ANNEX 5

REPORT OF THE WORKING GROUP ON FISH STOCK ASSESSMENT

(Hobart, Australia, 12 to 22 October 1998)

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INTRODUCTION

1.1 The meeting of WG-FSA was held at CCAMLR Headquarters, Hobart, Australia, from 12 to 22 October 1998.

1.2 Dr D. Miller (Chairman, Scientific Committee) explained to the Working Group that following the resignation of the Convener, Dr W. de la Mare (Australia), during the intersessional period, Dr R. Holt (USA) had agreed to convene the 1998 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. It was agreed that Subitem 3.6 be renamed 'Developments in Assessment Methods and Scheme for Validating Models' and the following subitems be added:

- 3.7 'Consideration of Management Areas and Stock Boundaries';
- 4.2.11 'Crozet Islands (Subarea 58.6) and Prince Edward and Marion Islands (Subarea 58.7)';
- 9.3 'Convenership of WG-FSA and Coordinator of ad hoc WG-IMALF'; and
- 9.4 'Workshop on *Champsocephalus gunnari*'.

It was also agreed to revise the structure and content of Agenda Item 7 'Incidental Mortality Arising from Longline Fishing'. 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 Dr A. Constable and Mr B. Baker (Australia), Dr E. Balguerías (Spain), Mr N. Brothers (Australia), Mr J. Cooper (South Africa), Profs J. Croxall (UK) and G. Duhamel (France), Drs I. Everson (UK), R. Gales (Australia) and S. Hanchet (New Zealand), Mr C. Jones (USA), Drs G. Kirkwood (UK) and D. Miller (Chairman, Scientific Committee), Ms J. Molloy (New Zealand), Prof. C. Moreno (Chile), Dr G. Parkes (UK), Mr M. Purves (South Africa), Drs G. Robertson and G. Tuck (Australia) and G. Watters (IATTC), Mr R. Williams (Australia) and the Secretariat.

2.4 Dr Everson informed the Working Group that it was very sad that Dr K.-H. Kock (Germany), who has regularly attended meetings of WG-FSA and made a major contribution to its work, was unable to participate this year due to ill health. The Working Group recognised that his presence would be missed and wished him a full and speedy recovery.

REVIEW OF AVAILABLE INFORMATION

Data Requirements Endorsed by the Commission in 1997

3.1 The Secretariat's work in support of WG-FSA was summarised in WG-FSA-98/5 and related papers. The Working Group considered this work, and agreed that the list of tasks and actions should be referred to during the meeting, and that specific issues should be addressed under the relevant agenda items. Specifically, priority tasks would be evaluated, and follow-up actions identified in Section 9 of this report. For example, the broadening of the role of technical coordinators to encompass fishery and CEMP data (SC-CAMLR-XVI, Annex 5, paragraph 3.5) required follow-up action, and this matter was referred to the Scientific Committee. As another example, the format of the table summarising the revised catch limits for new and exploratory fisheries in 1998/99 (WG-FSA-98/5, Appendix 1) needed to be revised under Agenda Item 4. In addition, the growing number of tasks in support of ad hoc WG-IMALF may indicate a need to appoint a coordinator to oversee the large amount of work of that group. The Working Group thanked the Secretariat for its work during the intersessional period.

Data Inventory and Developments in the CCAMLR Database

3.2 A large number of computer-based datasets are maintained by the Secretariat to support the work of CCAMLR, and the inventory was presented in WG-FSA-98/8. A long-term aim is to move all datasets into formats supported by a database management system, and to document each dataset in the Secretariat's Dataset User Guide.

3.3 As part of this long-term integration of datasets, the Secretariat is developing an intranet (WG-FSA-98/7). This intranet can only be accessed from within the Secretariat's local area network using a password, and no access outside this network is possible. The intranet will provide a way of distributing and collecting information within the Secretariat using the same infrastructure and technology as those used on internet websites.

Database Data Entry and Validation

3.4 Dr D. Ramm (Data Manager) presented a brief report on the status of data available at the meeting. All of the available fishery, observer and survey data for the 1997/98 split-year, and earlier years, have been entered and validated. However, as in previous years, some datasets have only recently been submitted, and these were being processed in the following order of priority:

(i) fine-scale catch and effort data to the end of the 1997/98 split-year (one dataset);
(ii) observer data with complete records (four datasets);
(iii) remaining fine-scale catch and effort data (one dataset);
(iv) fine-scale biological data to the end of the 1997/98 split-year (six datasets); and
(v) remaining data (seven datasets).

3.5 Some data for 1997/98 were either overdue or in the process of being submitted, and these were not available at the time of the meeting (see CCAMLR-XVII/BG/4 Rev. 1, Table 4).

3.6 The Working Group noted that some further problems had been identified with the survey data held in the CCAMLR database. Dr P. Gasiukov (Russia) had found a problem with the dates of samples taken in a UK survey dataset which the Secretariat had sent to him, and Dr Everson identified a further problem with some of the depth records within that dataset.

This was the third year during which problems had been found in transferring survey data from the CCAMLR database to Dr Gasiukov. The Secretariat was asked to investigate and correct these problems.

3.7 The Secretariat was also tasked with the transfer of all available survey data to the newly-designed database (see WG-FSA-98/5, Appendix 2). As part of this task, participants were encouraged to either submit or resubmit recent survey data and support documentation to the Secretariat so that these data could be used in future analyses of the Working Group. Survey data would need to be submitted in a format, and using data codes, compatible with those in use in the CCAMLR database.

Other

3.8 At last year's meeting, the Working Group used estimates of seabed area within two fishing depth ranges as the basis for estimating the amount of potentially suitable substrate available to *Dissostichus eleginoides* and *Dissostichus mawsoni* in regions where new and exploratory fisheries had been proposed. The fishing depth ranges were defined as 600 to 1 800 m for longlining, and 500 to 1 500 m for trawling. Some concern had been raised regarding the method of estimating seabed areas and the Secretariat had been tasked with further priority investigations (SC-CAMLR-XVI, Annex 5, paragraphs 3.13 and 3.14; WG-FSA-98/5).

3.9 Estimates of seabed areas by depth strata were revised, and compared with available information (WG-FSA-98/6). The estimates were derived from the Sandwell and Smith dataset which contained mean depths of 2 x 2 minute grid squares derived from data from satellite altimetry and shipboard soundings. This dataset covered waters within the Convention Area north of 72°S, and was the same dataset as used last year (SC-CAMLR-XVI/BG/17). However, the technique for sampling the Sandwell and Smith dataset had been improved, and modified to take advantage of a higher resolution (1 x 1 minute grid) version of the dataset which is due to be released in late 1998.

3.10 Two other papers presented alternative analyses of seabed areas. WG-FSA-98/14 estimated the surface areas of seabed within the 500 m isobath for waters adjacent to the South Shetland Islands in Subarea 48.1 using the Sandwell and Smith dataset, data collected during the 1998 US AMLR survey, and hydrographic charts from the US Defense Mapping Agency. WG-FSA-98/50 estimated seabed areas within fishing depth ranges for Subarea 88.1 using data from the US National Geophysical Data Center (GEODAS), the US Naval Oceanographic Office, and Sandwell and Smith. Estimates were calculated between 65° and 72°S for comparison with WG-FSA-98/5, and for the entire subarea. Seabed under permanent ice cover was excluded from the analysis of the southern region of Subarea 88.1. Comparison between depths estimated in WG-FSA-98/6 and those reported in WG-FSA-98/14 and 98/50 showed generally good agreement (see WG-FSA-98/6, Table 2).

3.11 While Sandwell and Smith data may be unreliable in shallow areas, the Working Group concluded that seabed areas within fishing depth ranges reported in WG-FSA-98/6 Rev. 1 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. Importantly, catch limits in new and exploratory fisheries were based on the ratio of the fishable area in known regions (e.g. Subarea 48.3) to the potentially fishable area in regions proposed for new and exploratory fisheries, and a consistent method for estimating seabed areas across all regions was essential.

3.12 The Working Group encouraged Members to continue collecting 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 the knowledge of key species.

Fisheries Information

Catch, Effort, Length and Age Data

3.13 Catches reported from the Convention Area during the 1997/98 split-year (1 July 1997 to 30 June 1998) were presented in SC-CAMLR-XVII/BG/1 Rev. 1 and are summarised in Table 1. These catches included those taken within South Africa's EEZ in Subareas 58.6 and 58.7, and within France's EEZ in Subarea 58.6 and Division 58.5.1.

3.14 Fisheries prosecuted under the conservation measures in force during the fishing season of 1997/98 were reported in CCAMLR-XVII/BG/4 Rev. 1. Reported catches from all fisheries are summarised in Table 2. The fisheries include:

(i) trawl fishery for *Euphausia superba* in Area 48 (80 980 tonnes, 10 vessels);

(ii) trawl fisheries for *Champsocephalus gunnari* in Subarea 48.3 (5 tonnes, one vessel – see paragraph 3.16) and Division 58.5.2 (115 tonnes, one vessel – see Table 2);

(iii) trawl fishery for *D. eleginoides* in Division 58.5.2 (2 699 tonnes, three vessels);

(iv) longline fisheries for *D. eleginoides* in Subareas 48.3 (3 328 tonnes, 11 vessels); 58.6 (1 tonne, one vessel, outside EEZs) and 58.7 (<1 tonne, one vessel, outside EEZ); and

(v) longline fishery for *Dissostichus* spp. in Subarea 88.1 (39 tonnes, one vessel).

3.15 Fishing in Division 58.5.2 was continuing at the time of the meeting. The remaining fisheries covered under the conservation measures in force were not prosecuted during the 1997/98 season. These included the new and exploratory fisheries for *Dissostichus* spp. in Subareas 48.6 and 88.2, and Divisions 58.4.3 and 58.4.4. The opening of new longline fisheries for *Dissostichus* spp. in Subareas 48.1 and 48.2 in 1997/98 was conditional on the results of a feasibility survey conducted by Chile. The mean catch rate in each subarea surveyed was below the Commission's criterion of 0.1 kg/hook (CCAMLR-XVI, paragraph 9.29), and the fisheries were not opened. There was no fishing for *Electrona carlsbergi, Martialia hyadesi* or crab reported during 1997/98.

3.16 Catches of *D. eleginoides* were also reported by France from the French EEZs around Kerguelen and Crozet Islands (Division 58.5.1 and Subarea 58.6 respectively), and by South Africa for the South African EEZ around the Prince Edward Islands (Subareas 58.6 and 58.7). All catches for *Dissostichus* spp. for the period between the end of the Commission meeting in 1997 and the time of the Working Group meeting are summarised in Table 2, including those for new and exploratory fisheries.

3.17 The fishery for *C. gunnari* in Subarea 48.3 was detailed in WG-FSA-98/53. One Chilean vessel targeted *C. gunnari* using a midwater trawl over 10 days in December 1997 and January 1998. The total catch of *C. gunnari* was 5 tonnes, and fish ranged from 22 to 30 cm in length. The distribution of the target species was patchy, and 67% of the total catch was taken in two tows. The total catch of non-target species was 0.2 tonne. It was not clear whether the poor catches were due to a low standing stock of *C. gunnari*, or the inexperience of the fishing master in locating fishable concentrations of the target species.

3.18 The development of a register of collections of otoliths and scales of *D. eleginoides* is detailed in WG-FSA-98/41. Collections are held by Australia, France, Germany, Spain and the UK.

3.19 The Working Group noted that the Secretariat had completed last year's request (SC-CAMLR-XVI, Annex 5, paragraph 4.304) to enter all available haul-by-haul data from the South African fishery for *D. eleginoides* in Subareas 58.6 and 58.7. The data had been used during the present analyses. The Working Group also noted that the Secretariat had sent a request to Ukraine seeking haul-by-haul data from the Ukrainian fishery in Division 58.5.1 (SC-CAMLR-XVI, Annex 5, paragraph 4.256). Data had been submitted, but problems encountered during processing and validation by the Secretariat remained unresolved (WG-FSA-98/5). The Working Group encouraged follow-up action.

Unreported Catches of *D. eleginoides*

Estimates of Catches of *D. eleginoides* and *D. mawsoni* inside and outside the CCAMLR Area

3.20 The Working Group considered information from various sources in order to be able to estimate the magnitude of catches in the authorised and in the unregulated fishery on *D. eleginoides*. Information was drawn from:

(i) STATLANT 08A reports;

(ii) domestic fishery statistics provided by Members;

(iii) reports of landings in ports of southern Africa and Mauritius from June 1996 to September 1998;

(iv) reports on fishing vessels implicated as taking part in fishing in various subareas and divisions, available from Commission circulars and national authorities;

(v) known and estimated fishing capacities of these vessels;

(vi) catch and effort data from fishing vessels taking part in authorised fishing in the same subareas and divisions; and

(vii) trade statistics from Japanese and US markets for *D. eleginoides*.

3.21 The information was considered in two parts, the CCAMLR split-year 1997/98 and the period from 1 July to 30 September 1998.

3.22 Reported catches of *D. eleginoides* and *D. mawsoni* and estimates of unreported catches by Members and Acceding States inside and outside the CCAMLR Convention Area are set out in Table 3. Catches for the 1996/97 split-year are shown in brackets. Information on the total catch in EEZs outside the CCAMLR Convention Area was available for most countries with the exception of Uruguay (Table 3). Estimates of unreported catches were available for Argentina, Chile, Portugal, South Africa and Uruguay. Estimates for these countries are based on a crude estimate of the catch and effort of vessels in the Indian Ocean sector. They should therefore be treated with the necessary caution.

3.23 Information on landings by all countries (CCAMLR Members and non-Members) of *D. eleginoides* in Cape Town (South Africa), Walvis Bay (Namibia) and Mauritius was available from South African and French authorities and commercial sources for the 1997/98 season and for the period July to September 1998 (Table 4). Estimates of landings for the 1996/97 split-year were adjusted when it was realised that product weights reported in Table D.2 (SC-CAMLR-XVI, Annex 5, Appendix D) were green weights and should not have been multiplied with a conversion factor. The original product weights were also adjusted using a conversion factor of 1.7 instead of the conversion factor of 1.6 used in the original

analyses. These adjusted landing figures are also shown in Table 4. Main ports for landing in the first half of the 1996/97 season were Cape Town and Walvis Bay, while Mauritius became more and more important from April/May 1997 onwards. From July 1997 onwards the only catches landed in Cape Town were from the regulated fishery. It is estimated that from July 1997 to September 1998 more than 80% of unregulated catches were landed in Mauritius.

3.24 Based on sightings of longliners in various subareas and divisions, their known fishing capacities in some instances, reports of some of their landings and estimates of their catch and effort, the Working Group attempted to estimate the magnitude of the unreported catch in these regions. The information on which these estimates are based is set out in Table 5.

3.25 The estimated unreported catch by subarea/division derived from catch and effort data of sighted vessels is shown in Table 6. In most subareas/divisions, unreported catches accounted for more than 60 to 90% of the estimated total catch derived from catch and effort data. Estimates for the 1997/98 split-year of landings of unregulated catches in Mauritius and Walvis Bay accounted for 25 503 tonnes. This is quite similar to the estimated unreported catch of 22 415 tonnes from the CCAMLR area (Table 6).

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

3.26 Estimates of total catches were required to update the current assessment for *D. eleginoides* in Subareas 58.6 and 58.7, and for those in Divisions 58.5.1 and 58.5.2. Therefore, a more detailed analysis was undertaken to provide a range of catches for the analyses.

3.27 The estimates of total catches of *D. eleginoides* in Subareas 58.6 and 58.7 were revised for 1996 and 1997. The updated estimates of catches are set out in Table 7. Adjusted attribution of the estimated unreported catches for Subarea 58.7 were based on catch rates of the legal fishery, which were substantially lower than the mean catch rates of 7.7 tonnes per day as was used in previous analyses (SC-CAMLR-XVI, Appendix D, Table D.3). It was also noted that landing figures for *D. eleginoides* in Cape Town and Walvis Bay for the 1996/97 split-year had mistakenly been adjusted with a conversion factor despite these totals already representing a green weight figure. This led to an overestimation of unregulated catches taken during this period and attributed to Subarea 58.7. It was further assumed that catches taken in the 1995/96 season were mostly from the Prince Edward Island area. These catches were reapportioned on the basis of the approximate seabed areas in respect of Subarea 58.7 and Subarea 58.6 (mostly Africana Rise). The total catch of 19 233 tonnes of catch taken in Subarea 58.6 in 1997 was based on the observed number of vessels and an estimate of their catch effort. It is assumed that most of this catch was taken around the Crozet Islands.

3.28 Estimates of total catch of *D. eleginoides* for the different subareas or divisions were calculated for the period November 1997 to September 1998 for assessment purposes (Table 8). These figures are based on sightings of longliners in the different areas, their known fishing capacity in some instances, reports of some landings and estimates of their catch and effort.

Estimated Trade in *D. eleginoides* for 1997 and 1998

3.29 Trade statistics for *D. eleginoides* were received from Japan, USA, Chile, Australia, Ukraine and the FAO. From these trade reports it was estimated that about 90% of *D. eleginoides* was exported to Japan and the USA. Other markets include China, Thailand, Taiwan, Uruguay, Spain, Canada and other European markets. No market statistics were

available for these smaller markets. For the 1997 calendar year (Table 9) trade figures were only available for *D. eleginoides* fillets on the Japanese market and total product for the USA market. Assuming that the proportion of products traded on these markets was similar to the more accurate trade figures of 1998, it was estimated that 69 978 tonnes of *D. eleginoides* were traded in 1997 (Table 9).

3.30 From combined trade statistics for 1997 and 1998 it was estimated that at least 60 518 tonnes of *D. eleginoides* were traded in the 1997/98 split-year. The total estimated catch for this period was 50 323 tonnes, 16 698 tonnes from national fisheries (Table 3), 11 210 tonnes from CCAMLR fisheries (Table 3) and 22 415 tonnes from the unregulated fishery (Table 5).

3.31 For 1998 import statistics were available from January to August 1998 for the Japanese market and from January to June for the USA market (Table 10). For this period 33 825 tonnes of *D. eleginoides* were traded. Chile and Argentina were responsible for 58% of this trade.

3.32 The Working Group noted that trade statistics should be treated with the necessary caution as the export sources of product are not necessarily responsible for the catching of the fish. Other anomalies between catch statistics and market figures might be caused by inter-market transfers of product and stockpiling of product in anticipation of better market prices.

3.33 The Working Group noted that estimates of total catch of *D. eleginoides* for the 1996/97 split-year (SC-CAMLR-XVI, Annex 5, Appendix D, Table D.1) of 70 261 tonnes were very similar to the estimated trade in *Dissostichus* spp. of 69 978 tonnes in 1997 (Table 9). It was also noted that catch figures in 1998 were similar to trade statistics for this period.

3.34 The Working Group further noted that catches reported from national and CCAMLR fisheries constituted less than 50% of the *D. eleginoides* trade during the 1997/98 split-year and that this has serious implications for yield estimates both over the short and long term.

WG-FSA Commentary on Estimated Total Removals of *D. eleginoides* and *D. mawsoni*

3.35 In 1997, the Scientific Committee expressed great concern at the continuing high levels of unregulated fishing, especially in the Indian Ocean sector. Such levels were as much as five- to six-times greater than in the regulated fishery and would be likely to affect the sustainability of the *D. eleginoides* stocks being targeted. These unreported catches were taken into account by WG-FSA in developing its management advice on the assumption that unregulated catches for *D. eleginoides* can be brought under control (see discussion in SC-CAMLR-XVI, paragraph 2.13 and associated discussion in paragraphs 5.100, 5.108 to 5.111, 5.130 and 5.138).

3.36 The Working Group noted that the total unreported catch for *Dissostichus* spp. in the Convention Area during 1997/98 was 22 415 tonnes (Table 6). This compared with an estimate of 38 000 to 42 800 tonnes in 1996/97 (SC-CAMLR-XVI, Annex 4, Appendix D, Table D.4). The observed drop in catches between the two years could not be attributed to any particular cause, although it may be speculated that declining catch rates across the Indian Ocean may be a contributing factor. In this context, Table 6 indicated that most unreported catches in 1997/98 were attributed to Division 58.5.1 compared to Subareas 58.6 and 58.7 in 1996/97 (SC-CAMLR-XVI, Annex 4, Appendix D, Table D.4). This would suggest some movement eastward by the unregulated fishery.

3.37 Attention was drawn to the fact that the 1997/98 catches for *D. eleginoides* reported for Walvis Bay and Mauritius (Table 4) were quite similar to the total unreported catches from the

CCAMLR area (Table 3) (paragraph 3.25). This would imply that such catches were being taken from the general region in which these two ports are located and would tend to substantiate the assignation of catches set out in the previous paragraph.

3.38 Comparison of *Dissostichus* spp. trade figures with estimated catches for the 1997/98 split-year (paragraph 3.29) showed that at least 10 000 tonnes remain unaccounted for in addition to the 22 415 tonnes assigned to the unregulated catches for that year. The combined discrepancy between trade figures and total catches was some 10 000 tonnes for 1996/97 and 1997/98 combined. The Working Group agreed that such reconciliation highlighted the points already made in paragraph 3.32.

3.39 The Working Group emphasised that the situation outlined holds serious implications for its efforts to assess the long-term yield of *D. eleginoides* in particular. Provided that unregulated catches can be eliminated and total removals of *D. eleginoides* in the Indian Ocean can be kept at levels close to those calculated for the precautionary catch limits (see Table 19), then the long-term effects of the high levels of unregulated fishing may not be so severe over the 35-year projection employed in the Working Group's assessment procedure. However, such an optimistic forecast may be untenable if, as indicated last year (especially SC-CAMLR-XVI, Annex 5, paragraphs 4.297, 4.299 and 4.308) for Subareas 58.6 and 58.7, total catches have been at such a high level over the past three years as to compromise median unexploited spawning stock biomass in the longer term (see also paragraph 4.154).

3.40 Furthermore, even though trends in CPUE (paragraph 4.153) indicate some short-term effects of the high total catch levels in Subareas 58.6 and 58.7, such effects may be masked if, for assessment purposes, constant median recruitment is assumed and mostly younger fish are caught. Consequently, it was agreed that there is some urgency in the need to investigate the stock-recruitment relationship for *D. eleginoides* in areas where there has been substantial unregulated fishing and for which current yield estimates are low.

3.41 Given that it is unlikely that unregulated fishing will cease immediately, the Working Group agreed that there is a distinct possibility that the *D. eleginoides* fishery will become self-regulating because catch levels and rates will reach levels which are no longercommercially viable. Under these circumstances, several bird populations would be reduced to very low levels. In such a state, this situation may contravene Article II.3(c) of the Convention. Attention would need to be given as to how long, and under what circumstances, *D. eleginoides* stocks would take to recover.

Scientific Observer Information

3.42 The available information collected by scientific observers was summarised for trawl operations (WG-FSA-98/9) and longline operations (WG-FSA-98/10 Rev. 2). International and national scientific observers provided 100% coverage of fishing operations of vessels targeting *Dissostichus* spp. or *C. gunnari* in the Convention Area during 1997/98, and reports and logbook data were submitted from 29 cruises aboard longliners and four cruises aboard trawlers. These cruises covered longlining in Subareas 48.3, 58.6, 58.7 and 88.1, trawling in Subarea 48.3 and Division 58.5.2, and a feasibility longline survey in Subareas 48.1, 48.2 and 88.3. In addition, the observer aboard during the feasibility survey reported on catches taken with pots, and two other observers are presently aboard trawlers fishing in Division 58.5.2.

3.43 The quality of the logbooks submitted this year had improved on previous years and all data had been submitted using the CCAMLR logbook forms, although some data forms were outdated and several lacked some information (e.g. numbers of hooks observed). However, with the fishing season for many fisheries ending on 31 August and delays in the arrival of some logbooks and reports at the Secretariat, there was a high data entry workload immediately

prior to and during the meeting. Eighteen logbooks arrived at the Secretariat within two weeks of the WG-FSA meeting. Of these, eleven arrived during the week leading up to the meeting and nine were from cruises on which the last day of observation was prior to July 1998. By the start of the meeting, eight logbooks from Subarea 48.3, two logbooks from Subareas 58.6 and 58.7 and one logbook from Subarea 88.1 had been entered into the database.

3.44 Whilst the submission of logbooks and reports had improved substantially compared to previous seasons, the Working Group requested that Members be encouraged to ensure that these data and information are submitted to the Secretariat as soon as possible after the observation periods and at least within the time specified in the Scheme of International Scientific Observation. Any problems with meeting the submission deadline should be reported at the earliest opportunity to the Secretariat by the observer technical coordinators.

3.45 At last year's meeting of WG-FSA, a task group was formed to consider comments from scientific observers on the utility and feasibility of data recording forms and procedures currently in use for observations on board longline vessels (SC-CAMLR-XVI, Annex 5, paragraphs 3.33 and 3.34). The group comprised all technical coordinators of national scientific observation programs. The task group has worked intersessionally and collated comments and suggestions received from scientific observers.

3.46 The report of the task group (WG-FSA-98/46) contains summaries of observers' comments submitted to the Secretariat by technical coordinators from Australia, UK and South Africa.

3.47 WG-FSA noted that due to the timing of the submission of observer reports, the task group had not yet been given the chance to consider the comments submitted by observers.

3.48 It was agreed that following the review of observers' comments by WG-FSA and intersessionally by the task group, a number of changes needed to be made to the observers' logbook forms and instructions. These changes would be made with the aim of updating and distributing new logbook forms and instructions by February 1999.

3.49 The Working Group therefore chiefly reviewed comments extracted directly from observer reports, advice received from ad hoc WG-IMALF and other matters raised by meeting participants.

3.50 Some of the observers indicated that they had had difficulties in gaining access to the vessel logbook. They reported that on some occasions the captain or officers prevented access to the logbook.

3.51 Many observers indicated that more space is necessary, in general, to complete the forms. In particular, Form L5 needs additional space.

3.52 Form L3 'Daily Work Schedule of Observers': Most observers found that this form was unworkable and time consuming to complete (see WG-FSA-98/46). Observers commented that it was difficult to divide tasks into time periods. WG-FSA recalled that the purpose of this form was to collect information on the daily work schedule of observers in order to enable the Scientific Committee to decide on allocating priorities to observation tasks on board different types of fishing vessels. It was noted that only a few completed L3 Forms were submitted to the Secretariat in the past. It was recommended that instructions on data recording for this form should be amended to reflect that completing this form should be done at the discretion of the observer for a limited number of days during the cruise. Existing completed forms should be reviewed and summarised intersessionally so that discussion on observer work schedules could take place at the 1999 WG-FSA meeting.

3.53 Form L4 'Daily Setting Observations':

(i) 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 (see WG-FSA-98/46). WG-FSA advised that data recording instructions should be changed to reflect the fact that there is no need to complete this form in full when visibility was 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, especially at-risk species (albatrosses, giant petrels, *Procellaria* petrels) was required.

(ii) Some observers indicated that it is difficult to record the frequent alterations in course during the set whilst observing from the stern. They felt that space for a pictorial representation of the set pattern extrapolated from the vessels' record on the GPS would be an improvement.

3.54 Form L5 'Daily Hauling Observations': Observers commented on the wording in the marine mammal interaction section L5(iv), indicating that the current observation area of 500 x 500 m astern did not allow recording observations of marine mammals around the vessel (WG-FSA-98/46). WG-FSA advised that data recording instructions for Form L5 should be amended to cover observations within a radius of 500 m from the hauling site of the vessel.

3.55 Form L5 (vii) 'Fish Age and Maturity Subsampling': Some observers felt that for determination of the gonadal maturity stages in *D. eleginoides* the *Scientific Observers Manual* should include visual guidance (drawings/photographs) of the stages (i.e. similar to that of krill). The task force was encouraged to develop guidelines.

3.56 Form L5(v) 'Seabird By-catch': Observers proposed that there could be space for recording incidental mortalities or injuries of seabirds caused by collision with the vessel (WG-FSA-98/46). WG-FSA advised that there was a provision in the Form L5(v), ('Cause of Injury') to record this information but might be simplest to have details of observations such as this recorded in the observer's cruise report.

3.57 The Working Group welcomed the offer made by Dr Robertson to review the logbook forms, based on his recent experiences observing longline operations on board a number of vessels using Spanish and autoliner systems. Comments received intersessionally from Dr Robertson would also be forwarded to the task group for consideration.

3.58 For the present, Dr Robertson noted that the description of the longline fishing gear and the illustration of its deployment were insufficiently detailed for assessing its likely performance, especially in relation to seabird by-catch issues. It would be desirable to have more detail of certain elements of the gear and better (and larger) illustration of its configuration.

3.59 The Working Group identified some additional potential tasks for observers in relation to fish work.

(i) Better description of the type of processing, i.e. headed, gutted and/or tailed product.

(ii) Although samples of scales of *D. eleginoides* are useful for age determination, these have rarely been collected. This task could be carried out more frequently with little effort.

3.60 Ad hoc WG-IMALF expressed concern over a number of aspects of the execution and reporting of observations on seabird by-catch:

(i) Location (vantage point) of observation. During hauling it is vital that observers have an unhindered view of the line from the time it breaks the surface to coming on board as it is hauled in and can include in their records birds lost before they are brought on deck. Specification of vantage position and whether by-catch observations relate to all birds, or only those brought on deck, are needed.

(ii) Recording of hauling observation time. This needs clearly defining as time spent actually observing the line being hauled (rather than the time span over which sample observations are made) (see WG-FSA-98/46 Addendum).

(iii) Proportion of time devoted to observation of seabird by-catch. Judging from the reported percentages of observed hooks (see e.g. WG-FSA-98/10 Rev. 2, Table 6), this ranges between 1 and 100%, with a mean value across all vessels of 24% (range 1–57%) for Subarea 48.3 and 61% (range 18–100%) for Subareas 58.6 and 58.7. Some of the values and differences between subareas may reflect different reporting bases (see subparagraph (ii) above). Nevertheless, observing less than 40 to 50% of the line-hauling operation may well yield unrealistic estimates of seabird by-catch.

3.61 The Working Group recognised the physical and practical difficulties for observers of spending long periods in exposed vantage points in order to acquire accurate records of seabird by-catch. It urged vessel owners and captains to provide as much protection as possible for observers against adverse weather conditions. It also believed that some Members were experimenting with the use of video recording to provide observers with a continuous uninterrupted view and record of line hauling. The use of such techniques should be further investigated (as they might greatly improve the amount and quality of scientific observer data); Members with relevant experience were urged to report these to the next meeting of the Working Group.

3.62 WG-FSA re-emphasised the importance of developing electronic forms and formats for the submission of observer data (see SC-CAMLR-XVI, Annex 5, paragraph 10.11). It requested the Secretariat to develop appropriate programs which could be distributed to all Members.

3.63 The Working Group recognised that simple programs for data entry, particularly for use in the field (see SC-CAMLR-XVI, Annex 5, paragraph 10.11) might also be useful, particularly with some types of fish data. However, it felt that real-time field data entry might not be appropriate for the collection of seabird information, as the time taken to enter data might reduce substantially the time an observer could spend making the actual observations.

3.64 Specifically, Dr Ramm was tasked with the development of a stand-alone database which would contain the essential elements of the CCAMLR observer database, and could be used on laptop computers commonly carried by scientific observers. The database should include the observer data forms and instructions, CCAMLR codes and basic validation routines. Such systems are already in use by some national observer programs, and participants were encouraged to submit details to the Secretariat so as to facilitate the development of a standard CCAMLR system.

3.65 Amendments to the method proposed last year by Mr J. Ashford (UK) and Prof. Duhamel for sampling *D. eleginoides* in a longline fishery (WG-FSA-97/4) were provided in WG-FSA-98/60.

3.66 This longline sampling method allows for the randomised sampling of a number of sections of the longline, with the objective of providing an unbiased random sample of fish on the longline and allowing statistical analysis of inter- and intra-line differences. While the method proposed has many advantages, it was found that single observers who had a number of other tasks additional to measuring fish were restricted in their ability to apply the method

due to time constraints. An alternative was proposed in WG-FSA-98/58 whereby observers adopted a sampling protocol in which samples would be taken at random over the duration of line haul. The expected duration of line haul would be divided into hourly or half-hourly periods, two periods being chosen at random for sampling the catch and two for recording events on deck. The result would be a dataset of random samples of fish from each haul which did not have power for intra-haul statistics but did allow inter-haul comparisons. Some flexibility would be required with this system as fishing operations would not be identical on all vessels.

3.67 The Working Group noted that in WG-FSA-98/58 scientists applying the methodology of WG-FSA-97/4 found that single observers, with a number of other tasks in addition to measuring fish, were restricted in their ability to apply the method due to time constraints.

3.68 The Working Group felt that whereas the randomised sampling design proposed might be very appropriate for sampling fish, it might not be adequate to ensure reliable recording of the much rarer events of seabird by-catch. A general concern was expressed over the practicality of applying a random sampling strategy to the way observers carry out their deck observations. Due to the nature of shipboard routines and harsh working conditions of observers, it was felt that a more routine observation pattern might be more feasible for an observer to carry out.

3.69 These views indicated the difficulty of expecting observers satisfactorily to execute the current range of fish and seabird tasks proposed for scientific observers.

3.70 The Working Group re-emphasised 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 instruction on work priorities and/or how to subsample within and between the main fish and seabird tasks. Evaluation of existing observer work tasks needs priority attention at the next meeting of the Working Group.

3.71 The Working Group thanked all scientific observers involved in monitoring fisheries in 1997/98 for the great deal of very good work which they had done under difficult conditions. The data and reports had contributed substantially to the analyses of the Working Group. The Working Group particularly acknowledged the efforts made by Mr M. Lewis (UK), scientific observer aboard the ill-fated longliner *Sudur Havid*, which sank while fishing in Subarea 48.3 on 6 June 1998, with the loss of 17 lives. The Working Group also acknowledged the efforts of the captain and crew of the Chilean longliner *Isla Camila* and Mr P. Marshall (UK), scientific observer on board, which rescued the survivors of the sinking.

3.72 The Working Group reviewed the contents of Tables 5 to 7 in last year's report (SC-CAMLR-XVI, Annex 5), and the revised tables in WG-FSA-98/10 Rev. 2. The Secretariat had prepared these revised tables as a priority request from the Working Group (WG-FSA-98/5). These tables were found to contain important information on the types of data available, and the revised format and contents is given in Tables 11 and 12. An evaluation of the vessels' compliance with Conservation Measure 29/XVI and other measures in force, and the crews' awareness of the publication *Fish the Sea Not the Sky*, is given in Section 7.

3.73 Many of the observers' reports contain information on experiments to determine conversion factors from processed to whole weight of *D. eleginoides*. The values determined by the observers are usually different from those used when calculating the catch taken by the vessel and are frequently higher (Table 13).

3.74 This can have a significant effect on the amount of catches reported. Table 13 shows information for all vessels in Subarea 48.3 during the 1996/97 and 1997/98 seasons for which data on vessel's conversion factor, observer-determined conversion factor and reported catch

are all available. This demonstrates that for both these seasons catches calculated using observer-determined conversion factors are about 10% higher than those actually reported from the vessels.

3.75 The Working Group noted that there is no standard methodology available to CCAMLR observers for the estimation of conversion factors, nor is there any standard terminology to describe the processing method used on a vessel. This makes it difficult to assess the validity of the various estimates of conversion factor.

3.76 A subgroup headed by Prof. Duhamel formulated a draft protocol for estimation of conversion factors to be evaluated by observers during the 1998/99 season. In doing this, experience was drawn from some Members' domestic fisheries. This protocol is detailed in Appendix D.

3.77 Last year a request was made (SC-CAMLR-XVI, Annex 5, paragraph 7.9; SC-CAMLR-XVI, paragraph 4.38) to acquire information on the awareness of fishing crews of CCAMLR conservation measures and on the availability and utility of the CCAMLR booklet *Fish the Sea Not the Sky*. A number of observers had commented on these topics. WG-FSA noted that while the level of awareness was good, there was still room for improvement and that some vessels were still unaware of CCAMLR regulations and measures to prevent incidental mortality of seabirds. The Working Group noted that technical coordinators and scientific observers have a vital role to play in ensuring that captains, fishing masters and crew are fully aware of the details of CCAMLR conservation measures in force.

3.78 The presence on board longline vessels of the CCAMLR information booklet was quite low, despite the fact that many copies had been sent to all the relevant fishing Members. The Working Group decided that in addition to the distribution of the booklet to CCAMLR Members and directly to fishing companies, sufficient copies (including in languages appropriate for vessels being observed) should be provided to technical coordinators for passing them on, via scientific observers, to crews of observed vessels.

3.79 WG-FSA commended the training program by Chile for their observers and also for observers from Uruguay (SCOI-98/8), and noted the importance training has for the reliability of the data collected. The Working Group noted that other Members had training programs in place for CCAMLR observers. It was also felt that holding a CCAMLR workshop for training technical coordinators and encouraging Members to send their technical coordinators to the meeting of WG-FSA, would improve their understanding of the data collection requirements and increase the completeness and standard of the data collected.

3.80 Very few observer reports provided any information on the disposal of garbage and fishing gear at sea (Table 7). One vessel (*Lord Auckland*, Subarea 88.1) was reported as returning all non-biodegradable garbage to its home port. Two vessels had plastic bands aboard, one of which (a trawler) was reported to have dumped them at sea in contravention of Conservation Measure 63/XV. Several observers reported the loss of hooks in fish heads, estimated as high as 20% of heads by one observer. No reports of oil spillages were made.

3.81 Ms Molloy informed the Working Group that the publication of the *Identification Guide to Southern Ocean Seabirds*, especially developed for use by scientific observers, is in the final stages of preparation. All illustrations are ready and all language versions of the text have been verified by appropriate specialists. A final progress report on the publication will be submitted by the Delegation of New Zealand at the forthcoming meeting of CCAMLR.

Research Surveys

3.82 The results of the US AMLR bottom trawl survey near Elephant Island and the lower South Shetland Islands in Subarea 48.1 were reported in WG-FSA-98/15 and 98/17. The

survey followed a random stratified design, and tows were made to depths of 500 m from March to April 1998. The survey provided information on the biology of *C. gunnari*, *Chaenocephalus aceratus*, *Chionodraco rastrospinosus*, *Gobionotothen gibberifrons* and *Lepidonotothen squamifrons*, and estimates of biomass for these species and *Notothenia rossii*, *Notothenia coriiceps* and *Lepidonotothen larseni*.

3.83 A longline research survey was conducted by Spain in the southeast Atlantic, including Subarea 48.6 and Division 58.4.4 from October to December 1997 (WG-FSA-98/48). The aim of the survey was to document the relative abundance and biology of *D. eleginoides* near seamounts. Longlines were set across the bathymetry gradient so as to sample a wide range of depths. The abundance and size structure of *D. eleginoides* varied substantially between seamounts, and changes in length with depth were influenced by local topography.

3.84 Results of a feasibility survey conducted by Chile in Subareas 48.1, 48.2 and 88.3 in February and March 1998 were reported in SC-CAMLR-XVII/BG/7 and WG-FSA-98/20. The mean catch rate of *Dissostichus* spp. was low: 19.1 g/hook in Subarea 48.1, 3.0 g/hook in Subarea 48.2 and 5.7 g/hook in Subarea 88.3. Pots were fished between 290 and 1 920 m, and the dominant species caught was *Paralomis anemerae* (mean catch rate: 111 g/pot); the highest catch rate for that species was in Subarea 48.2 (549 g/pot).

3.85 Australia conducted a random stratified trawl survey on Shell Bank and the Heard Plateau in Division 58.5.2 in June 1998. The data allowed a revision of catch limits for *C. gunnari* over the coming two seasons in 1999 and 2000 (WG-FSA-98/54). The survey also indicated that the abundance of *C. gunnari* was substantially lower than that estimated from a survey conducted eight months earlier. The Working Group considered reasons for this, including the possibility that the lower abundance was due to *C. gunnari* aggregating prior to spawning. However, the survey eight months earlier had been conducted during the spawning season, and no clear trend was identified.

3.86 The Working Group found that the information obtained during the longline survey in Subarea 48.6 and Division 58.4.4, and the feasibility survey in Subareas 48.1, 48.2 and 88.3, had made a valuable contribution to the knowledge on *Dissostichus* spp. in regions where new and exploratory fisheries had been proposed. Chile and Spain were thanked for their efforts, and Members were encouraged to conduct further surveys in regions where there was little, or no, information (see also Section 4.1).

Mesh/Hook Selectivity and Related Experiments Affecting Catchability

3.87 No papers on these topics were presented at the meeting. The Working Group identified the need for information on selectivity so as to estimate the potential range of catch rates in new and exploratory fisheries from observations made during surveys.

Status of Fisheries

Resumption of Closed or Lapsed Fisheries

3.88 At its meeting last year, WG-FSA had advised that there was a need for development of a formal procedure for dealing with closed or lapsed fisheries (SC-CAMLR-XVI, Annex 5, paragraphs 4.320 to 4.323). Such a procedure might be similar to those for new and exploratory fisheries. This view was endorsed by the Scientific Committee (SC-CAMLR-XVI, paragraphs 5.150 to 5.152) and the Commission had requested that the Scientific Committee and its working groups continue to work on this (CCAMLR-XVI, paragraphs 10.1 to 10.3).

3.89 In relation to fisheries that had lapsed for reasons not related to conservation concerns, and for which a stock assessment had been conducted previously by the Scientific Committee, Dr Constable noted that one unresolved issue was the currency of the previous assessment (i.e. for how long did the assessment remain valid). This was a matter that had not previously been considered by the Scientific Committee or WG-FSA.

3.90 For ongoing established fisheries, the Scientific Committee customarily conducts a new assessment each year, including assessments of long-term annual yield, and so the issue of the currency of the assessment does not really arise. However, for some lapsed fisheries, e.g. that for myctophids in Subarea 48.3, an assessment had been carried out using the GYM, which at least nominally provides estimates of long-term annual yields. Dr Constable noted, however, that the efficacy of such long-term annual yield estimates had not yet been formally assessed using techniques of management strategy evaluation. The currency of such assessments therefore remains an open question that should be addressed by the Working Group.

3.91 The question of how often lapsed or closed fisheries should be assessed also raises important issues relating to the workload of the Working Group, which has increased substantially over the last two years with the large number of notifications for new or exploratory fisheries. Dr Parkes pointed to the annotations to Item 4 of the WG-FSA agenda, which indicated that in the absence of new data, specific direction for the Scientific Committee or the existence of a fishery or notification for a fishery for a specific stock or area, that stock should not be considered on the agenda. These issues suggest that any formal procedure for resumption of closed or lapsed fisheries should include prior notification and advice from the Scientific Committee as to the date on which a previous assessment for a stock would lapse.

3.92 WG-FSA also noted that the development of a long-term management plan for *C. gunnari* would be highly relevant to the request for developing a formal procedure for closed or lapsed fisheries. This was to have been addressed at the Workshop on *C. gunnari* this year, but that had been postponed. These points would be taken into account when considering terms of reference for a rescheduled workshop (see paragraphs 9.9 and 9.10). Dr Constable noted that the current methods being used for *C. gunnari*, in which an estimate of the long-term yield can be supplemented by calculations of short-term yields if a recent survey had been conducted, might provide a possible solution for dealing with lapsed fisheries, and that this should also be considered by a future workshop on *C. gunnari*.

General Scheme

3.93 The submission by the European Community of a discussion paper on a unified regulatory framework for CCAMLR based on stages of fishery development (CCAMLR-XVII/18) was widely welcomed by WG-FSA. This was viewed as an important initiative, and WG-FSA endorsed the need to develop a framework of this type. The Working Group also agreed with the sentiments expressed in the final paragraph of this document, which indicated that development of such a framework will take some time, and that Conservation Measures 31/X and 65/XII should remain in force until a replacement scheme is adopted.

