occurred particularly in regions with substantial areas of continental shelf, but this feature was not restricted to those cases alone. The Working Group noted that the calculations had used agreed methods incorporating assumptions that it had believed to be the most appropriate it could make given the available information. The instances of clearly inappropriate calculated yields were therefore taken by the Working Group to signal that the methods and assumptions themselves must be flawed. Consequently, the Working Group was unable to use the calculated yields in Table 27 as a basis for recommending precautionary catch levels.

4.60 In attempting to identify the most likely reason for the failure of the methods for calculating precautionary yields, the Working Group agreed that almost certainly the problems lay in the extrapolations of recruitment to areas where no direct estimates of recruitment were available.

4.61 Over the last three years, considerable time and effort have been expended in developing and extending these methods based on extrapolated recruitment estimates, which were introduced originally in an attempt to investigate the possible effects of IUU catches. The Working Group agreed that it was no longer appropriate to attempt to use these methods for estimating precautionary yield levels for new or exploratory fisheries for *Dissostichus* spp.

4.62 The Working Group further agreed that the only methods that were likely to be able to result in reliable estimates of precautionary catch levels were those that were based on estimates of recruitment to the fishery obtained for the actual area subject to notification of a new or exploratory fishery. If such recruitment estimates were available, together with catch rate data for any fishing carried out in the area, the assessments based on them would then be similar in nature to those carried out in Subarea 48.3 and Division 58.5.2.

4.63 Well-designed scientific research surveys of the area under consideration were agreed by the Working Group to be the best sources of estimates of recruitment for that area. The Working Group recalled that it had recommended last year that research surveys to estimate biomass should be included in the very early stages of the development of new and exploratory fisheries for *Dissostichus* spp. (SC-CAMLR-XVII, Annex 5, paragraph 4.76).

4.64 Under the current circumstances, the urgency of this recommendation is even greater than it was before. In this context, the Working Group recognised that some subareas and divisions are rather large, and it may therefore be difficult for a single institution to undertake such a survey. However, as shown by the forthcoming CCAMLR 2000 Krill Synoptic Survey of Area 48, surveys of large areas are possible with collaboration between several institutions.

4.65 Other potential sources of data for an area are the new or exploratory fisheries notified for that area. Conservation Measure 65/XII, covering exploratory fisheries, explicitly requires

compliance with a Data Collection Plan developed by the Scientific Committee for that area and the submission of a Research and Fisheries Operation Plan by the Member making the notification. The Working Group noted that these requirements have in practice only very rarely been complied with in the notifications.

4.66 Given the Working Group's current inability to provide advice on precautionary catch levels for new or exploratory fisheries in the absence of data pertaining to the area concerned, the Working Group agreed that submission of a research plan considered acceptable by the Scientific Committee should be a prerequisite to the commencement of any new or exploratory fishery.

4.67 One important issue when conducting assessments of an area is identifying variations in density of *Dissostichus* spp. across the area. Data that would allow this to be addressed could be collected as part of exploratory fishing programs, however this would require sufficient hauls to be made in each potential fishing ground in order for differences in densities to be detected statistically.

4.68 The Working Group identified eight fishing grounds in Subareas 58.6 and 58.7 and Division 58.4.4 (Figure 2). These grounds are of a similar size to the grounds investigated for differences in CPUE around South Georgia. The coordinates of these areas are given in Table 28. The Working Group agreed that these grounds could form the basis of a research plan for new and exploratory longline fisheries. The research would involve each vessel undertaking a minimum number of longline sets in those squares in which exploration was to be undertaken.

4.69 The number of sets appropriate for this research activity was examined by using the CPUE data from Subarea 48.3. The analysis of haul-by-haul data for the *D. eleginoides* fishery in that subarea suggests that the square root of the CPUE (kg/hooks) is approximately normally distributed. In 1991/92 (the first season for which haul-by-haul data are available), the mean of this variable for the Shag Rocks fishing ground was 0.56 and the standard deviation was 0.19. The average number of hooks deployed per set in this ground was approximately 4 400. This information was used in a statistical power analysis to estimate the sample sizes of hauls needed to detect different proportional differences in densities between two areas using a two-sided 5% test with power 0.8. These sample sizes are shown in Table 29 and Figure 3.

4.70 In discussing the analysis, the Working Group agreed that, as part of a research plan for a new or exploratory fishery, a requirement to undertake a minimum number of longline sets in each small area fished had considerable merit, and that the results presented could form an appropriate basis for determining that minimum number.

4.71 It will also be necessary to specify the minimum number of hooks per set, the minimum length of longlines, and the minimum distance between sets. The Working Group agreed that there was insufficient time at this meeting to resolve issues concerning line deployment, and that this matter should be examined further at the next meeting.

4.72 Finally, the notification for a new trawl fishery in Division 58.4.2 by Australia (CCAMLR-XVIII/11) involved the taking of a number of fish species other than *Dissostichus* spp. The Working Group noted that there was no information available on the biology or abundance of these species in this division, and that it had been unable to undertake any assessments. It therefore had no sound basis to advise on the likely effects of the proposed levels of catch of these species. Dr Miller noted, however, that when yields had been assessed of these species in other areas, these have often been less than 200 tonnes.

4.73 As last year, the Working Group agreed that it was necessary for measures to be taken to restrict the by-catch levels in new or exploratory fisheries. For fisheries for *Dissostichus* spp., the key by-catch species are Rajidae and Macrouridae. Based on new information available this year (see paragraph 4.91), the Working Group agreed that a

maximum by-catch rate of 18%, by weight, per fine-scale rectangle would be appropriate as a basis for setting general by-catch levels for new and exploratory fisheries at this stage. While new information was also available on rajid by-catches, the Working Group agreed that the same by-catch provisions as recommended last year should be applied. The Working Group reiterated that it is important to assess the by-catch levels appropriate for fisheries in all areas (paragraph 4.98).

4.74 The Working Group agreed that there remains an urgent need for detailed catch, effort and biological data to be collected on all by-catch species and, in this regard, agreed that conservation measures specifying by-catch limitations on new and exploratory fisheries should specify data collection requirements for by-catch species that are commensurate with data collection requirements for the target species.

4.75 The Working Group noted that setting catch limits for trawl and longline fisheries in the same assessment area may cause problems in determining an appropriate combined catch that satisfies the CCAMLR decision rules. While the Working Group is developing methods of incorporating different fisheries into the GYM, no formal mechanism for indicating the sustainability of combined catches is available at this stage. It recalled its discussion last year (SC-CAMLR-XVII, Annex 5, paragraph 4.75) where some indication is given to what might be a maximum catch in a mixed fishery. The Working Group considered that a better way to determine the total catch is by the formula:

Trawl catch = (1 - proportion to be taken of longline long-term annual yield) x trawl long-term annual yield.

Management Advice

4.76 Three conservation measures relating to new fisheries were in force during 1998/99, but only in respect of one of these was fishing carried out. Seven conservation measures relating to exploratory fisheries were in force during 1998/99, but only in respect of four of these was fishing carried out. Information about new and exploratory fisheries during 1998/99 is contained in paragraphs 4.1 to 4.6.

4.77 The Secretariat received nine notifications for new fisheries in 1999/2000 (Table 23). All notifications for the 1999/2000 season were for fisheries on *Dissostichus* spp., except that the notification from Australia for a new trawl fishery in Division 58.4.2 also includes a number of other fish species. Information and Working Group comments on new and exploratory fisheries for 1999/2000 are in paragraphs 4.7 to 4.75.

4.78 As a result of apparent failures of assumptions in the methods used (see paragraphs 4.59 to 4.61), the Working Group was unable this year to provide advice on precautionary catch levels for new and exploratory fisheries notified for 1999/2000.

4.79 The Working Group further advised that it believed it is no longer appropriate to attempt to use these or similar methods based on extrapolated recruitment. The only methods that the Working Group believed likely to be able to result in reliable estimates of precautionary catch levels are those that are based on estimates of recruitment obtained for the actual area subject to notification of a new or exploratory fishery.

4.80 The Working Group therefore repeated its recommendation of last year that research surveys to estimate biomass should be included in the very early stages of the development of new and exploratory fisheries for *Dissostichus* spp. (SC-CAMLR-XVII, Annex 5, paragraph 4.76).

4.81 The Working Group stressed the importance of full compliance with the requirements of Conservation Measure 65/XII, which explicitly requires submission of data in accordance with

a Data Collection Plan developed by the Scientific Committee for that area and the submission of a Research and Fisheries Operation Plan by the Member making the notification. Submission of a research plan considered acceptable by the Scientific Committee should be a prerequisite to the commencement of any future new or exploratory fishery. Such research plans should include a minimum number of sets or hauls per small area as advised by the Scientific Committee (paragraphs 4.67 to 4.72).

4.82 The Working Group also noted that in nearly every instance, notifications of new or exploratory fisheries for 1999/2000 were deficient in the provision of information as required in Conservation Measures 31/X and 65/XII (paragraph 4.32).

4.83 The Working Group was unable to advise on the likely effects of the levels of catch of species other than *Dissostichus*, proposed in the notification for a new trawl fishery in Division 58.4.2 by Australia (CCAMLR-XVIII/11).

4.84 The Working Group agreed that a maximum by-catch rate of 18% per fine-scale rectangle should be imposed for by-catches of macrourids in new and exploratory fisheries. For rajid by-catches, the Working Group agreed that the same by-catch provisions as recommended last year should be applied (10 to 15%).

4.85 There remains an urgent need for detailed catch, effort and biological data to be collected on all by-catch species. Conservation measures specifying by-catch limitations on new and exploratory fisheries should specify data collection requirements for by-catch species that are commensurate with data collection requirements for the target species.

4.86 Management advice stemming from consideration of seabird by-catches in new and exploratory fisheries is given in paragraph 7.176.

4.87 The Working Group recognised that further development of alternative advice may be possible, and the attention of the Scientific Committee was drawn to this.

By-catch

4.88 At last year's meeting, WG-FSA reviewed the need to study elasmobranch by-catch in the light of discussions initiated at CCAMLR-XVI between Mr R. Shotton (FAO Observer) and Drs Miller and Ramm. The Working Group recognised the long-term need to document and assess, in general, by-catch in fisheries within the Convention Area, and to collect information which would allow the assessment of stocks of species caught as by-catch (SC-CAMLR-XVII, Annex 5, paragraphs 9.1 and 9.2). Several steps were envisaged:

(i) Quantify the data available in the CCAMLR database and the national archives of Members.

(ii) Identify the needs for additional data and develop strategies for collecting such data.

(iii) Analyse data on by-catch and, in particular, assess the stocks of species dominant within the by-catch.

4.89 Following up on these recommendations, three papers on the particular topic of by-catch were submitted for the consideration of the Working Group at this year's meeting: WG-FSA-99/40, 99/45 and 99/69.

4.90 WG-FSA-99/40 analysed data collected by UK scientific observers on vessels fishing *D. eleginoides* in Subarea 48.3. The overall average catch rate of rays was

0.7 individuals/thousand hooks, compared with 34.7 individuals/thousand hooks for *D. eleginoides* and 2.2 individuals/thousand hooks for macrourid species. GLM analyses demonstrated that there are significant differences between the catch rates of rays for different vessels, areas and depths in Subarea 48.3. Some vessels, fishing on the northern shelf edge at both Shag Rocks and South Georgia, achieved catch rates of over 1 ray/thousand hooks, and 20 to 30 rays/thousand *D. eleginoides*. The two species most frequently found were *R. georgiana* and *Bathyraja murrayi*. Additionally, *B. meridionalis*, *B. griseocauda* and *R. taaf* were also recorded by scientific observers, although confirmation of the identification of the two latter species was not possible and should be considered provisional. Catches were made in depths of 500 to 1 500 m and although most rays are released, they may sometimes retain hooks in their mouths. The level of mortality from this practice is unknown, but the authors intend to further investigate this question in future works.

4.91 An assessment of yield and status of the by-catch species *M. carinatus* on BANZARE Bank (Division 58.4.3/58.4.1) is given in WG-FSA-99/69. The authors estimated the long-term precautionary yield of this species using the GYM and results from the trawl survey on BANZARE Bank in 1999. Length and weight data were taken from a trawl survey conducted at Macquarie Island in 1999. Where parameters were not available for *M. carinatus*, estimates were obtained from the literature for similar species elsewhere in the world. The long-term annual yield calculated for the species was 550 tonnes, based on a critical value (γ) of 0.033 found using the CCAMLR decision rules. Applying the critical value of γ to the mean density observed in the survey results gave a catch rate of 5.81 kg/km^2 which corresponds to a precautionary yield of 17.9 tonnes per fine-scale rectangle. Such a yield represents 18% of the total catch allowed for *D. eleginoides* in fine-scale areas in new and exploratory fisheries. The authors suggested that this catch rate may be useful in setting general by-catch rules for *M. carinatus*.

4.92 WG-FSA-99/45 presented a research program aimed to assess the impact of the exploratory fishery for *Dissostichus* spp. proposed by New Zealand in Subarea 88.1 during the 1999/2000 season (CCAMLR-XVIII/10) on species of the family Rajidae. Information and biological material collected by scientific observers in the 1998/99 and 1999/2000 fishing seasons would be used to address the following objectives:

(i) determine the species of family Rajidae present in the study area;
(ii) estimate the catch rate of various skates;
(iii) determine the age and growth rate of various Rajidae species; and
(iv) assess the feasibility of live release of skates as a method for reducing the impact of incidental catch.

4.93 The amount of by-catch reported from longline fisheries targeting *Dissostichus* spp. during the 1998/99 season was estimated at the time of the meeting of the Working Group from data reported in the five-day catch and effort reports, scientific observer data and the haul-by-haul data. Reconstruction of by-catch using the observer data proved to be difficult because the proportion of the catch from which by-catch was recorded was usually not defined. In addition, by-catch was not always reported by weight, thus some numbers had to be converted to weights using a mean weight for each species. Nevertheless, results shown in Table 30 indicate that by-catch estimates from different reporting sources are quite similar for Subareas 58.6 and 58.7 (combined for the Prince Edward Island EEZ), and Subarea 88.1, the average values being 59.7 and 65.9 tonnes respectively. In contrast, values in Subarea 48.3 ranged from 27.4 tonnes in the catch and effort reports to 85.1 tonnes in the observer data.

4.94 The species composition of by-catch reported in the haul-by-haul data from longline fisheries in the 1998/99 season is summarised in Table 31. Estimates show that the total recorded by-catch accounted for 2%, 14%, 13% and 18% of the total catch in Subareas 48.3, 58.6, 58.7 and 88.1 respectively. By-catch comprised a total of 21 identified species belonging to nine families of Chondrichthyes, Osteichthyes and crustaceans. The dominant by-catch families, by weight, in Subarea 48.3 were Macrouridae (0.93% of total catch) and Rajidae

(0.76%). Macrouridae also dominated the by-catch in Subareas 58.6 (10.4%) and 58.7 (11.7%). In Subarea 88.1, Rajidae was the most abundant family (11.0%), followed by Macrouridae (6.2%).

4.95 The Working Group acknowledged the submission of the above-described papers and the results of the preliminary analyses conducted at the time of the meeting. It recognised the potential severity of the by-catch problem on the management of the stocks of the species involved and identified a number of difficulties that needed to be solved to adequately assess it.

4.96 The most important problem is obtaining reliable catch figures by species, which also implies the proper identification of the species that are caught. The Working Group noted that several conservation measures currently in force (51/XII, 61/XII, 121/XVI and 122/XVI) require the reporting of catches and length composition measurements of by-catch species and requested the Scientific Committee to draw the attention of Members, as appropriate, to the need to comply with these requirements. However, the Working Group recognised that additional information on survival rates of the different by-catch species would also be necessary to evaluate the full impact of fishing on these species.

4.97 The precise identification of by-catch species seems to be rather complicated with the available identification keys, specially in longline fisheries where most of the unwanted species are released before taking them on board (paragraph 3.75). In this respect, Dr Kock reiterated the offer for assistance with the development of suitable taxonomic keys for elasmobranchs made by Dr V. Siegel (Germany) at the last meeting of WG-FSA (SC-CAMLR-XVII, Annex 5, paragraph 9.3). The Working Group accepted this offer and looked forward to the new keys.

4.98 The Working Group felt that the quality and the quantity of the by-catch information available to the meeting do not allow any further progress in this matter, or with the request from last year's Scientific Committee to work towards general by-catch provisions for assessed fisheries. Therefore, the Working Group tasked a small group, comprising Drs D. Agnew (UK) and B. Prenski (Argentina), to work intersessionally according to the steps outlined in paragraph 4.88 and report its findings for consideration at next year's meeting of WG-FSA.

Assessed Fisheries

Dissostichus eleginoides

4.99 Methods for assessing *D. eleginoides* were established by WG-FSA in 1995 (SC-CAMLR-XIV, Annex 5, including Appendix E). Since that time, the Working Group has focused on determining whether there are any trends in CPUE and assessing long-term annual yields using the GYM. These were the primary components of the work this year.

4.100 Analysis of CPUE data was only undertaken for Subarea 48.3 where new data were available. The details and extensions of the analysis are discussed under that subarea.

4.101 Assessments of long-term annual yield were reviewed for Subarea 48.3 and Division 58.5.2. An important component of the work this year was to reassess the input parameters to the GYM, including the addition of new estimates of parameters for 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).

4.102 Part of this work included standardising the parameters to a specific start date in the year, specified as the time of recruitment. This is a refinement to scale data from different surveys and samples of fish taken at different times of the year. This is illustrated in Figure 4.

Lengths at age of younger fish can appear different between samples as a result of when the samples were taken. If most are taken at approximately the same time, then the bias is not a problem. Much of the sampling, however, is spread over the year. Thus, the sample time since the nominal start date of the year is factored into the analysis (see WG-FSA-99/68). Similarly, estimates of recruitment are adjusted to the nominal start date according to when the survey was undertaken. This is part of the procedure of projecting the cohorts identified in the mixture analyses to transform the numbers at age to numbers of fish at age four.

South Georgia (Subarea 48.3)

4.103 The catch limit of *D. eleginoides* in Subarea 48.3 for the 1998/99 season was 3 500 tonnes (Conservation Measure 124/XVI) for the period 1 April to 31 August 1999. A total of 15 vessels from Chile, South Africa, UK and Uruguay fished during the season. The fishery was closed on 17 July 1999, with a total reported catch of 3 652 tonnes (CCAMLR-XVIII/BG/1).

Standardisation of CPUE

4.104 GLM analyses were conducted using haul-by-haul catch and effort data for Subarea 48.3 submitted on C2 forms for the 1991/92 to 1998/99 fishing seasons. As agreed by the Working Group last year, only CPUE data for the winter months (March to August inclusive) were used in the analyses. CPUEs in numbers/hook and kg/hook were used as response variables, and nationality, winter season, month, area (east South Georgia, northwest South Georgia, south South Georgia, west Shag Rocks and Shag Rocks; see Figure 2), depth and bait type were considered as predictor variables. GLM analyses were conducted on positive CPUE data only, with an adjustment for zero catches being made afterwards.

4.105 The basic approach used to fit the GLMs was the same as that used last year. Details of the methodology are provided in SC-CAMLR-XIV, Annex 5, Appendix G. However, changes were made in the CPUE data transformation used and the particular type of GLM analysis used. These changes were made because the distribution of residuals produced by the GLM model fitted last year was found to have unsatisfactory features (see Figure 6 for a QQ-plot of residuals from the model fitted to CPUE in kg/hook). This year, a square-root transformation was used and a robust form of GLM analysis was carried out. For the analysis of CPUE in kg/hook, the model used was GLM(cpue ~ season + month + area + nationality + bait + poly(depth, 2), family = robust(quasi(link))), while for CPUE in numbers/hook, the model used was GLM(cpue ~ season + month + area + nationality + bait + poly(depth, 4), family = robust(quasi(link))). This resulted in a much more satisfactory distribution of residuals (see Figure 7 for the fit to CPUE in kg/hook).

4.106 Nationality, winter season, month, area, depth and bait type were each found to be highly statistically significant sources of variation to haul-by-haul CPUE, both in kg/hook and numbers/hook. These predictors were also highly significant in the Working Group's previous analyses.

4.107 The standardised time series of winter season CPUEs in kg/hook is plotted in Figure 8 and given in Table 32. The standardisation is with respect to Chilean vessels fishing in east South Georgia during March at 1 152 m using mackerel bait. This time series has also been adjusted for the presence of hauls with zero catches. As was done last year, the adjustment was made by estimating the proportions of non-zero catches in each fishing season and multiplying the standardised CPUEs predicted from the GLMs by these proportions. The proportions of non-zero catches are given in Table 33.

4.108 The time series of standardised winter season CPUEs in numbers/hook is plotted in Figure 9 and given in Table 34. The same standardisation as used for the CPUEs in kg/hook was used, and the time series has also been adjusted for the presence of hauls with zero catches.

4.109 Adjusted, standardised catch rates decreased between the 1993/94 and 1997/98 seasons, but they increased again in the 1998/99 season. However, the extent of the increase in standardised CPUE in the most recent season was quite different for the kg/hook and numbers/hook analyses. There was only a small increase in standardised CPUE in kg/hook, but a substantial increase in CPUE in numbers/hook. There was also a substantially greater difference between the nominal and standardised CPUEs in 1998/99 than in previous seasons.

4.110 Possible reasons for these features were examined by considering distributions of depths fished in Subarea 48.3 by season and area. These indicated clearly that in the last two seasons, but especially in 1998/99, there had been a considerable increase in the numbers of longlines being set at shallow depths (300 to 700 m), particularly to the north of Shag Rocks. Histograms of depths fished by season are shown in Figure 10, and by area around South Georgia for the 1997/98 and 1998/99 seasons in Figures 11 and 12. When these distributions are grouped by different levels of CPUE (in weight or numbers), it is clear that the shallow-depth fishing contributed substantially to the overall nominal CPUEs both in weight and numbers (see Figures 13 and 14).

4.111 The Working Group next examined mean weights of fish taken in the winter seasons, calculated as simple averages of mean weights per haul, with no catch weighting. For Subarea 48.3 as a whole, there was a small decline in mean weight for the most recent two seasons (Figure 15). The decline in mean weight in the last two seasons was much more obvious at Shag Rocks (Figure 16), and when this was further examined by depth zone at Shag Rocks (Figure 17), for the middle two depth zones there is a noticeable decline in mean weight in the most recent season. It is believed that these features largely explain the difference between nominal and standardised CPUE in the most recent season.

4.112 The Working Group finally examined the (full-season) catch-weighted length frequencies by season and area (Figures 18 to 20). These indicate that in the last two 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 two seasons and also a notable reduction in the spread of the length-frequency distributions. Unexpectedly, the length frequencies for depths above and below 900 m at Shag Rocks were very similar.

4.113 During discussion of these results, it was emphasised that, since depth was included as an explanatory variable in the analyses, the standardisation process should have taken full account of the most recent changes in depth distribution of fishing. It was noted, however, that the models fitted did not include a term for possible interaction between season and depth. It is unclear whether the data would support robust estimation of season–depth interactions given the current form of model used, especially that for CPUE in numbers/hook where depth is modelled as a fourth degree polynomial. One possibility that should be examined next year would be to treat depth as a factor with a small number of levels, in which case it ought to be possible to take account of possible season–depth interactions.

4.114 It was also noted that it had been necessary in the analyses to treat vessels flying the same national flag as replicates. This would imply that, if national fleets had increased in efficiency over time, for example with more efficient vessels joining the fleet to replace less efficient vessels, then this would not be accounted for in the analyses. However, no evidence was available to suggest that this had actually happened to any major extent.

Determination of Long-term Annual Yields using the GYM

4.115 The analysis of long-term annual yield was updated with the recent catches taken from Subarea 48.3 and a revision of the recruitment function, growth parameters and natural mortality.

Growth, Mortality and Fishing Selectivity

4.116 Estimates of the von Bertalanffy parameters were obtained from a reanalysis of length-at-age data used in 1995. This year, L_∞, k and t_0 were estimated by combining the lengths at age from two sources. The first source was lengths at age read from otoliths collected in the UK survey around South Georgia in January and February 1991. The second source was an age–length key compiled by Aguayo (1992) from readings of scales taken from the commercial longline fishery during February to May 1991. The parameters were estimated using a weighted non-linear regression in Mathcad 7.0. The results are presented in Figure 21. The estimated parameters were L_∞ = 194.6 cm, k = 0.066.yr^{-1} and t_0 = -0.56 years. These parameters do not substantially alter the estimates of length at age in younger fish arising from the previous estimates. The main difference is the estimate of L_∞. This increased size from 170.8 cm is consistent with the upper size range of fish observed in the longline fishery (the maximum observed in the database is 240.5 cm). The growth curve was adjusted to the beginning of the projection year by altering t_0.

4.117 The Working Group recalled the deliberations of WS-MAD in 1995 noting that scale readings may provide underestimates of age (SC-CAMLR-XIV, Annex 5, Appendix E, paragraphs 2.4 to 2.17). Similarly, underestimates of age from otoliths may arise due to a delay in laying the first ring (e.g. WG-FSA-99/68). It noted the continued work in developing methodologies to determine the age of fish using otoliths (see paragraphs 3.100 to 3.102). The Working Group considered that work to refine and validate age determination methods, including the validation of annual formation of rings in otoliths, is a high priority for future assessments. The Working Group agreed that a priority task for next year should be to re-estimate the growth parameters based on new information on length at age.

4.118 The Working Group examined the relationship between the weighted length-frequency distribution for all longline fishing in Subarea 48.3 from 1992 to the present (Figure 22). This distribution was consistent with selection of fish into the fishery occurring greater than 55 cm with full selection greater than 79 cm. Total mortality (Z = M + F) was estimated from these data using the Beverton and Holt method, giving Z = 0.255. The shape of the curve is different to those reported in 1995 (SC-CAMLR-XIV, Annex 5, Figure 6 and SC-CAMLR-XIV, Annex 5, Appendix E, Figure 5). The current weighted age frequency shows the average representation of different length classes in the fishery, taking into account variation in recruitment. The Working Group agreed that the fish were likely to be fully selected for lengths greater than 79 cm.

4.119 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. If this is the case, then the resulting long-term annual yield will need to be reduced. The Working Group considered that a more detailed analysis of the selectivity pattern needs to be undertaken next year in order to incorporate a changing selection pattern into the GYM. Work to accommodate this in the GYM also needs to be given high priority.

4.120 The estimate of M, the natural mortality rate, used last year was 0.16 yr^{-1}. The Working Group noted that this was not incompatible with an estimate of Z (total mortality rate) derived from the pooled 1991/92 to 1998/99 catch-weighted length frequency (0.255 yr^{-1}), but it

believed it appropriate to use a range of estimates of M, rather than a single value. Noting that the value 0.16 yr^{-1} is approximately 2.5 times the estimate of k, the Working Group agreed to use a range of values of M equivalent to the range 2k to 3k (i.e. 0.13–0.2 yr^{-1}).

Recruitment

4.121 At past meetings (1995 and 1997), the Working Group had analysed length-frequency data from trawl surveys expressed in terms of density (numbers per km^2) using the CMIX program (de la Mare, 1994) (termed 'length-density'), (SC-CAMLR-XIV, Annex 5, paragraphs 5.44 to 5.49) in order to generate estimates of recruitment to the population of *D. eleginoides* in Subarea 48.3. At last year's meeting, an attempt was made to incorporate data from trawl surveys in 1997 by Argentina and the UK into the recruitment function. Due to problems reconciling the data from these surveys with available data on growth, it was not possible to incorporate those data at that meeting.

4.122 Intersessionally, the WG-FSA subgroup on assessment methods had considered the problem of reconciling survey data with growth models. At this year's meeting, the Working Group decided to undertake a reanalysis of as much of the survey length-density data as possible, in conjunction with the development of new growth parameters (paragraph 4.116).

4.123 In the past, there have been problems with the extraction of length-density distributions from research survey data held in the CCAMLR database (SC-CAMLR-XVII, Annex 5, paragraph 105). Progress made at last year's meeting, and intersessionally by the subgroup on assessment methods, meant that it was possible to perform a routine data extraction from survey data held in the CCAMLR database, some of which were available in the new research survey format and others in the C1 commercial trawl format. Nevertheless, some difficulties were experienced with extracting the data from the C1 format and the Working Group again recommended that all available survey data be transferred into the new research data format as soon as possible (see paragraphs 3.7 to 3.10).

4.124 Length-density distributions were extracted from a total of 12 trawl surveys in Subarea 48.3 (Table 35). However, data from only 11 surveys were used in the final analyses.

4.125 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.

4.126 There were also several cases in the other 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. To achieve this, an average length distribution derived from other stations in the same stratum was applied to the catches where no fish were measured. The Working Group noted that for the surveys in Table 35 the number of cases and the catch of fish at stations where this occurred was generally low. However, in the case of the *Hill Cove* survey in 1990, there was a single station where the catch of *D. eleginoides* was 0.91 tonnes, but only six fish were measured. Nevertheless, a total of 715 fish were measured at other stations in the same stratum during the rest of the survey. The Working Group therefore agreed to apply the average length distribution of these samples to the catch at this station.

4.127 Following the procedure used at the 1995 meeting, the densities of fish in age classes 3, 4 and 5 for each survey were estimated by fitting a mixture of normal distributions directly to the length-density distributions. Length densities for separate strata were pooled according to the method described in WG-FSA-96/38 and paragraphs 4.67 and 4.68 of WG-FSA-96 (SC-CAMLR-XV, Annex 5). For *k* strata, the density data from each haul are rescaled by the composite sampling fraction:

$$D_{i,j} = d_{i,j} \frac{A_i}{\sum_k A_k} \frac{\sum_k n_k}{n_i}$$

where $D_{i,j}$ is the rescaled density at length for haul *I* in stratum *j*, $d_{i,j}$ is the original density-at-length estimate for that haul, and A_i and n_i are the area and number of hauls in stratum *I* respectively.

4.128 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 December. The results of the fitting process are illustrated in Table 36 and Figure 23. The graphs in Figure 23 illustrate the observed length densities, the fitted mixtures and the upper and lower confidence intervals of the observations. 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 estimated for Subarea 48.3 (paragraph 4.116). Differences between sums of observed expected densities were generally low 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 fish of lengths over the full range considered in the analysis (250–750 mm) were present, fish of more than 400 mm were rare in the catches. The majority of the catch was between 280 and 400 mm, considered to represent mainly two-year-olds. Although the fit was poor, and two-year-olds were not used in the estimation of recruitment, the mode observed was consistent with the strong mode of three-year-olds in the survey the following year.

4.129 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. For example, the Working Group noted that the strong 1989 year class discussed in paragraph 4.128 was not detected as five-year-olds in the 1993/94 surveys. Also, the age-3 and age-4 fish observed in the UK survey in January 1990 were detected only in low numbers in the survey the following year. Attempts to fit mixtures to lengths above 470 mm in the 1991 survey data were unsuccessful. As a result, there were no direct density estimates for age classes 3, 4 and 5 in 1990/91. Nevertheless, the Working Group considered that overall the results of the analysis of length densities were a reasonable basis for estimating recruit over the period of the analysis. Future work in this area could include a more detailed examination of modes moving through the population, and surveys to detect the two-year-old age class.

4.130 Fitted age-class densities were rescaled to observed densities by multiplying them by the ratio of observed to expected sums of densities. Multiplying the rescaled age-class densities by the area surveyed and assuming a catchability coefficient of 1.0 leads to an absolute abundance estimate for each age class in the analysis for each survey. The area surveyed was assumed to be as presented in Everson and Campbell (1990). This gives a total seabed area for 50 to 500 m of 40 993.3 km^2. Resulting estimates of numbers of recruits are given in Table 37.

4.131 In accordance with the methodology used in previous years, the number of recruits was standardised to age 4 by correcting the three- and five-year-old numbers for the effects of natural mortality (assumed to be 0.165). In some cases, the same cohort is represented as a different year class in different surveys, and the same cohort is represented in two surveys in the same year. In these cases, the number of recruits was estimated from the weighted average of the $\log_e$ recruit numbers from the different surveys.

4.132 The resulting estimates of recruits at age 4 for the years in the analysis are given in Table 38.

4.133 As in the past, the recruitment estimates were used to estimate a lognormal recruitment function for use in stock projections using the GYM. The Working Group noted that the length-density analysis produced no estimate of the abundance of 4-year-olds in 1992 for several reasons:

(i) the failure to fit mixtures to ages 3, 4 and 5 fish in the 1990/91 survey;
(ii) the failure to fit mixtures to ages 4 and 5 in the 1991/92 survey; and
(iii) the lack of a survey in the 1992/93 season.

4.134 The Working Group considered that although technically this excluded 1992 from the estimation of the recruitment function, evidence from the surveys in 1990/91 and 1991/92 suggested that the number of four-year-olds in 1991/92 was low. In the absence of additional information, for the purposes of estimating a recruitment function for input into the GYM, the Working Group decided to assume a number of four-year-olds in 1991/92 equal to the lowest estimated level over the period of the analysis. This was equal to 0.701 million individuals (the figure for 1996).

4.135 The parameters for the resulting recruitment function are given in Table 39. The Working Group again noted that this procedure assumes no trend in recruitment over the time period of the estimated recruitments.

Assessment

4.136 The input parameters for the GYM are shown in Table 39, 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 5 310 tonnes. The median escapement for this level of catch was 0.574.

4.137 The estimated long-term annual yield is greater than previous years because of the increased mean recruitment combined with the change in the selectivity function.

4.138 An analysis presented to the meeting used the standardised CPUE time series up to the 1997/98 season combined with the GYM, and indicated that the effect of the CPUE data was to reduce the estimate of yield. This was consistent with the advice in last year's report (SC-CAMLR-XVII, Annex 5, paragraph 4.117). The standardised CPUE in the 1998/99 season increased (paragraph 4.109), but the Working Group did not have sufficient time to update this assessment to ascertain the effects of the most recent data on the analysis (paragraph 3.141 and WG-FSA-99/60).

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

4.139 The estimate of yield from the GYM was 5 310 tonnes. This was higher than the result obtained at last year's meeting (3 550 tonnes), for two main reasons:

(i) the increase in the estimate of mean recruitment; and
(ii) the revision of the selectivity pattern to include all fish >79 cm.

4.140 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 the estimates of recruitment from survey data and estimates of growth parameters.

4.141 According to the analysis of available data for the most recent season, the standardised CPUE has increased since the 1997/98 season. This may be partially explained by the recruitment to the fishery of the strong 1989 year class (which was aged 4 in 1992/93 – Table 38), which was indicated by trawl surveys in 1990/91 and 1991/92, although this year class was not detected by trawl surveys in 1993/94.

4.142 The Working Group agreed that the catch limit for the 1999/2000 season should be 5 310 tonnes, as indicated by the analysis using the GYM. Other management measures for *D. eleginoides* in Subarea 48.3 in the 1999/2000 season should be similar to the 1998/99 season.

4.143 Dr Marschoff indicated that the catch should be less than 5 310 tonnes in order to maintain a degree of caution appropriate to the uncertainty indicated by the results of the CPUE analysis shown above (paragraph 4.138).

4.144 Any catch of *D. eleginoides* taken as part of research fishing in Subarea 48.3 should contribute towards this catch limit.

4.145 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.

South Sandwich Islands (Subarea 48.4)

4.146 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 1998/99 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)

4.147 The Working Group recommended that Conservation Measure 156/XVII be carried forward for the 1999/2000 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.

Kerguelen Islands (Division 58.5.1)

4.148 The total catch in the longline fishery in Division 58.5.1 during the 1998/99 season was 5 402 tonnes. The Working Group noted that the recent catch was less than the long-term annual yield derived from assessments last year. No new information was available to the Working Group. No assessments were undertaken this year.

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

4.149 The French authorities will allow trawling and longlining in their EEZ within this division in the 1999/2000 season (1 September 1999 to 31 August 2000). The French authorities have advised that there will be no increase in total catch of *D. eleginoides* over that taken last season, and that the catch for the trawl fishery will be reduced.

Heard and McDonald Islands (Division 58.5.2)

4.150 The catch limit of *D. eleginoides* in Division 58.5.2 for the 1998/99 season was 3 690 tonnes (Conservation Measure 131/XVI) for the period 8 November 1997 to the end of the Commission meeting in 1999. The catch reported for this division was 3 480 tonnes.

Determination of Long-term Annual Yields using the GYM

4.151 The analysis of long-term annual yield was updated with the recent catches taken from Division 58.5.2 and revised parameters for recruitment, growth, maturity, fishing selectivity and natural mortality. Until this meeting, the Working Group had used biological parameters estimated for *D. eleginoides* at South Georgia Island. WG-FSA-99/68 provided estimates of these parameters, except for mortality, for *D. eleginoides* at Heard Island (paragraph 3.79).

4.152 The maturity and fishing selectivity parameters used in the assessment were taken directly from WG-FSA-99/68, but the age-based functions were revised according to the growth parameters estimated during the meeting.

4.153 Estimates of the von Bertalanffy growth parameters in WG-FSA-99/68 were revised following the revision of these parameters for South Georgia. A difficulty with estimating the parameters for Heard Island is that the samples comprise mostly small fish (paragraphs 3.109 and 3.110). In the absence of other information on L_∞, the Working Group agreed to use the L_∞ estimated for South Georgia (194.6 cm). K and t_0 were estimated by non-linear regression. Ages of fish were adjusted to account for different dates of capture, which can affect the estimates of k (see WG-FSA-99/68). The final growth model was estimated as at 1 November and is shown in Figure 24. The estimates of parameters were $k = 0.0414$ yr^{-1} and $t_0 = -1.80$ years. The Working Group noted that the size of t_0 may indicate that the age of fish is being underestimated. The Working Group requested that further work be undertaken to clarify the growth model for this area (see also discussion in paragraphs 4.116 to 4.120).

4.154 This analysis has shown that the lengths at age of fish in the Heard Island region are much smaller than at South Georgia. Thus, it can no longer be assumed that the growth rates in these two areas are the same.

4.155 Natural mortality, M, was revised following the method of approximation accepted for South Georgia this year (paragraph 4.120). This yielded a range of M of 0.0828 to 0.1242 yr^{-1}.

4.156 The parameters for the lognormal recruitment function presented in WG-FSA-99/68 were revised to take account of different values for natural mortality. The mean lengths of the different cohorts estimated from the 1999 survey at Heard Island and from two previous surveys (1990 and 1993) analysed in 1996, were checked against the estimates of length at age from the new growth parameters. These lengths were consistent with the new estimates. Thus, no new mixture analyses were considered necessary at this meeting. The cohorts were combined using the revised mean M of 0.1035 yr^{-1}. The resultant time series of recruitments at Heard Island are given in Table 40 and the parameters for deriving the lognormal function are given in Table 39.

Assessment

4.157 The input parameters for the GYM are shown in Table 39, 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 3 585 tonnes. The median escapement for this level of catch was 0.547.

4.158 This long-term annual yield is similar to the previous estimates of yield despite the application of many new parameters derived from the Heard Island region. The combined effects of slower growth rates, lower mortality and revised fishing selectivity have been balanced by observations of very strong recruitments in recent years.

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

4.159 The Working Group recommended that the catch limit for Division 58.5.2 in the 1999/2000 season be revised to 3 585 tonnes, representing the annual yield estimate from the GYM.

4.160 The analysis resulting in this recommendation assumed that total removals of fish in 1999/2000 and future seasons are 3 585 tonnes.

Champsocephalus gunnari

South Georgia (Subarea 48.3)

4.161 The commercial fishery for *C. gunnari* around South Georgia (Subarea 48.3) was open from the end of the Commission meeting in November 1998 until 1 April 1999. The catch limit agreed by the Commission for this period was 4 840 tonnes (Conservation Measure 153/XVII). 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.

4.162 WG-FSA-99/57 provides a summary of the commercial fishing on *C. gunnari* in Subarea 48.3 during the 1998/99 season. Only one vessel, the Russian-registered stern trawler *Zakhar Sorokin*, took part in this fishery. The vessel fished for 23 days between 16 February and 10 March 1999. The catch of *C. gunnari* was 265 tonnes. Total catch of other species, including *Chaenocephalus aceratus*, *Pseudochaenichthys georgianus*, *Patagonotothen guntheri* and *Gymnoscopelus nicholsi* was 9.2 tonnes (Table 41).

4.163 In the four days between 28 February and 3 March 1999, 86% of the catch of *C. gunnari* was taken on the northwestern slope of South Georgia, where *C. gunnari* formed dense concentrations which were feeding on krill.

4.164 The vessel carried an observer, designated by the UK in accordance with the CCAMLR Scheme of International Scientific Observation, and an observer report was submitted to the Secretariat.

Past Assessment

4.165 The catch limit for the 1998/99 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 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 estimated catch limits for a period of two years. At last year's meeting, in view of the extremely low commercial catch in 1997/98, the projection was repeated, estimating catch limits of 4 840 tonnes in the 1998/99 season and 3 650 tonnes for 1999/2000.

Assessment at this Year's Meeting

4.166 The Working Group 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).

4.167 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*. The Working Group therefore agreed to repeat the short-term projection method performed at last year's meeting, incorporating the reported catch from the fishery, which was well below the catch limit.

4.168 The data inputs for the short-term assessment are provided in Table 42. The following changes were made compared to the projection performed at last year's meeting:

(i) there were 426 days of known catch (5 tonnes) from the UK survey in September 1997 to the meeting in 1998 (assumed to be 1 November);

(ii) 395 days of known catch (265 tonnes) were added from the 1 November 1998 to 30 November 1999 to take the stock to the end of the 1999 CCAMLR fishing year; and

(iii) the age when selection begins to the fishery was adjusted from 2.5 years to 1.5 years (selection then ramps to the age of full selection, which was set to 3 years).

4.169 The purpose of the change in the selectivity pattern was to take account of the observed commercial catch at age from the 1999 season, obtained from the length distribution of the catches and the most recent length-at-age key (WG-FSA-95/37) (Figures 25 and 26), which indicated that age-2 fish were at least partially recruited to the fishery.

4.170 The resulting fishing mortality for the forthcoming two years was 0.14. This resulted in a combined catch over two years of 6 810 tonnes, comprising 4 036 tonnes in the first year (1 December 1999 to 30 November 2000) and 2 774 tonnes in the second year (1 December 2000 to 30 November 2001).

4.171 The Working Group noted that it was now two years since the time of the last survey and that there is a large degree of uncertainty in the current state of the stock. The yields estimated from the short-term projections were based on the lower 95% confidence bound of the 1997 UK trawl survey and most participants considered that this constituted a conservative estimate of yield. It was also noted that the commercial vessel operating in the 1999 season had found a large concentration of fish and fished on it for four days before leaving the area to fish elsewhere for squid.

4.172 Dr Marschoff noted that given the time lapsed since the last survey and the events of yet to be explained high mortality experienced by this stock, this assessment might be invalid and a survey was needed before setting any catch limit. The Working Group noted that this view is supported by the failure of the commercial fishery for two consecutive seasons.

4.173 The Working Group welcomed the news that a new survey was planned for the 1999/2000 season (see section 6) and that the results of this survey should be available for the next meeting to update the assessment.

Protection of Young Fish and Spawning Aggregations

4.174 WG-FSA-99/52 reviewed and discussed the need to protect young fish and spawning aggregations in the *C. gunnari* fishery in Subarea 48.3. Measures put in place to date by the Commission include closed areas (Conservation Measure 1/III – no longer in force), mesh size regulations (Conservation Measure 19/IX), closed seasons (set annually), and, most recently, avoidance of catches of small fish (Conservation Measure 153/XVII, paragraph 4). A strategy for the future protection of young fish and spawning aggregations of *C. gunnari* in Subarea 48.3 was proposed, which included continuation of the mesh size and minimum fish size provisions to protect young fish, and adoption of a modified closed season and closed area for the protection of spawning.

4.175 The Working Group discussed the merits of various approaches to protection of young fish and spawning aggregations, including the closure of coastal spawning grounds and the establishment of refuge areas for young fish.

4.176 It was noted that, whilst spawning aggregations may need to be protected due to the possibility that fishing on such aggregations could disrupt spawning activity, there was no clear necessity at this stage to afford protection to non-spawning aggregations of adult fish (e.g. fish aggregating for the purposes of feeding) over and above the setting of catch limits.

4.177 Existing information indicates that peak spawning of *C. gunnari* at South Georgia occurs in the fjords and coastal areas from March to May, but may start in February and extend to June. Recent evidence from surveys indicates that interannual variation in spawning time may be dependant on the condition of the fish, related to krill availability (Everson et al., 1996, 1997). WG-FSA-99/65 provided evidence of spawning being concentrated in waters adjacent to the shore in April and May, as indicated by the predominance of fish in maturity stage V (spent) and a drop in CPUE on the shelf.

4.178 The Working Group agreed that the present closed season, from 1 April to the end of the Commission meeting, was not necessary for the protection of spawning and that a closed season of 1 March to 31 May would be more appropriate. It was also agreed that the priority for the protection of spawning was to apply this closed season to areas where spawning is known to take place (see Figure 27 – redrawn from WG-FSA-99/65).

4.179 The Working Group also considered the application of closed areas for the protection of young fish. Length data from seven bottom trawl surveys in the late 1980s and 1990s were analysed to examine the relationship between size of fish and depth, and size of fish and distance from shore. The surveys used were those for which data were available at this meeting in the new CCAMLR research survey database (Table 43).

4.180 The results of this analysis indicated that there was no clear relationship between size of fish and distance from shore, but as shown in previous analyses (e.g. Kock, 1991; WG-FSA-97/45), smaller fish tend to be found in shallower water. Figure 28 illustrates the relationship between the cumulative fraction of the survey catch at lengths below and above 24 cm (the size limit used in Conservation Measure 153/XVII which is approximately equal to

the size at maturity). This shows that at depths from approximately 110 to 180 m there is a consistent difference of about 0.4 between the cumulative fraction of the catch made up of fish less than 24 cm and the cumulative fraction of the catch made up of fish above 24 cm.

4.181 The Working Group noted that at this year's meeting it had been possible to analyse data from only a subset of the surveys undertaken in the area and that these were all conducted in summer. Information from WG-FSA-99/65 and other previous studies indicate that young fish are distributed widely over the shelf and may be present in different parts of the shelf at different times of the year.

4.182 It was also noted that the analysis had been conducted using length data from surveys which used bottom trawls with small mesh. The fishery uses semi-pelagic trawls with a mesh size limit and a requirement to move if the catch of young fish exceeds a certain threshold (Conservation Measure 153/XVII). The exploitation pattern of the commercial fishery is therefore likely to be different to that suggested by the survey results. This is illustrated by the low proportion of fish of less than 24 cm in the commercial catches in the 1998/99 season (Figure 28).

4.183 The Working Group 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 is required, 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*. The Working Group agreed that this issue was relevant for all areas where there are fisheries for *C. gunnari* and should be a priority task for the intersessional subgroup working on the assessment of this species.

4.184 In this respect, the Working Group discussed the need to undertake a workshop on the development of a long-term management strategy 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. However, the Working Group recommended that the intersessional subgroup on *C. gunnari* fisheries should aim to make progress on these issues and the issue of the requirement for a dedicated workshop should be considered at next year's meeting.

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

4.185 The Working Group agreed that the management measures for *C. gunnari* in Subarea 48.3 should be similar to those of 1998/99 with the following revisions:

(i) In order to protect spawning concentrations, the closed season should be revised from 1 April–30 November to 1 March–31 May.

(ii) The closure should apply to the areas where spawning is known to take place (paragraph 4.177).

4.186 Most participants agreed that the total catch limit should be revised to 4 036 tonnes for the period 1 December 1999 to 30 November 2000.

4.187 Dr Marschoff noted that the low catch in this fishery indicated that the stock remains at a low level and that a survey is needed before setting any catch limit.

Kerguelen Islands (Division 58.5.1)

4.188 No commercial fishing for *C. gunnari* took place in this division during the 1998/99 season.

4.189 The Working Group recalled that the brief survey conducted in February 1998 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. At last year's meeting, it was reported that France intended to conduct a full survey on *C. gunnari* during 1998/99 to assess the abundance of this new cohort using the same method as in the 1997 survey. According to information provided to the Working Group, the survey proved disappointing, with practically zero biomass detected 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. The late timing of the survey is apparently not sufficient to explain the low biomass. During associated scientific programs, *C. gunnari* were reportedly observed being preyed upon by Antarctic fur seals.

4.190 The French authorities have indicated that a resumption of fishing is not being contemplated at this time.

4.191 The survey will be repeated in the 1999/2000 season.

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

4.192 The Working Group looked forward to seeing the full analysis of the results of the survey conducted in 1998/99 and welcomed the reported intention to undertake a survey in 1999/2000.

Heard and McDonald Islands (Division 58.5.2)

Commercial Catch

4.193 The commercial fishery for *C. gunnari* around Heard Island (Division 58.5.2) was open from the end of the Commission meeting in November 1998 to 31 November 1999. The catch limit agreed by the Commission for this period was 1 160 tonnes to be taken on the Heard Island Plateau area only (Conservation Measure 159/XVII). 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 157/XVII).

4.194 The commercial catch in the 1998/99 fishing season was 2 tonnes. This was a result of the fishing vessels concentrating on the *D. eleginoides* fishery. The only aggregations of *C. gunnari* detected were of young fish.

4.195 No survey specifically for *C. gunnari* was undertaken in 1998/99. The design of a survey undertaken to assess the distribution and abundance of *D. eleginoides* was not suitable for the assessment of *C. gunnari*.

Assessment at this Meeting

4.196 During the meeting, an assessment of *C. gunnari* in the Heard Island Plateau area was made using the same short-term annual yield method adopted during the 1997 meeting (SC-CAMLR-XVI, Annex 5, paragraph 4.181), and used for this species in Subarea 48.3. Results of a survey conducted in 1998 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 42.

4.197 The resulting fishing mortality for 1999/2000 and 2000/2001 was 0.139. This resulted in a combined catch over two years of 1 518 tonnes, comprising 916 tonnes in the first year and 603 tonnes in the second year.

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

4.198 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 1999/2000 season should be similar to that in force last season, as detailed in Conservation Measure 159/XVII. The total catch limit should be revised to 916 tonnes in accordance with this year's short-term yield calculations. The fishery on Shell Bank should remain closed.

Other Fisheries

Antarctic Peninsula (Subarea 48.1)

Notothenia rossii, Gobionotothen gibberifrons,
Chaenocephalus aceratus, Chionodraco rastrospinosus,
Lepidonotothen larseni, Lepidonotothen squamifrons
and *Champsocephalus gunnari*

4.199 Finfish stocks in the Antarctic Peninsula region (Subarea 48.1) have been exploited from 1978/79 to 1988/89 with most of the commercial harvesting taking place in the first two years of the fishery. Given the substantial decline in biomass of the target species in the fishery, *C. gunnari* and *N. rossii*, by the mid-1980s, Subarea 48.1 was closed for finfishing from the 1989/90 season onwards (SC-CAMLR-XVII, Annex 5, paragraph 4.179).

4.200 New data pertaining to the biological characteristics (species composition, species assemblages, length composition, length–weight relationships, length at sexual maturity and length at first spawning, gonadosomatic indices and oocyte diameter) of Antarctic fish stocks, taken by random stratified bottom trawl around Elephant Island and the lower South Shetland Islands during 1998, were presented (WG-FSA-99/16). However, the new information available to the Working Group was not sufficient to undertake any assessment on the stocks in this subarea.

4.201 Data from an offshore scientific trawl survey of bottom fish sampling within the 50 to 500 m isobath of the lower South Shetland Islands during 1998 were combined with inshore data taken at Potter Cove during 1998 (WG-FSA-99/31). Combined length–weight relationships for *N. coriiceps* and *N. rossii* were constructed. Further data covering additional years is needed from the offshore area.

Management Advice

4.202 There appears to be little prospect for a substantial fishery given the low biomass estimates for the 1997/98 season and the absence of sufficient new information. The Working Group therefore recommended that Conservation Measure 72/XVII should remain in force.

South Orkney Islands (Subarea 48.2)

4.203 Surface areas of seabed within the 500 m isobath were presented (WG-FSA-99/33) for the South Orkney Islands. Revised estimates were based on several integrated datasets and incorporated seafloor slope. The updated estimates for the area within the 50 to 500 m area were approximately 20% larger than previous estimates. The Working Group agreed that this new dataset should be used for subsequent biomass estimates.

4.204 A random stratified bottom trawl survey within the 500 m isobath was carried out by the US AMLR Program around the South Orkney Islands in 1999. Information from the survey on the biology of several species (WG-FSA-99/16) and standing stock biomass (WG-FSA-99/32) was reported.

4.205 New data pertaining to the biological characteristics (species composition, species assemblages, length composition, length–weight relationships, length at sexual maturity and length at first spawning, gonadosomatic indices and oocyte diameter) of Antarctic fish stocks, taken by random stratified bottom trawl around the South Orkney Islands during 1999, were presented (WG-FSA-99/16).

4.206 Estimates of standing stock biomass for eight species of finfish are presented in Table 44. Computations were based on updated estimates of seabed area (WG-FSA-99/33).

4.207 Comparable biomass estimates for the trawl surveys conducted by Germany in 1985 and Spain in 1991 are also presented in Table 44. The 1985 and 1991 survey data were reanalysed using updated seabed and analyses methods.

4.208 On a species basis, there may have been some substantial shifts in levels of biomass from the three surveys (WG-FSA-99/32). For all species except *Lepidonotothen larseni* biomass levels have increased in the 1991 and 1999 surveys over the 1985 survey. However, biomass levels for only two species increased in 1999 over the 1991 survey, and there was an apparent decrease in biomass for all other species in 1999, particularly *C. gunnari*. If the 1999 biomass level of *C. gunnari* is accurate, even the upper 95% confidence limit is roughly at 4% of pre–exploitation levels (Kock et al., 1985) around the South Orkney Islands.