3.94 In addition to the points raised in paragraph 3.88 above, which relate to the recommencement of closed or lapsed fisheries, discussion of this paper centred around scientific criteria for transitions between the other categories of fisheries. Of particular importance was the transition from a developing to an established fishery. From a scientific point of view, this should only occur when the Scientific Committee has been able to conduct a satisfactory stock assessment. This was the intent of Conservation Measure 65/XII in relation to exploratory fisheries, particularly in respect of the need to continue to classify a fishery as exploratory until such time as sufficient information as set out in paragraph 1(ii) of the conservation measure is available. The Working Group agreed that it is important that any new framework should retain this requirement. Dr Miller emphasised that in his opinion this would

be more consistent with the application of a precautionary approach especially since the proposed framework made it possible to transfer directly to established fishery status immediately following notification.

3.95 The prominence given in the discussion paper to the need for prior notification of intention to fish was strongly endorsed by WG-FSA.

Fish and Squid Biology/Demography/Ecology

Dissostichus spp.

Identification

3.96 Three species of toothfish are known to occur in the Southern Ocean *D. eleginoides*, *D. mawsoni* and *Gvozdarus svetovidovi*; this last species being very rare. The distributions of *D. eleginoides* and *D. mawsoni* probably overlap and consequently it is essential to clearly differentiate between them in commercial catches.

3.97 The following diagnostic features, currently incorporated into the *Scientific Observers Manual*, were discussed:

(i) Scales on the top of the head. In *D. eleginoides* the top of the head has narrow elongate scale-free areas, whereas in *D. mawsoni* the head is fully scaled forward to the front of the eye. This feature appears to be a good one but experience indicates that it is often difficult to determine the extent of squamation in live fish.

(ii) Middle lateral line. In *D. eleginoides* this extends forward to the forward end of the ventral fin whereas in *D. mawsoni* it is very short. This feature was considered a good diagnostic feature for live fish.

3.98 In the Ross Sea where the species co-occur, it has been noted that the second dorsal, anal and caudal fins typically have a white margin in *D. eleginoides*. The margins of these fins in *D. mawsoni* are dark. Such differences had not been noted for other regions, but participants were requested to investigate whether this was a good diagnostic characteristic in other areas.

3.99 The otoliths are also clearly distinguishable between species. Otoliths of *D. eleginoides* are elongate with a deep sulcus acusticus and prominent cristae, whereas those of *D. mawsoni* are oval to quadrate in shape and have a much less prominent sulcus acusticus and cristae.

Distribution

3.100 Exploratory fishing for *Dissostichus* spp. in Subareas 48.1, 48.2 and 88.3 reported in SC-CAMLR-XVII/BG/7, indicated that *D. mawsoni* was present around Peter 1st Island, Bellingshausen Sea and north to Elephant Island. *D. eleginoides* was taken around King George Island and in the Scotia Sea. Large numbers of by-catch species such as *Chinobathyscus dewitti, Cryodraco antarcticus, Macrourus whitsoni* and *Lepidonotothen kempi* were also caught. These results indicate that there is a significant area of overlap between the two *Dissostichus* species.

3.101 Results from exploratory fishing in 1997/98 indicate that the distributions of *D. eleginoides* and *D. mawsoni* overlap in both the Pacific and the Atlantic Ocean sectors (WG-FSA-98/37 and SC-CAMLR-XVII/BG/7). In these overlap regions both species can be

caught on a single longline. North of the overlap area, the dominant species is *D. eleginoides*, and south of the overlap area, it is *D. mawsoni*. However, individuals of each species do occur outside their normal range.

3.102 The overlap area in Subarea 88.1 is approximately 66° to 68°S, or 120 n miles. Within this region all catches are mixed. However, in Subarea 48.1 the overlap region is further north, around 61° to 63°S.

3.103 The Working Group agreed that information on the distribution should be collated in order to facilitate assessments of new and exploratory fisheries on these species. The information is summarised in Figure 1. It was noted that the pattern of large-scale distribution was likely to vary with time due to variation in major ocean circulation patterns. This topic is discussed further in paragraphs 3.149 and 3.150.

Dissostichus eleginoides

Age Determination

3.104 During WG-FSA-97, Mr Williams had been requested to collate information on collections of toothfish otoliths and scales. This information is summarised in WG-FSA-98/41. Recognising that the list was incomplete, participants agreed to provide further information on samples that had been collected; this listing would lead to a central register to be held at the Secretariat.

3.105 WG-FSA-98/52 describes a study comparing age, estimated from annuli on otoliths, using two different discrimination criteria. The results were reasonably consistent although there were major differences between estimates on the same otolith when applying the different criteria. The CVs were also different, being much lower for C1, the criterion giving the higher readings.

3.106 Radiocarbon dating studies indicate that age determination is consistent with estimates of age from otolith sections (WG-FSA-98/40). Direct comparison between two readers indicated that the difference between readers was less than four years for most otoliths, however, this was equivalent to a 33% error. The results from both these studies indicated that *D. eleginoides* can live for over 40 years. It was noted that the radiocarbon dating method was still under development and that application to deepwater species may be seriously compromised by the time delay for the radionuclides to be carried to the location of the fish.

3.107 WG-FSA-98/23 reported a study on age determination using otoliths that had been baked and sectioned. The samples were from fish caught in Subarea 88.1 and the results fell broadly in line with those from Subarea 48.3. The results indicated that there was no clear difference between the growth rates of male and female fish.

3.108 Some participants reported that from their experience scales provided clearer annuli than otoliths and consequently provided a simpler and more accurate method for age determination. It was recalled that this had been described in WG-FSA-96/42. That paper had noted good agreement between ages estimated from scales and otoliths from the same fish. It had also been noted that annuli in otoliths were frequently indistinct. Participants were encouraged to report their findings on the use of scales and comparisons with otoliths for age determination to the next meeting of the Working Group.

3.109 It was recognised that further work was needed to validate ageing methods to determine the timescale of annulus formation. Studies were described relating microincrement counts to annulus counts, injection of strontium as an otolith marker during tagging experiments and comparisons of scales from tagged fish at the time of tagging and on recapture.

Reproduction

Fecundity

3.110 WG-FSA-98/13 describes a study on the fecundity of *D. eleginoides* on samples from Subarea 48.3. Absolute fecundity is highly size dependent varying from 56 900 to 567 500 over the size range 90 to 170 cm. The relationship to mass is well fitted by a straight line. Relative fecundity was not size dependent, mean 8.19 ± 1.73 (thousands). The study confirmed that two distinct groups of oocytes are typically present in a mature ovary. Immediately prior to spawning the gonadosomatic index was close to 10%.

Maturity

3.111 Concerns raised at WG-FSA-97 prompted two studies on size and age at maturity using data from the observer program. In WG-FSA-98/16 Rev. 1, the von Bertalanffy growth parameters from Aguayo (1992) were used to convert fish size at maturity to age at maturity. Since the growth rates of male and female fish are similar, the differences in L_{m50} are considered to be due to male fish maturing at a younger age than female fish.

3.112 In WG-FSA-98/27, data from the 1996 and 1997 seasons were compared. The data from 1996 for both sexes provide a clear maturity ogive in line with previous studies. The 1997 results for female fish, when the conventional model is fitted, provide a different L_{m50} and a poor fit to the data. An alternative model, which incorporates a component for 'non-response', provides a much better fit to the data. The proportion of fish coming into spawning condition appeared to be increasing as the season progressed. This may indicate that the spawning season was, for some reason, delayed in 1997. It was also considered possible that the result could be due to there being only one spawning period in that year rather than two, one during March/April and the other during July/August, as suggested in WG-FSA-98/58. It was concluded from the study that L_{m50} for males is correctly estimated at 75 to 80 cm and for females 98 to 100 cm.

3.113 Data from the observer program in 1996, 1997 and 1998 in Subarea 48.3 had been used to indicate the depth distribution and spawning patterns of *D. eleginoides*. It is inferred that in addition to a major spawning event in late July/August, there may be a small spawning event in April/May. Observed shifts in mean length of fish with depth were thought to indicate that spawning occurs at around 1 000 to 1 300 m after which the fish may migrate up the slope into shallower water.

Stock Structure

3.114 WG-FSA-98/39 reports on a study at Macquarie Island using DNA microsatellite markers. The loci had 7, 9, 12, 16 and 23 alleles. Two of the loci had P values <0.05, suggesting that samples from the two sites, Aurora Trough and Grand Canyon, were not homogeneous. Combining the individual probabilities for each locus (0.025, 0.046, 0.244, 0.637 and 0.135) gave the overall low P value of 0.019, again indicating a lack of genetic homogeneity and showing that there were genetic differences between the two sites.

3.115 As part of the same study TIRIS radio-frequency identification tags were used on samples of fish with the following results:

(i) Aurora Trough – 1 551 tagged, 336 recaptured all from tagging area; and
(ii) Grand Canyon – 1 081 tagged, 132 recaptured all except one from tagging location.

Only one fish out of a total of 469 recaptures was recaptured outside the ground at which it was released.

3.116 Because many tag recaptures occurred more than one year after initial release and the overall recapture rate approaches 20%, it is unlikely that insufficient mixing of the tagged fish in the general population or insufficient recaptures could be distorting the results.

3.117 The evidence from the tagging studies corroborates the conclusion that, even though the sites were separated by only 40 n miles and are situated on the same topographic feature, there is very little interchange between the sites. Bearing in mind that *D. eleginoides* is an apparently active and predatory fish with pelagic eggs and larvae, the Working Group was surprised that such little interchange was revealed by either the tagging or the DNA studies. If this degree of localisation of *D. eleginoides* stocks at Macquarie Island is confirmed in further studies, and is ultimately found to be applicable to this species in other areas, the assessment of current fisheries will have to be made on a finer geographical scale.

3.118 During the meeting, a report was received that a *D. eleginoides*, tagged in the Falklands/Malvinas area, was recaptured close to Coquimbo in Chile, a distance of several thousand kilometres from its initial tagging location. The Working Group looked forward to receiving information on this and other tagging studies at its next meeting.

3.119 Detailed studies of the otolith chemistry on samples from Heard Island, Macquarie Island, Chile, Falkland/Malvinas Islands, Prince Edward Island and Kerguelen Island were reported in WG-FSA-98/40. Eight elements were consistently above the detection threshold of the laser ablation-inductively coupled plasma mass spectrometer (LA-ICPMS) and of the elements lithium, magnesium, strontium and barium showed significant variation across otoliths. Analyses are still in progress but initial results indicate that lithium concentrations are significantly lower in the cores of otoliths from areas outside, compared to those from within the CCAMLR area.

By-catch

3.120 Results from a research longline cruise reported in WG-FSA-98/48 caught a total of 2 822 *D. eleginoides* (total mass 20.502 tonnes). The by-catch of less than 5% by mass was dominated by *Macrourus carinatus*, 210 individuals with a total mass of 0.53 tonnes.

3.121 Targeted trawl fishing on *D. eleginoides* in Division 58.5.2 produced catches almost exclusively (99.4%) of the target species.

Dissostichus mawsoni

3.122 During the experimental study undertaken in February and March 1998 and reported in SC-CAMLR-XVII/BG/7 most of the fish caught had gonads in maturity stage I, immature, or II indicating that the fish were in a resting condition.

3.123 Information contained in the observer report from the exploratory longline fishery in Subarea 88.1 indicated that 25% of a sample of 849 fish had empty stomachs. The diet was mostly piscivorous with 87% of the stomachs containing fish remains. Of the fish prey, 54% could not be identified, 15% were Macrouridae, 15% Muranolepididae, 10% Channichthyidae and 6% *Pagothenia* spp. The second major item was squid, which formed 10% of the diet. Other prey items included octopus, prawn and crabs, and an unidentified penguin of c. 50 cm.

3.124 There is considerable uncertainty over the growth rate and maximum age of *D. mawsoni*. A study based on 46 fish from McMurdo Sound (Burchett et al., 1984) produced a maximum age of 24 years and a growth curve with the following von Bertalanffy growth parameters: L_{inf} = 185.2; k = 0.056; t_0 = -4.73. The youngest fish recorded was age 7 and the model fitted the early growth of this species poorly as indicated by the t_0 of -4.7 years. An ageing study of *D. mawsoni* based on 20 fish was carried out by Horn (WG-FSA-98/23). These results indicated a faster growth rate than that of Burchett et al. (1984), but had the same maximum age of 24. The largest specimen so far reported was 2.04 m total length and weighed 162 kg.

3.125 Recaptures from 13 tagged fish at McMurdo Sound suggested growth rates of adult fish averaged 2 to 3 cm per year (WG-FSA-98/49).

3.126 Examination of scales indicates that the scales do not begin to form until the fish are in their second year (WG-FSA-98/49).

Ecosystem Interactions

3.127 During an 18-day period in December 1996 in the Ross Sea, a single Weddell seal caught and consumed about 150 lb (~65 kg) of *D. mawsoni* per night. These fish ranged in mass from 6.5 to 28 kg (WG-FSA-98/49). *D. mawsoni* are known to be preyed on by sperm whales (WG-FSA-98/37 and 98/49).

3.128 Although the fish are neutrally buoyant they do not possess a swim bladder. Neutral buoyancy is achieved by skeletal reduction and the incorporation of a large proportion (10%) of lipid into the body, mostly close to the skin. *D. mawsoni* feed predominantly on *Pleuragramma antarcticum* and deepwater mysids.

Champsocephalus gunnari

Standing Stock

3.129 The standing stock estimates of *C. gunnari* around Elephant Island and the South Shetlands from results from a bottom trawl survey in March 1998 are presented in WG-FSA-98/17. Using the seabed area estimates of Kock and Harm (1995), the estimated standing stock was 10 524 tonnes, whereas using the seabed area given in WG-FSA-98/14 the estimate is 8 166 tonnes. A large proportion of female fish were not coming into spawning condition (WG-FSA-98/15) making it difficult to estimate spawning stock biomass.

Length Frequency

3.130 The same paper gave length frequency results. For samples from Elephant Island there was a clear mode at 24 cm total length and a less clearly defined mode at around 35 cm. For samples from South Shetlands there was a clear mode at 28 cm, the second peak in the distribution was less clearly defined at around 34 cm.

Size at Maturity

3.131 Results presented in WG-FSA-98/15 indicate that sexual maturity occurs at a large size in fish from the South Shetlands and Elephant Island in comparison with the South Orkneys,

South Georgia and Kerguelen. The results from Elephant Island were biased upwards because a large proportion of fish large enough to be sexually mature did not appear to be coming into spawning condition.

By-catch

3.132 WG-FSA-98/9 and 98/53 describe catches made by a commercial trawler fishing for *C. gunnari* in Subarea 48.3. Catches of non-target species were low (4%) relative to the catch of *C. gunnari*.

3.133 Targeted trawl fishing on *C. gunnari* in Division 58.5.2 produced 80.5% of the target species. The main by-catch species were *D. eleginoides* (9.0%) and *Channichthysrhinoceratus* (4.2%) (WG-FSA-98/9).

Other Species

3.134 Results from a 15-year study on *N. rossii, G. gibberifrons* and *N. coriiceps* caught in trammel nets at Potter Cove (Subarea 48.1) were presented in WG-FSA-98/57. *N. rossii* and *G. gibberifrons*, two commercially fished species, had declined relative to *N. coriiceps*. The trammel net results are consistent with those from observations on the diet of *Phalacrocorax bransfieldensis*, a key predator which is also monitored (WG-EMM-98/11). The current relatively low abundance levels of *N. rossii* and *G. gibberifrons* are thought to be due to commercial fishing in the late 1970s.

3.135 It was noted that the trends observed in independent survey estimates of the standing stock of *G. gibberifrons* by Japanese surveys in 1981 and 1982 in the lower South Shetland Islands area, when the standing stock was high, and the US AMLR survey in 1998, when the standing stock was low, matched the observations in WG-FSA-98/57. It was agreed that a further examination of this relationship might provide a further index of the status of fish stocks on the shelf. Dr E. Barrera-Oro (Argentina) and Mr Jones agreed to investigate this further.

3.136 A study using pots attached to the end of experimental longlines fished in Subareas 48.1, 48.2 and 88.3 was described in WG-FSA-98/20. The main species caught was the crab *P. anemerae*, 28% by mass. Other species taken were *L. kempi* (17%), *Lycenchelys bellingshauseni* (13%) and *Muraenolepis microps* (11%).

Decision Rules and Biological Reference Points

3.137 No new information on these topics was presented at the meeting.

Developments in Assessment Methods

Generalised Yield Model (GYM)

3.138 Dr Constable introduced a user guide to the GYM (WG-FSA-98/21). The user guide detailed the computations used to project population characteristics, the algorithm for evaluating yields and the requirements for inputting parameters into the model, and was designed for interactive use.

3.139 Recent updates to the model were outlined in WG-FSA-98/22. Minor modifications were made to the version of the GYM used last year: all parameters are now referenced to dates in a year; and the output files have been reformatted to allow easy export to other programs. Two minor errors, identified during the initial validation (WG-FSA-98/18), had been rectified (see also paragraph 3.141). The new version also included two substantive additions: the incorporation of interannual variability in natural mortality; and a user interface. This version of the model (GY301) was used for the GYM assessments conducted during the meeting.

3.140 Validation of the GYM had been identified as a high priority task for the Secretariat during the past intersessional period (WG-FSA-98/5) and the findings were reported in WG-FSA-98/18. The GYM was validated by examining and testing selected components of the source code, and logistically testing the main steps in the model (version GY301). The validation was designed to test key elements of the model. All of the tests found the model to be correct, and the model outputs to agree with expected values generated using alternative software.

3.141 In the process of testing the major components of the model, two minor errors were identified in the source code. These caused the yield-per-recruit option to be inoperable, and an error in the generation of the plus age class under the special case of no mortality ($M = 0$ and $F = 0$). Neither of these minor errors would have affected past predictions of yield using the GYM and both errors have been rectified (WG-FSA-98/22).

3.142 The Working Group noted the recent developments and validation of the GYM. The availability of the user guide and the new user interface had now facilitated the operation of the model, and Members were encouraged to conduct further evaluation. The Secretariat was tasked with establishing a register of tests conducted on the GYM (see below).

Other Methods

3.143 WG-FSA-98/35 reported on the findings of an examination of the Generalised Linear Model (GLM) used for evaluating trends in catch rates of *Dissostichus* spp. Problems with the standardisation of catch rates were found when data from summer seasons of the fishery for *D. eleginoides* in Subarea 48.3 (1992/93) were analysed with data from subsequent winter seasons. The problem was rectified by excluding data from the summer seasons. However, some information was lost because these summertime data reported catch rates from the early phase of that fishery. The GLM based on data from the winter seasons could be further refined by including depth as a factor.

3.144 The efficiency of various stratification schemes for conducting trawl surveys for *C. gunnari* in Subarea 48.3 was evaluated in WG-FSA-98/47. Estimates derived from stratified surveys were found to be less accurate than those derived using simple random sampling. Further work will be conducted to establish the optimum sampling strategy for *C. gunnari*.

Status of Assessment Methods

3.145 Dr Everson outlined a proposal for recording the status of assessment methods and associated computer programs used by CCAMLR. The Working Group had expressed concern that some of the programs which it used regularly had not been fully validated. This did not mean that the results were necessarily incorrect. However, total reliance should not be placed on the results until validation was completed. The Working Group considered three categories for programs in use by CCAMLR:

(i) programs fully tested and internationally accepted (e.g. VPA);

(ii) programs currently used by CCAMLR and tested and approved for use in the assessments (e.g. GYM); and

(iii) programs considered to be suitable but still awaiting full evaluation (e.g. mixture analysis, trawlCI).

3.146 The Working Group recognised both the need to identify the status of programs used and the difficulties in conducting adequate validation. Following further discussion, the Working Group agreed that only those programs used routinely by CCAMLR should be allocated to the three categories. Members were encouraged to undertake validation of programs in category (iii), and to submit tests and datasets so as to develop a library of validation procedures.

3.147 Three main steps were identified in documenting and validating programs:

(i) description of the intent of the program;

(ii) verification that the program, including the source code, performed according to its intent and that it was properly documented; and

(iii) description of the limitations of the program and the underlying assumptions.

3.148 The Secretariat was tasked with establishing a central repository of programs used by CCAMLR and the tests conducted as part of their validation. As part of this work, it was essential that the Secretariat maintains an up-to-date suite of software which would enable it to fully document and operate validation procedures provided by Members, and conduct further tests as required.

Consideration of Management Areas and Stock Boundaries

Distribution of *D. eleginoides* and *D. mawsoni*

3.149 Last year, the Working Group had used the best available information on the geographic distributions of *D. eleginoides* and *D. mawsoni* to allocate catch limits to these species in new and exploratory fisheries. The area of overlap between the two species was believed to be small, and both the northern limit of the distribution of *D. mawsoni* and the southern limit of *D. eleginoides* had been set at 65°S in Subareas 48.1, 48.6, 88.1, 88.2 and 88.3, and 60°S in Subarea 48.2 and Divisions 58.4.3 and 58.4.4.

3.150 The geographic distribution of these species was revised in the light of reviews of the biology of *D. mawsoni* (WG-FSA-98/37 and 98/49), catches reported in 1997/98 and results from the Spanish and Chilean longline surveys (WG-FSA-98/48, SC-CAMLR-XVII/BG/7). Spatial overlap between *D. eleginoides* and *D. mawsoni* was reported in Subareas 48.1 and 88.1, and only *D. eleginoides* had been found in Subarea 48.6 and Division 58.4.4, north of 55°S. Accordingly, the limits of distributions were revised. The delineation between *D. eleginoides* and *D. mawsoni* was generally set, for the purpose of assessing catch limits in new and exploratory fisheries, at 60°S in Subarea 48.6 and Divisions 58.4.1, 58.4.3 and 58.4.4, and 65°S in Subarea 88.1 (Figure 1). *D. eleginoides* was believed to occur throughout BANZARE Bank (Divisions 58.4.1 and 58.4.3) and the boundary was shifted to 62°S in that region.

Stock Boundaries

3.151 The Working Group also discussed further developments in the assessments for new and exploratory fisheries, and the need to account for the possibility that discrete stocks of *Dissostichus* spp. may occur over smaller spatial scales than the management areas currently used by CCAMLR (e.g. paragraphs 3.114 to 3.119).

3.152 Analyses of seabed areas within the fishing depth range of 500 to 1 800 m (WG-FSA-98/6) have indicated that many of the statistical areas within the Convention Area contain seamounts and rises isolated by deep (>3 000 m) water. Notably, high densities of seamounts occur in Subarea 88.1 and the northern section of Subarea 48.6, and Ob and Lena Banks in Division 58.4.4 consist of a series of discrete rises. Other areas contain rises which may straddle statistical or political boundaries (EEZ and Convention Area), such as the Delcano Rise in Subareas 58.6 and 58.7, the Kerguelen/Heard Islands Plateau in Divisions 58.5.1 and 58.5.2, and BANZARE Bank in Divisions 58.4.1 and 58.4.3.

3.153 Given the present level of uncertainty regarding the structure of *Dissostichus* spp. stocks, and the geographic distribution of *D. eleginoides* and *D. mawsoni* in areas notified for new and exploratory fisheries, the most precautionary approach is to assume that discrete stocks of *Dissostichus* spp. may occur over small spatial scales. The Working Group considered two types of spatial scale: the geographic area over which stocks were assessed (assessment unit) and the geographic area over which stocks were managed (management unit).

3.154 The Working Group agreed that the assessment of catch limits for new and exploratory fisheries should be based on the method used last year, and that for this purpose the boundaries of assessment units should match those of the subareas and divisions under consideration. However, smaller management units should be used as a first step in distributing effort within each subarea or division (Table 15 and Figure 1).

ASSESSMENTS AND MANAGEMENT ADVICE

New and Exploratory Fisheries

New Fisheries in 1997/98

4.1 Seven conservation measures relating to new fisheries were in force during 1997/98, but fishing was conducted under the terms of only three of these measures. Summary information on the seven new fisheries during 1997/98 is contained in CCAMLR-XVII/BG/4 Rev. 1.

New Fisheries for *Dissostichus* spp. in Subareas 48.1, 48.2 and 88.3

4.2 Under the provisions of Conservation Measures 134/XVI, 135/XVI and 140/XVI, Chile conducted a prospecting cruise to determine the feasibility of new fisheries in these areas. The cruise was conducted during February and March 1998; results from the cruise were reported in SC-CAMLR-XVII/BG/7 Rev. 1. It was concluded that new fisheries in Subareas 48.1, 48.2, and 88.3 would not be feasible, and commercial-scale fishing operations were not conducted in these three subareas.

New Fisheries for *Dissostichus* spp. in Subareas 48.6 and 88.2 and Divisions 58.4.3 and 58.4.4

4.3 Although South Africa notified the Commission of its intent to conduct new fisheries in Subarea 48.6 and Divisions 58.4.3 and 58.4.4 during 1997/98 (CCAMLR-XVI/7), no South African vessels fished under the terms of Conservation Measures 136/XVI, 137/XVI and 138/XVI.

4.4 Although Norway notified the Commission of its intent to conduct a new fishery in Subarea 48.6 during 1997/98 (CCAMLR-XVI/10), no Norwegian vessels fished under the terms of Conservation Measure 136/XVI.

4.5 Although Ukraine notified the Commission of its intent to conduct a new fishery in Division 58.4.4 during 1997/98 (CCAMLR-XVI/6), no Ukrainian vessels fished under the terms of Conservation Measure 138/XVI. The Working Group noted that, at its last meeting, the Scientific Committee 'recommended that Ukraine be requested to submit historical trawl survey data for Division 58.4.4 as soon as possible' (SC-CAMLR-XVI, paragraph 9.89). The Secretariat had sent a letter to Ukraine, but such data were not received and were not available for use by the Working Group.

4.6 Although New Zealand notified the Commission of its intent to conduct a new fishery in Subarea 88.2 during 1997/98 (CCAMLR-XVI/17), no New Zealand vessels fished under the terms of Conservation Measure 139/XVI.

Exploratory Fisheries in 1997/98

4.7 Five conservation measures relating to exploratory fisheries were in force during 1997/98; fishing was conducted under the terms of four of these measures. Summary information on all five exploratory fisheries is contained in CCAMLR-XVII/BG/4 Rev. 1.

Exploratory Longline Fisheries for *D. eleginoides* in Subareas 58.6 and 58.7 outside EEZs

4.8 Although Ukraine notified the Commission of its intent to conduct exploratory fisheries in Subareas 58.6 and 58.7 outside EEZs during 1997/98 (CCAMLR-XVI/6), no Ukrainian vessels fished under the terms of Conservation Measures 141/XVI and 142/XVI.

4.9 Although Russia notified the Commission of it intent to conduct exploratory fisheries in Subareas 58.6 and 58.7 during 1997/98, no Russian vessels fished under the terms of Conservation Measures 141/XVI and 142/XVI.

4.10 Under the terms of Conservation Measures 141/XVI and 142/XVI, South African vessels conducted exploratory fishing operations for *D. eleginoides* in Subareas 58.6 and 58.7 during 1997/98. Outside the EEZs, one vessel fished in each subarea.

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

4.11 In Subarea 88.1, one vessel from New Zealand conducted exploratory fishing operations under the terms of Conservation Measure 143/XVI from 21 February to 25 March 1998. All fishing was conducted south of 65°S. Fishing was carried out over

30 fine-scale rectangles. *D. eleginoides* was recorded much further south than previously reported with a 7.5 kg fish caught at 73°S. *D. mawsoni* was present throughout the region, extending as far north as 65°S. *Dissostichus* spp. were present in 97% of the fine-scale rectangles, indicating these species are present over wide areas of Subarea 88.1.

Exploratory Trawl Fishery for *Dissostichus* spp. in Division 58.4.3

4.12 Although Australia notified the Commission of its intent to conduct an exploratory trawl fishery in Division 58.4.3 during 1997/98, no Australian vessels fished under the terms of Conservation Measure 144/XVI.

Exploratory Jig Fishery for *M. hyadesi* in Subarea 48.3

4.13 Although the UK and the Republic of Korea notified the Commission of their intentions to conduct an exploratory squid fishery in Subarea 48.3 during 1997/98 (CCAMLR-XVI/21), no vessels fished under the terms of Conservation Measure 145/XVI.

New Fisheries Notified for 1998/99

4.14 New fisheries notifications for 1998/99 are listed in Table 16.

4.15 The Working Group noted that all the new fisheries notifications listed in Table 16 were for subareas and divisions where conservation measures had been in place during 1997/98 but where no fishing had occurred.

4.16 To aid its discussions of new fisheries notifications for 1998/99, the Working Group continued to use the checklist approach developed at its last meeting. The checklist identifies items of information required by Conservation Measure 31/X and additional points in SC-CAMLR-XV, paragraph 8.17. Summaries in tabular form were then developed for each notification and these are given below.

New Longline Fisheries for *Dissostichus* spp. in Subarea 48.6 and Division 58.4.4

4.17 South Africa submitted a notification (CCAMLR-XVII/10) for new fisheries for *Dissostichus* spp. in Subarea 48.6 and Division 58.4.4. A summary is given in the following table.

Information Required	Information Supplied
Type of fishery	New
Member	South Africa
Species	*Dissostichus* spp.
Area	Subarea 48.6 and Division 58.4.4

Table (continued)

Information Required	Information Supplied
Reference	CCAMLR-XVII/10
Relevant conservation measures	136/XVI, 138/XVI, 29/XVI, 63/XV, 133/XVI
1998/99 notification by 28 July 1998	Yes
Catch level (tonnes) for a viable fishery	Precautionary catch levels estimated by WG-FSA.
Fishery plan	Longlines; set grid catch limit for target species at 100 tonnes/fine-scale grid; confine fishery to South African flagged vessels; fishing seasons as defined in Conservation Measures 136/XVI and 138/XVI; vessels to comply with Conservation Measures 29/XVI, 63/XV and 133/XVI.
Biological information	
Effect on dependent species	
Information for calculation of potential yield	
Data collection plan	As defined in Conservation Measures 51/XII, 121/XVI and 133/XVI. Vessels to report total number and weight of *Dissostichus* discarded, including those in the 'jellymeat' condition.
Observer coverage	International scientific observer on board each vessel.
Position verification	VMS in accordance with Resolution 12/XVI.
Registration of vessels details	
Other information/comment	Collection of environmental data, 'sliding scale' biological sampling.

4.18 The Working Group noted that the notification outlined above is essentially a restatement of the intentions that South Africa made at the last meeting of the Commission. The South African notification addresses all the requirements of Conservation Measure 31/X and the points in SC-CAMLR-XV, paragraph 8.17.

4.19 The South African notification was the only notification received for a new fishery in Subarea 48.6. France, Spain and Uruguay have also submitted notifications for new fisheries in Division 58.4.4.

4.20 The Working Group noted that the South African notification contained a description of a 'sliding scale' for biological sampling. According to the notification, biological sampling will be dependent on catch levels. When the daily catch is less than 2 tonnes, all fish will be sampled for biological data. When the daily catch is between 2 and 5 tonnes, 40% of the catch will be randomly sampled. When the daily catch is greater than 5 tonnes, 20% of the catch will be randomly sampled. The Working Group considered that such an approach might be useful for providing guidance to observers and agreed that, if such a sampling scheme is conducted, South African scientists should advise the Working Group on the advantages and disadvantages of such a scheme.

New Longline Fisheries for
D. eleginoides in Division 58.4.4

4.21 Spain submitted a notification (CCAMLR-XVII/12) for an exploratory fishery for *D. eleginoides* in Division 58.4.4.

4.22 The Working Group noted that although the Spanish notification was titled 'Notification of Spain's intention to initiate an exploratory fishery,' the notification should actually be for a new fishery under the definition in Conservation Measure 31/X. As such, the Working Group agreed to evaluate the notification as one for a new fishery. A summary of the notification is given in the following table.

Information Required	Information Supplied
Type of fishery	New (notified in accordance with 31/X)
Member	Spain
Species	*Dissostichus eleginoides*
Area	Division 58.4.4
Reference	CCAMLR-XVII/12
Relevant conservation measures	29/XVI, 31/X, 133/XVI, 138/XVI
1998/99 notification by 28 July 1998	Yes
Catch level (tonnes) for a viable fishery	580 tonnes
Fishery plan	Season from 1 April to 31 August 1999; maximum of two Spanish flagged vessels; by-catch limitation. Spanish longline.
Biological information	
Effect on dependent species	
Information for calculation of potential yield	
Data collection plan	In accordance with Conservation Measure 133/XVI.
Observer coverage	An international scientific observer, as well as a national observer, on board each vessel.
Position verification	
Registration of vessels details	

4.23 The Spanish notification addresses all the requirements of Conservation Measure 31/X and the points in SC-CAMLR-XV, paragraph 8.17.

4.24 France, South Africa and Uruguay also submitted notifications for new fisheries in Division 58.4.4.

4.25 Uruguay submitted a notification (CCAMLR-XVII/19) for a new fishery for *D. eleginoides* in Division 58.4.4. A summary is given in the following table.

Information Required	Information Supplied
Type of fishery	New
Member	Uruguay
Species	*Dissostichus eleginoides*
Area	Division 58.4.4
Reference	CCAMLR-XVII/19
Relevant conservation measures	29/XVI, 133/XVI, 138/XVI
1998/99 notification by 28 July 1998	Notified 20 August 1998.
Catch level (tonnes) for a viable fishery	580 tonnes
Fishery plan	Two Uruguayan vessels.
Biological information	
Effect on dependent species	
Information for calculation of potential yield	
Data collection plan	
Observer coverage	An international scientific observer on board each vessel.
Position verification	VMS in accordance with Resolution 12/XVI.
Registration of vessels details	Two Uruguayan-flagged vessels.

4.26 Uruguay's notification addresses all the requirements of Conservation Measure 31/X and the points in SC-CAMLR-XV, paragraph 8.17.

New Trawl and Longline Fisheries for *D. eleginoides* in Subareas 58.6 and 58.7 outside EEZs and Divisions 58.4.3 and 58.4.4

4.27 France submitted a notification (CCAMLR-XVII/9 Rev. 1) for new fisheries for *D. eleginoides* in Subareas 58.6 and 58.7 (outside EEZs) and Divisions 58.4.3, 58.4.4, 58.5.1 and 58.5.2. The notification was for both longline and trawl fisheries.

4.28 During the course of the Working Group's deliberations, Prof. Duhamel clarified that the notification no longer applied for Divisions 58.5.1 and 58.5.2. As such, the Working Group considered only the notifications for Subareas 58.6 and 58.7 (outside EEZs) and Divisions 58.4.3 and 58.4.4. A summary is given in the following table.

Information Required	Information Supplied
Type of fishery	New
Member	France
Species	*Dissostichus eleginoides*

Table (continued)

Information Required	Information Supplied
Area	Divisions 58.4.3, 58.4.4, Subareas 58.6, 58.7 outside EEZs of Australia, France and South Africa.
Reference	CCAMLR-XVII/9
Relevant conservation measures	2/III, 4/V, 19/IX, 29/XVI, 30/X, 63/XV, 118/XVI, 133/XVI, Resolutions 7/IX, 10/XII, 12/XVI
1998/99 notification by 28 July 1998	Yes
Catch level (tonnes) for a viable fishery	Minimum of 500 tonnes for all areas combined by longline plus 500 tonnes for trawls.
Fishery plan	Longlines and bottom trawls. Two French companies, both with fishing history in French EEZs in Area 58. Longlining operation: two vessels; Spanish longlining method; fish in Subareas 58.6, 58.7, Divisions 58.4.3, 58.4.4 outside EEZs; fish the whole of 1998/99 season – no scientific justification for closures; fishing depth = 500–2 000 m; minimum distance between sets – 2 n miles; minimum size for target species of 60 cm (-10%); night sets only; by-catch not to exceed 10% of total catch. Trawling operation. Demersal trawl; one vessel; fish in Subarea 58.6 and Division 58.4.4, outside EEZs; fishery depth 300–1 000 m. Fish the whole of 1998/99 season – no scientific justification for closures; minimum size for target species of 60 cm – (-10%).
Biological information	
Effect on dependent species	
Information for calculation of potential yield	
Data collection plan	As defined in conservation measures.
Observer coverage	International scientific observer on each vessel.
Position verification	VMS in accordance with Resolution 12/XVI.
Registration of vessels details	Trawler: *Kerguelen de Tremarec* (87 m). Longliners: *St-Jean* (45 m) and *Northern Pride* (50.75 m).

4.29 The French notification addresses all the requirements of Conservation Measure 31/X and the points in SC-CAMLR-XV, paragraph 8.17.

4.30 The French notification overlaps many other notifications. South Africa, Spain and Uruguay also submitted notifications for new fisheries in Division 58.4.4. South Africa submitted notifications for exploratory fisheries in Subareas 58.6 and 58.7 (outside EEZs).

4.31 The Working Group viewed the overlap between the French notification and the notifications by other Members with some concern because there could be trawl fisheries and longline fisheries simultaneously operating in the same area.

4.32 A mixed gear fishery raises some problems for conducting stock assessments with the GYM. Currently, separate assessments are conducted for longline and trawl fisheries. A mixed gear fishery cannot be assessed because each gear type has a different selectivity pattern. To conduct an assessment for a mixed gear fishery using the GYM, it would be necessary to have an estimate of the proportion of the total fishing effort that would be expended by each gear type. The Working Group noted that such an estimation might require an allocation of total effort between longline and trawl fisheries. In this regard, the Working Group agreed that the Commission needs to provide advice on issues of allocation between competing gear types. The Working Group also agreed that the sum of catch limits for each gear type in a mixed gear fishery should not exceed the estimated precautionary yield for the area over which the mixed gear fishery is operating.

4.33 Again, in relation to the French notification, the Working Group further noted that new trawl fisheries are not required to distribute fishing effort over a wide area and that 100-tonne catch limits for fine-scale rectangles are also not applicable to new trawl fisheries. Both these limitations apply to new longline fisheries (Conservation Measure 133/XVI). The Working Group agreed that such provisions should be applied to new trawl fisheries.

4.34 Since the French notification for a mixed fishery overlaps with those for longline fishing in Division 58.4.4 and Subarea 58.6 (outside the French and South African EEZs), there is likely to be a presence of vessels on the grounds fishing with different methods (longline and trawl). User conflict may then arise as a result.

4.35 The Working Group discussed France's notification that fishing operations would be conducted during the whole 1998/99 season. The implications of a year-long fishery on incidental mortality of seabirds are discussed in paragraph 7.116. Prof. Duhamel clarified that France would follow the Commission's direction with respect to the length of the fishing season, but noted that a year-long fishery would make it easier to monitor unregulated fishing in the Convention Area. If there is substantial unregulated fishing during a season closure, incidental mortality to seabirds could be increased. Prof. Duhamel also noted his concern that fishing only in winter would cause all catches to be taken during the *D. eleginoides* spawning season.

4.36 The Working Group noted that the French notification stated that an observer working under CCAMLR's International Scheme of Scientific Observation would 'possibly' be on board each vessel participating in the new fisheries. Prof. Duhamel clarified that a CCAMLR observer would definitely be on board each vessel participating in the new fisheries. There will also be a French observer on board each vessel.

Exploratory Fisheries Notified for 1998/99

4.37 Exploratory fisheries notifications for 1998/99 are listed in Table 16.

4.38 All notifications for exploratory fisheries in 1998/99 were for fisheries that were also in the exploratory stage during 1997/98. None of the fisheries that were considered to be new fisheries at the last meeting of the Commission have been notified as exploratory for the coming season.

4.39 The Working Group noted that in the preamble to Conservation Measure 65/XII, the Commission had agreed that exploratory fishing should not be allowed to expand faster than the acquisition of information necessary to ensure that the fishery can and will be conducted in accordance with the principles set forth in Article II. A vital element in ensuring this is the ability of the Scientific Committee to conduct stock assessments.

4.40 For *Dissostichus* spp., the assessment methods currently available to the Scientific Committee all require research survey estimates of biomass. For longline fisheries for *Dissostichus* spp., the Working Group has been unable to assess the status of the stocks using data from longline fishing only. The Working Group agreed that conducting research surveys was an essential element of the precautionary development of exploratory fisheries. The Working Group therefore recommended that research surveys to estimate biomass be included at the very early stages of the development of new and exploratory fisheries for *Dissostichus* spp. In this context, the Working Group welcomed the inclusion of plans for the early conduct of research surveys in the notification by Australia.

4.41 The Working Group continued to use the checklist approach when discussing notifications of exploratory fisheries. Summaries in tabular form were developed for each notification and these are given below.

Exploratory Longline Fisheries for *Dissostichus* spp.
in Subareas 58.6 and 58.7

4.42 South Africa submitted a notification (CCAMLR-XVII/14) for exploratory fisheries for *Dissostichus* spp. in Subareas 58.6 and 58.7 (outside EEZs). A summary is given in the following table.

Information Required	Information Supplied
Type of fishery	Exploratory
Member	South Africa
Species	*Dissostichus* spp.
Area	Subareas 58.6 and 58.7 (outside EEZs)
Reference	CCAMLR-XVII/14
Relevant conservation measures	51/XII, 63/XV, 112/XV, 113/XV, 114/XV, 116/XV, 117/XV, 121/XVI, 122/XVI
1998/99 notification by 28 July 1998	Notified 4 August 1998.
Catch level (tonnes) for a viable fishery	Decision rule precautionary catch levels.
Fishery plan	Limited to South African flagged longline vessels only. The fishing season to be in accordance with any season to be agreed by CCAMLR in respect of mitigating seabird mortality or any other reasons.
Biological information	As stipulated by Conservation Measures 117/XV, 121/XVI, 122/XVI. Propose a sampling regime based on a sliding scale dependent on catch levels. Where the daily catch is less than 2 tonnes, all fish will be sampled for biological data. At 2–5 tonnes, 40% of the catch will be randomly sampled, and at 5–10 tonnes sampling will reduce to 20% of catch.
Effect on dependent species	
Information for calculation of potential yield	Plan research cruises in Subareas 58.6 and 58.7.
Data collection plan	

Table (continued)

Information Required	Information Supplied
Observer coverage	An international scientific observer on board each vessel.
Position verification	VMS in accordance with Resolution 12/XVI.
Registration of vessels details	

4.43 The South African notification for exploratory fisheries in Subareas 58.6 and 58.7 (outside EEZs) coincides with notifications by France for new longline and trawl fisheries in these subareas.

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

4.44 Australia submitted a notification (CCAMLR-XVII/11) for exploratory trawl fisheries 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
Species	*Dissostichus* spp.
Area	Divisions 58.4.1 and 58.4.3
Reference	CCAMLR-XVI/11
Relevant conservation measures	2/III, 30/X, 144/XVI
1998/99 notification by 28 July 1998	Yes
Catch level (tonnes) for a viable fishery	963 tonnes requested from Elan and BANZARE Banks.
Fishery plan	Trawling with survey; fishing depth to 1 500 m.
Biological information	
Effect on dependent species	Elephant seals should not be affected as estimated escapement rates exceed 85%.
Information for calculation of potential yield	
Data collection plan	As defined in Conservation Measures 51/XII, 121/XVI, 122/XVI and 144/XVI.
Observer coverage	International scientific observer on board each vessel.
Position verification	VMS in accordance with Resolution 12/XVI.
Registration of vessels details	Trawler *Austral Leader* (85.2 m). Noted that another vessel may operate either in addition to, or in lieu of, the *Austral Leader*.