4.209 One species that may have increased is *N. rossii*. There is no indication that, historically, a large standing stock existed in the South Orkney Islands relative to *C. gunnari* and *G. gibberifrons*. This species has only been a by-catch species with substantial catches being made only in 1979/80 and 1983/84 (1 722 tonnes and 714 tonnes respectively). Current biomass levels of *N. rossii* are still small relative to other species.

4.210 Given the current low abundance of *C. gunnari* and the other species and the difficulties which CCAMLR had experienced previously in managing fisheries which exploit mixed-species assemblages, the Working Group did not attempt to calculate precautionary catch limits using the GYM during the meeting.

Management Advice

4.211 There appears to be little prospect for a substantial fishery given the low biomass estimates for the 1998/99 season and some of the uncertainties associated with the decline in biomass compared to 1985. The Working Group therefore recommended that Conservation Measure 73/XVII should remain in force until future surveys indicate an increase in fish biomass in the subarea.

South Georgia (Subarea 48.3)

Squid (*Martialia hyadesi*)

4.212 No notification of the intention to conduct an exploratory fishery for the squid *M. hyadesi* in Subarea 48.3 under Conservation Measure 165/XVII was received for the 1998/99 season; therefore no fishing was carried out. No new information was presented to the Working Group at this year's meeting.

4.213 The scientific basis on which the current conservation measure was based has not changed. WG-FSA, WG-EMM and the Scientific Committee had detailed discussions on the subject of a squid fishery in 1997 (SC-CAMLR-XVI, Annex 5, paragraphs 4.2 to 4.6; SC-CAMLR-XVI, Annex 4, paragraphs 6.83 to 6.87; and SC-CAMLR-XVI, paragraphs 9.15 to 9.18). The catch limit is considered to be precautionary since it is only 1% of a conservative estimate of annual predator consumption (SC-CAMLR-XV, paragraph 8.3).

Management Advice

4.214 The Working Group recommended that a conservative management scheme as contained in Conservation Measure 165/XVII is still appropriate for this fishery.

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

4.215 Between 7 and 20 September 1999, the UK vessel *Argos Helena* fished for *Paralomis* spp. in Subarea 48.3[1]. During the 14-day period, the vessel made 24 sets which included 1 323 pots for a total number of 20 283 pot hours. The vessel expended 7 192, 3 170, 5 047 and 4 874 pot hours in fishing blocks A, B, C, and D respectively (defined by Conservation Measure 150/XVII).

4.216 During all sets, the vessel caught 30 512 individuals of *P. formosa* and 4 602 individuals of *P. spinosissima*. This represented 7 184 and 1 900 kg respectively by weight of the two species. However, the percentages of retained crabs were very small (14 and 9%). Therefore only 4 129 individuals and 1 861 kg of *P. formosa* and 402 individuals and 317 kg of *P. spinosissima* were retained.

4.217 Concern was expressed regarding the degree of discard mortality. This was also a concern discussed by the 1993 CCAMLR Workshop on the Long-term Management of the Antarctic Crab Fishery (SC-CAMLR-XII, Annex 5, Appendix E, paragraphs 4.7 and 6.10). The workshop members agreed that discard mortality may not be evident until some months

[1] Report of South African-designated CCAMLR observer (Mr M. Purves) on board the British-registered longliner *Argos Helena* in Subarea 48.3, 31 August to 23 September 1999.

after the catching incident because damage may result in an inability to moult rather than immediate death, and consequently discard mortality studies should be of long duration. No data exist at present to investigate these effects.

4.218 During the 14-day fishery, 334 fish (1 189 kg) of seven species of finfish were also caught. The majority (49% by numbers and 95% by weight) of the by-catch was *D. eleginoides*.

4.219 The Working Group noted the intention of the UK to continue its crab fishery next season and the notification that a US company had requested a permit to begin crab fishing next season.

Management Advice

4.220 The Working Group, recognising the great utility of the experimental harvest regime set out in Conservation Measure 150/XVII in providing useful information for developing an assessment of the target species, reiterated the view expressed at its 1996 meeting that Conservation Measure 150/XVII should remain in force, but that, if new vessels were to enter the fishery, the Commission might wish to revise Phase 2 in the light of the comments made in paragraph 4.183 of the 1996 report (SC-CAMLR-XV, Annex 5).

4.221 The Working Group agreed that, at this time, no need was identified to require vessels to conduct activities under Phase 2 and this requirement could be eliminated from Conservation Measure 150/XVII.

4.222 The Working Group also stated that since the crab stocks were not assessed, a conservative management scheme as contained in Conservation Measure 151/XVII is still appropriate for this fishery.

Antarctic Coastal Area of Divisions 58.4.1 and 58.4.2

4.223 Notification of the intention to conduct a new trawl fishery for various fish species in Division 58.4.2 during the 1999/2000 season was provided by Australia (CCAMLR-XVIII/11). Details on the development of the fishery are given in paragraph 4.13.

Pacific Ocean Sector (Area 88) – Subareas 88.1 and 88.2

4.224 Notifications of the intention to conduct exploratory fisheries for various species of fish in Subareas 88.1 and 88.2 during the 1999/2000 season were lodged by the European Community (Portugal) and Chile, and in Subarea 88.1 by New Zealand (summarised in WG-FSA-99/9). Details on the development of the fishery in Subareas 88.1 and 88.2 are given in paragraphs 4.20 to 4.23, 4.25 and 4.26.

Pacific Ocean Sector (Area 88) – Subarea 88.3

4.225 No fishing occurred in Subarea 88.3 during the 1998/99 season and no Member has notified their intention to conduct exploratory fishing operations in this area during the 1999/2000 season.

Management Advice

4.226 In view of the low catch rates encountered by a feasibility study during the 1997/98 season, the Working Group recommended that fishing for *Dissostichus* spp. should be prohibited as defined in Conservation Measure 149/XVII.

Regulatory Framework

4.227 WG-FSA-99/67 entitled 'Working paper on Scientific Issues related to a Unified Regulatory Framework for CCAMLR based on Stages of Fishery Development' was presented to the Working Group. This paper had been prepared by an intersessional working group in response to a request from the Commission (CCAMLR-XVII, paragraph 10.7).

4.228 The paper was briefly introduced. It contained six major elements. These were:

(i) scientific information required in order to provide scientific advice;

(ii) the circumstances under which a fishery should be considered as 'established';

(iii) information requirements for an established fishery;

(iv) information from fisheries that are changing from one stage of development to another;

(v) scientific requirements of the research and data collection plan of a developing fishery; and

(vi) consistency of the regulatory framework with current CCAMLR fishery classifications.

Data collection, assessment and decision processes were partly illustrated by figures.

4.229 WG-FSA discussed several aspects of this topic in depth, and referred a number of items to the task group. The results of the task group discussions will be presented to the Scientific Committee.

CONSIDERATION OF ECOSYSTEM MANAGEMENT

Interaction with WG-EMM

By-catch of Young Fish in the Krill Fishery

5.1 No new information was provided on by-catch of juvenile fish in the krill fishery, even though it had been considered an important topic for further study (SC-CAMLR-XVII, paragraph 6.24). The Working Group felt that the topic was still one of potential concern and encouraged Members to undertake studies on the topic.

5.2 Dr Marschoff informed the meeting that during the 1998/99 season, Argentina had placed an observer on a krill fishing vessel. Although the observer was able to obtain a considerable amount of data, in the absence of a standardised reporting format it had not been possible to submit the data to the Secretariat. The Working Group welcomed the collection of these data and hoped that they would be available in the near future. The Scientific Committee's attention was drawn to the fact that a reporting format for observers on krill fishing vessels would greatly facilitate this process.

Interaction between Marine Mammals and Fishing Operations

5.3 During its meeting in 1998, the Working Group had noted that marine mammals, specifically killer and sperm whales, had been taking *D. eleginoides* from longlines (SC-CAMLR-XVII, Annex 5, paragraphs 5.18 to 5.22). Further reports from CCAMLR observers, summarised in WG-FSA-99/12 and anecdotal reports, were received at this meeting.

5.4 It was thought that although the interaction may at times be a major problem locally, the overall reduction in landings of fish was not thought to be causing a major problem for assessment purposes. It was also noted that the number of species involved in taking *D. eleginoides* from longlines had increased. From the observer reports it was noted that although during the 1998/99 season many longliners had operated with experimental mechanisms to help avoidance of interactions with marine mammals, these devices had produced little or no effect for their aim. The Working Group was unable to provide any further guidance on the subject of reducing the interaction.

Information arising from WG-EMM

5.5 Dr Everson drew the attention of the meeting to points made in the report of WG-EMM. Consideration of precautionary approaches was set out in Annex 4, paragraphs 7.43 to 7.45.

5.6 WG-EMM noted key issues regarding the scales at which observations had been made, and which needed to be taken into account in considering ecosystem variability. Key points are summarised in Annex 4, paragraph 7.56. It was noted that the way in which values were scaled or extrapolated to larger or different areas had implications when the Working Group was considering new and exploratory fisheries. Of particular importance was the consideration of stock structure and spawning locations. In taking this into account, it was agreed that it is necessary to consider the consequences for individual assessments.

5.7 WG-EMM had noted that there were likely to be some benefits from a closer interaction with commercial fishing operations, so that in any proposed revisions to conservation measures account could be taken of the additional burden on fishing operations which might arise. Although sympathetic to the idea, the Working Group had no specific suggestions to offer.

5.8 WG-EMM had noted that the next IUCN global review of threatened species would be published in October 2000 and that some Antarctic fish species might be candidates for globally threatened status under the new criteria (Annex 4, paragraphs 7.74 to 7.77). In this context it was noted that the Secretariat had agreed to investigate this and notify Members of the outcome.

5.9 Two points arising from the SCOR/ICES symposium held during March 1999 in Montpellier, France, reported in WG-EMM-99/26 were noted. Firstly, there was concern at the level of elasmobranch by-catch in commercial fisheries (this is considered further in paragraphs 4.88 to 4.98). The second point relates to the effects of trawling on the seabed.

Ecological Interactions

5.10 WG-FSA-99/30 and 99/31 reported that the information on the decline in abundance of *G. gibberifrons* and *N. rossii* in inshore waters of the lower South Shetland Islands observed in trammel net catches, had been supported by data on the diet of the Antarctic shag (*Phalacrocorax bransfieldensis*). Recent information obtained at Cierva Point on the Danco Coast, Antarctic Peninsula, indicated that in that region *G. gibberifrons* constitutes one of the main prey of the Antarctic shag. This likely reflects high availability of this fish species in a site

which is far away from the main historical commercial fishing grounds of the South Shetland Islands (Elephant Island and north of Livingston/King George Island) and the tip of the Antarctic Peninsula (Joinville Island).

5.11 Predator–prey interactions between *C. gunnari* and krill in the South Georgia region (Subarea 48.3) were described in WG-FSA-99/65 and WG-EMM-99/27. The former paper noted that feeding aggregations were found from October to November through to the summer on the northeastern and eastern parts of the shelf. During the summer months the fish aggregate and actively feed on krill. During this period, the fish undergo an extensive vertical feeding migration. It was noted that when krill is available over the shelf the fish concentrations are stable, but when krill is absent the fish disperse. When krill is absent the fish tend to be distributed throughout the water column over most of the 24-hour period.

5.12 Additional information was provided from observations from a commercial vessel working around South Georgia (WG-EMM-99/27) which indicated that the largest concentrations of *C. gunnari* were present to the northwest of the island in an area of high krill concentration. In that area the fish had stomachs full of krill.

5.13 WG-FSA-99/50 and 99/54 were tabled in response to SC-CAMLR-XVII, Annex 4, paragraph 7.32. The former paper indicated that there was a good correlation between condition indices from research surveys and krill density estimated from independent acoustic surveys during the same month. In addition, the condition indices were seen to vary through the season indicating that krill availability was unlikely to be constant throughout the period. WG-FSA/99-54 presented results which indicated that the gonad maturation cycle is subject to considerable variability in its timing, although in most years the majority of fish appear to come into spawning condition. It was suggested that the commencement of the maturation cycle is dependent on food availability late in the winter.

5.14 WG-FSA-99/63 examined possible reasons for observed reductions in icefish density between seasons. It was suggested that this was due to increased natural mortality due to predation by fur seals. This hypothesis had already been considered by the Working Group with respect to the development of a management plan as described in Agnew et al. (1998) and Parkes (1993).

RESEARCH SURVEYS

Simulation Studies

6.1 There were no new developments in survey design methods undertaken during 1998/99. WG-FSA-99/33 examined the effects of revised seabed areas within the 500 m isobath of the South Orkney Islands in Subarea 48.2 on estimates of standing stock biomass of nine species of finfish using the TRAWLCI model. The increase in total seabed area of 20% (1 424 n miles^2) resulted in an increase of 5 to 30% for eight species and a decrease of 20% for one species. Changes in confidence limits of biomass were affected by the degree of uneven spatial distribution within strata, coupled with the change in seabed area.

Recent and Proposed Surveys

Recent Surveys

6.2 Three recent cruises were undertaken in the Convention Area in 1998/99 covering Subareas 48.2, 48.3 and Division 58.5.2. Studies were undertaken by the USA, Russia and Australia respectively.

6.3 The Australian survey (WG-FSA-99/68) was conducted around the Heard Island Plateau, Division 58.5.2, from 27 March to 21 April 1999 on board the FV *Southern Champion*. The bottom trawl survey targeted *D. eleginoides*.

6.4 Russian scientists undertook research activities on board the trawler *Zakhar Sorokin* in Subarea 48.3 while it was engaged in commercial trawling from 16 February to 10 March 1999 (WG-FSA-99/57). A large pelagic trawl was used for the study and targeted *C. gunnari*.

6.5 The US AMLR Program conducted a bottom trawl survey of finfish around the South Orkney Islands in Subarea 48.2. Trawling operations were conducted from 9 to 25 March 1999 aboard the RV *Yuzhmorgeologiya* (WG-FSA-99/16 and 99/32). The USA also collected limited samples of fish aboard the RV *Lawrence M. Gould* in Subarea 48.1 from 22 March to 30 June 1999.

Proposed Surveys

6.6 Australia plans a *C. gunnari* and *D. eleginoides* pre-recruitment survey for the 1999/2000 season. This survey will probably occur during April and May 2000 on the Heard Island Plateau and Shell Bank areas (Division 58.5.2). The aim of this survey is to estimate the biomass and recruitment of *C. gunnari* and *D. eleginoides.* These estimates will be used for stock assessments at the next meeting of WG-FSA.

6.7 The UK plans to carry out a study on the feasibility of using pots to catch *D. eleginoides* in Subarea 48.3 (WG-FSA-99/41) from January to July 2000 aboard the FV *Argos Atlanta*. This study was notified in accordance with Conservation Measure 64/XII.

6.8 The UK also plans to conduct a bottom trawl survey in Subarea 48.3 during January and February 2000.

6.9 Russia plans to conduct a random-design bottom trawl survey in Subarea 48.3 during February 2000, targeting *C. gunnari* and other species.

6.10 Argentina plans to conduct a bottom trawl survey aboard the RV *Dr Eduardo E. Holmberg* in Subarea 48.3 during March and April 2000, targeting mixed species of fish.

6.11 New Zealand intends to conduct a tagging program in Subarea 88.1. The program will be conducted during January and February 2000 targeting skates and *D. mawsoni*.

6.12 The USA intends to collect limited fish specimens from Subarea 48.1 in October and December 1999 and February, March and May 2000. The Working Group requested that catch data be made available by any programs working within the Convention Area, even those that only sample small numbers of fish.

INCIDENTAL MORTALITY ARISING FROM LONGLINE FISHING

IMALF Intersessional Activities

7.1 The Secretariat reported on the intersessional activities of ad hoc WG-IMALF (WG-FSA-99/7). The IMALF group worked in accordance with the plan of intersessional activities developed immediately after the completion of CCAMLR-XVII (November 1998) by the Secretariat in consultation with Prof. Croxall (Convener), Mr Baker (Deputy Convener) and other members of ad hoc WG-IMALF. As in previous years, the intersessional work of the IMALF group was coordinated by the Secretariat's Science Officer.

7.2 The report of intersessional activities of ad hoc WG-IMALF contained records of all activities planned and their results. It was considered item by item to evaluate outcomes and to decide which tasks were complete, which needed continuing or repeating, and which were in essence annual standing requests. Major items of future work would be considered later under that agenda item (paragraphs 9.14 and 9.15). The remaining tasks which needed intersessional work would appear in the plan of intersessional activities for 1999/2000 (Appendix D).

7.3 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. 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 1998/99 fishing season.

7.4 The membership of ad hoc WG-IMALF was reviewed. The need for continuing membership of Ms K. Maguire (Australia), Dr M. Imber (New Zealand) and Ms J. Dalziell (New Zealand) was questioned. Mr T. Reid (Australia) was recommended as an additional member. The Science Officer and Convener would take up these suggestions with the members involved. WG-FSA noted that some CCAMLR Member countries which are involved in longline fishing and/or seabird research in the Convention Area (e.g. Norway, Ukraine, Uruguay and USA) are not represented in ad hoc WG-IMALF. Members were asked to review their representation in ad hoc WG-IMALF intersessionally and to facilitate attendance of as many of their members as possible at the meeting. In respect of the latter, attendance by representatives from France would be particularly appreciated.

7.5 The Working Group welcomed the appearance of the book *Identification of Seabirds of the Southern Ocean. A Guide for Scientific Observers aboard Fishing Vessels* by D. Onley and S. Bartle, published by CCAMLR and the National Museum of New Zealand in 1999. This book is intended as a guide for use by fisheries observers when aboard fishing vessels south of 40°S. The main purpose is to identify any birds that come on deck (live or dead) rather than to identify birds in flight. The Working Group offered some comments to help in any future revision.

(i) For effective use (e.g. on deck) it would be helpful for the pages to lie flat when open (e.g. using ring binding), and for the plates to be waterproof.

(ii) In the appropriate section of the book observers should be requested to supply any relevant information on why they thought birds were caught on particular sets/hauls.

(iii) The taxonomy and nomenclatures of albatrosses, particularly in the wandering albatross group, is inconsistent with the most recent comprehensive treatment (Robertson and Gales, 1998). This will create unnecessary confusion. It was noted that the Oversight Committee had suggested that authors adhere to the nomenclature, especially vernacular, used by Robertson and Gales (1998).

(iv) Since bills were being used predominantly for identifying species, it would have been helpful if all species were shown on one page so that observers could look them up quickly, once they had become familiar with the different species.

(v) Not all very young black-browed albatrosses have a pale eye, rendering *Diomedea melanophrys* and *Diomedea impavida* very difficult to distinguish at this age (and, in Australia at least, a large proportion of the birds are of this age).

(vi) Most photographs of the spectacled petrel show bills to have pale tips.

(vii) The book does not illustrate any species of penguin, despite at least gentoo and king penguins being caught by longliners with some regularity. On the other hand, southern fulmars and Antarctic petrels are shown, despite not having been caught by fishing vessels.

(viii) Because there is an expectation that the birds will be identified in the hand, measurements may be invaluable in deciding the identity of some birds. However, in this book the measurements given seem to only be a small subsample of those already published, and only a few measurements are given.

(ix) The section on breeding, populations, distribution and behaviour may be of somewhat restricted generality. Comments to improve this were provided to the authors a year ago, but only one has been incorporated in the text. Examples of misleading text are the statements that shy albatrosses are sometimes caught by southern bluefin tuna longliners and by trawl gear south and east of New Zealand (it is the species most commonly caught by domestic southern bluefin tuna longliners in southeast Australia), and that short-tailed shearwaters sometimes feed around trawlers and are caught by drift nets in the North Pacific (they are very common around, and sometimes caught by, longliners around Australia).

7.6 With respect to comments in paragraph 7.5(iii), the Secretariat advised that the species nomenclature used in the guide is same as used in the *CCAMLR Scientific Observers Manual*. The preface to the guide states that it was written taking into account, in particular, the requirements of the CCAMLR Scheme of International Scientific Observation. The list of seabird species appended to the guide also contains references to their CCAMLR codes. Therefore, any future changes to the guide will require similar changes to the *CCAMLR Scientific Observers Manual*.

Research into Status of Seabirds at Risk

7.7 In response to the request for information on current national research programs into the status of seabird species vulnerable to fisheries interactions (albatrosses, giant petrels, *Procellaria* petrels) (SC-CAMLR-XVII, Annex 5, paragraph 7.8), summary papers had been presented by Australia (WG-FSA-99/61), France (WG-FSA-99/27), New Zealand (WG-FSA-99/49), South Africa (WG-FSA-99/34) and the UK (WG-FSA-99/17).

7.8 The Working Group was unaware of any relevant current research additional to that reported in the above papers, given that WG-FSA-99/61 and 99/17 included collaborative projects involving Chile.

7.9 The information in the above papers was further summarised in Table 45. This indicates regions and sites at which research on populations and foraging ecology is currently in progress and also those regions/sites of importance for target species at which no current research is being undertaken. While it is encouraging that significant research programs have been initiated during the 1990s for a range of species at a number of sites, notable deficiencies remain. Some of these are indicated in paragraphs 7.10 to 7.15.

7.10 The populations of many regions (e.g. Falkland/Malvinas Islands, South Georgia, Crozet Islands) comprise sub-populations at numerous geographically distinct sites or islands; demographic monitoring and foraging range information is usually derived from studies at only one island/site. Recent studies of a number of species indicate that birds from different islands within a region may segregate at sea. This may result in differential interactions with fishing activities and so be reflected in differing population trends. Where possible, multisite studies within breeding regions are preferable.

7.11 Within the *Diomedea* albatrosses, researchers have indicated current research on both population monitoring and foraging ecology for all species at most sites. However, the adequacy of many of these programs for confident assessments of population trends and foraging distributions is not always clear from the available information. Summaries provided elsewhere (Gales, 1998; Croxall, 1998) indicate that some of the demographic programs have limited time series data and so may be of limited use at present. Many of the foraging range/ecology studies are limited to information from only a few adult birds at restricted times during the breeding season; results cannot necessarily be extended to other seasons or age groups.

7.12 For the *Thalassarche* albatrosses, the extent and utility of information is similarly restricted; for some important populations there are still no research or monitoring programs in place. Priority populations for targeted research and/or monitoring would include grey-headed albatrosses and Indian yellow-nosed albatrosses in the western Indian Ocean sector, as well as foraging ecology studies for both Salvin's and white-capped albatrosses. Notable also is the absence of recent population assessments for the critically endangered Chatham Island albatross.

7.13 Even less information is available for the two species of *Phoebetria* albatrosses. The need for population monitoring and foraging ecology studies at western Indian Ocean sites for both species, as well as for South Georgia and New Zealand populations of light-mantled albatrosses, remains a priority.

7.14 Both species of giant petrels are impacted by longline fishing, yet information on population trends remains inadequate for most populations. Recent satellite-tracking studies of giant petrels at South Georgia (WG-FSA-99/38 and 99/39) showed both species and sex-specific foraging segregation, these results highlighting the need for similar studies at other important breeding sites.

7.15 For white-chinned and grey petrels, population assessments remain inadequate. Population trends are unknown for all sites across the range of both species. Recent satellite-tracking studies of white-chinned petrels (WG-FSA-99/20 and 99/47), the commonest species in the by-catch of longliners in many sectors, show their extended foraging ranges overlap with longline fisheries from Antarctic to sub-tropical waters. Information on population trends and foraging distribution of both species at all important sites is urgently required.

7.16 Assessments of the genetic profiles of albatrosses from various sites are currently being undertaken in laboratories of a number of countries including Australia, New Zealand, South Africa, UK and the USA. The application of these results in determination of the provenance of birds killed in longline fisheries will assist in identifying the populations most at risk. To accelerate this process, cooperation and coordination in the dissemination of the population specific profiles is essential. Members were requested to table information on the current status of these research programs for next year's meeting of WG-FSA.

7.17 In order to determine more accurately the status and potential utility to CCAMLR of the research programs summarised in Table 45, further investigation and refinement of information is required. Dr Gales undertook to coordinate this intersessionally.

7.18 Members were requested to update the information summarised in Table 45 by means of appropriate reports to future meetings of the Working Group.

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

1998 Data

7.19 Last year, for Subareas 58.6 and 58.7, four of the observer logbooks were incomplete. An attempt was made intersessionally to get the missing information required to calculate the seabird catch rates and numbers of hooks observed; however, this information was not collected and could not be calculated from the available data. Table 46 summarises all available information on seabird catch rates and the numbers of birds observed for these areas. This updates the relevant parts of SC-CAMLR-XVII, Annex 5, Table 35 and necessitates recalculation of estimates of overall seabird by-catch and of the species composition of the catch.

7.20 The revised observed species composition for birds killed in the longline fishery for Subareas 58.6 and 58.7 during the 1997/98 season is given in Table 47. White-chinned petrels (91%) were the most common of all birds killed; no incidental mortality of albatrosses was recorded.

7.21 The estimated total incidental catch of seabirds for each vessel (Table 48) was calculated using the catch rate (birds/thousand hooks) for each vessel multiplied by the total number of hooks set by that vessel during the fishing season. For the four vessels where catch rates could not be calculated, the overall catch rate was used. The overall catch rate was calculated from the total number of hooks observed and the total observed seabird mortality. The catch rates for Subareas 58.6 and 58.7 was 0.15 and 0.54 birds/thousand hooks for night and day setting respectively (Table 46) and 0.19 birds/thousand hooks overall. The night rate was about 31% of the level of the previous season (0.49 birds/thousand hooks); however, the day rate was similar to that of the previous season (0.58 birds/thousand hooks). The estimated total of 528 birds killed was 63% of the 1997 total (834 birds); the overall catch rate in 1998 was 39% of that in 1997.

7.22 WG-FSA-99/28 used data collected by CCAMLR international scientific observers in 1997 and 1998 to examine potential relationships between seabird incidental mortality rates on longline vessels fishing for *D. eleginoides* and the nature and use of mitigating measures, as well as with environmental variables such as time of day, time of year.

7.23 Out of the 3 283 longline sets analysed, only 311 caught birds (9.4%). Data conformed most closely to a Delta distribution (many zero values and lognormal distribution of non-zero values) and were analysed using two GLMs, a binomial model for presence/absence of seabird catches and a Gamma model for the magnitude of non-zero catches. Sparsity of data precluded analysis of seabirds at a taxon level more detailed than albatrosses and petrels combined. Other analytical difficulties, particularly in using GLMs, related to the large number of potentially important factors, the lack of overlap between factors and the fact that fishing has purposely avoided making catches of seabirds. There were, for instance, only three records in the entire dataset where none of the mitigation measures has been used.

7.24 The only factors consistently significant were time of year (very few birds caught after April) and use of streamer lines, but the effects of most other factors could not be fully analysed with the present data. Even vessels using streamer lines and setting at night were found to catch albatrosses occasionally (Figure 29), although in all such cases the line weightings used were less than those specified by Conservation Measure 29/XVI.

7.25 Vessel-specific effects were not considered in this analysis. The shortening of the season between 1997 and 1998 significantly reduced the data available, such that only two vessels fished in March and April in both years, and both changed a number of their operating parameters in this time.

7.26 The Working Group concurred with the conclusion in WG-FSA-99/28 that given the difficulties of analysing this dataset, especially the problem of very low numbers of sets not using mitigation measures and sets catching birds, experimental approaches to identifying effective mitigation measures may be preferable to post hoc analysis of observer data.

7.27 It was noted, however, that the data distributions used in the models may not be entirely realistic. In particular, there is a need to cater for the assumption that with mitigation measures in use there is an expectation that the more likely by-catch may still be zero birds. Newly available analytical software may assist in improving the analysis described in WG-FSA-99/28, and it was recommended that this be investigated intersessionally.

7.28 In general, however, it was recognised that analysis of the existing observer data is unlikely to provide clear-cut answers with respect to the efficacy of mitigation measures. As observed seabird by-catch rates decrease, this will be increasingly true. Further improvements to, and assessments of, mitigation measures will need testing using carefully designed experiments.

1999 Data

7.29 A total of 32 cruises was conducted within the Convention Area during the 1998/99 season, with scientific observers (international and national) aboard all vessels. Twenty-one cruises were undertaken in Subarea 48.3 by 12 vessels, nine cruises were undertaken in Subareas 58.6 and 58.7 by three vessels and two cruises were undertaken by two vessels in Subarea 88.1. A detailed list of the observations conducted and the type of data submitted to the Secretariat is contained in Table 49.

7.30 The timeliness of logbook and cruise report submissions to the Secretariat greatly improved this season, with all of the logbooks being received before the start of the meeting. The quality of the logbooks submitted this year has been much improved on previous years. All of the logbooks have been submitted using the CCAMLR logbook forms, although some forms were outdated and lacked some information (e.g. numbers of hooks observed). Positive feedback was received from the observers, through their technical coordinators, on the use of the electronic observers logbook. Submission of data using this method should be encouraged.

7.31 The Working Group expressed concern that the proportion of hooks being observed to provide overall estimates of seabird mortality was still rather low (WG-FSA-99/18 and 99/26). A desirable level of observation would be about 40 to 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.

7.32 Average values (percentages with ranges in parenthesis) over the last three years, for Subareas 48.3 and 58.6/58.7 have 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); and
1999: 48.3 – 25 (10–91); 58.6/58.7 – 34 (13–62).

7.33 The Working Group agreed 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 by WG-IMALF 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.

7.34 The seabird catch rates for Subareas 48.3, 58.6, 58.7 and 88.1 were calculated from the combined numbers of hooks observed and the total seabird mortality observed (Table 50). No

incidental mortality was observed for Subarea 88.1. 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 data for calculating catch rates were unavailable, the overall catch rate for that area was used.

7.35 The data compiled and analyses undertaken by the Secretariat with respect to Subarea 48.3 included the results from the line-weighting experiment by the *Argos Helena* (WG-FSA-99/5). It was agreed that it was inappropriate to include these data in the estimation of by-catch and calculation of by-catch rates. However, there was insufficient time at the meeting to undertake the necessary recalculations in respect of Tables 16 and 50 to 52. Therefore it was agreed to highlight (and footnote as appropriate) these data in the above tables and to ensure that data from such experiments were excluded from the main calculations in future.

Subarea 48.3

7.36 For Subarea 48.3, the total catch rate of birds killed during daytime setting periods (0.08 birds/thousand hooks) was higher than that for night setting (0.01 birds/thousand hooks). However, this includes 88 birds killed in daytime during the line-weighting experiment on the *Argos Helena* (WG-FSA-99/5). If these data are excluded, the overall daytime catch rate would be 0.03 birds/thousand hooks and the combined overall value 0.01 birds/thousand hooks. The total estimated seabird mortality in Subarea 48.3 for 1999 was 306 birds (Table 51), a 48% decrease on the previous season, or 210 birds (a 65% decrease) if the *Argos Helena* line-weighting experiment is excluded.

7.37 The most commonly observed species killed in Subarea 48.3 (Table 52) was black-browed albatross, comprising 66% of the total seabird mortality, followed by white-chinned petrel (27%) and grey-headed albatross (3%). If *Argos Helena* data are excluded, the values are: black-browed albatross 81%, white-chinned petrel 7%, grey-headed albatross 5%.

7.38 The Working Group commended the continued reduction in the number of seabirds killed in this subarea and the maintenance of the previous year's very low by-catch rate. It noted, however, that further reductions could be achieved by:

(i) reconfigurations of offal discharge arrangements on the three vessels still discharging on the same side as the haul;

(ii) eliminating daytime setting; and

(iii) using line-weighting regimes that comply with Conservation Measure 29/XVI.

Division 58.5.1

7.39 CCAMLR-XVIII/BG/19 reported that during 1 481 longline sets by two Ukrainian vessels, 151 seabirds were killed, comprising 149 white-chinned petrels, 1 black-browed albatross and 1 light-mantled albatross.

7.40 The Working Group regretted that the full data from this fishery – and similar data from fishing within the French EEZ in Subarea 58.6 – had not been submitted to the Secretariat for analysis and evaluation at the meeting. It urged France to submit data in timely fashion to future meetings.

Subareas 58.6 and 58.7

7.41 For Subareas 58.6 and 58.7, no incidental mortality was observed during daylight setting (12% of total); the catch rate for night setting was 0.05 birds/thousand hooks. An estimated total of 156 birds were killed (Table 53), 30% of the value in 1998.

7.42 In Subareas 58.6 and 58.7, white-chinned petrels were the most common observed species killed, comprising 67% of the total seabird mortality (Table 52), followed by giant petrel (17%), gentoo penguin (8%) and grey petrel (6%).

7.43 Further analysis of the seabird by-catch in the longline fishery around the Prince Edward Islands (Subarea 58.7) in the 1998/99 season was provided in WG-FSA-99/42 Rev. 1. The 11 sanctioned fishing trips contributed a fishing effort of 5.1 million hooks, 19% more than the number of hooks set in 1997/98. Only 79 seabirds (15% of the total killed in 1997/98) were observed killed. Average seabird by-catch rate by sanctioned vessels was 0.016 birds/thousand hooks, compared with 0.289 in 1996/97 and 0.117 in 1997/98. Comparisons between years for the same vessel, using the same gear design and at the same time of year, show marked decreases in seabird by-catch rate during 1998/99.

7.44 Five bird species were reported killed: white-chinned petrels predominated (79%), followed by giant petrels *Macronectes* spp. (13%) and grey petrels (6%). The last is a concern as only one grey petrel had been killed prior to this year. Birds were caught on only 3.1% of lines set (n = 1 187). Bird by-catch was primarily linked to daytime sets, with most birds caught in the late afternoon or shortly after dusk. Use of an underwater setting device (a Mustad funnel) significantly reduced bird by-catch to very low levels (0.002 birds/thousand hooks), but it was not tested during the period when seabird by-catch typically peaks (mid- to late summer). An average of 4.5 live birds were caught per 100 hauls; although these were released alive, the higher catch rate of Spanish double-line gear is cause for concern.

7.45 WG-FSA-99/42 Rev. 1 suggested that the substantial reduction in seabird by-catch rates reported for 1998/99 was due to:

(i) continued application of mitigation measures (use of streamer lines, setting lines at night or in conjunction with an underwater setting device);

(ii) increasing experience by both crews and observers;

(iii) switch in fishing to waters more distant from the Prince Edward Islands; and

(iv) reduction in the amount of offal released from vessels.

The change in fishing area may have been especially important during the high-risk late summer period; it was recommended that fishing within 200 km of the islands from January to March should be prohibited.

7.46 The Working Group commended the efforts of South Africa in achieving continued improvement in the performance of the fishery within its EEZ in terms of reduction of seabird by-catch. It noted, however, that:

(i) there was evidence that a proportion of seabird by-catch went unobserved, at least on some vessels;

(ii) the biggest reductions in by-catch were achieved by the change in fishing area and by the use of underwater setting; and

(iii) further reduction would likely be achieved by elimination of daytime setting and by line-weighting regimes that complied with Conservation Measure 29/XVI.

It endorsed the recommendation that fishing within 200 km of the Prince Edward Islands should be prohibited from January to March inclusive.

General

7.47 The Working Group noted that over the last three years, comparing 1999 with 1997 (Table 54), seabird by-catch and by-catch rate in the regulated fishery have been reduced by 96.4% and 95.7% respectively in Subarea 48.3 and by 81.3% and 94.2% respectively in Subareas 58.6 and 58.7. This has been achieved by a combination of improved used of mitigating measures in compliance with Conservation Measure 29/XVI and by delaying the start of fishing until after the end of the breeding season of most albatross and petrel species.

Compliance with Conservation Measure 29/XVI

7.48 This section summarises information on the extent of compliance with the main elements of Conservation Measure 29/XVI in 1998/99. Table 16 provides a comparison between 1996/97, 1997/98 and 1998/99, together with an indication of the proportion of logbooks that provided data on each of the elements of Conservation Measure 29/XVI (see also WG-FSA-99/12). Based on available data, in 1998 two autoline vessels (*San Aotea II* and *Janus*), operating in Subarea 88.1, complied with all aspects of Conservation Measure 29/XVI, subject to the variation to allow daytime setting granted under Conservation Measure 169/XVII (see paragraph 7.85). For the remainder of the vessels, either insufficient data were provided to assess full compliance or not all elements of the conservation measure were complied with.

7.49 Line weighting: Data for each vessel and cruise are shown separately for Spanish system and autoline vessels in Figures 30 and 31. This year one vessel (*Illa de Rua*) complied with the line-weighting regime that applies to vessels using the Spanish system (6 kg every 20 m) on two of three cruises. One other vessel (*Koryo Maru 11*) used a line-weighting regime very close to the requirement (5 kg every 20 m) on two of five cruises. Overall (i.e. for all areas combined), the median weight and distance between weights for each of the last three years (1996/97, 1997/98 and 1998/99) for all vessels using the Spanish system was 5 kg at 45 m, 6 kg at 45 m and 7 kg at 44 m respectively. The average weight (kg) per metre of mainline for the three years was 0.111, 0.133 and 0.150 respectively. This indicates a substantial increase in overall weight added to lines in 1998/99, but is still well below the level specified by Conservation Measure 29/XVI.

7.50 Offal discharge: In Subareas 58.6, 58.7 and 88.1 there was 100% compliance with the requirement either to hold offal on board during the haul, or to discharge on the opposite side of the vessel to hauling. In Subarea 48.3, 71% of the vessels discharged offal on the opposite side to hauling. This was a substantial improvement on 1998 when only 31% of vessels complied in this regard. In Subarea 88.1 vessels achieved compliance through having a fish meal plant operating to process offal.

7.51 Night setting: Night setting was successfully completed for 80% of sets in Subarea 48.3 and 84% in Subareas 58.6 and 58.7. If the daytime sets made during mitigation measure experimentation by the *Argos Helena* in Subarea 48.3 and *Eldfisk* in Subareas 58.6 and 58.7 are removed, the percentage of night sets for the two subareas would be 86% and 98% respectively, compared with values for 1998 of 90% and 93% respectively.

7.52 Streamer lines: Vessel and cruise-specific data are summarised in Tables 16 and 17. Both vessels fishing in Subarea 88.1 used streamer lines that complied with Conservation Measure 29/XVI. However, no vessels fishing in Subareas 48.3, 58.6 and 58.7 used streamer lines that met all aspects of the CCAMLR design. The length of streamer lines was the element

with lowest compliance; only 10% of vessels in Subareas 58.6 and 58.7 and 26% in Subarea 48.3 had lines that were at least 150 m long. This situation has not improved over the last three seasons. Adequate streamer line length is very important because it is a crucial element in the amount of protection afforded by the streamer line. Compliance with attachment height is generally good, showing consistent improvement for vessels fishing in Subarea 48.3. The number and spacing of streamers is generally close to 100% (Table 17). Thirteen observers (compared to eight last year) noted that spare streamer line material was on board. However, two observers (none last year) indicated that spare material was absent.

7.53 Thawed bait: As with the previous two years, reporting on compliance with use of thawed bait was incomplete. It appears from the logbooks that at least one vessel (*Ibsa Quinto*) used frozen bait on more than one set.

7.54 Overall, levels of compliance with elements Conservation Measure 29/XVI are steadily improving, particularly with respect to night setting and offal discharge. Compliance with line weighting and overall use of streamer lines is still far from satisfactory.

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

7.55 The Working Group estimated the levels of seabird by-catch that might be associated with the unregulated longline fisheries in the Convention Area in 1998/99.

7.56 An estimate of total seabird by-catch for any fishery requires information on seabird by-catch rates from a sample of the particular fishery and an estimate of the total number of hooks deployed by the fishery. For unregulated fisheries, information is not available either for seabird catch rate or for total hooks set. To estimate these parameters, catch rates of seabirds and *Dissostichus* spp. from the regulated fishery and estimates of total fish catches from the unregulated fishery are required.

Unregulated Seabird By-catch

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

7.58 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-XVII, Annex 5, paragraphs 7.75 to 7.81) except that assessments this year also needed to be made for Subarea 48.3 and Division 58.4.4.

7.59 No seabird by-catch data are available for Division 58.4.4. The IMALF risk assessment for this division is level 3 (average) compared with level 5 (high) for Subareas 58.6 and 58.7, which lie immediately to the north. Seabird by-catch rates for Division 58.4.4 were therefore set at 60% of those pertaining to Subareas 58.6 and 58.7.

Unregulated Effort

7.60 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.

7.61 The fishing year was divided into two seasons, a summer season (S: September to April) and a winter season (W: May to August), corresponding to periods with substantially different bird 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.

7.62 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

7.63 The results of these estimations are shown in Tables 55 and 56.

7.64 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 3 200 to 4 300 birds in summer (and 30 to 60 in winter) to a potentially higher level (based on the maximum by-catch rate of regulated vessels) of 11 500 to 15 400 birds in summer (and 200 to 400 in winter).

7.65 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 12 000 to 16 000 birds in summer (and 70 to 140 in winter) to a potentially higher level (based on the maximum by-catch rate of regulated vessels) of 23 500 to 31 500 birds in summer (and 300 to 600 in winter).

7.66 It should be noted that Subarea 58.7, mainly due to low levels of fishing and catch rates of fish, makes rather little contribution to this year's total.

7.67 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 100 to 130 birds in summer (and 10 to 25 in winter) to a potentially higher level (based on the maximum by-catch rate of regulated vessels) of 3 650 to 4 900 birds in summer (and 75 to 150 in winter).

7.68 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 3 000 to 4 000 birds in summer (and 15 to 30 in winter) to a potentially higher level (based on the maximum by-catch rate of regulated vessels) of 5 000 to 7 000 birds in summer (and 30 to 130 in winter).

7.69 The overall estimated totals for the whole Convention Area (Table 56) indicate a potential seabird by-catch in the unregulated fishery of 18 000 to 25 000 (lower level) to 44 000 to 59 000 birds (higher level) in 1998/99.

7.70 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. Any suggestion of a decrease in 1998/99 should be viewed with caution, given the uncertainties and assumptions involved in these calculations.

7.71 The composition of the estimated potential seabird by-catch based on data from 1997 is set out in Table 57. This indicates a potential by-catch of 21 000 to 46 500 albatrosses, 3 600 to 7 200 giant petrels and 57 000 to 138 000 white-chinned petrels in the unregulated fishery in the Convention Area over the last three years.

7.72 As in the last two years, it was emphasised that the values in Tables 55 to 57 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.

7.73 Nevertheless, even taking this into account, the Working Group endorsed its conclusion of last year 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

7.74 IMALF 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 three years, an estimated 170 000 to 250 000 seabirds have been killed by these vessels. Of these, 21 000 to 46 500 were albatrosses, including individuals of four species listed as globally threatened (vulnerable) using the IUCN threat classification criteria. These and several other albatross and petrel species are facing potential extinction as a result of longline fishing. The Working Group urgently requests 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

Assessments of Risk in CCAMLR Subareas and Divisions

7.75 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 (SC-CAMLR-XVI, Annex 5, paragraph 7.118; SC-CAMLR-XVII, Annex 5, paragraph 7.98).

7.76 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.

7.77 The assessments made in 1997 and 1998 for new and exploratory fisheries proposed in those years are set out in SC-CAMLR-XVI, Annex 5, paragraph 7.126 and SC-CAMLR-XVII, Annex 5, paragraph 7.116. Similar assessments of two areas with established longline fisheries (Subarea 48.3 and Division 58.5.1) were undertaken in 1997 (SC-CAMLR-XVI, Annex 5, paragraph 7.127).

7.78 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.

7.79 This year new data on breeding distribution and population sizes of albatrosses and petrels were provided in WG-FSA-99/59, and on at-sea distribution from satellite-tracking studies in WG-FSA-99/19, 99/20, 99/21, 99/25, 99/36, 99/38, 99/39 and 99/47.

7.80 The areas for which proposals for new and exploratory fisheries were received by CCAMLR in 1999 were:

Subarea 48.6	(South Africa, European Community)
Division 58.4.1	(Australia – trawl)
Division 58.4.2	(Australia – trawl)
Division 58.4.3	(Australia – trawl, France, European Community)
Division 58.4.4	(Chile, South Africa, Uruguay, France, European Community)
Division 58.5.1	(Chile, France)
Division 58.5.2	(France)
Subarea 58.6	(Chile, France, South Africa, European Community)
Subarea 58.7	(France)
Subarea 88.1	(Chile, European Community, New Zealand)
Subarea 88.2	(Chile, European Community).

7.81 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 7.76 and adopted in previous years. Two areas, Division 58.4.2 and Subarea 88.2 were fully assessed for the first time. Full details of these two new assessments are provided in paragraph 7.84, together with summaries for the other areas.

7.82 The full texts of all assessments were combined into a background document for use by the Scientific Committee and Commission (SC-CAMLR-XVIII/BG/23). It was agreed that this document should in future be tabled annually for the Scientific Committee.

7.83 A summary of risk level, risk assessment, IMALF recommendations relating to fishing season and any inconsistencies between these and the proposals for new and exploratory fisheries in 1999 is set out in Table 58. The assessment conclusion, advice and full comments on the proposals are set out below.

7.84 (i) Subarea 48.6:

Assessment: moderately well-known area in terms of visiting species. Its very large area, however, suggests interaction potential is probably underestimated. The northern part of the area (north of c. 55°S) contains extensive potential fishing grounds and is also the area in which most seabirds potentially at risk occur.

Advice: 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.

It was noted that South Africa (CCAMLR-XVIII/9) and the European Community (CCAMLR-XVIII/21) propose to fish from 1 March to 31 August north of 60°S and from 15 February to 15 October south of 60°S and to comply fully with all elements of Conservation Measure 29/XVI. This does not conflict with the above advice.

(ii) Division 58.4.1:

Assessment: although no breeding populations are within the area, this is a potentially important foraging area for five albatross species (two threatened, one near-threatened), southern giant petrel, northern giant petrel, white-chinned petrel and short-tailed shearwater from important breeding areas for the species concerned.

Advice: average risk; prohibit longline fishing during the breeding season of albatrosses, giant petrels and white-chinned petrels (September–April); apply all elements of Conservation Measure 29/XVI.

It was noted that Australia (CCAMLR-XVIII/12) is proposing a trawl fishery in this area, and that longline fishing is not currently proposed.

It was also noted that 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.

(iii) Division 58.4.2 (new assessment)

Breeding species in this area: southern giant petrel.

Breeding species known to visit this area: wandering albatross, light-mantled albatross and white-chinned petrel from Crozet Islands.

Breeding species inferred to visit this area: black-browed albatross, light-mantled albatross, grey-headed albatross, northern giant petrel, white-chinned petrel and grey petrel.

Other species: short-tailed shearwater, sooty shearwater.

Assessment: this is an important foraging area for four albatross species (two threatened), southern giant petrel and white-chinned petrel.

Advice: average-to-low risk; prohibit longline fishing during the breeding season of giant petrels (October to April); maintain all elements of Conservation Measure 29/XVI.

It was noted that Australia (CCAMLR-XVIII/11) is proposing a trawl fishery in this area, and that longline fishing is not currently proposed.

(iv) Division 58.4.3:

Assessment: although no breeding populations are within the area, this is a potentially important foraging area for four albatross species (two threatened, one near-threatened), southern giant petrel and white-chinned petrel from important breeding areas for the species concerned.

Advice: average risk; prohibit longline fishing during the breeding season of albatrosses, giant petrels and white-chinned petrels (1 September to 30 April); maintain all elements of Conservation Measure 29/XVI.

It was noted that:

(a) France (CCAMLR-XVIII/20) proposes to fish the whole of the 1999/2000 season and to comply fully with all elements of Conservation Measure 29/XVI. This fishing season substantially conflicts with the IMALF advice;

(b) the European Community (CCAMLR-XVIII/21) intends to fish from 15 April to 31 August and to comply fully with all elements of Conservation Measure 29/XVI. This will overlap the recommended season closure by two weeks; and

(c) the proposal by Australia (CCAMLR-XVIII/12) is for a trawl fishery.

(v) Division 58.4.4:

Assessment: although no breeding populations are within the area, this is a potentially important foraging area for four albatross species (three threatened, one near-threatened), southern giant petrel, white-chinned petrel and grey petrel from very important breeding areas for the species concerned.

Advice: average risk; prohibit longline fishing during the main breeding season of albatrosses and petrels (1 September to 30 April); maintain all elements of Conservation Measure 29/XVI.

It was noted that:

(a) France (CCAMLR-XVIII/20) proposes to fish the whole of the 1999/2000 season and to comply fully with all elements of Conservation Measure 29/XVI. This fishing season substantially conflicts with the IMALF advice;

(b) Chile (CCAMLR-XVIII/13), South Africa (CCAMLR-XVIII/9), Uruguay (CCAMLR-XVIII/14) and the European Community (CCAMLR-XVIII/21) propose to fish from 15 April to 31 August. This will overlap the recommended season closure by two weeks; and

(c) Chile (CCAMLR-XVIII/13) states its intent to comply with streamer-line requirements under Conservation Measure 29/XVI, but makes no specific

reference to the other provisions of this conservation measure. However, it is understood that Chile intends to conform fully with all elements of Conservation Measure 29/XVI. South Africa, Uruguay and the European Community intend to comply fully with all elements of Conservation Measure 29/XVI.

(vi) Division 58.5.1:

Assessment: important foraging area for six albatross species (four threatened, one near-threatened), southern giant petrel, white-chinned petrel and grey petrel, for several of which Kerguelen is a very important breeding site. Most albatross and petrel species breeding at Heard and McDonald Islands will also forage in this area, as will birds of many of the species breeding at Crozet.

Advice: high risk; prohibit longline fishing during the main albatross and petrel breeding season (i.e. 1 September to 30 April); ensure strict compliance with Conservation Measure 29/XVI.

It was noted that:

(a) France (CCAMLR-XVIII/20) proposes to fish the whole of the 1999/2000 season and to comply fully with all elements of Conservation Measure 29/XVI. This fishing season substantially conflicts with the IMALF advice;

(b) Chile (CCAMLR-XVIII/13) states that it would comply with conservation measures that were in force concerning fishing seasons in relevant subareas and divisions. However, there was no fishing season conservation measure for Division 58.5.1 in force in 1998/99. Given the high-risk category of the division, it is recommended that the fishing season be restricted to 1 May to 31 August; and

(c) Chile (CCAMLR-XVIII/13) states its intent to comply with streamer-line requirements under Conservation Measure 29/XVI, but makes no specific reference to the other provisions of this conservation measure. However, it is understood that Chile intends to conform fully with all elements of Conservation Measure 29/XVI.

(vii) Division 58.5.2:

Assessment: important foraging area for six albatross species (four threatened, one near-threatened and including one of the only two albatross species which are critically endangered – Amsterdam albatross) and for both species of giant petrel and white-chinned petrels from globally important breeding sites at Kerguelen, Heard and Amsterdam Islands.

Advice: 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.

It was noted that:

(a) France (CCAMLR-XVIII/20) proposes to fish the whole of the 1999/2000 season and to comply fully with all elements of Conservation Measure 29/XVI. This fishing season substantially conflicts with the IMALF advice; and

(b) longline fishing is currently prohibited within the EEZ around Heard and McDonald Islands.

(viii) Subarea 58.6:

Assessment: known and potential interactions with seven species of albatross (five threatened, one near-threatened), for many of which Crozet is one of the most important world breeding sites, as it is for giant, white-chinned and grey petrels. Also substantial potential for fishery interactions with albatrosses and petrels from the Prince Edward Islands and albatrosses from a variety of other breeding sites in their non-breeding season. Even outside the French EEZ (within which commercial longline fishing is presently prohibited), this is one of the highest risk areas in the Southern Ocean.

Advice: high risk; prohibit longline fishing during the main albatross and petrel breeding season (i.e. 1 September to 30 April); ensure strict compliance with Conservation Measure 29/XVI.

It was noted that:

(a) France (CCAMLR-XVIII/20) proposes to fish the whole of the 1999/2000 season and to comply fully with all elements of Conservation Measure 29/XVI. This fishing season substantially conflicts with the IMALF advice;

(b) South Africa (CCAMLR-XVIII/8), Chile (CCAMLR-XVIII/13) and the European Community (CCAMLR-XVIII/21) propose to fish from 15 April to 31 August. This will overlap the recommended season closure by two weeks; and

(c) Chile (CCAMLR-XVIII/13) states its intent to comply with streamer-line requirements under Conservation Measure 29/XVI, but makes no specific reference to the other provisions of this conservation measure. However, it is understood that Chile intends to conform fully with all elements of Conservation Measure 29/XVI. South Africa and the European Community intend to comply full with all elements of Conservation Measure 29/XVI.

(ix) Subarea 58.7:

Assessment: known and potential interactions with five species of albatross (four threatened), for most of which the Prince Edward Islands is one of the most important world breeding sites, as it is for giant petrels. Also substantial potential for fishery interactions with albatrosses and petrels from the Crozet Islands and albatrosses from various other breeding sites in their non-breeding season. This small area is one of the highest risk areas in the Southern Ocean. It should be noted that within South Africa's EEZ, commercial longline fishing is currently permitted all year.

Advice: high risk; prohibit longline fishing during the main albatross and petrel breeding season (1 September to 30 April); ensure strict compliance with Conservation Measure 29/XVI.

It was noted that France (CCAMLR-XVIII/20) proposes to fish the whole of the 1999/2000 season and to comply fully with all elements of Conservation Measure 29/XVI. This fishing season substantially conflicts with the IMALF advice.

(x) Subarea 88.1:

Assessment: the northern part of this area lies within the foraging range of three albatross species (two 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.

It was noted that:

(a) Chile (CCAMLR-XVIII/13), the European Community (CCAMLR-XVIII/21) and New Zealand (CCAMLR-XVIII/10) propose to fish from 15 December to 31 August;

(b) Chile (CCAMLR-XVIII/13) states its intent to comply with streamer-line requirements under Conservation Measure 29/XVI, but makes no specific reference to the other provisions of this conservation measure. However, it is understood that Chile intends to conform fully with all elements of Conservation Measure 29/XVI. The European Community intends to comply fully with all elements of Conservation Measure 29/XVI; and

(c) New Zealand (CCAMLR-XVIII/10) proposes a continuation of the variation to Conservation Measure 29/XVI as provided for by Conservation Measure 169/XVII, to allow line-weighting experiments to continue south of 65°S in Subarea 88.1 (see paragraphs 7.85 to 7.91 for further discussion).

(xi) Subarea 88.2 (new assessment):

Breeding species in this area: none.

Breeding species known to visit this area: 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, black-browed albatross and grey-headed 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 (four 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.

It is noted that:

(a) the European Community (CCAMLR-XVIII/21) states that it will comply with Conservation Measure 29/XVI, including only setting gear at night; and

(b) Chile (CCAMLR-XVIII/13) states its intent to comply with streamer-line requirements under Conservation Measure 29/XVI, but makes no specific reference to the other provisions of this conservation measure. However, it is understood that Chile intends to conform fully with all elements of Conservation Measure 29/XVI.

New Zealand Proposal in respect of Subarea 88.1

7.85 The Working Group noted New Zealand's request for a continuation of the variation to Conservation Measure 29/XVI, as provided for last year by Conservation Measure 169/XVII, to allow line-weighting experiments to continue south of 65°S in Subarea 88.1 (CCAMLR-XVIII/10). Conservation Measure 169/XVII allowed 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. This variation was sought because during austral summer (December to March) there are no periods of darkness at these latitudes.

7.86 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 and seabird interactions for both autoliners and vessels using the Spanish system. The Working Group also noted in 1998 that while manual addition and removal of weights will probably be the best means of achieving the target sink rates in the short term, more efficient and safer ways of weighting longlines need to be developed.

7.87 New Zealand reported that no seabird mortalities were recorded either during the experimental line-weighting program or when fishing north of 65°S and complying in full with Conservation Measure 29/XVI. Time–depth recorders were used to monitor sink rate and the minimum sink rate of 0.3 m/s was consistently achieved.

7.88 The Working Group supported the variation in 1998 on the grounds that this would assist in the development of line weighting for all areas of CCAMLR. In considering New Zealand's request to continue line sink rate experimentation, the Working Group noted that the southern part of Subarea 88.1 was assessed as average to low risk for seabirds. This limits the usefulness of extrapolation of the results of the line-weighting experiment to other higher risk areas.

7.89 However, continuation of the experiment will build on last year's data. It should also provide the opportunity to experiment with ways to integrate weighting into the mainline.

7.90 The Working Group therefore supported the New Zealand proposal to continue the variation to Conservation Measure 29/XVI and encouraged New Zealand to investigate ways of more safely and efficiently weighting longlines. The Working Group suggested that a condition might be attached to this variation requiring vessels to determine what weighting regime would be required to achieve an integrated weighting system.

7.91 The Working Group also requested that New Zealand report to the next meeting of WG-FSA on the nature and effectiveness of its line-weighting regimes for minimising seabird mortality within the New Zealand EEZ during the 1998/99 and 1999/2000 seasons.

7.92 CCAMLR-XVIII/10 indicated that New Zealand vessels operating within Subarea 88.1 in 1999/2000, where possible, will be required to operate fishmeal plants for processing offal

and by-catch. If a vessel experiences operational problems with their meal plant, they will retain offal and by-catch on board for disposal in port on their return to New Zealand. This provision will apply to the whole of Subarea 88.1.

7.93 The Working Group noted that this constituted an excellent example of good operational practice and encouraged widespread emulation of this practice.

New and Exploratory Fisheries Operational in 1998/99

7.94 Table 59 provides information on the performance of new and exploratory fisheries undertaken in 1998/99. It was noted that little or no fishing was carried out in Subarea 48.6 and Divisions 58.4.1, 58.4.3 and 58.4.4.

7.95 Comprehensive reports on seabird interactions with longline fishing in Subareas 58.6, 58.7 and 88.1 have been provided by South Africa and New Zealand (WG-FSA-99/42 and 99/35). Information contained in these reports was used in assessments of new and exploratory fisheries in 1999/2000, where relevant. The seabird by-catch data and the effectiveness of mitigation measures employed in these new and exploratory fisheries are discussed in paragraphs 7.29 to 7.54 and 7.116.

Incidental Mortality of Seabirds during Longline Fishing outside the Convention Area

7.96 WG-FSA-99/18 reviewed seabird by-catch in the Australian Fishing Zone (AFZ) over the decade to 1997. Most of the birds killed in the tuna longline fishery were albatrosses. Analyses of the trends of seabird catch rates in the AFZ by Japanese longliners over 10 years show an apparent fall from the 1988 by-catch figure of 0.4 birds/thousand hooks to levels of between 0.1 to 0.2 birds/thousand hooks. Based on current fishing levels, these recent rates equate to between 1 000 and 3 500 birds being killed each year. Although the initial fall in the by-catch rate was achieved rapidly, the rate has plateaued or risen slightly since, indicating that there may have been changes to fishing practices or equipment which are detrimental to efforts to minimise seabird by-catch and/or adoption of mitigation methods has been slow. The paper emphasises that large amounts of data are necessary to gain clear insights into the suite of species impacted by a fishery, and the effect of different fishing gear, environmental variables, and the mitigation measures employed.

7.97 WG-FSA-99/73 reported on seabird interactions with longline fisheries in the AFZ in 1998. There was no fishing in 1998 by Japanese longline fishing vessels. Fishing in the AFZ by domestic pelagic longliners is logically treated as two fleets: a heterogenous local-style fleet and a homogenous Japanese-style fleet. The increase in local-style pelagic effort during the 1990s was sustained this year, with over 9 million hooks being set, a 22% rise over the number of hooks set during 1997. Of these, 13 700 (0.1%) were observed. Over 770 000 hooks, of which c. 50 000 (6.5%) were observed, were set in the AFZ by Australian-owned Japanese-style vessels. This number has been fairly constant throughout the 1990s.

7.98 In the local-style pelagic fishery, all observations were made around Tasmania in summer, most observed hooks were set at night, and the observed by-catch rate was 0.58 birds/thousand hooks. Shy albatrosses were the most commonly caught species of seabird. By-catch rates were influenced by moon phase. The importance of measures additional to bird lines (such as weights) was emphasised.

7.99 The observed by-catch rate in the Australian-owned Japanese-style fishery was 0.4 birds/thousand hooks. Most observed hooks were set during the day. The species caught

were mainly black-browed and wandering albatrosses. Bird lines were found to reduce the observed by-catch rate, but only if they were of good quality. Thawed bait and fewer birds around the vessel were observed to result in lower by-catch rates.

7.100 Measured by-catch rates of birds by both parts of the fleet are high (in the order of 0.4 to 0.6 birds/thousand hooks during 1998), and this suggests that both of these fleets continue to catch a substantial number of seabirds in the AFZ. Because of the small percentage of hooks observed, estimates of the total numbers of seabirds caught would be premature. Approximately 43 000 hooks were observed set by domestic demersal longline fishing vessels. No birds were observed to be caught by these hooks.

7.101 New data on foraging ranges outside the Convention Area of seabird species breeding within the Convention Area are provided for:

(i) white-chinned petrel in WG-FSA-99/20 and 99/47, showing substantial overlap with longline fisheries in coastal South America and with southern bluefin tuna fisheries in the Indian Ocean;

(ii) northern and southern giant petrels in WG-FSA-99/38 and 99/39, showing substantial overlap with longline fisheries in coastal South America; and

(iii) grey-headed albatross in WG-FSA-99/25, showing substantial overlap with southern bluefin tuna fisheries in the Indian Ocean.

7.102 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 New Zealand, South Africa, southern South America and the Falkland/Malvinas Islands.

7.103 Members were reminded that such information is likely to include data on incidental mortality of seabirds which breed in the Convention Area and were requested to provide relevant data for next year's meeting.

Research into and Experience with Mitigating Measures

7.104 The FAO review of incidental catch of seabirds by longline fisheries, including a review of, and technical guideline for, mitigation (WG-FSA-99/23), is to be published shortly. This is an authoritative source reference, the main conclusions of which have been taken forward into the FAO International Plan of Action on the Reduction of Incidental Catch of Seabirds in Longline Fishing (FAO IPOA–Seabirds) (WG-FSA-99/6, Appendix 1).

7.105 WG-FSA-99/26 reviewed factors affecting the number and the mortality of seabirds attending longliners and trawlers fishing in the Kerguelen area during 1994 and 1997, based on on-board observations by dedicated observers. The total numbers of seabirds attending vessels varied mainly according to the year, cloud cover and presence of offal from longliners. The dumping of offal increased the numbers of birds attending the vessel. The activity of the vessels also affected the numbers attending, birds being more abundant during line setting and during trawl hauling. The white-chinned petrel was the most abundant ship-following seabird, followed by black-browed albatross and giant and cape petrels. The number of white-chinned petrels, black-browed and grey-headed albatrosses attending fishing vessels increased through the season, whereas the converse was true for giant and cape petrels.

7.106 Four species of birds were caught by fishing gear (mainly by longliners), the order of frequency being white-chinned petrels, black-browed, grey-headed and wandering albatrosses. Taking into account the number of birds from each species attending longliners and known to be potential by-catch, white-chinned petrel and grey-headed albatross were caught in much

greater proportion than the number of potential by-catch present, whereas black-browed albatrosses were caught in lower proportions. Giant petrels were abundant around longliners, but not observed caught.

7.107 WG-FSA-99/26 reported that, for longline vessels, most birds were killed when the lines were set during the day or at other times when the deployment of the streamer lines was incorrect, at an overall rate of 0.47 birds/thousand hooks. Only one albatross was caught when the lines were set during the night. White-chinned petrels represented 92% of all birds killed by longliners. The number of birds caught varied significantly between months and between years. The type of bait used also affected the catch rate. The catch rate was related to the number of birds attending the longliner only for black-browed albatrosses. Most birds killed by trawlers were caught by the netsonde cable. Night setting is the most efficient method to reduce mortality of albatrosses. Additional methods need developing to reduce the mortality of species active at night, especially the white-chinned petrel, whose populations in the Indian Ocean are threatened by longline fisheries.

7.108 Observer effects on reported by-catch rates were evident from experiences reported in WG-FSA-99/26. For one vessel, the by-catch rate recorded while the observer was undertaking other fishery monitoring tasks was five times lower (0.05 birds/thousand hooks) than that recorded during dedicated observations of the line haul (0.25 birds/thousand hooks). These observations reinforce the need for caution when interpreting by-catch rate data, as comparisons between vessels and studies may be affected by differences in the quality of the reported data.

7.109 The Working Group reviewed new information relating to methods for mitigating seabird by-catch in longline fisheries, with special emphasis on those aspects and topics covered by Conservation Measure 29/XVI.

Offal Discharge

7.110 The Working Group commended the fact that available reports on vessels operating in the longline fisheries in Subareas 58.6 and 58.7 in 1998 (Table 50) indicate that all vessels discharge offal on the opposite side to the haul, as specified in Conservation Measure 29/XVI. The advantages of this, in respect of reducing seabird by-catch, were clearly indicated from last year's data (SC-CAMLR-XVII, Annex 5, paragraph 7.140) In Subarea 48.3, however, three vessels (*Isla Sofía*, *IslaCamila* and *Jacqueline*) are still operating with offal discharge on the same side as the haul, in contravention of the conservation measure. The fact that, unlike last year, high seabird by-catch rates are not associated with these vessels, probably reflects that they were fishing at a time when very few birds were available to be caught. The Working Group noted that the engineer's diagram of the waste-pipe reconfiguration of the *Koryo Maru 11* had been provided to the Secretariat, as requested last year (SC-CAMLR-XVII, Annex 5, paragraph 7.144). It was hoped that the vessels above could use this as a basis for reconfiguration.

Line Weighting

7.111 Three papers provided new insights on mitigation. WG-FSA-99/5 reported the results of line-weighting experiments on the *Argos Helena* in Subarea 48.3 in February 1999. Many commercial vessels using the Spanish longline system attach weights every 40 m, rather than the 20 m interval specified in Conservation Measure 29/XVI. The experiment was therefore designed to examine the effect on seabird mortality of increasing line weighting from 4.25 kg at 40 m intervals to 8.5 kg (double) and 12.75 kg (treble) at 40 m intervals. Doubling the weight

reduced the bird mortality from 3.98 birds/thousand hooks to <1/thousand hooks. There was no significant reduction in mortality with a line weighting of 12.75 kg per 40 m, compared to 8.5 kg per 40 m.

7.112 WG-FSA-99/5 noted that bird catch rates with twice and three times the normal weighting regime were similar to those found during daytime setting around South Georgia in the 1998 winter fishery. Many more birds are present around South Georgia in the February period than in winter. The fact that such low catch rates are achievable, even when fishing during the day at a time of year when certain species, especially black-browed albatrosses, are most vulnerable, suggests that it may be possible to develop a viable year-round fishing regime with an acceptably low threat to seabirds through the use of effective line weighting.

7.113 The Working Group was surprised that with line weightings of 8.5 kg at 40 m intervals, which should equate to sink rates of about 1 m/s (WG-FSA-95/58) (cf. Conservation Measure 29/XVI which specifies 6 kg at 20 m, giving a sink rate of about 0.9 m/s), the line still did not sink sufficiently fast to avoid catching any birds.

7.114 An important observation in WG-FSA-99/5 was that the distance of 40 m between the weights meant that the fishing line could loop up to the surface, increasing the danger of birds being caught on hooks. The effect of buoyancy of birds already caught on the line was particularly important in this regard. Observations from the stern indicated that this was still a problem even with the use of three times the normal weight, and emphasised the importance of the 20 m interval specified in Conservation Measure 29/XVI. WG-FSA-99/5 also reported on the effect of environmental conditions and seabird behaviour on the vulnerability of seabirds to hooking and the effectiveness of mitigation methods. Strong winds in particular reduced the effectiveness of the streamer line by blowing it away from the fishing line. The use of multiple streamer lines under these circumstances was suggested as a possible solution to this problem.

7.115 The Working Group recognised that this experiment was a useful contribution to the understanding of the importance of line weighting in the mitigation of seabird mortality, and the practicalities of increasing line weighting above that currently in general use in the fishery. It also provided a helpful example of the use of GLMs in the analysis of data on factors affecting seabird mortality. Further experimentation on longline-weighting regimes with the Spanish method is necessary before advice on the refinement of the relevant part of Conservation Measure 29/XVI can be provided.

7.116 WG-FSA-99/35 reported the results of line-weighting trials on autoline vessels in Subarea 88.1. For two vessels, 5 kg weights every 60 m sank longlines at 0.36 m/s (setting at 4.5 to 5 knots) and 5 kg weights at 65 m sank lines at 0.4 m/s (setting at 5.5 to 6 knots). Setting speed has a substantial effect on line sink rate. No seabirds were observed caught in Subarea 88.1 with these weighting regimes and sink rates. Although the numbers of seabirds around the vessel were high at times, few were of species known to be vulnerable to capture on longlines. WG-FSA-99/37 provides similar information as WG-FSA-99/35 in poster form but also notes that weights at larger spacings (5 kg every 400 m) have no effect on sink rate.

7.117 WG-FSA-99/62 reported the results of meetings with Norwegian autoline gear makers Mustad and Fiskevegn. Conclusions were that marine, autoline and rope engineers have much to offer in efforts to reduce seabird deaths in autoline longline fishing globally and have been under-utilised in efforts thus far. It was also concluded Mustad and Fiskevegn are unlikely to respond to requests to modify autoline gear (e.g. make heavier magazine carriers to support heavier ropes) and rope composition (to increase specific gravities) until client demand makes it economically viable to do so. An increase in client demand is most likely to come with the imposition of fishing licence conditions which require faster sinking longlines.

7.118 The Working Group noted that four of five autoline vessels fishing in the Convention Area in 1998/99 used weights on their longlines. In addition, the spacings between weights on

autoline vessels have varied over the last three years, from median values of 4 kg at 200 m (average 0.014 kg/m) in 1997, to 9 kg at 640 m (average 0.015 kg/m) in 1998, to 5 kg at 100 m (average 0.022 kg/m) in 1999.

Line Setter

7.119 No response from Mustad was received to the Secretariat's request for further information (SC-CAMLR-XVII, Annex 5, paragraph 7.155).

Streamer Line

7.120 No new specific or experimental information on design or use had been received this year. Several reports had testified to reduction in seabird by-catch achieved using streamer lines, the importance of constructing and using them correctly (e.g. WG-FSA-99/26) and to certain circumstances in which they were of reduced effectiveness (e.g. WG-FSA-99/5), together with suggestions to help rectify this.

Underwater Setting

7.121 WG-FSA-99/5 referred to potential tests of the effectiveness of an underwater setting tube on the Spanish system vessel *Argos Helena*. The trial was aborted due to poor tube design.

7.122 In Subareas 58.6 and 58.7, the autoliner *Eldfisk* used a Mustad underwater setting funnel, designed to set line at 2 m depth (WG-FSA-99/42 Rev. 1). It set 487 longlines (1.4 million hooks) during three cruises. Of these, 203 sets (41.0% of hooks) used the Mustad funnel (11.6% of total fishing effort). Fifteen birds were killed (13 white-chinned and 2 grey petrels); only one (a white-chinned petrel) was caught on a set made using the funnel. Seabird by-catch using the funnel (0.002 birds/thousand hooks) was markedly less than when not using the funnel (0.017), and the difference is significant despite the small sample size ($X^2 = 5.95$, df = 1, $P < 0.05$). This underestimates the efficacy of the funnel, because it does not take into account the much greater proportion of hooks set during the day using the funnel (97.0%) compared with night sets (11.1%). Given the known higher by-catch rate during day sets, the null model of an equal likelihood of mortalities occurring with and without the funnel is conservative. The sample size of night sets using the funnel was too small to be compared with night sets not using the funnel, but the only bird killed while using the funnel was caught during the day.

7.123 The line jumped out of the funnel during 22 of 203 sets (11%). With increasing experience this happened less frequently (16%, 13%, 3% on successive trips). This did not result in any birds being caught in this study, but could be a problem during day sets in areas/times with a high risk of seabird by-catch. There is also a problem with increased rates of bait loss as a result of the use of the funnel. This needs to be addressed by the funnel manufacturer.

7.124 The Working Group commended the work, and strongly encouraged further use and development of this system.

General

7.125 Consideration needs to be given to the use of coloured fishing gear as a possible aid to reducing seabird by-catch. It is possible that proper use of appropriate mitigation measures might result in reduction in the by-catch of albatrosses to acceptable levels, but that catch rates of white-chinned petrels will remain unacceptably high due to the reduced effectiveness of night setting with this species. One approach with this species might be to dye, either dark blue or black, hook lines, snood lines, hooks and bait in an attempt to make gear less visible to white-chinned petrels foraging, whether in daylight or in darkness.

7.126 Members expressed a desire to achieve better feedback from the fishing industry on operational issues and fishing strategy procedures that may influence the successful use of mitigation measures. Of particular concern was to learn more from the industry about practical implications of the line-weighting regimes promoted in Conservation Measure 29/XVI and similar regimes being suggested for autoliners.

7.127 Members, especially technical coordinators of national scientific observation programs, were requested to provide relevant information in advance of next year's meeting of WG-FSA.

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

7.128 WG-FSA-99/6 reviewed most of the current international initiatives relating to the elimination of seabird by-catch in longline fisheries. In addition to summarising progress on issues discussed in paragraphs 7.132 to 7.140, it noted that:

(i) the United Nations adopted a resolution at its 53rd Session (in 1998) noting its concern with loss of seabirds and urging states to reduce fishery by-catches;

(ii) workshops addressing seabird by-catch issues in longline fisheries are planned to be held in 2000:

(a) in Canada under the auspices of the Circumpolar Seabird Working Group of the Intergovernmental Committee on Conservation of Arctic Flora and Fauna;

(b) in Hawaii, USA, in May as part of the Second International Conference on Albatrosses and Petrels;

(c) in South Africa, with support from the Global Environmental Facility and BirdLife South Africa; and

(iii) the BirdLife International Seabird Conservation Programme, working through national partnership in 80 countries, intends to commence a global campaign addressing seabird by-catch issues, including persuading and facilitating the major longlining nations to prepare effective plans of action under the FAO IPOA (see paragraphs 7.129 to 7.131).

FAO International Plan of Action on the Reduction of Incidental Catch of Seabirds in Longline Fisheries (IPOA–Seabirds)

7.129 SC-CAMLR-XVIII/BG/14 reported that at the 23rd session of the FAO Committee on Fisheries (COFI; Rome, 15 to 19 February 1999) the IPOA–Seabirds was adopted and forwarded to the FAO Council, which endorsed it in June 1999.

7.130 Members of COFI are requested to report to its next meeting (in 2001) their progress in relation to IPOA–Seabirds in conducting assessments followed by adopting National Plans of Action (NPOAs) if warranted.

7.131 The Working Group recognised the importance of prompt preparation of detailed NPOA–Seabirds by relevant Member States, especially those with most experience in longline fisheries and seabird by-catch issues. It encouraged all Members of the Commission involved in longline fishing, especially those operating within the Convention Area, to develop appropriate NPOAs and to report on progress to the next meeting of ad hoc WG-IMALF.

Convention on Migratory Species

7.132 The Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention) provides a framework for countries to work together towards the conservation of migratory species throughout their range. At the 5th Conference of Parties to the Convention, held in 1997, all southern hemisphere species of albatrosses were listed on either Appendix I or II of the CMS. Listing on Appendix II obliges range states to endeavour to conclude regional agreements that facilitate cooperative conservation and management actions.

7.133 Since this listing, the Group of Temperate Southern Hemisphere Countries on the Environment (known as the Valdivia Group) have been endeavouring to develop an agreement 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. An ad hoc Valdivia Working Group on Albatrosses was formed to progress development of a regional agreement. In June 1999, Australia hosted the inaugural meeting of the working group which was attended by all member countries of the Valdivia Group. The group identified key elements for a framework of regional cooperation on the conservation of all southern hemisphere albatross species.

7.134 This meeting also agreed to explore the preparation of a program promoting exchange of experts, technicians and personnel responsible for developing and implementing different techniques for mitigating fishing impacts on albatross species. It was recognised that a number of organisations, such as CCAMLR and FAO, had recommended conservation measures pertinent to albatross conservation and Member countries agreed to exchange information regarding their implementation of CCAMLR and other measures.

7.135 The Working Group commended these approaches and encouraged the Valdivia Group to progress their initiatives and to contribute fully to other relevant undertakings, especially with respect to the FAO IPOA–Seabirds and to planned seabird by-catch workshops (paragraphs 7.144 to 7.149).

7.136 The Working Group was informed (WG-FSA-99/6) that South Africa is nominating seven members of the genera *Macronectes* and *Procellaria* (including the white-chinned petrel) to Appendix II of the Bonn Convention; this will be considered at the 6th Conference of Parties in November 1999.

Australian Threat Abatement Plan

7.137 The objective of the Australian Threat Abatement Plan, officially released on 2 August 1998, is to reduce seabird by-catch in all fishing areas, seasons and fisheries to below 0.05 birds/thousand hooks, based on current fishing levels. This represents a reduction of up

to 90% of seabird by-catch within the AFZ, and should be achievable within the five-year life of the plan. The ultimate aim of the threat abatement process is to achieve a zero by-catch of seabirds, especially threatened albatross and petrel species, in longline fisheries.

7.138 WG-FSA-99/53 reported on implementation of first-year actions. Critical actions under this plan include: regulation of fishing practices, implementation of an observer program to identify seabird by-catch rates throughout the AFZ, testing and refinement of underwater setting devices, further experimentation of line-weighting regimes, development of seabird collection kits, and development of a communication program to enhance industry understanding and adoption of new regulations and other measures contained in the plan.

7.139 A working group has been established to identify indicative 'best-practice' mitigation measures that may be appropriate in the sub-Antarctic fisheries, should demersal longlining be considered in the future in these areas.

7.140 A video has been produced, providing information on the correct use of mitigating measures to reduce seabird by-catch in pelagic tuna fisheries.

Commission for the Conservation of Southern Bluefin Tuna (CCSBT)

7.141 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 1999.

Indian Ocean Tuna Commission (IOTC)

7.142 SC-CAMLR-XVIII/BG/32 indicated that the inaugural meeting of the IOTC Scientific Committee acknowledged the importance of considering non-target, associated and dependent species (NTADs) in research and management measures. However, specific seabird mitigation measures were not considered.

7.143 The Working Group encouraged the IOTC to review the nature and extent of seabird by-catch in tuna longline fisheries within its area of jurisdiction and to require vessels to adopt appropriate mitigating measures.

International Fishers Forum

7.144 The Working Group noted New Zealand's intention to host an international forum for fishers, focused on solving the incidental capture of seabirds in demersal and pelagic longline fisheries, during the fourth quarter of 2000 (SC-CAMLR-XVIII/BG/16).

7.145 The forum will be an opportunity for fishers, gear technologists and researchers to meet, and hear first hand about mitigation measures used in longline fisheries around the world, and to learn about new measures currently under development.

7.146 The Working Group agreed that this exchange of information and ideas would result in a more coordinated response to this issue and hopefully accelerate progress in solving the problem. In addition, countries participating would be in a more informed position to prepare their NPOAs in relation to the FAO IPOA–Seabirds initiative (paragraphs 7.129 to 7.131; SC-CAMLR-XVIII/BG/4).

7.147 A second objective for the forum will be 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 address questions posed by the workshop participants.

7.148 Dr Robertson indicated that he had been holding discussions relating to the need for a focused workshop on seabird mortality in the autoline fishery. He felt this might advantageously be associated with the International Fishers Forum. The autoline workshop will attempt to bring together marine architects, autoline gear makers and rope manufacturers with the objective of encouraging engineers from these disciplines to manufacture longline vessels configured to deploy longlines that do not catch birds. A second objective will be to derive engineering modifications to existing vessels that would, through structural change, facilitate the deployment of fast-sinking longlines.

7.149 The Working Group supported the International Fishers Forum and associated autoline workshop, and encouraged Member countries longlining in the Convention Area to participate.

Strategic and Policy Issues

Regulated Fishing

7.150 The Working Group noted the Commission's endorsement of the strategic advice of the Scientific Committee concerning policies and practices believed essential to addressing and resolving the issue of seabird by-catch in longline fisheries (CCAMLR-XVII, paragraph 6.31), specifically 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.

7.151 The Working Group noted with appreciation the increased efforts, especially by New Zealand and South Africa, to use and develop underwater setting. It also commended the recent work, especially by Australia, New Zealand and the UK, directed at improving knowledge of appropriate line-weighting regimes. The results of work to date reinforce the view, suggested last year, that appropriate line weighting could lead to a relaxation of certain elements of existing conservation measures regulating longline fishing in the Convention Area.

7.152 The Working Group regretted, however, that compliance with Conservation Measure 29/XVI, especially in the critical area of line weighting, had not improved greatly since last year. In effect, no vessel engaged in longline fishing (using the Spanish method) in the Convention Area had operated in compliance with Conservation Measure 29/XVI in the 1998/99 fishing season. Only two vessels (and only on four of eight cruises) had complied with the line-weighting specifications of Conservation Measure 29/XVI.

7.153 The Working Group recollected the instruction of the Commission last year (CCAMLR-XVII, paragraph 6.24) that vessels discharging offal during the haul on the same side as the line hauling site should not be allowed to fish in the Convention Area.

7.154 The Working Group wished to extend this principle to recommend that vessels which had proven unable or unwilling to comply with all the provisions of Conservation Measure 29/XVI should not be allowed to fish in the Convention Area.

IUU Fishing

7.155 The Working Group noted the endorsement by the Scientific Committee (SC-CAMLR-XVII, paragraphs 4.49 and 4.50) and Commission (CCAMLR-XVII, paragraph 6.22) of its advice and concerns last year (SC-CAMLR-XVII, Annex 5, paragraphs 7.93 to 7.95) that levels of IUU fishing are generating levels of seabird by-catch about two orders of magnitude greater than in the regulated fishery and unsustainable for the albatross, giant petrel and white-chinned petrel populations concerned. It noted that the Commission viewed this with the greatest concern and was proposing a wide range of measures to address the problem of unregulated and illegal fishing (CCAMLR-XVII, paragraphs 5.16 to 5.69).

7.156 The Working Group reiterated its view that, within the Convention Area, IUU longline fishing now poses the principal survival threat for most, if not all, the species and populations of at-risk seabirds.

7.157 The Working Group recognised the difficulty of simultaneously trying to enhance the effectiveness of the regulated fishery and to diminish the attractiveness of the IUU fishery. It noted the impact of IUU fishing on seabirds could be reduced by increasing the benefit to fishers of using vessels or fishing practices which were configured and/or operated in ways to reduce the probability of seabird by-catch (e.g. underwater setting, integrated weighted autolines).

7.158 It also recollected the views expressed by some Members in previous years (e.g. CCAMLR-XVII, paragraph 9.10; SC-CAMLR-XVII, paragraphs 4.45 and 9.25) that:

(i) extending the regulated fishing season could achieve a reduction in levels of IUU fishing; and

(ii) the current closed season (September to April inclusive) may be promoting IUU fishing at the time of year when risk of seabird by-catch is greatest (i.e. during the breeding season of albatrosses and petrels).

7.159 However, other members felt that there was insufficient information on the operations of IUU fishing to have any confidence that extending the fishing season for regulated vessels would reduce the impact of IUU fishing.

Mitigating Measures and Fishing Seasons

7.160 The Working Group agreed that relaxation of current fishing season restrictions could only be recommended when there is compliance with all the main elements of Conservation Measure 29/XVI.

7.161 The key mitigation measures (excluding underwater setting) relevant to permitting year-round fishing by regulated vessels are, in approximate order of priority:

(i) appropriate line-weighting regime;
(ii) night-time setting;
(iii) correct use of streamer lines; and
(iv) minimisation of problems associated with offal discharge.

7.162 Compliance with night setting is currently about 80%. Offal discharge practice has steadily improved in recent years. Use of streamer lines, as specified by Conservation Measure 29/XVI, needs considerable improvement. Compliance with line weighting, potentially the most crucial element of Conservation Measure 29/XVI, is still very inadequate.

7.163 Ad hoc WG-IMALF proposed that vessels able to demonstrate that they have consistently (i.e. in every cruise) achieved full compliance with each element of Conservation Measure 29/XVI in the 1999/2000 fishing season should, in the following year, be allowed to fish at any time of year. Such compliance would be carefully verified, particularly with respect to line-weighting requirements, by WG-IMALF and WG-FSA, on the basis of all available data and the report of the scientific observer. WG-IMALF noted that an appropriate line-weighting regime for autoline vessels will need to be determined. From the results reported in WG-FSA-99/35 it is recommended that this should not be less than the achievement of a minimum sink rate of at least 0.3 m/s on every set, with a goal of achieving a sink rate of 0.4 m/s.

7.164 The Working Group endorsed this approach in principle. It felt, however, that it might be premature to advise adoption of this procedure at the present meeting.

7.165 The Working Group also recognised the existing risk that vessels, having complied consistently and fully with all elements of Conservation Measure 29/XVI in one year, could relax their compliance while fishing year round in the next year. This could lead to high levels of seabird by-catch during the austral summer.

7.166 To minimise this risk, the Working Group proposed that:

(i) to the extent feasible, there should be in-port inspections of vessels in order to ensure that they are configured, and have all fishing and related gear necessary, to be able to comply in full with Conservation Measure 29/XVI; and

(ii) longline fishing should cease if a significant level of bird by-catch occurs (cf. the Scientific Committee recommendation, in SC-CAMLR-XVII, paragraphs 4.67 and 4.68, with respect to the New Zealand proposal for fishing in Subarea 48.1 in 1998/99). Advice on appropriate levels of seabird by-catch, on an area-specific basis would be provided by WG-IMALF to WG-FSA.

7.167 An essential complement to the recommendations in paragraphs 7.162 and 7.163 is rapid further progress in defining the optimum (minimum) line-weighting regime that will eliminate (or reduce to a very low level) seabird by-catch for both autoliners and vessels using the Spanish system. Doing this will require dedicated experiments.

7.168 The Working Group recommended that such experiments be strongly encouraged. As an incentive to attract the cooperation of fishers and fishery managers, such experiments, which should be conducted in accordance with a strictly specified experimental design, could be undertaken under CCAMLR Conservation Measure 64/XII, being eligible for an appropriate catch level (i.e. more than 50 tonnes) under the CCAMLR research exemption provisions. Any such experiments will need to be conducted before the commercial fishery has exhausted the catch limit and would require notification at least six months in advance of the starting date of the research.

7.169 An appropriate experimental design could be rapidly devised by WG-IMALF in consultation with WG-FSA, in particular taking account of the design and experience reported in WG-FSA-99/5. For the Spanish system, the main research priorities are to quantify, for different seabird species, the area in which baits are available to seabirds and for this to be expressed in terms of longline sink rates and line-weighting regimes, together with data relating to other factors that affect longline sink rate and bird behaviour, such as wind strength and direction and setting speed. The main measures of effectiveness would be bird mortality and

rates of bird attacks on bait. Cruises of up to three weeks duration and considerable flexibility in fishing to allow for experimental manipulations, would be required. Cruises would take place at times of high bird numbers, with appropriate limits on bird by-catch, so that the effectiveness of line-weighting regimes can be properly tested.

7.170 For the autoline system, in addition to the research requirements outlined for the Spanish system, a method of incorporating weighting into the fishing line is a high priority. This would eliminate safety risks, increase ease of use and, with appropriate sink rates, achieve compliance with CCAMLR conservation measures.

Advice to the Scientific Committee

7.171 The Scientific Committee was requested to note the following recommendations/advice.

7.172 General:

(i) The Working Group welcomed the appearance of the book *Identification of Seabirds of the Southern Ocean. A Guide for Scientific Observers aboard Fishing Vessels* published by CCAMLR and the National Museum of New Zealand in 1999; some comments are offered to help in any future revision (paragraph 7.5).

(ii) There had been a comprehensive response to the request for information on research programs into the population status and foraging ecology of seabird species at risk from longline fishing in the Convention Area (paragraph 7.7). Interim advice on important gaps was provided; intersessional investigation and refinement of information is required to determine more accurately the potential utility to CCAMLR of data from these research programs (paragraphs 7.9 to 7.18).

(iii) The sampling effort required to estimate accurately seabird by-catch rates is to be investigated intersessionally (paragraph 7.33).

7.173 Data on incidental mortality of seabirds during regulated longline fishing in the Convention Area:

1998:

(i) Revision of data and results for Subareas 58.6 and 58.7 (Tables 46 to 48) gave new by-catch totals and rates that were 63% and 39% of the 1997 values (paragraph 7.21).

(ii) Results of intersessional analysis of all scientific observer data from 1997 and 1998 confirmed the importance of time of year (very few birds caught after April) and use of streamer lines in reducing seabird by-catch but the effects of most other factors (including line weighting) could not be fully analysed with the existing data (paragraphs 7.22 to 7.25).

(iii) The Working Group concluded that further improvements to, and assessments of, mitigation measures will need testing using carefully designed experiments (rather than continuing analysis of general scientific observer data) (paragraph 7.28).

1999:

(iv) Timely data submissions ensured excellent availability of data for scrutinising at the meeting (paragraph 7.30).

(v) For Subarea 48.3, the seabird by-catch (210 birds) was reduced by 65% and the by-catch rate (0.01 birds/thousand hooks) by 67%, compared with 1998. However, there was scope for further reductions through improving offal discharge, daytime setting and line weighting (paragraphs 7.36 to 7.38).

(vi) For Division 58.5.1, no data were received, but at least 151 seabirds were killed. France was asked to submit data in timely fashion to future meetings (paragraphs 7.39 and 7.40).

(vii) For Subareas 58.6 and 58.7, seabird by-catch (156 birds) was reduced by 70% and by-catch rates (0.03 birds/thousand hooks) by 85%, compared with 1998 (paragraphs 7.41 to 7.44). The biggest reductions in by-catch were achieved by the change in fishing area and by the use of underwater setting. The Working Group recommended that fishing within 200 km of the Prince Edward Islands should be prohibited from January to March inclusive (paragraphs 7.45 and 7.46).

(viii) For Subarea 88.1, there was no seabird by-catch (paragraph 7.34).

General:

(ix) In comparing seabird by-catch and by-catch rate in the regulated fishery over the last three years (Table 54), these have been reduced by 96.4% and 95.7% respectively in Subarea 48.3, and by 81.3% and 94.2% respectively in Subareas 58.6 and 58.7 from 1997 to 1999. This has been achieved by a combination of improved used of mitigating measures in compliance with Conservation Measure 29/XVI and by delaying the start of fishing until after the end of the breeding season of most albatross and petrel species (paragraph 7.47).

7.174 Compliance with Conservation Measure 29/XVI:

(i) Overall, levels of compliance with elements of Conservation Measure 29/XVI are steadily improving, particularly with respect to night setting and offal discharge. Compliance with line weighting and overall use of streamer lines is still far from satisfactory. Two autoline vessels, operating in Subarea 88.1, complied with all aspects of Conservation Measure 29/XVI (subject to the variation to allow daytime setting granted under Conservation Measure 169/XVII). For the remainder of the vessels, either insufficient data were provided to assess full compliance or not all elements of the conservation measure were complied with (paragraph 7.48 and Table 16).

(ii) Line weighting: one vessel complied with the line-weighting regime that applies to vessels using the Spanish system (6 kg every 20 m) on two of three cruises; one other vessel used a line-weighting regime very close to the requirement (5 kg every 20 m) on two of five cruises. The average weight (kg) per metre of mainline for 1997, 1998 and 1999 was 0.102 (5 kg at 45 m), 0.096 (6 kg at 45 m) and 0.142 (7 kg at 44 m) respectively. This indicates a substantial increase in overall weight added to lines in 1998/99, but still well below the level specified by Conservation Measure 29/XVI (paragraph 7.49).

(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 during the haul, or to discharge on the opposite side of the vessel to hauling. In Subarea 48.3, 71% of the vessels discharged offal on the opposite side to hauling, compared with only 31% in 1998. In Subarea 88.1, vessels achieved compliance through having a fish meal plant operating to process offal (paragraph 7.50).

(iv) Night setting: night setting was successfully completed for 80% of sets in Subarea 48.3 and 84% in Subareas 58.6 and 58.7. Excluding daytime sets made during mitigation measure experimentation by the *Argos Helena* in Subarea 48.3 and *Eldfisk* in Subareas 58.6 and 58.7, values are 86% and 98% respectively, compared with 90% and 93% for 1998 (paragraph 7.51).

(v) Streamer lines: both vessels fishing in Subarea 88.1 used streamer lines that complied with Conservation Measure 29/XVI. No vessels fishing in Subareas 48.3, 58.6 and 58.7 used streamer lines that met all aspects of the CCAMLR design. The length of streamer lines was the element with lowest compliance; only 10% of vessels in Subareas 58.6 and 58.7 and 26% in Subarea 48.3 had lines that were at least 150 m long. Compliance with attachment height and number and spacing of streamers is generally close to 100% (paragraph 7.52, Tables 16 and 17).

7.175 Assessment of incidental mortality of seabirds during unregulated longline fishing in the Convention Area:

(i) The estimates of potential seabird by-catch by area for 1999 (paragraphs 7.64 to 7.68, Tables 55 and 56) were:

Subarea 48.3:	3 230–4 360 to 11 700–15 800 seabirds;
Subareas 58.6 and 58.7:	12 070–16 140 to 23 800–32 100 seabirds;
Divisions 58.5.1 and 58.5.2:	110–155 to 3 725–5 050 seabirds; and
Division 58.4.4:	3 015–4 030 to 5 030–7 130 seabirds.

(ii) The overall estimated totals for the whole Convention Area (paragraph 7.69 and Table 56) indicate a potential seabird by-catch in the unregulated fishery of 18 000–25 000 (lower level) to 44 000–59 000 birds (higher level) in 1998/99. 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. Any suggestion of a decrease in 1998/99 should be viewed with caution, given the uncertainties and assumptions involved in these calculations.

(iii) The species composition of the estimated potential seabird by-catch (Table 57) indicates a potential by-catch of 21 000 to 46 500 albatrosses, 3 600 to 7 200 giant petrels and 57 000 to 138 000 white-chinned petrels in the unregulated fishery in Convention Area over the last three years.

(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 7.73).

(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.

7.176 Incidental mortality of seabirds in relation to new and exploratory fisheries:

(i) Of those new and exploratory fisheries approved for 1998 which were operational in 1998/99, that in Subarea 88.1 (New Zealand) caught no seabirds (paragraph 7.34). Those in Subareas 58.6 and 58.7 (South Africa) had low levels of seabird by-catch and are reviewed in detail in paragraphs 7.41 to 7.47.

(ii) The full texts of assessments of risk of by-catch of seabirds in all statistical subdivisions of the Convention Area (except Subarea 48.5) were compiled into a background document for the use of the Scientific Committee and Commission (paragraph 7.82; SC-CAMLR-XVIII/BG/23).

(iii) All proposals this year for new and exploratory fisheries were reassessed in terms of risk of by-catch of species and groups of seabirds at risk (paragraph 7.84 and Table 58). In respect of this year's proposals, potential conflict between proposed fishing seasons and advice on seasons closed to fishing to protect seabirds was:

(a) minor for Divisions 58.4.3 (European Community), 58.4.4 (Chile, European Community, South Africa and Uruguay), Subareas 58.6 (Chile, European Community, South Africa) and 58.7 (South Africa);

(b) substantial for Divisions 58.4.3 (France), 58.4.4 (France), 58.5.1 (France), Subareas 58.6 (France) and 58.7 (France); and

(c) uncertain for Division 58.5.1 (Chile).

(iv) Detailed advice was provided in respect of the New Zealand request for a continuation of the variation from Conservation Measure 29/XVI for exploratory fishing in Subarea 88.1 (paragraphs 7.85 to 7.93). Otherwise it was recommended that Conservation Measure 29/XVI should be retained for longline fisheries in all parts of the Convention Area.

7.177 Incidental mortality of seabirds during longline fishing outside the Convention Area:

(i) Information on seabird by-catch outside the Convention Area, submitted by Australia, continues to indicate that substantial by-catch occurs of species and populations breeding within the Convention Area (paragraphs 7.96 to 7.100).

(ii) The Working Group received no data from other Members, especially for regions adjacent to the Convention Area, such as New Zealand, South Africa, southern South America and the Falkland/Malvinas Islands; appropriate Members were requested to provide relevant data for next year's meeting (paragraphs 7.102 and 7.103).

7.178 Research into, and experience with, mitigating measures:

(i) Offal discharge: vessels still operating with offal discharge on the same side as the haul, in contravention of the Conservation Measure 29/XVI, should undertake waste-pipe reconfiguration using information from the *Koryo Maru 11* (paragraph 7.110).

(ii) Line weighting: experiments into line-weighting regimes using the Spanish system vessels in Subarea 48.3 in February (paragraphs 7.111 to 7.115) and autoline vessels in Subarea 88.1 in January and February (paragraph 7.116) showed reductions in bird by-catch rates from 3.98 birds/thousand hooks to <1 bird/thousand hooks (in Subarea 48.3) and zero by-catch (in Subarea 88.1). These results have potentially important implications for longline fishing practices in the Convention Area.

(iii) The experiment using a Mustad underwater setting funnel in Subareas 58.6 and 58.7 between August 1998 and June 1999, showed that seabird by-catch using the funnel (0.002 birds/thousand hooks) was significantly less than when not using the funnel (0.017 birds/thousand hooks) (paragraph 7.122). Further use and development of this system was strongly encouraged (paragraph 7.124).

(iv) Technical coordinators of national scientific observation programs were requested to provide relevant information on operational issues and fishing strategy procedures that may influence the successful use of mitigation measures, especially line-weighting regimes, for next year's meeting of WG-FSA (paragraphs 7.126 and 7.127).

7.179 International and national initiatives:

(i) Initiatives relating to reducing seabird by-catch in longline fisheries by FAO, CMS, Australia and New Zealand (paragraphs 7.128 to 7.149).

(ii) Adoption by FAO of its IPOA–Seabirds in 1999 and its request for FAO member States to produce NPOAs and report on them to FAO in 2001. Longlining Members of the Commission are encouraged to develop their own NPOA–Seabirds and to report on progress (paragraphs 7.129 to 7.131).

(iii) An initiative by the Valdivia Group to assist conservation of southern hemisphere albatrosses (paragraph 7.133).

(iv) Progress with implementation of the Australian Threat Abatement Plan (paragraphs 7.137 to 7.140).

(v) The intention of New Zealand to host an International Fishers Forum in 2000 to improve the development of mitigation measures and encouragement to Members to participate (paragraphs 7.144 to 7.149).

7.180 Strategic and policy issues:

(i) The recommendation that vessels which had proven unable or unwilling to comply with all the provisions of Conservation Measure 29/XVI should not be allowed to fish in the Convention Area (paragraphs 7.152 to 7.154).

(ii) Within the Convention Area, IUU longline fishing now poses the principal survival threat for most, if not all, the species and populations of at-risk seabirds (paragraph 7.156).

(iii) The impact of IUU fishing on seabirds could be reduced by increasing the benefit to fishers of using vessels or fishing practices which were configured and/or operated in ways to reduce the probability of seabird by-catch (e.g. underwater setting, integrated weighted autolines) (paragraph 7.157).

(iv) Relaxation of current fishing season restrictions could only be recommended when there is compliance with all the main elements of Conservation Measure 29/XVI (paragraph 7.160).

(v) Vessels able to demonstrate that they have consistently (i.e. in every cruise) achieved full compliance with each element of Conservation Measure 29/XVI in a fishing season should, in the following year, be allowed to fish at any time of year (paragraphs 7.163 to 7.166). In respect of this:

(a) compliance would need careful verification, particularly with respect to line weighting, by ad hoc WG-IMALF and WG-FSA, on the basis of all available data and the report of the scientific observer;

(b) appropriate line-weighting regimes for autoline vessels need determining.

(c) to the extent feasible, there should be in-port inspections of vessels in order to ensure that they are configured, and have all fishing and related gear necessary, to be able to comply in full with Conservation Measure 29/XVI; and

(d) longline fishing should cease if a significant level of bird by-catch occurs (cf. the Scientific Committee recommendation in SC-CAMLR-XVII, paragraphs 4.67 and 4.68, with respect to the New Zealand proposal for fishing in Subarea 48.1 in 1998/99). Advice on appropriate levels of seabird by-catch, on an area-specific basis, would be provided by ad hoc WG-IMALF to WG-FSA.

Given these considerations, the Working Group felt that it might be premature to advise adoption of this procedure at the present meeting (paragraph 7.164).

(vi) The need for rapid further progress in conducting experiments to define the optimum (minimum) line-weighting regime that will eliminate (or reduce to a very low level) seabird by-catch for both autoliners and vessels using the Spanish system. As an incentive to attract the cooperation of fishers and fishery managers, such experiments, which should be conducted in accordance with a strictly specified experimental design, could be undertaken under CCAMLR Conservation Measure 64/XII (paragraphs 7.167 and 7.168).

OTHER INCIDENTAL MORTALITY

Longline Vessels – Marine Mammals

8.1 Interactions between longline vessels and marine mammals appear to be increasingly reported by scientific observers (paragraph 3.55 and Table 15). However, no deaths of marine mammals were reported. A dolphin (species undetermined) was hooked in Subarea 48.3 but released itself. Sperm whales were temporarily entangled on two occasions in longlines in Subareas 58.6 and 58.7 (Table 15).

Trawl Fishing

8.2 In Subarea 48.2 Japanese krill fishery vessels killed two seals (species unreported but most likely to be Antarctic fur seals); a third seal was released alive.

8.3 In Subarea 48.3 the observer on the Russian trawler *Zakhar Sorokin*, fishing for *C. gunnari*, reported that a total of six seabirds (four black-browed albatrosses and two white-chinned petrels (actually reported as sooty albatross)), were killed by the warps of the net during hauling; and one white-chinned petrel was released in poor condition.

8.4 CCAMLR-XVIII/BG/31 reported that, during fishing in Division 58.5.2, the *Southern Champion* reported three white-chinned petrels killed after entanglement in trawl nets. One cape petrel was found dead on deck, probably striking the warp; one Antarctic fur seal was recovered from the codend of a trawl. On the *Austral Leader*, one cape petrel was found dead on deck, near the trawl doors.

8.5 Information provided in WG-FSA-99/26 and 99/72 emphasised the importance of minimising seabird interactions with relevant trawl operation. Procedures causing fewer interactions or bird mortalities occurred with vessels operating according to the following procedures:

(i) no netsonde cable;
(ii) no discharge of waste products; and
(iii) low levels of lighting.

8.6 The following requirements, largely derived from operations described in WG-FSA-99/72, are considered appropriate for all trawl fishery operations in the Convention Area. All vessels should have demonstrated capacity to:

(i) retain waste products from fishing;

(ii) operate without the need for plastic packaging bands in fishing operations (this is already prescribed in Conservation Measure 63/XV); and

(iii) maintain lighting levels and locations so as to give minimum outwardly-directed illumination.

8.7 However, the Working Group noted that, although such measures may minimise seabird by-catch, there are other aspects of the activities of trawl fisheries that may have adverse effects on seabirds (e.g. alteration of nest attendance patterns, provisioning rate etc.) that need further research.

8.8 Vessels conducting trawl fishing operations in the Convention Area should have a demonstrated capacity to retain waste products from fishing and to organise the location and power of lights so as to minimise the risk of bird strikes.

FUTURE WORK

9.1 The Working Group reviewed the activities of subgroups which had worked during the intersessional period, and provided 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 1999/2000 intersessional period. Where possible, each subgroup would focus on a small number of key tasks, achievable within the intersessional period. 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.

Intersessional Work of Subgroups

9.2 WG-FSA identified major tasks for the 1999/2000 intersessional period, and assigned these to seven subgroups:

(i) A subgroup to compile catch and effort data from regulated and IUU fishing activities, coordinated by Mr B. Watkins (South Africa) and assisted by Mr S. Fitch (Australia), Dr Prenski and Prof. Duhamel.

(ii) A subgroup to review observer reports and information, coordinated by Dr Balguerías with assistance from Dr Barrera-Oro and an IMALF member.

(iii) An assessment group coordinated by Dr Constable and assisted by Drs Agnew, Gasiukov, Kirkwood and Parkes. This subgroup was asked to focus on further developments of the GYM, including the incorporation of multiple selection

functions and the development of post-processing capabilities (paragraph 3.145). The subgroup was also asked to address some of the key management issues regarding *C. gunnari* (paragraph 9.8).

(iv) A subgroup to review, and where necessary, assess the biology and demography of species considered by the Working Group, coordinated by Dr Everson and assisted by Dr Prenski, Prof. C. Moreno (Chile), and Drs J. Ashford (UK), P. Horn (New Zealand) and J. Kalish (Australia). WG-FSA recognised that this subgroup had expertise in ageing fish and had established a mechanism for reading otoliths from *D. eleginoides* (e.g. WG-FSA-99/43 and 99/68). The subgroup was asked to finalise a method for ageing *D. eleginoides* using otoliths and to provide advice on how best to advance the analysis of otoliths collected by scientific observers. Advice on otolith collection strategies was also sought.

(v) A subgroup to compile data necessary for ad hoc WG-IMALF activities;

(vi) A subgroup to review the tasks of scientific observers, coordinated by Mr Watkins with the assistance of Mr Williams. The subgroup was asked to:

(a) review the tasks of scientific observers;
(b) determine the relevance of data collected;
(c) address priorities for data collection and activities; and
(d) coordinate data requests with requests from WG-EMM and ad hoc WG-IMALF.

(vii) A subgroup to document the extent of by-catch in CCAMLR fisheries, coordinated by Dr Agnew with the assistance of Dr Prenski (paragraph 4.98). Tasks would include:

(a) quantifying the data available in the CCAMLR database and the national archives of Members;

(b) identifying the needs for additional data and develop strategies for collecting such data;

(c) analysing data on by-catch; and

(d) investigating options for general by-catch provision for assessed fisheries.

9.3 The work of last year's subgroup tasked with the review of new and exploratory fisheries activities and notifications had been undertaken by the Secretariat, and the Working Group requested that this be repeated for the next meeting (paragraph 9.8).

9.4 The Working Group proposed that the Secretariat investigate the feasibility of establishing news groups via the website to assist with the coordination of this work.

Other Intersessional Work

9.5 The Working Group agreed that a summary of the issues discussed, assumptions made and problems encountered during this meeting should be circulated to all participants prior to the next meeting. This summary would provide a focused starting point for future assessments. The Working Group tasked the Convener, subgroup coordinators and the Secretariat with the preparation of such a summary soon after this meeting. This summary should be included in the Secretariat's paper 'Data and Resources Available to WG-FSA-2000' which will be distributed one to two months prior to the next meeting.

9.6 The Working Group identified a number of other tasks which should be carried out by participants and the Secretariat during the intersessional period. These tasks are summarised below. References are given to paragraphs in the report which contain details of these tasks.

9.7 The following tasks were identified as part of developing the CCAMLR database:

Secretariat:

(i) Finalise the transfer of survey data to the new database, and validate data extraction routines (paragraph 3.7).