4.45 The Australian notifications for exploratory trawl fisheries in Divisions 58.4.1 and 58.4.3 do not overlap with notifications from other Members.

4.46 The Working Group noted that the Australian notification is essentially the same as the notification made at the last meeting of the Commission and applies only to Elan and BANZARE Banks. During 1997/98 exploratory trawling on these banks was supposed to be conducted under the terms of Conservation Measure 144/XVI. Conservation Measure 144/XVI was clearly intended to permit exploratory fishing over the entirety of both banks, but a large portion of BANZARE Bank is included in Division 58.4.1 and this division was closed to directed fishing for *Dissostichus* spp. under the terms of Conservation Measure 120/XVI. Thus, the Australian notification is a resubmission that includes notification of intention to fish in a small portion of Division 58.4.1 (that portion covering BANZARE Bank).

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

4.47 New Zealand submitted a notification (CCAMLR-XVII/13 Rev. 1) 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
Species	*Dissostichus* spp.
Area	Subarea 88.1
Reference	CCAMLR-XVII/13
Relevant conservation measures	51/XII, 63/XVI, 65/XII, 29/XVI, 121/XVI, 122/XVI
1998/99 notification by 28 July 1998	Received 31 July 1998.
Catch level (tonnes) for a viable fishery	Decision rule precautionary catch levels.
Fishery plan	Limited to two New Zealand flagged longlining vessels; propose season from 15 December 1998 to 31 August 1999; propose variation to Conservation Measure 29/XVI to allow daytime setting in high latitudes south of 65°S in Subarea 88.1; propose that new non-target by-catch provisions of 200 tonnes be applied for *Macrourus.*
Biological information	
Effect on dependent species	
Information for calculation of potential yield	
Data collection plan	As defined by Conservation Measures 51/XII, 122/XVI and 121/XVI, and a data plan in accordance with the criteria set by the Scientific Committee for exploratory fisheries.
Observer coverage	International scientific observer and New Zealand fisheries observer on each vessel.

Table (continued)

Information Required	Information Supplied
Position verification	VMS in accordance with Resolution 12/XVI.
Registration of vessels details	

4.48 New Zealand's notification of an exploratory fishery in Subarea 88.1 does not overlap with notifications from other Members.

4.49 New Zealand's notification lays out a scheme for determining catch limits in fine-scale rectangles based on decision rules related to initial catch rates. Under the scheme, catch limits for fine-scale rectangles are increased when initial catch rates are high. The Working Group noted that similar schemes for determining catch limits in fine-scale rectangles had previously been suggested by South Africa (CCAMLR-XVI/8 Rev. 1) and New Zealand (CCAMLR-XVI/17).

4.50 The Working Group agreed that, in principle, there might be some merit in setting catch limits for fine-scale rectangles based on decision rules related to initial catch rates. However, the Working Group had some difficulty with the scheme outlined in New Zealand's notification. The Working Group recognised that the decision rules outlined in New Zealand's notification are based on information about *D. eleginoides* catch rates from the Falkland/Malvinas Islands. This could be problematic because the decision rules in Subarea 88.1 should also be based on information about catch rates of *D. mawsoni*. The Working Group determined that a detailed analysis of catch rates of *D. mawsoni* could not be undertaken at this meeting. In this regard, the Working Group reiterated the statement made in paragraph 4.81 of last year's report and agreed that 'it could consider the adaptive approach further if a paper considering further development of it were submitted for the Working Group's consideration at its next meeting.'

4.51 The notification by New Zealand indicates that there was a significant by-catch of *M. carinatus* (9.48 tonnes; 17% of the total catch (kilograms); 23% of the *Dissostichus* spp. catch (kilograms)) during exploratory fishing in the 1997/98 season. The significant by-catch resulted from the exploratory nature of the fishery during 1997/98. In this regard, the New Zealand notification proposed a 200-tonnes by-catch limit for *Macrourus* spp. in Subarea 88.1. The Working Group agreed to evaluate this proposal by studying haul-by-haul catch rates of *M. carinatus* from the exploratory fishery conducted by New Zealand during 1997/98.

4.52 The Working Group plotted the by-catch rate of *M. carinatus* (as percent of the total kilograms caught per set) against the catch per set (kilograms) of *Dissostichus* spp. (Figure 2). Figure 2 indicates that the by-catch rate of *M. carinatus* is frequently in the range of 10 to 20% when catches of *Dissostichus* spp. are greater than 1 tonne. The figure also suggests that by-catch rates of *M. carinatus* could be minimised by focusing fishing effort in areas where catch rates of *Dissostichus* spp. are highest. The Working Group noted that the actual level of by-catch was relatively constant across the range of *Dissostichus* spp. catches that were observed.

4.53 The Working Group could not determine whether a by-catch limit of 200 tonnes would be appropriate for *Macrourus* spp. Such a determination was not possible because there is almost no information on these fish. The Working Group did, however, note the principle of requiring trawlers move to other fishing locations when there is a relatively high by-catch rate that is contained in Conservation Measures 131/XVI and 144/XVI. The Working Group agreed that this principle should also be applied to new and exploratory longline fisheries.

4.54 Considering the results in Figure 2, the Working Group agreed that a by-catch rate of 10 to 15% should limit catches of *M. carinatus* but allow the exploratory fishery to conduct

prospecting operations. The Working Group also agreed that this by-catch limitation should be supplemented by a maximum level (in kilograms) of by-catch. The effect of simultaneously exceeding both the specified by-catch rate and the by-catch threshold in any one haul would cause fishing vessels to move to other fishing locations. The Working Group determined that a threshold level of 100 kg of by-catch of *Macrourus* spp. would be appropriate in Subarea 88.1.

4.55 The Working Group viewed by-catch limitations as an issue that should be addressed for all new and exploratory longline fisheries. As such, the Working Group then developed a general approach to minimising by-catch in new and exploratory longline fisheries (see paragraph 4.79). A critical component of the general approach to minimising by-catch in new and exploratory longline fisheries is that detailed biological data be collected on the by-catch species.

4.56 New Zealand's notification indicated that the 1997/98 fishing season in Subarea 88.1 was severely restricted by the presence of ice, both icebergs and sea-ice. The 1997/98 fishing season in Subarea 88.1 began in the late austral summer, and, due to the rapid growth northwards of the ice shelf in mid-March, there was only a four-week period that could be fished within the Ross Sea. In this regard, the New Zealand notification proposed that the 1998/99 fishing season start on 15 December 1998. The Working Group considered this proposal in relation to its impacts on incidental mortality to seabirds (paragraphs 7.117 to 7.119).

Calculation of Precautionary Catch Levels

4.57 The Working Group agreed to continue the approach it adopted at its last meeting and calculated precautionary catch limits for new and exploratory fisheries by extrapolating from estimated yields for *D. eleginoides* in Subarea 48.3 and Division 58.5.2. The extrapolations were discounted to take implicit account of incomplete knowledge of previously unexploited or lightly exploited areas and adjusted for the relative areas of fishable seabed.

4.58 The Working Group calculated precautionary catch limits for new and exploratory fisheries with the GYM. The calculations involved four main components.

(i) Estimates of mean recruitment in each area under consideration were obtained by proportional adjustments for fishable seabed areas. For longline fisheries the adjustments 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.

(ii) Other biological and fishery parameters were set equal to the values most appropriate for the area under consideration. For most areas, this meant using parameters from assessments for Subarea 48.3 for longline fisheries, or those for Division 58.5.2 for trawl fisheries (see Tables 17 and 18). Growth parameters (k and L_∞) for *D. mawsoni* were taken from Burchett et al. (1984) for calculating precautionary catch limits in those areas where *D. mawsoni* would be the predominant target species (see Figure 1).

(iii) The recent catch history for each area under consideration was updated to include the most recent information on regulated (Tables 1 and 2) and unregulated (Tables 3 to 10) catches.

(iv) The GYM was run for each area under consideration, and precautionary yield estimates were multiplied by a factor less than 1.0 to account for the uncertainty of extrapolation to previously unfished or lightly fished areas.

4.59 The Working Group examined growth rate data from both *Dissostichus* spp. (Figure 3) to determine which would be most appropriate for use in stock assessments of *D. mawsoni*. Although both species appear to have similar growth rates, WG-FSA agreed to use the growth curve for *D. mawsoni* from Burchett et al. (1984) when assessing this species.

4.60 For *D. mawsoni*, size at maturity was assumed to be 100 cm TL (WG-FSA-98/37). The length–weight relationship, taken from the observer report from Subarea 88.1, was assumed to be $W = 4 \times 10^{-6} L^{3.2413}$. The length–weight relationship from Subarea 88.3 was very similar, $W = 6.973 \times 10^{-6} L^{3.129}$ (SC-CAMLR-XVII/BG/7).

4.61 It has been noted in earlier reports that *D. mawsoni* may be more pelagic than *D. eleginoides*, thus making it less vulnerable to capture in a bottom trawl survey (SC-CAMLR-XVI, Annex 5, paragraph 3.61; SC-CAMLR-XVI, paragraph 9.34).

4.62 The Working Group had considerable discussion about which seabed area calculations would be most appropriate for calculating the precautionary catch limits. This discussion is summarised in paragraphs 3.151 to 3.154. The seabed areas used to estimate adjusted mean recruitments are provided in Table 15.

4.63 At its last meeting, the Working Group identified all of the seabed area between 600 and 1 800 m in Subarea 48.3 as adult habitat for *D. eleginoides*. These adult fish were considered to produce the recruitments measured by the various trawl surveys around South Georgia. A substantial portion of the adult habitat area in Subarea 48.3 is, however, on Maurice Ewing Bank. Maurice Ewing Bank is on the northwestern boundary of Subarea 48.3 and is not immediately adjacent to juvenile habitat areas (0 to 500 m shelf areas) around South Georgia. In this regard, the Working Group acknowledged that there is considerable uncertainty about whether adult *D. eleginoides* on Maurice Ewing Bank actually contribute to recruitment around South Georgia. The Working Group recognised that if Maurice Ewing Bank is not included in the calculations of proportional seabed areas when scaling estimates of mean recruitment, precautionary yield estimates for new and exploratory fisheries would increase. However, given current knowledge about stock structure in Subarea 48.3, the Working Group agreed that it is still most appropriate and precautionary to include Maurice Ewing Bank in calculations of seabed area. This is the approach that the Working Group used at its last meeting.

4.64 The Working Group recognised that the Delcano Rise is another area where adult *Dissostichus* are captured on banks that are not immediately adjacent to juvenile habitat (the shelf around Crozet Island). The Working Group agreed that studies need to be conducted to determine whether adult fish on Maurice Ewing Bank and the Delcano Rise contribute to recruitment of juvenile fish around South Georgia and Crozet Island respectively. Scientists from Member countries were encouraged to undertake such work, particularly along the lines of the otolith chemistry study summarised in paragraph 3.119. The Working Group also agreed that during the intersessional period work should be conducted to more rigorously determine the effects of removing Maurice Ewing Bank from seabed area calculations on estimates of precautionary yield for new and exploratory fisheries.

4.65 The Working Group noted that the catches in the 1997/98 season, including unreported catches, are unlikely to substantially affect the precautionary long-term annual yields. However, these catches were substantially greater than the crude estimates of yield presented here. The Working Group agreed that sustained catches substantially above estimates of the long-term annual yield could cause the spawning stocks to collapse.

4.66 The Working Group used various sets of parameter estimates to run the GYM for areas where there are notifications for new and exploratory fisheries. The GYM parameter sets for new and exploratory fisheries are identified in Table 18.

4.67 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

indicated, different growth parameters were used for each species. However, the Working Group reiterated a statement made in its last report and 'expressed concern that the available knowledge about *D. mawsoni* was much less than that for *D. eleginoides*.' This implied that precautionary catch levels calculated in the manner outlined in paragraph 4.65 would be more uncertain for *D. mawsoni* than for *D. eleginoides*. In these circumstances, it may be appropriate for a greater discount factor for uncertainty to be applied for *D. mawsoni*. The discount factor used for *D. eleginoides* was 0.45, matching the factor used by the Commission for calculating precautionary catch limits during the last two years. The discount factor used for *D. mawsoni* was 0.30.

4.68 The Working Group emphasised that there is no scientific basis for selecting a particular value for either discount factor.

4.69 The results of the GYM are given in Table 19. Areas where the parameters were the same and for which no catches occurred were pooled into single runs to save time. This resulted in three pooled runs being undertaken. These pooled runs used the appropriate recruitment densities prorated by the ratio of the combined area with the area from which the recruitment density originated. The resulting yield from a pooled run was then apportioned to a respective area according to the proportion of the total pooled area taken by that respective area. The seabed areas used to prorate recruitments are provided in Table 15. Limited time did not allow a comparison with results obtained from the seabed areas used at last year's meeting. Discounted yields are presented in Table 20.

4.70 The Working Group reiterated last year's account of the intrinsic uncertainties involved in the calculation of precautionary yields (SC-CAMLR-XVI, paragraph 4.109) and noted that the results in Tables 19 and 20 must be interpreted with considerable caution. The list of intrinsic uncertainties follows:

(i) the values calculated for precautionary catch limits should not be taken to imply that such quantities of fish would actually be available for capture;

(ii) the calculation procedure relies explicitly on extrapolation from assessments of existing fisheries to new and exploratory fisheries in previously unfished or lightly fished areas. In particular, it makes the assumption that the recruitment rate per unit area of fishable seabed is the same across all areas;

(iii) there is greater uncertainty associated with the calculations for *D. mawsoni*, and the discount factors used are arbitrary; and

(iv) the estimates of unreported catches are uncertain.

4.71 Despite these uncertainties, the Working Group agreed that the methods used to calculate precautionary catch limits were, scientifically, the best available given existing information.

4.72 The Working Group recommended that the precautionary yield estimates given in Table 19 for *D. eleginoides* and *D. mawsoni* be used when calculating catch limits for the new and exploratory fisheries operating during 1998/99.

Management Advice

4.73 Seven conservation measures relating to new fisheries were in force during 1997/98, but fishing was conducted under the terms of only three of these measures. Information about new fisheries during 1997/98 is contained in paragraphs 4.1 to 4.6. The Secretariat received nine notifications for new fisheries in 1998/99 (Table 16). All notifications for the 1998/99 season were for fisheries on *Dissostichus* spp. Information and Working Group comments on new fisheries for 1998/99 are in paragraphs 4.14 to 4.36.

4.74 Five conservation measures relating to exploratory fisheries were in force during 1997/98, but fishing was conducted under the terms of only three of these measures. Information about exploratory fisheries during 1997/98 is contained in paragraphs 4.7 to 4.13. The Secretariat received five notifications for exploratory fisheries in 1998/99 (Table 16). All notifications for the 1998/99 season were for fisheries on *Dissostichus* spp. Information and Working Group comments on exploratory fisheries for 1998/99 are in paragraphs 4.37 to 4.56.

4.75 The Working Group noted that there is substantial overlap between some of the new and exploratory fishery notifications for 1998/99 (Table 16) and reiterated its comments on assessing mixed gear fisheries (paragraphs 4.31 to 4.34). It is not currently possible to use the GYM to assess stocks of *Dissostichus* spp. that are simultaneously targeted by longliners and trawlers. The Working Group agreed that the Commission needs to provide advice on issues of allocation between competing gear types. The Working Group also agreed that the sum of catch limits for each gear type in a mixed gear fishery should not exceed the estimated precautionary yield for the area over which the mixed gear fishery is operating.

4.76 The Working Group agreed that new trawl fisheries should be required to distribute fishing effort over a wide area (paragraph 4.33). The Working Group also agreed that 100-tonne catch limits for fine-scale rectangles should also apply to new trawl fisheries. Both these limitations are currently applied to new longline fisheries.

4.77 The Working Group also raised the issue of other methods for distributing effort in new and exploratory fisheries (see also paragraph 3.154), and would welcome data which would assist in determining the size of fish aggregations.

4.78 The Working Group recommended that research surveys to estimate biomass be included at the very early stages of the development of new and exploratory fisheries for *Dissostichus* spp. (paragraph 4.40). In this regard, the Working Group noted that it has been unable to assess the status of *Dissostichus* spp. stocks using data from longline fishing only.

4.79 The Working Group agreed that there should be by-catch limitations on exploratory longline fisheries that are similar to those currently in force for exploratory trawl fisheries (paragraphs 4.54 and 4.55). The principle of by-catch limitations should be to require that longliners move to other fishing locations when there is a relatively high by-catch on any one haul. By-catch limitations should be operationally flexible and simple to understand. The Working Group agreed that by-catch limitations for exploratory longline fisheries should involve a maximum by-catch rate of 10 to 15% (as percent of the total kilograms caught per set) and a by-catch threshold level of 100 kg. Fishing vessels should be required to move to another location if the maximum by-catch rate and the by-catch threshold are simultaneously exceeded in any one haul. Moving to another location may simply involve fishing at a different depth. The Working Group noted that the terms of Conservation Measures 131/XVI and 144/XVI require trawlers to move at least 5 n miles when by-catch limits are exceeded. The Working Group noted that detailed catch, effort and biological data need to be collected on all by-catch species and, in this regard, agreed that a conservation measure specifying by-catch limitations on exploratory longline fisheries should specify data collection requirements for by-catch species that are commensurate with data collection requirements for the target species.

4.80 The Working Group calculated precautionary yield estimates for new and exploratory fisheries in 1998/99 using the same methods that were used last year. These methods are described in paragraphs 4.58 to 4.67. The Working Group agreed that the methods used to calculate precautionary yield estimates were, scientifically, the best available given existing information (paragraph 4.71). However, there were still significant uncertainties in the assessment method that imply a need to take account of the points discussed in paragraph 4.63.

4.81 Separate precautionary catch limits were calculated for *D. eleginoides* and *D. mawsoni*. The final step in the calculation involved multiplying by a factor that allowed for the uncertainty in extrapolation from known fisheries (Subarea 48.3 for longlines and Division 58.5.2 for trawl

fisheries) to previously unfished or lightly fished areas. A factor of 0.45 (as used by the Commission for the last two years) was used for *D. eleginoides* and 0.3 (making a greater allowance for uncertainty) was used for *D. mawsoni*. While it believed the factor should be less for *D. mawsoni* than for *D. eleginoides*, the Working Group emphasised that there was no scientific basis for selecting appropriate values for either of these factors.

4.82 Estimates of precautionary yield for each area under consideration are presented in Table 19. Discounted yields are presented in Table 20.

4.83 Management advice stemming from consideration of seabird by-catches in new and exploratory fisheries is given in paragraph 7.200(x).

Other Fisheries

Dissostichus eleginoides

4.84 Consideration of stock boundaries and management units for *D. eleginoides* is provided in paragraphs 3.149 to 3.154.

Methods Applied to the Assessment of *D. eleginoides*

4.85 Following on from the work conducted at previous meetings, the assessment of *D. eleginoides* at the 1998 meeting comprised three main areas of data analysis:

(i) standardisation of CPUE data;
(ii) determination of long-term annual yields using the GYM; and
(iii) exploratory analysis of length data to investigate trends in size at capture.

Standardisation of CPUE Data

4.86 The aim of this study is to determine whether there are any time trends in CPUE after accounting for the effects of other factors/covariates which influence observed CPUE, such as season (month), nationality, bait and depth. GLM and generalised additive models (GAM) are used for this purpose. In 1997, the GLM/GAM methodology was applied to *D. eleginoides* CPUE datasets for Subareas 48.3 (South Georgia, longline fishery), 58.6 (Crozet, longline survey) and 58.7 (Prince Edward Islands, longline fishery) and Division 58.5.1 (Kerguelen, trawl fishery). Descriptions of the methodology are provided in SC-CAMLR-XVI, Annex 5, paragraphs 4.143 to 4.146, 4.288, 4.289, 4.303, 4.304 and 4.242 to 4.245 respectively. The main advance in this analysis at this year's meeting was updating the CPUE datasets to include data from the 1997/98 season. Any changes to the specific analyses for the various fisheries are described in the following sections of the report dealing with the subareas and divisions.

Determination of Long-term Annual Yields using the GYM

4.87 At last year's meeting, the GYM was used to assess the long-term annual yields of *D. eleginoides* in Subarea 48.3 and Division 58.5.2 on the basis of recruitment data derived from trawl surveys in these areas. It was also used to predict long-term annual yield for areas covered by new and exploratory fisheries for *D. eleginoides*. The sources of data for these new

and exploratory fisheries are described in SC-CAMLR-XVI, Annex 5, paragraph 4.99, including proportional adjustments of estimates of mean recruitment using relative seabed areas in appropriate fishable depth ranges.

4.88 At this year's meeting the GYM was used to update estimates of long-term annual yield in Subarea 48.3, Division 58.5.2 and areas under notifications of new and exploratory fisheries. Developments in the GYM since the 1997 meeting, including the status of its validation by the Secretariat, are described in WG-FSA-98/22 and paragraphs 3.139 to 3.141 of this report. Any variations in input data for runs of the GYM compared to last year are described in the following sections of the report dealing with the subareas and divisions.

Trends in Size at Capture

4.89 At last year's meeting an attempt was made to analyse trends in the size of fish caught in Subarea 48.3 since 1990. At that meeting it was not possible to correct length frequency data for size of catch and size of sample measured and the Working Group considered that uncorrected data were unlikely to be of much use (SC-CAMLR-XVI, Annex 5, paragraph 4.163). The Working Group requested that routines be developed by the Secretariat for the 1998 meeting to extract data corrected in the required manner.

4.90 WG-FSA-98/5, Appendix 3 reported on the progress made by the Secretariat in developing a routine for extracting the length frequency data. The approach outlined in the paper was endorsed by the Working Group and the data were duly extracted from the CCAMLR database. Analyses of length data were undertaken for the fishery in Subarea 48.3.

South Georgia (Subarea 48.3)

4.91 The catch limit of *D. eleginoides* in Subarea 48.3 for the 1997/98 season was 3 300 tonnes (Conservation Measure 124/XVI) for the period 1 April to 31 August 1998. A total of 11 vessels from Chile, South Africa, UK and Uruguay fished during the season. The fishery was closed on 22 August, with a total reported catch of 3 328 tonnes (CCAMLR-XVII/BG/4). The season was marred by the tragic sinking of the South African registered longliner *Sudur Havid* on 6 June with the loss of 17 lives.

Standardisation of CPUE

4.92 The GLM analyses were updated to include revised information from previous fishing seasons as well as new information from the 1997/98 fishing season. At the time of the Working Group meeting, a substantial proportion of the CPUE data remained to be submitted to the Secretariat (see Table 21). Nevertheless, the Working Group decided to include the data submitted for 1997/98 in order to investigate the trend in CPUE on the basis of the most recent information available. 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.

4.93 The Working Group discussed the results of a study comparing GLMs fitted to winter CPUEs and to data from the entire fishing season (WG-FSA-98/35). The study concluded that analyses of winter CPUEs provide better overlap between nationality and fishing season, making the parameters of the GLM easier to estimate. Additionally, the winter GLM showed trends that were very similar to those of the full-season GLM. The disadvantage of modelling winter CPUEs is that data from the 1993 fishing season can not be included in the analysis. The Working Group considered these tradeoffs and agreed to use the winter CPUE series in the GLM.

4.94 The GLMs were fitted to winter series haul-by-haul data with non-zero catches submitted on form C2 over the period 1992 to 1998. Data from years prior to 1992 were not available in haul-by-haul format so they could not be used in the analyses. Numbers per hook and kilograms per hook were used as response variables, and nationality, winter season, month, area, depth and bait type were considered as predictor variables. Winter seasons were defined as occurring from 1 March to 30 August; this definition was consistent with the approach in WG-FSA-98/35.

4.95 Nationality, winter season, month, area, depth and bait type were statistically significant sources of variation to haul-by-haul CPUE. These predictors were also significant in the Working Group's previous analyses.

4.96 The time series effect of winter season on kilogram per hook is plotted in Figure 4. This time series is adjusted for the presence of hauls with zero catches. This adjustment was made by estimating the probability of a non-zero catch in each fishing season and multiplying this probability by standardised CPUEs predicted from the GLMs.

4.97 The probabilities of zero catches for each fishing season are provided in Table 22. These probabilities should be viewed with some caution because very few vessels have actually reported zero catches. The Working Group noted that the C2 database may be biased because hauls with zero catches may not always be reported to CCAMLR. In this regard, the Working Group reiterated its request that Members make every possible effort to assure that zero catches are also recorded on the form C2 and reported to CCAMLR.

4.98 The time series effect of winter season on numbers per hook is plotted in Figure 5. This time series is also adjusted for the presence of hauls with zero catches.

4.99 Adjusted, standardised catch rates have decreased from 1994 to the present (Figures 4 and 5). The trends are similar for kilogram/hook and numbers/hook. The decline of both CPUE indices was most rapid between the 1994 and 1996 winter seasons and has slowed during the last three winter seasons. Both CPUE indices were less variable at the end of the time series than they were at the beginning of the time series.

4.100 Variability about the standardised CPUE indices provided in last year's report of the Working Group was exaggerated due to a plotting error. There are two standard errors plotted around the estimates in Figures 4 and 5.

4.101 The Working Group noted the declining trends in Figures 4 and 5 with concern. Whilst it was possible to analyse only a portion of the CPUE data for the most recent year, these results indicate that the CPUE has continued to decline between 1997 and 1998.

4.102 The Working Group noted that the *D. eleginoides* fishery began before the 1992 fishing season, but no haul-by-haul data are available for these earlier years. The Working Group cannot comment on how the standardised catch rates for 1998 compare to those years prior to 1992.

4.103 It was suggested that these declines could be fitted using an analytical model such as an age-structured stock reduction analysis (Kimura et al., 1984; Francis, 1990). Such an analysis would use the estimated catches and biological parameters used in the existing GYM. Future extensions to the stock reduction analysis could include fitting proportion at age from surveys, catch at age, age specific selectivities, etc.

Determination of Long-term Annual Yields using the GYM

4.104 The analysis undertaken at last year's meeting was updated using the latest version of the GYM, incorporating total reported catches for the 1997/98 season. An attempt was made to incorporate data from trawl surveys in 1997 by Argentina and the UK into the recruitment function using the length-density method (de la Mare, 1994). Due to problems reconciling the data from these surveys with available data on growth, it was not possible to incorporate the data at this meeting. The recruitment function used this year was therefore the same as that used last year.

4.105 In addition to the need to address problems associated with the 1997 survey length density data, the Working Group noted that to date the survey length-density data used in developing the recruitment function for *D. eleginoides* in Subarea 48.3 have not been extracted directly from survey data stored in the CCAMLR database. This is due to problems with the format in which such data have been stored in the past. The Working Group noted the progress made by the Secretariat since last year's meeting in developing a data format and procedure for handling research survey data submitted to CCAMLR (SC-CAMLR-XVI, Annex 5, paragraphs 9.2(iv) and 10.13).

4.106 The Working Group recommended that all available survey data be transferred into this format as soon as possible and analysed using the procedure for extracting length-density distributions developed at this year's meeting. This should include preparation of pooled density at length distributions (SC-CAMLR-XV, Annex 5, paragraphs 4.66 to 4.68).

4.107 The input parameters for the GYM are shown in Table 17. The only change from 1997 is the update of the catch vector to include 1997/98 data. As last year, 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 3 550 tonnes. The median escapement for this level of catch was 0.53**.**

Comparison of GYM Output with the CPUE Trend shown by the GLM

4.108 Last year, WG-FSA had noted that the trends in median biomass predicted from the GYM indicated a smaller decline than that indicated by the GLM analyses of CPUE (SC-CAMLR-XVI, Annex 5, paragraphs 4.164 to 4.167). The new GLM analyses of CPUE data conducted this year had indicated a continued decline in CPUE between 1997 and 1998.

4.109 In an attempt to explain the results of the CPUE analyses, the GYM was used to examine the effects of the time series of observed recruitments and the catch history on the status of the spawning stock. This was achieved by running the GYM in the standard way (see Table 17 for the parameters for this year), but inserting the sequence of observed recruitments from 1981 to 1993 (SC-CAMLR-XVI, Annex 5, Table 18) and the catch vector from 1989 to 1998. The lognormal recruitment parameters were used to initialise the age structure and to project recruitments from 1994 to the present.

4.110 The decline in median ratio of spawning biomass at the end of the catch period over the median pre-exploitation spawning biomass shown by this run indicated that the decline in CPUE may be explained partly by the series of low recruitments in the early 1980s. However, the Working Group acknowledged the preliminary nature of this analysis and the need to develop this approach further in the future. In this regard, the Working Group highlighted a number of issues for future work required to interpret the CPUE analyses and for determining how to provide advice based on CPUE data:

(i) Over what period should projections be undertaken in order to examine catch strategies given recent (and continued) catch histories greater than the long-term sustainable annual yield?

(ii) What are the implications of incorporating a stock-recruitment relationship in estimating long-term annual yield?

(iii) In general, how can the two methods (CPUE analyses and GYM) be used together to provide advice on short- and long-term management options.

Trends in Size at Capture

4.111 An exploratory analysis of length data for *D. eleginoides* in Subarea 48.3 was undertaken during the meeting. The Working Group noted the considerable amount of data which is now available, particularly resulting from the work of CCAMLR observers on vessels in this area.

4.112 Catch weighted length frequencies for the period 1992 to 1998 are shown in Figure 6. The Working Group noted changes in the form of the length distribution over time. The greatest change appeared to be between distributions for the period before 1994 and those after. This may be because the period of fishing sampled in the 1992 and 1993 seasons was the summer. Length samples for 1995 to 1998 were from the winter months.

4.113 Weighted mean lengths and maximum and minimum length over the same period are shown in Figure 7. The Working Group noted that the mean and maximum lengths in the catch did not show a consistent pattern of decline as might be expected from the decline in CPUE shown by the results of the GLM analysis. However, the Working Group noted that several elements of the fishing operation can influence length distributions of the catch, including season, hook selectivity and depth of capture (as shown in WG-FSA-98/58). Such effects would need to be considered in interpreting trends over time. It was not possible to undertake a comprehensive analysis of trends in size at capture using catch-weighted length frequencies in the time available.

4.114 The Working Group recommended that the routines for extracting catch-weighted length frequency data developed by the Secretariat prior to the 1998 meeting be further developed in the intersessional period. The data should be extracted in a form which allows graphical presentation of catch-weighted length frequencies and standardisation of data to examine trends over time. The Working Group recognised the complex nature of the data analyses required and the difficulty in completing such analyses at the Working Group meeting within the time available. Participants interested in the assessment of this fishery were encouraged to undertake analysis in the intersessional period and present the results for consideration at next year's meeting.

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

4.115 The estimate of yield from the GYM was 3 550 tonnes. This was very similar to the result obtained at last year's meeting (3 540 tonnes).

4.116 According to the analysis of available data for the most recent season the CPUE has continued to decline from 1997 to 1998. Preliminary analysis using the GYM indicated that the decline in CPUE may be partly explained by a series of low recruitments in the early 1980s.

Notwithstanding these results, the Working Group considered that the information available to the Working Group on which to base management advice for the 1998/99 season was very similar to that available at last year's meeting.

4.117 The Working Group therefore considered that the catch limit for the 1998/99 season should be less than the 3 550 tonnes indicated by the GYM in order to maintain a degree of caution appropriate to the uncertainty indicated by the results above. As last year, the Working Group was unable to advise on what lower catch limit is appropriate (SC-CAMLR-XVI, Annex 5, paragraph 4.170).

4.118 The Working Group reiterated its advice from last year that the development of advice to address the reconciliation of different indicators of stock status is a high priority.

South Sandwich Islands (Subarea 48.4)

4.119 Despite a catch limit of 28 tonnes (Conservation Measure 128/XVI), no fishing in this subarea was reported to the Commission during the 1997/98 season. No new information was made available to the Working Group on which to base an update of the assessment.

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

4.120 The Working Group recommended that Conservation Measure 128/XVI be carried forward for the 1998/99 season. 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)

Standardisation of CPUE for the Trawl Fishery

4.121 The Working Group also used a GLM to standardise an updated series of CPUE data from the trawl fishery for *D. eleginoides* in Division 58.5.1. This GLM analysis followed the approach used at the Working Group's last meeting.

4.122 The GLM was fitted to haul-by-haul data from the French and Ukrainian trawl fisheries operating off the western, northern, and eastern coasts of Kerguelen during the period 1990 to 1998. Tonnes per minute towed was used as the response variable, and nationality, year, month, area and depth were considered as predictor variables. Year was defined as split-year.

4.123 All five predictor variables were statistically significant sources of variation in haul-by-haul CPUEs from the trawl fishery.

4.124 Figure 8 illustrates the effects of year on standardised catch rates from the trawl fishery. The time series is adjusted for the presence of hauls with zero catches. This adjustment was made by estimating the probability of a non-zero catch in each fishing season and multiplying this probability by standardised CPUEs predicted from the GLMs. The probabilities of zero catches for each fishing season are provided in Table 23.

4.125 Adjusted, standardised catch per unit effort decreased between 1990/91 and 1993/94 and have been relatively stable since then (Figure 8). Nevertheless, the standardised CPUE index for the 1997/98 split-year is the lowest on record. Standardised CPUEs were less variable at the end of the time series than at the beginning.

4.126 The Working Group viewed the declining trend in standardised catch rates with concern and noted that the trend in nominal catch rates demonstrated a more precipitous decline in CPUE during the early part of the time series (Figure 8). Further concern was expressed over the apparent increase in the percentage of hauls with small catches (Table 23).

Longline CPUE

4.127 The total catch in the longline fishery in Division 58.5.1 during the 1997/98 season was 1 118 tonnes. It was not possible to undertake an analysis of longline CPUE data at this year's meeting because haul-by-haul data were only available for the most recent season.

Determination of Long-term Annual Yields using the GYM

4.128 The GYM was used to assess long-term annual yield in Division 58.5.1. Parameters have been adopted from Subarea 48.3 and are presented in Table 24. Recruitments were prorated from the estimate for Subarea 48.3 using the method described in paragraph 4.69. The catch history, including unreported catches, was used in the projection (see Table 24).

4.129 The results of the projection are shown in Table 19. The estimated long-term annual yield was 6 900 tonnes. The Working Group noted that this yield is higher than most years in the catch history, except for 1992, 1997 and 1998. Given this potentially high yield, the Working Group noted that verification of recruitment at this level to this division is necessary. The Working Group would welcome any data or analyses to help assess the status of recruits in this area.

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

4.130 The declining trend in CPUE in the trawl fishery demonstrated by the GLM analysis confirms previous studies of this stock (WG-FSA-93/15). Reduction of the French catch limit (from the 1996 season onwards) shows the concern in the management of the fishery in the French EEZ.

4.131 The French authorities have allocated a catch limit for trawling for the 1998/99 season (1 September 1998 to 31 August 1999). A maximum of 3 400 tonnes applies for two vessels only in the whole area, including a 1 000-tonne limit in the eastern sector.

4.132 The longlining catch limit in the western sector has already been established up to the end of 1998 (October–December). A catch limit of 500 tonnes applies for two foreign (Ukrainian) vessels only. The total value for the 1998/99 season in this sector will not exceed the value of the long-term sustainable yield estimated at the 1994 meeting (1 400 tonnes).

4.133 A catch limit of 1 100 tonnes will apply for the 1998/99 season for one French longliner in the eastern sector outside the area used by trawlers.

4.134 The Working Group considered that the GLM analysis of factors affecting CPUE in the trawl fishery is a useful technique to improve its assessments and recommended the continued reporting of catch and effort data on a haul-by-haul basis. In addition, efforts should continue to acquire haul-by-haul data collected on board Ukrainian longline vessels from the Ukrainian authorities, and to ensure that such data are also collected from the longliner working in the eastern sector.

4.135 Management of this fishery, in common with other subareas in the Indian Ocean sector, will be severely compromised as long as illegal catches continue.

Heard and McDonald Islands (Division 58.5.2)

4.136 The catch limit of *D. eleginoides* in Division 58.5.2 for the 1997/98 season was 3 700 tonnes (Conservation Measure 131/XVI) for the period 8 November 1997 to the end of the Commission meeting in 1998. The catch reported for this division by the time of the Working Group meeting was 3 264 tonnes. This was expected to increase to 3 700 tonnes by the end of the Commission meeting.

Determination of Long-term Annual Yields using the GYM

4.137 The analysis undertaken at last year's meeting was updated using the latest version of the GYM, incorporating total reported catches for the 1997/98 fishing season. The estimate of unreported catch in the 1996/97 fishing season was revised from 18 400 tonnes to 17 099 tonnes, resulting from a reworking of the numbers in SC-CAMLR-XVI, Annex 5, Appendix D, paragraph 6. This reworking was based on new information regarding catch rates, the number of vessels, landing figures in Mauritius and a corrected application of the conversion factor.

4.138 There was some uncertainty in the level of unreported catch during the 1997/98 season which was estimated to be between 520 and 3 500 tonnes (see Table 8). One run was made using the upper estimate of unreported catch (3 500 tonnes).

4.139 The input parameters for the GYM runs are shown in Table 17.

4.140 The decision rule concerning the escapement of spawning stock after 35 years was binding. The future long-term annual yield at which the median escapement is 0.5 was 3 690 tonnes for the upper estimate of catch, provided that high levels of unreported catches do not continue.

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

4.141 The Working Group recommended that the catch limit for Division 58.5.2 in the 1998/99 season should be revised to 3 690 tonnes, representing the annual yield estimate from the GYM, assuming removals in 1997/98 were equal to the reported catches plus the upper estimate of unreported catches (Table 8).

4.142 The analysis resulting in this recommendation assumed that total removals of fish in 1998/99 and future seasons are reduced to the level of 3 690 tonnes.

4.143 The Working Group noted that estimates of unreported catches in Division 58.5.2 in the 1997/98 season were less than 20% of those estimated for the previous fishing season. It was nevertheless reiterated that there will be a much greater effect on the catch limit in future years if the level of removals continues to exceed catch limits.

Crozet Islands and Prince Edward Islands (Subareas 58.6 and 58.7)

4.144 The catch reported for these subareas in 1997/98 comprised 88 tonnes caught inside the Crozet Islands EEZ (Subarea 58.6) and 814 tonnes from inside the Prince Edward Islands EEZ (140 tonnes from Subarea 58.6 and 674 tonnes from Subarea 58.7). Only 1 tonne was reported for the exploratory fisheries held under Conservation Measures 141/XVI and 142/XVI, which set catch limits of 658 tonnes and 312 tonnes for Subareas 58.6 and 58.7 respectively.

4.145 The fishery in the Crozet Islands EEZ took place only in November 1997. A total of 77 sets were made in 12 small-scale units (0.5° x 1° square). No new analysis of the data was undertaken.

4.146 The GYM was used to assess the long-term annual yield for the purposes of the new and exploratory fisheries notified for these areas (paragraphs 4.27 to 4.36, 4.42 and 4.43). The catch history used in the model included estimates of unreported catches from these subareas.

4.147 The Working Group noted the estimated yields from the GYM of 8 766 tonnes and 1 520 tonnes for longlining in Subarea 58.6 and 58.7 respectively (Table 19). These assumed removals from the 1997/98 season of 1 994 tonnes and 1 574 tonnes for the two subareas respectively. Given these potentially high yields, the Working Group noted that the verification of recruitment to these subareas is necessary. The Working Group welcomed any data for analyses to facilitate assessment of the status of recruits in these subareas.

4.148 The results of the assessment and management advice for new and exploratory fisheries in these areas are provided in paragraphs 4.27 to 4.36 and Table 20.

Standardisation of CPUE for the Prince Edward Islands (Subarea 58.7)

4.149 The Working Group used a GLM to standardise an updated series of CPUE data from the longline fishery for *D. eleginoides* around the Prince Edward Islands. This GLM analysis followed the approach that was used at the Working Group's last meeting (SC-CAMLR-XVI, Annex 5, paragraphs 4.303 to 4.306).

4.150 The CPUEs were calculated as kilogram per hook. Year, month, vessel and depth were considered as predictor variables. The haul-by-haul data covered the period October 1996 to June 1998. As with last year, not all the data available could be used in the GLM analysis; this year, data for two vessels that fished in each of the three years were used.

4.151 The vessel, month and year factors were each highly statistically significant ($p < 0.01$), but depth was not. The effect of month is illustrated in Figure 9.

4.152 Figure 9 illustrates the effects of year on standardised catch rates from the longline fishery. No adjustment was necessary for zero catches. Standardised catch per unit effort has decreased very substantially between 1996 and 1998.

4.153 The Working Group expressed grave concern at the decline in CPUE shown in Figure 9. The major drop in CPUE between 1996 and 1997 occurred over a period in which the Working Group has estimated substantial unreported catches were taken from this region.

Management Advice for *D. eleginoides* (Subareas 58.6 and 58.7)

4.154 The Working Group recalled its advice for Subareas 58.6 and 58.7 from last year that the total estimated catch, including the unreported component has represented a substantial proportion of the estimated median unexploited biomass from the GYM (SC-CAMLR-XVI, Annex 5, paragraphs 4.297 and 4.306).

4.155 This information, coupled with the major decline in the CPUE index since 1996 suggests that the estimate of annual yield provided by the GYM for the purposes of the new and exploratory fisheries for Subarea 58.7 (Table 19) should be viewed with considerable caution.

4.156 The extent to which the standardised CPUE data for the Prince Edward Islands EEZ are indicative of the situation in Subarea 58.6 is uncertain. However, the Working Group agreed that in view of the history of unregulated catch and the decline in CPUE indicated at last year's meeting, the annual yield estimate calculated for the purpose of new and exploratory fisheries for Subarea 58.6 should also be treated with caution.

4.157 Advice on new and exploratory fisheries notified for Subareas 58.6 and 58.7 is provided in paragraphs 4.27 to 4.36 (new trawl and longline fisheries for *D. eleginoides* in Subareas 58.6 and 58.7 outside EEZs).

4.158 The Working Group noted that estimates of unreported catches in these areas in the 1997/98 season were less than 15% of those estimated for the previous fishing season. It was nevertheless reiterated that there will be a much greater effect on the catch limit in future years if the level of removals continues to exceed the estimated yield.

Champsocephalus gunnari

South Georgia (Subarea 48.3)

Commercial Catch

4.159 The commercial fishery for *C. gunnari* around South Georgia (Subarea 48.3) was open from the end of the Commission meeting in November 1997 until 1 April 1998. The catch limit agreed by the Commission for this period was 4 520 tonnes (Conservation Measure 123/XVI). 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.

4.160 WG-FSA-98/53 provides a summary of the commercial fishing on *C. gunnari* in Subarea 48.3 during the 1997/98 season. Only one vessel, the Chilean-registered stern trawler *Betanzos*, took part in this fishery. The vessel fished for 10 days between 25 December 1997 and 5 January 1998. The catch of *C. gunnari* was 5.04 tonnes out of a total catch of 5.25 tonnes. *C. gunnari* was caught on 20 out of 34 hauls. 67% of the catch was taken in just two hauls, confirming the patchy distribution of this species around South Georgia. Four species were taken as by-catch: *C. aceratus, Pseudochaenichthys georgianus, N. rossii* and *N. squamifrons*.

4.161 The vessel carried an observer, designated by the UK in accordance with the CCAMLR Scheme of International Scientific Observation. The observer noted that the vessel's fishing master had no prior experience of either fishing for the target species or fishing around South Georgia. The Working Group agreed that it was unclear whether the poor catches by the FV *Betanzos* were due to a low standing stock of the target species, or the inexperience of the fishing master in locating fishable concentrations of *C. gunnari*. It is therefore difficult to use the results of the limited fishing in 1997/98 to provide a reliable indication of the current viability of the fishery.