(ii) Link descriptions of maturity scales to research survey datasets (paragraph 3.122).

(iii) Process all available fishery and observer data from the split-year prior to the meeting (ongoing).

(iv) Process, where possible, all available fishery and observer data from the current fishing season prior to the meeting (ongoing).

(v) Publish seabed areas (by subarea and division, and by fishable depth ranges of *Dissostichus* spp.) in the *Statistical Bulletin* (paragraphs 10.7 and 10.8).

(vi) Publish the *Fishery Data Manual* (paragraph 10.13).

Members:

(vii) Submit overdue fishery data (paragraph 3.14).

(viii) Submit corrected C2 data (the UK and others as requested by the Secretariat, paragraph 3.16).

(ix) Submit detailed bathymetry data (paragraphs 3.21 and 10.8).

(x) Inform the Secretariat of any errors in the descriptions of maturity scales (paragraph 3.122).

(xi) Submit data on catches of target species taken outside the Convention Area by next meeting (ongoing).

(xii) Submit observer logbook data and reports within the deadlines set by the Commission (ongoing).

(xiii) Submit recent survey data and support documentation to the Secretariat so that these data could be used in future analyses of the Working Group – note that survey data need to be submitted in a format, and using data codes, compatible with those in use in the CCAMLR database (ongoing).

9.8 The following tasks were identified as part of the work in stock assessment analyses and modelling:

Secretariat:

(i) Maintain an up-to-date suite of software so as to fully document and operate validation procedures and models (ongoing).

(ii) Review notifications for new and exploratory fisheries.

(iii) Update estimates of seabed areas in relation to notifications of new and exploratory fisheries (ongoing).

Members:

(iv) Collect information on mesh/hook selectivity for *Dissostichus* spp. (paragraph 3.82).

9.9 The Working Group reaffirmed the urgent need to examine the short-term implications of the current management strategies for *C. gunnari*, and to develop long-term management strategies. A workshop to investigate options for long-term management had been planned for 1999 and subsequently postponed (SC-CAMLR-XVII, Annex 5, paragraph 9.10). The Working Group agreed that the need for such a workshop remained high, although its timing could not be established at this stage. In the interim, some management issues were referred to the assessment subgroup for advancement during the intersessional period.

9.10 In addition, the Working Group encouraged participants to undertake as a matter of urgency, the necessary analyses required under the major biological components of the terms of reference. These were:

(i) to review the fisheries on *C. gunnari* in various subareas and divisions, including trends in catches and changes in stock composition in terms of length and age;

(ii) to review information on the biology and demography of the species, including age, growth, reproduction and diet;

(iii) to review information on stock identity, structure and movements, including distribution, movements, segregation by age and stock separation;

(iv) to review estimates of absolute and relative abundance and year-class strength;

(v) to review the historical assessment methods, including short- and long-term methods and highlight their shortcomings; and

(vi) to evaluate interactions of *C. gunnari* with other components of the ecosystem, including krill and fur seals, to investigate past fluctuations in natural mortality and explore the potential to predict changes in M.

9.11 The following tasks were identified as part of the revision of data collection and procedures for scientific observers:

Secretariat:

(i) Investigate sampling strategies for measuring fish, and identify implications for assessments (paragraph 9.2(iii)).

(ii) Extend the table of nautical twilight times (paragraph 3.68).

9.12 The data collection priorities of scientific observers were further discussed, and WG-FSA agreed, as an interim measure for 2000, that technical coordinators ask scientific observers to concentrate on one of three major fish data collection activities during each trip: the collection of otoliths (especially from large fish), or the collection of by-catch data, or the collection of biological data. This, however, should not imply that any of the three data collection activities should be completely ignored on any one cruise.

9.13 WG-FSA also confirmed that factual sightings by scientific observers of vessels engaged in IUU fishing were valuable in identifying fishing areas. This task had been endorsed by the Commission (CCAMLR-XVII, paragraph 8.16) on the proviso that the independence

and integrity of scientific observers were not compromised, and that this activity be confined to gathering data in support of the Scientific Committee. The Working Group recommended that scientific observers should continue reporting data on sightings in their reports.

IMALF Intersessional Work

9.14 The tasks listed below were identified as part of the work on the assessment of incidental mortality of seabirds and marine mammals arising from fishing operations. The list comprises those tasks which are not standing requests or repetition or continuation of items which appeared in the 1999 plan of intersessional work. The latter items will be so identified in the 2000 work plan, which is attached as Appendix D. The following tasks were identified:

Secretariat:

(i) Intersessional analysis of scientific observer data in order to evaluate the resolution and accuracy of estimates of seabird by-catch rates in relation to observed by-catch rates (paragraph 7.33).

(ii) Document exact procedure for converting observer data on seabird by-catch into estimates of overall by-catch and by-catch rates for vessels and subareas (e.g. in relation to Tables 46 to 54).

(iii) Coordinate responses from technical coordinators on feedback requested from the industry on operational issues (paragraphs 7.126 and 7.127).

(iv) Circulate observer reports to one representative of each country participating in WG-IMALF.

Members:

(v) Assist interpretation of research programs into the population status and foraging ecology of albatross, giant petrel and *Procellaria* petrels (paragraphs 7.17 and 7.18).

(vi) Provide information on current status of research programs on population genetic profiles of albatrosses (paragraph 7.16).

(vii) Further use and development of underwater setting systems (paragraph 7.124).

(viii) Data on incidental mortality of seabirds for regions adjacent to the Convention Area, especially from Argentina, Chile, France, New Zealand, South Africa and the UK (paragraph 7.102).

(ix) Acquisition of any outstanding data from EEZs to ensure comprehensive assessments can be undertaken (paragraph 7.40).

(x) Report on efficacy of mitigating measures in use in longline fisheries in New Zealand in 1998/99 and 1999/2000 (paragraph 7.91).

(xi) Participation in workshops addressing issues relating to seabird by-catch in longline fisheries (paragraphs 7.128 and 7.144 to 7.149).

(xii) Implementation of actions under the Australian Threat Abatement Plan (paragraphs 7.137 to 7.140).

(xiii) Reports on progress towards development of NPOAs in relation to FAO IPOA–Seabirds (paragraph 7.131).

9.15 The following tasks should be carried out intersessionally in cooperation with technical coordinators:

(i) review the comments of scientific observers, revise logbook forms and instructions, publish and distribute updates by February 2000;

(ii) urge vessel owners and captains to provide as much protection as possible for observers against adverse weather conditions (SC-CAMLR-XVII, Annex 5, paragraph 3.61); and

(iii) encourage technical coordinators and scientific observers in promoting awareness of the details of CCAMLR conservation measures in force (SC-CAMLR-XVII, Annex 5, paragraph 3.77).

OTHER BUSINESS

Website

10.1 Dr Ramm reported on recent developments and usage of the CCAMLR website. This had been the second year that meeting papers submitted electronically had been available via a secure webpage, and a growing number of participants had accessed material through the Internet. Approximately 20% of all papers submitted to the meeting had been sentelectronically and loaded on the website.

10.2 Documents submitted in paper format were not suitable for placing on the website because these would need to be either scanned as images or as text using character recognition software. Documents scanned as images usually result in large files, leading to long download times via the Internet. Documents scanned using character recognition software would require additional proofreading to ensure that all characters were correctly assigned. WG-FSA encouraged all participants to submit papers electronically to future meetings.

10.3 Participants who had used the website had found the facility extremely useful. They encouraged the Secretariat to continue development of the website, and other participants to make use of this new tool. Dr Miller emphasised the need to quantify hit rates so as to objectively evaluate the usage of the website. This information would also provide guidance in further development of the website.

10.4 Dr Everson reported on the recommendations of WG-EMM concerning the website (Annex 4, paragraphs 10.1 to 10.12). WG-EMM had identified several tasks for the Secretariat during 1999/2000 (Annex 4, paragraph 12.7), including:

(i) placing advance copies of meeting reports on a secure webpage;

(ii) providing public access to a text file containing information (authors, dates, titles and abstracts) on papers and documents held in the CCAMLR bibliography, and related to the work of WG-EMM; and

(iii) providing public access to text files summarising STATLANT data reported in the *Statistical Bulletin.*

10.5 In addition, WG-EMM had encouraged its members to submit via email, all documents intended for circulation prior to meetings and other information for use on the web, using formats specified in Annex 4, paragraph 10.4.

10.6 WG-FSA explored the possibility of loading all meeting documents on the server used by the Working Group during the meeting, so that these may be accessed by participants using their laptop computers. The Secretariat was encouraged to investigate this option.

Seabed Areas

10.7 WG-FSA discussed the central role of seabed area estimates in its work on new and exploratory fisheries, and a proposal to publish summary information on seabed areas in the *Statistical Bulletin*. This proposal would ensure that key information was readily available, and updated as new data were acquired and analyses refined.

10.8 The Working Group recommended that a summary of seabed areas, by subarea and division, and by fishable depth ranges of *Dissostichus* spp., be published annually in the *Statistical Bulletin*. In addition, disaggregated data used in these estimations should be submitted to the CCAMLR database so that these data may be available to future assessments.

Fishes and Fish Resources of the Antarctic

10.9 The need to translate a newly published book by Dr K. Shust (Russia) on *Fishes and Fish Resources of the Antarctic* was reviewed by a subgroup during the meeting. The book was written in Russian, with an English summary. The subgroup, led by Dr Kock, concluded that it would be useful to translate from Russian to English the headings, figure and table captions, and the references to Russian publications; Dr Kock estimated that this task would require about two days of one of the Secretariat's Russian translators. Dr Miller stressed the need to establish criteria for evaluating such requests, and to determine which material should be translated. The Working Group referred this matter to the Scientific Committee.

Bibliography on Antarctic Fish

10.10 Dr Kock advised that he had received a number of requests to update and distribute a bibliography on Antarctic fish which he had compiled over many years. However, due to other work commitments, he had been unable to complete this task, and sought support from the Working Group to secure funding for an assistant to complete the task. Dr Kock estimated that approximately A$8 000 would be required to update the bibliography, transfer the information to CD-ROM, and distribute. WG-FSA agreed that this type of information would be generally useful to publish. However, most members of WG-FSA already had access to such material. The Working Group referred this matter to the Scientific Committee; financial support may be sought from SCAR.

Biology of Polar Fish

10.11 Dr Everson reminded the Working Group of the forthcoming international symposium on the 'Biology of Polar Fish'. This symposium is being hosted by the Fisheries Society of the British Isles and will be held in Cambridge, UK, from 24 to 28 July 2000.

CCAMLR Science

10.12 Following last year's request by the Scientific Committee, the Secretariat has applied to the Institute for Scientific Information (ISI) to include *CCAMLR Science* in its publication *Current Contents* and in the *Science Citation Index.* An application was forwarded to ISI in February. The institute recently advised that the evaluation will be completed following the issue of the sixth volume of the journal.

Fishery Data Manual

10.13 WG-FSA reviewed the draft *Fishery Data Manual* (WG-FSA-99/8), and recommended that it be published as a loose-leaf publication in the four languages of the Commission, as recommended last year (SC-CAMLR-XVII, Annex 5, paragraphs 9.4 to 9.6).

Martin White

10.14 The Working Group learnt, with great sadness, of the passing of Martin White of the British Antarctic Survey, UK. Martin was a distinguished Antarctic fish biologist, and had been an active and highly respected member of the CCAMLR community. He died on 3 July 1999, after a short battle with cancer.

ADOPTION OF REPORT

11.1 The report of the meeting was adopted.

CLOSE OF THE MEETING

12.1 Dr Miller, on behalf on the Working Group, thanked Mr Williams for his excellent work in convening the meeting. He had done an excellent task in his first year as Convener, and had skilfully steered the group through difficult assessments and lengthy discussions. The Working Group had also greatly appreciated the long hours that participants had worked during the meeting, and in particular thanked Dr Constable, Ms E. van Wijk (Australia) and Drs Parkes, Kirkwood and Marschoff. The Working Group also thanked all the staff at the Secretariat for their high level of support at the meeting.

12.2 The Working Group reflected on the length of the meeting and the amount of work which it had faced over the past 11 days. Several options for facilitating an earlier start to substantive work at future meetings were discussed. Ideas proposed to shorten the lead-up period at the start of the next meeting included:

(i) reducing the amount of new material distributed during the first day of the meeting by encouraging participants to submit their papers electronically at least one to two weeks in advance of the meeting;

(ii) providing a summary of key events during the last meeting to all participants one to two months in advance of the meeting (paragraph 9.5); and

(iii) encouraging participants to meet for an informal 'ice-breaker' on the Sunday evening prior to the start of the meeting.

12.3 Mr Williams agreed to investigate such options for the meeting in 2000. In addition, he expressed concern at the growing amount of work associated with the assessments, and the increasing burden carried by a small number of participants. He sought assistance of colleagues in encouraging more experts in assessments modelling and statistics to participate in the activities of WG-FSA, therefore spreading the load of this aspect of the Working Group's work.

12.4 In closing the meeting, the Convener thanked the Working Group for their excellent work. He also thanked the rapporteurs for their efforts, and especially Drs Kirkwood, Constable and Parkes for working under extreme pressure in the final days of the meeting.

12.5 The meeting was closed.

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Table 1: Summary of available bathymetry data.

Region	Data Available
Southwest Atlantic	
48.1	Kock (1986), Kock and Harm (1995), GEBCO, GEODAS, Sandwell and Smith
48.2	GEBCO, GEODAS (see WG-FSA-99/33), Sandwell and Smith
48.3	Everson (1987), Everson and Campbell (1990), GEBCO, GEODAS, Sandwell and Smith
48.4	GEBCO, GEODAS, Sandwell and Smith
48.5[2]	GEBCO, GEODAS, Sandwell and Smith
48.6	GEBCO, GEODAS, Sandwell and Smith[1]
Western Indian	
58.4.2	GEBCO, GEODAS, Sandwell and Smith[1]
58.4.3	GEBCO, GEODAS, Sandwell and Smith[1]
58.4.4	GEBCO, GEODAS, Sandwell and Smith[1]
58.5.1	GEBCO, GEODAS, Sandwell and Smith[1]
58.5.2	GEBCO, GEODAS, Sandwell and Smith[1]
58.6	GEBCO, GEODAS, Sandwell and Smith[1]
58.7	GEBCO, GEODAS, Sandwell and Smith[1]
Eastern Indian	
58.4.1	GEBCO, GEODAS, Sandwell and Smith[1]
Southwest Pacific	
88.1[2]	GEBCO, GEODAS, Sandwell and Smith[1], ETOPO5[1] (see WG-FSA-98/50)
88.2[2]	GEBCO, GEODAS, Sandwell and Smith[1]
Southeast Pacific	
88.3	GEBCO, GEODAS, Sandwell and Smith

[1] Dataset used to estimate seabed areas reported in Table 24
[2] Extends south of 72°S

Table 2: Catches (tonnes) by species and area reported from the split-year 1998/99 (1 July 1998 to 30 June 1999). Source: STATLANT data.

Species Names	Area/Subarea/Division											All Areas
	48	48.1	48.2	48.3	58.4.1	58.4.3	58.5.1	58.5.2	58.6	5.87	88.1	
Raja georgiana											11	11
Antimora rostrata				<1	<1	<1			3	3	<1	6
Bathyraja eatonii											1	1
Bathyraja spp.											1	1
Chaenocephalus aceratus			1	<1								1
Chaenodraco wilsoni			<1									<1
Champsocephalus gunnari			1	265				73				339
Channichthyidae			<1								<1	<1
Channichthys rhinoceratus							1	2				3
Chionodraco rastrospinosus			1									1
Dissostichus eleginoides				4 291		<1	5 402	5 451	1 912	205	1	17 262
Dissostichus mawsoni			<1								296	296
Elasmobranchii				<1					1			1
Euphausia superba	76 341	8 150	12 585	4 741								101 817
Lepidonotothen squamifrons			5					10				15
Lithodes murrayi				<1					<1			<1
Lithodes spp.				<1								<1
Lithodidae				<1								<1
Macrourus carinatus											20	20
Macrourus spp.				12	<1	<1	1	1	24	21	1	61
Macrourus whitsoni											1	1
Medusae								2				2
Muraenolepis microps											4	4
Muraenolepis spp.											1	1
Myctophidae			<1	5								5
Gobionotothen gibberifrons			5									5
Notothenia neglecta			<1									<1
Notothenia rossii			<1				1	<1				2
Nototheniidae				<1				3			<1	3
Osteichthyes spp.			<1					<1				<1
Paralomis aculeata				<1								<1
Patagonotothen brevicauda				3								3
Porifera								<1				<1
Pseudochaenichthys georgianus			3	<1								3
Raja spp.											6	6
Rajiformes spp.			<1	15			6	4	1	<1		26
Somniosus pacificus								1				1
Trematomus spp.			<1									<1
Total	76 341	8 150	12 602	9 333	<1	<1	5 410	5 548	1 942	230	342	119 898

Table 3: Catches (tonnes) by species, area and gear reported for the 1998/99 fishing season (i.e. the period between the end of the Commission meeting in 1998 and the time of the WG-FSA meeting in 1999, except for krill fisheries).

Conservation Measure	Subarea/ Division	Location	Fishing Method	Catch Limit (tonnes)	Reported Catch (tonnes)
Euphausia superba:					
32/X	48		Trawl	1 500 000	101 820
45/XIV	58.4.2		Trawl	450 000	0
106/XV	58.4.1		Trawl	775 000	0
Dissostichus spp.:					
Established fisheries:					
154/XVII	48.3	South Georgia	Longline	3 500	3 652
156/XVII	48.4	South Sandwich Is	Longline	28	0
158/XVII	58.5.2	Heard Island	Trawl	3 690	3 480
–	58.5.1	Kerguelen EEZ	Trawl		3 042
–	58.5.1	Kerguelen EEZ	Longline		1 194
–	58.6	Crozet EEZ	Trawl		52
–	58.6	Crozet EEZ	Longline		1 019
–	58.6	Prince Edward Is EEZ	Longline		201
–	58.7	Prince Edward Is EEZ	Longline		180
Exploratory fisheries:					
166/XVII	58.4.1	West of 90°E	Trawl	261	<1
		East of 90°E		0	0
167/XVII	58.4.3		Trawl	625	<1
168/XVII	58.6	Outside EEZs	Longline	1 555	0
New fisheries:					
162/XVII	48.6	North of 60°S	Longline	707	0*
		South of 60°S	Longline	495	0
163/XVII	58.4.3	North of 60°S	Longline	700	0
		South of 60°S	Longline	0	0
164/XVII	58.4.4	North of 60°S (outside EEZ)	Longline	572	0
		South of 60°S	Longline	0	0
169/XVII	88.1	North of 65°S	Longline	271	0
		South of 65°S	Longline	2 010	298
Champsocephalus gunnari:					
153/XVII	48.3	South Georgia	Trawl	4 840	265
159/XVII	58.5.2	Heard Island	Trawl	1 160	2
Electrona carlsbergi:					
155/XVII	48.3	South Georgia	Trawl	109 000	0
Martialia hyadesi:					
165/XVII	48.3	South Georgia	Jig	2 500	0
Crab:					
151/XVII	48.3	South Georgia	Pot	1 600	4

* One South African vessel fished for three days.

Table 4: Reported catches (in tonnes) of *D. eleginoides* and *D. mawsoni* by Members and Acceding States in EEZs and in the CCAMLR Convention Area, and estimates of unreported catches from the CCAMLR Convention Area by Members and Acceding States in the 1998/99 split-year. Catches for the 1997/98 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	9 172[1]	(8 692)	1 668	(1 479)[4]	3 280	(5 640)[8]	14 120	(15 811)
Argentina	8 297	(5 651)	10	(0)	800	(5 760)[9]	9 107	(11 411)
France	0	(0)	6 260	(3 032)	0	(0)	6 260	(3 832)
Australia	100	(575)[2]	5 451	(2 418)	0	(0)	5 551	(2 993)
South Africa	79	(0)	948	(1 149)[5]	0	(1 200)[10]	957	(2 349)
UK	>1 416	(1 624)[3]	1 238	(590)	0	(0)	2 654	(2 214)
Uruguay	1 059	(?)	517	(262)[4]	0	(800)[11]	1 576	(1 062)
Ukraine	0	(0)	760	(997)[6]	0	(0)	760	(997)
Spain	0	(0)	154	(196)[4]	0	(0)	154	(196)
Rep. of Korea	0	(0)	255	(170)[4]	0	(0)	255	(170)
Peru	0	(156)	0	(0)	0	(0)	0	(156)
Japan	0	(0)	0	(76)[4]	0	(0)	0	(76)
New Zealand	<1	(0)	296	(41)[7]	0	(0)	323	(41)
USA	0	(0)	<1	(0)	0	(0)	<1	(0)
All countries	20 124	(16 698)	17 558	(11 210)	4 080	(13 400)	41 718	(41 308)

1 1998 calendar year
2 From Macquarie Island
3 From Falkland/Malvinas Islands
4 From Subarea 48.3
5 From South African EEZ in Subareas 58.6 and 58.7 and from Subarea 48.3
6 From French EEZ in Division 58.5.1
7 From Subarea 88.1; catch consisted mostly of *D. mawsoni*
8 Based on the following estimates: three vessels observed in Division 58.5.1, five vessels observed in Walvis Bay and Mauritius, assumed that eight vessels were fishing at some time during the season taking into account that some of these vessels were also involved in the regulated fishery in Subarea 48.3 for part of the year, effort – 940 days fishing, mean daily catch rate – 6 tonnes.
9 Based on the following estimates: four vessels observed or arrested in Division 58.5.1, three vessels landing catches in Walvis Bay, assumed that seven vessels were fishing at some time during the season, effort – 960 days fishing, mean daily catch rate – 6 tonnes.
10 Based on the following estimates: one vessel sighted in Division 58.5.1, probably fishing for the whole season, effort – 200 days fishing, mean daily catch rate – 6 tonnes.
11 Based on the following estimates: one vessel landing catch in Walvis Bay, assumed the vessel was fishing for part of the season when not involved in the regulated fishery in Subarea 48.3, effort – 133 days fishing, mean daily catch rate – 6 tonnes.

NB: An additional unreported catch of 1 200 tonnes was attributed to Portugal (European Community) in the 1997/98 split-year based on two vessels sighted in Division 58.5.1 fishing for part of the season (see SC-CAMLR-XVII, Annex 5, Table 3).

Table 5: Estimated landings (in tonnes) of IUU-caught *D. eleginoides* in southern African ports, Mauritius and Montevideo in the 1997/98 split-year, the 1998/99 split-year and the beginning of the 1999/2000 split-year. Values in parentheses indicate the number of recorded landings. Total green weight landings for 1998/99 are estimated as 16 636 tonnes.

Port	Product Weight 1997/98	Estimated Green Weight 1997/98	Product Weight Jul–Sep 1998	Estimated Green Weight Jul–Sep 1998	Product Weight 1998	Estimated Green Weight 1998	Product Weight 1998/99	Estimated Green Weight 1998/99	Product Weight Jul–Sep 1999	Estimated Green Weight Jul–Sep 1999
Walvis Bay	3 222[1]	5 477[1]	422[1]	717[1]	268[1,5] (2)	469[1,5] (2)	2 571[1,5] (19)	4 502	260[1,5] (1)?	455[1,5]
Cape Town/Durban	780[2]	1 326[1]	85[2]	150[1]			30 (1)	53	21[1,5] (1)	37[1,5]
Mauritius	11 780[3]	20 026[1]	4 320[3]	7 344[1]	1 286[1,5] (3)	2 251[1,5] (3)	6 813[1,5] (36)	11 923	146[1,5] (?)	256[1,5]
Montevideo							90 (1)	158		

1 Catches/landings conversion factor of product to green weight: 1.7.
2 Information from Australian commercial sources. Catches mostly from Kerguelen Plateau.
3 Information from Japanese Seafood Daily Newspaper, September 1997.
4 Minimum estimate from known landings.
5 Landings in Cape Town include catches from unregulated fishing up to the end of the 1996/97 split-year. Landings thereafter were from the licensed fishery only.
6 From data in WG-FSA-99/51.

Table 6: Estimated effort, mean catch rates/day and total catches by subarea/division in the unregulated fishery on *D. eleginoides* in the 1998/99 split-year. Estimates for the 1997/98 split-year are given in parentheses. The total estimated unreported catch for 1998/99 is 6 653 tonnes (or 8 573 tonnes[1]). The reported catch for 1998/99 is given in Table 4. The estimated total catch for 1998/99 is 23 914 tonnes (or 25 834 tonnes[1]).

Area/ Subarea/ Division	Estimated Start of Unregulated Fishery	No. of Vessels Sighted in Unregulated Fishery[1]	No. of Surveillance Vessels	Estimated No. of Vessels Fishing	No. of Days Fishing per Fishing Trip	Estimated Effort in Days Fishing (1)	Mean Catch Rate per Day[4] (tonnes) (2)	Estimated Unreported Catch (1) x (2)	Estimated Total Catch
48.6	No info								
48.3	1991	1[2] (0)		1[4] (0)				300–400[4]	4 931 (3 258)
58.7	Apr/May 1996	1 (8)	6 (5)	2 (10)	40[3]	100 (370)	1.4	140	345 (1 501)
58.6	Apr/May 1996	4 (6)	4 (3)	6 (30–35)[5]	40	920 (504)	1.9	1 748	3 660 (1 940)
58.5.1	Dec 1996	11 (26)	6 (6)	15 (35–40)[5]	40	310 (2 365)	2.0	620	6 022 (16 566)
58.5.2	Feb/Mar 1997	2 (3)	2 (2)	4 (30)[5]	40	80 (1 400)	2.0	160	5 611 (9 418)
58.4.4	Sep 1996	2 (0)	0	7 (2)	40	1 230 (180)	1.5	1 845	1 845 (900)
58		3 (40–50)		5	40	1 000	1.5	1 500	1 500

1 The additional reported three vessels would increase the unreported catch by 1 920 tonnes. However, other reports indicate a total IUU catch for 1998/99 in Subarea 48.3 of the order of 300 to 400 tonnes (see paragraph 3.33).
2 Double sightings in one zone not counted
3 Data from licensed operations.
4 Report of additional three vessels in 1998/99 in this subarea.
5 Estimated number of vessels not in areas throughout period, but moving between areas.

Table 7: Estimated total catch (in tonnes) by subarea/division of *D. eleginoides* and *D. mawsoni* in the CCAMLR Convention Area for the 1998/99 split-year. Estimates for the 1997/98 split-year are in parentheses.

Subarea/ Division	Estimated Total Catch		Reported Catch 1998/99		Estimated Unreported Catch		Unreported Catch in % of the Estimated Total Catch
48.1	(<1)		0	(<1)	probably low		
48.2	(<1)		0	(<1)	probably low		
48.3	4 931[1]	(3 258)	4 291	(3 258)	300–400[1]		13 or 65[1]
58.4.4	1 845	(900)	0	(0)	1 845	(900)	100
58.5.1	6 022	(16 566)	5 402	(4 741)	620	(11 825)	10
58.5.2	5 611	(9 418)	5 451	(2 418)	160	(7 000)	3
58.6	3 660	(1 940)	1 912	(175)	1 748	(1 765)	48
58.7	345	(1 501)	205	(576)	140	(925)	40
88.1	297	(41)	297	(41)	probably low		
88.3	(<1)		0	(<1)	probably low		
All subareas	24 211[2]	(33 625)	17 558	(11 210)	6 653[1]	(22 415)	27 or 38[1] or 69[3]

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 Proportion based on total landings in various ports (see Table 5).

Table 8: Estimates of total catches of *D. eleginoides* and *D. mawsoni* in various subareas and divisions from November 1998 to September 1999.

Subarea/Division	Convention Area Reported Catch[1]	Estimated Unreported Catch[2]	Estimated Total Catch
48.3	3 652	648[3]	4 300
58.4.4	0	1 845	1 845
58.5.1	4 236	698	4 934
58.5.2	3 480	148	3 628
58.6	1 272	1 715	2 987
58.7	180	150	330
88.1	298	0	298

1 From Table 3
2 Assumes no IUU catches between 1 July and 1 September 1999.
3 Calculation made during the meeting, but information on IUU fishing indicated 300–400 tonnes (Table 7, pargraph 3.33).

Table 9: Imports of whole *Dissostichus eleginoides* (tonnes) in Japan and the USA in 1998 (January–December) and 1999 (Japan: January–July; USA: January–June). Trade data for Japan were supplied by FAO. Whole weights were estimated by the Secretariat using a factor of 2.2 to convert fillet weight to whole weight.

Source	1998 (January–December)				1999 (January–June/July)			
	Japan	USA	Total	% of Total	Japan	USA	Total	% of Total
Argentina	1 820	3 984	5 805	14	696	1 909	2 605	11
Australia	1 781	457	2 237	5	1 459	268	1 727	7
Belize	892	403	1 294	3	99		99	<1
British Virgin Islands		2	2	<1		3	3	<1
Bulgaria	58		58	<1	78		78	<1
Canada	22	44	65	<1		1	1	<1
Cayman Islands		27	27	<1				0
Chile	18 539	1 936	20 475	48	9 274	990	10 265	44
China	656		656	2	2 095	324	2 419	10
Falkland/Malvinas	281	45	325	1	78	35	113	<1
France	2 477	57	2 534	6	1 816	385	2 202	9
Gambia	87		87	<1				0
Guinea-Bissau		31	31	<1				0
Guyana		4	4	<1				0
Hong Kong				0		36	36	<1
India		5	5	<1		10	10	<1
Indonesia				0		127	127	1
Maldives		41	41	<1				0
Mauritania	8		8	<1				0
Mauritius	3 066	537	3 603	8	714	251	965	4
Namibia	470	451	920	2	19		19	<1
Netherlands	6		6	<1				0
New Zealand	4		4	<1	16	129	145	1
Norway	269		269	1	71		71	<1
Panama	504	201	705	2	27	121	148	1
Republic of Korea	40		40	<1	205		205	1
Reunion Island	631		631	1	661		661	3
Seychelles		65	65	<1				0
Singapore					12		12	<1
South Africa	1 204	221	1 426	3	89	120	209	1
Spain	129		129	<1	180		180	1
St Helena	207		207	<1	24		24	<1
Thailand		43	43	<1		32	32	<1
United Kingdom	72	12	83	<1	32		32	<1
Uruguay	641	305	946	2	123	655	778	3
USA	21		21	<1	23		23	<1
Vanuatu	44		44	<1	20		20	<1
Total	33 929	8 867	42 796		17 811	5 396	23 207	

Table 10: Exports of *Dissostichus eleginoides* (tonnes) from Australia from 1 July 1998 to 30 June 1999. Data were supplied by Australia. Whole weights were estimated by the Secretariat using a factor of 2.2 to convert fillet weight to whole weight, and a factor of 1.7 to convert headed, gutted and tailed (HAT) weight to whole weight; 'heads' were not included.

Destination	Exports (tonnes)	
	Product	Whole Fish[1]
Contracting Parties to CCAMLR		
Japan	3 370	4 990
USA	227	336
Republic of Korea	58	85
Non-Contracting Parties to CCAMLR		
China	494	511
Others[2]	315	325
Total	4 463	6 247

Product Breakdown	Weight (tonnes)	
	Product	Whole Fish
HAT	1 906	3 239
Fillets	691	1 521
Heads	407	0
Whole fish	651	651
All products	3 654	5 411
HAT	448	761
Fillets	3	6
Heads	289	0
Whole fish	69	69
All products	809	836

[1] Pro-rata based on the product breakdown in the shaded box and the amount of product exported.
[2] Taiwan, Thailand, Singapore and Hong Kong

Table 11: Exports of *Dissostichus eleginoides* (tonnes) from Chile from January to July 1999. Data were supplied by FAO. It was not known whether the weights referred to processed or whole fish; no conversion factor was applied.

Product	Export (tonnes)
Frozen fish	5 002
Fresh fish on ice	1 521
Smoked fish	6
Total	6 529

Table 12: Estimated and reported catches of *Dissostichus* spp. by regulated and IUU operations.

Year	Regulated Catch Estimated	Reported IUU Catch	Estimated IUU Catch	Outside CCAMLR	Total Reported	Total
1996/97	12 897	10 626	38 000–42 800	22 365	45 888	73 262–78 062
1997/98	11 210	14 600	33 583	16 698	42 508	61 491
1998/99	17 558	?	10 733	20 124	37 165	41 201

Table 13: Summary of information contained in the observer cruise reports for the 1998/99 fishing 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; Fishing method: A – autoliner, Sp – Spanish, OTM – midwater trawl, OTB – bottom trawl, Pot – crab pots; Information on: LF – length frequency, CF – conversion factor; Y – yes, N – no, - unknown.

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)	10/4–30/7/99	Sp	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N
Argos Helena (GBR)	31/8–23/9/99	Pot	Y	Y	N	Y	Y	N	Y	Y	-	-	Y
Ibsa Quinto (ESP)	10/4–4/6/99	Sp	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Ibsa Quinto (ESP)	8/6–21/7/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Illa de Rua (URY)	8/4–28/6/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Illa de Rua (URY)	1/7–17/7/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N
Isla Camila (CHL)	11/4–22/6/99	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Isla Camila (CHL)	15/6–18/7/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
Isla Gorriti (URY)	8/5–12/6/99	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Isla Gorriti (URY)	12/6–17/7/99	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Isla Sofía (CHL)	31/3–31/6/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Isla Sofía (CHL)	28/6–22/7/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
Jacqueline (GBR)	11/4–21/7/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
Koryo Maru 11 (ZAF)	10/4–27/6/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Koryo Maru 11 (ZAF)	30/6–4/8/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N
Lyn (GBR)	9/4–14/6/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Lyn (GBR)	17/6–20/7/99	Sp	Y	Y	N	Y	Y	N	Y	Y	N	N	Y
Magallanes III (GBR)	14/5–21/8/99	Sp	Y	Y	Y	Y	Y	-	Y	Y	Y	Y	N
No. 1 Moresko (KOR)	11/4–22/7/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
Tierra del Fuego (CHL)	11/4–23/6/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	N	N	N
Tierra del Fuego (CHL)	17/6–25/7/99	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
Zakhar Sorokin (RUS)	13/2–13/3/99	OTM	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Subareas 58.6 and 58.7													
Arctic Fox (ZAF)	21/9–14/11/98	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Arctic Fox (ZAF)	24/11/98–11/1/99	A	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N
Arctic Fox (ZAF)	31/3–29/5/99	A	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
Arctic Fox (ZAF)	8/6–23/7/99	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N

continued

Table 13 continued

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	
Eldfisk (ZAF)	2/10–1/11/98	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Eldfisk (ZAF)	1/5–23/6/99	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Koryo Maru 11 (ZAF)	3/11–28/12/98	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Koryo Maru 11 (ZAF)	5/1–5/2/99	Sp	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Koryo Maru 11 (ZAF)	6/2–24/3/99	Sp	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Subarea 88.1													
Janas (NZL)	23/12/98–5/3/99	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
San Aotea II (NZL)	22/12/98–3/3/99	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Division 58.5.2													
Austral Leader (AUS)	20/8–24/9/98	OTB	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
Southern Champion (AUS)	27/9-11/11/98	OTB	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y
Southern Champion (AUS)	19/11/98–6/1/99	OTB	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	N
Southern Champion (AUS)	13/1–3/3/99	OTB	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	N
Southern Champion (AUS)	10/3–29/4/99	OTB	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Southern Champion (AUS)	8/5–14/7/99	OTB	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	N
Divisions 58.5.2, 58.4.3, and 58.4.1													
Austral Leader (AUS)	14/3–13/5/99	OTB	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	N

Table 14: Disposal of wastes and oil reported by observers. Nationality: AUS – Australia, CHL – Chile, ESP – Spain, GBR – United Kingdom, KOR – Republic of Korea, NZL – New Zealand, RUS – Russia, URY – Uruguay, ZAF – South Africa; Fishing method: A – autoliner, Sp – Spanish, OTM – midwater trawl, OTB – bottom trawl, Pot – crab pots; 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 Helena (GBR)	10/4–30/7/99	Sp	-	-	Y	Y	-
Argos Helena (GBR)	31/8–23/9/99	Pot	-	-	-	-	-
Ibsa Quinto (ESP)	10/4–4/6/99	Sp	-	-	Y	Y	Y
Ibsa Quinto (ESP)	8/6–21/7/99	Sp	-	-	-	-	-
Illa de Rua (URY)	8/4–28/6/99	Sp	-	-	-	-	-
Illa de Rua (URY)	1/7–17/7/99	Sp	-	-	-	-	-
Isla Camila (CHL)	11/4–22/6/99	Sp	-	-	-	-	Y
Isla Camila (CHL)	15/6–18/7/99	Sp	-	-	-	-	-
Isla Gorriti (URY)	8/5–12/6/99	A	-	-	-	-	-
Isla Gorriti (URY)	12/6–17/7/99	A	-	-	-	Y	-
Isla Sofía (CHL)	31/3–31/6/99	Sp	-	-	-	-	-
Isla Sofía (CHL)	28/6–22/7/99	Sp	-	-	-	-	-
Jacqueline (GBR)	11/4–21/7/99	Sp	-	-	-	-	-
Koryo Maru 11 (ZAF)	10/4–27/6/99	Sp	-	-	-	-	-
Koryo Maru 11 (ZAF)	30/6–4/8/99	Sp	-	-	-	-	-
Lyn (GBR)	9/4–14/6/99	Sp	-	-	-	-	-
Lyn (GBR)	17/6–20/7/99	Sp	N	-	Y	-	-
Magallanes III (GBR)	14/5–21/8/99	Sp	-	-	-	Y	-
No. 1 Moresko (KOR)	11/4–22/7/99	Sp	-	-	-	-	-
Tierra del Fuego (CHL)	17/6–25/7/99	Sp	-	-	-	-	-
Tierra del Fuego (CHL)	11/4–23/6/99	Sp	-	-	-	-	-
Zakhar Sorokin (RUS)	13/2–13/3/99	OTM	N	-		N	
Subareas 58.6 and 58.7							
Arctic Fox (ZAF)	21/9–14/11/99	A	-	-	-	Y	-
Arctic Fox (ZAF)	24/11–1/1/99	A	-	-	-	N	-
Arctic Fox (ZAF)	31/3–29/5/99	A	-	-	-	-	-
Arctic Fox (ZAF)	8/6–23/7/99	A	N	N	N	N	-
Eldfisk (ZAF)	2/10–1/11/98	A	-	-	-	-	Y
Eldfisk (ZAF)	1/5–23/6/99	A	-	-	Y	-	-
Koryo Maru 11 (ZAF)	3/11–28/12/98	Sp	N	-	N	Y	-
Koryo Maru 11 (ZAF)	5/1–5/2/99	Sp	N	-	N	Y	-
Koryo Maru 11 (ZAF)	6/2–24/3/99	Sp	-	-	N	N	-
Subarea 88.1							
Janas (NZL)	23/12/98–5/3/99	A	N	-	-	N	-
San Aotea II (NZL)	22/12/98–3/3/99	A	N	N	N	N	-
Division 58.5.2							
Austral Leader (AUS)	20/8–24/9/98	OTB	N	N	N	N	
Southern Champion (AUS)	27/9–11/11/98	OTB	N	N	N	N	
Southern Champion (AUS)	19/11/98–6/1/99	OTB	N	N	N	N	
Southern Champion (AUS)	13/1–3/3/99	OTB	N	N	N	N	
Southern Champion (AUS)	10/3–29/4/99	OTB	-	-	-	Y	
Southern Champion (AUS)	8/5–14/7/99	OTB	N	N	N	N	
Divisions 58.4.1, 58.4.3 and 58.5.2							
Austral Leader (AUS)	14/3–13/5/99	OTB	N	N	N	N	

Table 15: Marine mammal incidental mortality and interactions with fishing operations reported by observers. 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 Helena (GBR)	10/4–30/7/99	Y	N	N	Y (KIW, SEA, SPW)
Argos Helena (GBR)	31/8–23/9/99	Y	N	N	N
Ibsa Quinto (ESP)	10/4–4/6/99	Y	N	N	Y (KIW)
Ibsa Quinto (ESP)	8/6–21/7/99	Y	N	N	Y (SEA, SPW)
Illa de Rua (URY)	8/4–28/6/99	Y	N	N	N
Illa de Rua (URY)	1/7–17/7/99	Y	N	N	Y (SPW)
Isla Camila (CHL)	11/4–22/6/99	Y	N	N	Y (KIW, SPW)
Isla Camila (CHL)	15/6–18/7/99	Y	N	N	Y (SEA, SPW)
Isla Gorriti (URY)	8/5–12/6/99	Y	N	N	N
Isla Gorriti (URY)	12/6–17/7/99	Y	N	N	Y (KIW)
Isla Sofía (CHL)	31/3–31/6/99	Y	N	Y (DLP)	Y (KIW, SEA)
Isla Sofía (CHL)	28/6–22/7/99	Y	N	N	N
Jacqueline (GBR)	11/4–21/7/99	Y	N	N	Y (KIW, SEA)
Koryo Maru 11 (ZAF)	10/4–27/6/99	Y	N	N	Y (KIW, SEA)
Koryo Maru 11 (ZAF)	30/6–4/8/99	Y	N	N	N
Lyn (GBR)	9/4–14/6/99	Y	N	N	Y (KIW)
Lyn (GBR)	17/6–20/7/99	Y	N	N	Y (KIW)
Magallanes III (CHL)	14/5–21/8/99	Y	N	N	Y (SPW, SEA)
No. 1 Moresko (KOR)	11/4–22/7/99	Y	N	N	Y (KIW, SPW)
Tierra del Fuego (CHL)	11/4–23/6/99	Y	N	N	Y (KIW, SEA)
Tierra del Fuego (CHL)	17/6–25/7/99	Y	N	N	Y (SEA, SPW, KIW)
Zakhar Sorokin (RUS)	13/2–13/3/99	Y	N	N	N
Subarea 58.6 and 58.7					
Arctic Fox (ZAF)	21/9–14/11/98	Y	N	N	Y (SPW, KIW)
Arctic Fox (ZAF)	24/11/98–1/1/99	Y	N	N	Y (KIW, SPW)
Arctic Fox (ZAF)	31/3–29/5/99	Y	N	Y (SPW)	Y (KIW, SPW)
Arctic Fox (ZAF)	8/6–23/7/99	Y	N	N	Y (KIW, SPW)
Eldfisk (ZAF)	2/10–1/11/98	Y	N	Y (SPW)	N
Eldfisk (ZAF)	1/5–23/6/99	Y	-	N	KIW SPW
*Koryo Maru 11 (*ZAF)	3/11–28/12/98	Y	N	N	N
Koryo Maru 11 (ZAF)	5/1–5/2/99	Y	N	N	N
Koryo Maru 11 (ZAF)	6/2–24/3/99	Y	N	N	Y
Subarea 88.1					
Janas (NZL)	23/12/98–5/3/99	Y	N	N	N
San Aotea II (NZL)	22/12/98–3/3/99	Y	N	N	N
Division 58.5.2					
Austral Leader (AUS)	20/8–24/9/98	Y	N	N	N
Southern Champion (AUS)	27/9–11/11/98	Y	Y (SEA)	Y	Y (SEA)
Southern Champion (AUS)	19/11/98–6/1/99	Y	N	N	N
Southern Champion (AUS)	13/1–3/3/99	Y	N	N	N
Southern Champion (AUS)	10/3–29/4/99	Y	N	N	N
Southern Champion (AUS)	8/5–14/7/99	Y	N	N	Y (SEA)
Divisions 58.4.1, 58.4.3 and 58.5.2					
Austral Leader (AUS)	14/3–13/5/99	Y	N	N	N

Table 16: Summary of compliance with Conservation Measure 29/XVI, based on data from scientific observers, for 1996/97, 1997/98 and 1998/99. 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]
Subareas 58.6 and 58.7												
1996/97	0 (60)	6	35	52	69 (87)	10 (66)	100 (60)	10 (66)	90 (66)	60 (66)	0.52	0.39
1997/98	0 (100)	6	55	93	87 (94)	9 (92)	91 (92)	11 (75)	100 (75)	90 (83)	0.08	0.11
1998/99	0 (100)	8	50	84[2]	100 (89)	0 (100)	100 (90)	10 (100)	100 (90)	100 (90)	0.05	0
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

[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.

Table 17: Compliance with streamer line minimum specifications, as reported by scientific observers, in accordance with the specifications of Conservation Measure 29/XVI. Nationality: CHL – Chile, ESP – Spain, GBR – United Kingdom, KOR – Republic of Korea, NZL – New Zealand, 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)		No. Streamers per Line		Spacing of Streamers per Line (m)		Length of Streamers (m)		
Subarea 48.3														
Argos Helena (GBR)	10/4–30/7/99	Sp	N	Y	(4.5)	N	(120)	Y	(35)	Y	(2)	-		-
Ibsa Quinto (ESP)	10/4–4/6/99	Sp	N	Y	(5)	Y	(150)	N	(4)	Y	(5)	-		-
Ibsa Quinto (ESP)	8/6–21/7/99	Sp	Y	Y	(5)	Y	(150)	-		Y	(1)	-		N
Illa de Rua (URY)	8/4–28/6/99	Sp	N	Y	(4.8)	N	(100)	Y	(5)	Y	(5)	-		Y
Illa de Rua (URY)	1/7–17/7/99	Sp	N	N	(4)	N	(125)	Y	(8)	Y	(5)	-		Y
Isla Camila (CHL)	11/4–22/6/99	Sp	N	Y	(7)	N	(60)	Y	(25)	Y	(2)	-		-
Isla Camila (CHL)	15/6–18/7/99	Sp	N	N	(3)	Y	(150)	Y	(5)	Y	(5)	-		-
Isla Gorriti (URY)	8/5–12/6/99	A	N	N	(3)	Y	(155)	Y	(6)	Y	(5)	-		Y
Isla Gorriti (URY)	12/6–18/7/99	A	N	Y	(4.5)	N	(35)	Y	(5)	-		Y	(5)	-
Isla Sofía (CHL)	31/3–25/6/99	Sp	N	Y	(5.5)	N	(85)	Y	(19)	Y	(4.5)	-		-
Isla Sofía (CHL)	28/6–22/7/99	Sp	N	Y	(6.4)	N	(78.5)	Y	(21)	Y	(3.3)	Y	(3)	-
Jacqueline (GBR)	11/4–21/7/99	Sp	N	Y	(5.5)	N	(75)	Y	(30)	Y	(2)	N	(0.5)	-
Koryo Maru 11 (ZAF)	10/4–27/6/99	Sp	Y	Y	(4.5)	Y	(150)	-		Y	(5)	-		Y
Koryo Maru 11 (ZAF)	30/6–4/8/99	Sp	N	Y	(5)	N	(120)	Y	(5)	Y	(5)	-		-
Lyn (GBR)	9/4–14/6/99	Sp	N	Y	(4.5)	N	(80)	Y	(26)	N	(6)	Y	(6)	Y
Lyn (GBR)	17/6–20/7/99	Sp	N	Y	(4.5)	N	(80)	Y	(25)	Y	(2.3)	-		N
Magallanes III (CHL)	14/5–21/8/99	Sp	N	Y	(5)	N	(25)	Y	(5)	Y	(4)	-		-
No. 1 Moresko (KOR)	11/4–22/7/99	Sp	N	Y	(6)	N	(51)	N	(4)	Y	(25)	-		Y
Tierra del Fuego (CHL)	11/4–23/6/99	Sp	N	Y	(7.5)	N	(45)	-		-		-		-
Tierra del Fuego (CHL)	17/6–25/7/99	Sp	N	N	(3)	N	(75)	Y	(11)	Y	(1.8)	-		-
Subareas 58.6 and 58.7														
Arctic Fox (ZAF)	21/9–14/11/98	A	Y	Y	(12)	Y	(150)	-		-		-		-
Arctic Fox (ZAF)	24/11/98–1/1/99	A	N	Y	(4.5)	N	(125)	Y	(10)	Y	(2.5)	-		-
Arctic Fox (ZAF)	31/3–29/5/99	A	N	Y	(4.5)	N	(125)	Y	(10)	Y	(2.5)	Y	(3.5)	Y
Arctic Fox (ZAF)	8/6–23/7/99	A	N	Y	(4.5)	N	(100)	Y	(7)	Y	(5)	-		-
Eldfisk (ZAF)	2/10–1/11/98	A	N	-		N	(120)	Y	(7)	Y	(4)	-		Y
Eldfisk (ZAF)	1/5–23/6/99	A	N	Y	(5.5)	N	(100)	Y	(8)	Y	(5)	-		Y

continued

Table 17 continued

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)		No. Streamers per Line		Spacing of Streamers per Line (m)		Length of Streamers (m)
Koryo Maru 11 (ZAF)	3/11–28/12/98	Sp	N	Y	(4.5)	N	(45)	Y	(10)	Y	(3)	-	Y
Koryo Maru 11 (ZAF)	5/1–5/2/99	Sp	N	Y	(4.5)	N	(45)	Y	(10)	Y	(3)	-	Y
Koryo Maru 11 (ZAF)	6/2–24/3/99	Sp	N	Y	(8)	N	(100)	Y	(12)	Y	(3)	N (0.2)	Y
Subarea 88.1													
Janas (NZL)	23/12/98–5/3/99	A	Y	Y	(8)	Y	(200)	Y	(5)	Y	(1.8)	-	Y
San Aotea II (NZL)	22/12/98–3/3/99	A	Y	Y	(5)	Y	(200)	Y	(10)	Y	(5)	-	-

Table 18: Summary of data on conversion factors collected by observers in the 1998/99 season.

Area/Subarea/ Division	No. of Vessels	No. of Cruises	No. of Hauls	No. of Fish in Sample Unit	No. of Sample Units
48.3	14	19	587	1	1 785
48.3*	1	1	56	1	205
48.3	2	2	19	2–5	19
48.3	2	2	5	6–15	5
48.3	3	3	14	16–29	14
48.3	2	2	21	>30	21
58.5.1	1	1	1	70	1
58.5.2	2	5	7	?	7
58.7	3	6	7	?	7
88	2	2	2	?	2

* All fish were headed, gutted and tailed with the exception of some fish in Subarea 48.3 which were headed and gutted.

Table 19: Comparisons of conversion factors determined by observers and used by vessels in reporting their catches in the 1998/99 season.

Area/Subarea/ Division	Difference (%)	Observer			Vessel		
		Mean	SD	n	Mean	SD	n
48.3	15	1.658	0.163	22	1.441	0.062	21
58.5.2	3	1.79	0.058	8	1.737	0.004	4
58.7	7	1.718	0.144	7	1.6	-	9
88	0	1.73	0.07	2	1.73*	0.07	2

* Figures determined by observers.

Table 20: Possible extent of under-reporting in Subarea 48.3.

Season	Total Catches Reported (tonnes)	Revised Catch Using Correction Factors
1996/97	3 812	4 163*
1997/98	3 328	3 727*
1998/99	3 652	4 197

* Factors taken from Table 13 of SC-CAMLR-XVII, Annex 5.

Table 21: History of new and exploratory fisheries within the Convention Area. Information was derived from STATLANT data, fine-scale data and/or catch and effort reports submitted by 29 September 1999. CM: Conservation Measure.

Area	Season	Type	CM	Catch Limit (tonnes)	Vessels	Vessel Days	Grids Fished	Reported Catch (tonnes)		Country
48.1	Longline fishery for *Dissostichus* spp. in Subarea 48.1									
	1997/98	New	134/XVI	1 957	1	14	12	1*	survey	Chile
	** pre-fishery survey – catch rate <0.1kg/hook – fishery not opened*									
48.2	Longline fishery for *Dissostichus* spp. in Subarea 48.2									
	1997/98	New	135/XVI	1 401	1	4	2	<1*		Chile
	** pre-fishery survey – catch rate < 0.1kg/hook – fishery not opened*									
48.3	Pot fishery for crab (Lithodidae) in Subarea 48.3									
	1992/93	Exploratory	60/XI	1 600				0	no fishing	
	1993/94	Exploratory	74/XII	1 600				0	no fishing	
	1994/95	Exploratory	79/XIII	1 600	1	60*	?	137		USA
	1995/96	Exploratory	91/XIV	1 600	1	90*	?	497		USA
	1996/97	Exploratory	104/XV	1 600				0	no fishing	
	1997/98	Exploratory	126/XVI	1 600				0	no fishing	
	1998/99	Exploratory	151/XVII	1 600	1	13	?	4		UK
	** assuming 10 vessel days per 10-day reporting period (SC-CAMLR-XV, Annex 5, Table 19)*									
48.3	Jig fishery for *Martialia hyadesi* in Subarea 48.3									
	1995/96	Survey			1	7	?	52		Republic of Korea
	1996/97	New	99/XV	2 500	1	19	2	81		Republic of Korea*, UK
	1997/98	Exploratory	145/XVI	2 500				0	no fishing	Republic of Korea, UK
	1998/99	Exploratory	165/XVII	2 500				0	no fishing	
	** fished*									
48.6	Longline fishery for *Dissostichus* spp. in Subarea 48.6									
	1996/97	New	114/XV	1 980				0	no fishing	South Africa
	1997/98	New	136/XVI	1 536				0	no fishing	Norway, South Africa
	1998/99	New	162/XVII	1 202	1	3	1	0		South Africa
58.4.1	Trawl fishery for *Dissostichus* spp. in Division 58.4.1									
	1998/99	Exploratory	166/XVII	261	1	7	5	<1		Australia

continued

Table 21 continued

Area	Season	Type	CM	Catch Limit (tonnes)	Vessels	Vessel Days	Grids Fished	Reported Catch (tonnes)		Country
58.4.3	Trawl fishery for *Dissostichus* spp. in Division 58.4.3									
	1995/96	New	88/XIV	200				0	no fishing	Australia
	1996/97	New	113/XV	1 980*	1	5	5	<1		Australia, South Africa**
	1997/98	Exploratory	144/XVI	963				0	no fishing	Australia
	1998/99	Exploratory	167/XVII	625	1	15	10	<1		Australia
	** combined catch limit for trawl and longline fisheries* *** did not fish*									
58.4.3	Longline fishery for *Dissostichus* spp. in Division 58.4.3									
	1996/97	New	113/XV	1 980*				0	no fishing	Australia, South Africa
	1997/98	New	137/XVI	1 782				0	no fishing	South Africa
	1998/99	New	163/XVII	700				0	no fishing	France
	** combined catch limit for trawl and longline fisheries*									
58.4.4	Longline fishery for *Dissostichus eleginoides* in Division 58.4.4									
	1997/98	New	138/XVI	580				0	no fishing	South Africa, Ukraine
	1998/99	New	164/XVII	572				0	no fishing	France, South Africa, Spain, Uruguay
58.5.2	Trawl fishery for deep-water species in Division 58.5.2									
	1995/96	New	89/XIV	50*	2**	?	?	<1		Australia
	1996/97	New	111/XV	50*				0	no fishing	Australia
	** per species* *** fishing operation combined with target fishery for Dissostichus*									
58.6	Longline fishery for *Dissostichus eleginoides* in Subarea 58.6 (except for waters adjacent to Crozet Islands and the Prince Edward Islands)									
	1996/97	New	116/XV	2 200				0	no fishing	South Africa
	1997/98	Exploratory	141/XVI	658	1	1	1	1		South Africa*, Russia, Ukraine
	1998/99	Exploratory	168/XVII	1 555				0	no fishing	South Africa, France
	** fished*									
58.7	Longline fishery for *Dissostichus eleginoides* in Subarea 58.7 (except for waters adjacent to the Prince Edward Islands)									
	1996/97	New	116/XV	2 200				0	no fishing	South Africa
	1997/98	Exploratory	142/XVI	312	1	2	2	<1		South Africa*, Russia, Ukraine
	1998/99	Ban on fishing	160/XVII	0				0	no fishing	
	** fished*									

continued

Table 21 continued

Area	Season	Type	CM	Catch Limit (tonnes)	Vessels	Vessel Days	Grids Fished	Reported Catch (tonnes)		Country
88.1	Longline fishery for *Dissostichus* spp. in Subarea 88.1									
	1996/97	New	115/XV	1 980	1	2	1	<1		New Zealand
	1997/98	Exploratory	143/XVI	1 510	1	29	27	39		New Zealand
	1998/99	Exploratory	169/XVII	2 281	2	76	38	298		New Zealand
88.2	Longline fishery for *Dissostichus* spp. in Subarea 88.2									
	1996/97	New	115/XV	1 980	1	1	1	<1		New Zealand
	1997/98	New	139/XVI	63				0	no fishing	New Zealand
88.3	Longline fishery for *Dissostichus* spp. in Subarea 88.3									
	1997/98	New	140/XVI	455	1	12	10	<1		Chile

Table 22: Data requirements for CCAMLR fisheries in 1998/99, as defined by conservation measures. TAC – catch and effort report, C – fine-scale catch and effort data, B – fine-scale biological data, Obs – observer logbooks and reports. Note: In addition, Member countries must submit STATLANT data for each split-year, including separate recordings of effort data for finfish and krill operations (e.g. CCAMLR-IV, paragraph 45b(ii); CCAMLR-XII, paragraph 4.18).

Fishery	Status	Gear	Target Species	Area	Types of Data			
					TAC	C	B	Obs
153/XVII		Trawl	*Champsocephalus gunnari*	48.3	51/XII	122/XVI*	121/XVI	153/XVII
159/XVII		Trawl	*Champsocephalus gunnari*	58.5.2	159/XVII	159/XVII	159/XVII	159/XVII
154/XVII		Longline	*Dissostichus eleginoides*	48.3	51/XII	122/XVI*	121/XVI	154/XVII
168/XVII	Exploratory	Longline	*Dissostichus eleginoides*	58.6	51/XII	122/XVI	121/XVI	161/XVII*
158/XVII		Trawl	*Dissostichus eleginoides*	58.5.2	158/XVII	158/XVII	158/XVII	158/XVII
164/XVII	New	Longline	*Dissostichus eleginoides*	58.4.4	51/XII	122/XVI	121/XVI	161/XVII*
156/XVII		Longline	*Dissostichus* spp.	48.4	51/XII	122/XVI*	121/XVI	156/XVII
162/XVII	New	Longline	*Dissostichus* spp.	48.6	51/XII	122/XVI	121/XVI	161/XVII*
166/XVII	Exploratory	Trawl	*Dissostichus* spp.	58.4.1	51/XII		121/XVI	167/XVII*
163/XVII	New	Longline	*Dissostichus* spp.	58.4.3	51/XII	122/XVI	121/XVI	161/XVII*
167/XVII	Exploratory	Trawl	*Dissostichus* spp.	58.4.3	51/XII		121/XVI	167/XVII*
169/XVII	Exploratory	Longline	*Dissostichus* spp.	88.1	51/XII	122/XVI	121/XVI	161/XVII*
155/XVII		Trawl	*Electrona carlsbergi*	48.3	40/X	122/XVI	121/XVI	
32/X		Trawl	*Euphausia superba*	48	32/X	32/X		
106/XV		Trawl	*Euphausia superba*	58.4.1	106/XV	106/XV		
45/XIV		Trawl	*Euphausia superba*	58.4.2	45/XIV	45/XIV		
165/XVII	Exploratory	Jig	*Martialia hyadesi*	48.3	61/XII	165/XVII		165/XVII
150/XVII	Exploratory	Pot	Crab	48.3	61/XII	151/XVII (Annex)	151/XVII (Annex)	150/XVII

* Reported on a haul-by-haul basis.

Table 23: Summary of notifications of new and exploratory fisheries in 1999/2000.

Member	Type of fishery[1]	Gear	Target Species	Subarea or Division[2]
Australia	New	Trawl	*Dissostichus* spp., *Chaenodraco wilsoni*, *Lepidonotothen kempi*, *Trematomus eulepidotus*, *Pleuragramma antarcticum*	58.4.2
Australia	Exploratory	Trawl	*Dissostichus* spp.	58.4.1 and 58.4.3
Chile	Exploratory	Longline	*Dissostichus* spp.	58.4.4, 58.5.1, 58.6, 88.1 and 88.2
France	New and exploratory	Longline	*Dissostichus* spp.	58.4.3, 58.4.4, 58.5.1, 58.5.2, 58.6 and 58.7
New Zealand	Exploratory	Longline	*Dissostichus* spp.	88.1
South Africa	New	Longline	*Dissostichus* spp.	48.6 and 58.4.4
South Africa	Exploratory	Longline	*Dissostichus eleginoides*	58.6
Uruguay	New	Longline	*Dissostichus* spp.	58.4.4
European Community (Portugal)	New and exploratory	Longline	*Dissostichus eleginoides*	48.6, 58.4.3, 58.4.4, 58.5.1, 58.6, 88.1 and 88.2

[1] Some fisheries may be considered as exploratory if new fisheries are conducted in 1998/1999.
[2] Outside Australian, South African and/or French EEZs.

Table 24: Seabed areas between 500 and 1 800 m and within the fishable depth ranges for trawling (500–1 500 m) and longlining (600–1 800 m) in Subareas 48.3, 48.6, 58.6, 58.7, 88.1, 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3, 58.4.4, 58.5.1 and 58.5.2. See WG-FSA-98/6 and 98/50 for the methodologies. Excludes regions of permanent ice, including the Ross Sea ice shelf in Subarea 88.1 and Amery ice shelf in Division 58.4.2.

Area/ Subarea/ Division	Region	Fishery Proposed	Species	Seabed Areas (km^2)					
				Depth Range (m)				Fishing Depth Range (m)	
				0–500	500–600	600–1500	1500–1800	500–1500	600–1800
48.3[1]	Maurice Ewing Bank (North of 52.3°S)	Y	*D. eleginoides*	*	0	12 739	21 869	12 739	34 608
	South Georgia	Y	*D. eleginoides*	*	2 415	21 320	10 705	23 735	32 025
	Total			42 400	2 415	34 059	32 574	36 474	66 633
48.6	North of 60°S	Y	*D. eleginoides*	*	244	10 452	17 618	10 696	28 070
	South (60°S–72°S)	Y	*D. mawsoni*	*	6 974	36 868	19 278	43 842	56 146
	Total (to 72°S)			133 861	7 218	47 320	36 896	54 538	84 216
58.4.1	BANZARE Bank	Y	*D. eleginoides*	0	0	14 401	40 766	14 401	55 167
	Outside BANZARE Bank		*D. eleginoides*	0	43 524	198 567	77 410	242 091	275 977
	Total			0	43 524	212 968	118 176	256 492	331 144
58.4.2	62°S–72°S	Y	*D. mawsoni*	210 355	29 839	99 220	22 037	129 059	121 257
58.4.3	Inside EEZ	Y	*D. eleginoides*	101	0	0	3 053	0	3 053
	Outside EEZ			0	203	48 694	45 097	48 897	93 791
	Total			101	203	48 694	48 150	48 897	96 844
58.4.4	Total		*D. eleginoides*	7 499	1 721	15 587	7 156	17 308	22 743
58.5.1	Inside EEZ	Y	*D. eleginoides*	*	31 382	85 523	32 551	116 905	118 074
	Outside EEZ	Y	*D. eleginoides*	*	34	2 938	3 416	2 972	6 354
	Total			117 768	31 416	88 461	35 967	119 877	124 428
58.5.2	Inside EEZ (AUS)	Y	*D. eleginoides*	46 627	10 960	81 827	28 196	92 787	110 023
	Outside EEZ (AUS)	Y	*D. eleginoides*	0	14	629	454	643	1 083
	Total			46 627	10 974	82 456	28 650	93 430	111 106

continued

Table 24 continued

Area/ Subarea/ Division	Region	Fishery Proposed	Species	Seabed Areas (km^2)					
				Depth Range (m)				Fishing Depth Range (m)	
				0–500	500–600	600–1500	1500–1800	500–1500	600–1800
58.6	Delcano Rise outside EEZ (SA)	Y	*D. eleginoides*	*	169	8 450	19 313	8 619	27 763
	Delcano Rise inside EEZ (SA)	Y	*D. eleginoides*	*	245	8 065	17 355	8 310	25 420
	Crozet Islands outside EEZ (FRA)	Y	*D. eleginoides*	*	0	0	0	0	0
	Crozet Islands inside EEZ (FRA)	Y	*D. eleginoides*	*	1 550	13 041	5 071	14 591	18 112
	Total			18 148	1 964	29 556	41 739	31 520	71 295
58.7	Outside EEZ	Y	*D. eleginoides*	*	0	76	427	3 741	6 445
	Inside EEZ	Y	*D. eleginoides*	*	273	6 547	5 605	3 155	6 210
	Total			1 650	273	6 623	6 032	6 896	12 655
88.1	North of 65°S	Y	*D. eleginoides*	0	0	3168	7 670	3 168	10 838
	65°S–80°S	Y	*D. mawsoni*	202 022	114 973	197 114	39 277	312 087	236 391
	Total			202 022	114 973	200 282	46 947	315 255	247 229
88.2	North of 65°S	Y	*D. eleginoides*	0	26	299	0	325	299
	65°S–72°S[2]	Y	*D. mawsoni*	1 246	1 794	19 544	11 442	21 338	30 986
	Total			1 246	1 820	19 843	11 442	21 663	31 285

[1] Everson and Campbell depth estimates for Subarea 48.3 not utilised in this assessment.
[2] Does not include seabed areas south of 72°S which are not covered by the Sandwell–Smith database.
* Not calculated.

Table 25: Catch rates (kg/hook) by species, weighted by the number of hooks set in each region, by subarea and division, and the proportions these represent of the 1991/92 catch rate in Subarea 48.3.

Area	Years	Hooks	Species	Catch (kg)	CPUE (kg/hook)	Proportion of Subarea 48.3
48.3	1992	6 075 371	*D. eleginoides*	3 799 551	0.50	1.00
48.6	1997	12 350	*D. eleginoides*	494	0.04	0.09
58.5.1	1997	1 281 600	*D. eleginoides*	449 518		
	1998	3 348 317	*D. eleginoides*	1 117 152		
					0.33	0.66
58.6	1997	430 780	*D. eleginoides*	206 352		
	1998	1 595 430	*D. eleginoides*	623 459		
					0.30	0.60
58.7	1997	3 762 390	*D. eleginoides*	1 869 233		
	1998	2 946 651	*D. eleginoides*	639 513		
					0.37	0.74
88.1	1998	241 000	*D. mawsoni*	40 971		
	1999	1 400 824	*D. mawsoni*	296 236		
					0.20	0.39
58.4.4	1997	38 550	*D. eleginoides*	13 879	0.36	0.72

Table 26: Parameters input to the GYM for evaluation of long-term annual yield of exploratory fisheries for *D. eleginoides* and *D. mawsoni*. Requirements for GYM assessments are discussed in the text and the combinations of parameters (biological, recruitment, CPUE, seabed area) are given in Table 27. Parameters given here are for assessments of *D. eleginoides* requiring the adaptation for a longline fishery of biological parameters and recruitments from Division 58.5.2, and for assessments of *D. mawsoni* for exploratory longline fisheries and exploratory trawl fisheries. In the latter two cases, recruitments have been pro-rated by the fishable seabed area and the recruitment area respectively. Assessments requiring biological parameters and recruitments directly estimated from Subarea 48.3 longline fisheries and Division 58.5.2 trawl fisheries are given in Table 39.

Category	Parameter	*D. eleginoides* Division 58.5.2 Longline (outside EEZ)	*D. mawsoni* Subarea 88.1 Longline Total Fishing Area	*D. mawsoni* Division 58.4.2 Trawl Recruitment Area
Age structure	Recruitment age	4	4	4
	Plus class accumulation	35	35	35
	Oldest age in initial structure	55	55	55
Recruitment	Mean $\log_e$(recruits)	14.9285	15.888	16.435
	SE of mean $\log_e$(recruits)	0.2593	0.2528	0.259
	SD $\log_e$(recruits)	0.935	0.8385	0.935
Natural mortality	Mean annual M	0.0828–0.1242	0.18–0.22	0.18–0.22
von Bertalanffy growth	Time 0	-1.7969	-0.015	-0.015
	L_∞	1 946.0	182.9	182.9
	k	0.04136	0.089	0.089
Weight at age	Weight–length parameter – A	2.59E-09	0.000006	0.000006
	Weight–length parameter – B	3.2064	3.1509	3.1509

continued

Table 26 continued

Category	Parameter	*D. eleginoides* Division 58.5.2 Longline (outside EEZ)	*D. mawsoni* Subarea 88.1 Longline Total Fishing Area	*D. mawsoni* Division 58.4.2 Trawl Recruitment Area
Maturity	L_{m50}		100.0	100.0
	Range: 0 to full maturity		10.0	10.0
	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)		
Spawning season		01/07	01/08	01/08
Simulation characteristics	Number of runs in simulation	1 001	1 001	1 001
	Depletion level	0.2	0.2	0.2
	Seed for random number generator	-24 189	-24 189	-24 189
Characteristics of a trial	Years to remove initial age structure	1	1	1
	Observations to use in median SB_0	1 001	1 001	1 001
	Year prior to projection	1998	1997	1997
	Reference start date in year	01/11	01/12	01/12
	Increments in year	180	180	180
	Vector of known catches		0.039e6 0.298e6	
	Years to project stock in simulation	35	35	35
	Reasonable upper bound for annual F	5.0	5.0	5.0
	Tolerance for finding F in each year	0.000001	0.000001	0.000001
Fishing mortality	Length, 50% recruited	67.0	0.0	0.0
	Range over which recruitment occurs	24.0	0.0	0.0
	Fishing selectivity with age	0(1)	0(0), 5.27(0), 5.28(1), 16.27(1), 16.28(0)	0(0), 5(0.4), 6(0.7), 7.5(0.88), 8(0.9), 8.5(0.8), 10(0.3), 12(0.01), 16(0.005), 30(0)

Table 27: Assessment of long-term annual yields for new and exploratory fisheries for *D. eleginoides* and *D. mawsoni*. Approximate estimates are given in italics. Estimates in bold are derived from projections using the GYM. See text for details about how the approximate estimates were derived. Input parameters for the GYM are contained in Table 39 for respective longline and trawl fisheries from Subarea 48.3 and Division 58.5.2. Mean $\log_e$(recruits) were determined by adjusting the mean recruitment for South Georgia or Heard Island by the relative size of seabed area and, for longline fisheries that had CPUE estimates, the relative magnitude of CPUE compared to South Georgia. In the latter case, recruitments from South Georgia were applied. For other fisheries in the Indian Ocean, recruitments from Heard Island were applied. The origin of biological parameters is given. T – trawl, L – longline, E – *D. eleginoides*, M – *D. mawsoni*.

Subarea/ Division	Fishing Method	Species	Origin of Biological Parameters	Recruitment Area[1]	Fishing Area[2]	Catch History (tonnes) 1996, 1997, 1998, 1999	Mean Longline CPUE	Mean $\log_e$(recruits)			Yield Estimate (tonnes)		
								Seabed Only	Seabed and CPUE		Seabed Only	Seabed and CPUE	
								Fishing Ground	Recruitment Ground	Fishing Ground	Fishing Ground	Recruitment Ground	Fishing Ground
48.6	L	E	48.3		28070		0.04		12.147	11.23153	*2237*	**453**	**179**
48.6	L	M	88.1	133861	56146		0.04		12.84026	11.92479	*5142*	*1028*	*411*
58.4.1	T	E	58.5.2	0	14401			15.93837			*27870*		
58.4.2	T	M	88.1	210355	129059				16.4351	15.25155		**30394**	*9306*
58.4.3	L	E	58.5.2	0	93791			14.964			*7124*		
58.4.3	T	E	58.5.2	0	48897			14.28099			*94624*		
58.4.4	L	E	58.5.2	7499	22743	0, 0, 0, 1845	0.36		12.56088	13.21831		**746**	**1525**
58.5.1[3]	L	E	58.5.2		6354			15.17774			*482*		
58.5.2[3]	L	E	58.5.2	0	1083			14.92849			*80*		
58.6	L	E	58.5.2	18148	71295	9531, 19233, 2726, 2987	0.3	14.68939	13.26235	14.17856	*5878*	**1410**	**3526**
58.7	L	E	58.5.2	1650	12655	6137, 6951, 1611, 330	0.37	12.96061	11.07428	12.65951	*2250*	*184*	**900**
88.1	L	M	88.1	205022	236391	0, 0, 39, 298	0.2	15.88805	15.28144	14.97176	**21570**	**11690**	**8639**
88.1	L	E	58.5.2	0	10838		0.2	12.80562		11.88933	*1042*	*0*	*417*
88.2	L	M	88.1	1246	30986		0.2		10.17826	12.93981		*72*	*1135*
Reference details													
58.5.2	T	E	58.5.2	46627	93430			14.929	14.929	14.929	**3585**		
58.5.2	L	E			111106								
48.3	L	E	48.3	42400	66633		0.5	14.622	14.622	14.622	**5310**		

[1] 0 to 500 m
[2] 500 to 1 500 m depth in the trawl fishery and 600 to 1 800 m in the longline fishery
[3] Outside EEZ

Table 28: The coordinates of eight fishing grounds in Subareas 58.6, 58.7 and Division 58.4.4 (Figure 2).

Grid	Grid Coordinates				Length (n miles)		Seabed Area (km^2)
	Top Left Latitude	Top Left Longitude	Bottom Right Latitude	Bottom Right Longitude	Top	Side	0–2 000 m
1	-45	37	-48	40	130	180	33 921
2	-45	40	-48	44	170	180	33 918
3	-45	44	-48	48	170	180	39 213
4	-45	48	-48	51	130	180	25 367
5	-45	51	-48	54	130	180	13 232
6	-51	40	-54	42	80	180	4 031
7	-51	42	-54	46	150	180	14 180
8	-51	46	-54	50	150	180	7 749

Table 29: Estimation of sample sizes required to detect a proportional difference in sqrt(CPUE.kg) using a two-sided 5% test with power 0.8

Proportional Difference	Sample Size
0.05	362
0.07	161
0.10	91
0.15	41
0.20	23
0.25	15
0.30	11
0.35	8
0.40	6
0.45	5
0.50	54

Table 30: By-catch reported from longline fisheries targeting *Dissostichus* spp. during the 1998/99 season. TAC: catch and effort reports; OBS: observer data; C2: haul-by-haul longline data.

Subarea	By-catch (tonnes)		
	TAC	OBS	C2
48.3	27.4	85.1	41.1
Prince Edward Island EEZ (58.6 and 58.7)	62.0	57.3	no data
88.1	65.8	66.9	65.0

Table 31: Overall species composition of by-catch reported in the haul-by-haul data from longline fisheries in the 1998/99 season. The relative abundance of each taxon is expressed as the percentage by weight of the total catch.

Family	Species	% in Catch				
		48.3	58.6	58.7	88.1	Total
Lamnidae	*Lamna nasus*	0.01				0.01
Total Lamnidae		**0.01**				**0.01**
Rajidae	*Raja georgiana*	0.05			3.36	0.48
	Bathyraja eatonii	<0.01	0.02		0.29	0.04
	Bathyraja irrasa	<0.01				<0.01
	Bathyraja murrayi	0.02	1.46	0.13	<0.01	0.13
	Bathyraja spp.	<0.01			0.94	0.13
	Raja spp.			0.01	6.37	0.84
	Rajidae nei	0.69	0.13	0.16	<0.01	0.54
Total Rajidae		**0.76**	**1.60**	**0.30**	**10.96**	**2.16**
Other *Chondrichthyes*	Chondrichthyes nei	<0.01	0.63	0.11	<0.01	0.05
Total Other Chondrichthyes		**<0.01**	**0.63**	**0.11**	**<0.01**	**0.05**
Channichthyidae	*Pseudochaenichthys georgianus*	<0.01				<0.01
	Channichthyidae nei	<0.01			0.05	0.01
Total Channichthyidae		**<0.01**			**0.05**	**0.01**
Macrouridae	*Macrourus berglax*	<0.01				<0.01
	Macrourus carinatus	<0.01			5.54	0.74
	Macrourus holotrachys	0.03				0.02
	Macrourus spp.	0.89	4.87	10.20	0.28	1.38
	Macrourus whitsoni	<0.01	5.53	1.46	0.35	0.52
Total Macrouridae		**0.93**	**10.39**	**11.66**	**6.17**	**2.66**
Moridae	*Antimora rostrata*	0.07	1.55	0.99	0.01	0.20
Total Moridae		**0.07**	**1.55**	**0.99**	**0.01**	**0.20**
Muraenolepididae	*Muraenolepis microps*	<0.01			1.18	0.16
	Muraenolepis orangiensis				0.01	<0.01
	Muraenolepis spp.	<0.01	0.02	<0.01		<0.01
Total Muraenolepididae		**<0.01**	**0.02**	**<0.01**	**1.19**	**0.16**
Nototheniidae	*Notothenia kempi*	0.03				0.02
	Notothenia neglecta	<0.01				<0.01
	Notothenia squamifrons	<0.01				<0.01
	Nototheniops larseni			<0.01		<0.01
	Pagothenia hansoni				<0.01	<0.01
	Patagonotothen brevicauda	0.01				0.01
	Trematomus spp.		0.01	<0.01		<0.01
	Nototheniidae	0.01			0.01	0.01
Total Nototheniidae		**0.04**	**0.01**	**0.01**	**0.02**	**0.04**
Other Osteichthyes	Osteichthyes nei	0.01	<0.01	0.02	<0.01	0.01
Total Other Osteichthyes		**0.01**	**0.00**	**0.02**	**<0.01**	**0.01**
Lithodidae	*Lithodes murrayi*	0.02	0.03	0.01		0.01
	Paralithodes spp.		0.05	0.10		0.01
	Paralomis aculeata	0.04				0.03
	Lithodidae	0.01	<0.01		<0.01	0.01
Total Lithodidae		**0.07**	**0.09**	**0.12**	**<0.01**	**0.06**
Total Chondrichthyes		0.77	2.23	0.41	10.96	2.22
Total Ostheichthyes		1.05	11.97	12.67	7.44	3.07
Total Crustaceans		0.07	0.09	0.12	<0.01	0.06
Total		**1.89**	**14.29**	**13.19**	**18.39**	**5.36**

Table 32: Standardised series of CPUEs in kg/hook.

Season	Std. CPUE	SE
1991/92	0.441	0.034
1993/94	0.548	0.038
1994/95	0.541	0.022
1995/96	0.334	0.016
1996/97	0.267	0.015
1997/98	0.255	0.015
1998/99	0.271	0.015

Table 33: Proportions of non-zero catches by season.

Season	Proportion
1991/92	0.96
1993/94	0.94
1994/95	0.99
1995/96	0.98
1996/97	0.98
1997/98	0.98
1998/99	0.99

Table 34: Standardised series of CPUEs in numbers/hook.

Season	Std. CPUE	SE
1991/92	0.043	0.0044
1993/94	0.058	0.0052
1994/95	0.072	0.0032
1995/96	0.044	0.0022
1996/97	0.038	0.0023
1997/98	0.039	0.0023
1998/99	0.051	0.0025

Table 35: Trawl surveys from which length-density distributions 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
	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
	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

Table 36: Estimates of mean length (mm) and total density (numbers per km^2) for mixtures of normal distributions fitted to survey length-density distributions from surveys over the period 1986/87 to 1996/97 (assuming a split-year of 1 December to 30 November).

Survey	Nominal Age >>>	3	4	5	Sum of Observed Densities	Sum of Expected Densities
1987 US/Polish survey Nov–Dec 1986	mean length (mm)	380.27	465.945		49.7674	47.2886
	SD	19.4485	31.5855			
	total density (numbers per km^2)	20.4784	26.9235			
	SE	7.08769	4.42636			
1988 US/Polish survey Dec 1987–Jan 1988	mean length (mm)		467.821	560	21.3409	22.0951
	SD		41.3527	34.0006		
	total density (numbers per km^2)		14.4966	8.66871		
	SE		11.2833	12.5805		
1990 UK survey Jan 90	mean length (mm)	414.192	483.01	581.52	468.472	473.282
	SD	15.9212	22.693	34.9999		
	total density (numbers per km^2)	165.111	195.885	85.0901		
	SE	116.813	105.115	42.0315		
1991 UK survey Jan 91	mean length (mm)				578.823	199.007
	SD					
	total density (numbers per km^2)					
	SE					
1992 UK survey Jan 92	mean length (mm)	406.782			287.62	281.167
	SD	23.9804				
	total density (numbers per km^2)	281.373				
	SE	174.354				
1994 UK survey Jan–Feb 1994	mean length (mm)	444.837	521.726		122.462	125.88
	SD	13.9903	25.6162			
	total density (numbers per km^2)	36.2709	89.8471			
	SE	20.0802	32.6139			
1994 Argentine survey Feb–March 1994	mean length (mm)	469.404	529.3		48.029	49.578
	SD	1.73907	33.6715			
	total density (numbers per km^2)	2.61879	47.3539			
	SE	2.65314	9.32859			

continued

Table 36 continued

Survey	Nominal Age >>>	3	4	5	Sum of Observed Densities	Sum of Expected Densities
1995 Argentine survey Feb–March 1995	mean length (mm)	409.814	497.163	580	60.5409	65.5784
	SD	10.8096	29.858	39.3591		
	total density (numbers per km^2)	8.25306	21.9359	35.7098		
	SE	5.16069	9.22319	8.83209		
1996 Argentine survey March–April 1996	mean length (mm)	424.455	524.006	602.158	167.895	167.867
	SD	19	19	19		
	total density (numbers per km^2)	114.138	18.0444	22.2229		
	SE	39.7255	5.33346	6.7232		
1997 Argentine survey March–April 1997	mean length (mm)	426.46	500.479	573.708	122.912	124.561
	SD	19	19	19		
	total density (numbers per km^2)	26.3148	46.2928	16.3421		
	SE	8.31875	13.4333	6.77879		
1997 UK survey Sep 97	mean length (mm)	457.893	542.762	627.077	100.425	111.622
	SD	24.7427	29.9999	20.0001		
	total density (numbers per km^2)	52.9244	45.7511	13.6754		
	SE	32.2021	33.2331	16.6639		

Table 37: Estimated abundance at age (millions of fish) from a series of trawl surveys carried out at South Georgia.

Survey	Age 3		Age 4		Age 5	
	Numbers	SE	Numbers	SE	Numbers	SE
1987 US/Polish survey	0.883	0.306	1.162	0.191		
1988 US/Polishsurvey			0.574	0.447	0.343	0.498
1990 UK survey	6.700	4.740	7.948	4.265	3.453	1.705
1991 UK survey						
1992 UK survey	11.799	7.311				
1994 UK survey	1.446	0.801	3.583	1.301		
1994 Argentine survey	0.104	0.105	1.881	0.370		
1995 Argentine survey	0.312	0.195	0.830	0.349	1.351	0.334
1996 Argentine survey	4.680	1.629	0.740	0.219	0.911	0.276
1997 Argentine survey	1.064	0.336	1.873	0.543	0.661	0.274
1997 UK survey	1.952	1.188	1.687	1.226	0.504	0.615

Table 38: Recruitment to the stock of *D. eleginoides* in the Subarea 48.3 as numbers of fish at age 4, estimated from trawl surveys at South Georgia.

Split-year of Survey (1 December–30 November)	Weighted Mean Recruitments (age 4 in millions)
1986/87	1.146
1987/88	0.722
1988/89	4.106
1989/90	8.055
1990/91	5.786
1991/92	no estimate
1992/93	10.19
1993/94	2.061
1994/95	0.961
1995/96	0.701
1996/97	2.649
1997/98	1.119

Table 39: Input parameters for generalised yield model 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)	14.622	14.929
	SE of mean $\log_e$(recruits)	0.242	0.259
	SD $\log_e$(recruits)	0.839	0.935
Natural mortality	Mean annual M	0.132–0.198	0.0828–0.1242
von Bertalanffy growth	Time 0	-0.21	-1.7969
	L_∞	194.6	1946.0
	k	0.066	0.04136
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	01/11
	Increments in year	180	180
	Vector of known catches	8.501e6 4.206e6 7.309e6 5.589e6 6.605e6 6.171e6 4.362e6 2.619e6 3.201e6 4.3e6	18.96e6 3.913e6 3.628e6
	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

continued

Table 39 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 40: Recruitment to the stock of *D. eleginoides* in Division 58.5.2 as numbers of fish at age 4, estimated from three trawl surveys at Heard Island.

Split-year of Survey (1 November–31 October)	Weighted Mean Recruitments (age 4 in millions)
1987/88	1.550
1988/89	1.590
1989/90	3.649
1990/91	1.956
1991/92	1.793
1992/93	4.575
1993/94	2.435
1994/95	2.944
1995/96	5.674
1996/97	9.548
1997/98	21.557
1998/99	3.440
1999/2000	0.551

Table 41: Total catch (tonnes) by species of FV *Zakhar Sorokin* in Subarea 48.3 from 16 February to 10 March 1999.

Species	Catch (tonnes)	% of Total Catch
Champsocephalus gunnari	264.921	96.65
Chaenocephalus aceratus	0.153	0.05
Pseudochaenichthys georgianus	0.056	0.02
Patagonotothen guntheri	3.679	1.35
Myctophidae including *Gymnoscopelus nicholsi* (4.989 tonnes)	5.248	1.92
Other	0.035	0.01
Total	274.092	100

Table 42: Parameters input to the short-term yield calculations for *C. gunnari* in Subarea 48.3 and Division 58.5.2.

Category	Parameter	Subarea 48.3	Division 58.5.2
Survey	Date (days since birthday)	29 September 1997 (29)	1 June 1998 (213)
	Biomass – lower one-sided 95% confidence bound	31 563 tonnes	10 462 tonnes
Age structure	Estimated numbers at age	2 $1.194\ 10^8$	2 $4.882\ 10^5$
		3 $1.284\ 10^8$	3 $2.532\ 10^7$
		4 $2.332\ 10^7$	4 $2.880\ 10^7$
		5 $9.192\ 10^6$	5 $6.561\ 10^5$
		6 $9.369\ 10^5$	
Natural mortality	Mean annual M	0.42	0.4
Fishing mortality	Age when fully recruited to fishery	3.0	3.0
	Age when selection to fishery begins (ramps linearly to full selection)	1.5	1.5
von Bertalanffy growth	Birthday	01 September	01 September
	Time 0	0	0.234
	L_∞	455.0 mm	411.0 mm
	K	0.332	0.410
Weight–length ($W = aL^b$)	a (kg)	$6.172\ 10^{-10}$	$2.629\ 10^{-10}$
	b	3.388	3.515
Projection	Days of known catch since survey (until 1 November in current year)	426 + 395	152 + 395
	Catch since survey	5 tonnes + 265 tonnes	100 tonnes + 2 tonnes

Table 43: Trawl surveys used to generate length-density distributions analysed at this meeting.

Split-year	Survey	Vessel	Timing
1986/87	US/Polish	*Profesor Siedlecki*	November–December 1986
1991/92	UK	*Falklands Protector*	January 1992
1993/94	UK	*Cordella*	January–February 1994
	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

Table 44: Estimates of biomass (tonnes) and 95% confidence intervals (using method of de la Mare) by stratum for the South Orkney Islands (Subarea 48.2) for the three surveys examined (WG-FSA-99/32).

Species	Strata	Biomass (tonnes)		
		1985	1991	1999
C. aceratus	50–150 m	108 (56–156)	928 (201–15606)	1859 (887–7594)
	150–250 m	1119 (491–5313)	4014 (2423–8155)	5962 (2994–17599)
	250–500 m	3949 (2004–11510)	11089 (6707–21490)	2610 (1344–7012)
	Total	5175 (2997–12203)	16031 (10897–31093)	10431 (6628–22220)
C. gunnari	50–150 m	326 (96–7643)	74 (29–343)	501 (320–1002)
	150–250 m	273 (129–1073)	2415 (1040–8526)	1249 (757–2591)
	250–500 m	4225 (1764–18647)	21132 (10087–58918)	1267 (551–4280)
	Total	4824 (2297–18318)	23621 (12274–61450)	3016 (2027–6073)
C. rastrospinosus	50–150 m	12 (3–40)	10 (4–34)	153 (73–623)
	150–250 m	386 (179–1599)	605 (367–1191)	399 (282–640)
	250–500 m	4586 (1890–20846)	14795 (8751–29750)	12881 (7373–29114)
	Total	4983 (2254–15640)	15410 (9353–30368)	13434 (7921–28796)
G. gibberifrons	50–150 m	458 (237–675)	2089 (640–15999)	6248 (2304–49329)
	150–250 m	2865 (1396–10585)	4141 (2741–7241)	10173 (5960–22700)
	250–500 m	15642 (7702–50121)	47252 (22042–134375)	22479 (12840–50640)
	Total	18965 (10637–53483)	53483 (27924–140646)	38900 (26091–82780)
L. larseni	50–150 m	4 (2–9)	3 (1–17)	45 (14–474)
	150–250 m	141 (42–1635)	40 (21–96)	91 (47–249)
	250–500 m	301 (151–909)	412 (215–1005)	151 (105–241)
	Total	446 (239–1945)	455 (255–1049)	288 (205–718)
L. squamifrons	150–250 m	215 (11–489534)	57 (17–448)	875 (160–22497)
	250–500 m	5858 (1308–93944)	14099 (5373–56560)	50059 (14345–372432)
	Total	6073 (1444–495401)	14156 (5429–56617)	50934 (15129–373309)
N. rossii	50–150 m		2 (0–308)	58 (14–532)
	150–250 m	22 (4–57)	27 (13–59)	61 (25–126)
	250–500 m	140 (60–268)	384 (128–2257)	3160 (675–61159)
	Total	163 (77–293)	412 (155–1719)	3278 (790–60672)
P. georgianus	50–150 m	25 (na)	2 (na)	167 (48–1425)
	150–250 m	156 (50–1054)	349 (159–1121)	6504 (2350–35071)
	250–500 m	4557 (1173–55578)	18498 (8975–50461)	2057 (910–6836)
	Total	4739 (1319–42432)	18847 (9316–50810)	8728 (4138–36461)

Table 45: 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 paragraph 7.7; also Gales, 1998; Marchant and Higgins, 1990).

Species	Species Status[1]	Study Location	Annual Pairs	Year Commenced	Objectives	
					PM	FE
Wandering albatross	Vulnerable	South Georgia	2 178	1972	√	√
Diomedea exulans		Crozet	1 734	1960	√	√
		Kerguelen	1 455	1973	√	√
		Macquarie	10	1994	√	
				1998		√
		Marion	1 794	1979	√	√
		Prince Edward	1 277			
Gibson's albatross	Vulnerable	Auckland	65	1991	√	√
Diomedea gibsoni		Adams	5 762			
Antipodean albatross	Vulnerable	Antipodes	5 148	1994	√	√
Diomedea antipodensis						
Amsterdam albatross	Critically Endangered	Amsterdam	13	1983	√	√
Diomedea amsterdamensis						
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	√	√
Thalassarche chrysostoma		Diego Ramirez	10 000	1999	√	√
		Macquarie	84	1994	√	
				1999		√
		Campbell	6 400	1995	√	√
		Marion	6 217	1984	√	√
		Prince Edward	1 500			
		Kerguelen	7 900			
Black-browed albatross	Near Threatened	South Georgia	96 252	1976	√	√
Thalassarche melanophris		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	1995	√	√
Thalassarche impavida						
Indian yellow-nosed albatross	Vulnerable	Amsterdam	25 000	1978	√	√
Thalassarche carteri		Prince Edward	7 000			
		Crozet	4 430			

continued

Table 45 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	Data	Macquarie	1 100	1993	√	
Phoebetria palpebrata	deficient			1998		√
		Crozet	2 151	1970	√	√
		South Georgia	6 500			
		Marion	201			
		Kerguelen	3 000–5 000			
		Heard, McDonald	500-700			
		Auckland	5 000			
		Campbell	>1 500			
		Antipodes	<1 000			
Sooty albatross	Vulnerable	Crozet	2 298	1970	√	√
Phoebetria fusca		Amsterdam	300-400	1992	√	√
		Tristan da Cunha	2 750			
		Gough	5 000–10 000			
		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	1979	√	
		Marion		1984	√	√
		Adélie Land	9–11	1952	√	
		South Sandwich	800			
		Gough				
		Prince Edward	3 000			
		Kerguelen	3–5			
		Heard	2 350			
		South Orkney	8 755			
		South Shetland	7 185			
		Enderby Land	no estimate			
		Frazier	250			
		Antarctic Peninsula	1 125			
		Falklands/Malvinas	5 000			
Northern giant petrel	(Near	South Georgia	3 000	1980	√	
Macronectes halli	Threatened)		1 280	1998		√
		Macquarie	1 313	1994	√	
		Crozet		1979	√	
		Marion	500	1984	√	√
		Prince Edward				

continued

Table 45 continued

Species	Species Status[1]	Study Location	Annual Pairs	Year Commenced	Objectives	
					PM	FE
Northern giant petrel continued		Kerguelen	1 450–1 800			
		Auckland	no estimate			
		Campbell	230+			
		Antipodes	320			
		Chatham	no estimate			
White-chinned petrel *Procellaria aequinoctialis*	(Vulnerable)	South Georgia	2 000 000	1995–98	√	√
		Crozet	10 000s	1970	√	√
		Prince Edward	10 000s	1996	√	√
		Falklands/Malvinas	1 000–5 000			
		Kerguelen	100 000s			
		Auckland, Campbell, Antipodes	10 000–50 000			
Grey petrel *Procellaria cinerea*	(Vulnerable)	Gough	100 000s			
		Tristan da Cunha	1 000s			
		Prince Edward	1 000s			
		Crozet	1 000s			
		Kerguelen	1 000s			
		Campbell	10 000s			
		Antipodes	10 000s			

[1] As classified using IUCN criteria for threatened species (see Croxall and Gales, 1998).

Table 46: Incidental mortality of seabirds in the longline fisheries for *D eleginoides* in Subareas 58.6 and 58.7 during the 1997/98 season. Fishing method: A – autoliner, Sp – Spanish; Offal discharge at haul: O – opposite side to hauling, S – same side as hauling; D – day setting (including nautical dawn and dusk); N – night setting.

Vessel Name	Dates of Fishing	Fishing Method	Sets Deployed				No. of Hooks (1 000s)			Hooks Baited (%)	No. of Birds Observed						Observed Seabird Mortality (Birds/1 000 hooks)			Streamer Line in Use (%)		Offal Discharge at Haul (Position)
											Dead		Alive		Total							
			N	D	Total	%N	Observed	Set	% Observed		N	D	N	D	N	D	N	D	Total	N	D	
Aquatic Pioneer	15/1/97–9/1/98	A	105	0	105	100	129.8	296.2	43	80	1	0	0	0	1	0	0.01	0	0.01	72		-
Aquatic Pioneer	1/2–12/3/98	A	76	0	76	100	-	315.8	-	81	8	0	1	0	9	0	-	-	-	90		O
Aquatic Pioneer	1/4–14/598	A	95	0	95	100	-	341.6	-	78	1	0	0	0	1	0	-	-	-	100		O
Aquatic Pioneer	23/6–26/7/98	A	151	6	157	96	-	348.6	-	68	0	2	0	0	0	2	-	-	-	98	83	O
Eldfisk	3/3–17/4/98	A	240	0	240	100	164	884	18	85	8	0	1	0	9	0	0.05	0	0.05	85		O
Eldfisk	9/1–12/2/98	A	164	0	164	100	136.1	496.1	27	82	18	0	0	0	18	0	0.13	0	0.13	0		O
Eldfisk	19/8–14/9/98	A	69	69	138	50	58.2	395.2	14	63	0	0	0	0	0	0	0	0	0	100	98	O
*Koryo Maru 11**	19/11/97–15/1/98	Sp	-	-	101	-	451.7	533	84	100	27		27		54		-	-	0.06	-	-	S
Koryo Maru 11	3/2–10/3/98	Sp	57	13	70	81	434.1	434.1	100	100	104	55	11	2	115	57	0.29	0.68	0.37	0	0	O
Koryo Maru 11	28/7–31/8/98	Sp	48	0	48	100	40.4	269.4	15	100	1	0	3	0	4	0	0.02	0	0.02	100		O
Total						92%		4 314.0									0.15	0.54	0.19			

* Data obtained from observer cruise report (logbook data incomplete).

Table 47: Species composition of birds killed in longline fisheries in Subareas 58.6 and 58.7 during the 1997/98 season. D – daylight setting (including nautical dawn and dusk), N – night setting; MAH – northern giant petrel, MAI – southern giant petrel, PRO – white-chinned petrel, PTZ – unidentified petrels.

Vessel Name	Dates of Fishing	No. Birds Killed by Group						Species Composition (%)			
		Albatross		Petrels/ Fulmars		Total					
		N	D	N	D	N	D	MAI	PRO	MAH	PTZ
Aquatic Pioneer	15/1/97–9/1/98	0	0	1	0	1	0			1	
Aquatic Pioneer	1/2–12/3/98	0	0	8	0	8	0		8		
Aquatic Pioneer	1/4–14/5/98	0	0	1	0	1	0		1		
Aquatic Pioneer	23/6–26/7/98	0	0	0	2	0	2	2			
Eldfisk	9/1–12/2/98	0	0	18	0	18	0		18		
Eldfisk	3/3–17/4/98	0	0	8	0	8	0		8		
Eldfisk	19/8–14/9/98	0	0	0	0	0	0				
Koryo Maru 11	3/2–10/3/98	0	0	104	55	104	55		142		17
*Koryo Maru 11**	19/11/97–15/1/98	0	0		27		27		27		
Koryo Maru 11	28/7–31/8/98	0	0	1	0	1	0				1
Total %		0	0	141	27 57	141	27 57	2 (1)	204 (91)	1 (<1)	18 (8)

* Data obtained from observer cruise report (logbook data incomplete).

Table 48: Estimated seabird mortality by vessel for Subareas 58.6 and 58.7 during the 1997/98 season.

Vessel Name	Hooks Observed (1 000s)	Hooks Set (1 000s)	% Night Sets	Estimated Seabird Mortality during Line Setting		
				Night	Day	Total
Aquatic Pioneer	129.8	296.2	100	3	0	3
*Aquatic Pioneer**		315.8	100	47	0	47
*Aquatic Pioneer**		341.6	100	51	0	51
*Aquatic Pioneer**		348.6	96	50	8	58
Eldfisk	58.2	395.2	50	0	0	0
Eldfisk	136.1	496.1	100	64	0	64
Eldfisk	164.0	884.0	100	44	0	44
Koryo Maru 11	40.4	269.4	100	5	0	5
Koryo Maru 11	434.1	434.1	81	102	56	158
Koryo Maru 11	451.7	533.0	92	73	23	97
Total	1 414.3	4 314.0	92	441	87	528

* Estimates are based on the total observed catch rates.

Table 49: Summary of observations on fisheries conducted in the 1998/99 season by designated CCAMLR scientific observers.

Flag State	Vessel	Fishing Method	Observer	Subarea/ Fishery	Period of Observation	Report / Date Submitted	Data Reported
Chile	*Isla Camila*	LLS Spanish	P. Boyle Great Britain	48.3 *D. eleginoides*	15/6–18/7/99	Scientific Observer Logbook 31/8/99 Cruise Report 13/9/99	Cruise, vessel, and IMALF details
Chile	*Isla Camila*	LLS Spanish	N. Mynard Great Britain	48.3 *D. eleginoides*	11/4–22/6/99	Scientific Observer Logbook 3/8/99 Cruise Report 3/8/99	Cruise, vessel, and IMALF details
Chile	*Isla Sofía*	LLS Spanish	D. Owen Great Britain	48.3 *D. eleginoides*	28/6–22/7/99	Scientific Observer Logbook 30/8/99 Cruise Report 2/9/99	Cruise, vessel, and IMALF details
Chile	*Isla Sofía*	LLS Spanish	M. Murphy Great Britain	48.3 *D. eleginoides*	31/3–25/6/99	Scientific Observer Logbook 3/8/99 Cruise Report 3/8/99	Cruise, vessel, and IMALF details
Chile	*Magallanes III*	LLS Spanish	H. Brachetta Argentina	48.3 *D. eleginoides*	14/5–21/8/99	Scientific Observer Logbook 17/9/99 Cruise Report 11/10/99	Cruise, vessel, and IMALF details
Chile	*Tierra del Fuego*	LLS Spanish	J. Taylor Great Britain	48.3 *D. eleginoides*	17/6–25/7/99	Scientific Observer Logbook 30/8/99 Cruise Report 2/9/99	Cruise, vessel, and IMALF details
Chile	*Tierra del Fuego*	LLS Spanish	N. Ansell Great Britain	48.3 *D. eleginoides*	11/4–23/6/99	Scientific Observer Logbook 10/8/99 Cruise Report 17/8/99	Cruise, vessel, and IMALF details
Great Britain	*Argos Helena*	LLS Spanish	A. Black Great Britain	48.3 *D. eleginoides*	2/1–16/2/99	Scientific Observer Logbook 31/3/99 Cruise report submitted as FSA paper	Cruise, vessel, and IMALF details
Great Britain	*Argos Helena*	LLS Spanish	Y. Marin Uruguay	48.3 *D. eleginoides*	10/4–30/7/99	Scientific Observer Logbook 1/9/99 Cruise Report 25/8/99	Cruise report, limited IMALF
Great Britain	*Jacqueline*	LLS Spanish	M. Purves South Africa	48.3 *D. eleginoides*	11/4–21/7/99	Scientific Observer Logbook 30/8/99 Cruise Report 6/9/99	Cruise, vessel, and IMALF details
Great Britain	*Lyn*	LLS Spanish	C. Cardenas Chile	48.3 *D. eleginoides*	17/6–20/7/99	Scientific Observer Logbook 30/8/99 Cruise Report 6/9/99	Cruise, vessel, and IMALF details
Great Britain	*Lyn*	LLS Spanish	P. Casas-Cordero Chile	48.3 *D. eleginoides*	9/4–14/6/99	Scientific Observer Logbook 30/8/99 Cruise Report 6/9/99	Cruise, vessel, and IMALF details
New Zealand	*Janas*	LLS Auto	F. Stoffberg South Africa	88.1 *Dissostichus* spp.	23/12/98–5/3/99	Scientific Observer Logbook 14/4/99 Cruise Report 26/3/99	Cruise, vessel, and IMALF details
New Zealand	*San Aotea II*	LLS Auto	B. Watkins South Africa	88.1 *Dissostichus* spp.	22/12/98–3/3/99	Scientific Observer Logbook 14/4/99 Cruise Report 21/5/99	Cruise, vessel, and IMALF details

continued

Table 49 continued

Flag State	Vessel	Fishing Method	Observer	Subarea/ Fishery	Period of Observation	Report / Date Submitted	Data Reported
Republic of Korea	*No. 1 Moresko*	LLS Spanish	A. Williams Great Britain	48.3 *D. eleginoides*	11/4–22/7/99	Scientific Observer Logbook 30/8/99 Cruise Report 2/9/99	Cruise, vessel, and IMALF details
South Africa	*Koryo Maru 11*	LLS Auto	G. Fulton Great Britain	48.3 *D. eleginoides*	10/4–27/6/99	Scientific Observer Logbook 10/8/99 Cruise Report 13/9/99	Cruise, vessel, and IMALF details
South Africa	*Koryo Maru 11*	LLS Auto	D. Byrom Great Britain	48.3 *D. eleginoides*	30/6–4/8/99	Scientific Observer Logbook 30/8/99 Cruise Report 2/9/99	Cruise, vessel, and IMALF details
Panama	*Eldfisk*	LLS Auto	Watkins/Wium South Africa	58.6 , 58.7 *D. eleginoides*	2/10–1/11/98	Scientific Observer Logbook 21/4/99 Cruise Report 16/3/99	Cruise, vessel, and IMALF details
South Africa	*Arctic Fox*	LLS Auto	B. Fairhead South Africa	58.6, 58.7 *D. eleginoides*	24/11/98–11/1/99	Scientific Observer Logbook 21/4/99 Cruise Report 28/1/99	Cruise, vessel, and IMALF details
South Africa	*Eldfisk*	LLS Auto	Watkins/Pienaar South Africa	58.6, 58.7 *D. eleginoides*	1/5–23/6/99	Scientific Observer Logbook 23/7/99 Cruise Report 23/7/99	Cruise, vessel, and IMALF details
South Africa	*Koryo Maru 11*	LLS Auto	J. Wium South Africa	58.6, 58.7 *D. eleginoides*	6/2–24/3/99	Scientific Observer Logbook 21/5/99 Cruise Report 23/7/99	Cruise, vessel, and IMALF details
South Africa	*Arctic Fox*	LLS Auto	H. Crous South Africa	58.6, 58.7 *D. eleginoides*	8/6–23/7/99	Scientific Observer Logbook 6/9/99 Cruise Report 6/9/99	Cruise, vessel, and IMALF details
South Africa	*Arctic Fox*	LLS Auto	F. Stoffberg South Africa	58.7 *D. eleginoides*	21/9–14/11/98	Scientific Observer Logbook 21/4/99 Cruise Report 11/10/99	Cruise, vessel, and IMALF details
South Africa	*Arctic Fox*	LLS Auto	B. Fairhead South Africa	58.7 *D. eleginoides*	31/3–29/5/99	Scientific Observer Logbook 23/7/99 Cruise Report 23/7/99	Cruise, vessel, and IMALF details
South Africa	*Koryo Maru 11*	LLS Auto	M. Davies South Africa	58.7 *D. eleginoides*	5/1–5/2/99	Scientific Observer Logbook 21/5/99 Cruise Report 22/2/99	Cruise, vessel, and IMALF details
South Africa	*Koryo Maru 11*	LLS Auto	M. Davies Great Britain	58.7 *D. eleginoides*	3/11–28/12/98	Scientific Observer Logbook 21/4/99 Cruise Report 22/2/99	Cruise, vessel, and IMALF details
Spain	*Ibsa Quinto*	LLS Spanish	M. Endicott Great Britain	48.3 *D. eleginoides*	8/6–21/7/99	Scientific Observer Logbook 30/8/99 Cruise Report 2/9/99	Cruise, vessel, and IMALF details
Spain	*Ibsa Quinto*	LLS Spanish	L. Fearnehough Great Britain	48.3 *D. eleginoides*	10/4–4/6/99	Scientific Observer Logbook 9/7/99 Cruise Report 9/7/99	Cruise, vessel, and IMALF details
Uruguay	*Illa de Rua*	LLS Spanish	P. Ghey Great Britain	48.3 *D. eleginoides*	8/4–28/6/99	Scientific Observer Logbook 10/8/99 Cruise Report 20/8/99	Cruise, vessel, and IMALF details

Table 49 continued

Flag State	Vessel	Fishing Method	Observer	Subarea/ Fishery	Period of Observation	Report / Date Submitted	Data Reported
Uruguay	*Illa de Rua*	LLS Spanish	P . Wright Great Britain	48.3 *D. eleginoides*	1/7–17/7/99	Scientific Observer Logbook 30/8/99 Cruise Report 2/9/99	Cruise, vessel, and IMALF details
Uruguay	*Isla Gorriti*	LLS Auto	P. Boyle Great Britain	48.3 *D. eleginoides*	8/5–12/6/99	Scientific Observer Logbook 31/8/99 Cruise Report 13/9/99	Cruise, vessel, and IMALF details
Uruguay	*Illa de Rua*	LLS Auto	G. Bruce Great Britain	48.3 *D. eleginoides*	12/6–17/7/99	Scientific Observer Logbook 31/8/99 Cruise Report 13/9/99	Cruise, vessel, and IMALF details
Russia	*Zakhar Sorokin*	Trawl	A. King Great Britain	48.3 *C. gunnari*	13/2–13/3/99	Scientific Observer Logbook 24/4/99 Cruise Report 24/4/99	Cruise, vessel, and IMALF details
Australia	*Austral Leader*	Trawl	J. Hunter Australia	58.5.2 *D. eleginoides C. gunnari*	20/8–24/9/98	Scientific Observer Logbook 13/11/98 Cruise Report 25/3/99	Cruise, vessel, and IMALF details
Australia	*Southern Champion*	Trawl	M. Scott Australia	58.5.2 *D. eleginoides C. gunnari*	27/9–11/11/98	Scientific Observer Logbook 18/12/98 Cruise Report 24/3/99	Cruise, vessel, and IMALF details
Australia	*Southern Champion*	Trawl	M. Tucker Australia	58.5.2 *D. eleginoides C. gunnari*	19/11/98–6/1/99	Scientific Observer Logbook 22/2/99 Cruise Report 25/3/99	Cruise, vessel, and IMALF details
Australia	*Southern Champion*	Trawl	J. Parkinson Australia	58.5.2 *D. eleginoides C. gunnari*	13/1–3/3/99	Scientific Observer Logbook 27/4/99 Cruise Report 15/4/99	Cruise, vessel, and IMALF details
Australia	*Southern Champion*	Trawl	I. Brown Australia	58.5.2 *D. eleginoides C. gunnari*	10/3–29/4/99	Scientific Observer Logbook 19/5/99 Cruise Report 23/8/99	Cruise, vessel, and IMALF details
Australia	*Austral Leader*	Trawl	C. Heinecken South Africa	58.4.1, 58.4.3, 58.5.2 *D. eleginoides*	14/3–13/5/99	Scientific Observer Logbook 1/6/99 Cruise Report 23/7/99	Cruise, vessel, and IMALF details
Australia	*Southern Champion*	Trawl	H. Sturmann Australia	58.5.2 *D. eleginoides C. gunnari*	8/5–14/7/99	Scientific Observer Logbook 19/7/99 Cruise Report 23/8/99	Cruise, vessel, and IMALF details
Great Britain	*Argos Helena*	Pot	M. Purves South Africa	48.4 *Paralomis* spp.	31/8–23/9/99	Scientific Observer Logbook 11/10/99 Cruise Report 11/10/99	Cruise, vessel, and IMALF details

Table 50: Incidental mortality of seabirds in the longline fisheries for *D. 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, * – the average seabird catch rate was used due to lack of observed hooks. The highlighted row indicates data from the UK line-weighting experiment.