Assessment at this Meeting

4.162 The catch limit for the 1997/98 season of 4 520 tonnes was derived from a short-term cohort projection performed at last year's meeting (SC-CAMLR-XVI, Annex 5, paragraphs 4.199 to 4.208). This was based on a biomass estimate from a UK trawl survey in September 1997. In view of the extremely low catches and the lack of a new survey, an assessment of yield over the period 1998/99 and 1999/2000 was performed, using the short-term projection method. The data inputs are provided in Table 25. The resulting fishing mortality for the coming two years was 0.143. This resulted in a combined catch over two years of 8 490 tonnes, comprising 4 840 tonnes in the first year and 3 650 tonnes in the second year. Analysis with the GYM was not carried out this year because the survey results used last year were still considered current.

4.163 The projected yield estimate for the 1998/99 season was higher than that estimated at last year's meeting (4 140 tonnes), due to the negligible catch in 1997/98.

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

4.164 Most participants agreed that the management of the fishery for *C. gunnari* in Subarea 48.3 during the 1998/99 season should be similar to that in force last season, as detailed in Conservation Measure 123/XVI. The total catch limit should be revised to 4 840 tonnes in accordance with this year's short-term yield calculations.

4.165 Dr E. Marschoff (Argentina) noted that the low catch rates in this fishery and the high percentage of small fish taken indicate that the stock remains at a low level. While further research is needed on the causes of this situation the stock should be afforded maximum protection by closing the fishery.

4.166 In response, several participants recalled that the yields estimated from the short-term projections were based on the lower 95% confidence bound of the 1997 UK trawl survey, and that therefore they constituted conservative estimates of yield (SC-CAMLR-XVI, Annex 5, paragraph 4.211).

Kerguelen Islands (Division 58.5.1)

4.167 No commercial fishing for *C. gunnari* took place in this division during the 1997/98 season.

4.168 A brief survey was conducted in February 1998 which indicated that the previous strong cohort (4+ years old) had almost disappeared, but it seems that a new year 1+ cohort (~170 mm long fish) is present this year. Remains of fish from the 1+ cohort have occurred in many scats of fur seals since March 1998.

4.169 During 1998/99, France intends to conduct a full survey on *C. gunnari* to assess the abundance of this new cohort, which will then be aged 2+ years, using the same method as in the 1997 survey. No commercial fishing is envisaged in 1998/99 on this species.

4.170 If the presence of a strong year 2+ cohort is confirmed in 1998/99, fishing may take place on this species in the 1999/2000 season.

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

4.171 The Working Group supported the French plan to conduct a pre-recruit survey in the 1998/99 season and looked forward to seeing the analysis of the results at the next meeting.

Heard and McDonald Islands (Division 58.5.2)

Commercial Catch

4.172 The commercial fishery for *C. gunnari* around Heard Island (Division 58.5.2) is open from the end of the Commission meeting in November 1997 until the end of CCAMLR-XVII. The catch limit agreed by the Commission for this period was 900 tonnes to be taken on the Heard Plateau area only (Conservation Measure 130/XVI). 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 132/XVI).

4.173 Two vessels, *Austral Leader* and *Sil* took part in this fishery. *C. gunnari* was targeted sporadically between mid-May and September 1998, as commercial demand required, while the vessels were engaged in their principal fishery for *D. eleginoides*. A total of 115.2 tonnes was caught up to 24 September 1998. Another vessel, *Southern Champion*, will remain in the fishery until early November 1998, and may catch more *C. gunnari*.

4.174 Between 29 May and 4 June 1998, *AustralLeader* conducted a random stratified trawl survey for *C. gunnari* on Heard Island Plateau and Shell Bank, similar to that conducted in August 1997 and reported in WG-FSA-97/29. Compared to the previous survey, fish were much more concentrated on Gunnari Ridge, and densities were very low over the remainder of Heard Island Plateau. Densities on Shell Bank were much lower than in the previous year.

Assessment at this Meeting

4.175 An assessment of *C. gunnari* in the Heard Island Plateau area was made using the same short-term annual yield method adopted last year (SC-CAMLR-XVI, Annex 5, paragraph 4.181). Estimates of yield for Shell Bank were not made because of the very low abundance of this population. These results were reported in WG-FSA-98/54. During the meeting, the assessment was updated to include an estimate of catches taken since the survey was conducted, comprising 62.5 tonnes taken up to the beginning of WG-FSA which was advanced to 100 tonnes to allow for further catches up to the end of the season (6 November 1998).

4.176 The resulting fishing mortality for 1998/99 and 1999/2000 was 0.139. This resulted in a combined catch over two years of 1 984 tonnes, comprising 1 160 tonnes in the first year and

824 tonnes in the second year. Unlike the previous three years, the age 2 cohort in 1998 is very weak and is expected to contribute little to the biomass in subsequent years. If recruitment to age 2 in 1999 is also weak then the fishery in 2000 will be predominantly on age 5 fish. After this time, catch limits may need to be set by some other method to be determined by the Working Group, and be maintained thereafter unless a further survey demonstrates that abundant cohorts are recruited.

4.177 Despite the estimate of biomass on Heard Island Plateau being lower than in the survey of the previous year, the calculated yield is higher. This results from the fact that the fish in the 1998 survey were mostly concentrated in one area, and so the biomass estimate had a low variance and the lower 95% confidence limit of the estimate, which is used in the yield calculation, was consequently higher than in the previous year (Table 26).

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

4.178 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 1998/99 season should be similar to that in force last season, as detailed in Conservation Measure 130/XVI. The total catch limit should be revised to 1 160 tonnes in accordance with this year's short-term yield calculations. The fishery on Shell Bank should remain closed.

Other Species

Antarctic Peninsula (Subarea 48.1)

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

4.179 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.

4.180 Surface areas of seabed within the 500 m isobath were presented (WG-FSA-98/14) for the lower South Shetland Islands from King George Island to Livingston Island; and recalculated for the Elephant Island region. Revised estimates were based on several integrated datasets and incorporated seafloor slope.

4.181 A random, stratified bottom trawl survey within the 500 m isobath was carried out by the US AMLR program in two regions of Subarea 48.1: Elephant Island and the lower South Shetland Islands. Information from the survey on the biology of several species (WG-FSA-98/15) and standing stock biomass (WG-FSA-98/17) were reported.

4.182 Information on species composition and catch levels of all species encountered during the survey of Subarea 48.1, length frequency distributions for 11 species, and length–weight relationships for six species are summarised in WG-FSA-98/15. Sufficient data were collected from Subarea 48.1 to construct maturity ogives for *C. gunnari, G. gibberifrons, C. aceratus, C. rastrospinosus* and *L. squamifrons*. Lengths at maturity were compared to previous studies and other regions.

4.183 Estimates of standing total stock biomass for eight species of finfish, and standing spawning stock biomass for six species of finfish are presented in Table 27. Biomass was estimated for Elephant Island and the lower South Shetland Islands separately, and combined as one system. Computations were based on updated estimates of seabed area (WG-FSA-98/14), as well as previously used seabed areas. Differences in stock biomass were observed for all species based on estimate of seabed area employed.

4.184 Comparable biomass estimates for the 1987, 1996 and 1998 trawl surveys are presented in Table 28. These estimates are based on the previously used seabed areas for all surveys because there was insufficient time available during the meeting to re-run the earlier analyses. Biomass estimates for most species were still less than the 1987 survey, indicating that stocks of fish in this area have not recovered since the early fishery.

4.185 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.

4.186 A feasibility longlining and potting survey using the longliner *Tierra del Fuego* was carried out in Subarea 48.1 for 12 days during February and March 1998 in accordance with the Conservation Measure 134/XVI for a new fishery for *D. eleginoides* and *D. mawsoni* (SC-CAMLR-XVII/BG/7). Total catch from the longlining activity was low (<1 tonne) and CPUE for both species were lower than the minimum required of 0.1 kg/hook that was established by the Commission (CCAMLR-XVI, paragraph 9.29). Total catch and catch rates from the pots were also low with the Antarctic crab (*P. anemerae*) predominating (WG-FSA-98/20). In spite of those results, the Working Group noted that this cruise provided interesting data on the distribution of the two *Dissostichus* species.

Management Advice

4.187 There appears to be little prospect for a substantial fishery given the low biomass estimates for the 1997/98 season and some of the uncertainties associated with decline in biomass compared to 1987. The Working Group therefore recommended that Conservation Measure 72/XII should remain in force for the species considered in this section until future surveys indicate an increase in fish biomass in the subarea.

4.188 In view of the low catch rates in the exploratory *Dissostichus* spp. fishery, the Working Group recommends that fishing for *Dissostichus* spp. should be prohibited in this area.

South Orkney Islands (Subarea 48.2)

4.189 A feasibility longlining and potting survey using the longliner *Tierra del Fuego* was carried out in Subarea 48.2 for three days during March 1998 in accordance with Conservation Measure 135/XVI for a new fishery for *D. eleginoides* and *D. mawsoni* (SC-CAMLR-XVII/BG/7). Total catch from the longlining activity was low (<1 tonne) and CPUE for both species were lower than the minimum required of 0.1 kg/hook that was established by the Commission (CCAMLR-XVI, paragraph 9.29). Total catch and catch rates from the pots were also low with the Antarctic crab (*P. anemerae*) predominating (WG-FSA-98/20). In spite of those results, the Working Group noted that this cruise provided interesting and useful data on the distribution of the two *Dissostichus* species.

Management Advice

4.190 In the absence of new information on stocks in this subarea, the Working Group noted that fisheries in Subarea 48.2 should remain closed in accordance with Conservation Measure 73/XII. In view of the low catch rates in the exploratory toothfish fishery the Working Group recommends that fishing for *Dissostichus* spp. should be prohibited in this area.

South Georgia (Subarea 48.3)

Squid (*Martialia hyadesi*)

4.191 A notification of the intention to conduct an exploratory fishery for the squid *M. hyadesi* in Subarea 48.3 by the Republic of Korea and the UK during the 1997/98 season was approved under Conservation Measure 145/XVI. No fishing was carried out due to adverse economic conditions. No new information was presented to the Working Group at this year's meeting.

4.192 The scientific basis on which both the notification and the current conservation measure were based has not changed. WG-FSA, WG-EMM and SC-CAMLR 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; 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

4.193 The Working Group recommended that a conservative management scheme as contained in Conservation Measure 145/XVI is still appropriate for this fishery.

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

4.194 There has been no fishing activity on crab stocks since January 1996.

Management Advice

4.195 The Working Group, recognising the great utility of the experimental harvest regime set out in Conservation Measure 90/XV in providing useful information for developing an assessment of the target species, reiterated the view expressed at its 1996 meeting that Conservation Measure 90/XV 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).

4.196 The Working Group also stated that since the crab stocks were not assessed, a conservative management scheme as contained in Conservation Measure 126/XV is still appropriate for this fishery.

Antarctic Coastal Area of Division 58.4.1 and Division 58.4.2

4.197 No new information was available to the Working Group to undertake any assessment on the stocks in these divisions.

Pacific Ocean Sector (Area 88)

Subareas 88.1 and 88.2

4.198 Notification of the intention to conduct an exploratory fishery for *D. eleginoides* and *D. mawsoni* in Subareas 88.1 and 88.2 during the 1997/98 season was lodged by New Zealand (CCAMLR-XVI/17). Details on the development of the fishery in Subarea 88.1 are given in paragraph 4.6. No fishing was carried out in Subarea 88.2.

Subarea 88.3

4.199 A feasibility longlining and potting survey using the longliner *Tierra del Fuego* was carried out in Subarea 88.3 for 10 days during February 1998 in accordance with Conservation Measure 140/XVI for a new fishery for *D. eleginoides* and *D. mawsoni* (SC-CAMLR-XVII/BG/7). Total catch from the longlining activity was low (<1 tonne) and CPUE for both species were lower than the minimum required of 0.1 kg/hook that was established by the Commission (CCAMLR-XVI, paragraph 9.29). Total catch and catch rates from the pots were also low with the Antarctic crab (*P. anemerae*) predominating (WG-FSA-98/20). In spite of those results, the Working Group noted that this cruise provided interesting and useful data on the distribution of the two *Dissostichus* species.

Management Advice for *Dissostichus* spp. (Area 88)

4.200 In view of the low catch rates in the feasibility survey of *Dissostichus* spp. in Subarea 88.3, the Working Group recommended that fishing for *Dissostichus* spp. should be prohibited in that subarea.

General By-catch Provisions

4.201 In this section of the report the Working Group considered issues associated with the by-catch of fish. Information on the by-catch (incidental mortality) of seabirds can be found under Section 7 ‘Incidental Mortality Arising from Longline Fishing’.

4.202 The Working Group recalled its discussion in last year’s meeting and recognised that the mixed strategy referred to in SC-CAMLR-XVI, Annex 5, paragraph 4.319 has been in operation during the past season. The mixed strategy has two components: (i) total removals of each by-catch species are limited by estimates of potential yield; and (ii) haul-specific by-catch limits are set at levels that permit prospecting but are not likely to cause the potential yield from Component 1 to be exceeded. It was agreed that this approach is appropriate and should be retained in the coming season for by-catch species generally but noted that variations may be possible in some circumstances, such as for the assessments of two by-catch species in Division 58.5.2 considered below.

4.203 The *C. gunnari* fishery conducted in Subarea 48.3 provided information on haul-by-haul by-catch levels in the semipelagic fishery for this species. It was noted that *G. gibberifrons* was not present in the catches and that the threshold level of 100 kg of by-catch in a single haul was not reached for any species.

Assessments of By-catch in Division 58.5.2

4.204 WG-FSA-98/55 detailed data available for estimating recruitment parameters for two by-catch species, *C. rhinoceratus* and *L. squamifrons*, in Division 58.5.2. Lognormal recruitment parameters were estimated by undertaking mixture analyses using data from three trawl surveys around Heard Island from 1990 to 1993 (Williams and de la Mare, 1995). Cohort strengths were determined from the results of these analyses using the method described in SC-CAMLR-XIV, Annex 5, paragraphs 5.44 to 5.49. The resultant parameters are given in Table 29.

4.205 Recruitment variability in *C. rhinoceratus* is approximately the same as used in last year's assessments while recruitment variability in *L. squamifrons* was estimated to be much greater than that used last year. The Working Group agreed to use these new estimates in assessments using the GYM in the same manner as is undertaken for *D. eleginoides*.

4.206 The input parameters for the GYM are given in Table 29. The results are displayed in Table 25. The estimates of long-term annual yield for *C. rhinoceratus* and *L. squamifrons* are 150 tonnes and 78 tonnes respectively. The Working Group agreed that these estimates are more reliable than those for last year because they are now based on recruitment estimates from the area in which fishing takes place.

Management Advice

4.207 The Working Group agreed that the mixed strategy for protecting by-catch species detailed in SC-CAMLR-XVI, Annex 5, paragraph 4.319 should be retained as a general policy unless acceptable assessments of long-term annual yield and methods to ensure these species are not targeted, have been determined.

4.208 The Working Group considered that the estimates of yield for *C. rhinoceratus* and *L. squamifrons* for Division 58.5.2 undertaken this year are more reliable than the indicative assessments provided last year. It therefore recommended that the catch limit in Division 58.5.2 for *C. rhinoceratus* should be 150 tonnes, and that for *L. squamifrons* should be 80 tonnes.

4.209 The Working Group agreed that as these assessments are equivalent to those of target species, the main mechanism for protecting these species needs only be the catch limit. Therefore the provisions in Conservation Measures 130/XVI and 131/XVI dealing with catches of these species in excess of 5% of the total catch in any one haul are no longer required. Because of their low long-term annual yields, however, it is still advisable to retain the 2-tonne limitation on individual hauls in Conservation Measures 130/XVI and 131/XVI to avoid directed fishing on these species.

CONSIDERATION OF ECOSYSTEM MANAGEMENT

Interactions with WG-EMM

5.1 Dr I. Everson (Convener, WG-EMM) outlined those aspects of ecosystem assessment conducted by WG-EMM at its 1998 meeting (Annex 4) directly related to WG-FSA's work.

5.2 The Working Group noted that WG-EMM had encouraged further work on the possible relationship between *C. gunnari* condition and krill density in Subareas 48.1 and 48.3 (Annex 4, paragraphs 7.32 and 12.3(xii)). Further work on this relationship should result in an index of *C. gunnari* condition as a function of the species' krill-dependence.

5.3 The Working Group also noted WG-EMM's view that declines in black-browed albatrosses in Subarea 48.3 are likely to result from incidental mortality in the longline fishery (Annex 4, paragraphs 8.10 and 12.4(xiv)). Further work on this problem was encouraged (see also section 7).

5.4 Information concerning the by-catch of fish in the krill fishery was reported to WG-EMM (SC-CAMLR-XVII, paragraph 7.11).

5.5 WG-FSA-98/11 summarised the activities of the ad hoc correspondence group established by WG-FSA in 1995 (SC-CAMLR-XV, Annex 4, paragraphs 6.1 to 6.4) to analyse all available data on fish by-catch in the krill fishery.

5.6 The Secretariat has established a comprehensive database on fish by-catch in the krill fishery. The inventory of this database and the results of preliminary analyses were reported to WG-FSA's 1997 meeting (WG-FSA-97/46). The Working Group tasked the Secretariat with compiling and validating all outstanding information on the by-catch of fish in the krill fishery (SC-CAMLR-XVI, Annex 5, paragraphs 5.4 to 5.6) during the 1997/98 intersessional period.

5.7 Only a limited number of corrections to the CCAMLR database were made and a single new dataset was provided. Analyses of the available data indicated that despite a comparatively long time series (>20 years), data exhibited a marked lack of coherence and consistency in terms of the sampling methods used and the level of attached detail on sample protocols provided. In particular:

(i) data provided are a mixture of data from commercial krill catches and from research vessel catches using commercial equipment;

(ii) there is incomplete reporting of null records (i.e. of hauls in which fish by-catches were not present) in relation to the reporting of catches in which fish were present;

(iii) information on sampling protocols (especially the relationship between sample size and total sampling) is limited as is information on fishing gear characteristics or performance; and

(iv) information is incomplete on the biological characteristics (especially size) of fish caught as by-catch.

5.8 Similarly, the data compiled to date do not facilitate analyses aimed at evaluating the geographical and seasonal distribution of fish by-catch in terms of species caught, the numbers of individual species taken and their associated spatial/temporal distribution.

5.9 The Working Group was concerned that in spite of these developments, it is still unable to provide a clear indication of the likely impact of krill harvesting on larval and juvenile fish. It reiterated the view that even a relatively low incidence of larval/juvenile fish in krill catches

could result in a substantial impact on the future abundance of key fish species in some areas. Consequently, there is a need for increased sampling effort on krill catches as well as for additional studies on the demography and distribution of larval/juvenile fish.

5.10 In order to evaluate effectively the potential scope and impact of krill fishing on fish by-catch, WG-FSA-98/11 suggested that scientific observers should be deployed aboard krill fishing vessels in accordance with the CCAMLR Scheme of International ScientificObservation to monitor fish by-catch.

5.11 This would require a dialogue with krill fishers on practical issues as well as the development of observation protocols. Members were encouraged to pursue these matters and report back to WG-FSA's next meeting.

5.12 Dr Everson suggested that it may be possible to sample a small number of blocks of frozen whole krill once landed. Such an approach would provide at least some direct indication of the proportion of small fish taken by the krill fishery. Additional insight would be forthcoming the greater the information provided on the sourcing of the blocks of frozen krill. The Working Group welcomed this suggestion and looked forward to pilot studies on its efficacy and implementation.

5.13 Members were again encouraged to undertake studies on the distribution and abundance of larval/juvenile fish. In this connection it was noted that planning for the 1999/2000 synoptic survey for krill is well advanced (Annex 4, paragraphs 9.49 to 9.93). In this connection, it was noted that no data collection plans had been submitted for the collection of information on larval and juvenile fish as part of the survey's net sampling program. Since such plans had been requested by the Working Group in 1997 (SC-CAMLR-XVI, Annex 5, paragraph 5.15), Members with an interest in collecting fish data as part of the krill survey were strongly urged to provide data collection plans to the survey planning workshop scheduled for March 1999 (Annex 4, paragraph 9.85).

5.14 Following previous submissions to both WG-EMM and WG-FSA (i.e. SC-CAMLR-XVI, Annex 5, paragraphs 5.8 to 5.9), WG-EMM-98/11 reported on efforts to monitor coastal fish populations using pellets of the Antarctic shag (*P. bransfieldensis*). The Working Group noted that WG-EMM had agreed that this approach should be approved as a CEMP standard method (Annex 4, paragraph 9.30) for a five-year trial period initially. The method is currently being refined and will be published and circulated to all Members.

5.15 The Working Group acknowledged the progress made by WG-EMM in the development of comprehensive ecosystem assessments and especially in the combination of key biotic indices (Annex 4, paragraphs 7.1 to 7.4) and the elucidation of possible links between harvested and dependent species to the environment. The Working Group encouraged further development of these approaches and looked forward to future collaboration with WG-EMM on such matters.

Ecological Interactions

5.16 WG-FSA-98/26 described measurements of *C. gunnari* otolith chord length and mass as predictors of fish length and mass. Both measures serve as good predictors of fish length, with the latter being slightly better. The same measures did not predict fish total mass as accurately, since fish mass is affected by fish condition, state of feeding and maturity stage. The Working Group agreed that this work showed promise and encouraged future application of the method over a wide area. It also recognised the important implication of such results for fish predator studies and its application to other fish species.

5.17 WG-FSA-98/49 identified several references describing ecological interactions between both *D. eleginoides* and *D. mawsoni* with other components of the Antarctic marine ecosystem. Further discussion in this regard is contained in paragraphs 3.127 and 3.128.

5.18 As in 1997, several observer reports from the *D. eleginoides* longline fishery had mentioned interactions between marine mammals and fishing vessels (Table 30) during the hauling of lines. Since it is apparent that the number of fish taken by marine mammals (especially killer whales) is likely to be substantial, the Working Group welcomed further studies of the potential interactions between marine mammals and longline fishing as well as of the feeding of marine mammals on both *D. eleginoides* and *D. mawsoni* in particular (see paragraph 5.13 above).

5.19 Observers noted frequent interactions between orcas and the fishing line during the haul in Subareas 48.1, 48.2, 48.3, 58.6, 58.7 and 88.3. When orcas were present, between 50% and 100% of the catch was taken. Generally, the head of the fish was left on the line.

5.20 It was also noted that on some occasions when sperm whales were present around the vessel during the haul, there were sections of lines without fish. Several observers suggested that unlike orcas, sperm whales remove whole fish from the line. However, direct evidence is still lacking for sperm whales taking *D. eleginoides*.

5.21 On some occasions there was evidence that Antarctic fur seals took fish, based on the presence of half-eaten fish on the line; on other occasions, however, fur seals present during hauling were reported as not taking fish. One observer reported an increase in take of fish by fur seals over the course of the cruise, suggesting that a learning process may have occurred.

5.22 There are two reports of single leopard seals *Hydrurga leptonyx* taking *D. eleginoides* from the longlines.

RESEARCH SURVEYS

Simulation Studies

6.1 Drs Gasiukov and Marschoff reported on progress made on the study of the influence of spatial correlation in the estimates of the *C. gunnari* stock (SC-CAMLR-XVI, Annex 4, paragraph 6.2). The Argentine survey results have been preliminarily analysed under the assumption of an isotropic field of densities. The autocorrelation and structure functions (variogram) as functions of the distance between stations were obtained. Preliminary results indicate that the correlation between stations at a distance in the order of 10 km is small enough to treat them as uncorrelated. This work will continue in the intersessional period relaxing the assumption of isotropy.

Recent and Proposed Surveys

Recent Surveys

6.2 Four recent surveys were undertaken in CCAMLR waters during 1997/98, covering Subareas 48.1, 48.2, 48.6 and 88.3 and Divisions 58.4.4 and 58.5.2. These surveys were carried out by Australia, Chile, Spain and USA.

6.3 The Australian survey was conducted around Heard Island between 20 May and 4 June 1998 on the *Austral Leader*. The objective was to sample two populations of *C. gunnari* (Heard Plateau and Shell Bank).

6.4 Chilean scientists on board the longliner *Tierra del Fuego* visited Subareas 48.1, 48.2 and 88.3 during a 43-day cruise in February and March. The cruise was conducted in accordance with Conservation Measures 134/XVI, 135/XVI and 140/XVI (SC-CAMLR-XVII/BG/7 Rev. 1 and WG-FSA-98/20).

6.5 Spain undertook a bottom longline research cruise on several seamounts between South Africa and the Antarctic Convergence, and in the CCAMLR area (Shona, Spiess, western slope of Bouvet Island, and Ob and Lena Banks). The cruise was carried out between 22 October and 1 December 1997 on board the longliner *Ibsa Quinto* (WG-FSA-98/48).

6.6 The US AMLR program reported on a bottom trawl survey around Elephant Island and the lower South Shetland Islands. Trawling operations were conducted on board the RV *Yuzhmorgeologiya* from 12 March to 1 April 1998 (WG-FSA-98/5 and 98/17).

Proposed Surveys

6.7 Australia plans a *C. gunnari* pre-recruitment survey for the 1998/99 season. This survey will probably occur during May to August 1999 on the Heard Island Plateau and Shell Bank areas. A similar pre-recruitment survey may be conducted on Pike Bank in 1998. The aim of both surveys is to estimate the biomass and recruitment of *C. gunnari*. These estimates will be used for stock assessment at the next meeting of WG-FSA.

6.8 France and USA notified four research surveys for finfish. The French scientific vessel *La Curieuse* plans to visit Division 58.5.1 in winter 1999. The USA intends to conduct three different cruises: the first, on board RV *Laurence M. Gould*, will sample various Antarctic fish in Subarea 48.1 between March and July 1999; the second will conduct studies, including sampling of silverfish on board RV *Nathaniel B. Palmer* in the same subarea during May and June 1999; and the third cruise on RV *Yuzhmorgeologiya* will be to conduct bottom trawls for finfish studies in Subareas 48.1 and 48.2.

INCIDENTAL MORTALITY ARISING FROM LONGLINE FISHING

IMALF Intersessional Activities

7.1 The Secretariat reported on the intersessional activities of ad hoc WG-IMALF. The report was submitted as WG-FSA-98/5. The IMALF group worked in accordance with the plan of intersessional activities developed immediately after the completion of CCAMLR-XVI (November 1997) by the Secretariat in consultation with Prof. J. Croxall (UK) and other members of 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 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. The remaining tasks which needed intersessional work would appear in the plan of intersessional activities for 1998/99 (Appendix F).

7.3 The Working Group noted the large volume of 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 1997/98 fishing season.

7.4 The membership of ad hoc WG-IMALF was reviewed intersessionally and a number of new members were added. The revised list of members is appended (Appendix E). WG-FSA welcomed new members and 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 WG-IMALF. It was agreed that technical coordinators and the Scientific Observer Data Analyst should be ex-officio members of 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.

7.5 The Chairman of the Scientific Committee suggested that taking into account the large volume of intersessional work, and especially the work of WG-IMALF during annual meetings of WG-FSA, the latter should consider the appointment of a scientist who would lead discussions at annual meetings and also be involved in the coordination of intersessional activities. Ad hoc WG-IMALF considered the proposal and decided to recommend Prof. Croxall and Mr Baker to act as Convener and Deputy Convener respectively of ad hoc WG-IMALF. It was also decided that, within the Secretariat, coordination of the intersessional work of ad hoc WG-IMALF should be continued by the Science Officer.

Research into Status of Seabirds at Risk

7.6 In response to CCAMLR's request for information on national research programs into the status of albatrosses, giant petrels and white-chinned petrels (SC-CAMLR-XVI, Annex 5, paragraphs 7.18 and 7.20; SC-CAMLR-XVI, paragraph 4.40), New Zealand tabled a summary of research currently underway on New Zealand seabirds vulnerable to fisheries interactions, and a list of papers resulting from this work which have either been published or are in press (WG-FSA-98/28). Three other seabird research papers which provide interim results were also tabled (SC-CAMLR-XVII/BG/8, BG/9 and BG/13).

7.7 The Working Group noted that of the eight species listed in the table in WG-FSA-98/28, there is evidence that four forage in the CCAMLR area. These are the Antipodean wandering albatross (Walker and Elliott, unpub. data), grey-headed albatross and Campbell albatross (Waugh, unpub. data) and southern royal albatross (Woehler et al., 1990). The usefulness of the summary table was noted. Similar summaries from other nations would enable the Working Group to carry out an overall review of research programs being carried out on albatrosses and petrels which either breed or forage in the CCAMLR area.

7.8 The Secretariat was requested to ask all Members to supply in advance of the next meeting, relevant summary data (in a format similar to WG-FSA-98/28, listing at least species, site, nature and duration of study, scientists responsible and publications) on their research programs into the status of albatrosses, giant petrels and *Procellaria* petrels. The highest priority should be accorded to acquiring information from France, the only Member known to be undertaking relevant programs which has so far failed to respond to all requests for information. The Working Group would review this information at its 1999 meeting.

Reports on Incidental Mortality of Seabirds
during Longline Fishing in the Convention Area

1997 Data

7.9 At the 1997 meeting of WG-FSA, the data entry and analysis of the 1996/97 observer data for Subarea 58.7 was only partially completed. The task of entering and completing the analysis was given a high priority during the intersessional period; this is reported on in WG-FSA-98/10.

7.10 Of the 15 observer logbooks supplied for Subarea 58.7, only eight complied with the format of the CCAMLR Scientific Observers Logbook. An attempt was made to get the 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 31 (which replaces SC-CAMLR-XVI, Annex 5, Table 41) summarises the available information on seabird catch rates and the numbers of birds observed; some information was obtained from the observer cruise reports.

7.11 The observed species composition for birds killed in the longline fishery for Subarea 58.7 during the 1996/97 season is given in Table 32 (which replaces SC-CAMLR-XVI, Annex 5, Table 42). White-chinned petrels (*Procellaria aequinoctialis*) (66%) and grey-headed albatrosses (*Diomedea chrysostoma*) (11%) were still the most common species killed. Of white-chinned petrels and grey-headed albatrosses, 83% and 86% respectively were males, increasing the potential significance of the mortality (Ryan and Boix-Hinzen, in press).

7.12 The estimated total incidental catch of seabirds for each vessel in Subarea 58.7 (Table 33) was calculated using the observed catch rate (birds/thousand hooks) for each vessel multiplied by the total number of hooks set during the fishing season. For those vessels where catch rates could not be calculated, a total catch rate (average by-catch across all vessels for which by-catch rates were available) was used. The total catch rate was calculated from the total number of hooks observed and the total observed seabird mortality. The total seabird by-catch rate for Subareas 58.6 and 58.7 was 0.49 and 0.58 birds/thousand hooks for night and day setting respectively (Table 31). An estimated 696 birds were killed during night setting and 866 birds were killed during daylight setting. The total revised estimated seabird mortality (1 562 birds) for the 1997 season was then divided into species (Table 34) using the observed catch rates for each species (Table 32). This estimated total by-catch of 1 562 birds is 69% greater than the observed total mortality of 923 birds (see SC-CAMLR-XVI, Annex 5, paragraph 7.67). This reflects the difference between the number of dead birds actually seen by the observers and the estimated total which is the extrapolation to the complete haul from the proportion watched by observers.

1998 Data

Data Submission

7.13 As reported in WG-FSA-98/10 and paragraph 3.27, a total of 29 cruises of longline vessels was conducted within the Convention Area during the 1997/98 season, with scientific observers (international and national) on board all vessels. Comments on the quality and timeliness of observer data submissions are provided in paragraphs 3.43 and 3.44.

Data Validation

7.14 The reliability of data in the scientific observer database has been an issue in the past. With the current system there is insufficient time to validate recently-entered data in time for analysis at the meeting. Reconciling submitted data with information in the scientific observer reports is a critical part of the validation process. This and other validation procedures need to be completed before analysis is undertaken.

Data Analysis

7.15 As a result of the problems with data submission and validation, even preparing basic summaries of the submitted data on seabird by-catch is barely feasible by the end of the first week of the WG-FSA meeting.

7.16 Undertaking appropriate analyses (e.g. comparing by-catch rates in terms of vessel, season, area, year, species and mitigation measure) at the meeting is impossible under the present system. Such analyses are of fundamental importance for assessing the effectiveness of the existing CCAMLR measures and for identifying those measures (or elements thereof) which contribute to changes in seabird by-catch.

7.17 The Working Group therefore proposed that analyses involving the elements and addressing the topics outlined in paragraph 7.16 above, be undertaken as a priority element of the intersessional program.

7.18 Such analyses would not, therefore, be able to use the data for the current year as these will not be submitted in time. At the meeting, however, it should prove possible to summarise the current year's data at a level adequate to undertake a preliminary assessment and to identify for WG-FSA and Scientific Committee any topics of particular concern.

7.19 It would still be possible at WG-FSA to consider data analyses, and recommendations therefrom, contained in papers submitted to the meeting based on the current year's data.

7.20 Concern was raised that the assessments of seabird by-catch undertaken for WG-FSA were not comprehensive, in terms of covering all regulated longline fishing occurring in the Convention Area.

7.21 At present most, if not all data from Areas 48 and 88 are reported in full (i.e. logbook and scientific observer data) to the Secretariat and are thereby available for analysis and assessment.

7.22 Within Area 58, however, most of the current longline fishing is undertaken within the French and South African EEZs in Division 58.5.1 and Subareas 58.6 and 58.7. Only summarised observer data from the French EEZ are submitted to the Secretariat. Although all logbook and observer data from the South African EEZ are submitted to the Secretariat, a substantial proportion of this currently lacks data on the proportion of hooks observed, thereby precluding some analyses essential for overall estimates of seabird by-catch.

7.23 At present it is impossible, therefore, for WG-FSA to undertake any comprehensive analysis – and to make any comprehensive assessment – of seabird by-catch in Area 58 as a whole.

7.24 It was agreed to request appropriate French scientists to see if the detailed data on seabird by-catch, collected by observers, could be submitted to CCAMLR in a form consistent with that acquired from other longline fisheries.

Results

Subareas 48.1, 48.2 and 88.3

7.25 On the 52 hauls (24 in Subarea 48.1, 7 in Subarea 48.2 and 21 in Subarea 88.3, with a fish catch of <1 tonne in each), no seabird capture or mortality was reported (WG-FSA-98/19). During the fishing period (14 February to 18 March 1998) standard (10-minute) observations of seabirds around the ship during hauling recorded a total of 436 seabirds of 13 species, with

black-browed albatross (47%), Wilson's storm petrel (18%), brown skua (9%) and grey-headed albatross (9%) predominating. Very few interactions (especially in Subarea 88.3) between seabirds and the vessel, even during hauling, were noted (WG-FSA-98/19).

Subarea 88.1

7.26 In the 43-day cruise in February/March 1998, 82 sets were made, 24 (29%) during the day. Observation of 18% of hooks produced no reports of seabird by-catch (WG-FSA-98/10).

Subarea 48.3

7.27 WG-FSA-97/10 Rev. 2 indicates that a total of 79 seabirds was observed killed (66 at night, 11 in daytime, 2 unknown) and 249 seabirds were caught alive (227 at night, 22 in daytime) on the 3 154 thousand hooks observed (24.4% of the total set) in Subarea 48.3 (Table 35).[1]

7.28 Although most seabird by-catch, whether of birds observed killed or caught alive, occurred at night, the by-catch rates in daytime (0.043 birds/thousand hooks) are nearly double those at night (0.023 birds/thousand hooks), with an overall rate of 0.025 birds/thousand hooks. Last year the equivalent values for Subarea 48.3 were 0.93 birds/thousand hooks in daytime, 0.18 birds/thousand hooks at night and 0.23 birds/thousand hooks overall.

7.29 Of the overall observed by-catch, 95% (75 birds) relates to only four vessels: *Koryo Maru 11* (42%), *Isla Sofía* (first cruise: 32%), *Argos Helena* (11%), *Tierra del Fuego* (first cruise: 10%). Similarly, of birds caught alive, 67% relate to two vessels; *Isla Sofía* (first cruise: 35%), *Argos Helena* (32%). All these vessels were fishing in April and May, all the seabird by-catch occurred in these months, 97% (77 birds) in April.

7.30 However, not all vessels fishing in April and May had high by-catch rates. Thus, on the *Illa da Rua* (first cruise) only one bird was killed and one caught alive, *Northern Pride* reported 20 birds caught but only one killed and *Arctic Fox* (first cruise) only killed one bird and caught three others.

7.31 Failure consistently to use streamer lines is likely to have been an important contributory factor to the high seabird mortality rate of *Isla Sofía* (no streamer lines used at night; used on only 75% of daytime sets) and *Argos Helena* (used on only 20% of daytime and 57% of night-time sets). However, this cannot explain the high by-catch rates on the *Koryo Maru 11* and *Tierra del Fuego* which used streamer lines comprehensively.

7.32 The high rates of live capture of seabirds is likely particularly to be influenced by offal discharge on the same side as the haul. This was likely to be the case for the *Isla Sofía*, *Argos Helena* and *Tierra del Fuego*, but would not account for the relatively high catch rates of live birds by the *Koryo Maru 11* and *Northern Pride*.

7.33 The species comprising the observed by-catch (Table 36) were white-chinned petrel (83%), black-browed albatross (12%), southern giant petrel (3%), wandering albatross (1%) and southern fulmar (1%). Eight of the 10 albatrosses (80%) were killed during the day; 65 of the 66 white-chinned petrels (98%) were killed at night.

[1] All birds killed on sets which begin during daytime or night-time (as defined by CCAMLR in Conservation Measure 29/XVI, footnote 3) are defined as daytime or night-time for the purposes of these analyses. A small proportion of sets started at night continued into daytime and vice versa, resulting in some small amount of potential misallocation of birds.

7.34 Using the observed by-catch data together with the proportion of hooks observed (Table 35) enables estimation of the overall seabird mortality in Subarea 48.3 in 1998 (Table 37). As last year, it should be emphasised that only a small proportion of hooks was observed on some vessels and cruises and therefore some quite large extrapolations are made from small original samples. This is particularly so for *Isla Sofía* and *Argos Helena*, with only 6% and 7% of hooks observed respectively and with substantial by-catch in the observed sample. Bearing this in mind, the overall estimated by-catch of 640 birds is still a very substantial reduction from the 5 755 birds estimated killed in 1997 in this subarea.

7.35 In comparison with 1997, in 1998, 5% fewer hooks were set, 6% fewer were set in daytime but 11% fewer were observed. There was only 12% of the seabird by-catch with daytime, night-time and overall by-catches reduced to 13%, 5% and 11% respectively of 1997 values. The proportion of albatrosses in the by-catch was reduced from 40% to 13% of the total, whereas the proportion of white-chinned petrels increased from 55% to 83% of the total.

7.36 Although there was some improvement in confining line setting to night-time and an improved use of streamer lines, it is likely that a major factor in reducing seabird by-catch in 1998 was the one-month delay (until 1 April) in the start of the fishing season. Thus in Subarea 48.3 in 1997, of 712 birds observed killed, 67% were caught in March, 30% in April and 3% in May to August. For 1998, of 79 birds observed killed, 97% were caught in April and 3% in May.

7.37 A comprehensive analysis is planned intersessionally into the relationships between vessel, daytime and night-time setting, time of year and seabird by-catch.

7.38 Overall, the Working Group noted that there had been a substantial (order of magnitude) improvement in the level and rate of seabird incidental mortality in Subarea 48.3 in 1998, compared with 1997. This is due to much higher levels of compliance with CCAMLR conservation measures.

Division 58.4.4

7.39 Two white-chinned petrels were caught by a Spanish longliner conducting a research cruise on Ob Bank in the period October to December 1997 (WG-FSA-98/48).

Division 58.5.1

7.40 CCAMLR-XVII/BG/41 includes summary reports of incidental mortality of seabirds on three cruises by two longliners. The *St Paul* reported no seabird by-catch from 30 sets (215 117 hooks) in December 1997. The *Reshetniak* reported 15 deaths (all white-chinned petrels; all but one at night) on 381 sets (962 400 hooks) in October to December 1997 and 11 deaths (all white-chinned petrels; all at night) on 285 sets (706 800 hooks) in February 1998. The overall catch rate of seabirds by the *Reshetniak* is stated to be 0.016 birds/thousand hooks. In addition, data from the lines of two unregulated Mustad autoline vessels were obtained, one having caught six white-chinned petrels on a haul of c. 3 750 hooks, the other catching six white-chinned petrels, one black-browed albatross and one grey-headed albatross on a haul of c. 3 500 hooks. This gave a minimum by-catch rate of 1.93 birds/thousand hooks.

Subareas 58.6 and 58.7

7.41 The most comprehensive data for this subarea available at the meeting are those summarised in WG-FSA-98/42. This reports the results of 11 longline fishing trips for *D. eleginoides* to the Prince Edward Island EEZ during 1997/98 (Table 38). The total fishing effort was approximately 4.3 million hooks, up 13% from the 1996/97 season (WG-FSA-97/51).

7.42 Observers reported that 498 seabirds from five species were killed during 1997/98 (Table 39). White-chinned petrels comprised almost all birds killed (96% of the total), with smaller numbers of giant petrels (3%), yellow-nosed albatrosses, and crested penguins. The average catch rate was 0.117 birds/thousand hooks, but this varied greatly among trips (Table 38). Only three trips, by two vessels, had by-catch rates exceeding 0.1 birds/thousand hooks. Two vessels, *Aquatic Pioneer* and *Koryo Maru 11*, had catch rates exceeding 0.3 birds/thousand hooks when fishing in February/early March.

7.43 Most birds killed were reported to have sodden plumage when hauled aboard, suggesting they were killed during setting. No observers reported birds being killed during hauling, but one northern giant petrel was badly injured.

7.44 As in 1996/97 (WG-FSA-97/51), there was great variation in bird by-catch within and between trips. Most sets caught no birds (85%), whereas a few sets caught large numbers of birds (maximum 30, all white-chinned petrels). Twenty sets caught five or more birds, and although they comprised <2% of sets, they accounted for more than half (52%) of birds killed. Important sources of variation include: fishing season, time of setting, wind strength, moon phase, distance from the Prince Edward Islands and vessel.

7.45 Fishing season: Seabird by-catch occurred primarily during summer, with by-catch rates peaking during the chick-rearing period for white-chinned petrels (Figure 10). No white-chinned petrels were caught during July/August, and the by-catch rate for this species decreased markedly by mid-March (0.375 birds/thousand hooks for the first half of March compared with 0.047 for the second half of March). Only two were caught in April/May (by-catch rate 0.003). Most giant petrels were caught in November (87%), whereas all three yellow-nosed albatrosses were caught in February. The crested penguins were all caught by the *Koryo Maru 11* in three incidents on successive trips in January and February.

7.46 Time of setting: Although permit holders were supposed to set lines only at night, in accordance with Conservation Measure 29/XVI, 15% of sets (17% of hooks) were set during the day or spanned nautical dawn or dusk (Table 38). This is an improvement on the situation in 1996/97, when more than half the hooks were set during the day (WG-FSA-97/51), and probably is the single factor most responsible for the marked reduction in by-catch of albatrosses and, to a lesser extent, giant petrels. During 1997/98 by-catch rate of giant petrels during day sets was almost 20 times greater than during night sets. White-chinned petrels are caught both during day and night sets, but the by-catch rate averaged higher for day sets (0.159 birds/thousand hooks) than night sets (0.102). The comparative by-catch rates for all other species combined were 0.0167 for day sets and 0.003 for night sets. Six of the 20 sets that caught five or more birds were made during the day. There was no clear pattern in by-catch rate during the night; the apparent peak in by-catch of white-chinned petrels three to four hours before dawn was strongly influenced by a small number of sets that caught >10 birds on the two trips with high by-catch rates (Figure 11). Surprisingly few birds were caught during sets around dawn compared with those around dusk (Figure 11).