Vessel Name	Dates of Fishing	Fishing Method	Sets Deployed				No. of Hooks (1 000s)			Hooks Baited (%)	No. of Birds Caught						Observed Seabird Mortality (Birds/1 000 hooks)			Streamer Line in Use (%)		Offal Discharge at Haul
											Dead		Alive		Total							
			N	D	Total	%N	Ob-served	Set	% Ob-served		N	D	N	D	N	D	N	D	Total	N	D	
Subarea 48.3																						
Argos Helena	1/2–16/2/99	Sp	0	24	24	0	81.6	89.1	91	100		88		11		99	0	1.08	1.08		91	O
Argos Helena	16/4–29/5/99	Sp	173	1	174	99	191	1259	15	100	1	0	13	0	14	0	0.005	0	0.005	83	0	O
Ibsa Quinto	13/7–3/9/98	Sp	29	0	29	100	50.9	249.1	20	100	0	0	1	0	1	0	0	0	0	100		O
Ibsa Quinto	15/4–28/5/99	Sp	38	0	38	100	131.8	339.0	38	100	5	0	8	0	13	0	0.04	0	0.04	89		O
Illa de Rua	15/4–21/6/99	Sp	114	6	120	95	207.5	1102.8	18	100	52	2	11	0	16	2	0.03	0.22	0.03	99	100	O
Illa de Rua	6/7–17/7/99	Sp	18	0	18	100	39.6	176.3	22	100	0	0	0	0	0	0	0	0	0	77		S
Isla Camila	18/4–11/6/99	Sp	88	8	96	91	433.6	749.8	57	100	30	0	16	1	46	1	0.08	0	0.07	77	87	S
Isla Camila	17/6–17/7/99	Sp	41	7	48	85	67.5	451.2	14	100	1	0	2	0	3	0	0.02	0	0.01	100	100	S
Isla Gorriti	17/5–10/6/99	Auto	39	12	51	76	48.5	463.0	10	88	0	0	0	0	0	0	0	0	0	97	100	O
Isla Gorriti	13/6–17/7/99	Auto	42	28	70	60	236.7	643.2	36	90	0	0	2	2	2	2	0	0	0	0	17	O
Isla Sofía	15/4–20/6/99	Sp	86	17	103	83	117.0	772.6	15	92	6	0	2	0	8	0	0.06	0	0.05	100	100	S
Isla Sofía	2/7–16/7/99	Sp	26	4	30	86	47.4	245.0	19	100	0	0	0	0	0	0	0	0	0	84	75	S
Jacqueline	15/4–17/7/99	Sp	77	2	79	97	354.5	971.5	36	100	1	0	30	0	31	0	0.003	0	0.003	94	100	S
Koryo Maru 11	22/4–21/6/99	Sp	57	3	60	95	134.0	761.0	17	100	0	0	0	0	0	0	0	0	0	100	100	O
Koryo Maru 11	6/7–17/7/99	Sp	10	0	10	100	26.1	145.2	18	100	0	0	0	0	0	0	0	0	0	100		O
Lyn	15/4–7/6/99	Sp	74	13	87	85	101.9	795.5	12	100	1	4	0	1	1	5	0.01	0.19	0.04	100	100	O
Lyn	27/6–15/7/99	Sp	30	4	34	88	66.0	277.0	23	100	0	0	0	1	0	1	0	0	0	0	0	O
Magallanes III	23/5–14/7/99	Sp	53	26	79	67	275.3	736.8	37	100	0	1	1	5	1	6	0	0.01	0.004	100	100	O
No. 1 Moresko	15/4–16/7/99	Sp	85	45	130	65	360.7	1074.4	33	100	0	0	2	1	2	1	0	0	0	84	91	O
*Tierra del Fuego**	15/4–11/6/99	Sp	102	6	108	94		732.0		100	20	0	7	2	9	2	0.01	0.08	0.07	97	100	O
Tierra del Fuego	19/6–17/7/99	Sp	73	15	88	82	104.8	354.5	29	100	0	0	1	0	1	0	0	0	0	87	86	O
Total						83	3076.4	12388	25								0.01	0.08	0.07			
Subarea 58.6, 58.7																						
Arctic Fox	27/9–6/11/98	Auto	128	3	131	97	390.4	914.4	42	87	14	0	0	0	14	0	0.04	0	0.04	0	0	O
Arctic Fox	30/11/98–4/1/99	Auto	82	1	83	98	159.5	479.7	33	84	1	0	0	0	1	0	0.01	0	0.01	100	100	O
Arctic Fox	6/4–22/5/99	Auto	122	4	126	96	190.7	726.2	26	83	3	0	0	0	3	0	0.02	0	0.02	99	100	O
Arctic Fox	14/6–15/7/99	Auto	131	7	138	94	259.3	415.1	62	82	5	0	1	0	6	0	0.02	0	0.02	95	100	O
Eldfisk	7/10–6/11/98	Auto	76	86	162	46	67.4	500.0	13	82	7	0	0	0	7	0	0.19	0	0.10	100	100	O
Eldfisk	7/5–8/6/99	Auto	128	54	182	70	102.8	507.3	20	83	2	0	0	0	2	0	0.03	0	0.02	100	100	O
Koryo Maru 11	8/11–20/12/98	Sp	50	0	50	100	166.4	383.5	43	100	15		5		20		0.09	0	0.09	98		O
Koryo Maru 11	10/1–31/1/99	Sp	38	4	42	90	105.0	194.3	54	100	0	0	3		3	1	0	0	0	100	100	O
Koryo Maru 11	10/2–17/3/99	Sp	64	0	64	100	73.3	367.4	19	100	1		5		6		0.01	0	0.01	100		O
Total						88	1514.8	4487.9	34								0.05	0	0.03			

continued

Table 50 continued

Vessel Name	Dates of Fishing	Fishing Method	Sets deployed				No. of Hooks (1 000s)			Hooks Baited (%)	No. of Birds Caught						Observed Seabird Mortality (Birds/1 000 hooks)			Streamer Line in Use (%)		Offal Discharge at Haul
											Dead		Alive		Total							
			N	D	Total	%N	Ob-served	Set	% Ob-served		N	D	N	D	N	D	N	D	Total	N	D	
Subarea 88.1																						
Janus	6/1–26/2/99	Auto	2	126	128	1	234.9	725.3	32	80	0	0	0	0	0	0	0	0	0	100	95	S
San Aotea II	30/12/98–22/2/99	Auto	0	126	126	0	205.8	687.0	29	83	0	0	0	0	0	0	0	0	0	100		S
Total						0.5	440.7	1412.3	31								0	0	0			

Table 51: Estimated seabird mortality by vessel for Subarea 48.3 during the 1998/99 season. The highlighted row indicates data from the UK line-weighting experiment.

Vessel Name	Hooks Observed (1 000s)	Hooks Set (1 000s)	% Night Sets	Estimated Number of Birds Caught Dead		
				Night	Day	Total
Argos Helena	81.6	89.1	0	0	96	96
Argos Helena	191	1 259	15	6	0	6
Ibsa Quinto	50.9	249.1	100	0	0	0
Ibsa Quinto	131.8	339	100	14	0	14
Illa de Rua	39.6	176.3	100	0	0	0
Illa de Rua	207.5	1 102.8	95	31	12	43
Isla Camila	67.5	451.2	85	8	0	8
Isla Camila	433.6	749.8	91	55	0	55
Isla Gorriti	48.5	463	76	0	0	0
Isla Gorriti	236.7	643.2	60	0	0	0
Isla Sofía	47.4	245	86	0	0	0
Isla Sofía	117	772.6	83	38	0	38
Jacqueline	354.5	971.5	97	3	0	3
Koryo Maru 11	26.1	145.2	100	0	0	0
Koryo Maru 11	134	761	95	0	0	0
Lyn	66	277	88	0	0	0
Lyn	101.9	795.5	85	7	23	30
Magallanes III	275.3	736.8	67	0	2	2
No. 1 Moresko	360.7	1 074.4	65	0	0	0
Tierra del Fuego	104.8	354.5	82	0	0	0
*Tierra del Fuego**		732	94	7	4	11
Total	3 076.4	12 388	79	169	137	306

* Estimates are based on the total observed catch rates.

Table 52: Species composition of birds killed in longline fisheries in Subareas 48.3, 58.6 and 58.7 during the 1998/99 season. N – night setting, D – daylight setting (including nautical dawn and dusk), DIM – black-browed albatross, DIC – grey-headed albatross, MAI – southern giant petrel, PCI – grey petrel, PRO – white-chinned petrel, DAC – cape petrel, OCO – Wilson's storm petrel, PYP – Gentoo penguin, ( ) – % composition. The highlighted row indicates data from the UK line-weighting experiment.

Vessel Name	Dates of Fishing	No. Birds Killed by Group						Species Composition (%)															
		Albatross		Petrels/Fulmars		Total		DIM		DIC		MAI		PRO		OCO		DAC		PYP		PCI	
		N	D	N	D	N	D																
Subarea 48.3																							
Argos Helena	1/2–16/2/99	0	51	0	37	0	88	50	(57)	1	(1)	1	(1)	36	(41)								
Argos Helena	16/4–29/5/99	1	0	0	0	1	0	1	(100)														
Ibsa Quinto	13/7–3/9/98	0	0	0	0	0	0																
Ibsa Quinto	15/4–28/5/99	2	0	3	0	5	0	2	(40)					2	(40)					1	(20)		
Illa de Rua	15/4–21/6/99	3	2	2	0	5	2	3	(43)	2	(29)			1	(14)	1	(14)						
Illa de Rua	6/7–17/7/99	0	0	0	0	0	0																
Isla Camila	18/4–11/6/99	30	0	0	0	30	0	3	(100)														
Isla Camila	17/6–17/7/99	0	0	1	0	1	0											1	(100)				
Isla Gorriti	17/5–10/6/99	0	0	0	0	0	0																
Isla Gorriti	13/6–17/7/99	0	0	0	0	0	0																
Isla Sofía	15/4–20/6/99	6	0	0	0	6	0	6	(100)														
Isla Sofía	2/7–16/7/99	0	0	0	0	0	0																
Jacqueline	15/4–17/7/99	0	0	1	0	1	0							1	(100)								
Koryo Maru 11	22/4–21/6/99	0	0	0	0	0	0																
Koryo Maru 11	6/7–17/7/99	0	0	0	0	0	0																
Lyn	15/4–7/6/99	1	3	1	0	2	3	4	(80)			1	(20)										
Lyn	27/6–15/7/99	0	0	0	0	0	0																
Magallanes III	23/5–14/7/99	0	1	0	0	0	1			1	(100)												
No. 1 Moresko	15/4–16/7/99	0	0	0	0	0	0																
Tierra del Fuego	15/4–11/6/99	2	0	0	0	2	0	2	(100)														
Tierra del Fuego	19/6–17/7/99	0	0	0	0	0	0																
Total %								98	(66)	4	(3)	2	(1)	40	(27)	1	(1)	1	(1)	1	(1)		
Subareas 58.6, 58.7																							
Arctic Fox	27/9–6/11/98	0	0	14	0	14	0					6	(43)	8	(57)								
Arctic Fox	6/4–22/5/99	0	0	3	0	3	0					1	(33)	1	(33)							1	(33)
Arctic Fox	14/6–15/7/99	1	0	4	0	5	0			1	(20)									4	(80)		
Arctic Fox	30/1198–4/1/99	0	0	1	0	1	0					1	(100)										
Eldfisk	7/10–6/11/98	0	0	7	0	7	0							7	(100)								
Eldfisk	7/5–8/6/99	0	0	2	0	2	0															2	(100)
Koryo Maru 11	8/11–20/12/98	0	0	15	0	15	0							15	(100)								
Koryo Maru 11	10/1–31/1/99	0	0	0	0	0	0																
Koryo Maru 11	10/2–17/3/99	0	0	1	0	1	0							1	(100)								
Total %										1	(2)	8	(17)	32	(67)					4	(8)	3	(6)

Table 53: Estimated seabird mortality by vessel for Subareas 58.6 and 58.7 during the 1998/99 season.

Vessel Name	Hooks Observed (1 000s)	Hooks Set (1 000s)	% Night Sets	Estimated Number of Birds Caught Dead		
				Night	Day	Total
Arctic Fox	159.5	479.7	98	5	0	5
Arctic Fox	190.7	726.2	96	14	0	14
Arctic Fox	259.3	415.1	94	8	0	8
Arctic Fox	390.4	914.4	97	35	0	35
Eldfisk	67.4	500.0	46	44	0	44
Eldfisk	102.8	507.3	70	11	0	11
Koryo Maru 11	73.3	367.4	100	5	0	5
Koryo Maru 11	105.0	194.3	90	0	0	0
Koryo Maru 11	166.4	383.5	100	35	0	35
Total	1 514.8	4 487.9	87.89	156	0	156

Table 54: Total estimated seabird by-catch and by-catch rate (birds/1 000 hooks) in longline fisheries in Subareas 48.3, 58.6 and 58.7, 1997 to 1999.

Subarea	Year		
	1997	1998	1999
48.3			
Estimated by-catch	5 755	640	210*
By-catch rate	0.23	0.03	0.01*
58.6, 58.7			
Estimated by-catch	834	528	156
By-catch rate	0.52	0.19	0.03

* Excluding *Argos Helena* line-weighting experiment cruise.

Table 55: 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 1998/99. 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	640	80	20	512	128	0.31	1 652	413	2.608	0.07	9.31	0.51	4 307	29	15 377	211
	640	70	30	448	192	0.31	1 445	619	2.608	0.07	9.31	0.51	3 769	43	13 454	316
	640	60	40	384	256	0.31	1 239	826	2.608	0.07	9.31	0.51	3 231	58	11 532	421
58.6	1 728	80	20	1 382	346	0.09	15 360	3 840	1.049	0.017	1.88	0.07	16 113	65	28 877	269
	1 728	70	30	1 210	518	0.09	13 440	5 760	1.049	0.017	1.88	0.07	14 099	98	25 267	403
	1 728	60	40	1 037	691	0.09	11 520	7 680	1.049	0.017	1.88	0.07	12 084	131	21 658	538
58.7	140	80	20	112	28	0.10	1 120	280	0.049	0.017	1.88	0.07	55	5	2 106	20
	140	70	30	98	42	0.10	980	420	0.049	0.017	1.88	0.07	48	7	1 842	29
	140	60	40	84	56	0.10	840	560	0.049	0.017	1.88	0.07	41	10	1 579	39
58.4.4	1 845	80	20	1 476	369	0.24	6 150	1 538	0.629	0.01	1.128	0.042	3 868	15	6 937	65
	1 845	70	30	1 292	554	0.24	5 381	2 306	0.629	0.01	1.128	0.042	3 385	23	6 070	97
	1 845	60	40	1 107	738	0.24	4 613	3 075	0.629	0.01	1.128	0.042	2 901	31	5 203	129
58.5.1	620	80	20	496	124	0.24	2 067	517	0.049	0.017	1.88	0.07	101	9	3 885	36
	620	70	30	434	186	0.24	1 808	775	0.049	0.017	1.88	0.07	89	13	3 400	54
	620	60	40	372	248	0.24	1 550	1 033	0.049	0.017	1.88	0.07	76	18	2 914	72
58.5.2	160	80	20	128	32	0.24	533	133	0.049	0.017	1.88	0.07	26	2	1 003	9
	160	70	30	112	48	0.24	467	200	0.049	0.017	1.88	0.07	23	3	877	14
	160	60	40	96	64	0.24	400	267	0.049	0.017	1.88	0.07	20	5	752	19

Table 56: Estimates of potential seabird by-catch in unregulated longline fishing in the Convention Area in 1998/99.

Subarea/ Division	Potential By-catch Level	Summer	Winter	Total[1]
48.3	Lower	3 200–4 300	30–60	3 200–4 400
	Higher	11 500–15 400	210–420	11 700–15 800
58.6	Lower	12 100–16100	65–130	12 200–16 200
	Higher	21 650–28 900	270–540	21 900–29 400
58.7	Lower	40–55	5–10	50–60
	Higher	1 600–2 100	20–40	1 600–2 100
58.4.4	Lower	2 900–3 900	15–30	2 900–3 900
	Higher	5 200–6 900	65–130	5 300–7 000
58.5.1	Lower	80–100	10–20	100
	Higher	2 900–3 900	40–70	2 900–4 000
58.5.2	Lower	20–30	2–5	20–30
	Higher	750–1 000	10–20	800–1 000
Total	Lower	18 300–24 500*	100–300[1]	18 000–25 000[2]
	Higher	43 600–58 200*	600–1 200[1]	44 000–59 000[2]

[1] Rounded to nearest hundred birds
[2] Rounded to nearest thousand birds

Table 57: Composition of estimated potential by-catch in unregulated longline fisheries in the Convention Area from 1997 to 1999.

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 12 000–16 000	1 505 6 020	70 280	1 680 6 720
Subareas 58.6, 58.7[4]				
1996/97	17 000–27 000 66 000–107 000	4 840 19 030	880 3 460	13 860 54 495
1997/98	9 000–11 000 15 000–20 000	2 200 3 850	400 700	6 300 11 025
1998/99	12 000–16 000 23 500–31 500	3 080 6 050	560 1 100	8 820 17 325
Divisions 58.5.1, 58.5.2[4]				
1996/97	-	-	-	-
1997/98	34 000–45 000 61 000–81 000	8 690 15 620	1 580 2 840	24 885 44 730
1998/99	c. 100 4 000–5 000	c. 22 990	c. 4 180	c. 63 2 835
Division 58.4.4[4]				
1996/97	-			
1997/98	-			
1998/99	3 000–4 000 5 000–7 000	770 1 320	140 240	2 205 3 780
Total				
1996/97	17 000–27 000 66 000–107 000	4 840 19 030	880 3 460	13 860 54 495
1997/98	43 000–54 000 76 000–101 000	10 890 19 470	1 980 3 540	30 185 55 755
1998/99	18 000–24 000 44 000–59 000	5 377 8 892	774 1 800	12 768 30 660
Overall Total	78 000–105 000 186 000–265 000	21 107 47 392	3 634 7 342	56 813 140 910

[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, 6% white-chinned petrels (10% unidentified petrels) (see SC-CAMLR-XVI, Annex 5, Table 42).

Table 58: Summary of IMALF risk level and assessment in relation to proposed new and exploratory fisheries in 1999/2000.

Subarea/ Division	Risk Level	IMALF Risk Assessment	Reference	Notes
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.	SC-CAMLR-XVII, Annex 5, 7.116(i)	• South Africa (CCAMLR-XVIII/9) and the European Community (CCAMLR-XVIII/21) propose to fish from 1 March to 31 August north of 30°S; and from 15 February to 15 October south of 30°S, complying with Conservation Measure 29/XVI. • This does not conflict with the IMALF advice. • Conservation Measure 162/XVII applied in 1998/99.
58.4.1	3	Average risk. Prohibit longline fishing during the breeding season of albatrosses, giant petrels and white-chinned petrels (1 September to 30 April). Maintain all elements of Conservation Measure 29/XVI.	SC-CAMLR-XVII, Annex 5, 7.116(ii)	• Australia (CCAMLR-XVIII/12) is proposing a trawl fishery in this area; longlining is not currently proposed.
58.4.2	2	Average-to-low risk. Prohibit longline fishing during the breeding season of giant petrels (1 October to 31 March). Maintain all elements of Conservation Measure 29/XVI.	7.84(iii)	• Australia (CCAMLR-XVIII/11) is proposing a trawl fishery in this area; longlining is not currently proposed.
58.4.3	3	Average risk. Prohibit longline fishing during the breeding season of albatrosses, giant petrels and white-chinned petrels (1 September to 30 April). Maintain all elements of Conservation Measure 29/XVI.	SC-CAMLR-XVII, Annex 5, 7.116(iii)	• France (CCAMLR-XVIII/20) proposes to fish the whole of the 1999/2000 season, complying with Conservation Measure 29/XVI. This season substantially conflicts with the IMALF advice. • The European Community (CCAMLR-XVIII/21) intends to fish between 15 April to 31 August, complying with Conservation Measure 29/XVI. This season will overlap the recommended season closure by two weeks. • Conservation Measure 163/XVII applied in 1998/99.

continued

Table 58 continued

Subarea/ Division	Risk Level	IMALF Risk Assessment	Reference	Notes
58.4.4	3	Average risk. Prohibit longline fishing during the main breeding season of albatrosses and petrels (1 September to 30 April) Maintain all elements of Conservation Measure 29/XVI.	SC-CAMLR-XVII, Annex 5, 7.116(iv)	• France (CCAMLR-XVIII/20) proposes to fish the whole of the 1999/2000 season, complying with Conservation Measure 29/XVI. This season substantially conflicts with the IMALF advice. • Chile (CCAMLR-XVIII/13), South Africa (CCAMLR-XVIII/9), Uruguay (CCAMLR-XVIII/14) and the European Community (CCAMLR-XVIII/21) propose to fish from 15 April to 31 August, complying with Conservation Measure 29/XVI. This season will overlap the recommended season closure by two weeks. • Conservation Measure 164/XVII applied in 1998/99.
58.5.1	5	High risk. Prohibit longline fishing during the main albatross and petrel breeding season (i.e. 1 September to 30 April). Ensure strict compliance with Conservation Measure 29/XVI.	SC-CAMLR-XVII, Annex 5, 7.116(v)	• France (CCAMLR-XVIII/20) proposes to fish the whole of the 1999/2000 season, complying with Conservation Measure 29/XVI. This season substantially conflicts with the IMALF advice. • Chile (CCAMLR-XVIII/13) stated that it would comply with conservation measures that were in force concerning fishing seasons in relevant subareas and divisions. • I t is understood that Chile intends to comply fully with Conservation Measure 29/XVI. • No conservation measures applied to this area in 1998/99.
58.5.2	4	Average-to-high risk. Prohibit longline fishing within the breeding season of the main albatross and petrel species (1 September to 30 April). Ensure strict compliance with Conservation Measure 29/XVI.	SC-CAMLR-XVII, Annex 5, 7.116(vi)	• France (CCAMLR-XVIII/20) proposes to fish the whole of the 1999/00 season, complying with Conservation Measure 29/XVI. This season substantially conflicts with the IMALF advice. • Longline fishing is currently prohibited within the EEZ around Heard/McDonald Islands. • No conservation measures applied to this area in 1998/99.

continued

Table 58 continued

Subarea/ Division	Risk Level	IMALF Risk Assessment	Reference	Notes
58.6	5	High risk. Prohibit longline fishing during the main albatross and petrel breeding season (i.e. 1 September to 30 April). Ensure strict compliance with Conservation Measure 29/XVI.	SC-CAMLR-XVII, Annex 5, 7.116(vii)	• France (CCAMLR-XVIII/20) proposes to fish the whole of the 1999/2000 season, complying with Conservation Measure 29/XVI. This season substantially conflicts with the IMALF advice. • South Africa (CCAMLR-XVIII/8), Chile (CCAMLR-XVIII/13) and the European Community (CCAMLR-XVIII/21) propose to fish from 15 April to 31 August, complying with Conservation Measure 29/XVI. This season will overlap the recommended season closure by two weeks. • Conservation Measure 168/XVII applied in 1998/99.
58.7	5	High risk. Prohibit longline fishing during the main albatross and petrel breeding season (i.e. 1 September to 30 April). Ensure strict compliance with Conservation Measure 29/XVI.	SC-CAMLR-XVII, Annex 5, 7.116(viii)	• France (CCAMLR-XVIII/20) proposes to fish the whole of the 1999/2000 season, complying with Conservation Measure 29/XVI. This season substantially conflicts with the IMALF advice. • Conservation Measure 160/XVII applied in 1998/99.
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.	SC-CAMLR-XVII, Annex 5, 7.116(ix)	• Chile (CCAMLR-XVIII/13), the European Community (CCAMLR-XVIII/21) and New Zealand (CCAMLR-XVIII/10) propose to fish from 15 December to 31 August. • This does not conflict with the IMALF advice. • Chile and the European Community intend to comply fully with Conservation Measure 29/XVI. • New Zealand (CCAMLR-XVIII/10) proposes a continuation of the variation to Conservation Measure 29/XVI as provided for by Conservation Measure 169/XVII, to allow line-weighting experiments to continue south of 65°S in Subarea 88.1 (see paragraphs 7.85 to 7.91 for further discussion). • Conservation Measure 169/XVII applied in 1998/99.

continued

Table 58 continued

Subarea/ Division	Risk Level	IMALF Risk Assessment	Reference	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.	7.84(xi)	• The European Community (CCAMLR-XVIII/21) will comply with Conservation Measure 29/XVI, including only setting gear at night. • It is understood that Chile intends to comply fully with Conservation Measure 29/XVI. • No conservation measures applied to this area in 1998/99.

Table 59: Results from new and exploratory longline fisheries proposed in 1998/99.

Subarea/Division	Country	Catch (tonnes)	Report on Seabird By-catch
48.6	South Africa	0	
58.4.3	France	No fishing	
58.4.4	South Africa Spain Uruguay France	No fishing No fishing No fishing No fishing	
58.6	South Africa	201 in EEZ	WG-FSA-99/42
58.7	South Africa	180 in EEZ	WG-FSA-99/42
88.1	New Zealand	298	WG-FSA-99/35

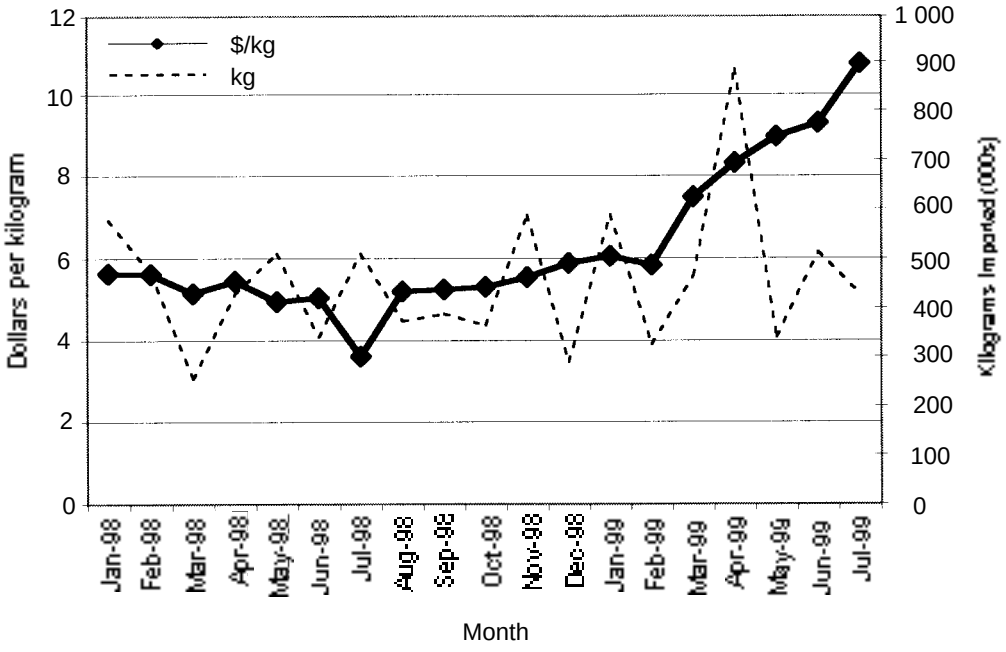


Figure 1: Import quantity and price of *Dissostichus* spp. into the US market, from January 1998 to July 1999. Dollars are US$.

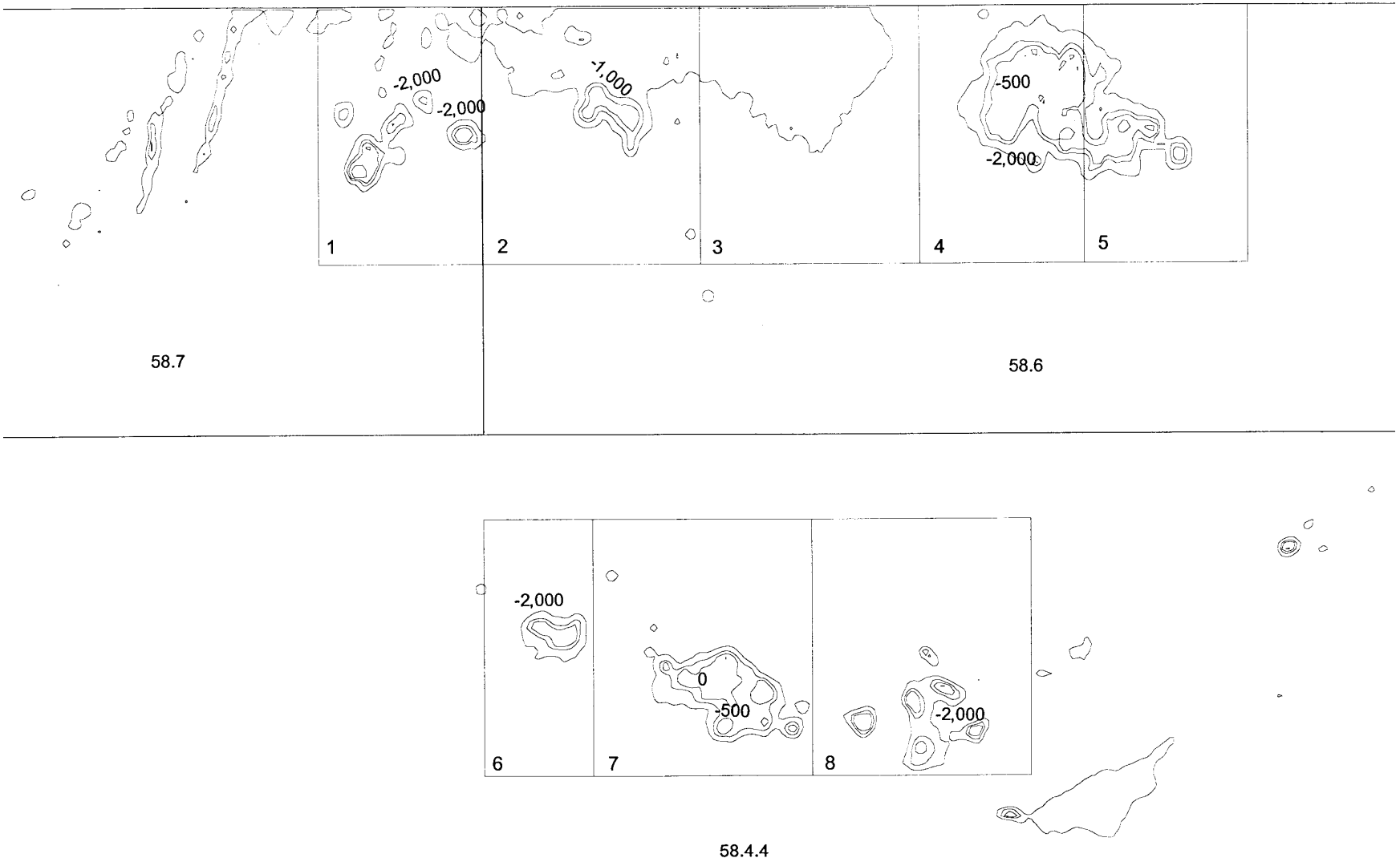


Figure 2: Outline of an experimental design for acquiring spatial information in new and exploratory fisheries in Subareas 58.6 and 58.7 and Division 58.4.4.

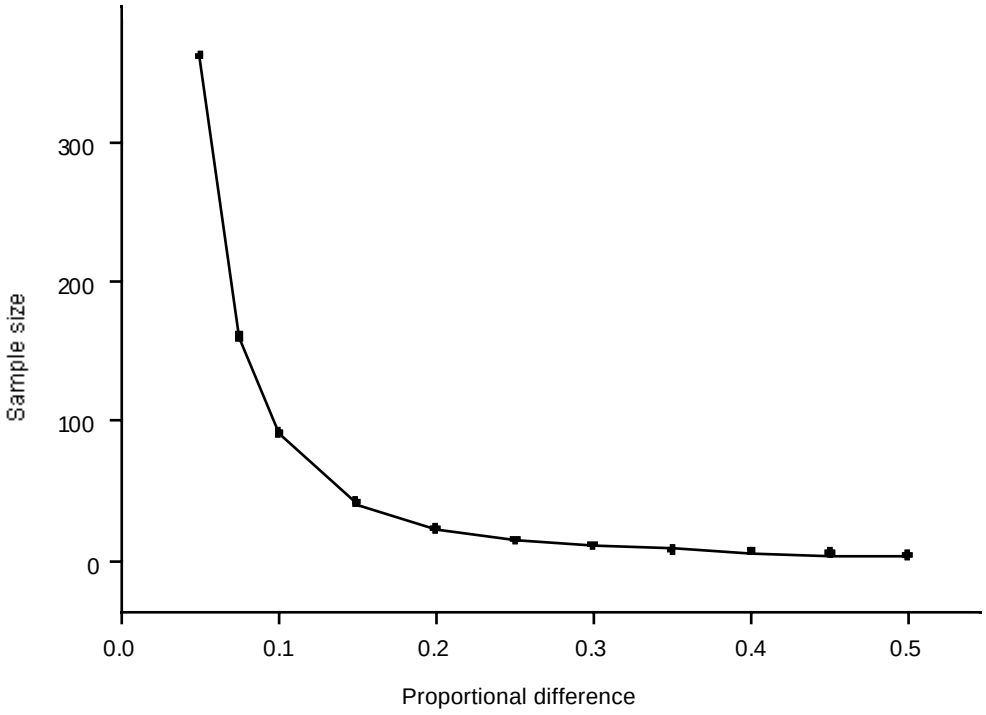


Figure 3: Sample sizes to detect a proportional difference in sqrt(CPUE/kg) with a two-sided 5% test and power 0.8.

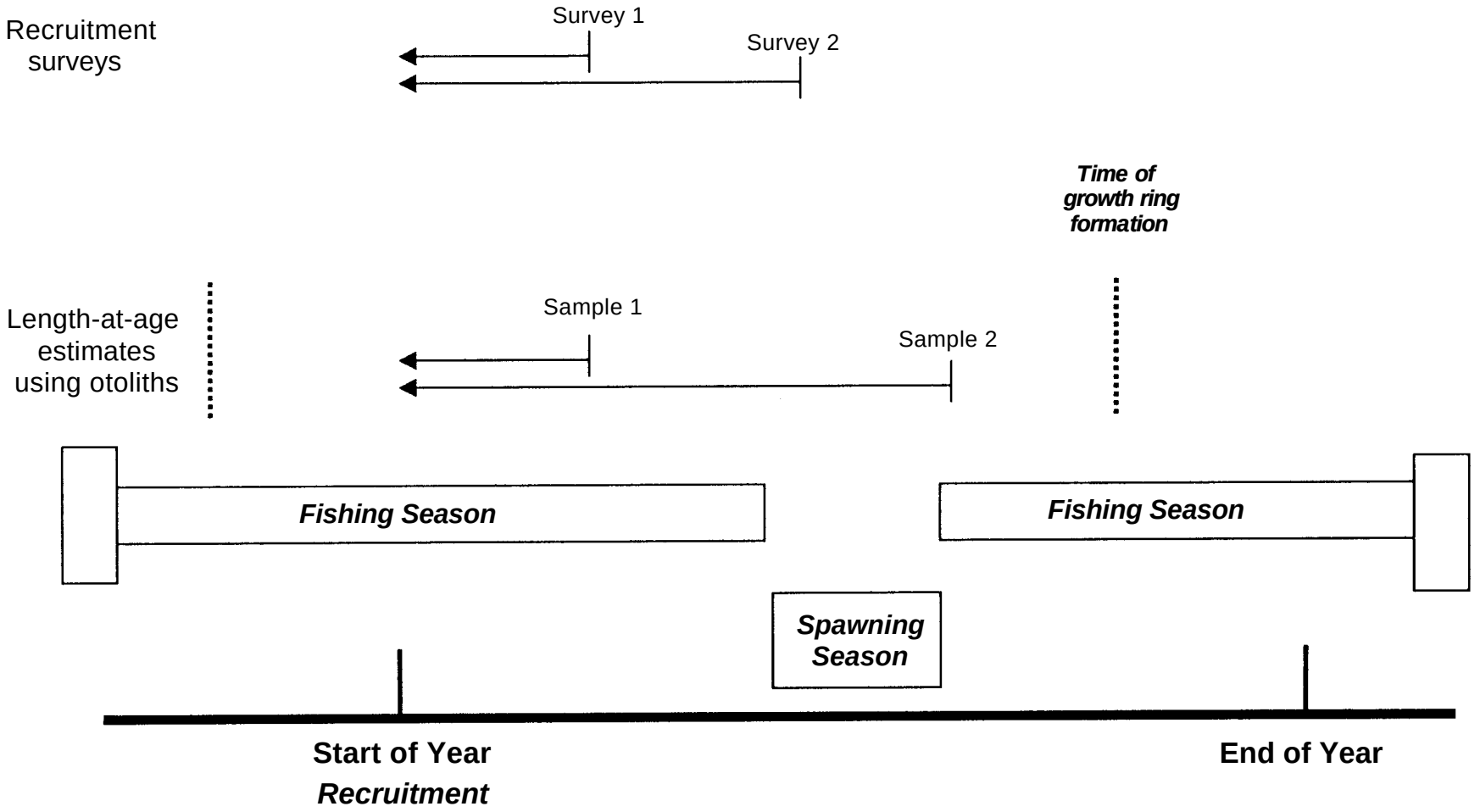


Figure 4: Schematic diagram to show the relationships between data collected to estimate growth and recruitment and the starting point in the projections using the GYM. The 'start of year' is the time, when new recruits enter the simulated population. Example timings of the spawning season and fishing season are shown.

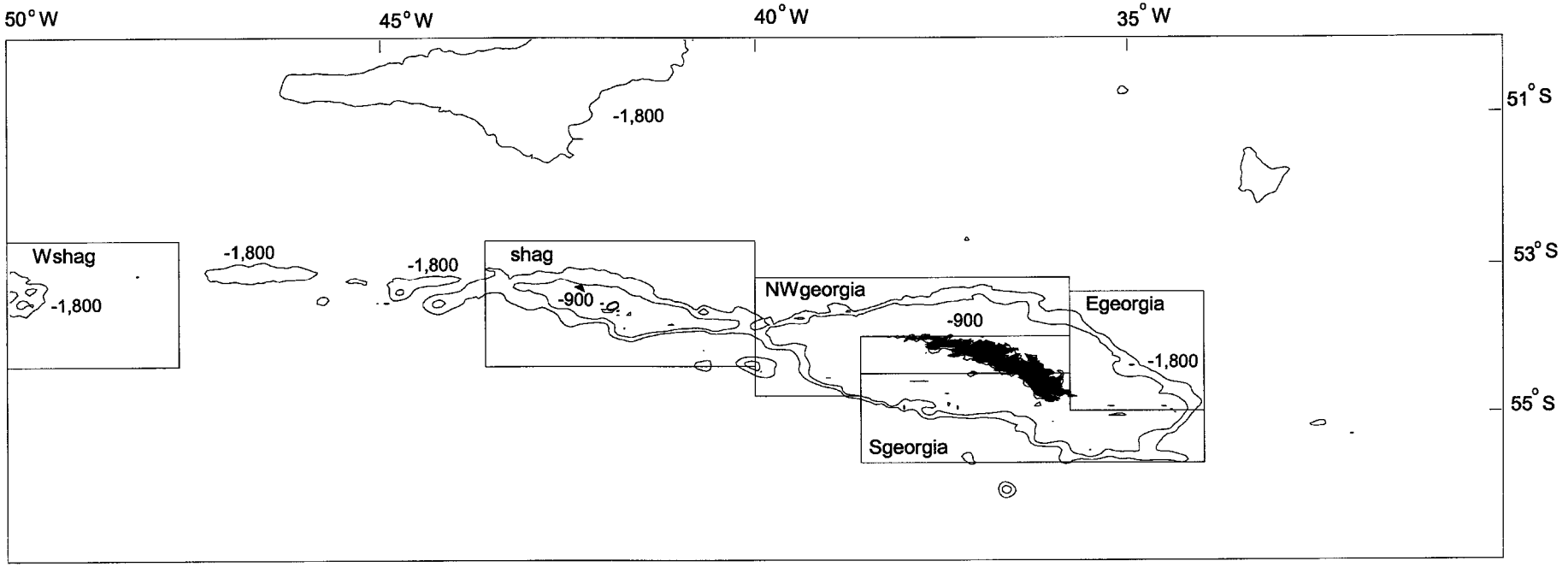


Figure 5: Fishing grounds in Subarea 48.3 used in the CPUE analysis for *D. eleginoides*. The 900 m and 1 800 m depth contour lines are indicated. shag – Shag Rocks, georgia – South Georgia.

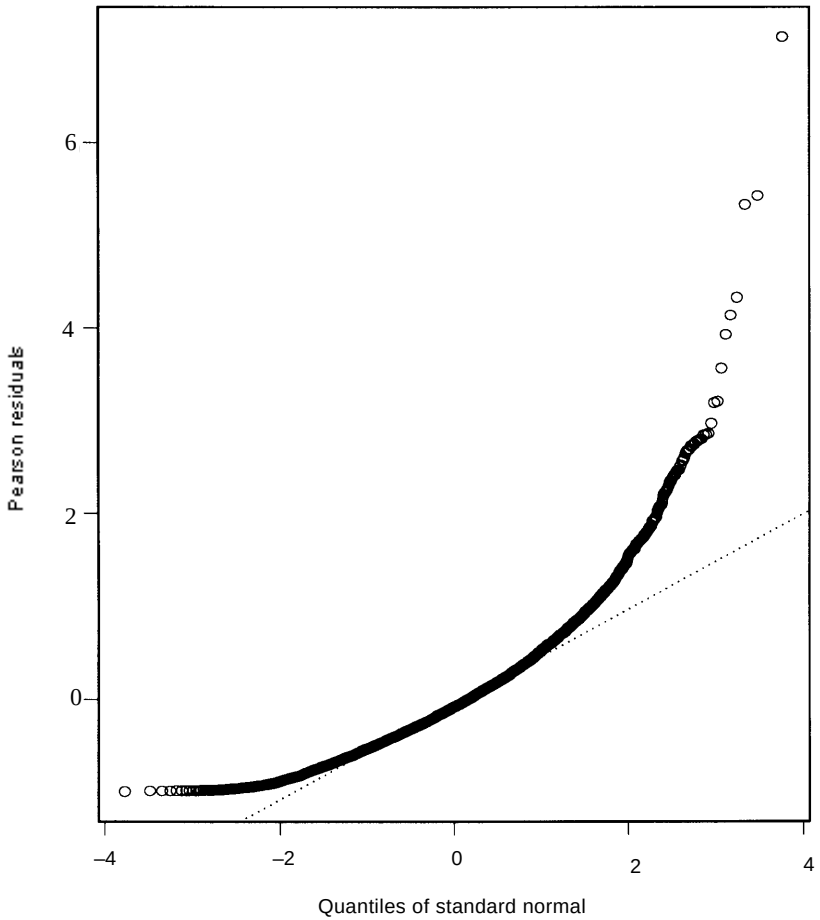


Figure 6: QQ plot of standardised residuals for the GLM fitted to CPUEs in kg/hook using the Gamma distribution family with a log link.

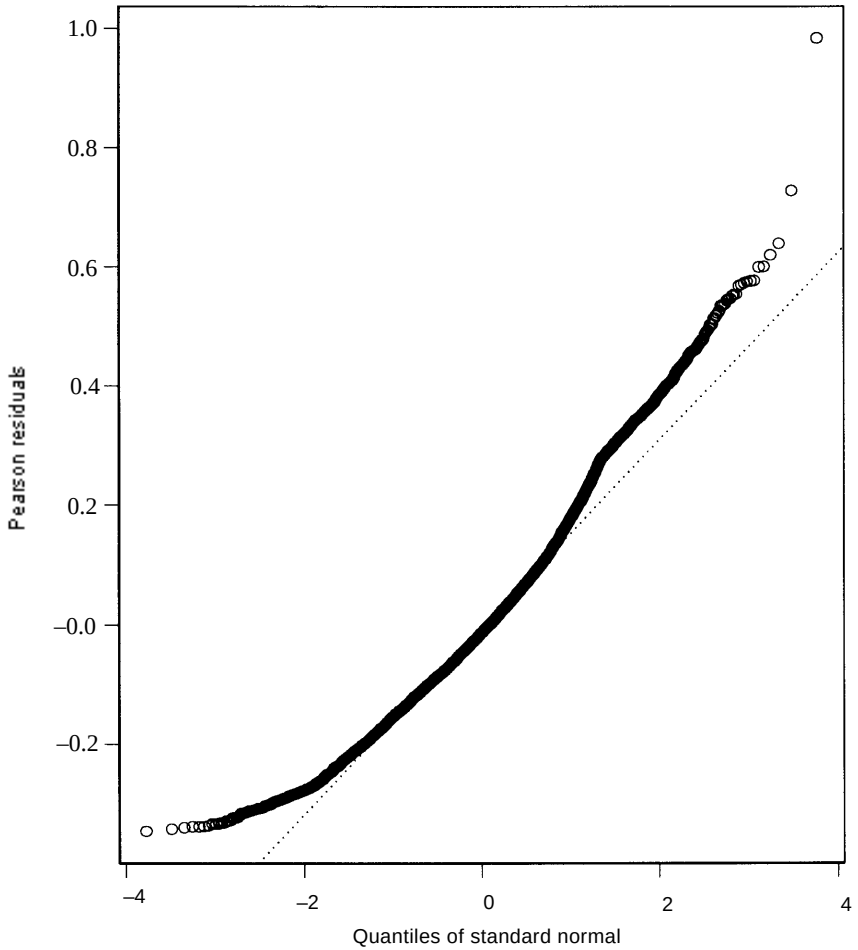


Figure 7: QQ plot of standardised residuals for the GLM fitted to CPUEs in kg/hook using a robust GLM with the quasi distribution family with a sqrt link.

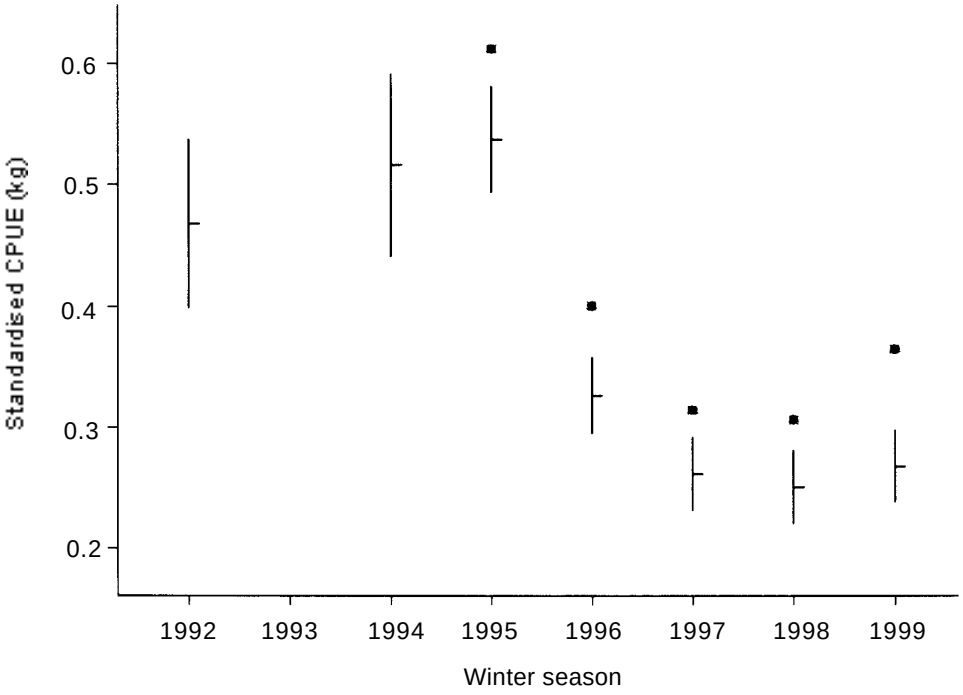


Figure 8: Standardised and nominal winter season CPUEs in kg/hook for Subarea 48.3.

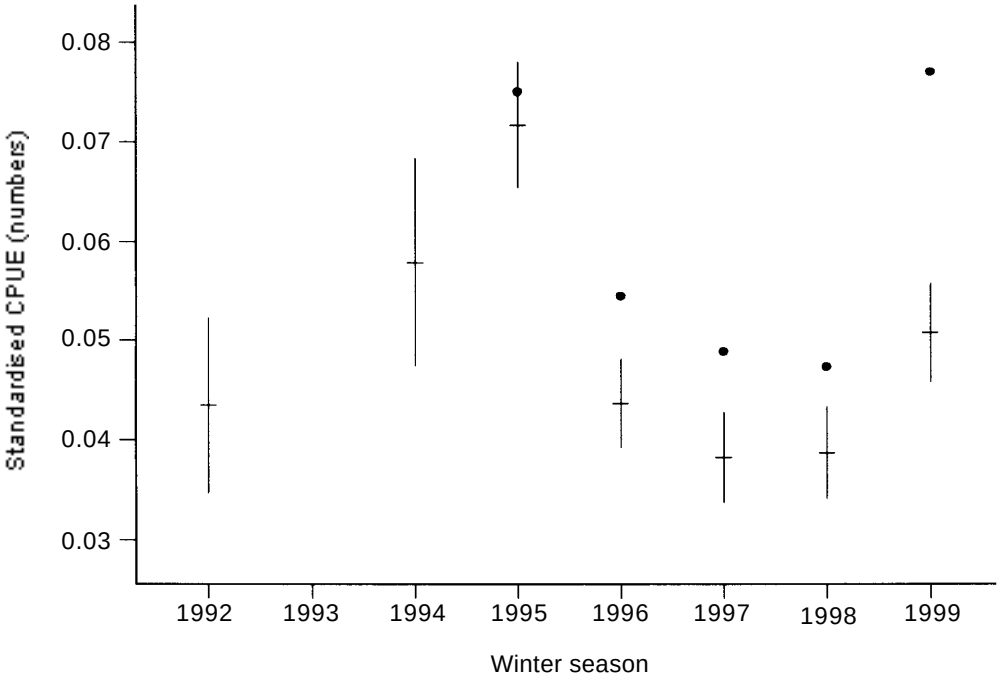


Figure 9: Standardised and nominal winter season CPUEs in numbers/hook for Subarea 48.3.