7.47 Wind strength during setting: Seabird by-catch rates were considerably higher when there were gale force winds (≥ force 8 on the Beaufort scale), and were reduced in calm or near calm conditions (force 0–1). These data are based on summer fishing effort only (November to March), but this pattern persists throughout the year, and is still apparent even if the two high catch rate trips are excluded (especially with regard to low by-catch during calm conditions).

Of the 20 sets that caught five or more birds, all occurred at wind speeds ≥ force 3, with 12 ≥ force 5 and four ≥ force 8. Observers reported that streamer lines often were ineffective when setting in high winds, and in some cases could not be deployed when winds were very strong. Less than 10% of hooks were set in gale force winds.

7.48 Distance from the Prince Edward Islands: Most birds were caught within 100 km of the islands, where more than 60% of fishing effort took place. By-catch rates of white-chinned petrels decreased almost linearly with distance from the islands (0.151 at <100 km; 0.074 at 100–200 km; 0.003 at >200 km), but if the two high catch rate trips are excluded, the distinction between the <100 km (0.07) and 100–200 km (0.06) zones disappears. All giant petrels and penguins were caught within 100 km of the islands, whereas the three yellow-nosed albatrosses were caught 100 to 200 km from the islands.

7.49 Moon phase: The relationship between seabird by-catch and moon phase was not very strong. The greatest by-catch rate occurred during half moon conditions, but this was influenced by the two trips with high catch rates. Excluding these trips, summer by-catch rates showed a slight elevation for moon states above 0.2 (moonless = 0; full moon = 1). All three yellow-nosed albatrosses were caught on moonlit sets (moon phase 0.8–1.0), as were the giant petrels (0.4–0.8), but the four penguins were caught when there was little or no moonlight (0.0–0.3). Of the 20 sets that caught five or more birds, nine of the 14 night sets took place with at least some moonlight. However, six of these sets also occurred with strong winds, suggesting that moonlight alone may be insufficient to cause serious by-catch problems.

7.50 Differences between vessels: There were strong inter-vessel differences in seabird by-catch rates. All sets that caught four or more birds (n = 29 sets) were made by only two vessels (the *Aquatic Pioneer* and *Koryo Maru 11*). The two trips by the *Koryo Maru 11* and one of the four trips by the *Aquatic Pioneer* accounted for 87% of all birds caught, despite representing less than one third of all fishing effort (32% of hooks set). Inter-vessel differences were most marked during the period of high by-catches in February to mid-March. At this time three vessels were fishing in the area (Table 38), but despite similar fishing times and locations, the catch rate of one vessel, the *Eldfisk*, was four to six times less than that of the other two vessels.

7.51 Overall, as reported in WG-FSA-98/42, there was a marked reduction in observed seabird by-catch in the *Dissostichus* spp. fishery at the Prince Edward Islands compared with 1996/97 (WG-FSA-97/51). Excluding white-chinned petrels, the by-catch rate of all other seabird species decreased 15 fold, from 0.079 birds/thousand hooks to 0.005. The biggest change was among albatrosses, whose by-catch rates decreased by two orders of magnitude (from 0.066 to less than 0.001 birds/thousand hooks). Giant petrels showed a more modest three-fold decrease, from 0.011 to 0.004 birds/thousand hooks. The mortality of crested penguins was surprising, as penguins are seldom observed to be caught on longlines. At least some of the penguins caught had swallowed hooks, suggesting that they were foraging from the longline. Most of these reductions in seabird by-catch compared to 1996/97 probably result from the reduction in the amount of daylight setting. However, the creation of a fishery exclusion zone to a radius of 5 n miles from the Prince Edward Islands, may have also made a contribution.

7.52 White-chinned petrels remain the main seabird by-catch problem particularly because they are caught at night. Their by-catch rate in 1997/98 (0.111 birds/thousand hooks) was almost half that in 1996/97 (0.210; WG-FSA-97/51), irrespective of the difference in the proportion of day sets between the two periods. The decreased catch rate presumably results from the more widespread use of effective streamer lines in 1997/98. However, the exclusion zone (see paragraph 7.51) may also have contributed to this.

7.53 The authors of WG-FSA-98/42 were requested to undertake analysis to assess the relative contribution that the exclusion zone may have made to the reduction in by-catch rates between 1997 and 1998.

7.54 Three factors were obvious influences on the by-catch of white-chinned petrels. Season was the most important, with most birds caught during the end of the chick-rearing period in both 1996/97 and 1997/98. The marked decline in by-catch from mid-March occurs more than a month before adult birds leave the waters around the Prince Edward Islands, but corresponds with the end of chick feeding. Within the late chick-rearing period, wind strength (possibly by preventing the effective deployment of streamer lines) and differences between vessels appear to be most important factors determining by-catch.

7.55 In respect of these results, WG-FSA-98/42 recommended that the fishery be closed during February until mid-March; the Working Group endorsed the suggestion.

7.56 WG-FSA-98/42 also recommended that fishers should be discouraged from setting lines when winds exceed force 7. However, given that some vessels were able to avoid catching birds at this time, such a recommendation was felt to be inappropriate at this time.

7.57 The Working Group noted that data for Subareas 58.6 (outside the French EEZ) and 58.7 in WG-FSA-98/42 are, as in WG-FSA-97/51 from last year, based on the absolute numbers of birds observed killed. In addition to being underestimates because an unknown proportion of birds caught at the set are lost prior to hauling, not all hooks set are observed during hauling. Table 35 indicates that, in Subareas 58.6 (outside the French EEZ) and 58.7, for the five cruises with data, the average proportion of hooks observed was 61%. For four of these cruises, the observed total of 265 birds killed is 75% of the estimated total (for all hooks set) of 354 birds.

7.58 The Working Group thanked the authors of WG-FSA-98/42 for such a comprehensive report which addressed especially interactions between catch rates and other variables of interest to the Working Group.

7.59 It was noted that an important element of the IMALF intersessional work program would be to analyse existing by-catch data to evaluate the importance of various environmental, fishing and mitigation variables on seabird by-catch (paragraph 7.16).

7.60 The summarised results of observations on seabird by-catch on a single cruise in November 1997 are reported in CCAMLR-XVII/BG/41. On 77 sets (325 673 hooks) the *St Paul* killed four birds (two white-chinned petrels and two black-browed albatrosses) at an overall mortality rate of 0.012 birds/thousand hooks.

Compliance with Conservation Measure 29/XVI

7.61 This section summarises information on the extent to which there was compliance with the main elements of Conservation Measure 29/XVI in 1998 and compares this with the situation in 1997.

7.62 Thawed bait (Conservation Measure 29/XVI, paragraph 1). Last year (1997), there was no evidence of frozen bait being used but data reporting (in the reports of scientific observers) was incomplete or inconclusive. This year (1998), one vessel (*Sudur Havid*) reported using frozen bait. The completeness of reporting on this topic from other vessels is uncertain at present.

7.63 Line weighting (Conservation Measure 29/XVI, paragraph 2). Last year, no vessel using the Spanish method of longline fishing was in compliance with the conservation measure (see paragraph 7.145 and Figure 12). Data for this year show a similar pattern (Figure 12).

7.64 Night setting (Conservation Measure 29/XVI, paragraph 3). In Subareas 48.3 and 88.1, the proportion of sets commenced during daylight were 8% (126 of 1 557 sets) and

29% (24 of 52 sets) respectively (Table 35). This compares with values of 14% (173 of 1 214 sets) and 50% (one of two sets) for Subareas 48.3 and 88.1 respectively in 1997 (SC-CAMLR-XVI, Annex 5, Table 40). In Subareas 58.6 and 58.7, the proportion of sets commencing in daylight in 1998 was 15% (paragraph 3.53) compared with 55% in 1997 (SC-CAMLR-XVI, Annex 5, paragraph 7.67).

7.65 Offal discharge (Conservation Measure 29/XVI, paragraph 4). In 1998, the proportion of vessels discharging offal during the haul from the same side as line hauling (Table 35), i.e. failing to comply with the conservation measure, was 55% (six of 11 vessels; two holding offal on board during the haul) for Subarea 48.3, 0% (one vessel; holding offal on board during the haul), for Subarea 88.1 and 0% (three of three vessels, but information on two other vessels *Zambezi* and *Sudur Havid*, which discharged on the same side as hauling last year, is not available to the Secretariat at present) for Subareas 58.6 and 58.7. Equivalent values for 1997 are 90%, 0% and 33% for Subareas 48.3, 58.6/58.7 and 88.1, respectively (SC-CAMLR-XVI, Annex 5, Tables 38 to 40).

7.66 Live bird release and hook removal (Conservation Measure 29/XVI, paragraph 5). Observers provided information on whether hooks were removed from live birds caught on the haul for around half of the trips. On four trips, the crew removed hooks from all seabirds caught, while on three other trips hooks were only removed from a proportion of the seabirds.

7.67 Streamer lines (Conservation Measure 29/XVI, paragraph 6). In 1998, streamer lines were used on vessels in Subarea 48.3 on 61% of night-time and 81% of daytime hauls (Table 35). For 1997, comparable values were 37% and 27%. In Subareas 58.6 and 58.7, data (Table 35) suggest that streamer lines were set on about 80% of night-time hauls. Data for daytime hauls and for 1997 are insufficiently available in the database to make any estimates. In Subarea 88.1, streamer lines were used on 96% of night-time and 100% of daytime sets (100% for both in 1997).

7.68 These data on streamer lines simply reflect that such a line was used, rather than whether it complied with the specification in Conservation Measure 29/XVI. Table 40 summarises the specifications of streamer lines present on vessels, and shows whether the streamer lines meet the minimum standards described in Conservation Measure 29/XVI. The information was taken from both observer cruise reports and observer logbooks. See also further discussion on streamer line design in paragraphs 7.156 to 7.160.

7.69 Streamer lines which meet the specifications were present on vessels during nine of the 27 trips (33%). Streamer lines that fall short of the minimum specifications were present on 16 trips. No information was available for one trip, and no streamer line was present on another trip.

7.70 There was reasonable compliance (78%) with height above water of the attachmentpoint of the streamer line to the vessel, but only 26% of trips had a streamer line which met the minimum length. Streamer lines on most trips had at least the minimum number of streamer lines (70%) and met the minimum number of spacings (67%), but compliance with minimum length of streamer lines was poor (33%). Eight observers noted that the vessel had spare streamer line material on board.

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

7.71 The Working Group estimated the levels of seabird by-catch that might be associated with the unregulated longline fisheries in the Convention Area in 1997/98.

7.72 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 (Table 31) and *Dissostichus* spp. (Table 2) from the regulated fishery and estimates of total fish catches from the unregulated fishery have been used (Tables 3 to 10).

Seabird By-catch

7.73 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.

7.74 In view of the fact that:

(i) seabird by-catch rates in the regulated fishery were substantially lower in 1998 than 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 was more realistic to use the seabird by-catch rates from 1997.

7.75 This year, therefore, followed the identical procedure to that used last year. However, the seabird by-catch values used are revised totals following the incorporation of additional data not available at last year's meeting. Last year, the mean and maximum summer rates used (for Subareas 58.6 and 58.7) were 0.363 birds/thousand hooks and 1.446 birds/thousand hooks, respectively. The revised summer values for the complete 1997 dataset are 1.049 birds/thousand hooks and 1.88 birds/thousand hooks (Table 31). Winter mean and maximum values last year were 0.009 birds/thousand hooks and 0.02 birds/thousand hooks, respectively; the revised values are 0.017 birds/thousand hooks and 0.07 birds/thousand hooks.

Unregulated Effort

7.76 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.

Subarea 48.3

7.77 The Working Group identified no catch from unregulated fishing in this subarea this year, so no estimate of unregulated seabird by-catch is necessary (paragraphs 3.20 to 3.41).

Subareas 58.6 and 58.7

7.78 For this fishery, the year has been divided into two seasons, a summer season (S: September–April) and a winter season (W: May–August), corresponding to periods with substantially different bird by-catch rates. Fish catch rates are from South African and French data for their fisheries in Subareas 58.6 and 58.7 (Table 2). 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.

7.79 The seabird catch rates, from Table 31, were:

summer: mean 1.049 birds/thousand hooks; maximum 1.88 birds/thousand hooks; and
winter: mean 0.017 birds/thousand hooks; maximum 0.07 birds/thousand hooks.

Divisions 58.5.1 and 58.5.2

7.80 For the fisheries in these areas fishery catch rates are from the French data for their fisheries in Division 58.5.1 (Tables 1 and 2). The same alternative proportionate splits of catches and effort between summer and winter as in Subareas 58.6 and 58.7 were used.

7.81 The seabird by-catch rates used were the same values as used above for Subareas 58.6 and 58.7. There are two empirical values for this division, both from 1998 (CCAMLR-XVII/BG/41). One, of 1.93 birds/thousand hooks, is from a single set of two unregulated vessels; this value is very close to the value of 1.88 birds/thousand hooks used in Subareas 58.6 and 58.7. The other, of 0.016 birds/thousand hooks, is for a single cruise of a regulated vessel. It did not seem appropriate to use this value to represent the by-catch rate of unregulated vessels. Therefore analysis was confined to the use of the same values as for Subareas 58.6 and 58.7.

Results

7.82 The results of these estimations are shown in Table 41.

7.83 For Subareas 58.6 and 58.7, 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 8 500 to 11 000 birds in summer (and 50 to 100 in winter) to a potential higher level (based on the maximum by-catch rate of regulated vessels) of 15 000 to 20 000 birds in summer (and 200 to 400 in winter).

7.84 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 34 000 to 45 000 birds in summer (and 200 to 350 in winter) to a potential higher level (based on the maximum by-catch rate of regulated vessels) of 60 000 to 80 000 birds in summer (and 1 000 to 1 500 in winter).

7.85 The overall estimates of seabird by-catch are shown in Table 42.

7.86 As last year, it was emphasised that the values in Table 42 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.

7.87 Given the uncertainties involved, it cannot be concluded that there is any real difference between the lower/higher range of 50 000 to 89 000 birds potentially killed in 1998 compared with similar values of 31 000 to 111 000 birds potentially killed in 1997 (SC-CAMLR-XVI, Annex 5, paragraph 7.91 and Table 48). However, there is a probable change in the distribution of the potential bird by-catch in the unregulated fishery, which was mainly in Subareas 58.6 and 58.7 in 1997, whereas it is mainly in Divisions 58.5.1 and 58.5.2 in 1998.

7.88 On the basis of the species composition of the observed seabird by-catch in Subareas 58.6 and 58.7 in 1997 (63% white-chinned petrel, 22% albatross species (15% grey-headed albatross), 4% giant petrel species) the 1998 estimated potential by-catch in the unregulated fishery in the Convention Area would equate to 31 000 to 56 000 white-chinned petrels, 11 000 to 20 000 albatrosses and 2 000 to 4 000 giant petrels.

7.89 It was noted that these estimates are at least one order of magnitude higher than those reported to the Working Group for regulated fisheries in the same region.

7.90 For grey-headed albatrosses, for which accurate censuses are available of annual breeding populations (c. 21 500 pairs, but only about half the population breeds each year) for their breeding islands within Subareas 58.6, 58.7 and Divisions 58.5.1 and 58.5.2 (Gales, 1998), it may be roughly estimated that unregulated fishing in 1998 killed 9 to 15% of its breeding population.

7.91 For white-chinned petrels, available data are much less precise but the breeding populations at the Prince Edward, Crozet and Kerguelen Islands total less than 500 000 breeding birds (Croxall et al., 1984) so that an annual removal of 30 000 to 50 000 birds would have a substantial effect.

7.92 Breeding populations of giant petrels in Subareas 58.6, 58.7 and Divisions 58.5.1 and 58.5.2 total 20 000 breeding birds (WG-FSA-97/22), so that potential by-catch levels would equate to 10 to 20% of this.

7.93 The Working Group noted that levels of mortality in the unregulated fisheries will not be sustainable for these populations of petrel and albatross species breeding in the Convention Area.

7.94 With the estimated levels of seabird by-catch in the unregulated fisheries in the southern Indian Ocean in 1997 and 1998, it is likely that the local populations of white-chinned petrels, albatrosses and giant petrels would already be becoming reduced in numbers, perhaps to the extent that estimated seabird by-catch rates might be expected to decline from this cause alone.

7.95 The Working Group urged the Commission to take the strongest possible measures to address the problem of unregulated fishing in the Convention Area.

Assessment of Incidental Mortality of Seabirds in Relation to New and Exploratory Fisheries

Data from New and Exploratory Fisheries Proposed in 1997

7.96 The feasibility survey undertaken in Subareas 48.1, 48.2 and 88.3 between 14 January and 18 March 1998 all reported no seabird by-catch. Observations of birds around the vessel

during the set (WG-FSA-98/19) indicated the highest index of relative abundance was in Subarea 48.1 (11.1 birds per haul; black-browed albatross commonest), followed by Subarea 48.2 (7.6 birds per haul; brown skua commonest) and Subarea 88.3 (5.0 birds per haul; Wilson's storm petrel and black-browed albatross commonest).

Streamer lines (albeit not those specified by CCAMLR) and thawed bait were used throughout. Offal was not discharged during the set; offal treatment at other times is not specified in the logbook or observers report. However, when fishing in Subarea 48.3, this vessel was discharging offal on the same side as the haul.

The assessments last year of seabird risk from longline in these areas (SC-CAMLR-XVII, Annex 5, paragraph 7.126) were:

Subarea 48.1 – average risk;
Subarea 48.2 – average to low risk; and
Subarea 88.3 – low risk.

These potential risks are broadly in line with the relative abundance of relevant species recorded in WG-FSA-98/19.

7.97 Similarly, in Subarea 88.1, no seabirds were observed caught during the hauls observed (19% of total hauls made). A total of 84% of total sets made were observed and no direct interactions between seabirds and baited hooks were recorded. During 75% of the settings observed the number of seabirds observed astern of the vessel was five or less. Albatrosses were only recorded in the northern part of the subarea. Bird counts during the day were generally higher than at night. The maximum number of seabirds observed around the vessel was 109, of which 98 were cape petrels. Other species observed in Subarea 88.1 included black-browed albatross, light-mantled sooty albatross, southern giant petrel and southern fulmar. These species were generally observed in low numbers.

The vessel made 29% of the sets during day, which is a contravention of Conservation Measure 29/XVI. These daytime sets were made because of the dangers associated with submerged icebergs. The vessel limited setting time to night time once it was made aware of the contravention. A streamer line which met the minimum standards outlined in Conservation Measure 29/XVI was used at all times, and offal was not discharged during setting or hauling.

New and Exploratory Fisheries Proposed in 1998

7.98 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).

7.99 For assessment purposes advice was requested on known and potential interactions with seabirds, relating to the:

(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.

7.100 Last year the Working Group undertook the first comprehensive assessment on this basis. It assessed new and exploratory fisheries for most subareas and divisions of the Convention Area. For comparison, it also undertook assessments of areas with established longline fisheries (Subarea 48.3 and Division 58.5.1) (SC-CAMLR-XVI, Annex 5, paragraphs 7.126 and 7.127).

7.101 This year, the Working Group reviewed and revised those assessments from last year for areas where new and exploratory fishery proposals had been received for 1998.

7.102 The Working Group believed that, ideally, all statistical subdivisions of the Convention Area should be subject to assessments of risk from longline fishing, so that prospective applicants for new and exploratory fisheries would have advance information on the nature of potential problems. Accordingly, Division 58.4.1, an area not assessed last year, was included in this process even though this year's proposal was for a trawl fishery.

7.103 In the light of the revisions to last year's assessments and the new assessment of Division 58.4.1, the Working Group, to maintain consistency overall, undertook interim revisions of all other assessments made last year and made preliminary assessments for Subarea 48.5 and Division 58.4.2, the only two areas remaining unassessed. Full details of all assessments relating to the new and exploratory fishing proposals are set out below; the overall risk classifications of these and of the reassessments and interim assessments are summarised in Figure 1.

7.104 The Working Group would expect to undertake reassessments annually, on the basis of new data on seabird distribution and especially taking account of data on seabird by-catch obtained from the new and exploratory fisheries.

7.105 As part of its intersessional work, ad hoc WG-IMALF intends to review the distribution of all seabirds known to be at risk of by-catch in longline fisheries in the Convention Area. Arising from this risk, assessments will be carried out for all CCAMLR subareas and divisions to provide the basis for future advice for new and exploratory fisheries.

7.106 The Working group 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 can be devised, should permit longline fishing activities to be carried out in any season and area with negligible seabird by-catch. Nonetheless, the Working group carried out seabird risk assessments for all areas proposed for new and exploratory fisheries in 1999.

7.107 Last year, in addition to basic general reference material on the breeding and at-sea distribution of Southern Ocean seabirds, more specific information was provided on breeding, distribution and population sizes of albatrosses and petrels in WG-FSA-97/22, 97/23, 97/28 (now Gales, 1998) and on at-sea distribution from satellite-tracking studies in WG-FSA-97/56 (now Croxall, 1998). The species particularly at risk were assumed to be all species of albatross, both species of giant petrel and *Procellaria* petrels (in the Convention Area white-chinned petrel, *P. aequinoctialis* and, in some areas, grey petrel, *P. cinerea*). No further information on distribution at sea was tabled at the meeting this year. However, recently published information (Nicholls et al., 1997) indicates that the short-tailed shearwater, *Puffinus tenuirostris*, forages in CCAMLR waters. This species is now also considered to be at risk, together with the sooty shearwater, *P. griseus*.

7.108 The estimates of site-specific breeding populations and of total world breeding populations are principally derived from WG-FSA-97/22 and 97/28 (now Gales, 1998), together with data summarised in Croxall et al. (1984), Marchant and Higgins (1990), and Woehler et al. (1990).

7.109 In the assessments that follow, known potential for interaction was based exclusively on the known ranges of breeding birds determined by recent satellite-tracking studies. These are, therefore, minimum estimates of the home range of breeding populations. Within the Convention Area there have been no recent satellite-tracking studies of giant petrels. The only such data for white-chinned petrels are currently unpublished (Weimerskirch et al., in press) ; there are no data for grey petrels, but recent data for short-tailed shearwater (Nicholls et al., 1998).

Inferred potential for interaction is based on:

(i) ranges for breeding populations analogous to those determined by satellite-tracking at other breeding sites; and

(ii) at-sea distributions derived from seabird at-sea sightings during the breeding season as published in distribution atlases.

7.110 To assess distributions for 'other species' (see definition below), the following references were used: Abrams (1983), Brothers et al. (1997), Marchant and Higgins (1990), Tickell (1993) and Woehler et al. (1990). Advice was also sought from Mr T. Reid, an experienced Australian fisheries and seabird observer. For the areas under review the distributions are as follows:

wandering albatross	all, but only northern part of Subarea 88.1
Gibson's albatross	no data
royal albatross	Subareas 58.5, 58.6 and 58.7 only
black-browed albatross	all, but only northeast part of Subareas 48.6, 88.1; rare in Division 58.4.4
Campbell albatross	Subarea 88.1 and Division 58.4.1 only
grey-headed albatross	all, but only northern part of Subarea 48.6
Indian yellow-nosed albatross	Subareas 58.5, 58.7 and Division 58.4.1
Atlantic yellow-nosed albatross	no data
shy albatross	Subareas 58.6 and 58.7, Divisions 58.4.1, 58.4.3, 58.5.1 and 58.5.2
white-capped albatross	no data
Salvin's albatross	Subareas 58.6 and 88.1
Chatham albatross	Subarea 88.1
sooty albatross	Subareas 58.6 and 58.7, Divisions 58.4.1 and 58.4.4
light-mantled albatross	all
Amsterdam albatross	no data, no records for Division 58.4.1
Antipodean albatross	Subarea 88.1, no records for Division 58.4.1
southern giant petrel	all
northern giant petrel	all, but only northern half of Subareas 48.6 and 88.1,
white-chinned petrel	all, but only northeast half of Subarea 88.1; only extreme north of Subarea 48.6
grey petrel	all, but only northern part of Subareas 48.6 and 88.1

sooty shearwater	Subareas 48.6 and 88.1, Divisions 58.4.1, 58.4.2, 58.4.3 and 58.5.2
short-tailed shearwater	Subarea 88.1, Divisions 58.4.1, 58.4.2, 58.4.3, and 58.5.2

7.111 Some new data on bird populations and distributions contributed to the assessments and reassessments this year and influenced the advice provided. The Working Group requested that in future new information be highlighted and that assessments and advice that differ from previous years be so identified. It was noted that the proposed ad hoc WG-IMALF intersessional comprehensive assessment of all parts of the Convention Area should provide WG-FSA with a new benchmark for these assessments.

7.112 The overall assessments were made against a five-point scale of potential risk of interaction between seabirds, especially albatrosses, and longline fisheries. The five levels are:

(i) low (1);
(ii) average-to-low (2);
(iii) average (3);
(iv) average-to-high (4); and
(v) high (5).

7.113 For the purposes of these assessments the following definitions were applied:

(i) 'Breeding species in this area' means those seabird species considered to be at risk and which breed within the relevant area, subarea or division under consideration;

(ii) 'Breeding species known to visit this area' means seabird species which breed within CCAMLR waters and are considered to be at risk, and which are known to visit the relevant area, subarea or division under consideration, as determined by satellite tracking studies;

(iii) 'Breeding species inferred to visit this area' means seabird species which breed within CCAMLR waters and are considered to be at risk, and which are thought to visit the relevant area, subarea or division under consideration, as determined by at-sea distributions derived from either at-sea sightings during the breeding season, or as published in the scientific literature; and

(iv) 'Other species' means seabird species which breed outside CCAMLR waters and are considered to be at risk, and are known to occur in significant numbers in the relevant area, subarea or division under consideration.

7.114 An additional criterion, used in this year's (but not last year's) assessments, was the potential for longline fishing in an area, as deduced from inspection of bathymetric maps of the area in question. The map used (see Figure 13) was generally very helpful in making assessments. However, difficulties were encountered with areas with uneven distribution of potential fishing grounds. Areas which had been, or were being, considered as subdivided in respect of fishery assessments (e.g. Subareas 88.1 and 48.6) were therefore also assessed for seabird risk in relation to the subdivisions; comments on other areas are included as appropriate.

7.115 The advice section is based purely on consideration of reducing seabird by-catch by vessels operating under CCAMLR regulations (see SC-CAMLR-XVI, Annex 5, paragraphs 7.125 and 7.128).

7.116 The areas assessed were those where proposals for new and exploratory fisheries were received by CCAMLR in 1998:

Subarea 48.6	(South Africa)
Division 58.4.1	(Australia) - trawl
Division 58.4.3	(Australia, France)
Division 58.4.4	(South Africa, Spain, Uruguay, France)
Division 58.5.1	(France)
Division 58.5.2	(France)
Subarea 58.6	(France, South Africa)
Subarea 58.7	(France, South Africa)
Subarea 88.1	(New Zealand).

The French proposal for Divisions 58.5.1 and 58.5.2 was subsequently withdrawn.

(i) Subarea 48.6:

Breeding species in this area: southern giant petrel (until c. 1981).

Breeding species known to visit this area: none.

Breeding species inferred to visit this area: wandering albatross and light-mantled albatross from Prince Edward Islands; black-browed albatross, grey-headed albatross, sooty albatross, white-chinned petrel from elsewhere within the Convention Area.

Other species: shy albatross, sooty shearwater (Abrams, 1983).

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-XVII/10) proposes to fish from 1 April to 31 August. This does not conflict with the above proposal.

(ii) Division 58.4.1:

Breeding species in this area: none.

Breeding species known to visit this area: light-mantled albatross.

Breeding species inferred to visit this area: all species breeding at Heard/McDonald Islands; wandering albatross, grey-headed albatross, yellow-nosed albatross, sooty albatross, light-mantled albatross, northern giant petrel, southern giant petrel, white-chinned petrel from Kerguelen; yellow-nosed albatross from Amsterdam Island.

Other species: short-tailed shearwater; sooty shearwater.

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; apply all elements of Conservation Measure 29/XVI.

It was noted that Australia (CCAMLR-XVII/11) is proposing only to trawl 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 58.4.3:

Breeding species in this area: none.

Breeding species known to visit this area: wandering albatross from Crozet Islands.

Breeding species inferred to visit this area: black-browed albatross, light-mantled albatross, southern giant petrel from Heard/Macdonald Islands; grey-headed albatross, black-browed albatross, light-mantled albatross, northern giant petrel, white-chinned petrel, grey petrel from Kerguelen; white-chinned petrel, grey petrel from Crozet Islands.

Other species: short-tailed shearwater, sooty shearwater.

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 (September–April); maintain all elements of Conservation Measure 29/XVI.

It was noted that France (CCAMLR-XVII/9) proposes to fish the whole of the 1998/99 season, and states that there is no scientific justification for closures. The proposal by Australia (CCAMLR-XVII/11) is for a trawl fishery only.

(iv) Division 58.4.4:

Breeding species in this area: none.

Breeding species known to visit this area: wandering albatross, light-mantled albatross from Crozet.

Breeding species inferred to visit this area: grey-headed albatross, yellow-nosed albatross, southern giant petrel, white-chinned petrel, grey petrel from Crozet; wandering albatross, grey-headed albatross, yellow-nosed albatross, light-mantled albatross, southern giant petrel, white-chinned petrel, grey petrel from Prince Edward Islands.

Other species: short-tailed shearwater, sooty shearwater.

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 (September–April); maintain all elements of Conservation Measure 29/XVI.

It was noted that:

(a) France (CCAMLR-XVII/9) proposes to fish the whole of the 1998/99 season, and states that there is no scientific justification for closures;

(b) Spain (CCAMLR-XVII/12) and South Africa (CCAMLR-XVII/10) propose to fish from 1 April to 31 August. This will overlap the recommended season closure by one month; and

(c) Uruguay (CCAMLR-XVII/19) did not specify when it intended to fish, but indicated that it would comply with Conservation Measure 29/XVI.

(v) Division 58.5.1:

Breeding species in this area: wandering albatross (1 455 pairs; 17% world population), grey-headed albatross (7 900 pairs; 9% world population), black-browed albatross (3 115 pairs; 0.5% world population), yellow-nosed albatross (50 pairs; 0.1% world population), sooty albatross (c. 5 pairs), light-mantled albatross (c. 4 000 pairs; 19% world population), northern giant petrel (1 800 pairs; 17% world population), white-chinned petrel (100 000+ pairs – second most important site), grey petrel (5 000–10 000 pairs) at Kerguelen.

Breeding species known to visit this area: wandering albatross from Crozet Islands, black-browed albatross from Kerguelen, Amsterdam albatross from Amsterdam Island.

Breeding species inferred to visit this area: all the remaining species breeding at Kerguelen; most, if not all, species breeding at Heard/McDonald Islands; many species breeding at Crozet Islands.

Other species: unknown.

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. September–April); ensure strict compliance with Conservation Measure 29/XVI.

(vi) Division 58.5.2:

Breeding species in this area: black-browed albatross (750 pairs; 0.1% world population), light-mantled albatross (c. 350 pairs; 1.5% world population), southern giant petrel (2 350 pairs; 7% world population) at Heard/McDonald Islands.

Breeding species known to visit this area: wandering albatrosses from Crozet; black-browed albatrosses from Kerguelen; Amsterdam albatross from Amsterdam Island.

Breeding species inferred to visit this area: all species breeding at Heard/McDonald Islands; wandering albatross, grey-headed albatross, yellow-nosed albatross, sooty albatross, light-mantled albatross, northern giant petrel, white-chinned petrel from Kerguelen; yellow-nosed albatross from Amsterdam Island.

Other species: short-tailed shearwater, sooty shearwater.

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 Island.

Advice: average-to-high risk; prohibit longline fishing within the breeding season of the main albatross and petrel species (September–April). Ensure strict compliance with Conservation Measure 29/XVI.

It was noted that longline fishing is currently prohibited within the EEZ around Heard/McDonald Islands.

(vii) Subarea 58.6:

Breeding species in this area: wandering albatross (1 730 pairs; 20% world population), grey-headed albatross (5 950 pairs; 6% world population), black-browed albatross (1 000 pairs; 0.1% world population), Salvin's albatross (4 pairs), Indian yellow-nosed albatross (4 500 pairs; 12% world population), sooty albatross (1 200 pairs; 8% world population), light-mantled albatross (2 200 pairs; 10% world population), southern giant petrel (1 000 pairs; 3% world population), northern giant petrel (1 300 pairs; 13% world population), white-chinned petrel (thousands of pairs), grey petrel (thousands of pairs) at Crozet Islands.

Breeding species known to visit this area: wandering albatross, sooty albatross, light-mantled albatross from Crozet Islands.

Breeding species inferred to visit this area: in addition to all the Crozet Islands breeding species, wandering albatross from Prince Edward Islands and Kerguelen; black-browed, yellow-nosed, sooty, light-mantled albatrosses, northern giant petrel, southern giant petrel, white-chinned petrel, grey petrel from the Prince Edward Islands; grey-headed albatross, white-chinned petrel, grey petrel from Kerguelen.

Other species: unknown.

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. September–April); ensure strict compliance with Conservation Measure 29/XVI.

It was noted that:

(a) France (CCAMLR-XVII/9) proposes to fish the whole of the 1998/99 season, and states that there is no scientific justification for closures;

(b) South Africa (CCAMLR-XVII/14) proposes to fish from 1 April to 31 August. This will overlap the recommended season closure by one month.

(viii) Subarea 58.7:

Breeding species in this area: wandering albatross (3 070 pairs, 36% world population – most important site), grey-headed albatross (7 720 pairs; 8% world population), yellow-nosed albatross (7 000 pairs; 19% world population), sooty albatross (2 750 pairs; 18% world population), light-mantled albatross (240 pairs; 1% world population), southern giant petrel (1 750 pairs; 5% world population), northern giant petrel (500 pairs; 5% world population), white-chinned petrel (10 000+ pairs), grey petrel (thousands of pairs) at Prince Edward Islands.

Breeding species known to visit this area: wandering albatrosses from Crozet Islands.

Breeding species inferred to visit this area: all species breeding at the Prince Edward Islands; grey-headed albatross, black-browed albatross, yellow-nosed albatross, southern giant petrel, northern giant petrel, white-chinned petrel, grey petrel from Crozet Islands.

Other species: unknown.

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 (September–April); ensure strict compliance with Conservation Measure 29/XVI.

It was noted that:

(a) France (CCAMLR-XVII/9) proposes to fish the whole of the 1998/99 season, and states that there is no scientific justification for closures; and

(b) South Africa (CCAMLR-XVII/14) proposes to fish from 1 April to 31 August. This will overlap the recommended season closure by one month.

(ix) Subarea 88.1:

Breeding species in this area: none.

Breeding species known to visit this area: Antipodean albatross from Antipodes Island, light-mantled albatross from Macquarie Island.

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

Other species: short-tailed shearwater, sooty shearwater.

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 (subject to any variation in respect of the proposal in paragraph 7.117).

New Zealand Proposal in respect of Subarea 88.1

7.117 The Working Group noted New Zealand's request for a variation from Conservation Measure 29/XVI for the exploratory fishery in Subarea 88.1 (CCAMLR-XVII/13 Rev. 1). New Zealand proposes line weighting as an alternative to night setting in the area south of 65°S. This is because during the austral summer (December–March), there are no periods of darkness at these latitudes. The Working Group recognised the need to develop alternative mitigation measures to provide fishers with more options with regard to minimisation of incidental capture of seabirds. This is particularly pertinent to high latitude fisheries. The Working Group noted that line weighting has the best potential as an alternative mitigation measure. Understanding of line weighting is in a developmental phase and additional information on longline sink rates and seabird interactions is urgently needed.

7.118 The Working Group was supportive of the variation but recommended an alternative performance measure than that proposed. Instead of using a sinking depth of 10 m at the end of the aerial section of the streamer line as a performance measure, the Working Group recommended that a sink rate be used, and proposed 0.4 m/sec as the target, with a minimum standard of 0.3 m/sec for all parts of the line. Results from experiments undertaken on an autoliner in the *D. eleginoides* fishery around the Falkland/Malvinas Islands showed that a sink rate greater than 0.3 m/sec will minimise incidental capture of black-browed albatrosses which are efficient at taking bait during line setting (WG-FSA-98/44). However, other species at risk, such as grey-headed albatross and white-chinned petrel, are more efficient bait-takers than black-browed albatross and no seabird mortality occurred when the line sink rate was maintained at or above 0.4 m/second on a vessel using the Spanish fishing system (Brothers, 1995).

7.119 The Working Group stressed that this variation to Conservation Measure 29/XVI should be treated as an experiment to progress knowledge of the relationship between line weighting and line sink rates. Target sink rates may alter in future as a better understanding of the relationship between seabird mortality and sink rates is developed. In addition, the Working

Group noted that because line weighting is in an experimental phase, manual addition and removal of weights will probably be the means of achieving the target sink rate in the short term. More efficient and safe ways of weighting longlines need to be developed.

Reports on Incidental Mortality of Seabirds during Longline Fishing outside the Convention Area

7.120 Many species of seabird, especially albatrosses, giant petrels and white-chinned petrels, breeding in the Convention Area are abundant and widely distributed outside the Convention Area, especially in adjacent areas to the north. They are regularly reported outside their breeding season, sometimes in substantial numbers, as by-catch in longline fisheries in these regions. Some species, especially wandering albatrosses and white-chinned petrels, forage widely outside the Convention Area, even when breeding within it; they are frequently caught in longline fisheries outside the Convention Area at this time.

7.121 In continuing recognition of the significance of the incidental mortality of seabirds from the Convention Area during longline fishing operations outside the Convention Area, CCAMLR has a standing request to Members to report on the details of the nature and magnitude of such information. The Working Group welcomed the information summarised below as supplied by South Africa, New Zealand and Australia. Such information was also supplied by Taiwan (via the Secretariat).

7.122 Mr Cooper reported that a comprehensive global review of seabird by-catch from longline fisheries produced for the FAO International Plan of Action on the Reduction of Incidental Catch of Seabirds in Longline Fishing (IPOA) and currently in draft form, highlights the paucity of information on by-catch for a number of nations close to the Convention Area, especially the South American countries of Argentina, Brazil, Chile and Uruguay, in whose waters species breeding in the CCAMLR area have been reported (Schiavini et al., 1998; Neves and Olmos, 1998; Stagi et al., 1998) or are thought to be at risk.

7.123 WG-FSA-98/25 provides summarised data collected between 1990 and 1997 regarding the by-catch in southern bluefin tuna and related tuna longline fisheries in the New Zealand 200 n mile EEZ. This annual review (as prepared for the 1998 meeting of CCSBT-ERSWG) briefly reviews the history of the southern bluefin tuna fisheries in the New Zealand EEZ, the protocols of fisheries monitoring and by-catch rates and species compositions of sharks and other non-target fish species, marine mammals and marine reptiles and seabirds.

7.124 The data from observed captures of seabirds during the tuna longline fishing operations in New Zealand are detailed in WG-FSA-98/25. A summary of one of the main datasets and of the composition of the seabird by-catch is provided in Tables 43 and 44. The mean by-catch rates for seabirds has varied greatly over the years for each fleet (domestic, foreign licensed and chartered fleet), particularly in the northern region. Highest by-catch rates for both fleets in this region however were recorded in 1996/97; for domestic vessels (1 453 929 hooks deployed) 82 seabirds were observed caught, at a mean by-catch rate of 1.10 birds/thousand hooks (s.e. = 0.19). Japanese vessels, operating under charter agreements, deployed 1 385 820 hooks in the northern region in 1996/97 and 178 seabirds were observed caught, a by-catch rate of 1.40 birds/thousand hooks (s.e. = 0.31). It was noted that a significant proportion of the 82 seabirds observed caught on the domestic vessels were caught during the haul and alive when brought aboard.

7.125 Data and analyses provided by Australia (WG-FSA-98/31) report on the rates and nature of seabird mortality in the Japanese tuna longline fishery around Australia between 1988 and 1995. Whilst Japanese fishing effort in the region has declined over the 1990s, the estimated catch rate of seabirds by this pelagic fleet during this time has been in the order of

0.15 birds/thousand hooks, equivalent to the deaths of 1 000 to 3 500 birds each year in the area. These estimates are underestimates as not all birds killed remain on hooks to be hauled aboard the vessels.

7.126 The observed seabird catch rate in the zone varied annually, seasonally and spatially. Most birds are killed during summer (even though most effort is expended during winter), in the southern regions of the zone, and when lines are set during daylight. Uncertainties in the observed and estimated catch rates prevent confident assessment of trends over time but seabird catch rates do not appear to be continuing to decrease. The authors conclude that the process of the incidental collection of seabird by-catch data (by observers who are primarily engaged to undertake fish sampling duties) renders the seabird by-catch data inadequate for reliable assessment of trends of total numbers of birds killed over time.

7.127 Of the birds retained by observers in the zone, 74% were albatrosses, the species composition of the by-catch varying with both season and area. Sixteen species of birds killed on longlines around Australia were identified, including black-browed, shy, grey-headed, yellow-nosed and wandering albatrosses, southern giant petrels, flesh-footed shearwaters and white-chinned petrels. Most species of birds killed were characterised by unequal representation of sex and age cohorts, and these unequal representations were not consistent between fishing grounds and season. The provenance of 55 birds was evident from band records, and 34 (62%) of these birds killed off the Australian coast, representing five species, originated from five islands within the CCAMLR Convention Area (South Georgia, South Shetland, Marion, Crozet and Kerguelen Islands). Information from satellite tracking of individuals breeding within the CCAMLR area also shows that several species, including wandering and black-browed albatrosses and white-chinned petrels, move to adjacent areas where they are at risk to longlining.

7.128 WG-FSA-98/30 provides a 1997 update of the seabird interactions with longline fishing in the Australian Fishing Zone (AFZ), for the Japanese and Australian domestic pelagic tuna fleets, as well as providing details of observations aboard a demersal autoliner operating off northern Tasmania. Whilst the data are sparse, domestic longline vessels continue to catch seabirds, at relatively high catch rates in some areas, although efforts to reduce rates of seabird catch included night setting with reduced deck lighting and use of bird poles. There were no observations of seabird deaths during the single voyage (60 500 hooks) aboard the demersal autoliner. The reasons for this lack of interactions are not clear; further investigation is under way.

7.129 The overall mean catch rate for the Japanese pelagic tuna fleet for the AFZ during 1997 was lower than in previous years (0.02 birds/thousand hooks) reflecting, among other factors, a shift in fishing to concentrate effort during the winter and in the northern regions. However, catch rates around Tasmania, an area of characteristically high catch rates, did not reflect a decrease from previous years. Four banded albatrosses were observed killed off Tasmania during 1997, two originating from islands within the Convention Area (Kerguelen and Marion Islands).

7.130 WG-FSA-98/32 reports on assessments of the influence of environmental variables and mitigation measures on the seabird catch rates in the Japanese tuna longline fishery within the AFZ. Logistic regression analyses were used to examine how the probabilities of birds being caught varied with factors associated with fishing tactics, equipment and weather conditions. In this zone, seabirds were most likely to be killed on longlines that were set during summer, in southern zones and during daylight hours. However, changes in catch rates resulting from changes in use of mitigation measures were problematic due to interrelationships between the measured factors. Interpretation and accurate assessments were further complicated by ongoing changes to fishing practices and equipment, and due to changes in the priority that fisheries observers placed on the collection of seabird data. The data for this fishery, in terms of assessments of ways to reduce seabird by-catch, are insufficiently robust to allow appropriate statistical analysis to examine the efficacy of mitigation measures.

7.131 The authors suggest that, for more confident determination of factors influencing seabird catch rates and assessments of methods aimed at reducing their capture rates, dedicated observations coupled with statistical assessments and manipulation of variables where possible and appropriate, are essential. Results of this approach suggest that appropriate use of bird lines, bait casting machines and thawed bait are effective in reducing seabird catch rates on longlines.

7.132 A synthesis of the information detailed in the above papers is provided in WG-FSA-98/29, which the Working Group recommended as an excellent overview for those interested in this topic. This document presents the experiences of a decade of seabird catch rates on Japanese longlines set within the AFZ since 1988 as a case study, together with a brief assessment of the efficacy of mitigation measures. The processes to accelerate the implementation of the effective mitigation measures are also documented together with brief details of other actions being pursued by the Australian Federal Government including the current Threat Abatement Plan, as well as international actions which complement the domestic actions.

7.133 As demonstrated, Australia is well advanced in its understanding of the nature of seabird by-catch in pelagic longline fisheries and also in its efforts to ameliorate the threat posed by this fishery. However, following the cessation of Japanese longline fishing in the AFZ in 1997 due to failure of the members of CCSBT (New Zealand, Japan and Australia) to reach agreement over tuna quota limits, the opportunities to maintain the advances made over the last 10 years are reduced. The implications of this to seabird conservation in other oceanic sectors, including the Convention Area, were noted with concern by the Working Group.

7.134 WG-FSA-98/43 presents data collected during fishing operations on both a Mustad autoliner and a Spanish longline vessel around the Falkland/Malvinas Islands between December 1997 and January 1998. For the Mustad vessel 200 000 hooks were observed deployed in 20 sets, during which 25 seabirds (24 black-browed albatrosses and one northern giant petrel) were killed. For the vessel using the Spanish system, no birds were seen to be killed during the three sets observed (30 000 hooks). The Working Group noted with regret that the UK had not provided CCAMLR with any data regarding incidental mortality during longline fishing operations in this area for the current year.

7.135 In 1997, WG-FSA noted that improved information on longline fishing effort and direct observations on by-catch rates of seabirds was needed for all longline fisheries to the north of the Convention Area. In particular, attention was drawn to the magnitude of the reported effort by Taiwanese vessels in the Southern Ocean in recent years (SC-CAMLR-XVI, Annex 5, paragraph 7.109). Following approaches by the Secretariat in 1998, the Overseas Fisheries Development Council (OFCD) in Taipei provided information on the distribution of fishing effort to the north of the Convention Area and south of 35°S for the years 1993, 1994 and 1995 (WG-FSA-98/38). In these years, 50 565 930 hooks, 56 403 739 hooks and 26 443 679 hooks respectively, were set, probably not entirely in the area south of 35°S. It was noted with concern that the distribution of fishing effort was co-extensive with the foraging ranges of a number of threatened albatross species breeding within the Convention Area. This fishery may present a significant risk to these birds and more accurate fine-scale fishing effort statistics are required to estimate the potential magnitude of interactions. As noted last year (SC-CAMLR-XVI, Annex 5, paragraph 7.107), there remains no direct information on seabird by-catch rates for this fleet. Enhanced links and information exchange between the OFCD and CCAMLR are encouraged by the Working Group.

7.136 The Working Group noted with interest the seabird identification chart and Taiwanese translation of the booklet *Longline Fishing: Dollars and Sense* produced by the OFCD, which were available at the meeting. Mr Cooper reported that South Africa is producing an Afrikaans language translation of the booklet. The Working Group applauded these initiatives and encouraged the OFCD to collect and report on by-catch rates and their progress with implementation of mitigation measures.

Effectiveness of Mitigation Measures

7.137 The Working Group noted the existence of a draft technical paper for the FAO IPOA which reviewed longline mortality of seabirds worldwide and extensively reviewed mitigation measures. The Working Group expected to consider this paper, once it is published, at its 1999 meeting.

7.138 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

7.139 Several papers (e.g. WG-FSA-98/44) and observer reports documented that jettisoning offal close to line hauling sites can have serious consequences for by-catch of seabirds. Despite this practise being prohibited under Conservation Measure 29/XVI, many vessels fishing in the Convention Area are still failing to comply.

7.140 Analysis of the observer data and observer reports for trips undertaken in 1997 and 1998 shows that for all but one of the 12 trips where observers recorded a catch of live seabirds greater than 0.1 birds/thousand hooks, offal was discharged on the same side as the line was hauled. Only one of these vessels was known to retain offal on board during hauling. All of these vessels were using the Spanish longline fishing method. In contrast, for the 11 trips where no live seabirds were caught, five of the vessels were discharging on the opposite side to the haul. Of the six that had a discharge point on the same side, four retained their offal on board during hauling. Seven of these 11 trips were undertaken by autoliners.

7.141 The Working Group reconfirmed that paragraph 4 of Conservation Measure 29/XVI should be retained as it stands. It further recommended that vessels discharging offal during the haul on the same side as the line hauling site should no longer be allowed to fish in the Convention Area (see also SC-CAMLR-XVI, paragraph 4.5(iii)) – and drew this especially to the attention of those involved in licensing of vessels to fish in national EEZs.

7.142 It was noted that discharge of spilled bait from autoliners should not take place during line setting in order to reduce bird attraction.

7.143 The Working Group noted with approval the report by Mr Purves that the *Koryo Maru 11* had reconfigured its waste-pipe system so as to discharge on the opposite side of the vessel from the line haul site. This had achieved a substantial reduction in interactions with and mortality of seabirds.

7.144 The Working Group asked that the *Koryo Maru 11* be requested to make available an engineer's diagram of the reconfigured waste-pipe system (to divert offal discharge to the side opposite the line hauling site), to assist other vessels in reconfiguration to rectify offal discharge problems. All Members should be requested by the Secretariat to submit any other relevant information on similar vessel reconfigurations.

Line Weighting

7.145 Conservation Measure 29/XVI states that for vessels using the Spanish method of longline fishing, weights of at least 6 kg mass should be used, spaced at intervals of no more than 20 m. However, as WG-FSA-98/44 indicates, no vessel fishing in 1997 was complying with this element of the conservation measure; a similar situation prevailed in 1998 (paragraph 7.63; see Figure 12).

7.146 It is possible that the weighting regime specified for the Spanish method of longlining in Conservation Measure 29/XVI is close to the limit of what is possible operationally. However, further investigation of seabird by-catch rates with other weighting and spacing regimes is needed before any changes to the existing conservation measure could be recommended. Such information is unlikely to be acquired from analysis of data already in the scientific observer database. Therefore experimental work on longliners during fishing will be essential in order to indicate what combination of weighting and spacing could, using the Spanish method, eliminate seabird by-catch.

7.147 Similar experimentation on Mustad autoliners into appropriate line weighting and spacing to ensure line sink rates that would preclude seabird by-catch is also essential. This should take account of effects due to variations in vessel speed at setting.

7.148 It was noted that full compliance with an appropriate line weighting regime might enable vessels to have much greater flexibility in streamer line use and design and possibly to become exempt from night-setting requirements.

7.149 WG-FSA-98/44 and 98/51 presented information on line weighting regimes for autoline vessels. WG-FSA-98/51 found that the mid-section of the unweighted autoline took a mean time of 63 seconds to reach 10 m. The streamer line used on the vessel which met the minimum standards outlined in Conservation Measure 29/XVI covered the longline for a mean time of 26.3 seconds. When weights (either 2.5 or 5 kg) were added to the line at intervals of 400 m, there was no detectable affect on the sink rate. WG-FSA-98/44 showed that line sink rates varied with distance between weights on the line. Lines with weights at <50 m intervals on lines sank much faster (0.3–0.4 m/sec) than lines with weight spacings that exceeded 70 m (0.1–0.15 m/sec). Weight spacings of 4 kg every 40 m on the lines of the autoline vessel in question were thought to reduce the capture of black-browed albatrosses to near zero levels.

7.150 The Working Group noted that line weighting is potentially a very effective mitigating measure. Indeed, achieving rapid sinking of the baited longline is probably the measure which offers at present the best opportunity substantially to reduce, if not eliminate, seabird by-catch in longline fisheries. If an appropriate weighting and spacing regime can be used, no seabirds should be caught, even in daytime sets. However, at present, addition of weights to lines is a cumbersome process for fishers. The Working Group strongly encouraged longline gear manufacturers to develop automated methods for adding and removing weights to the line, or to manufacture longlines with weights incorporated within them.

7.151 The Working Group recognised that effective progress on these issues would require interaction and collaboration with fishing companies and fishers. It was agreed that technical coordinators were well placed to assist in developing appropriate dialogue.

7.152 Line floats are increasingly used as part of longline setting operations. They have the capacity to increase seabird catch rates substantially. Therefore, consideration should be given to adding a provision governing their use to Conservation Measure 29/XVI. Until it is possible to prescribe a minimum line sink rate that must be achieved, use of line floats should either be prohibited or permitted only with a prescribed minimum length of line attaching the float to the fishing line. A minimum buoy line length of c. 10 m is suggested, irrespective of individual float buoyancy capacity.

7.153 The Working Group agreed that the current Conservation Measure 29/XVI requirement for weighting regimes should remain unchanged for the time being.

Line Setter

7.154 Members of the Working Group were aware that Mustad had recently developed a line setter for autoline vessels. The line setter operates by pulling the main line through the baiting

machine allowing slack line to enter the water. This differs from the present setting method where the drag of the line in the water and the forward movement of the vessel pull the line from the vessel under tension. The line setter has the potential to:

(i) decrease the time interval for which baited hooks are available to seabirds and improve the performance of a line weighting regime;

(ii) assist in minimising bait loss that may result as a consequence of weights being attached to the line and disruption of a smooth setting process; and

(iii) improve the operation of the Mustad underwater setting funnel by removing line wear problems and assisting in maintaining the line within the funnel during rough weather. The combined use of a line setter and a Mustad funnel has significant potential for assisting in reducing seabird mortality.

7.155 The Working Group noted that it would appreciate receiving information on the line setter from Mustad; the Secretariat was asked to pursue intersessionally. The importance of assessing the effect of line setters on line sink rate was emphasised.

Streamer Line

7.156 The Working Group noted information provided in WG-FSA-98/19 with regard to a proposal for a new streamer line design. The information presented covered data collected in 1997 when no seabirds were caught with the new streamer line design. However, the vessel using the new design was operating in areas where there are few seabirds susceptible to being caught. In the absence of rigorous statistical comparison of the new design and the CCAMLR design the Working Group saw no reason to change the existing specifications of the conservation measure.

7.157 Many scientific observers reported difficulties with the construction, deployment and effectiveness of streamer lines of the CCAMLR design. Tangling with fishing lines and lack of effectiveness in high winds were frequently mentioned as problems (see also SC-CAMLR-XVI, Annex 5, paragraph 7.132).

7.158 As last year (SC-CAMLR-XVI, Annex 5, paragraph 7.133), it was felt that many of the difficulties experienced were likely to result from some combination of incorrect construction and/or use of the streamer line, especially by inexperienced operators. It was re-emphasised that familiarity with the advice in WG-FSA-95/58 (concerning construction and use of CCAMLR-design streamer lines), which was the basis for the advice in the CCAMLR booklet *Fish the Sea Not the Sky*, was essential for correct use of these lines.

7.159 Overall, however, the Working Group agreed that the provisions provided in Conservation Measure 29/XVI relating to streamer line designs were adequate. It noted that there are specific provisions in the conservation measure for the testing of new streamer line designs.

7.160 Some flexibility in streamer line design (in respect of swivels) is already permitted in Conservation Measure 29/XVI (paragraph 6). Further relaxation of specifications was not thought desirable (or feasible to define) at this stage. If improvements in line sink rate are achieved through appropriate line weighting, then considerable scope for revising streamer line specification might exist.

Underwater Setting

7.161 There are a number of existing initiatives developing underwater setting devices for both pelagic and demersal operations. It was noted that both Norway and South Africa were undertaking testing of the Mustad underwater setting tube in terms of efficacy of reducing bird by-catch. Ongoing South African testing is taking place on a commercial longliner in Subareas 58.6 and 58.7. To date, no birds have been caught during daytime sets when using the Mustad tube on this vessel. Mr Cooper indicated that preliminary results from a Norwegian vessel fishing in the North Sea are that birds continued to be caught when the tube is used. Available information on this methodology had been comprehensively reviewed as part of the draft background paper for the FAO IPOA.

7.162 The Working Group understood that design and operational improvements have been made to the Mustad underwater setting funnel and line setter and asked the Secretariat to solicit a report on the modifications and results of at-sea trials.

7.163 Progress on the development of underwater setting devices in New Zealand and Australia was noted (WG-FSA-98/24). These underwater setting devices are designed specifically for pelagic longline fishing and are not suitable at present for demersal longlining operations due to the short snood lengths utilised in demersal longlines. It was noted that one of the pelagic devices (underwater setting chute) has potential for modification to enable its use on demersal vessels. Results of at-sea trials are not yet available.

Timing of Setting

7.164 It was noted that there had been some improvement with night setting requirements this year, and that this, along with commencing the fishing season one month later than previously in many areas probably contributed to the reduction in the number of birds reported killed this year.

7.165 It was re-emphasised that effective line weighting regimes might remove the necessity for night setting.

General

7.166 Experiences reported in WG-FSA-98/44 suggested that research should be undertaken on the effects of artificial bait, snoodline colour and mainline colour on seabird capture potential.

7.167 The Working Group endorsed the suggestion in WG-FSA-98/45 that research should be undertaken to investigate bait taking by different seabird species in relation to bait depth, propeller wash turbulence and streamer lines.

7.168 The Working Group recommended that research on the effects of line sink rates (taking account of vessel speed) on seabird by-catch should be undertaken as a very high priority.

7.169 The Working Group recommended that Conservation Measure 29/XVI should be retained as it stands, especially its provisions in relation to offal discharge, night-time setting and line weighting, subject to any modification relating to the New Zealand proposal for Subarea 88.1 (see paragraphs 7.117 to 7.119).

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

FAO International Plan of Action (IPOA)

7.170 The Working Group noted the existence of a draft background paper reviewing the incidental catch of seabirds by longline fisheries on a worldwide basis, prepared as supporting information for the FAO IPOA (SC-CAMLR-XVII/BG/5; paragraph 7.122). The Working Group requested that the final published version of the background document be circulated for consideration at its next meeting.

7.171 Last year the Commission requested the Secretariat to arrange for comments from ad hoc WG-IMALF to be forwarded to FAO in time for consideration of the IPOA at the FAO Consultation, to be held in Rome from 26 to 30 October 1998 (CCAMLR-XVI, paragraph 12.4). In accordance with FAO's timetable, the revised IPOA will then be submitted for adoption at the next meeting of the FAO Committee on Fisheries (COFI), to be held in February 1999.

7.172 In consultation with the Chairman of the Scientific Committee it was decided that, taking into account the timing of various CCAMLR meetings, it would be possible to arrange for the intersessional comments of ad hoc WG-IMALF to be considered at WG-FSA and then sent to FAO. After consulting with Members of the Scientific Committee, Mr Cooper was nominated as CCAMLR observer at the FAO meeting (26 to 30 October 1998). Mr Cooper will inform FAO of recent CCAMLR activities in relation to the reduction of seabird by-catch in longline fisheries in the CCAMLR Convention Area and submit comments of CCAMLR scientists regarding the FAO IPOA. Mr Cooper will also try to report direct to the CCAMLR Scientific Committee, during its 1998 meeting, on the outcome of the FAO meeting.

7.173 The CCAMLR Scientific Committee and the Commission will take the opportunity to consider further the draft of the FAO IPOA during their forthcoming meetings with a view to sending their comments to FAO for consideration at the COFI meeting in February 1999.

7.174 By correspondence ad hoc WG-IMALF members had made comments on an earlier draft of the IPOA (WG-FSA-98/34). These comments were reviewed in the light of the revisions to the plan.

7.175 Support was expressed by the Working Group regarding the inclusion of timeframes in the draft IPOA and that nations produce Assessment Reports to ascertain whether there is a need to develop National Plans of Action. Additional comments from the Working Group on the draft FAO IPOA considered that the Assessment Reports and the subsequent National Plans of Action should be independently assessed to ensure consistency and appropriateness of decisions, particularly in relation to reviewing the initial Assessment Reports to determine whether or not National Plans of Action are required. It was also suggested that technical measures which are of unknown effectiveness be relegated to a separate section.

7.176 The Working Group supported suggestions that a Seabird Technical Advisory Group be formed to give FAO advice, in respect of the IPOA, concerning scientific, technical and educational matters relating to seabird populations and seabird by-catch issues, especially measures for by-catch mitigation.

7.177 All these suggestions were incorporated into the document to be forwarded to FAO at its meeting in Rome, Italy (WG-FSA-98/34 Rev. 2).

7.178 The Working Group recommended to the Commission that, once the IPOA is adopted, it encourages all nations which engage in longline fishing in CCAMLR waters to prepare Assessment Reports, and if justified, National Plans of Action, following the guidelines contained in the IPOA.

Convention on Migratory Species

7.179 The Working Group noted the progress outlined in WG-FSA-98/36 in relation to the development of a regional agreement for southern hemisphere albatrosses.

7.180 The Working Group commended the listing of all southern hemisphere albatrosses on the Appendices to the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and expressed support for the development of a regional agreement covering southern hemisphere albatrosses. The Working Group encouraged an early meeting in Chile of the proposed ad hoc working group to examine options for regional cooperation.

7.181 It was noted that the 6th Conference of Parties (CoP) for the CMS will be held in Capetown, South Africa, from 4 to 16 November 1999. The occurrence of the CoP in Capetown provides an excellent opportunity for further meetings focusing on the development of a regional agreement.

7.182 The CCAMLR Secretariat advised that they had contacted the CMS Secretariat intersessionally enquiring whether the data collected by CCAMLR would be useful to the CMS in their work. No response has been received as yet.

Australian Threat Abatement Plan

7.183 The Working Group noted the tabling of the Australian document *Threat Abatement Plan for the incidental catch (or by-catch) of seabirds during oceanic longline fishing operations*. The objective of Threat Abatement Plan 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. However, using currently available mitigation methods, it is not possible to achieve this goal in the short term.

7.184 Specific actions in the plan prescribe the mitigation measures which must be used by domestic and foreign longline vessels in longline fisheries, fishing areas and fishing seasons in the AFZ to minimise the by-catch of seabirds. These include the following measures for pelagic longline fishing in the AFZ:

(i) night setting of hooks as one of three mandatory options available for selection by fishers;

(ii) use of lines which are sufficiently weighted to cause the baits to sink out of reach of diving birds immediately after they are set, as part of one of three mandatory options to be selected by fishers;

(iii) the use of thawed bait, as part of one of three mandatory options to be selected by fishers; and

(iv) a requirement that from 1998 all vessels operating in the AFZ will carry bird lines and use them when appropriate. Use of bird lines below 30°S will remain mandatory.

7.185 It should be noted that currently there are no commercial demersal longline operations for *Dissostichus* spp. occurring within the AFZ. However, the Threat Abatement Plan addresses the potential for this to occur in the future and includes appropriate actions. The plan states that if a new demersal fishery is to be established, particularly around sensitive areas such

as Heard and McDonald Islands (which are within CCAMLR waters), then suitable mitigation measures will be developed before the fishery proceeds. It is intended that any mitigation measures developed will be, at a minimum, in accordance with current CCAMLR conservation measures.

Commission for the Conservation of Southern Bluefin Tuna (CCSBT)

7.186 SC-CAMLR-XVII/BG/4 reports on the third meeting of the CCSBT Ecologically Related Species Working Group (ERSWG) which met in Japan from 9 to 12 June 1998. This working group was established to advise CCSBT on matters relating to ecologically-related species. The prime focus of this group to date has been the incidental mortality of seabirds in the southern bluefin tuna fishery. CCAMLR papers WG-FSA-98/25, 98/31, 98/32 and 98/33 were among the papers tabled at that meeting. As SC-CAMLR-XVII/BG/4 states, some of the key outcomes included a paper describing the member countries priorities for mitigation research, a paper describing ways to determine the effect of time of day on southern bluefin tuna catch, and a set of guidelines for the construction and deployment of streamer lines, for endorsement by CCSBT. The ad hoc WG-IMALF commented that the outcomes achieved at ERSWG may be of relevance to CCAMLR, and looked forward to receiving the full report once it had been considered by CCSBT.

Global Environment Facility (GEF)

7.187 The Working Group was informed by Mr Cooper of preliminary plans by BirdLife International to apply for funding from the Marine Topics program of GEF, a funding initiative emanating from the Convention on Biological Diversity, specifically to enable conservation actions in developing countries. Funding would be sought to hold an expert workshop in South Africa to assess the need and desirability of transferring relevant expertise on seabird by-catch to developing countries, such as on mitigation measures, observer programs and research needs and protocols. Such an initiative would support the FAO IPOA and follows directly from a recommendation made at the Workshop on Incidental Mortality of Albatrosses in Longline Fisheries held in 1995. In this regard, the Working Group noted with approval the workshop held in Chile in March 1998 to train scientific observers (SCOI-98/8).

Approaches to Eliminating Seabird By-catch in Longline Fisheries in the Convention Area

7.188 The Working Group briefly reviewed the practices and policies which can contribute to enhancing progress on this issue.

7.189 The Working Group believes that eliminating seabird by-catch associated with longline fisheries requires effective progress on a number of related topics. These include seabird research, fish research, fishing technology, education and legislation.

7.190 Important improvements can be achieved in the long term by the development of new fishing methods, particularly those involving underwater setting. When successful, such methods should remove the need for most, if not all, of the existing constraints on longline fishing arising from the need to use other types of mitigating measure (including closed seasons and areas) to protect seabirds.

7.191 In the meantime, however, research into improvements to, and better use of, existing mitigating measures is at least of equal importance. The highest priority should be given to devising line weighting arrangements that ensure line sink rates that will effectively preclude seabirds gaining access to baits.

7.192 Once such systems have been developed and implemented successfully, vessels using them would very likely be exempt from the use of other types of mitigating measure to protect seabirds, especially those relating to night setting and closed seasons and areas.

7.193 In most foreseeable circumstances, ensuring compliance in the use of mitigation measures will be an important part of the management of longline fisheries. The Working Group endorsed the suggestions of the Scientific Committee last year (SC-CAMLR-XVI, paragraph 4.52) that better compliance could be achieved through:

(i) access to the fishery only of vessels able and equipped to comply fully with CCAMLR conservation measures (e.g. constructed to allow offal discharge on the opposite side from the haul);

(ii) in-port inspection to ensure understanding by fishers of the relevant CCAMLR conservation measures and to ensure that vessels possess appropriate fishing and related gear to be able to comply with them;

(iii) preferential access to fisheries of vessels which have a good level of compliance with conservation measures (coupled with ready access to appropriate assistance to help vessels with a poorer record of compliance).

7.194 Complementary to many of these provisions is appropriate education of fishing companies, vessel captains, fishing masters and crew. Special training courses for these and for scientific observers and national technical coordinators would be valuable. Additional support involving specialists well-versed in the at-sea use of seabird mitigating measures would be desirable. The Working Group recommended that CCAMLR and its Members should support initiatives to secure international funding to facilitate such undertakings.

7.195 The Working Group recommended that CCAMLR should review its own materials aimed at improving education of those involved in longline fishing. To address fishing crews may require simpler and more graphic material than currently provided, perhaps by means of posters or videos. To inform fishing gear manufacturers and fishing companies of the more technical and scientific issues, a periodic newsletter on relevant developments and issues might be appropriate (see WG-FSA-98/45, paragraph 10).

7.196 Further desirable complementary initiatives include developing national (e.g. the Australian Threat Abatement Plan; see paragraphs 7.183 to 7.185) and international plans of action or agreements to tackle the relevant issues. Important international agreements would include those currently being developed by FAO (see paragraphs 7.170 to 7.178) and under the CMS (see paragraphs 7.179 to 7.182).

7.197 One of the major problems in tackling issues relating to longline fishing is regulating activities on the high seas and by countries not signatory to relevant international instruments. Effective action (including investigating potential for trade sanctions) in relation to issues like fishing overcapacity (tackling national/regional subsidies for building longliners) and reflagging of vessels to avoid liability under national legislation, will need pursuing. In relation to these and to improve the management of longline fisheries, ratification (and entry into force) of the 1995 UN Agreement for the Implementation of Provisions of the United Nations Convention on the Law of the Sea relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNIA) should be afforded a high priority since this agreement aims to harmonise management measures on the high seas, especially when such measures have been promulgated by regional fisheries management bodies such as CCAMLR.

In addition, both the FAO Compliance Agreement and Code of Conduct for Responsible Fisheries contain elements which are consistent with CCAMLR's objectives and which provide a global framework for successive international agreements on fisheries management consistent with the 1982 UN Convention on the Law of the Sea (UNCLOS) and the UNIA. The Working Group recommended that CCAMLR should encourage its Members and all other countries fishing in the Convention Area to ratify and promote the entry into force of these instruments as soon as possible.

Advice to the Scientific Committee

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

7.199 General:

(i) The appointment of Prof. Croxall as Convener and Mr Baker as Deputy Convener of ad hoc WG-IMALF (paragraph 7.5).

(ii) The intention of ad hoc WG-IMALF to review information on research programs into the status of albatrosses, giant petrels and *Procellaria* petrels at its 1999 meeting; to enable this, all Members were requested to submit relevant summary data intersessionally (paragraph 7.8).

(iii) International and national initiatives relating to reducing seabird by-catch in longline fisheries by FAO, CMS, CCSBT and Australia (paragraphs 7.170 to 7.187).

(iv) Comments on the draft FAO IPOA which are to be forwarded to the FAO (paragraphs 7.170 to 7.178 and WG-FSA-98/34 Rev. 2).

(v) A proposal to seek funding from the Global Environmental Facility (GEF) to facilitate reduction of bird by-catch in developing countries (paragraph 7.187).

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

1997

Intersessional revision of results from Subareas 58.6 and 58.7 (paragraphs 7.9 to 7.12), showing that:

(i) Species most abundantly killed by regulated fisheries were white-chinned petrels (66%) and grey-headed albatrosses (11%) (paragraph 7.11 and Table 32).

(ii) Catch rate (birds/thousand hooks) was estimated as 0.49 and 0.58 for day and night setting, respectively, in Subareas 58.6 and 58.7 (paragraph 7.12 and Table 31).

(iii) An estimated 696 birds were killed during night setting and 866 during day setting. This total estimated mortality of 1 560 is 69% greater than the observed total mortality of 923 birds (paragraph 7.12 and Tables 33 and 34).

1998 – General

(iv) Continuing difficulties with timely data submission and validation preclude the undertaking of comprehensive analysis of the current year's data (paragraphs 7.15 and 7.16). The main analysis should be undertaken intersessionally

(paragraphs 7.17, 7.37 and 7.59), complemented by preliminary assessment of the current year's data at the WG-FSA meeting (paragraphs 7.18 and 7.19).

(v) Request for all data for longline fisheries in the Convention Area in order to undertake comprehensive analysis and assessment (paragraphs 7.22 to 7.24).

(vi) Results from the 1998 fishing feasibility study in Subareas 48.1, 48.2, 88.1 and from the new fishery in Subarea 88.3 showed no by-catch of seabirds (paragraphs 7.25 and 7.26).

1998 – Results for Subarea 48.3:

(vii) 79 seabirds (83% white-chinned petrels, 12% black-browed albatross) were observed killed at an overall catch rate of 0.025 birds/thousand hooks (paragraphs 7.27, 7.28 and 7.33 and Tables 35 and 36), compared with 712 seabirds at a catch rate of 0.23 birds/thousand hooks in 1997.

(viii) An estimated 640 birds were killed, a substantial reduction (88% fewer) of the estimated 1997 kill of 5 755 (paragraph 7.34 and Table 37).

(ix) These results represent a major improvement compared with 1997, due to the much higher levels of compliance with CCAMLR conservation measures (paragraphs 7.35 and 7.40).

(x) The one-month delay (until 1 April) in the start of the fishing season is thought to be a major factor in reducing bird by-catch in 1998 (paragraph 7.36).

1998 – Results for Subareas 58.6 and 58.7

(xi) 498 seabirds of five species (mainly white-chinned petrels (96%)) were observed killed with an average catch rate of 0.117 birds/thousand hooks (paragraph 7.42 and Tables 38 and 39), compared with 834 seabirds at a catch rate of 0.52 birds/thousand hooks in 1997.

(xii) Important factors associated with higher rates of seabird by-catch were daytime setting (though reduced three-fold from last year), high winds, distance from breeding island, vessel and time of year (paragraphs 7.45 to 7.50 and Figure 10).

(xiii) By-catch occurred mainly during summer, peaking during February to mid-March, the chick-rearing period of white-chinned petrels (paragraph 7.45 and Figure 11).

(xiv) Seabird by-catch rates were considerably reduced compared with 1997; this was probably because of improved compliance with Conservation Measure 29/XVI, especially with respect to night setting and use of streamer lines (though the 5 n miles fishing exclusion zone around the Prince Edward Islands may have contributed) (paragraphs 7.51 and 7.52).

(xv) The fishery in Subarea 58.7 should be closed during February to mid-March during the chick-rearing period of white-chinned petrels (paragraph 7.55).

7.201 Compliance with Conservation Measure 29/XVI:

(i) No vessels were in compliance in respect of line weighting, for the second successive year (paragraph 7.63 and Figure 12).

(ii) Improvements in the prevalence of night setting, compared with 1997, were noted in all subareas (paragraph 7.64).

(iii) Despite some improvements since 1997 (principally relating to retaining offal during the haul) many vessels are still discharging offal during the haul on the same side as line hauling (paragraph 7.65).

(iv) Streamer lines were used on more vessels than last year, but most streamer lines do not meet CCAMLR specifications (paragraphs 7.67 to 7.70 and Table 40).

7.202 Assessment of potential levels of by-catch of seabirds in the Convention Area due to unregulated longline fishing:

(i) The estimate of potential seabird by-catch for 1998 (taken exclusively in the Indian Ocean sector) was between 50 000 and 89 000 seabirds (potentially comprising 31 000 to 56 000 white-chinned petrels, 11 000 to 20 000 albatrosses and 2 000 to 4 000 giant petrels) (Tables 41 and 42). This compares with estimated values for 1997 of 31 000 to 111 000 seabirds.

(ii) These levels of mortality would be unsustainable for the populations of these species breeding within the Convention Area in the southern Indian Ocean.

(iii) The Commission was asked to take the most stringent measures possible to combat unregulated fishing in the Convention Area.

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

(i) Fishing feasibility studies proposed in 1997 and undertaken in Subareas 48.1, 48.2, 88.1 and 88.3 resulted in no reported seabird by-catch (paragraphs 7.96 and 7.97).

(ii) Most statistical subdivisions of the Convention Area, including all with 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 (paragraphs 7.101 to 7.116 and Figure 13). In respect of this year's proposals (paragraph 7.116) potential conflict between proposed fishing seasons and advice on seasons closed to fishing to protect seabirds was:

(a) minor for Division 58.4.4 (Spain and South Africa), Subarea 58.6 (South Africa) and Subarea 58.7 (South Africa);

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

(c) uncertain for Division 58.4.4 (Uruguay).

(iii) Detailed advice was provided in respect of the New Zealand request for a variation from Conservation Measure 29/XVI for exploratory fishing in Subarea 88.1 (paragraphs 7.117 to 7.119). Otherwise it was agreed that Conservation Measure 29/XVI should be retained for longline fisheries in all parts of the Convention Area.

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

(i) Information on seabird by-catch outside the Convention Area, especially that submitted by Australia and New Zealand, continues to indicate that substantial by-catch occurs of species and populations breeding within the Convention Area (paragraphs 7.122 to 7.134 and Tables 43 and 44).

(ii) Efforts to obtain information on fishing effort and on bird by-catch by Taiwanese pelagic longliners for tuna in the Southern Ocean were noted and further dialogue encouraged (paragraph 7.135).

7.205 Effectiveness of mitigation measures:

Ad hoc WG-IMALF considered new information relating to methods for mitigating seabird by-catch in longline fisheries and offered new advice relating to:

(i) offal discharge, including bait spillage and vessel reconfiguration (paragraphs 7.139 to 7.144);

(ii) the importance of adequate line weighting as potentially the most effective of existing mitigating measures (paragraph 7.150), the need to develop more efficient methods to weight lines and the high priority of research on effects of line sink rates (paragraph 7.168);

(iii) the potential need to add a provision to Conservation Measure 29/XVI governing the use of line floats (paragraph 7.152);

(iv) the need to investigate the use of line-setting devices (paragraph 7.154);

(v) development and testing of underwater setting tubes by Australia, New Zealand, Norway and South Africa was noted and encouraged (paragraphs 7.161 to 7.163);

(vi) the need for research into artificial bait, gear colour and bait-taking behaviour of seabirds (paragraphs 7.166 and 7.167).

7.206 Approaches to eliminate seabird by-catch in longline fisheries in the Convention Area:

The Working Group prepared a brief review of policies and practices (involving seabird and fish research, fishing gear development, education and legislation) which it believed essential to resolving this issue (paragraph 7.189) recommending:

(i) sustained development of underwater setting, as the likely medium- to long-term solution (paragraph 7.190);

(ii) enhanced work to develop line weighting regimes to ensure sink rates that will preclude seabirds accessing baits (paragraph 7.191) and the implications of this for exemption from other mitigating measures (paragraph 7.192);

(iii) improving compliance with the existing suite of mitigation measures (paragraph 7.193);

(iv) improved training and education of fishing companies, vessel captains, fishing masters, crew, scientific observers and technical coordinators (paragraph 7.194);

(v) development of a range of national and international plans of action, e.g. those under FAO, CMS and the Australian Threat Abatement Plan (paragraph 7.196); and

(vi) action relating to improved regulation of high seas fishing (especially through harmonisation of management measures) with CCAMLR encouraging Members (and other countries fishing in the Convention Area) to ratify and promote entry into force of instruments such as UNIA, FAO Compliance Agreement and Code of Conduct for Responsible Fisheries (paragraph 7.197).

OTHER INCIDENTAL MORTALITY

8.1 From the reports of scientific observers the only report of a marine mammal entanglement with a longline vessel was of a dead seal, recorded during hauling on the *Koryo Maru 11* in Subarea 48.3 (Table 30). The observer reported it was probably a Weddell seal, although the specimen was not brought on board.

8.2 The Working Group noted that there were no reports from observers of seabirds killed in collision with net monitor cables. The use of these cables had been banned in the Convention Area since the 1994/95 fishing season (Conservation Measure 30/X). France and Australia both indicated that no trawlers fishing in their EEZs used net monitor cables.

8.3 One grey-headed albatross was killed by collision with a trawl warp line on a trawler in Division 58.5.1 (CCAMLR-XVII/BG/41).

8.4 The Working Group noted that New Zealand had constructed a marine mammal exclusion device for use on trawl vessels, and had undertaken trials in a flume tank (CCAMLR-XVII/BG/7). The device appears to have considerable potential and the Working Group asked to be kept informed of future progress.

8.5 During the longline fishing feasibility survey in Subarea 48.1 by the *Tierra del Fuego*, the observer reported seeing a group (c. 20) of freshly dead black-browed albatrosses floating on the water to the north of Elephant and Clarence Islands, South Shetland Island group. Several birds were inspected and all appeared to have had at least their internal organs removed. One hour previously, an unflagged Japanese-design trawler had been seen leaving the area (at 60°53'S 55°14'W). Later in the cruise, at 60°20'S 46°56'W, a similar incident was observed, involving a group of freshly dead Adélie penguins which had been similarly treated. A trawler of similar design to the previous observation was seen to leave the area at the same time.

FUTURE WORK

Elasmobranch By-catch

9.1 The Working Group 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 (Chair of the Scientific Committee) and Ramm. Mr Shotton had outlined a FAO initiative to review the elasmobranch by-catch in world fisheries, and to present findings at a meeting in October 1998. As part of this review, FAO had expressed interest in a baseline study of elasmobranch by-catch in the Southern Ocean.

9.2 The Working Group confirmed 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. 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; and

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

9.3 Dr V. Siegel (Germany) identified the need to develop taxonomic keys so as to allow data collectors to accurately record information at the level of species. The Working Group agreed that this was an important prerequisite to any study of by-catch, and especially to studies of elasmobranchs within CCAMLR waters. Dr Siegel offered assistance with the development of suitable taxonomic keys for elasmobranchs.

Fishery Data Manual

9.4 The Working Group discussed the Secretariat's proposal to publish the data reporting requirements for CCAMLR fisheries as a loose-leaf publication (WG-FSA-98/12). The fishery data are central to the analyses of the Scientific Committee and its working groups. However, unlike other major CCAMLR datasets (e.g. CEMP data and observer data), there are no published guidelines on the methods for collecting the fishery data. Instead, detailed information on data forms and codes, as presented in WG-FSA-98/12, is distributed each year by the Secretariat prior to the fishing seasons.

9.5 The proposed loose-leaf publication would be produced in the four languages of the Commission, and would be aimed at ensuring the accurate completion and timely submission of fisheries data. The publication would follow the successful loose-leaf format of the *Scientific Observers Manual.* The loose-leaf format allows material to be updated for the production cost of the replacement pages, rather than the cost of the whole publication. In addition, an electronic version of this publication would be held on the CCAMLR website where it could be browsed and downloaded as required. The proposed title for this publication was *FisheryData Manual.*

9.6 The Working Group agreed that the data reporting requirements for CCAMLR fisheries should be produced as loose-leaf publication, and suggestions were made concerning presentation and format. Most of these related to the need to make the manual user-friendly. The data forms should be brought to the front of the document, with examples on how to complete the forms. The instructions should be easily referenced so that users, including fishers, encountering problems may easily find the appropriate information. A table listing the current data forms should be included, and updated each year.

Workshop on *Champsocephalus gunnari*

9.7 Last year, the Working Group had identified a high priority need for further developments of long-term management strategies for *C. gunnari*. This need was endorsed by the Scientific Committee and a three-and-a-half day workshop was planned in association with the 1998 meeting of WG-FSA. The terms of reference of the workshop were outlined in SC-CAMLR-XVI, paragraph 5.62.

9.8 The Scientific Committee recommended that the workshop should proceed pending the submission of data and appropriate papers by 1 August 1998, and that the decision to hold the workshop would be taken by the Convener of WG-FSA, in consultation with the Chairman of the Scientific Committee and the Data Manager (SC-CAMLR-XVI, paragraph 5.61). Consequently, the workshop was postponed in August 1998 because key participants had been unable to prepare data and information by the time of the deadline.

9.9 The Working Group reviewed the needs for such a workshop, and confirmed that the development of long-term management strategies for *C. gunnari* remained a high priority. The Working Group also recognised that the terms of reference were ambitious, and that much work was required prior to holding such a workshop. However, the current assessments of *Dissostichus* spp. had also identified other high priority needs for further work. The Working

Group agreed that work on *Dissostichus* spp. should take precedence over work on *C. gunnari*, given the state of fisheries for *Dissostichus* spp., and the low catches of *C. gunnari* reported in recent years.

9.10 The Working Group agreed that a workshop to develop long-term management strategies for *C. gunnari* could be postponed until after 1999, and 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, and 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.

High-priority Intersessional Work on *Dissostichus* spp.

9.11 This year's assessments had identified high priority areas for future work, and the Working Group agreed that this work should be afforded equally high priority to that on *C. gunnari*, if not higher for the reasons stated above. These areas of work are:

(i) consider the currency of assessments for both *D. eleginoides*, as well as other species;

(ii) subject to the advice of the Scientific Committee and the Commission, define a start date for fisheries for *Dissostichus* spp. and review the 35-year period of which stock trajectories are projected with the GYM, especially in terms of reconciling the outputs of the GYM and information derived from CPUE;

(iii) identify stocks and define the home ranges;

(iv) analysis and interpretation of CPUE data;

(v) develop and validate growth models for *D. eleginoides* and *D. mawsoni* in different parts of their range;

(vi) derive recruitment indices from mixture analyses and analysis of their sensitivity to expected outcomes from growth and mortality functions; and

(vii) define ways of apportioning assessments in areas where both trawling and longlining may occur.

9.12 Recognising the high priority need for further work on *Dissostichus* spp., the Working Group examined the idea of holding a thematic session during the 1999 meeting of WG-FSA. If such a session was feasible, then key new work on *Dissostichus* spp. could be reviewed during the meeting, and would alleviate the need for a workshop prior to the meeting. The success of the thematic session would hinge on the success of intersessional activities, and the ability to report findings in papers focused on key elements of the assessments.

9.13 The Working Group recommended that the role of subgroup coordinators at this year's meeting be extended to the intersessional period, and that these people be tasked with coordinating the relevant and high priority aspects of the work identified at the meeting. The Working Group concluded that such an approach was likely to ensure the success of the thematic session. It was recommended that the Convener of the Working Group and Chairman of the Scientific Committee in consultation with Working Group members, will appoint coordinators for the following activities:

(i) compilation of catch data (from regulated and unregulated fishing activities);

(ii) review of observer reports and information;

(iii) review of new and exploratory fisheries activities and notifications;

(iv) assessment of *D. eleginoides*;

(v) assessment of *C. gunnari*;

(vi) review, and where necessary assess, the biology and demography of species considered by the Working Group; and

(vii) compilation of data necessary for ad hoc WG-IMALF activities.

9.14 It was recognised that the appointment of these coordinators should be undertaken as soon as possible after the 1998 meeting of the Scientific Committee. However, it was acknowledged that their work would be triggered by the arrival of the data necessary for them to address the various topics identified.

Work during the Intersessional Period

9.15 The Working Group identified a number of 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.

9.16 The following tasks were identified as part of developing the CCAMLR database:

Secretariat:

(i) Investigate and correct problems in the survey data (paragraph 3.6).

(ii) Transfer of all available survey data to the newly designed database (paragraph 3.7).

(iii) Develop data entry program for use by scientific observers in the field (paragraphs 3.63 and 3.64).

(iv) Develop electronic data submission procedures for fishery and observer data (paragraph 3.62).

(v) Process all available data from the split-year prior to the meeting.

(vi) Process, where possible, all available data from current fishing season prior to the meeting.

(vii) Resolve problems with the haul-by-haul data submitted by Ukraine (paragraph 3.19, see WG-FSA-98/5).

(viii) Maintain a register of collections of scales and otoliths from *Dissostichus* spp. (paragraph 3.104).

(ix) Develop and publish the *Fishery Data Manual* (paragraph 9.6).

Members:

(x) Collect detailed bathymetry data and submit to the CCAMLR database (paragraph 3.12).

(xi) Submit observer logbook data and reports within the deadlines set by the Commission (paragraph 3.44).

(xii) Submit examples of electronic data entry systems for consideration by the Secretariat (paragraph 3.64).

(xiii) Assist the Secretariat with the development of electronic data submission procedures for fishery and observer data (paragraph 3.62).

(xiv) Revise the sampling protocol of Mr Ashford and Prof. Duhamel (paragraph 3.66).

(xv) Encourage technical coordinators to participate in the meetings of WG-FSA (paragraph 3.79).

(xvi) 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 (paragraph 3.7).

(xvii) Resolve problems with the haul-by-haul data submitted by Ukraine (paragraph 3.19).

(xviii) Develop strategies for collecting data on fish by-catch in krill fisheries using port sampling and laboratory analysis of samples collected by fishers (paragraph 5.12).