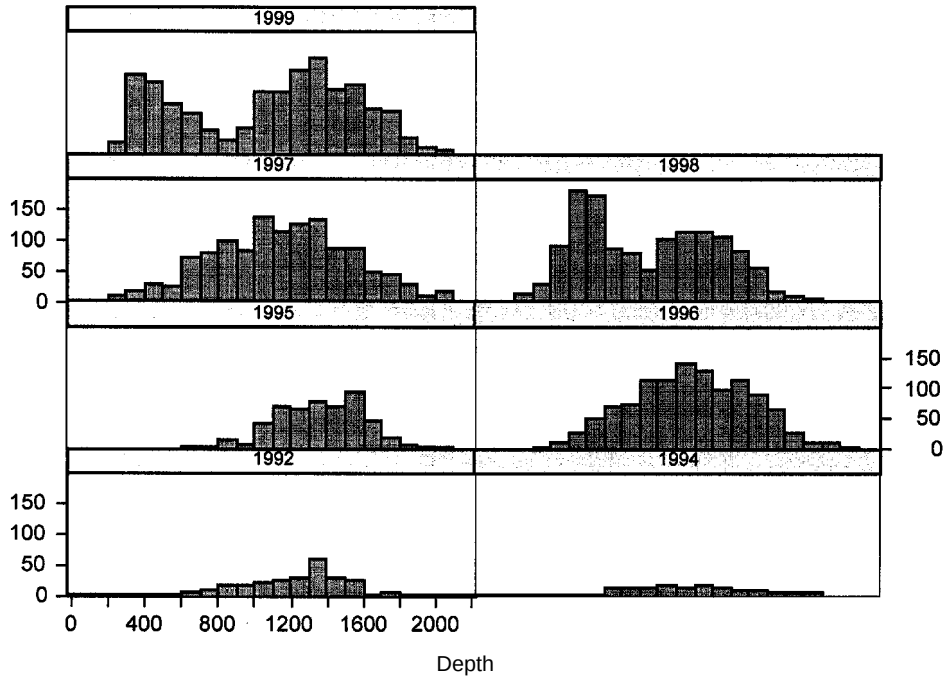


Figure 10: Histograms of depths fished during the winter seasons in Subarea 48.3.

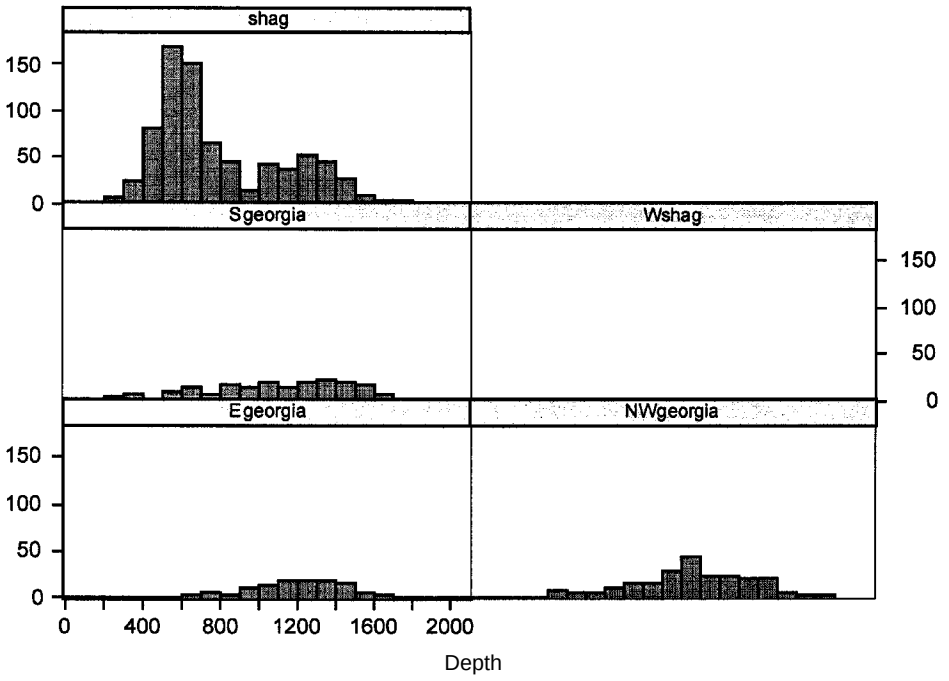


Figure 11: Histograms of depths fished during the winter 1997/98 season by area in Subarea 48.3.

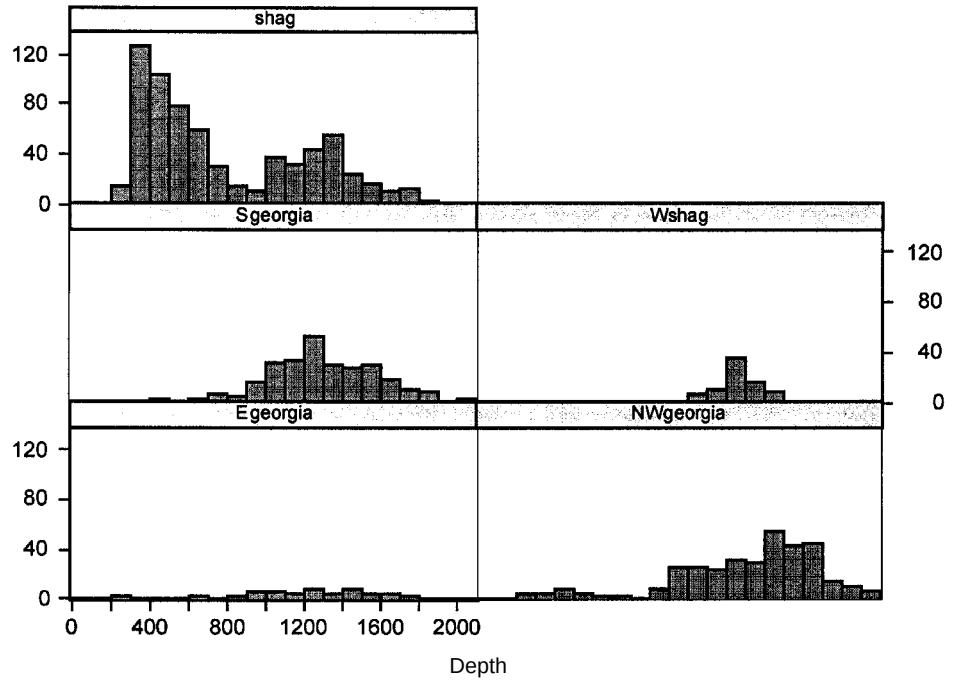


Figure 12: Histograms of depths fished during the winter 1998/99 season by area in Subarea 48.3.

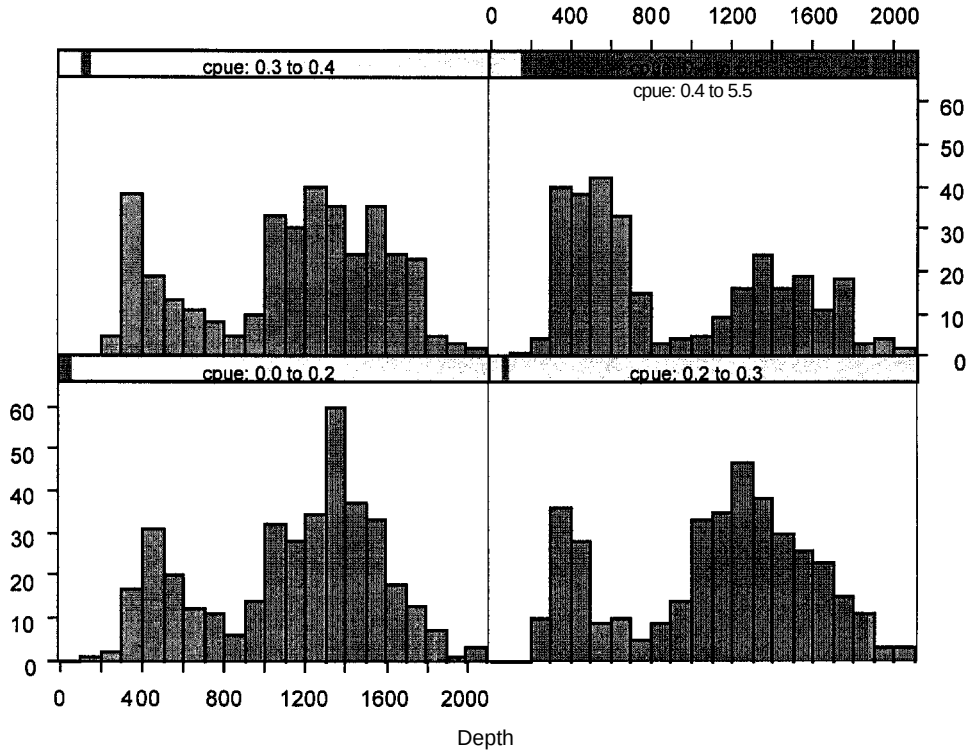


Figure 13: Histograms of depths fished during the winter 1998/99 season in Subarea 48.3 for different levels of CPUE in kg/hook.

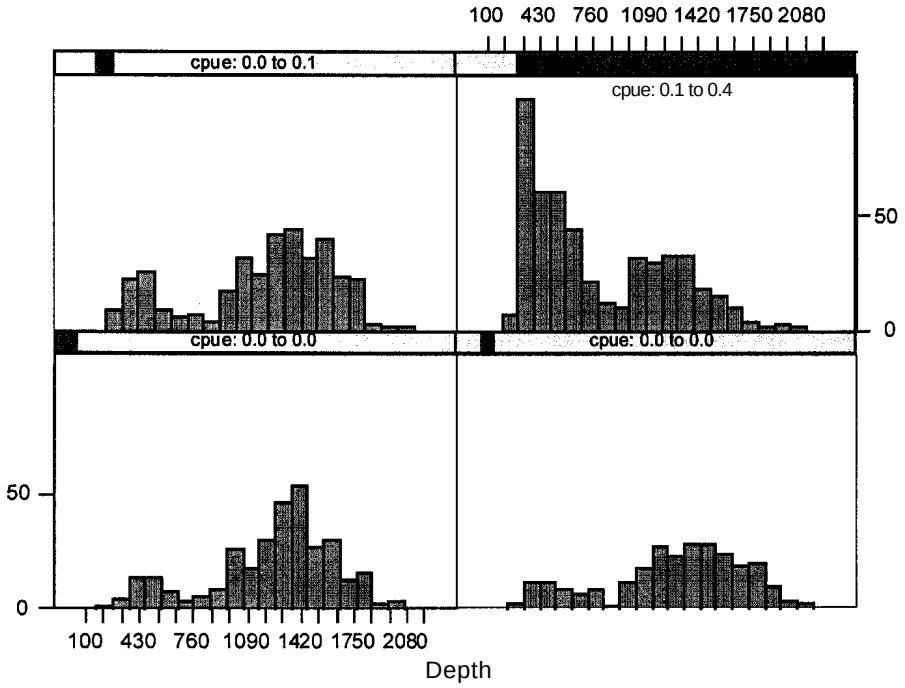


Figure 14: Histograms of depths fished during the winter 1998/99 season in Subarea 48.3 for different levels of CPUE in numbers/hook.

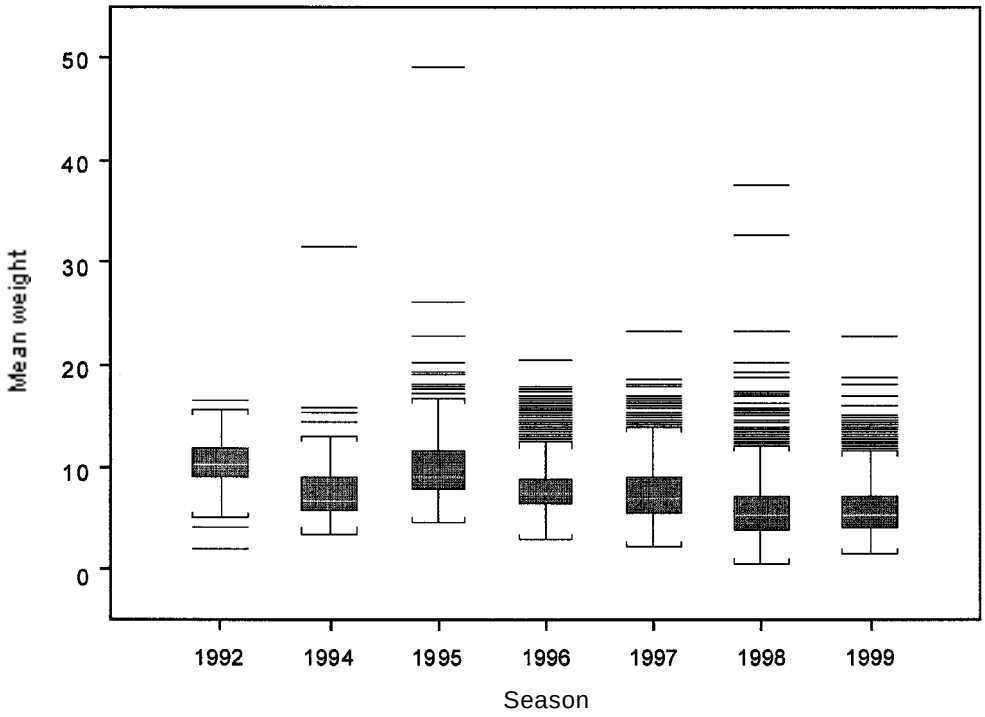


Figure 15: Mean weights of fish taken during the winter seasons in Subarea 48.3.

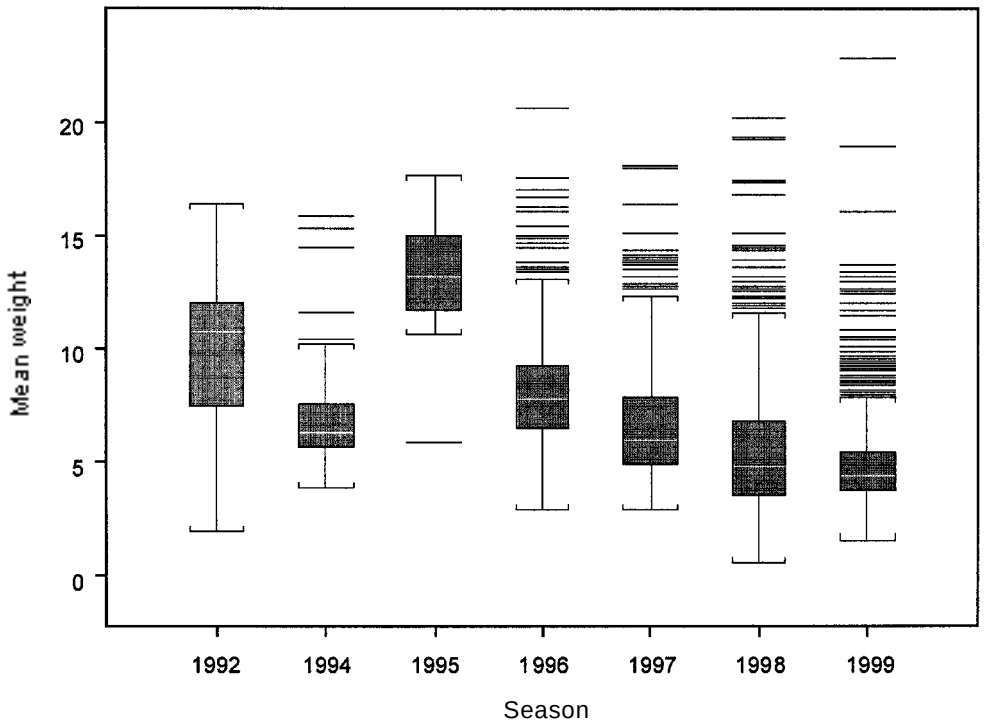


Figure 16: Mean weights of fish taken during the winter seasons at Shag Rocks.

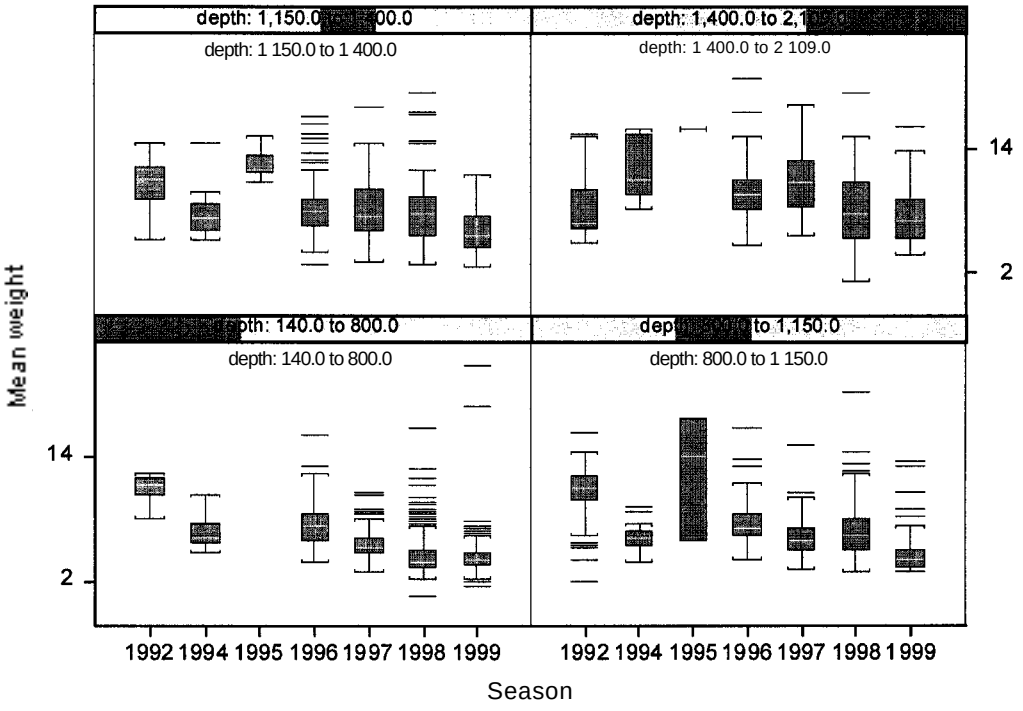


Figure 17: Mean weights of fish taken during the winter seasons at Shag Rocks by depth.

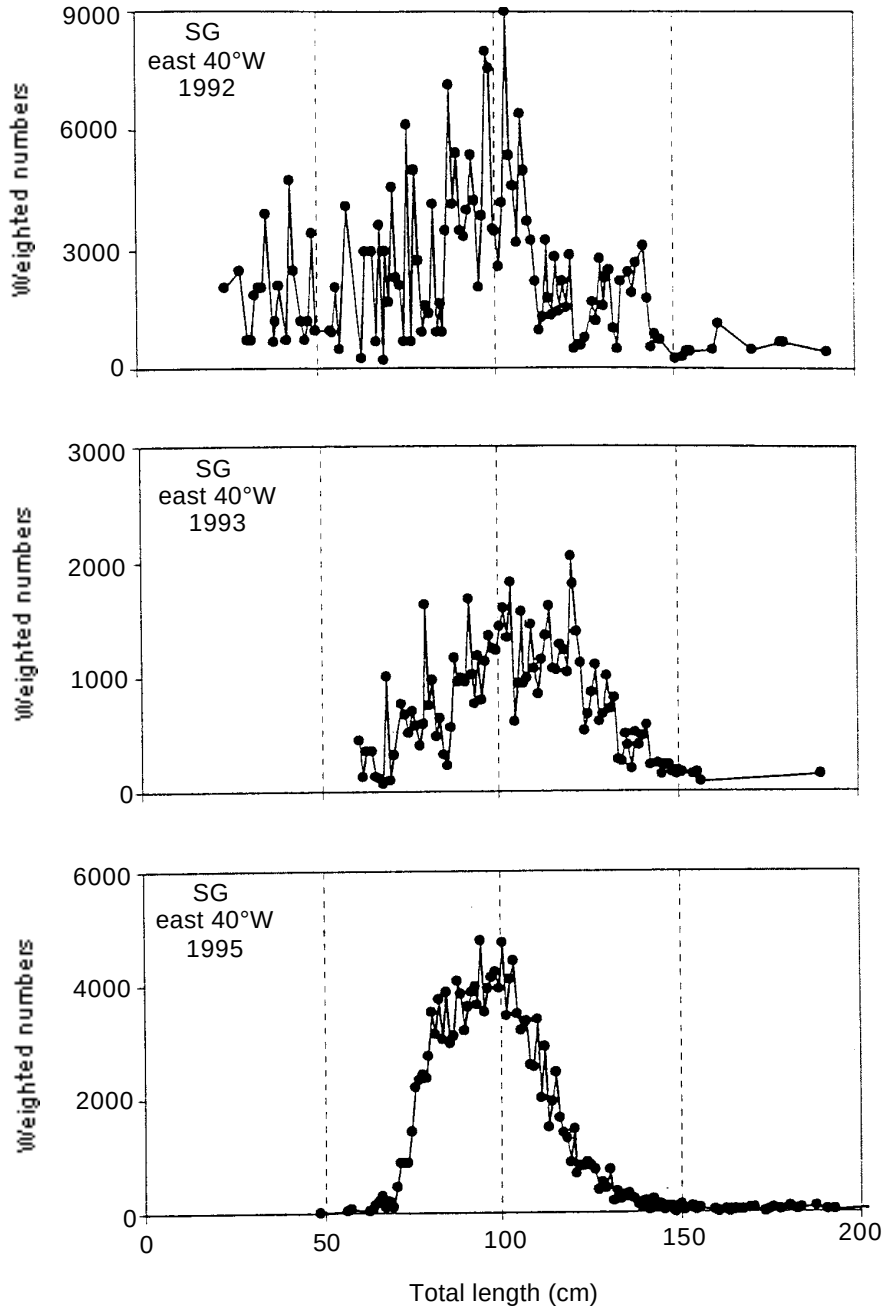


Figure 18: Catch-weighted length frequencies by season for fish taken around South Georgia.

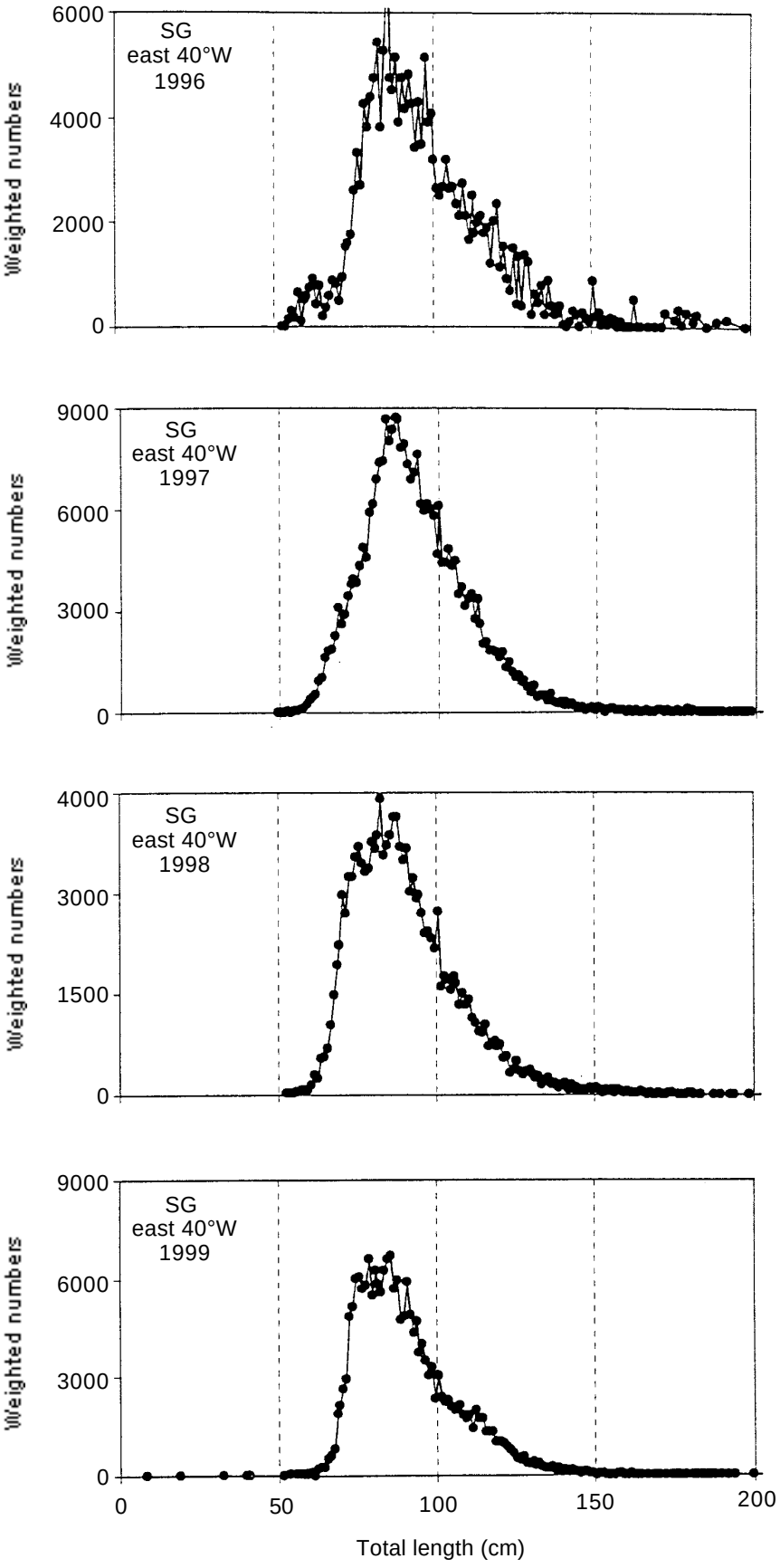


Figure 18 (continued)

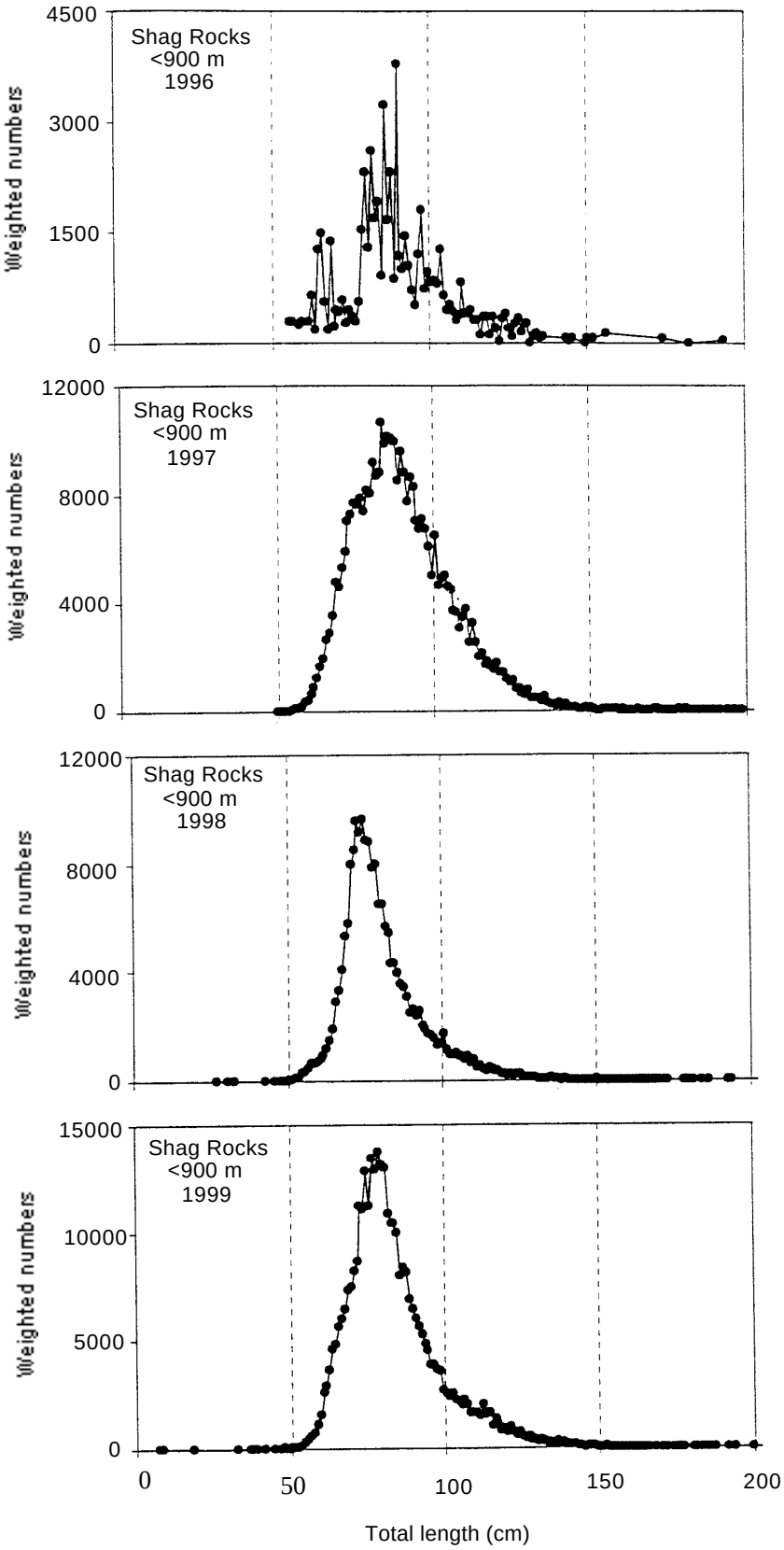


Figure 19: Catch-weighted length frequencies by season for fish taken around Shag Rocks at depths less than 900 m.

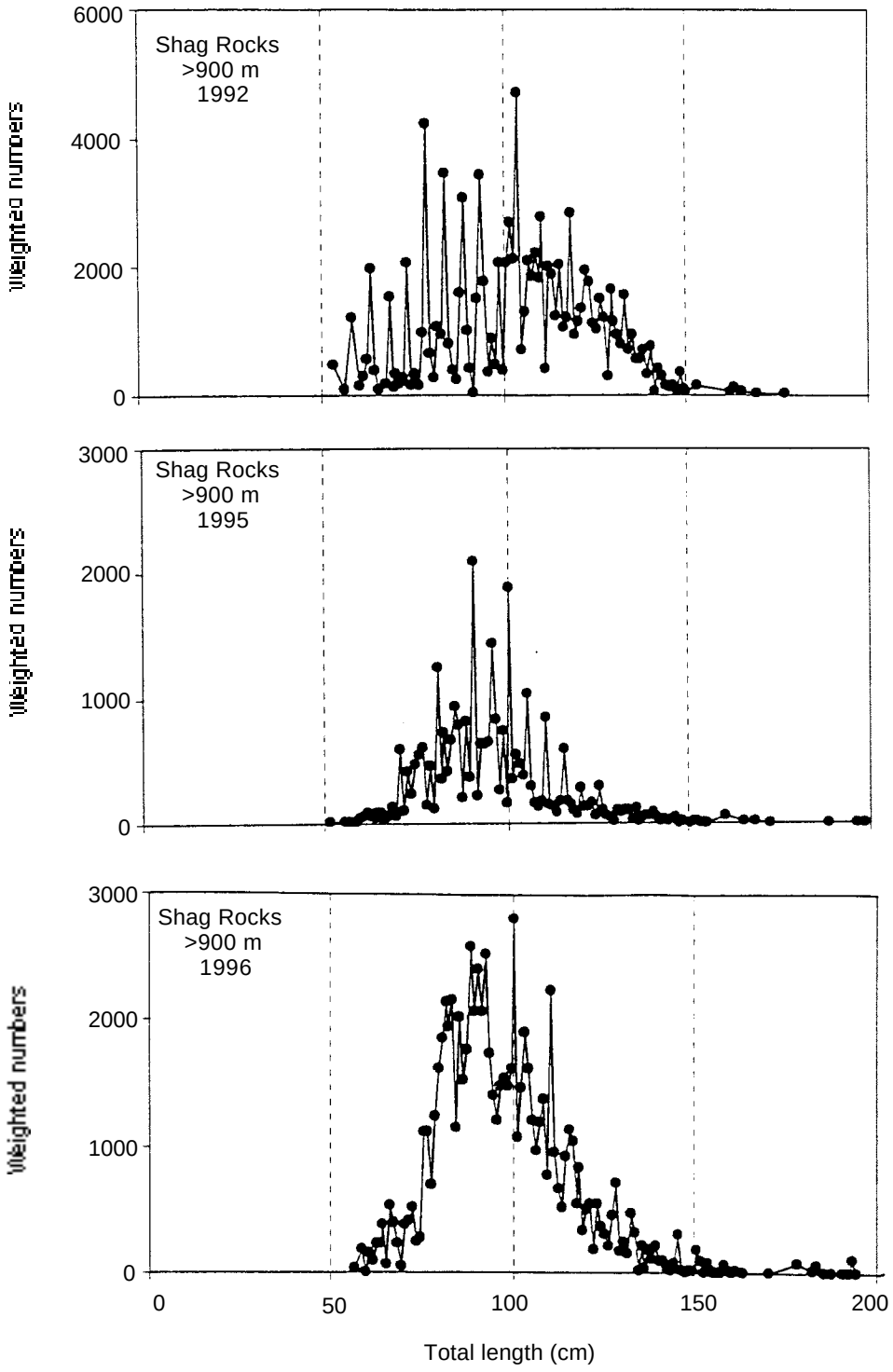


Figure 20: Catch-weighted length frequencies by season for fish taken aorund Shag Rocks at depths greater than 900 m.

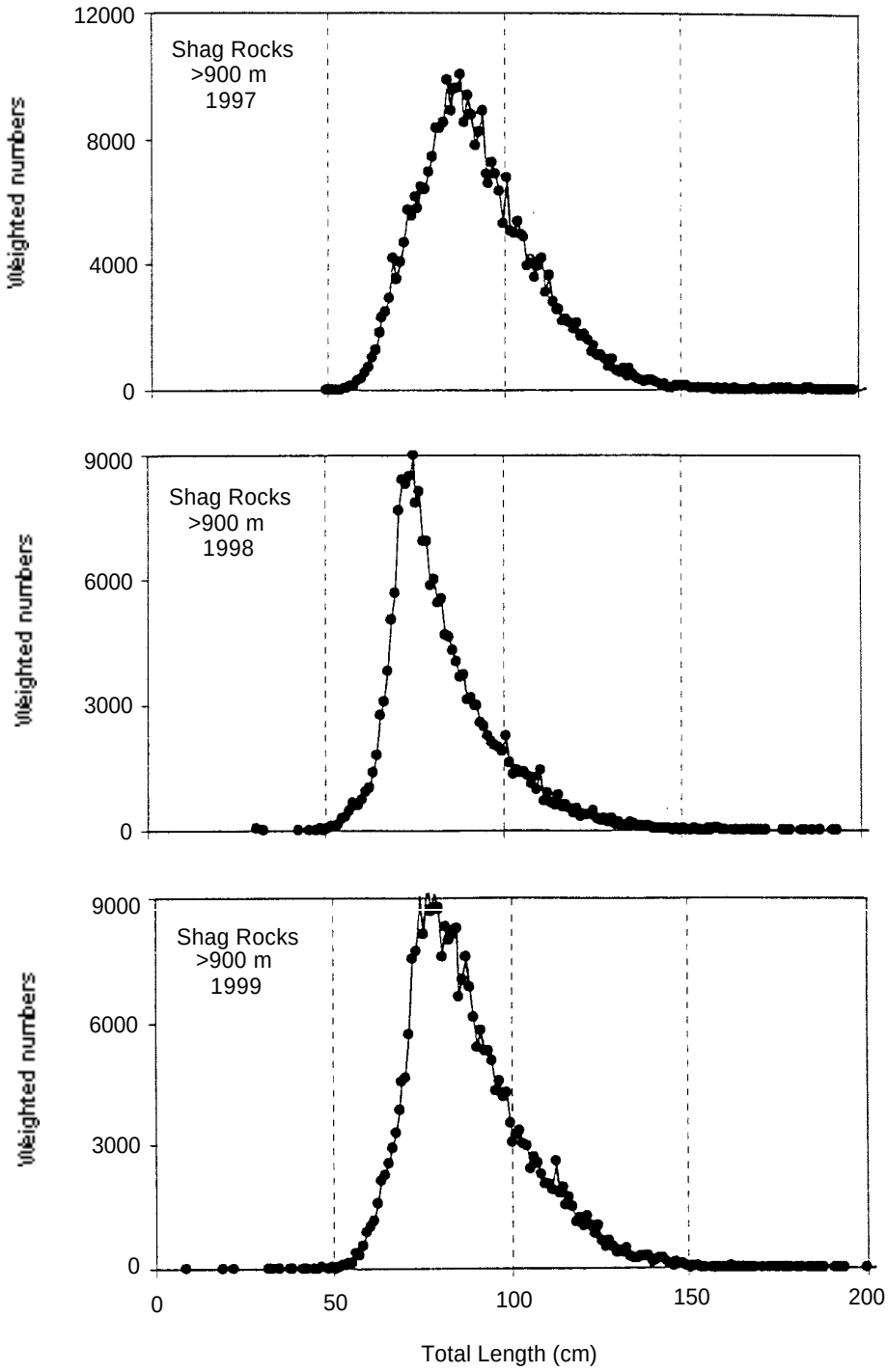


Figure 20 (continued)

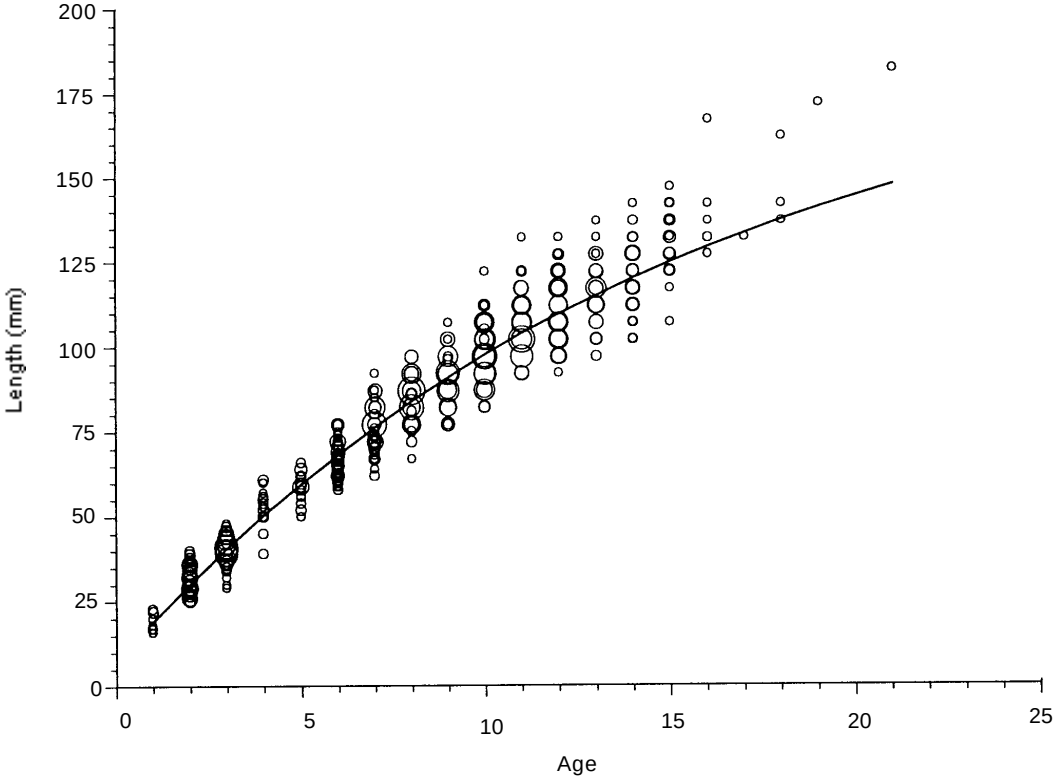


Figure 21: Lengths at age for *D. eleginoides* in Subarea 48.3 taken during 1991 from a UK trawl survey in January and February and as age–length keys from the Chilean fishery from February to May. The fitted curve is for the estimated parameters – L_∞ = 194.6 cm, k = 0.066.yr^{-1} and t_0 = -0.56 years.

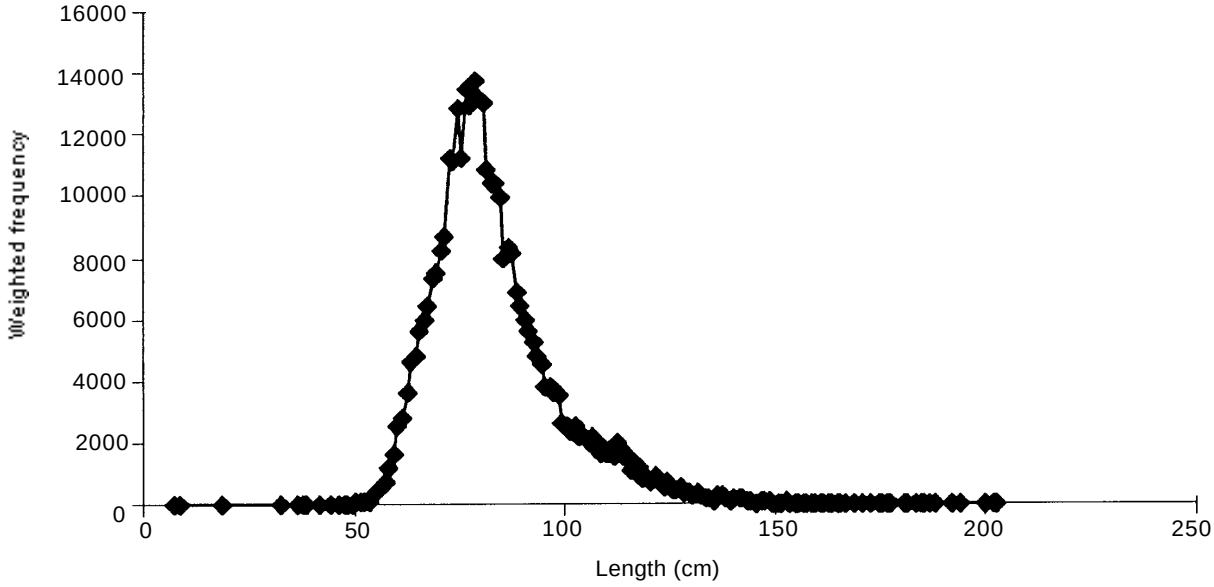


Figure 22: Weighted length frequencies of *D. eleginoides* from the commercial longline fishery in Subarea 48.3 from 1992 to the present.

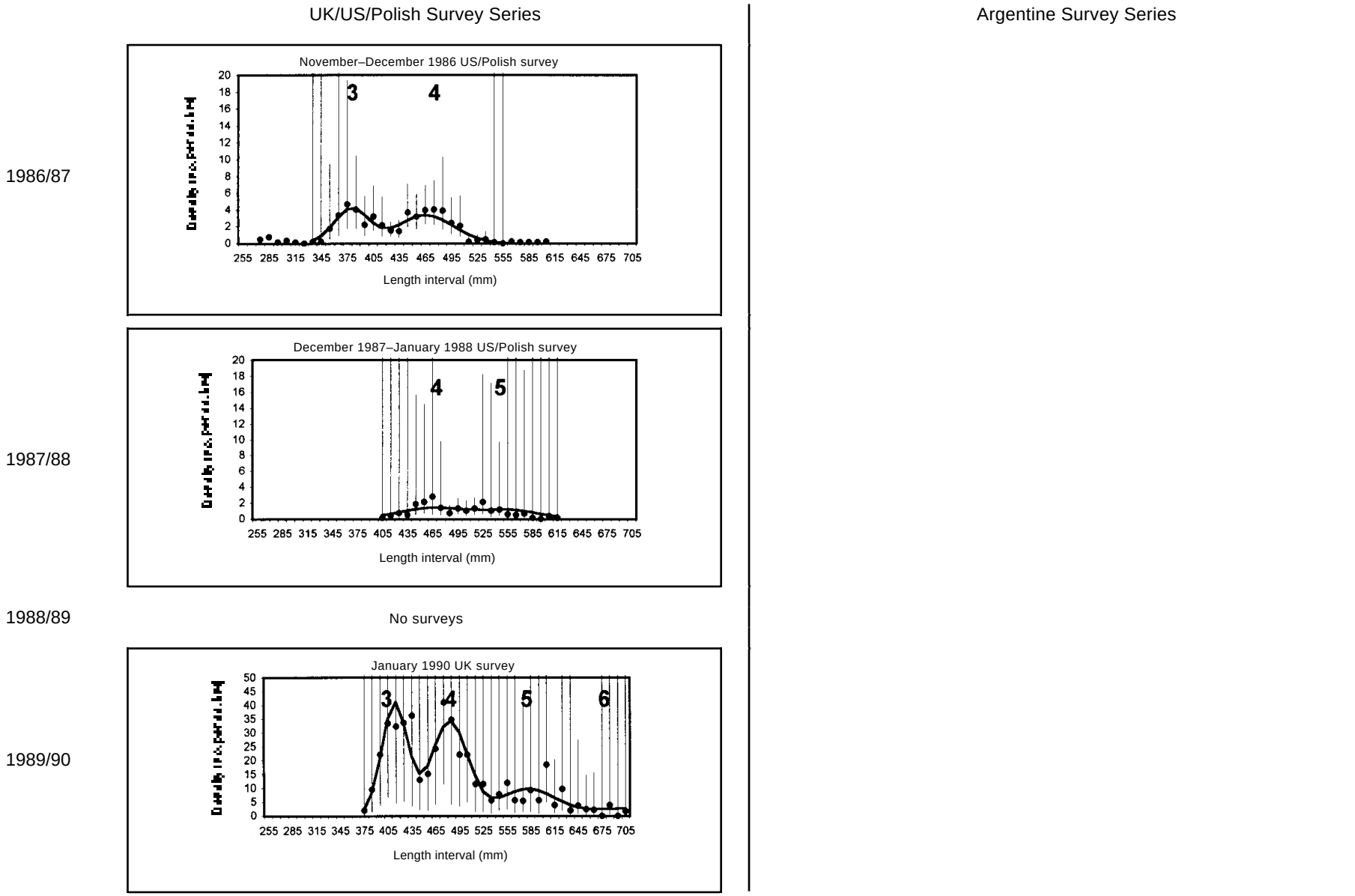


Figure 23: Plots of observed and expected length-density data produced using the CMIX program. Vertical bars represent upper and lower confidence intervals on observed density at length. Numbers superimposed on the plots indicate nominal ages assigned to each mixture.

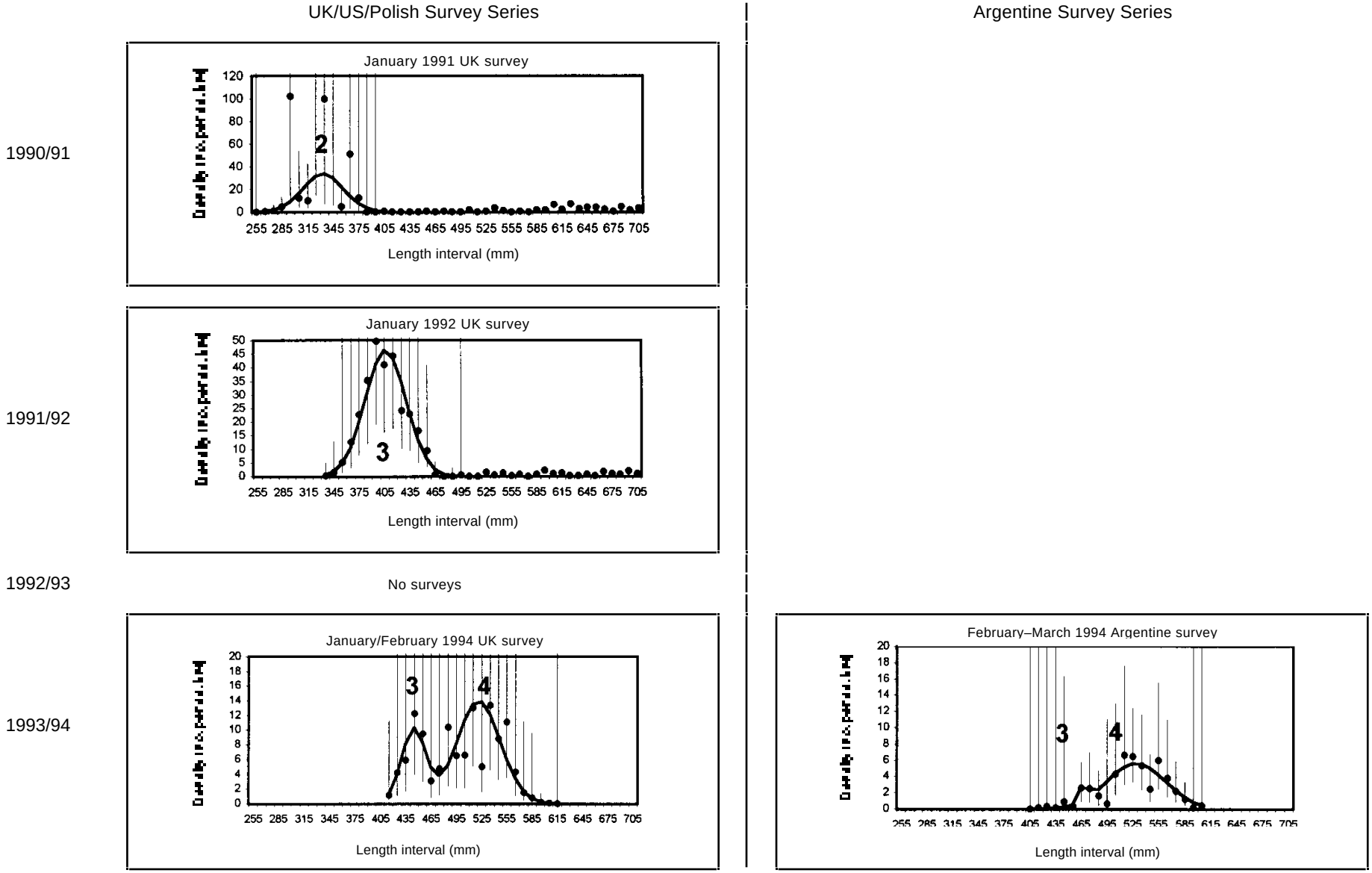


Figure 23 continued

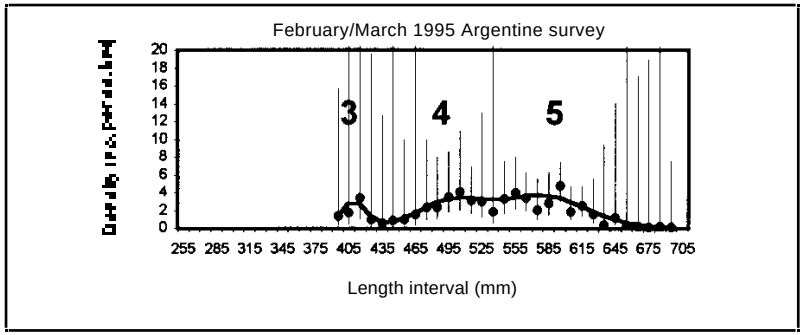
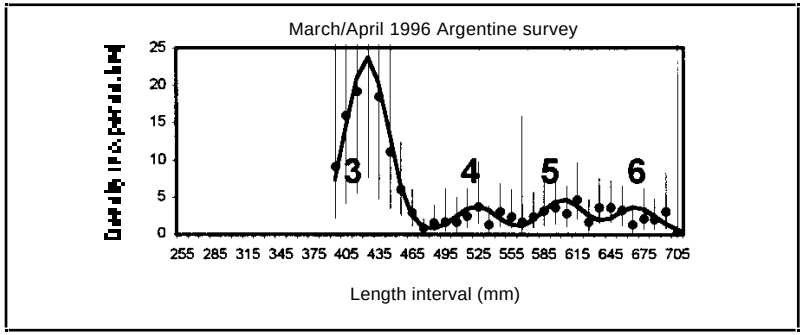
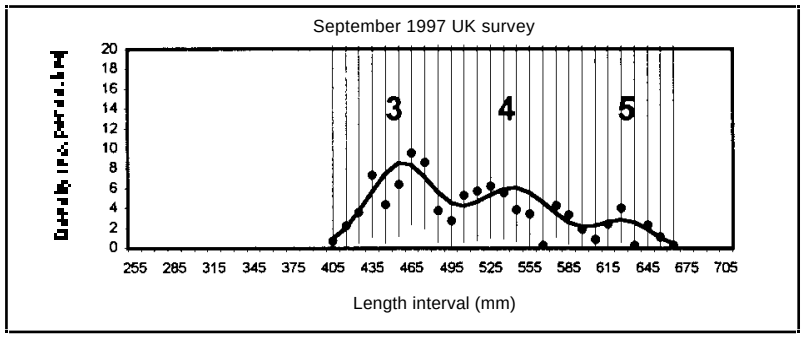
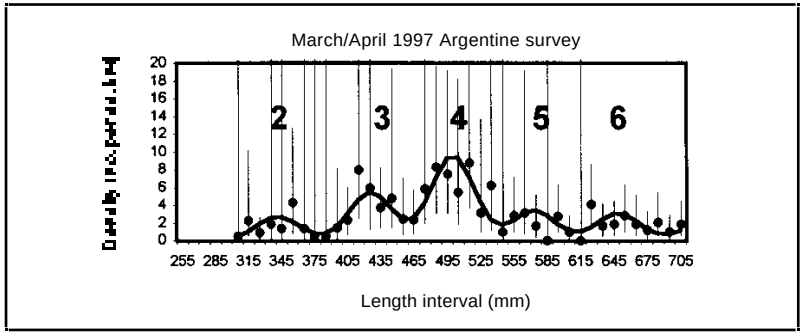
	UK/US/Polish Survey Series	Argentine Survey Series
1994/95		
1995/96		
1996/97		

Figure 23 continued

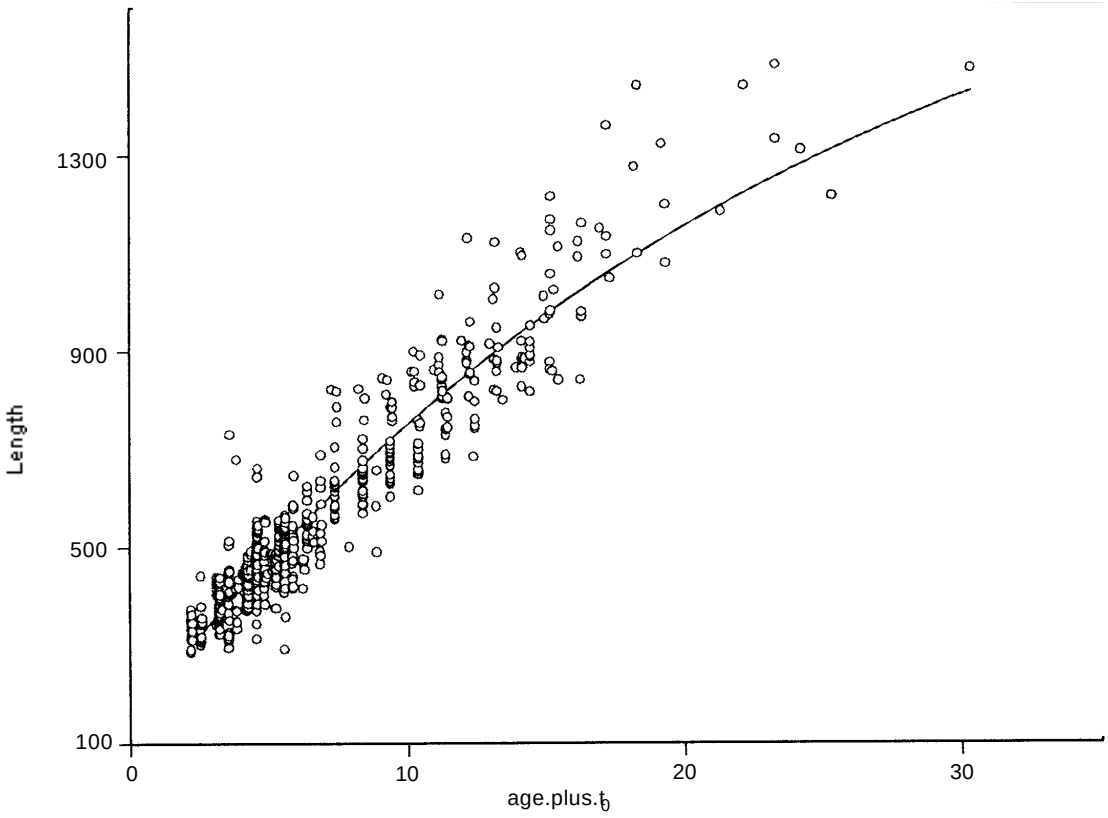


Figure 24: Lengths at age for *D. eleginoides* in Division 58.5.2 taken during trawl surveys in 1990 and 1993 and in the commercial fishery since 1997. The fitted curve is for the estimated parameters – L_∞ = 194.6 cm, k = 0.0414.yr^{-1} and t_0 = -1.80 years.