(xix) Provide feedback on the experience on the draft protocol method for estimating conversion factors (paragraph 3.76).

9.17 The following tasks were identified as part of the work in stock assessment analyses and modelling:

Secretariat:

(i) Establish and maintain a register of tests on the GYM (paragraph 3.142) and other models used by CCAMLR (paragraph 3.146).

(ii) Maintain an up-to-date suite of software so as to fully document and operate validation procedures and models (paragraph 3.146).

(iii) Develop the routine for extracting weighted length-frequency data and perform routine length-frequency analyses.

(iv) Document the history of assessments (paragraph 9.10(v)).

(v) Continue collecting information on *D. mawsoni*.

(vi) Update estimates of seabed areas in relation to notifications of new and exploratory fisheries.

Members:

(vii) Quantify the gene flow of *Dissostichus* spp. between fishing grounds and, in particular, determine the origin of the stock of *D. eleginoides* found in the Maurice Ewing Bank in Subarea 48.3 (paragraph 9.11(iv)).

(viii) Analyse and interpret CPUE data from fisheries for *Dissostichus* spp. (paragraph 9.11).

(ix) Develop and validate growth models for *D. eleginoides* and *D. mawsoni* in different parts of their range (paragraphs 3.108 and 9.11(v)).

(x) Derive recruitment indices for *Dissostichus* spp. using mixture analyses and analysis of their sensitivity to expected outcomes from growth and mortality functions (paragraph 9.11(vi)).

(xi) Collect information on mesh/hook selectivity for *Dissostichus* spp. (paragraph 3.87).

(xii) Conduct further validation of the GYM (paragraph 3.142) and other models used by CCAMLR (paragraph 3.146).

(xiii) Identify the scope for a study on by-catch in trawl and longline fisheries for *Dissostichus* spp. (paragraph 9.2).

(xiv) Examine decision rules related to by-catch in new and exploratory fisheries (paragraph 4.51).

(xv) Examine the short-term implications of the current management strategies for *C. gunnari* (paragraph 9.9).

(xvi) Reconcile yield estimates for *Dissostichus* spp. derived from short-term and long-term projections (paragraph 9.11(ii)).

(xvii) Evaluate the performance of management strategies against fixed starting dates for fisheries for *Dissostichus* spp. (paragraph 9.11(ii)).

(xviii) Analyse changes in length-frequency distribution of *D. eleginoides*.

(xix) Examine ways of apportioning catch limits in new and exploratory fisheries with mixed gear (paragraph 9.11).

(xx) Quantify the catch of *Dissostichus* spp. in illegal and unregulated fisheries.

(xxi) Evaluate ways of determining the currency of particular assessments (paragraph 3.90).

(xxii) Conduct a stock reduction analysis on *Dissostichus* spp. fisheries (paragraph 9.11).

(xxiii) Conduct surveys in regions where there was little, or no, information on *Dissostichus* spp. (paragraph 3.86).

(xxiv) Task subgroup coordinators at this year's meeting with coordinating the relevant and high priority aspects of the work identified for the intersessional period (paragraph 9.13).

9.18 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 1998 plan of intersessional work. The latter items will be so identified in the 1999 work plan, which is attached as Appendix F. The following tasks were identified:

Secretariat:

(i) Intersessional analysis of scientific observer data in order to evaluate interactions between vessel, season, area, year, species and mitigation measure in relation to seabird by-catch (paragraphs 7.16, 7.37 and 7.59). This will require the completion of entry and validation of observer logbook data for the 1997/98 season.

(ii) Acquisition of information by the Secretariat from Mustad on line setting devices (paragraph 7.155).

(iii) Appropriate circulation of the CCAMLR booklet *Fish the Sea Not the Sky* (paragraph 3.78).

(iv) Potential CCAMLR workshop for technical coordinators (paragraph 3.79).

Members:

(v) Review research programs into the status of albatross, giant petrel and *Procellaria* petrel populations (paragraph 7.8).

(vi) Intersessional analysis of scientific observer data in order to evaluate interactions between vessel, season, area, year, species and mitigation measure in relation to seabird by-catch (paragraphs 7.16, 7.37 and 7.59). This will require the completion of entry and validation of observer logbook data for the 1997/98 season.

(vii) Acquisition of any outstanding data from EEZs to ensure comprehensive assessments can be undertaken (arising from paragraphs 7.24 and 7.37).

(viii) Analysis of data from Subareas 58.6 and 58.7 to assess the influence of the exclusion zone around the Prince Edward Islands on local seabird by-catch rates (paragraph 7.53).

(ix) Intersessional work assessing risk of seabird by-catch in all statistical subareas and divisions of the Convention Area (paragraphs 7.104 and 7.105).

(x) Research into optimum configuration of line weighting regimes and equipment in order to achieve longline sink rates to eliminate seabird by-catch (paragraphs 7.146, 7.147, 7.150 and 7.167).

(xi) Promote and encourage work into the effects of:

(a) artificial bait, snood line colour and mainline colour on seabird capture rates (paragraph 7.166); and

(b) bait taking by seabirds in relation to bait depth and sink rates (paragraph 7.167).

(xii) Review scientific observer logbook forms (paragraph 3.48).

(xiii) Report experiences with video recording of line hauling operations (paragraph 3.61).

(xiv) Potential CCAMLR workshop for technical coordinators (paragraph 3.79).

9.19 The following tasks should be carried out by participants of the task group on reporting forms and instructions for scientific observation:

(i) review the comments of scientific observers, revise logbook forms and instructions, publish and distribute updates by February 1999 (paragraph 3.48);

(ii) urge vessel owners and captains to provide as much protection as possible for observers against adverse weather conditions (paragraph 3.61); and

(iii) encourage technical coordinators and scientific observers in promoting awareness of the details of CCAMLR conservation measure in force (paragraph 3.77) and the booklet *Fish the Sea Not the Sky* (paragraph 3.78).

9.20 As was the practice in the past, a plan of work on the incidental mortality of marine animals in fisheries will be considered during CCAMLR-XVII by Members of the IMALF Coordinating Group. The Secretariat will report on the work of the coordinating group to the next meeting of WG-FSA.

Convenership

9.21 The Working Group thanked Dr Holt for convening the meeting following the resignation of Dr de la Mare. The Working Group discussed the convenership of the meetings for 1999 and 2000, and noted Mr Williams' willingness to serve as the next Convener of WG-FSA.

9.22 The Working Group also examined the need for a coordinator of ad hoc WG-IMALF, and appointed Prof. Croxall as Convener of WG-IMALF, and Mr Baker as Deputy-Convener.

9.23 The Working Group congratulated these appointees.

OTHER BUSINESS

Publication of CCAMLR Work in the Journal *Reviews in Fish Biology and Fisheries*

10.1 The Working Group considered a letter from Prof. T. Pitcher (Founding Editor of *Reviews in Fish Biology and Fisheries*) to the Secretariat in April 1998. Dr Miller indicated that this letter should have been circulated earlier to provide members of WG-FSA and WG-EMM time to reflect on its contents. This would have also provided members of the Scientific Committee with an opportunity to comment, and procedurally would have been a more correct approach. In his view, nevertheless, there would still be considerable merit in the Working Group considering the letter's contents despite the fact that it had been brought to the participants attention rather late in the meeting's proceedings.

10.2 Prof. Pitcher's letter offered to publish a short review of the scientific highlights from CCAMLR's work in the journal *Reviews in Fish Biology and Fisheries*. The format would be analogous to the journal's 'Points of View' section, and would include four to five pages of text plus one figure and table. As with all contributions to that journal, the paper would be fully peer reviewed before acceptance. The Secretariat had decided to refer the matter to the working groups and Scientific Committee at the annual meetings. No further correspondence had taken place regarding this matter. Prof. Moreno, who is a member of the Editorial Board of that journal, explained the proposal in further detail.

10.3 The Working Group agreed that the idea of publicising highlights of CCAMLR's work in a highly cited scientific journal was attractive, and would promote CCAMLR's work to the broader scientific community. The Working Group also agreed that there should be no binding agreement to publish highlights annually. Possible topics for short review would include the application of GYM. The Working Group referred this matter to the Scientific Committee for consideration.

10.4 Prof. Moreno also encouraged participants to consider submitting reviews to the journal, and the Working Group identified a review of CCAMLR's approach to resource management as a possible candidate paper.

10.5 The Working Group recognised the need to raise the scientific profile of CCAMLR Science though enhancing the journal's citations index in a journal of the calibre of *Reviews in Fish Biology and Fisheries*. The Working Group indicated that in its view the Scientific Committee should also strive to ensure that *CCAMLR Science* be included in the 'Current Contents'.

Symposium on the Biology of Polar Fish

10.6 Dr Everson informed the meeting that the annual symposium for the year 2000 of the Fisheries Society of the British Isles would be held in Cambridge and that the theme is 'Biology of Polar Fish'. The program is still being prepared, but it is anticipated that, subject to demand, there will be sessions on harvested species. He agreed to include all participants at WG-FSA on the mailing list for information.

Workload of the Secretariat

10.7 The Working Group recognised that in recent years the size and complexity of its reports had continually increased; a situation aggravated by the fact that the meetings of WG-FSA and ad hoc WG-IMALF have run together as one. This has put considerable strain on the

Secretariat Staff and in particular Ms Genevieve Tanner who has prepared the draft report this year to her usual highly professional standard. Despite the allocation of additional Secretariat resources, the Working Group was concerned that her workload had risen to an undesirable level and discussed possible ways whereby the workload might be reduced. Arising from this, it was agreed that in future all draft text should be submitted in electronic format and rapporteurs should assume more responsibility for the initial editing and development of text.

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 Dr Holt for stepping in at short notice, and convening the meeting. Dr Holt's work had been difficult and very well done, and the Working Group expressed its appreciation.

12.2 Dr Holt thanked the Working Group. He had appreciated the large amount of work that the Secretariat had done in supporting the meeting, and thanked all staff involved. He also thanked ad hoc WG-IMALF for its significant contribution to the meeting, and ex-conveners of WG-FSA for their help during the meeting.

12.3 The Convener then closed the meeting.

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Table 1: Catches (tonnes) by species and area reported for the split-year 1997/98 (1 July 1997 to 30 June 1998). Source: STATLANT data.

Species	Area/Subarea/Division										
	48	48.1	48.2	48.3	58.5.1	58.5.2	58.6	58.7	88.1	88.3	All Areas
A. rostrata				1				2			3
C. gunnari				6		68					74
C. rhinoceratus					1	5					6
D. eleginoides		<1	<1	3 258	4 741	2 418	175	576	<1	<1	11 168
D. mawsoni		1							41		42
E. superba	80 981										80 981
L. squamifrons						3					3
Macrourus spp.		<1	<1	21	12		15	22	9		79
Notothenidae		<1	<1	<1					<1	<1	<1
Osteichthyes spp.		1	<1	6				<1			7
M. hyadesi				53							53
Lithodidae				<1				<1	<1		<1
P. spinosissima				<1							<1
Rajiformes spp.		<1	<1	14	18	1	3	<1	4	<1	40
Total	80 981	2	<1	3 359	4 772	2 495	193	600	54	<1	92 456

Table 2 : Catches (tonnes) of *Dissostichus* spp. and *C. gunnari* by statistical areas and gear reported for the 1997/98 fishing season (i.e. the period between the end of the Commission meeting in 1997 and the time of the WG-FSA meeting in 1998).

Conservation Measure	Subarea/ Division	Location	Fishing Method	Catch Limit (tonnes)	Reported Catch (tonnes)
Dissostichus eleginoides: Established/Assessed fisheries:					
124/XVI	48.3	South Georgia	Longline	3 300	3 328
128/XVI	48.4	South Sandwich Is	Longline	28	0
131/XVI	58.5.2	Heard Island	Trawl	3 700	3 264[a]
-	58.5.1	Kerguelen EEZ	Trawl		3 624[b]
-	58.5.1	Kerguelen EEZ	Longline		1 118[c]
-	58.6	Crozet EEZ	Longline		88[b]
-	58.6	Prince Edward Is EEZ	Longline		140[d]
-	58.7	Prince Edward Is EEZ	Longline		674[d]
Exploratory fisheries:					
141/XVI	58.6	Outside EEZs	Longline	658	1.0
142/XVI	58.7	Outside EEZ	Longline	312	<1
Dissostichus spp.:					
143/XVI	88.1	North of 65°S	Longline	338	0
		South of 65°S	Longline	1 172	39
144/XVI	58.4.3		Trawl	963	0
New fisheries:					
134/XVI	48.1	North of 65°S	Longline	1 863	<1
		South of 65°S	Longline	94	<1 (Closed due to results of survey)
135/XVI	48.2	North of 65°S	Longline	429	<1
		South of 65°S	Longline	972	<1 (Closed due to results of survey)
136/XVI	48.6	North of 65°S	Longline	888	0
		South of 65°S	Longline	648	0
137/XVI	58.4.3	North of 60°S	Longline	1 782	0
		South of 60°S	Longline	0	0
138/XVI	58.4.4	North of 60°S (outside EEZ)	Longline	580	0
		South of 60°S	Longline	0	0
139/XVI	88.2	North of 65°S	Longline	25	0
		South of 65°S	Longline	38	0
140/XVI	88.3	North of 65°S	Longline	0	0
		South of 65°S	Longline	455	<1
Champsocephalus gunnari:					
123/XVI	48.3	South Georgia	Trawl	4 520	5[e]
130/XVI	58.5.2	Heard Island	Trawl	900	115[f]

[a] Advised by Australia at the time of the meeting. Expected to reach 3 700 tonnes (i.e. the catch limit) before the end of the Commission meeting in 1998.
[b] Catch reported by France for French vessels
[c] Catch reported by France for Ukrainian (997 tonnes) and French (121 tonnes) vessels
[d] Catch reported by South Africa for the period from the end of the Commission meeting in 1997 to 10 October 1998
[e] As reported in WG-FSA-98/53
[f] Advised by Australia at the time of the meeting

Table 3: 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 1997/98 split-year. Catches for the 1996/97 split-year are given in brackets.

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	8 692	(6 796)	1 479[9]	(1 275)	5 640[12]	(17 600)[4]	15 811	(25 671)
Argentina	5 651	(9 395)	0	(0)	5 760[13]	(19 670)[5]	11 411	(29 065)
France	0	(0)	3 832	(3 674)	0	(0)	3 832	(3 674)
Australia	575[1]	(1 000)[1]	2 418	(837)	0	(0)	2 993	(1 837)
South Africa	0	(0)	1 149[11]	(2 386)[8]	1 200[14]	(0)	2 349	(2 386)
UK	1 624[6]	(1 164)[6]	590	(398)	0	(0)	2 214	(1 562)
Portugal (EC)	0	(0)	0	(0)	1 200[15]	(?)[7]	1 200	(?)
Uruguay	?	(?)	262[9]	(0)	800[16]	(0)	1 062	(?)
Ukraine	0	(0)	997[2]	(1 007)[2]	0	(0)	997	(1 007)
Spain	0	(0)	196[9]	(291)	0	(?)[7]	196	(291)
Rep. of Korea	0	(0)	170[9]	(425)	0	(0)	170	(425)
Peru	156	(4 000)	0	(0)	0	(0)	156	(4 000)
Japan	0	(0)	76[9]	(333)[3]	0	(?)[7]	76	(333)
New Zealand	0	(10)	41[10]	(<1)	0	(0)	41	(10)
USA	0	(0)	0	(0)	0	(?)[7]	0	(?)
Norway	0	(0)	0	(0)	0	(?)[7]	0	(?)
All countries	16 698	(22 365)	11 210	(10 626)	14 600	(37 270)	42 508	(70 261)

1 From Macquarie Island
2 From French EEZ in Division 58.5.1
3 From joint venture in French EEZ in Subarea 58.6
4 Based on the following estimates: 18 vessels sighted of 22 vessels departing Chile, 14 vessels fishing at any time, effort: 2 104 days fishing, mean daily catch rate: 8.56 tonnes
5 Based on the same catch and effort data as [4], but pro-rata by the number of Argentinian vessels sighted
6 From Falkland/Malvinas Islands
7 Vessels running the flag of the respective Member were sighted fishing in Area 58
8 From South African EEZ in Subareas 58.6 and 58.7
9 From Subarea 48.3
10 From Subarea 88.1; catch consisted mostly of *D. mawsoni*
11 From South African EEZ in Subareas 58.6 and 58.7 and from Subarea 48.3
12 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
13 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
14 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
15 Based on the following estimates: two vessels sighted in Division 58.5.1 fishing for part of the season, effort: 200 days fishing, mean daily catch rate: 6 tonnes
16 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

Table 4: Estimated landings (in tonnes) of *D. eleginoides* in southern African ports and Mauritius in the 1996/97 split-year, the 1997/98 split-year and the beginning of the 1998/99 split-year.

Port	Product Weight 1996/97	Estimated Green Weight 1996/97	Product Weight 1997/98	Estimated Green Weight 1997/98	Product Weight Jul–Sep 1998	Estimated Green Weight Jul–Sep 1998
Walvis Bay	7 100[1]	1 2 070[1]	3 222[1]	5 477[1]	422[1]	717[1]
Cape Town	13 939[5]	23 696[1]	780[5]	1 326[1]	88[5]	150[1]
Unknown	3 199[1]	5 438[1]				
Mauritius	6 900[2]	11 730[1]	11 780[4]	20 026[1]	4 320[4]	7344[1]
Mauritius	9 000 –12 000[3]	15 300 – 20 400[1]				

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.

Table 5: Estimated effort, mean catch rates/day and total catches by subarea/division in the unregulated fishery on *D. eleginoides* in the 1997/98 split-year. Estimates for the 1996/97 split-year are given in brackets.

Area/ Subarea/ Division	Estimated Start of Unregulated Fishery	No. of Vessels Sighted in Unregulated Fishery[1]	No. of Vessels Surveilling	Estimated No. of Vessels Fishing	No. of Days Fishing per Fishing Trip	Estimated Effort in Days Fishing (1)	Mean Catch Rate per Day (tonnes) (2)	Estimated Unreported Catch (1) x (2)	Estimated Total Catch
48.6	No information								
48.3	1991	0	4	0	-	-	-	0	3 258 (2 389)
58.7	Apr/May 1996	8 (23)[2]	5 (5)	10 (32)[4]	40[4] (32)[4]	370 (1 540)	2.5[4] (7.7)[4]	925 (11 900)	1 501 (14 129)
58.6	Apr/May 1996	6 (35)	3 (3)	30–35[8] (40)	40 (40)	504 (2 700)	3.5 (7–10)	1 765 (18 900)[6]	1 940 (19 233)
58.5.1	Dec 1996	26 (7)	6 (6)	35–40[8] (40)	40 (40)	2 365 (270)	5 (7–10)	11 825 (2 000)	16 566 (6 681)
58.5.2	Feb/Mar 1997	3 (10)	2 (2)	30[8] (35)	40 (35)	1 400 (825–1 360)	5 (8–10) (8–15)	7 000 (7 200) (12 000)	9 418 (8 037)[7] (12 837)[7]
58.4.4	Sep 1996	0	0	2[9]	45	180	5	900	900
58		40–50 (90)							

[1] Double sightings in one zone not counted
[2] Size of vessels ranging from 364 tonnes (39.7 m) to 1 103 tonnes (73.5 m)
[3] Number of vessels actually seen fishing
[4] Data from licensed operations
[5] Some transhipment suspected, catch rates ranged from 2.8 to 23 tonnes/day
[6] Minimum estimate based on vessels sighted and their landings
[7] Based on lower and upper limit of the range of catch and effort estimates
[8] Estimated number of vessels not in areas throughout period, but moving between areas
[9] Industry sources

Table 6: Estimated total catch (in tonnes) by subarea/division of *D. eleginoides* and *D. mawsoni* in the CCAMLR Convention Area for the 1997/98 split-year.

Subarea/ Division	Estimated Total Catch	Reported Catch 1997/98	Estimated Unreported Catch	Unreported Catch in % of the Estimated Total Catch
48.3	3 258	3 258	Probably low	Probably low
58.7	1 501	576	925	61.6
58.6	1 940	175	1 765	91.0
58.5.1	16 566	4 741	11 825	71.4
58.5.2	9 418	2 418	7 000	74.3
88.1	41	41	Probably very low	Probably very low
58.4.4	900	0	900	Probably very low
48.1	<1	<1	Probably very low	Probably very low
48.2	<1	<1	Probably very low	Probably very low
88.3	<1	<1	Probably very low	Probably very low
All subareas	33 625	11 210	22 415	66.7

Table 7: A revision of total catch estimates of *D. eleginoides* taken in Subareas 58.6 and 58.7 for 1996 and 1997 and an estimation of total catch taken in 1998.

Subarea	November 1995 to September 1996	November 1996 to September 1997	November 1997 to September 1998
58.7	6 136	6 951	1 574
58.6	9 531	19 233	1 994

Table 8: Estimates of total catch of *D. eleginoides* taken in Subareas 48.3, 58.6 and 58.7 and Divisions 58.5.1 and 58.5.2 from November 1997 to September 1998.

Subarea/ Division	CCAMLR Area Reported Catch	Estimated Unreported Catch	Estimated Total Catch
48.3	3 328	0	3 328
58.7	674	900	1 574
58.6	229	1 765	1 994
58.5.1	4 741	11 825	16 566
58.5.2	3 264	520–3 500	3 784–6 764

Table 9: Imports of *D. eleginoides* (in tonnes) into Japan and USA for the 1997 calendar year. Market statistics were only available for some products and an estimation of the total market is based on comparisons with figures for the 1998 calendar year.

Source	Japan[1]	USA[2]	Total	% of Market	Estimated Total for Both Markets[3]
Chile	22 255	159	22 415	62	
Argentina	2 569	2 539	5 109	14	
South Africa	2 072	492	2 564	7	
China	1 449	0	1 449	4	
France	1 200	0	1 200	3	
Mauritius	13	856	869	2	
Namibia	178	274	453	1	
Panama	0	376	377	1	
Reunion	300	0	300	1	
Belize	4	285	289	1	
Spain	0	242	242	1	
Australia	61	146	207	1	
Falklands/Malvinas	115	0	115	0	
St Helena	3	100	102	0	
Uruguay	5	75	80	0	
Norway	0	61	61	0	
USA	43	0	43	0	
UK	20	0.5	21	0	
New Zealand	0	0.7	1	0	
Total	30 287	5 608	35 896		69 978

1 Market statistics only for fillets; conversion factor of 2.2 to convert product weight to green weight.

2 Market statistics only for possible toothfish products (not separated as HAG (headed and gutted) and fillets); product weight shown in table; no conversion factor applied yet.

3 Assumes that green weight of fillets is ca. 50% of the total Japanese market green weight for toothfish based on 1998 statistics. This would give an estimated total for the Japanese market of 60 574 tonnes green weight. It was also assumed that the proportion of fillets to HAG product on the US market was the same as for 1998 statistics. For 13.3% of product a conversion factor of 2.2 was used (as for fillets) and for 86.7% of product a conversion factor of 1.7 was used (as for HAG product). This would give an estimated total for the US market of 9 404 tonnes green weight.

Table 10: Imports of *D. eleginoides* (in tonnes) into Japan and USA for 1998 from different sources showing their market share.

Source	Japan[1]	USA[2]	Total[3]	% of Market
Chile	13 436	1 481	14 917	44.0
Mauritius	4 603	180	4 782	14.0
Argentina	1 606	1 456	3 062	9.0
France	2 514	0	2 514	7.0
Australia	1 225	228	1 453	4.0
South Africa	1 226	61	1 287	4.0
Namibia	552	451	1 003	3.0
Uruguay	790	209	999	3.0
Belize	773	41	814	2.0
Panama	506	157	663	2.0
Reunion	647	0	647	2.0
China	393	0	393	1.0
Norway	380	0	380	1.0
Falklands/Malvinas	232	0	232	1.0
Gambia	147	0	147	0.4
St Helena	138	0	138	0.4
Spain	94	0	94	0.3
Thailand	0	43	43	0.1
Maldives	0	41	41	0.1
Canada	37	0	37	0.1
USA	35	0	35	0.1
S Korea	34	0	34	0.1
Guinea-Bissau	0	31	31	0.1
Cayman Islands	0	27	27	0.1
Seychelles	0	23	23	0.1
Mauritania	14	0	14	0.04
Netherlands	10	0	10	0.03
New Zealand	6	0	6	0.02
Guyana	0	1	1	0.01
Total	29 396	4 428	33 825	

[1] Japanese market statistics for the period: January to August 1998

[2] USA market statistics for the period: January to June 1998

[3] Conversion factors of 1.7 was used for HAG (headed and gutted) and 2.2 for fillets to estimate product to green weight

Table 11: Summary of fishing operations covered by scientific observers on board vessels in the Convention Area in 1997/98. Nationality: AUS – Australia, CHL – Chile, GBR – United Kingdom, NZL – New Zealand, URY – Uruguay, ZAF – South Africa; Fishing method: A – autoliner, OTB – bottom trawl, OTM – midwater trawl, Sp – Spanish; Target species: ANI – *C. gunnari*, TOP – *D. eleginoides*; Type of product: FLT – fillet, HAG – headed and gutted, HAT – headed and tailed.

Vessel Name (Nationality)	Observer	Dates of Fishing	Fishing Method	Target Species	Sets/Hauls Deployed	No. of Hooks		Type of Product	Conversion Factor (from report)	
						Set (1 000s)	Baited (%)		Observer	Vessel
Subareas 48.1, 48.2 and 88.3:										
Tierra del Fuego (CHL)	Sinconegui, Argentina	9/2–23/3/98	Sp	TOP	52	114.7		HAG	1.7764	1.7764
Subarea 48.3:										
Arctic Fox (ZAF)	Thurston, UK	7/5–26/6/98	A, Sp	TOP	159	1 012.8	85	HAG	1.49, 1.52	1.45
Arctic Fox (ZAF)	Fulton, UK	13/7–3/9/98	A	TOP	121	830.4	85	HAG	1.55	1.45
Argos Helena (GBR)	du Plessis, Sth Africa	1/4–21/8/98	Sp	TOP	175	1 366.8	100	HAG	1.67	1.43
Betanzos (CHL)	King, UK	17/12/97–5/1/98	OTM							
Illa de Rua (URY)	Harrison, UK	8/4–10/6/98	Sp	TOP	86	977.6	100	HAG	1.7858	1.4085
Illa de Rua (URY)	Mynard, UK	29/6–22/8/98	Sp	TOP	83	806.6	100	HAT	1.48	1.4085
Isla Camila (CHL)	Marshall, UK	23/6–22/8/98	Sp	TOP	72	620.6	100	HAG	1.85	1.4085
Isla Camila (CHL)	Watson, UK	1/4–6/6/98	Sp	TOP	90	654.2	100	HAG	1.923	1.4085
Isla Sofía (CHL)	Ansell, UK	1/4–20/5/98	Sp	TOP	71	584.0	100	HAG	1.78, 1.69	1.4085
Isla Sofía (CHL)	Cooke, UK	3/6–23/8/98	Sp	TOP	91	750.2	100	HAG	1.408	1.454, 1.411
Jacqueline (GBR)	Heinecken, Sth Africa	31/5–22/8/98	Sp	TOP	86	841.5	100	HAG	1.75	1.43
Koryo Maru 11 (ZAF)	Quelch, UK	3/4–29/6/98	Sp	TOP	87	1 002.84	100	HAT	1.80	1.66, 1.35
Magallanes III (CHL)	Elton, UK	7/7–18/8/98	Sp	TOP	80	573.6	98	HAG	1.67	1.43
Northern Pride (ZAF)	Johnson, UK	17/4–19/6/98	Sp	TOP	59	734.6	100	HAG	1.538	1.538
Northern Pride (ZAF)	Day, UK	8/7–13/8/98	Sp	TOP	36	607.5	100	HAG	1.40	1.54
*Sudur Havid** (ZAF)	Lewis, UK	20/4–6/6/98	Sp	TOP	37	500	100	HAG	1.55	1.55
Tierra del Fuego (CHL)	Hoogesteger, UK	1/4–3/6/98	Sp	TOP	153	767.0	100	HAG	1.64	1.428
Tierra del Fuego (CHL)	Berkieta, UK	17/6–18/8/98	Sp	TOP	110	761.3	100	HAT	1.623	1.428
Division 58.5.2:										
Austral Leader (AUS)	Aoki/Kalish, Australia	4/5–4/6/98	OTB	TOP	92			HAT, FLT	1.73, 2.38	1.69, 2.40
				ANI	48			-	-	-
Austral Leader (AUS)	Barron, Australia	3/7–7/8/98	OTB	TOP	144			HAT	1.77	1.69
				ANI	19			-	-	-
Sil (AUS)	Stanley/Parkinson, Australia	6/6–7/7/98	OTB	TOP	68			WHO	1	1
				ANI	5			WHO	1	1

continued ...

Table 11 (continued)

Vessel Name (Nationality)	Observer	Dates of Fishing	Fishing Method	Target Species	Sets/Hauls Deployed	No. of Hooks		Type of Product	Conversion Factor (from report)	
						Set (1 000s)	Baited (%)		Observer	Vessel
Subareas 58.6 and 58.7:										
Aquatic Pioneer (ZAF)	Pienaar, Sth Africa	15/11/97–10/1/98	A	TOP	143	532.7	80	HAG	1.73	1.6
Aquatic Pioneer (ZAF)	Pienaar, Sth Africa	1/2–12/3/98	A	TOP	90	420.7	82	HAG		1.6
Aquatic Pioneer (ZAF)	Enticott, UK	1/4–5/5/98	A	TOP	95	365.2	80	HAG	1.84	1.6
Aquatic Pioneer (ZAF)	Enticott, UK	23/6–27/7/98	A	TOP	159	338.7	80	HAT	1.83	1.6
Eldfisk (ZAF)	Le Roux, Sth Africa	10/1–10/2/98	A	TOP	164	312.8–471.7	82	HAG	1.62	1.51
Eldfisk (ZAF)	Osborne, Sth Africa	3/3–18/4/98	A	TOP	240	884.0	85			
Eldfisk (ZAF)	Molenaar, Sth Africa	19/8–15/9/98	A	TOP	138	415.0	65	HAT	1.4	1.6
Koryo Maru 11 (ZAF)	Stoffberg, Sth Africa	19/11/97–16/1/98	Sp	TOP	101	553.0	100	HAG	1.84	1.84
Koryo Maru 11 (ZAF)	Heinecken, Sth Africa	2/2–11/3/98	Sp	TOP	70	434.1	100		2.01	1.6
Koryo Maru 11 (ZAF)	Stoffberg, Sth Africa	23/7/98–	-	-	-	-	-	-	-	-
Subarea 88.1:										
Lord Auckland (NZL)	Purves, Sth Africa	22/2–26/3/98	A	TOP	82	241.0	74	HAG?, FLT	1.71, 2.37	1.71, 2.37

* *Sudur Havid* sank on 6 June 1998 with the loss of 17 lives (see paragraph 3.71)

Table 12: Summary of information contained in the scientific observer cruise reports. Nationality: AUS – Australia, CHL – Chile, GBR – United Kingdom, NZL – New Zealand, URY – Uruguay, ZAF – South Africa; Fishing method: A – autoliner, OTB – bottom trawl, OTM – midwater trawl, Sp – Spanish; 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	
Subareas 48.1, 48.2, 88.3:													
Tierra del Fuego (CHL)	9/2–23/3/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N
Subarea 48.3:													
Arctic Fox (ZAF)	1/5–6/7/98	A, Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Arctic Fox (ZAF)	13/7–3/9/98	A	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
Argos Helena (GBR)	22/3–28/8/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
Betanzos (CHL)	25/12–10/1/98	OTM	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Illa de Rua (URY)	26/3–17/6/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Illa de Rua (URY)	21/6–28/8/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N
Isla Camila (CHL)	26/3–8/6/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
Isla Camila (CHL)	19/6–27/8/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Isla Sofía (CHL)	24/3–25/5/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
Isla Sofía (CHL)	30/5–30/8/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
Jacqueline (GBR)	28/5–28/8/98	Sp	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y
Koryo Maru 11 (ZAF)	23/3–13/7/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
Magallanes III (CHL)	2/7–24/8/98	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern Pride (ZAF)	4/4–27/6/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N
Northern Pride (ZAF)	2/7–25/8/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
Sudur Havid (ZAF)	6/4–6/6/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Tierra del Fuego (CHL)	25/3–9/6/98	Sp	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y
Tierra del Fuego (CHL)	12/6–23/8/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
Division 58.5.2:													
Austral Leader (AUS)	25/4–18/6/98	OTB	-	-	-	Y	Y	Y	Y	Y	Y	N	-
Austral Leader (AUS)	24/6–14/8/98	OTB	-	-	-	Y	Y	Y	Y	Y	Y	N	-
Sil (AUS)	29/5–14/7/98	OTB	-	-	-	Y	Y	Y	Y	Y	Y	N	-
Subareas 58.6 and 58.7:													
Aquatic Pioneer (ZAF)	9/11/97–16/1/98	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Aquatic Pioneer (ZAF)	26/1–19/3/98	A	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N
Aquatic Pioneer (ZAF)	26/3–22/5/98	A	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
Aquatic Pioneer (ZAF)	17/6–1/8/98	A	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
Eldfisk (ZAF)	31/12/97–17/2/98	A	Y	Y	N	Y	Y	Y	Y	Y	?	?	N
Eldfisk (ZAF)	26/2–23/4/98	A	Y	Y	N	Y	Y	Y	Y	N	Y	N	Y
Koryo Maru 11 (ZAF)	9/11/97–21/1/98	Sp	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Koryo Maru 11 (ZAF)	29/1–16/3/98	Sp	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
Subarea 88.1:													
Lord Auckland (NZL)	15/2–1/4/98	A	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y

Table 13: Information for all vessels in Subarea 48.3 during the 1996/97 and 1997/98 seasons for which data on vessel's conversion factor, observer-determined conversion factor and reported catch are all available. HAG – headed and gutted, HAT – headed and tailed.

Vessel Name	Dates of Fishing	Reported by Vessel			Reported by Observer			Difference in Catch	
		Processing Method	Conversion Factor	Catch (A) (kg)	Processing Method	Conversion Factor	Catch using Observer's Conversion Factor (B) (kg)	B - A	Correction Factor
1997/98 season:									
Arctic Fox	7/5/98–21/8/98	HAG	1.45	321 531	HAT	1.52[1]	337 053	15 522	
Illa de Rua	8/4/98–10/6/98	HAT	1.408	262 166	HAT	1.785[2]	332 362	70 196	
Isla Sofía	3/6/98–31/7/98	HAG	1.408	129 501	HAG	1.443[3]	132 720	3 219	
Koryo Maru 11	3/4/98–29/6/98	HAT	1.66	197 237	HAT	1.80[3]	213 871	16 634	
Tierra del Fuego	1/4/98–3/6/98	HAT	1.43	277 404	HAT	1.62	314 262	36 858	
			Sum	1 187 839			1 330 269		1.120
1996/97 season:									
Cisne Verde	24/3/97–24/5/97	HAT	1.673	185 718	HAT	1.678[2]	186 273	555	
Cisne Verde	22/6/97–29/8/97	HAG	1.54	184 387	HAG	1.54	184 387	0	
Elqui	18/3/97–1/9/97	HAG	1.47	577 259	HAG	1.671[5]	656 190	78 931	
Ercilla	16/4/97–31/8/97	HAG	1.47	451 210	HAG	1.70[1]	521 807	70 597	
Ibsa Quinto	18/4/97–31/8/97	HAG	1.82	294 520	HAG	1.82	294 520	0	
Isla Isabel	13/3/97–11/8/97	HAG	1.408	289 384	HAG	1.684[4]	346 110	56 726	
Jacqueline	15/4/97–31/8/97		1.64	267 189		1.64[2]	267 189	0	
			Sum	2 249 667			2 456 477		1.092

Total catches reported (tonnes):		Revised catches using correction factors:
1996/97 season	3 812	4 163
1997/98 season	6 201	6 944

[1] Mean of three observer determinations on this vessel
[2] Mean of two observer determinations on this vessel
[3] Mean of four observer determinations on this vessel
[4] Mean of 32 observer determinations on this vessel
[5] Mean of seven observer determinations on this vessel

Correction factor = (sum of catch using observer's CF)/(sum of catches reported by vessels)

Table 14: Disposal of wastes and oil pollution. Nationality: CHL – Chile, GBR – United Kingdom, NZL – New Zealand, URY – Uruguay, ZAF – South Africa; Fishing method: A – autoliner, T – trawl, Sp – Spanish; Band: Y – packaging bands used; Gear: Y – gear disposed overboard; Garbage: Y – garbage disposed overboard, N – garbage stored on board; Hooks in heads: Y – hooks in fish heads disposed overboard; - no information.

Vessel Name (Nationality)	Dates of trips	Fishing Method	Band	Oil	Debris		Hooks in Heads
					Gear	Garbage	
Subareas 48.1, 48.2, 88.3:							
Tierra del Fuego (CHL)	9/2–23/3/98	Sp	-	-	-	-	-
Subarea 48.3:							
Arctic Fox (ZAF)	13/7–3/9/98	A	-	-	-	-	-
Arctic Fox (ZAF)	1/5–6/7/98	A	-	-	-	-	-
Argos Helena (GBR)	2/4–21/8/98	Sp	-	-	-	-	-
Betanzos (CHL)	25/12/97–10/1/98	T	Y	-	-	Y	-
Illa de Rua (URY)	8/4–11/6/98	Sp	-	-	-	-	-
Illa de Rua (URY)	29/6–22/8/98	Sp	-	-	-	-	Y
Isla Camila (CHL)	26/3–8/6/98	Sp	-	-	-	-	-
Isla Camila (CHL)	16/6–22/8/98	Sp	-	-	-	-	Y (20%)
Isla Sofía (CHL)	1/4–20/5/98	Sp	-	-	-	-	-
Isla Sofía (CHL)	2/6–23/8/98	Sp	-	-	-	-	Y
Jacqueline (GBR)	28/5–22/8/98	Sp	-	-	-	-	-
Koryo Maru 11 (ZAF)	23/3–13/7/98	Sp	-	-	-	-	-
Magallanes III (CHL)	7/8–18/8/98	Sp	-	-	-	Y	-
Northern Pride (ZAF)	17/4–19/6/98	Sp	-	-	-	-	Y
Northern Pride (ZAF)	2/7–26/8/98	Sp	-	-	-	-	-
Sudur Havid (ZAF)	6/4–6/6/98	Sp	-	-	-	-	Y
Tierra del Fuego (CHL)	17/6–7/8/98	Sp	-	-	-	-	-
Tierra del Fuego (CHL)	25/3–8/6/98	Sp	-	-	-	-	Y
Subareas 58.6, 58.7:							
Aquatic Pioneer (ZAF)	9/11/97–16/1/98	A	Y	-	-	-	-
Aquatic Pioneer (ZAF)	26/1–19/3/98	A	-	-	-	-	-
Aquatic Pioneer (ZAF)	26/3–22/5/98	A	-	-	-	-	-
Aquatic Pioneer (ZAF)	17/7–1/8/98	A	-	-	-	-	-
Koryo Maru 11 (ZAF)	9/11/97–21/1/98	Sp	-	-	Y	-	-
Koryo Maru 11 (ZAF)	29/1–16/3/98	Sp	-	-	-	-	-
Eldfisk (ZAF)	10/1–10/2/98	A	-	-	-	-	-
Eldfisk (ZAF)	26/2–23/4/98	A	-	-	-	-	Y
Subarea 88.1:							
Lord Auckland (NZL)	21/2–26/3/98	A	-	-	-	N	-

Table 15: Seabed areas (km^2) between 500–600 m, 600–1 500 m 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 and 88.1, and Divisions 58.4.1, 58.4.3, 58.4.4, 58.5.1 and 58.5.2. See WG-FSA-98/6 for the methodology. The regions are shown on the map contained in Figure 1.

Subarea/ Division	Map Ref.	Region	Depth Range (m)			Fishing Depth Range (m)	
			500–600	600–1 500	1 500–1 800	500–1 500	600–1 800
48.3	a	Maurice Ewing Bank (north of 52.3°S)	0	12 739	21 869	12 739	34 608
	b	South Georgia	2 415	21 320	10 705	23 735	32 025
		Total	2 415	34 059	32 574	36 474	66 633
48.6	a	North of 60°S	244	10 452	17 618	10 696	28 070
	b	South (60°S–72°S)	6 974	36 868	19 278	43 842	56 146
		Total (to 72°S)	7 218	47 320	36 896	54 538	84 216
58.4.1	a	BANZARE Bank	0	14 401	40 766	14 401	55 167
	b	Outside BANZARE Bank	43 524	198 567	77 410	242 091	275 977
		Total	43 524	212 968	118 176	256 492	331 144
58.4.3	b	Inside EEZ	0	0	3 053	0	3 053
	a	Elan Bank	0	9 054	9 551	9 054	18 605
	c	BANZARE Bank	203	39 640	35 546	39 843	75 186
		Total	203	48 694	48 150	48 897	96 844
58.4.4	c	Ob Bank (west of 42.6°E)	171	1 428	772	1 599	2 200
	d	Lena Bank (42.6–46°E)	1 223	5 905	1 565	7 128	7 470
	e	East of Lena Bank (46–49.3°E)	278	3 581	1 490	3 859	5 071
	f	Marion Dufresne (east of 49.3°E)	49	4 673	3 329	4 722	8 002
		Total	1 721	15 587	7 156	17 308	22 743
58.5.1	a	Inside EEZ	31 382	85 523	32 551	116 905	118 074
	b	Outside EEZ	34	2 938	3 416	2 972	6 354
		Total	31 416	88 461	35 967	119 877	124 428
58.5.2	b	Inside EEZ (Australia)	10 960	81 827	28 196	92 787	110 023
	a	Outside EEZ (Australia)	14	629	454	643	1 083
		Total	10 974	82 456	28 650	93 430	111 106

continued ...

Table 15 (continued)

Subarea/ Division	Map Ref.	Region	Depth Range (m)			Fishing Depth Range (m)	
			500–600	600–1 500	1 500–1 800	500–1 500	600–1 800
58.6	b	Delcano Rise West (40–43.3°S, outside EEZ)	169	3 942	6 316	4 111	10 258
	a	Delcano Rise West (40–43.3°S, inside EEZ)	245	6 345	5 700	6 590	12 045
	c	Delcano Rise East (43.3–48°S, outside EEZ)	0	4 508	12 997	4 508	17 505
	d	Delcano Rise East (43.3–48°S, inside EEZ)	0	1 720	11 655	1 720	13 375
	f	Crozet Islands (outside EEZ)	0	0	0	0	0
	e	Crozet Islands (inside EEZ)	1 550	13 041	5 071	14 591	18 112
	a b	Delcano Rise West (40–43.3°S, total area)	414	10 287	12 016	10 701	22 303
	c d	Delcano Rise East (43.3–48°S, total area)	0	6 228	24 652	6 228	30 880
	e f	Crozet Islands (total area)	1 550	13 041	5 071	14 591	18 112
		Total	1 964	29 556	41 739	31 520	71 295
58.7	a	SW Indian Rise (outside EEZ)	0	76	427	76	503
	b	SW Indian Rise (inside EEZ)	34	3 121	3 089	3 155	6 210
	c	Prince Edward and MarionIslands (outside EEZ)	0	0	0	0	0
	d	Prince Edward and Marion Islands (inside EEZ)	239	3 426	2 516	3 665	5 942
	a b	Southwest Indian Rise (total area)	34	3 197	3 516	3 231	6 713
	c d	Prince Edward and Marion Islands (total area)	239	3 426	2 516	3 665	5 942
		Total	273	6 623	6 032	6 896	12 655
88.1		Coast (south of 72°S – from WG-FSA-98/50)	99 288	112 040	10 623	211 328	122 663
		Coast (65–72°S)	12 923	66 577	21 380	79 500	87 957
	a	Coast (65°S to edge of permanent ice)	112 211	178 617	32 003	290 828	210 620
	c	Balleny Is	308	7 372	5 210	7 680	12 582
	b	East of Balleny Is (and 65–70°S)	132	1 851	2 016	1 983	3 867
	d	North of 65°S	0	3 168	7 670	3 168	10 838
		Total	112 651	191 008	46 899	303 659	237 907

Table 16: Notifications for new and exploratory fisheries for *Dissostichus* spp. during 1998/99.