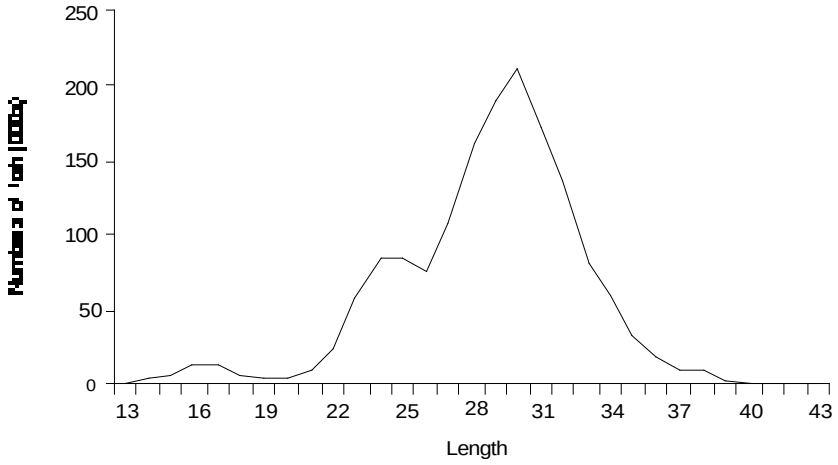


Figure 25: Weighted length frequency of *C. gunnari* during the 1998/99 season in Subarea 48.3.

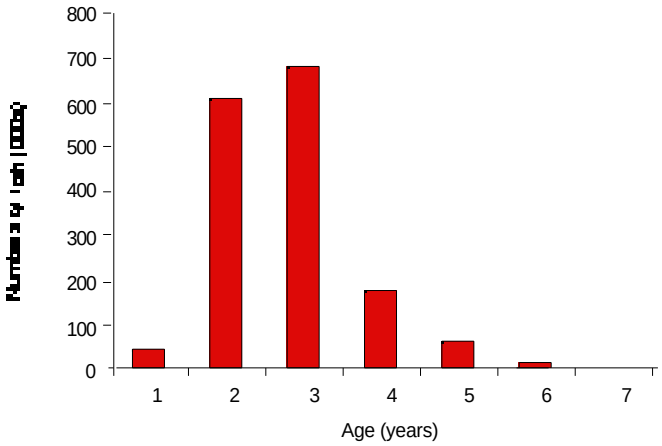


Figure 26: Catch at age of *C. gunnari* during the 1998/99 season in Subarea 48.3.

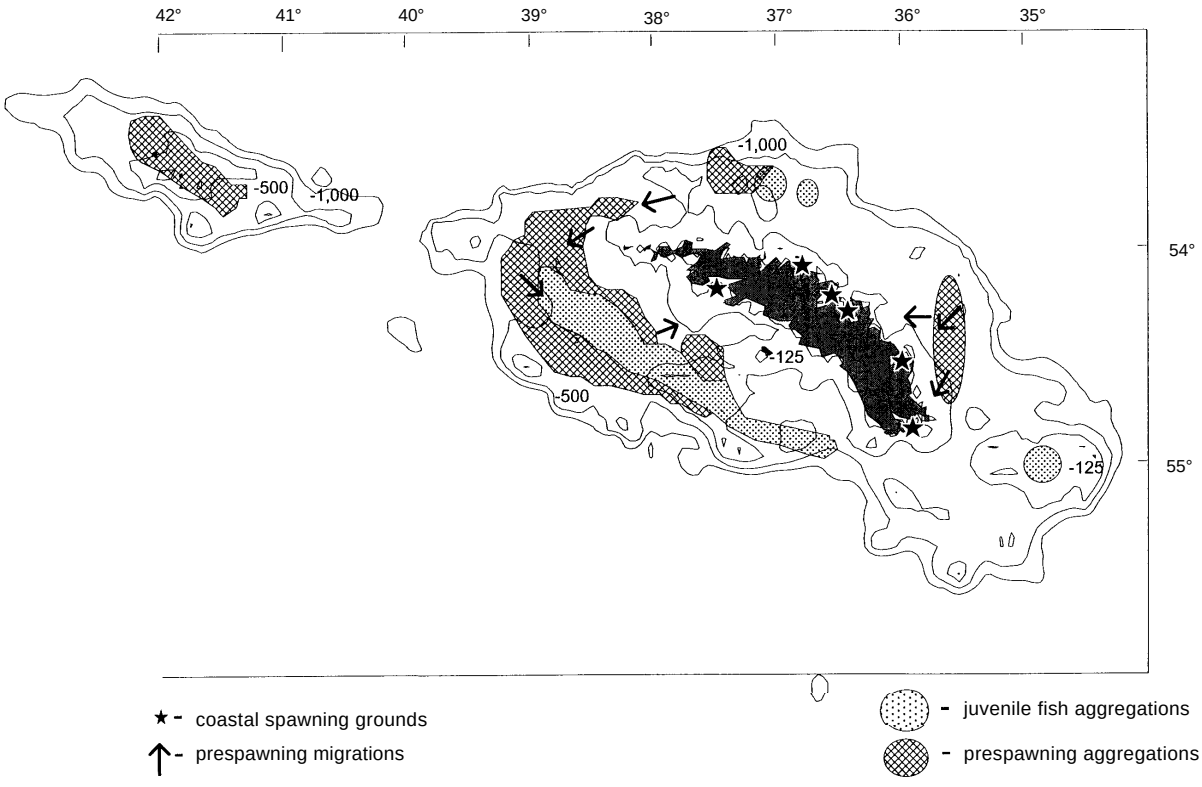


Figure 27: Spawning grounds, main aggregation of juvenile icefish and prespawning migrations.

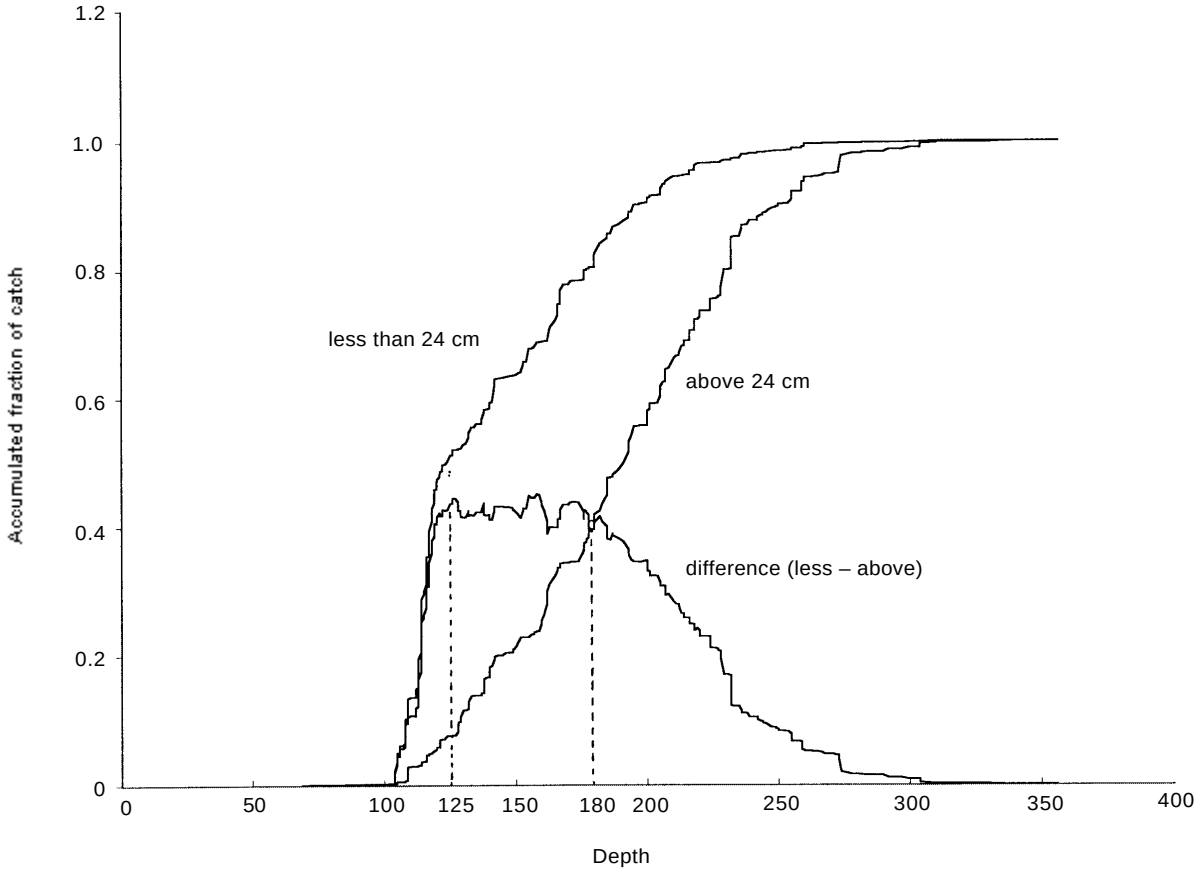


Figure 28: Relationship between the cumulative fraction of the survey of *C. gunnari* at lengths below and above 24 cm in Subarea 48.3.

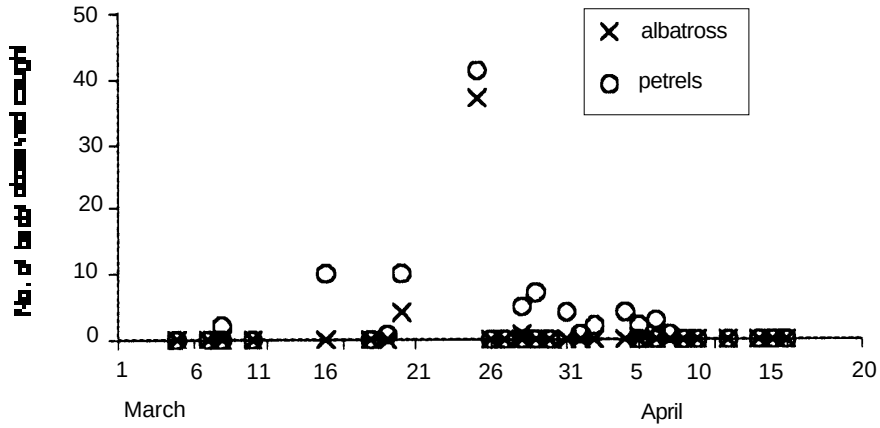


Figure 29: Catches of seabirds in March and April 1997 on longline sets where streamer lines were used, offal was not discharged and setting was at night with no moon. Line weighting was 0.1 to 0.19 kg/m (greater line weightings were not available in 1997).

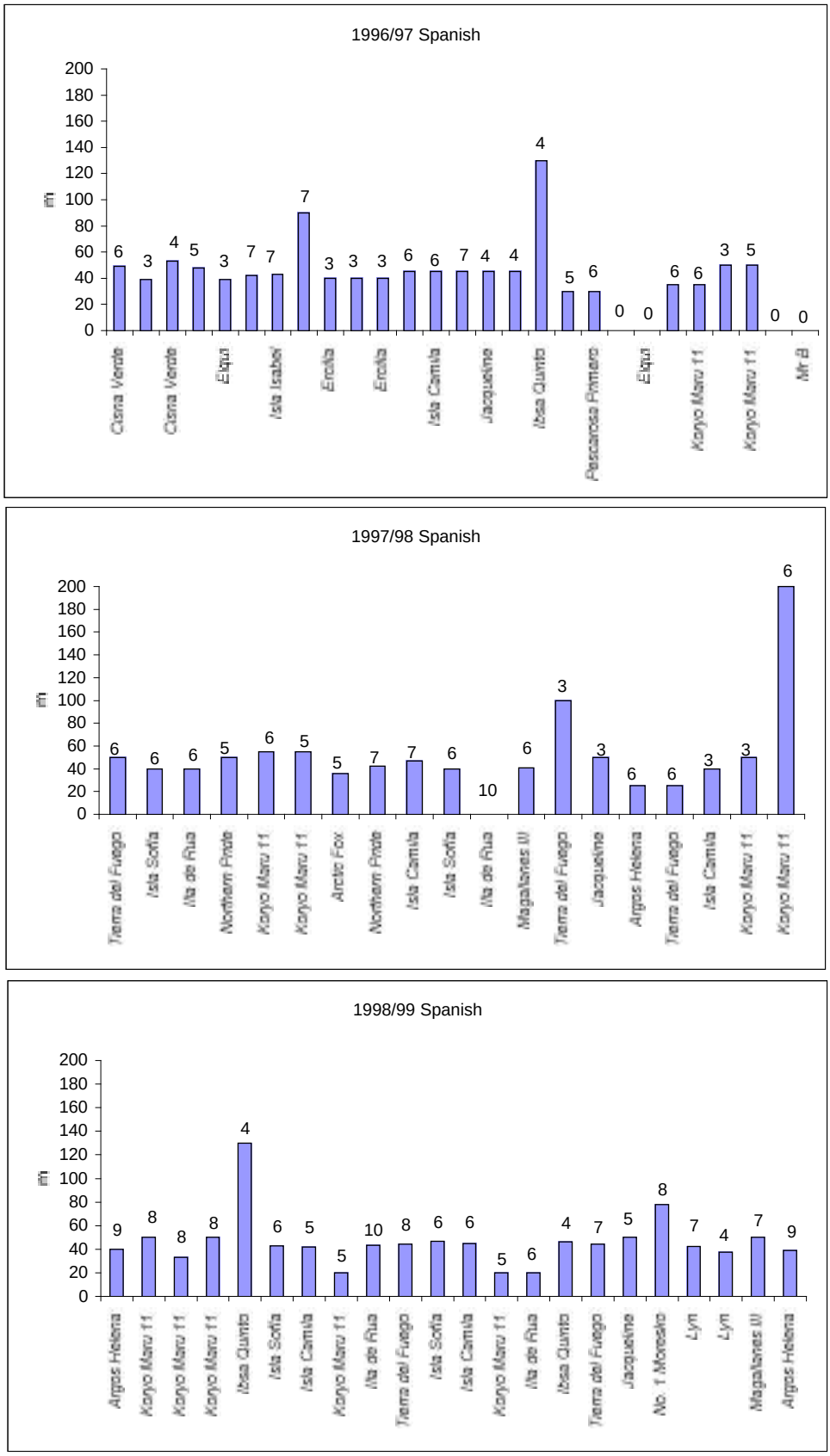


Figure 30: Mass of weights (kg) and weight spacings (m) used by vessels using the Spanish method in 1996/97, 1997/98 and 1998/99.

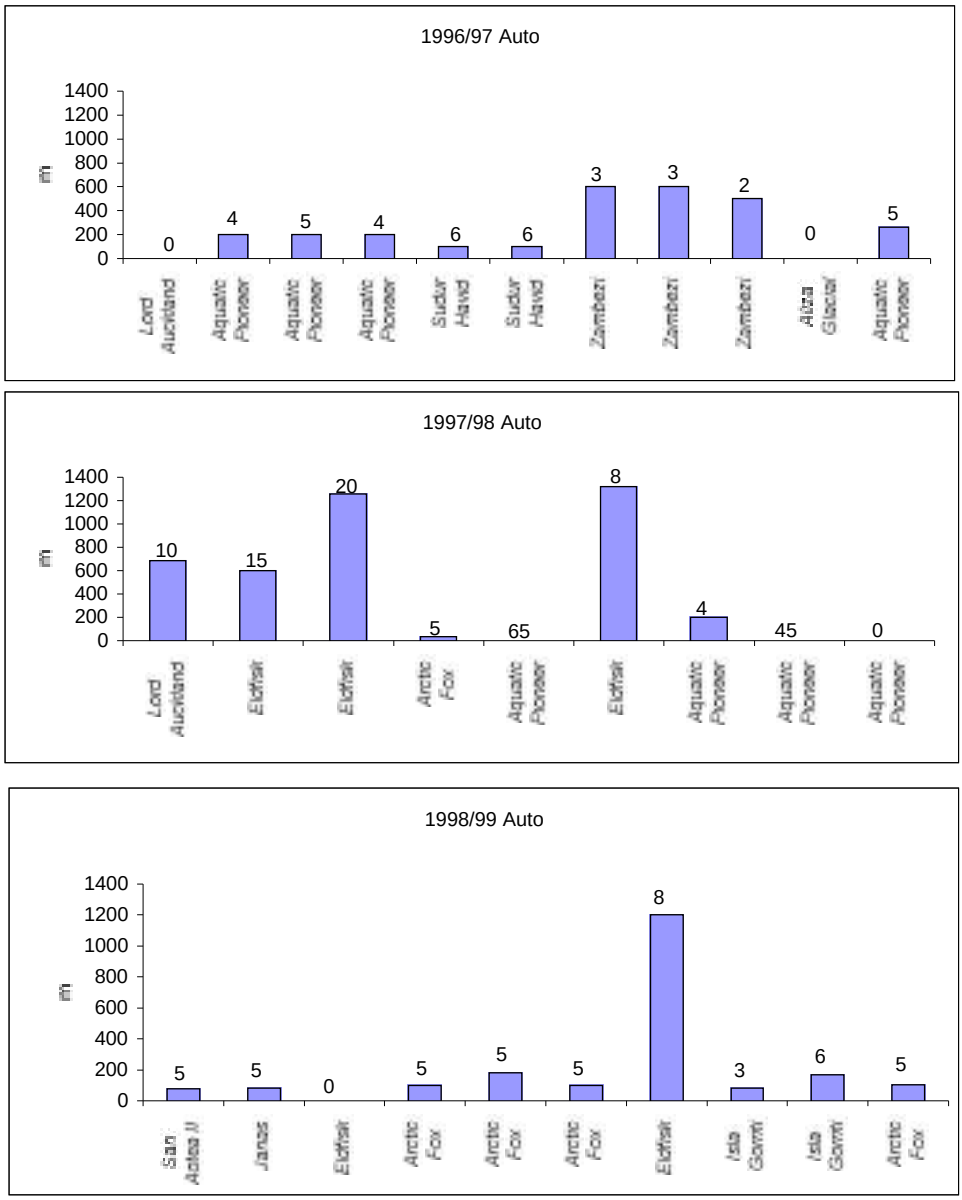


Figure 31: Mass of weights (kg) and weight spacings (m) used by autoline vessels in 1996/97, 1997/98 and 1998/99.

APPENDIX A

AGENDA

Working Group on Fish Stock Assessment
(Hobart, Australia, 11 to 21 October 1999)

1. Opening of the Meeting

2. Organisation of the Meeting and Adoption of the Agenda

3. Review of Available Information

   3.1 Data Requirements Endorsed by the Commission in 1998
      3.1.1 Data Inventory and Developments in the CCAMLR Database
      3.1.2 Database 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 Toothfish Fisheries 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 1998/99
      4.1.2 Exploratory Fisheries in 1998/99
      4.1.3 New Fisheries Notified for 1999/2000 (Subgroup report)
      4.1.4 Exploratory Fisheries Notified for 1999/2000 (Subgroup report)
      4.1.5 Progress Towards Assessments in Exploratory Fisheries
      4.1.6 By-catch
      4.1.7 Apportioning Catch Limits

   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
4.5 Regulatory Framework for Fisheries Development

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
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 1998 Data
7.3.2 1999 Data
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 1998/99
7.5.3 New and Exploratory Fisheries Proposed for 1999/2000

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 Strategic and Policy Issues

7.10 Advice to the Scientific Committee

8. Other Incidental Mortality

9. Future Work

9.1 Data Requirements
9.2 Software and Analyses to be Prepared or Developed Prior to the Next Meeting

10. Other Business

11. Adoption of Report

12. Close of Meeting.

APPENDIX B

LIST OF PARTICIPANTS

Working Group on Fish Stock Assessment
(Hobart, Australia, 11 to 21 October 1999)

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APPENDIX C

LIST OF DOCUMENTS

Working Group on Fish Stock Assessment
(Hobart, Australia, 11 to 21 October 1999)

WG-FSA-99/1	Provisional Agenda and Annotation to the Provisional Agenda for the 1999 Meeting of the Working Group on Fish Stock Assessment (WG-FSA)
WG-FSA-99/2	List of participants
WG-FSA-99/3	List of documents
WG-FSA-99/4	Data and resources available to WG-FSA-99 Secretariat
WG-FSA-99/5	Results of experimental trials of bird by-catch reduction methods conducted by the UK-registered longliner *Argos Helena* in Statistical Subarea 48.3 D.J. Agnew, A. Black, J.P. Croxall and G. Parkes (United Kingdom)
WG-FSA-99/6	Off the hook? Initiatives to reduce seabird by-catch in longline fisheries J. Cooper (South Africa), J.P. Croxall (United Kingdom) and K.S. Rivera (USA)
WG-FSA-99/7	Secretariat work in support of WG-FSA Secretariat
WG-FSA-99/8	Fishery Data Manual – draft English version Secretariat
WG-FSA-99/9	Fishery information for WG-FSA-99 Secretariat
WG-FSA-99/10	Summary of observations aboard longline vessels operating in the Convention Area Secretariat
WG-FSA-99/11	Summary of observations aboard trawl vessels operating in the Convention Area during the 1998/99 season Secretariat
WG-FSA-99/12	Summary of observations on compliance with Conservation Measures 29/XVI and 63/XV Secretariat
WG-FSA-99/13	Estimates of seabed areas within the range of distribution of *Dissostichus* spp. Secretariat

WG-FSA-99/14	Research survey data Secretariat
WG-FSA-99/15	Catch-weighted length frequencies from commercial data Secretariat
WG-FSA-99/16	Biological characteristics of Antarctic fish stocks in the Southern Scotia Arc region K.-H. Kock (Germany), C. Jones (USA) and S. Wilhelms (Germany)
WG-FSA-99/17 Rev. 1	United Kingdom research underway on Southern Ocean seabirds vulnerable to fisheries interactions J.P. Croxall (United Kingdom)
WG-FSA-99/18	Seabird mortality on longlines in Australian waters: a case study of progress and policy R. Gales, N. Brothers, T. Reid, D. Pemberton and G.B. Baker (Australia) (In: Adams, N.J. and R.H. Slotow (Eds). *Proc. 22 Int. Ornithol. Congr*., Durban: 648–675)
WG-FSA-99/19	Quantifying habitat use in satellite-tracked pelagic seabirds: application of kernel estimation to albatross locations A.G. Wood (United Kingdom), B. Naef-Daenzer (Switzerland), P.A. Prince and J.P. Croxall (United Kingdom) (*Journal of Avian Biology*, in press)
WG-FSA-99/20	Foraging location and range of white-chinned petrels *Procellaria aequinoctialis* breeding in the South Atlantic S.D. Berrow, A.G. Wood and P.A. Prince (United Kingdom) (*Journal of Avian Biology*, in press)
WG-FSA-99/21	Areas and scales of interactions between albatrosses and the marine environment: species, populations and sexes P.A. Prince (United Kingdom), H. Weimerskirch (France), A.G. Wood and J.P. Croxall (United Kingdom) (In: Adams, N.J. and R.H. Slotow (Eds). *Proc. 22 Int. Ornithol. Congr.*, Durban: 2001–2020. Johannesburg: BirdLife South Africa)
WG-FSA-99/22	Withdrawn
WG-FSA-99/23	The incidental catch of seabirds by longline fisheries: worldwide review and technical guidelines for mitigation FAO Fisheries Circular No. 937 Submitted by FAO
WG-FSA-99/24	Effect of a shore-based sampling program on *Notothenia coriiceps* populations R. Casaux and E. Barrera-Oro (Argentina)
WG-FSA-99/25	Foraging ecology of grey-headed mollymawks at Marion Island in relation to longline fishing activity D.C. Nel, J.L. Nel, P.G. Ryan, N.T.W. Klages (South Africa), R.P. Wilson (Germany) and G. Robertson (Australia)

WG-FSA-99/26	Factors affecting the number and mortality of seabirds attending trawlers and longliners in the Kerguelen area H. Weimerskirch, D. Capdeville and G. Duhamel (France)
WG-FSA-99/27	French research underway on Southern Ocean seabirds vulnerable to fisheries interactions H. Weimerskirch (France)
WG-FSA-99/28	Preliminary analysis of seabird by-catch using CCAMLR observer data D.J. Agnew and J.P. Croxall (United Kingdom)
WG-FSA-99/29	Vacant
WG-FSA-99/30	Increase in relative abundance of fjord *Notothenia rossii* in Potter Cover, South Shetland Islands, after the decrease associated with commercial fishing in the area E.R. Barrera-Oro, E.R. Marschoff and R.J. Casaux (Argentina)
WG-FSA-99/31	Notes on the availability of three important finfish species in offshore waters of the lower South Shetland Islands (Subarea 48.1) C.D. Jones (USA), E.R. Barrera-Oro, E.R. Marschoff and R.J. Casaux (Argentina)
WG-FSA-99/32	Changes in biomass of eight species of finfish around the South Orkney Islands (Subarea 48.2) from three bottom trawl surveys C.D. Jones (USA), K.-H. Kock (Germany) and E. Balguerías (Spain)
WG-FSA-99/33	Revised estimates of seabed areas within the 500 m isobath of the South Orkney Islands (Subarea 48.2) and consequences for standing stock biomass estimates of nine species of finfish C.D. Jones (USA)
WG-FSA-99/34	Research underway on South African seabirds vulnerable to fisheries interactions Delegation of South Africa
WG-FSA-99/35	Avoidance of incidental mortality of seabirds and the implementation of Conservation Measure 169/XVII in Statistical Subarea 88.1 in the 1998/99 season J. Molloy and N. Smith (New Zealand)
WG-FSA-99/36	Risk assessment of wandering albatrosses *Diomedea exulans*, breeding on Marion Island, to by-catch within CCAMLR statistical areas D.C. Nel, J. Cooper (South Africa) and G. Robertson (Australia)
WG-FSA-99/37	Longline sink rates on bottom autoline vessels N. Smith (New Zealand)

WG-FSA-99/38	Sexual dimorphism and sexual segregation in foraging strategies of northern giant petrels *Macronectes halli* during incubation J. González-Solís, J.P. Croxall and A.G. Wood (United Kingdom)
WG-FSA-99/39	Foraging partitioning between giant petrels *Macronectes* spp. and its relationship with breeding population changes at Bird Island, South Georgia J. González-Solís, J.P. Croxall and A.G. Wood (United Kingdom)
WG-FSA-99/40	Rajid by-catch in the longline fishery for toothfish in Subarea 48.3 D.J. Agnew, J. Taylor and I. Everson (United Kingdom)
WG-FSA-99/41	Notification of research vessel activity in the Convention Area Delegation of the United Kingdom
WG-FSA-99/42 Rev. 1	Seabird by-catch in the Patagonian toothfish longline fishery at the Prince Edward Islands: 1998–1999 P.G. Ryan and B.P. Watkins (South Africa)
WG-FSA-99/43	Age and growth of Patagonian toothfish (*Dissostichus eleginoides*) and Antarctic toothfish (*D. mawsoni*) in waters from the New Zealand Exclusive Economic Zone to CCAMLR Subarea 88.1 P.L. Horn (New Zealand)
WG-FSA-99/44	Fishes collected during the 1998/99 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 A. Stewart (New Zealand)
WG-FSA-99/45	Assessing the impact of the proposed exploratory fishery for *Dissostichus* spp. in CCAMLR Subarea 88.1 in the 1999/2000 season on the family Rajidae N. Smith (New Zealand)
WG-FSA-99/46	Genetic studies on toothfish (*Dissostichus eleginoides* and *Dissostichus mawsoni)*: progress report for CCAMLR P. Smith (New Zealand)
WG-FSA-99/47	Satellite tracking of white-chinned petrels and comparison with other Procellariiformes A. Catard and H. Weimerskirch (France)
WG-FSA-99/48	Utilización de la tecnica de isoelectroenfoque en la identificación de ejemplares de merluza negra *Dissostichus eleginoides* (Smitt 1898) en el Atlantico sudoccidental A. Pereira, H. Nion, Y. Marín y O. Pin (Uruguay)
WG-FSA-99/49	Research underway on New Zealand seabirds vulnerable to fisheries interactions J. Molloy (New Zealand)

WG-FSA-99/50	Variations in condition indices of mackerel icefish at South Georgia from 1972 to 1997 I. Everson (United Kingdom) and K.-H. Kock (Germany)
WG-FSA-99/51	Undeclared catches of *Dissostichus eleginoides* (compilation of available data) – report of the subgroup on IUU fisheries Prepared by G. Duhamel, S. Fitch, M. Purves and B. Watkins
WG-FSA-99/52	Protection of young fish and spawning aggregations in the fishery for *Champsocephalus gunnari* in Subarea 48.3 (South Georgia): a discussion G. Parkes (United Kingdom)
WG-FSA-99/53	Progress in Australian initiatives for the conservation of albatrosses G.B. Baker, N. Montgomery and A. McNee (Australia)
WG-FSA-99/54	Inter-annual variation in spawning status of mackerel icefish I. Everson (United Kingdom) and K.-H. Kock (Germany)
WG-FSA-99/55 Rev. 1	A comparison of the maturity stages used to estimate the reproductive status of mackerel icefish *Champsocephalus gunnari* I. Everson, J. Ellison (United Kingdom) and K.-H. Kock (Germany)
WG-FSA-99/56	An inter-laboratory comparison of ages estimated for *Dissostichus eleginoides* using otoliths J. Ashford (United Kingdom) and P. Horn (New Zealand)
WG-FSA-99/57	Fishing cruise of the Russian trawler *Zakhar Sorokin* to the Antarctic (Subarea 48.3) from 16 February to 10 March 1999 V.L. Senioukov and P.N. Kochkin (Russia)
WG-FSA-99/58	On observations of ectoparasites of icefish *Champsocephalus gunnari* in Subarea 48.3 in March 1999 V.L. Senioukov (Russia)
WG-FSA-99/59	Relative abundance of seabirds at sea within CCAMLR statistical areas E.J. Woehler (Australia), E.J. Appleyard (Secretariat) and D.J. Watts (Australia)
WG-FSA-99/60	Using additional information for generalised yield model P.S. Gasiukov (Russia)
WG-FSA-99/61	Australian research underway on seabirds vulnerable to fisheries interactions G.B. Baker (Australia)
WG-FSA-99/62	Report on meetings with Norwegian gear manufacturers Mustad and Fiskevegn G. Robertson (Australia)

WG-FSA-99/63	Variation in standing stock of the mackerel icefish *Champsocephalus gunnari* at South Georgia I. Everson, G. Parkes (United Kingdom), K.-H. Kock (Germany) and I. Boyd (United Kingdom) *Journal of Applied Ecology* (1999), 36: 591–603
WG-FSA-99/64	On the problem of diurnal migrations of some fish species on the South Georgia shelf (Subarea 48.3) I.A. Trunov, J.A. Frolkina and M.P. Konstantinova (Russia)
WG-FSA-99/65	Distribution and some biological features of icefish (*Champsocephalusgunnari*) at different life cycle stages in the South Georgia subarea Zh.A. Frolkina (Russia)
WG-FSA-99/66	Extract from Natural History of British Fishes I. Everson (United Kingdom)
WG-FSA-99/67	Working paper on scientific issues related to a unified regulatory framework for CCAMLR based on stages of fishery development Ad Hoc Task Group on the Development of a Unified Regulatory Framework for CCAMLR Draft
WG-FSA-99/68	Revision of biological and population parameters for *Dissostichus eleginoides* on the Heard Island Plateau (Division 58.5.2) based on a comprehensive survey of fishing grounds and recruitment areas in the region A.J. Constable, R. Williams, T. Lamb and E. van Wijk (Australia)
WG-FSA-99/69	Assessment of yield and status of *Macrourus carinatus* on BANZARE Bank in the southern Indian Ocean: implications for managing by-catch in CCAMLR fisheries E.M. van Wijk, A.J. Constable, R. Williams and T. Lamb (Australia)
WG-FSA-99/70	Preliminary evaluation of global aggregate long-term annual yield for Patagonian toothfish, *Dissostichus eleginoides* A.J. Constable, L.S. Meyer and R. Williams (Australia)
WG-FSA-99/71	1999 Report of the WG-FSA Subgroup on Approaches to Assessments A. Constable (Australia), G. Parkes, D. Agnew, G. Kirkwood (United Kingdom), R. Williams (Australia) and D. Ramm (Secretariat)
WG-FSA-99/72	Seabird, seal and fishing vessel interactions in the Heard and MacDonald Islands and Macquarie Island Patagonian toothfish trawl fishery G. Robertson and B. Wienecke (Australia)

WG-FSA-99/73	Seabird interactions with longline fishing in the AFZ: 1998 seabird mortality estimates and 1988–1998 trends N. Brothers, R. Gales and T. Reid (Australia) *Wildlife Report 99/x*, Parks and Wildlife Service, Tasmania
WG-FSA-99/74	Problems with estimation of size at maturity of *Dissostichus mawsoni* in Subarea 88.1 G. Patchell (New Zealand)
Other Documents	
WG-EMM-99/27	Correlation between krill and *Champsocephalus gunnari* stocks in the South Georgia Area 48.3 K.V. Shust, V.L. Senioukov, P.N. Kochkin and N.A. Petrukhina (Russia)
CCAMLR-XVIII/8	Notification of South Africa's intention to initiate an exploratory fishery Delegation of South Africa
CCAMLR-XVIII/9	Notification of South Africa's intention to initiate new/exploratory fisheries Delegation of South Africa
CCAMLR-XVIII/10	Notification of New Zealand's intention to continue an exploratory fishery Delegation of New Zealand
CCAMLR-XVIII/11	Notification of Australia's intention to initiate a new fishery Delegation of Australia
CCAMLR-XVIII/12	Notification of Australia's intention to initiate an exploratory fishery Delegation of Australia
CCAMLR-XVIII/13	Notification of Chile's intention to initiate exploratory fisheries Delegation of Chile
CCAMLR-XVIII/14	Notification of Uruguay's intention to initiate a new fishery Delegation of Uruguay
CCAMLR-XVIII/20	Notification of France's intention to initiate new and exploratory fisheries Delegation of France
CCAMLR-XVIII/21	Notification of an exploratory fishery Delegation of the European Community
CCAMLR-XVIII/BG/9	Implementation of conservation measures in 1998/99 Secretariat
CCAMLR-XVIII/BG/30	US plans for fishing for crab in Subarea 48.3 in accordance with Conservation Measures 150/XVII and 151/XVII Delegation of the USA

CCAMLR-XVIII/BG/32	Report from CCAMLR observers at Indian Ocean Tuna Commission Scientific Committee and Commission Meetings CCAMLR Observer (Australia)
SC-CAMLR-XVIII/BG/1	Catches in the Convention Area in 1998/99 and related data Secretariat
SC-CAMLR-XVIII/BG/4	Attendance at the 23rd Session of the Committee on Fisheries of the Food and Agriculture Organisation of the United Nations Rome, Italy, 15–19 February 1999 CCAMLR Observer (J. Cooper, South Africa)
SC-CAMLR-XVIII/BG/16	International fishers forum: solving the incidental capture of seabirds Delegation of New Zealand
SC-CAMLR-XVIII/BG/19	FAO's fisheries global information system Secretariat

APPENDIX D

INTERSESSIONAL WORK PLAN FOR AD HOC WG-IMALF

INTERSESSIONAL WORK PLAN FOR AD HOC WG-IMALF

The Secretariat will coordinate the intersessional work of the IMALF group. An interim review of work will be conducted in June 2000 and advised to ad hoc WG-IMALF at the time of WG-EMM (July 2000). The outcome of the intersessional work will be reviewed in August/September 2000 and reported to WG-FSA in October 2000.

* Tasks carried forward from 1998 (SC-CAMLR-XVII, Annex 5)

	Task/Topic	Paragraphs of WG-FSA Report	Members' Assistance	Start/ Completion Deadlines	Action
1.	**Planning and coordination of work:**				
1.1	Circulation of CCAMLR-XVIII reports on IMALF matters.			1 Dec 1999	Circulate all relevant sections of CCAMLR-XVIII 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.			1 Dec 1999	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.			1 Dec 1999	Commend technical coordinators and all observers for their effort in the 1998/99 fishing season.
1.4	Circulation of observer reports (seabird interactions) within WG-IMALF.	9.14(iv)		As available	Copy observer reports to one member of each country participating in WG-IMALF.
1.5	Membership of WG-IMALF.	7.4	Members	Nov 1999/ as required	Update membership during the year as required. Request appropriate Members to nominate their technical coordinators to IMALF and send them to the WG-FSA meeting.
1.6	Education and training of fishing companies and fishermen on issues of incidental mortality of seabirds.	*3.79	Members	Dec 1999/ Aug 2000	Urge Members to improve education and training of fishers on issues of incidental mortality of seabirds via technical coordinator; report to IMALF-2000.
1.7	Protection for observers on board against adverse weather conditions.	*9.19(ii)	Technical Coordinators	Jan 2000	Request technical coordinators to ask vessel owners and captains to provide as much protection as possible for observers against adverse weather conditions.

	Task/Topic	Paragraphs of WG-FSA Report	Members' Assistance	Start/ Completion Deadlines	Action
1.8	Awareness of CCAMLR conservation measures in force.	*9.19(iii)	Technical Coordinators	Dec 1999/ Aug 2000	Request feedback information from technical coordinators.
1.9	Submission of scientific observers' data from the 1999/2000 fisheries.		Technical Coordinators	Dec 1999/ as required	Liaise with technical coordinators, as necessary, on data submission for the 1999/2000 season.
2.	**Members' research and development activities:**				
2.1	Update information on national research programs into status of seabirds at risk.	7.18	Members	As available	Members report, as appropriate, to IMALF-2000.
2.2	Assist interpretation of research programs in 2.1 with respect to WG-FSA/CCAMLR objectives.	7.17	Members	Nov 1999/ Oct 2000	Dr Gales to coordinate and report to IMALF-2000.
2.3	Acquire reports on research on genetic profiles of albatrosses.	7.16	Members		Request IMALF members in Australia, France, New Zealand, South Africa, UK to assist in provision of information. Need to get response from USA.
2.4	Analysis of seabird interactions with longline fisheries.		New Zealand	Nov 1999	Request New Zealand report when work is completed.
2.5	Information on the use of underwater longline setting devices in fisheries conditions.	7.124	Members	Nov 1999/ Sep 2000	Request information on underwater setting development from Australia, New Zealand, Norway, South Africa; collate responses for IMALF-2000.
2.6	Updates on the work on seabird capture rates in relation to artificial bait, snood line and mainline colour; bait depth and sink rates.	*9.18(xi)	Members	Nov 1999/ Sep 2000	Standing item, request reports of work, collate responses for IMALF-2000.
2.7	National research into optimum configuration of line-weighting regimes and equipment.	*9.18(x)	Members	Nov 1999/ Sep 2000	Request Members to report on research undertaken; collate responses for IMALF-2000.
2.8	Development of automated methods for adding and removing weights to and from the line.	*7.150, 7.151	Technical Coordinators	Nov 1999/ Sep 2000	Request technical coordinators to interact and collaborate on the matter with fishing companies; review the situation at IMALF-2000.
2.9	Video recording of line-hauling operations.	*9.18(xiii)	Members	Nov 1999/ Sep 2000	Request reports, collate responses for IMALF-2000.
2.10	Information on the performance of natural and artificial bait in relation to their attractiveness to seabirds.			As required	Request reports from companies/groups involved in testing artificial bait.

	Task/Topic	Paragraphs of WG-FSA Report	Members' Assistance	Start/ Completion Deadlines	Action
2.11	Information on line-setting devices for autoline vessels.	*9.18(ii), 7.154, 7.155		As required	Request information from 'Fiskevegn' (Norway).
2.12	Risk assessment of seabird by-catch in the Convention Area.		Members	Nov 1999/ Aug 2000	Further work as appropriate.
2.13	Feedback from the fishery industry on issues affecting use of mitigation measures.	7.126, 7.127	Members	Nov 1999/ Sep 2000	Request technical coordinator to facilitate this.
2.14	Line-weighting experiments on autoliners.	7.91	New Zealand	Sep 2000	Report to IMALF-2000.
3.	**Information from outside the Convention Area:**				
3.1	Information on longline fishing effort in the Southern Ocean to the north of Convention waters.	*7.121, 7.136	Members, non-Contracting Parties, international organisations	By Sep 2000	Request information intersessionally from those Members known to be licensing fishing in areas adjacent to CCAMLR (e.g. Argentina, Australia, Chile, France, New Zealand, South Africa and UK [in respect of Falkland/Malvinas Islands]); review situation at IMALF-2000.
3.2	Information on incidental mortality outside the Convention Area of seabirds breeding within the area.	7.102, 7.103	Members	By Sep 2000	Repeat request to all IMALF members, especially to those mentioned under item 3.1 above.
3.3	Implementation of provisions of Conservation Measure 29/XVI in fisheries adjacent to the CCAMLR Convention Area.		Members, non-Contracting Parties, international organisations	Nov 1999/ as required	Request information on use/implementation of provisions of Conservation Measure 29/XVI, review responses at IMALF-2000.
3.4	Reports on effectiveness of use of mitigating measures outside the Convention Area.	7.91	Members	Nov 1999/ Sep 2000	Especially New Zealand, in respect of autoliners in its EEZ.
4.	***Scientific Observers Manual*:**				
4.1	Intersessional work of the task group on scientific observation forms and guidelines.	*9.18(xii), 9.19(i)	Task Group	Nov 1999/ Sep 2000	Coordinate work of the task group to address matters relating to: the utility and feasibility of data recording, time constraints and difficulties in fulfilling observer duties; and amendments to and revisions of the *Scientific Observers Manual.*

	Task/Topic	Paragraphs of WG-FSA Report	Members' Assistance	Start/ Completion Deadlines	Action
4.2	Consultation with IMALF members on issues of relevance to the work of technical coordinator.		Members/ Task Group	Nov 1999/ as required	Consult on any issue of relevance to observation of seabirds as required, submit comments received to the task group for consideration.
4.3	Publication and circulation of updates to the *Scientific Observers Manual.*	*3.48	Task Group	January 2000	Update the manual as recommended by WG-FSA, circulate replacement pages.
5.	**Cooperation with international organisations:**				
5.1	Participation at the 2000 meeting of CCSBT ERSWG; invite CCSBT to attend WG-FSA.		CCSBT Secretariat	Jan–Feb 2000/ Jul 2000	Standing request.
5.2	Cooperation with the Secretariat of the Convention on CMS on CCAMLR work on albatross conservation.		CMS Secretariat, South Africa	Dec 2000	Request report on CMS COP-6, November 1999, Cape Town, from Mr J. Cooper.
5.3	Cooperation with ICCAT and IOTC on specific issues regarding incidental mortality of seabirds.		CCAMLR observers	Nov 1999	Remind observers of desired feedback on IMALF matters.
5.4	Develop National Plan of Action in respect of FAO (IPOA-Seabirds).	7.131	Members	Nov 1999	Provide report on progress to IMALF for information and consideration.
6.	**Data acquisition and analysis:**				
6.1	Comprehensive analyses of data from the 1998/99 fisheries.		Members	Dec 1999/ Aug 2000	Undertake analyses of data (including the relationship between vessels, daytime and night-time setting, time of year and seabird by-catch), prepare report and circulate it prior to IMALF-2000 for comments.
6.2	Preliminary analyses of data from 1999/2000 fisheries.			Sep–Oct 2000	Standing request: summarise current year data at a level adequate to undertake a preliminary assessment at IMALF-2000.
6.3	Acquisition of EEZ data.	7.40	France	Nov 1999/ Sep 2000	Discuss with French scientists how basic observer data, consistent with CCAMLR logbook data, can be acquired.
6.4	Analysis of Subareas 58.6 and 58.7 EEZ data.		South Africa	Nov 1999/ Sep 2000	Request South Africa to undertake analysis and report to IMALF-2000.

APPENDIX E

1999 ASSESSMENT SUMMARIES

Assessment Summary: *Dissostichus eleginoides*, Subarea 48.3

Source of Information: This report

Year:	1994	1995	1996	1997	1998	1999	Max[2]	Min[2]
Recommended TAC		-	4000	5000	3540	5310		
Agreed TAC	1300	2800	4000	5000	3300			
Landings	604	6171[4]	3871[5]	3924[6]	3328			
Survey Biomass		14923[*a] 4831[+a]					2012[*b] 67259[+b]	
Surveyed by	UK[a] Arg[b]							
Stock Biomass[3]								
Recruitment (age...)								
Mean F (.....)[1]								

Weights in tonnes

1 ... weighted mean over ages (...)
2 Over period 1982 to 1992
3 Estimated from cohort projections
4 Estimated by WS-MAD from various sources
5 For the period 1 March to 24 July 1996
6 For the period 1 March to 31 August 1997

* Shag Rocks
+ South Georgia

Conservation Measures in Force: 154/XVII

Catches:

Data and Assessment:

Fishing Mortality:

Recruitment: Revised recruitments.

State of Stock:

Forecast for 1999/2000:

Assessment Summary: *Dissostichus eleginoides*, Division 58.5.1

Source of Information: This report

Year:	1994	1995	1996	1997	1998	1999	Max[2]	Min[2]	Mean[2]
Recommended TAC									
Agreed TAC									
Landings	5083	5534	4869	4683	4742		7492	121	
Landings[4]	5772	5588	5709	12180	16560				
Survey Biomass									
Surveyed by									
Sp. Stock Biomass[3]									
Recruitment (age...)									
Mean F (.....)[1]									

Weights in tonnes, recruits in .....

1 ... weighted mean over ages (...)

2 Over period 1982 to 1994

3 From VPA using (.....)

4 Including unreported catches

Conservation Measures in Force: None. Recommendation not to exceed 1 400 tonnes in western fishing grounds (CCAMLR-XII, paragraph 4.21).

Catches:

Data and Assessment: No assessment.

Fishing Mortality:

Recruitment:

State of Stock:

Forecast for 1999/2000:

Assessment Summary: *Dissostichus eleginoides*, Division 58.5.2

Source of Information: This report

Year:	1994	1995	1996	1997	1998	1999	Max[2]	Min[2]	Mean[2]
Recommended TAC	297	297	297	3800	3700	3690			
Agreed TAC			297	3800	3700				
Landings	0	0	0	1861[4]	3264[5]				
Landings[6]				18960	7200				
Survey Biomass	11880					Survey			
Surveyed by						Mar–Apr 1999			
Sp. Stock Biomass[3]						Recruit-			
Recruitment (age...)						ments			
Mean F (.....)[1]						estimated			

Weights in tonnes, recruits in .....

1 ... weighted mean over ages (...)
2 Over period 1982 to 1992
3 From VPA using (.....)
4 For fishing season ending 31 August 1997
5 Up to time of WG-FSA meeting in 1998
6 Including unreported catches

Conservation Measures in Force: 158/XVII

Catches:

Data and Assessment: New biology and recruitment parameters and fishing/exploitation pattern.

Fishing Mortality:

Recruitment: New estimates of mean recruitment.

State of Stock:

Forecast for 1999/2000: Yield of 3 585 tonnes.

Assessment Summary: *Champsocephalus gunnari*, Subarea 48.3

Source of Information: This report

Year:	1994	1995	1996	1997	1998	1999	Max[2]	Min[2]
Recommended TAC	0			4520	4840	4036		
Agreed TAC		1000	1300	4520	4840			
Landings	13	10	0	5	265			
Survey Biomass	16088[+a] 4870[*a] 2012[+b] 67259[*b]			122561[a] 69753[b]				
Surveyed by	UK[a] Arg[b]			Arg[a] UK[b]				
Stock Biomass[3]								
Recruitment (age 1)								
Mean F (.....)[1]								

Weights in '000 tonnes

[1] ... weighted mean over ages (...)
[2] Over period 1982 to 1992
[3] From VPA (2+)
[*] Shag Rocks
[+] South Georgia

Conservation Measures in Force: 19/IX and 153/XVII

Catches: 265 tonnes by one vessel in February–March 1999.

Data and Assessment: Short-term yield calculation based on UK survey in September 1997.

Fishing Mortality: 0.14 if the catch limit is taken.

Recruitment: Unknown

State of Stock:

Forecast for 1999/2000: Catch limit forecast is 4 036 tonnes, survey planned.

Assessment Summary: *Champsocephalus gunnari*, Division 58.5.1

Source of Information: This report

Year:	1994	1995	1996	1997	1998	1999	Max[2]	Min[2]	Mean[2]
Recommended TAC					0	0			
Agreed TAC									
Landings (Kerguelen)	12	3936		<1	0		25852	0	
Landings (Combined)									
Survey Biomass				3890[a] 1837[b]		(very low)			
Surveyed by				France					
Sp. Stock Biomass[3]									
Recruitment (age...)									
Mean F (.....)[1]									

Weights in tonnes, recruits in .....

1 ... weighted mean over ages (...)

2 Over period 1982 to 1994

3 From VPA using (.....)

a Survey 1: 18 318 km^2

b Survey 2: 5 246 km^2

Conservation Measures in Force: CCAMLR: None. Recommendation that the fishery be closed until at least the 1997/98 season, and any fishing in that season to be preceded by a pre-recruit biomass survey in the 1996/97 season (SC-CAMLR-XIV, Annex 5, paragraph 5.152).

- French minimum legal size: 25 cm.

Catches: Zero in 1998/99.

Data and Assessment: None

Fishing Mortality: None

Recruitment: Unknown. Survey in 1998/99 found very few fish.

State of Stock: See above.

Forecast for 1999/2000: No commercial catch, survey planned.

Assessment Summary: *Champsocephalus gunnari*, Division 58.5.2

Source of Information: This report

Year:	1994	1995	1996	1997	1998	1999	Max[2]	Min[2]	Mean[2]
Recommended TAC	311			900	1160	916			
Agreed TAC	311	311		900					
Landings	0		216	115	2				
Survey Biomass	31701		7194–112745		9460–26446				
Surveyed by			Australia[4]		Australia[5]				
Sp. Stock Biomass[3]									
Recruitment (age...)									
Mean F (.....)[1]									

Weights in tonnes, recruits in .....

1 ... weighted mean over ages (...)
2 Over period 1982 to 1992
3 From VPA using (.....)
4 August 1997
5 June 1998

Conservation Measures in Force: 159/XVII

Catches: Very small in 1998/99.

Data and Assessment: Short-term yield calculation based on survey in April 1998.

Fishing Mortality: 0.14 if the catch limit is taken.

Recruitment:

State of Stock:

Forecast for 1999/2000: Catch limit forecast is 916 tonnes, survey planned.