Gear	Subarea/Division	New	Exploratory
Longline:	48.6	South Africa*	
	58.4.3	France	
	58.4.4	France, Spain, South Africa*, Uruguay	
	58.6	France	South Africa*
	58.7	France	South Africa*
	88.1		New Zealand*
Trawl:	58.4.1		Australia*
	58.4.3		Australia*
	58.4.4	France	
	58.6	France	

* Denotes fisheries for both *D. eleginoides* and *D. mawsoni*

Table 17: Parameters input to the GYM for evaluation of precautionary yield of *D. eleginoides* for longline fisheries in Subarea 48.3 and a trawl fishery in Division 58.5.2.

Category	Parameter	Subarea 48.3 Longline	Division 58.5.2 Trawl
Ages	Recruitment	4	4
	Plus class accumulation	35	35
	Oldest in initial age structure	55	55
Resolution	Increments per year	365	365
Natural mortality	Mean annual M	0.16	0.12–0.20
Fishing mortality	Length selection (lr50)		
	Range of recruitment		
	Age selection function Age (selectivity)	0.(0.), 5.27(0.0), 5.28(1.0), 16.27(1.0), 16.28(0.)	0.(0.), 3.(0.), 3.5(0.07), 4.5(0.311), 5.5(0.699), 6.5(1.0), 7.5(1.038), 8.5(0.849), 9.5(0.579), 10.5(0.341), 11.5(0.179), 12.5(0.085), 13.5(0.037), 14.5(0.015), 15.(0.)
	Upper bound annual F	5	5
	Tolerance (error) for F	1E-05	1E-05
von Bertalanffy growth	Birthday	01 November	01 November
	Time 0	0	0
	L_∞	170.8 cm	170.8 cm
	K	0.088	0.088
Weight–length ($W = aL^b$)	a	2.5E-05	2.5E-05
	b	2.8	2.8
Spawning biomass	Maturity ogive – Lm_{50}	93 cm	
	Range: 0–full maturity	78–108 cm	
	Maturity at age		0.(0.), 1.39(0.0002), 2.32(0.0009), 3.10(0.0027), 4.13(0.0096), 4.82(0.0213), 5.76(0.0564), 6.56(0.117), 7.67(0.270), 8.45(0.418), 9.49(0.617), 10.7(0.792), 11.59(0.871), 12.58(0.924), 14.07(0.964), 16.08(0.985), 18.9(0.995), 21.48(1.0)
	Spawning season	1 August – 1 August	1 July – 1 July
Recruitment	Mean $\log_e$ (recruits)	14.219	14.585
	SE of mean of $\log_e$ (recruits)	0.194	0.159
	SD $\log_e$ (recruits)	0.698	0.422
Simulation details	Trials per test	1 001	1 001
	Years before start	1	1
	Year prior to first catch	1989	1996
	Known catch vector (tonnes)	8 501, 4 206, 7 309, 5 589, 6 605, 6 171, 4 362, 2 619, 3 328	18 960, 7 200
	Years to project stock	35	35
	Seed	-24 189	-24 189
	Depletion level	0.2	0.2

Table 18: Parameter sets used to run the GYM for new and exploratory fisheries.

Subarea/Division	Fishing Method	Parameters for *D. eleginoides*	Parameters for *D. mawsoni*
48.6	Longline	Table 17, Column 3	Table 24, Column 5
58.4.1 BANZARE Bank	Trawl	Table 17, Column 4	
58.4.3	Longline	Table 17, Column 3	
	Trawl	Table 17, Column 4	
58.4.4	Longline	Table 17, Column 3	
	Trawl	Table 17, Column 4	
58.6	Longline	Table 17, Column 3	
	Trawl	Table 17, Column 4	
58.7	Longline	Table 17, Column 3	
	Trawl	Table 17, Column 4	
88.1	Longline	Table 17, Column 3	Table 24, Column 5

Table 19: Results of the GYM runs for *D. eleginoides* in Subarea 48.3, Division 58.5.2, Subarea 58.7 and Division 58.5.1 and for areas for which notification was received for new and/or exploratory fisheries for *Dissostichus* spp. These results use the new seabed areas in Table 15. E – *D. eleginoides*, M – *D. mawsoni*.

Subarea/Division		Fishing Method	Species	Seabed Areas	Catch History 1996	1997	1998	Recruitments[2] Longline	Pooled	Yield Estimates Escapement	Depletion	Outside EEZ Escapement	Depletion
48.3		Longline	E	66 633	see Table 17			14.219		3 753	3 548		
58.5.2		Trawl	E	93 430	see Table 17			14.585		3 692	4 044		
								Prorated Recruitments					
58.5.1		Longline	E	124 428	see Table 24			14.844		6 900	6 990		
58.6		Longline	E	71 295	9 531	19 233	1 994	14.287		8 766	10 000	3 414	3 894
58.6		Trawl		31 520				13.498		2 342	2 398	640	656
58.7		Longline	E	12 655	6 137	6 951	1 574	12.558		1 520	1 600	60	64
58.7		Trawl		6 896				11.979		491	405	5	4
88.1	North of 65°S	Longline	E	10 838				12.403		600	645		
88.1	South of 65°S	Longline	M	227 069			39	15.445		6 602	11 283		
Pooled	1	Longline	E	202 824[1]				15.332	1	11 170	15 055		
48.6	North of 60°S	Longline	E	28 070					1	1 546	2 084		
58.4.3		Longline	E	96 844					1	5 333	7 188	5 165	6 962
58.4.4		Longline	E	22 743					1	1 253	1 688		
Pooled	2	Trawl		80 606				14.437	2	3 246	3 600		
58.4.1		Trawl		14 401					2	580	643		
58.4.3		Trawl		48 897					2	1 969	2 184	1 969	2 184
58.4.4		Trawl		17 308					2	697	773		
Pooled	3	Longline	M	332 123[1]				15.825	3	9 612	13 088		
48.6	South of 60°S	Longline	M	56 146					3	1 625	2 213		

1 Other areas were included in these runs but only the estimates pertinent to new and exploratory fisheries are presented in this table.
2 Mean of $\log_e$ recruitment function

Table 20: Discounted yields for new and exploratory fisheries – 0.45 was applied to estimates of yield for *D. eleginoides* and 0.3 to estimates for *D. mawsoni* contained in Table 19.

Subarea/Division		Fishing Method	*D. eleginoides* Total Area 0.45	*D. eleginoides* Outside EEZ 0.45	*D. mawsoni* 0.30
48.6	North of 60°S	Longline	696		
48.6	South of 60°S	Longline			487
58.4.1	BANZARE Bank	Trawl	261		
58.4.3		Longline	2 400	2 324	
58.4.3		Trawl	886	886	
58.4.4		Longline	564		
58.4.4		Trawl	314		
58.6		Longline	3 945*	1 536	
58.6		Trawl	1 054*	288	
58.7		Longline	684*	27	
58.7		Trawl	182*	2	
88.1	North of 65°S	Longline	270		
88.1	South of 65°S	Longline			1 981

* These yields do not apply to the current notifications for new and exploratory fisheries.

Table 21: CPUE data to be submitted to the Secretariat.

Time	Estimated Catch	C2 Data	% of Catch Reported as C2
March 1997	313 525	325 025	104
April 1997	627 731	559 562	89
May 1997	706 690	736 697	104
June 1997	798 449	736 638	92
July 1997	855 760	782 725.7	91
August 1997	636 569	597 278	94
April 1998	550 242	382 102	69
May 1998	764 472	449 569.5	59
June 1998	455 933	235 651	52
July 1998	872 526	228 892	26
August 1998	684 621	167 274	24

Table 22: Percentage of longline hauls with zero catches for *D. eleginoides* from Subarea 48.3.

Winter Season	No. of Vessels	Mean % Hauls with Catch = 0
1992	2	9.28
1993		
1994	1	3.03
1995	2	5.12
1996	7	3.13
1997	7	2.74
1998	5	2.96

Table 23: Percentages of trawl hauls with small catches of *D. eleginoides* from Division 58.5.1.

Year	Total % Hauls with Catch = 0	Total % Hauls with Catch < 0.5 tonnes
1990	0.00	5.75
1991	0.00	4.44
1992	0.00	2.01
1993	0.00	4.59
1994	0.56	5.38
1995	1.59	7.38
1996	2.35	7.18
1997	1.93	8.06
1998	2.54	9.92

Table 24: Parameters input to the GYM for evaluation of long-term annual yield of *D. eleginoides* for longline fisheries in Subarea 58.7 and Division 58.5.1 and *D. mawsoni* for longline fisheries in Subarea 88.1. Parameters are mostly based on Subarea 48.3 (see text for details), except for maturity, length and weight at age, spawning and fishing selectivity in Subarea 58.7.

Category	Parameter	Subarea 58.7 *D. eleginoides* Longline	Division 58.5.1 *D. eleginoides* Longline	Subarea 88.1 *D. mawsoni* Longline
Ages	Recruitment	4	4	4
	Plus class accumulation	35	35	35
	Oldest in initial age structure	55	55	55
Resolution	Increments per year	365	365	365
Natural mortality	Mean annual M	0.16	0.16	0.16
Fishing mortality	Length selection (lr50)	65 cm		
	Range of recruitment	60–70 cm		
	Age selection function Age (selectivity)		0.(0.), 5.27(0.0), 5.28(1.0), 16.27(1.0), 16.28(0.)	0.(0.), 5.27(0.0), 5.28(1.0), 16.27(1.0), 16.28(0.)
	Upper bound annual F	5	5	5
	Tolerance (error) for F	1E-05	1E-05	1E-05
von Bertalanffy growth	Birthday	01 Nov	01 Nov	01 Nov
	Time 0	0	0	0
	L_∞	210.0 cm	170.8 cm	185.2 cm
	K	0.088	0.088	0.056
Weight–length ($W = aL^b$)	a	1.E-05	2.5E-05	4.0E-06
	b	3.0021	2.8	3.2413
Spawning biomass	Maturity ogive – Lm_{50}	85 cm	93 cm	100 cm
	Range: 0–full maturity	70–100 cm	78–108 cm	95–105 cm
	Maturity at age			
	Spawning season	1 Aug – 1 Aug	1 Aug – 1 Aug	1 Aug – 1 Aug
Recruitment	Mean $\log_e$ (recruits)	12.558	14.8435	15.4450
	SE of mean of $\log_e$ (recruits)	0	0	0
	SD $\log_e$ (recruits)	0.698	0.698	0.698
Simulation details	Trials per test	1 001	1 001	1 001
	Years before start	1	1	1
	Year prior to first catch	1995	1979	1979
	Known catch vector (tonnes)	6137, 6951, 1574	167, 28, 124, 118, 2219, 4975, 1415, 2378, 35, 1557, 1760, 2516, 8250, 2944, 5772, 5588, 5709, 12180, 16560	39
	Years to project stock	35	35	35
	Seed	-24 189	-24 189	-24 189
	Depletion level	0.2	0.2	0.2

Table 25: 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)	2.5	2.5
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	152
	Catch since survey	0 tonnes	100 tonnes

Table 26: Abundance estimates and confidence intervals for icefish from the Heard Island survey from May to June 1998 for the Heard Island Plateau population and the Shell Bank population.

Stratum	Delta Lognormal Maximum Likelihood				Sample Statistics with Bootstrap			
	Abundance (tonnes)	Std. Error	95% Confidence Interval		Abundance (tonnes)	Std. Error	95% Confidence Interval	
			Lower	Upper			Lower	Upper
Shell Bank:								
Shell inner	537.2	454.5	62.7	65 796	455.0	354.0	14.6	1 212.3
Shell outer					1.03	1.03	0.0	3.09
Shell inner/outer					456.0	355.9	15.2	1 236.9
Heard Island Plateau:								
Plateau	4 772.1	1 468.4	2 747.6	11 929	4 327.2	890.7	2 778.7	6 045.5
Gunnari Ridge	27 219	19 051	6 174	567 543	12 867.2	4 047.5	5 690.6	2 0671.1
Gunnari Ridge/ Plateau	31 991	19 107	10 517	572 313	17 194.4	4 484.4	9 460.0	26 445.7

Table 27: Estimates of total and spawning stock biomass (MT) and 95% confidence intervals for Elephant Island, the lower South Shetland Islands and combined regions from a trawl survey carried out in March 1998. Estimates were based on seabed areas presented in WG-FSA-98/14.

Species	Area	Total Biomass		Spawning Stock Biomass	
C. gunnari	Elephant Is	2 765	(1 088–12 471)	70	(49–143)
	South Shetland Is	5 616	(2 280–40 410)	1 032	(578–3 105)
	Combined	8 166	(4 036–24 586)	676	(445–1 184)
G. gibberifrons	Elephant Is	10 272	(4 205–29 306)	5 080	(1689–15 943)
	South Shetland Is	20 283	(6 732–136 452)	2 169	(679–7 489)
	Combined	38 709	(17 882–119 902)	12 359	(4 949–27 077)
C. aceratus	Elephant Is	965	(531–165 881)	487	(259–24 264)
	South Shetland Is	3 080	(1 171–7 636)	800	(459–1 852)
	Combined	4 440	(2 782–615 956)	1 789	(1 070–91 199)
N. coriiceps	Elephant Is	341	(193–1 152)	311	(157–801)
	South Shetland Is	6 674	(2 018–81 782)	5 699	(1 943–50 501)
	Combined	3 232	(1 719–9 186)	3 177	(1 626–9 650)
C. rastrospinosus	Elephant Is	551	(254–1 887)	288	(144–785)
	South Shetland Is	2 962	(1 541–29 302)	1 648	(986–6 571)
	Combined	3 011	(1 785–6 323)	1 598	(1 057–2 710)
L. squamifrons	Elephant Is	998	(233–15 189)	180	(61–794)
	South Shetland Is	1 676	(695–7 060)	281	(153–590)
	Combined	3 068	(1 289–11 579)	513	(275–1 141)
N. rossii	Elephant Is	78	(62–136)		
	South Shetland Is	255	(103–1 381)		
	Combined	344	(211–602)		
L. larseni	Elephant Is	62	(35–143)		
	South Shetland Is	164	(96–346)		
	Combined	237	(157–406)		

Table 28: Total biomass estimates (in tonnes) and their upper and lower 95% confidence intervals of finfish in the vicinity of Elephant Island in 1987, 1996 and 1998. Estimates were based on seabed areas presented in Kock and Harm (1995).

Species	1987		1996		1998	
	Mean	95% CI	Mean	95% CI	Mean	95% CI
C. gunnari	2 059	929–8 406	606	374–1 268	2 692	1 059–12 147
N. rossii	630	223–3 414	32	16–48	59	33–109
G. gibberifrons	21 309	10 982–45 679	5 157	2 679–212 193	10 051	4 141–26 266
C. aceratus	5 530	3 234–12 251	2 124	1 169–13 015	1 111	567–254 219
C. rastrospinosus	475	28 –985	282	135–856	853	391–2 933
L. larseni	533	317–944	182	131–269	70	39–160
L. squamifrons	139	48–809	312	65–5 564	1 208	28–18 374

Table 29: Parameters input to the GYM for evaluation of precautionary yield of the by-catch species, *C. rhinoceratus* and *L. squamifrons* in Division 58.5.2.

Category	Parameter	*C. rhinoceratus*	*L. squamifrons*
Ages	Recruitment	3	4
	Plus class accumulation	12	25
	Oldest in initial age structure	20	35
Resolution	Increments per year	365	365
Natural mortality	Mean annual M	0.1–0.34	0.1–0.3
Fishing mortality	Length selection (lr50)	270–300 mm	170 mm
	Range of recruitment	60 mm	0 mm
	Upper bound for annual F	5	5
	Tolerance (error) for F	1E-05	1E-05
von Bertalanffy growth	Birthday	01 Jan	01 Jan
	Time 0	0	0.1075
	L_∞	583 mm	670 mm
	K	0.163	0.078
Weight–length ($W = aL^b$)	a	5.142E-10	2.934E-9
	b	3.398	3.240
Spawning biomass	Maturity ogive – Lm_{50}	350 mm	300–350 mm
	Range from 0–full maturity	280 mm	330 mm
	Maturity at age		
	Spawning season	1 Mar – 1 Mar	1 Nov – 1 Nov
Recruitment	Mean $\log_e$ (Recruits)	14.412	13.652
	SE of mean of $\log_e$ (recruits)	0.174	0.374
	SD $\log_e$ (recruits)	0.549	0.991
Simulation characteristics	Trials per test	1 001	1 001
	Years before start	1	1
	Year prior to first catch	1	1
	Known catch vector (tonnes)		
	Years to project stock	20	20
	Seed	-24 189	-24 189
Decision rules	Depletion reference point	0.2	0.2

Table 30: Data on marine mammal incidental mortality and interactions with fisheries from observer reports. Nationality: CHL – Chile, GBR – United Kingdom, NZL – New Zealand, URY – Uruguay, ZAF – South Africa; Species: ANT – *Antimora rostrata,* KIW – killer whale, SEA – Antarctic fur seal, SEL – leopard seal, SLW – Weddell seal, SPW – sperm whale, TOP – *D. eleginoides*; Y – yes, N – no, - no information.

Vessel Name (Nationality)	Dates of Trips	Mammals (Species)		Observations	Fish Loss Observed (Species)
		Killed	Entangled		
Subareas 48.1, 48.2, 88.3:					
Tierra del Fuego (CHL)	9/2–23/3/98	0	0	Y	N
Subarea 48.3:					
Arctic Fox (ZAF)	1/5–6/7/98	0	0	Y	N
Arctic Fox (ZAF)	13/7–3/9/98	0	0	Y	Y (KIW) (TOP)
Argos Helena (GBR)	2/4–21/8/98	0	0	Y	Y (KIW) (TOP)
Betanzos (CHL)	25/12/97–10/1/98	0	0	Y	N
Illa de Rua (URY)	8/4–11/6/98	0	0	Y	Y (SPW) (KIW) (T)
Illa de Rua (URY)	29/6–22/8/98	0	0	Y	Y (SEA) (KIW) (TOP)
Isla Camila (CHL)	26/3–8/6/98	0	0	Y	Y (KIW) (TOP)
Isla Camila (CHL)	16/6–22/8/98	0	0	Y	Y (KIW) (TOP) (SEL)
Isla Sofía (CHL)	1/4–20/5/98	0	0	Y*	Y (KIW) (TOP)
Isla Sofía (CHL)	2/6–23/8/98	0	0	Y	Y (KIW) (TOP)
Jacqueline (GBR)	28/5–22/8/98	0	0	Y*	Y (KIW) (SEA) (TOP)
Koryo Maru 11 (ZAF)	23/3–13/7/98	1 (SLW?)	0	Y	Y (KIW) (TOP)
Magallanes III (CHL)	7/8–18/8/98	0	0	Y	Y (SPW) (KIW) (TOP)
Northern Pride (ZAF)	17/4–19/6/98	0	0	Y*	Y (SPW) (KIW) (TOP)
Northern Pride (ZAF)	2/7–26/8/98	0	0	Y	N
Sudur Havid (ZAF)	6/4–6/6/98*	0	0	Y	Y (KIW) (TOP)
Tierra del Fuego (CHL)	25/3–8/6/98	0	0	Y	Y (KIW) (TOP)
Tierra del Fuego (CHL)	17/6–7/8/98	0	0	Y	Y (KIW) (SEA) (SEL) (TOP)
Subareas 58.6, 58.7:					
Aquatic Pioneer (ZAF)	9/11/97–16/1/98	0	0	Y	Y (KIW) (TOP)
Aquatic Pioneer (ZAF)	26/1–19/3/98	0	0	Y	Y (KIW) (TOP)
Aquatic Pioneer (ZAF)	26/3–22/5/98	0	0	Y	Y (KIW) (TOP)
Aquatic Pioneer (ZAF)	17/7–1/8/98	0	0	Y	Y (KIW) (TOP)
Koryo Maru 11 (ZAF)	9/11/97–21/1/98	0	0	Y	Y (KIW) (TOP) (ANT)
Koryo Maru 11 (ZAF)	29/1–16/3/98	0	0	Y	Y (KIW) (TOP)
Eldfisk (ZAF)	10/1–10/2/98	0	0	Y	N
Eldfisk (ZAF)	26/2–23/4/98	0	0	Y*	-
Subarea 88.1:					
Lord Auckland (NZL)	21/2–26/3/98	0	0	Y	

* Quantitative information available

Table 31: Incidental mortality of seabirds in the longline fisheries for *D. eleginoides* in Subarea 58.7 during the 1996/97 season. Fishing method: A – autoliner, Sp – Spanish; Offal discharge at haul: O – opposite side to hauling, S – same side as hauling; D – daytime setting (including nautical dawn and dusk), N – night-time setting.

Vessel Name	Dates of Fishing	Fishing Method	Streamer Line in Use (%)		Offal Discharge at Haul	Sets Deployed				Number of Hooks (1 000s)					Hooks Baited (%)	Number of Birds Observed Dead			Observed Catch Rates of Dead Birds (birds/1 000 hooks)		
										Observed			Set Total	% Observed							
			N	D		N	D	Total	%N	N	D	Total				N	D	Total	N	D	Total
*Aliza Glacial**	7/12/96–7/1/97	A			O	29	122	151	19				106.7			1	9	10			
*Aquatic Pioneer**	31/10–10/12/96	A			O	25	76	101	24				287.1					137			
Aquatic Pioneer	13/1–22/2/97	A	100	100	O	61	21	82	74	214	73	287	287	100		337	78	415	1.57	1.07	1.45
Aquatic Pioneer	26/4–11/6/97	A	11	71	O	88	21	109	81	313	75.5	388.5	388.5	100	80	0	4	4	0	0.05	0.01
Aquatic Pioneer	22/7–22/8/97	A	7	62	O	38	16	54	70	63.6	26.9	90.5	205.5	44	60	0	1	1	0	0.04	0.01
Garoya	5/4–10/5/97	Sp	29	65	O	17	29	46	36	8.6	14.3	22.9	147.1	15	68	6	37	43	0.69	2.59	1.88
*Koryo Maru 11**	10/11/96-5/1/97	Sp	100	100	S	29	19	48	60				248.1			14	28	42			
Koryo Maru 11	17/1–22/3/97	Sp	75	93	S	8	73	81	15	29.5	207	236.5	297.9	79	100	10	120	130	0.34	0.58	0.55
Mr B	22/10–28/11/96	A	0	0		10	35	45	22	3.9	20.6	24.5	58	42		2	9	11	0.51	0.44	0.45
*Mr B**	29/1–14/2/97	A	0	40		3	5	8	37				4.7			0	0	0	0	0	0
Sudur Havid	15/5–16/6/97	Sp	2	89	S	47	19	66	71	37.5	16.4	53.9	281.6	19	100	1	3	4	0.03	0.18	0.07
Sudur Havid	4/7–24/7/97	Sp	30	0	S	20	0	20	100	62.3	0	62.3	74	84	100	1	0	1	0.02	0	0.02
*Zambezi**	19/3–16/5/97	A	4	50	O	63	56	119	52				414		83	2	35	37			
*Zambezi**	28/5-12/7/97	A			O	3	0	3	100				11.6		85	0	0	0	0	0	0
*Zambezi**	25/7–29/9/97	A	44	33	O	63	3	66	95				165		71						
Total						504	495	999	56				2 976.8						0.49	0.58	0.52

* Fields missing due to incomplete logbook information

Table 32: Species composition of birds killed in longline fisheries in Subarea 58.7 during the 1996/97 season. D – daytime setting (including nautical dawn and dusk), N – night-time setting, ALZ – albatross unidentified, DCR – yellow-nosed albatross, DIC – grey-headed albatross, DIM – black-browed albatross, DIX – wandering albatross, MAH – northern giant petrel, MAI – southern giant petrel, PCI – grey petrel, PHE – light-mantled sooty albatross, PRO – white-chinned petrel, PTZ – petrels unidentified, SKZ – skuas, UNK – unknown.

Vessel Name	Dates of Fishing	Number Birds Killed by Group						Species Composition (%)												
		Petrels		Albatross		Total														
		N	D	N	D	N	D	DIX	DIM	DIC	DCR	PHE	ALZ	MAI	MAH	PCI	PRO	PTZ	SKZ	UNK
Aliza Glacial	7/12/96–7/1/97	0	4	1	5	1	9			2 (20)	2 (20)		2 (20)	1 (10)			3 (30)			
*Aquatic Pioneer**	31/10–10/12/96	112		25		137			2 (1)	15 (11)	8 (6)			3 (2)	1 (1)		108 (78)		1 (1)	
Aquatic Pioneer	13/1–22/2/97	336	75	0	3	336	78			2 (0.5)		1 (0.25)		6 (1)	2 (0.5)		403 (97)			1 (0.25)
Aquatic Pioneer	26/4–11/6/97	0	0	0	4	0	4			4 (100)										
Aquatic Pioneer	22/7-22/8/97	0	1	0	0	0	1							1 (100)						
Garoya	5/4–10/5/97	6	5	0	32	6	37	2 (5)		30 (70)				3 (7)	6 (14)	1 (2)	1 (2)			
Koryo Maru 11	10/11/96–5/1/97	14	13	0	15	14	28			11 (26)	4 (10)			7 (16)			20 (48)			
Koryo Maru 11	17/1-22/3/97	10	71	0	49	10	120						49 (38)	1 (1)			4 (3)	76 (58)		
Mr B	22/10–28/11/96	2	8	0	1	2	9						1 (9)		1 (9)		9 (82)			
Mr B	29/1–14/2/97	0	0	0	0	0	0													
Sudur Havid	15/5–16/6/97	1	3	0	0	1	3							3 (75)				1 (25)		
Sudur Havid	4/7–24/7/97	1	0	0	0	1	0							1 (100)						
Zambezi	19/3–16/5/97	2	5	0	30	2	35		1 (3)	29 (78)				1 (3)			6 (16)			
Zambezi	28/5–12/7/97	0	0	0	0	0	0													
*Zambezi**	25/7–29/9/97	0		0		0														
Total (%)		669		165		834		2 (0.2)	3 (0.4)	93 (11.1)	14 (1.7)	1 (0.1)	52 (6.2)	27 (3.2)	10 (1.2)	1 (0.1)	554 (66.3)	77 (9.2)	1 (0.1)	1 (0.1)

* Data obtained from observer cruise report

Table 33: Estimated seabird mortality by vessel for Subarea 58.7 during the 1996/97 season.

Vessel Name	Hooks Set (1 000s)	% Night Sets	Estimated Seabird Mortality during Line Setting		
			Night	Day	Total
*Aliza Glacial**	106.70	19.00	10	50	60
*Aquatic Pioneer**	287.10	24.00	34	127	160
Aquatic Pioneer	287.00	74.00	333	80	413
Aquatic Pioneer	388.50	81.00	0	4	4
Aquatic Pioneer	205.50	70.00	0	2	2
Garoya	147.10	36.00	37	244	280
*Koryo Maru 11**	248.10	60.00	73	58	130
Koryo Maru 11	297.90	15.00	15	147	162
Mr B	58.00	22.00	7	20	26
*Mr B**	4.70	37.00	0	0	0
Sudur Havid	281.60	71.00	6	15	21
Sudur Havid	74.00	84.00	1	0	1
*Zambezi**	414.00	52.00	105	115	220
Zambezi	11.60	100.00	0	0	0
*Zambezi**	165.00	95.00	76	5	81
Total	2 976.80	56.00	696	866	1562

* Estimates are based on the total observed catch rates

Table 34: Estimated seabird mortality by species for Subarea 58.7 during the 1996/97 season.

Species	Setting		
	Night	Day	Total
Wandering albatross	2	2	4
Black-browed albatross	2	3	6
Grey-headed albatross	77	96	174
Yellow-nosed albatross	12	15	26
Light-mantled sooty albatross	1	1	2
Albatross unidentified	43	54	97
Southern giant petrel	22	28	50
Northern giant petrel	8	10	19
White-chinned petrel	461	574	1 035
Grey petrel	1	1	2
Petrels unidentified	64	80	144
Skuas unidentified	1	1	2
Unidentified	1	1	2
Total	696	866	1 562

Table 35: Incidental mortality of seabirds in the longline fisheries for *D. eleginoides* in Subareas 48.1, 48.2, 48.3, 58.6, 58.7, 88.1 and 88.3 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 – daytime setting (including nautical dawn and dusk); N – night-time setting.

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	
Subareas 48.1, 48.2, 88.3:																						
*Tierra del Fuego**	9/2–23/3/98	Sp			52							0		0		0	0	0	0			
Subarea 48.3																						
Arctic Fox	7/5–26/6/98	Sp/A	156	3	159	98	155.4	1012.8	15	85	1	0	3	0	4	0	0.01	0	0.01	23	33	S
*Arctic Fox**	13/7–3/9/98	Sp/A	121	0	121	100	6.9	830.4	1	85	0		0		0		0	0	0			S
Argos Helena	2/4–21/8/98	Sp	170	5	175	97	104.2	1360.1	7	100	8	1	73	7	81	8	0.08	0.18	0.09	57	20	S
Illa de Rua	8/4–9/6/98	Sp	75	11	86	87	458.4	977.6	46	100	0	1	0	1	0	2	0	0.02	0.002	100	100	O
Illa de Rua	29/6–22/8/98	Sp	68	15	83	81	466.1	806.6	57	100	0	0	5	1	5	1	0	0	0	94	100	O
*Isla Camila**	26/3–8/6/98	Sp	90	0	90	100	317.6	654.2	49	100	2				2							S
Isla Camila	23/6–19/8/98	Sp	69	3	72	96	59.4	620.6	9	100	0	0	1	0	1	0	0	0	0	94	100	S
Isla Sofía	1/4–20/5/98	Sp	67	4	71	94	40.6	584.0	6	100	20	5	81	7	101	12	0.52	2.10	0.62	0	75	S
Isla Sofía	2/6–23/8/98	Sp	90	1	91	98	167.7	750.2	22	100	0	0	15	0	15	0	0	0	0	24	100	S
Jacqueline	28/5–22/8/98	Sp	81	3	84	96	276.8	841.5	32	100	0	0	3	1	3	1	0	0	0	77	100	S
Koryo Maru 11	3/4–29/6/98	Sp	86	1	87	99	402.0	1002.8	40	100	32	1	1	1	33	2	0.08	0.27	0.08	94	100	O
Magallanes III	7/8–18/8/98	Sp	49	31	80	61	12.0	573.6	2	98	0	0	2	0	2	0	0	0	0	8	90	S
Northern Pride	17/4–18/6/98	Sp	59	0	59	100	119.2	734.6	16	100	1	0	20	0	21	0	0.01		0.01	89		O
Northern Pride	8/7–12/8/98	A	32	4	36	89	29.2	607.5	4	100	0	0	1	0	1	0	0	0	0	96	75	O
*Sudur Havid**	6/4–6/6/98	Sp			37			500		100	2				2							S
Tierra del Fuego	1/4–2/6/98	Sp	129	24	153	84	424.0	767.0	55	100	4	4	11	4	15	8	0.01	0.05	0.02	96	95	S
Tierra del Fuego	17/6–7/8/98	Sp	89	21	110	80	114.5	761.3	15	100	0	0	11	1	11	1	0	0	0	5	52	S
Total						91%		13384.8									0.03	0.04	0.03			
Subareas 58.6, 58.7:																						
*Aquatic Pioneer**	9/11/97–16/1/98	A			143			532.7		80	11		0		11				0.02			O
*Aquatic Pioneer**	26/1–19/3/98	A			90			420.7		82	194				194				0.419			O
*Aquatic Pioneer**	26/3–22/5/98	A	95	0	95	100	326.6	365.2	56		1									100		O
*Aquatic Pioneer**	17/6–1/8/98	A			159			338.7		80			1		1							O
Eldfisk	9/1–12/2/98	A	164	0	164	100	136.2	312.8	43	82	18	0	0	0	18	0	0.13		0.13	50		O
Eldfisk	26/2–23/4/98	A	240	0	240	100	164.0	884.0	18	85	8	0	1	0	9	0	0.05	0	0.05	84		O
*Koryo Maru 11**	9/11/97–21/1/98	Sp	101	0	101	100	491.7	553.0	89	100	80								0.16			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	85	92	O
Total						96%		3842.4									0.20	0.68	0.32			
Subarea 88.1:																						
Lord Auckland	21/2–25/3/98	Auto	58	24	82	71	44.2	241.0	18	74	0	0	0	0	0	0	0	0	0	96	100	S

* Data obtained from observer cruise report

Table 36: Species composition of birds killed in longline fisheries in Subareas 48.3, 58.6 and 58.7, and adjacent areas during the 1997/98 season. D – daytime setting (including nautical dawn and dusk), N – night-time setting, DAC – cape petrel, DIC – grey-headed albatross, DIM – black-browed albatross, DIP – royal albatross, DIX – wandering albatross, FUG – southern fulmar, MAH – northern giant petrel, MAI – southern giant petrel, PHE – light-mantled sooty albatross, PHU – sooty albatross, PRO – white-chinned petrel, PTZ – petrels unidentified, UNK – unknown.

Vessel Name	Dates of Fishing	No. Birds Killed by Group						Species Composition (%)											
		Albatross		Petrels/ Fulmars		Total		DIX	DIP	DIM	DIC	PHU	PHE	MAI	PRO	MAH	DAC	PTZ	FUG	UNK
		N	D	N	D	N	D													
Subarea 48.3:																				
Arctic Fox	7/5–26/6/98	0	0	1	0	1	0							1 (100)						
Argos Helena	2/4–21/8/98	0	1	8	0	8	1			1 (11)					8 (89)					
Illa de Rua	8/4–9/6/98	0	1	0	0	0	1			1 (100)										
Isla Camila	23/6–19/8/98	0		0		0														
Isla Sofía	1/4–20/5/98	1	5	19	0	20	5	1 (4)		5 (20)				1 (4)	18 (72)					
Koryo Maru 11	3/4–29/6/98	1	0	31	1	32	1			1 (3)					32 (97)					
Northern Pride	17/4–18/6/98	0	0	1	0	1	0												1 (100)	
Northern Pride	8/7–12/8/98	0		0		0														
Tierra del Fuego	1/4–2/6/98	1	0	3	4	4	4			1 (12)					7 (88)					
Total %								1 (1)		9 (12)				2 (3)	65 (83)				1 (1)	
Subareas 58.6 and 58.7:																				
Eldfisk	9/1–12/2/98	0	0	18	0	18	0								18 (100)					
Eldfisk	26/2–23/4/98	0	0	8	0	8	0								8 (100)					
Koryo Maru 11	3/2–10/3/98	0	0	104	55	104	55								142 (89)			17 (11)		
Total %															168 (91)			17 (19)		

Table 37: Estimated seabird mortality by vessel for Subarea 48.3 during the 1997/98 season.

Vessel Name	Hooks Set (1 000s)	% Night Sets	Estimated Seabird Mortality during Line Setting		
			Night	Day	Total
Arctic Fox	1 012.80	98.00	10	0	10
*Arctic Fox**	830.40	100.00	20	0	20
Argos Helena	1 360.10	96.00	104	10	114
Illa de Rua	977.60	87.00	0	3	3
Illa de Rua	806.60	100.00	0	0	0
Isla Camila	620.60	96.00	0	0	0
*Isla Camila**	654.20	100.00	15	0	15
Isla Sofía	584.00	94.00	285	74	359
Isla Sofía	750.20	100.00	0	0	0
Jacqueline	841.50	100.00	0	0	0
Koryo Maru 11	1 002.80	99.00	79	3	82
Magallanes III	573.60	98.00	0	0	0
Northern Pride	734.60	100.00	7	0	7
Northern Pride	607.50	89.00	0	0	0
*Sudur Havid**	500.00	95.77	11	1	12
Tierra del Fuego	761.30	100.00	0	0	0
Tierra del Fuego	767.00	84.00	6	6	13
Total	13 384.80	96.00	544	96	640

* Estimates are based on the total observed catch rates

Table 38: Fishing cruises for *D. eleginoides* to the Prince Edward Islands EEZ (Subareas 58.6 and 58.7) from July 1997 to June 1998, reporting fishing effort, proportion of daytime sets, numbers of birds caught and bird by-catch rates. Data from WG-FSA-98/42. A – autoliner, Sp – Spanish.

Vessel Name	Fishing Method	Dates of Fishing	No. of Sets	No. of Hooks	% of Sets during the Day[1]	Number of Birds Killed	By-catch Rate (birds/1 000 hooks)
Aquatic Pioneer	A	15/11/97–9/1/98	143	533 205	18.2	11	0.021
Aquatic Pioneer	A	1/2–12/3/98	90	420 710	5.6	192	0.456
Aquatic Pioneer	A	1/4–14/5/98	95	341 560	15.8	0	0.000
Aquatic Pioneer	A	28/7–22/8/97	54	212 500	31.5	1	0.005
Eldfisk	A	9/1–13/2/98	164	496 181	5.5	38	0.077
Eldfisk	A	3/3–17/4/98	240	889 360	3.8	13	0.015
Koryo Maru 11	Sp	19/11/97–15/1/98	101	533 002	55.4[2]	81	0.152
Koryo Maru 11	Sp	3/2–10/3/98	70	434 100	20.0[2]	161	0.371
Sudurhavid	Sp	9–16/7/97	20	74 000	0.0	1	0.014
Zambezi	A	3–6/7/97	10	38 307	10.0	0	0.000
Zambezi	A	30/7–22/8/97	79	300 000	10.1	0	0.000
Total			1 066	4 272 925	15.0	498	0.117

[1] Defined as per CCAMLR regulations in terms of nautical twilight, with sets that spanned the twilight period being considered daylight sets.
[2] The proportion of daytime sets for the *Koryo Maru II* may have been overestimated because of slow setting speeds relative to single-line vessels.

Table 39: Seabirds killed in the longline fishery for *D. eleginoides* within the Prince Edward Islands EEZ (Subareas 58.6 and 58.7) during 1997/98, reported by fishery observers (see Table 35). Data from WG-FSA-98/42.

Species		n	%	By-catch Rate (birds/1 000 hooks)
White-chinned petrel	*Procellaria aequinoctialis*	476	95.6	0.111
Giant petrels	*Macronectes* spp.*	15	3.0	0.004
Crested penguins	*Eudyptes* spp.	4	0.8	0.001
Yellow-nosed albatross	*Thalassarche chlororhynchos*	3	0.6	0.001

* Both southern *M. giganteus* and northern *M. halli* giant petrels were reported, but species identifications are not all reliable.

Table 40: Summary of compliance in streamer line minimum specifications with Conservation Measure 29/XVI. Nationality: CHL – Chile, GBR – United Kingdom, NZL – New Zealand, URY – Uruguay, ZAF – South Africa; Fishing Method: A – autoliner, Sp – Spanish; Y – Yes, N – No, - no information.

Vessel Name (Nationality)	Fishing Method	Dates of Trips	Streamer Line Complied with CCAMLR Specifications (Y/N)	Compliance with Details of Streamer Line Specifications					Spare Streamer Line Material on Board (Y/N)
				Height Above Water of Attachment Point (m)	Total Length (m)	No. of Streamers per Line	Spacings of Streamers per Line (m)	Length of Streamers	
Subareas 48.1, 48.2, 88.3:									
Tierra del Fuego (CHL)	Sp	9/2–23/3/98	N	Y (11)	N (95)	Y (12)	N (6)	N	-
Subarea 48.3:									
Arctic Fox (ZAF)	A	13/7–3/9/98	No streamer line	nil	nil	nil	nil	nil	nil
Arctic Fox (ZAF)	A	1/5–6/7/98	N	Y (4)	N (50)	-	-	-	-
Argos Helena (GBR)	Sp	2/4–21/8/98	N	Y (5)	Y (150)	Y (7)	Y (5)	N	Y
Illa de Rua (URY)	Sp	8/4–11/6/98	Y	Y (4.5)	Y (160)	Y (5–7)	Y (5)	Y	-
Illa de Rua (URY)	Sp	29/6–22/8/98	Y	Y (4)	Y (150)	Y (5)	Y (5)	Y	Y
Isla Camila (CHL)	Sp	26/3–8/6/98	N	Y (>4.5)	-	-	Y (4)	Y	-
Isla Camila (CHL)	Sp	16/6–22/8/98	N	Y (8)	N (80)	-	-	N	Y
Isla Sofía (CHL)	Sp	1/4–20/5/98	N	N (3.95)	N (90)	Y (12)	Y (0.9–2.3)	N	-
Isla Sofía (CHL)	Sp	2/6–23/8/98	N	Y (4.89)	N (101)	Y (27)	Y (1.73–4.8)	Y	-
Jacqueline (GBR)	Sp	28/5–22/8/98	N	Y (5.5)	N (75)	Y (8–10)	Y (2.5)	N	Y
Koryo Maru 11(ZAF)	Sp	23/3–13/7/98	N	Y (5.2)	N (60)	Y (8)	Y (2.8–5.9)	Y	-
Magallanes III (CHL)	Sp	7/8–18/8/98	N	Y (4)	N (50)	Y (6–8)	Y (1–2)	N	-
Northern Pride (ZAF)	Sp	17/4–19/6/98	N	Y (6)	N (30)	Y (8)	Y (3)	N	-
Northern Pride (ZAF)	Sp	2/7–26/8/98	N	Y (5)	N (50)	Y (12)	Y (2)	Y	-
*Sudur Havid(*ZAF)	Sp	6/4–6/6/98	N	N (2)	N (30)	-	Y (2)	N	-
Tierra del Fuego (CHL)	Sp	25/3–8/6/98	N	Y (4)	Y (150)	Y (18)	Y (2)	N	-
Tierra del Fuego (CHL)	Sp	17/6–7/8/98	N	Y (4)	N (75)	Y (25)	Y (3)	N	-
Subareas 58.6, 58.7:									
Aquatic Pioneer (ZAF)	A	9/11/97–16/1/98	Y	Y (>4.5)	-	-	-	-	Y
Aquatic Pioneer (ZAF)	A	26/1–19/3/98	Y	-	-	-	-	-	-
Aquatic Pioneer (ZAF)	A	26/3–22/5/98	Y	-	N (80)	Y (6)	-	N	Y
Aquatic Pioneer (ZAF)	A	17/7–1/8/98	Y	Y (4.5)	Y (100–150)	Y (6–9)	Y (2.5)	-	Y
Eldfisk (ZAF)	A	10/1–10/2/98	Y	Y (4–5)	Y (150)	Y (5)	Y (5)	Y	Y
Eldfisk (ZAF)	A	26/2–23/4/98	N	Y (8)	N (80)	Y (6)	N (10)	-	-
Koryo Maru 11(ZAF)	Sp	9/11/97–21/1/98	-	-	-	Y (2)	-	-	-
Koryo Maru 11(ZAF)	Sp	29/1–16/3/98	Y	Y (6)	N (125)	Y (6)	Y (2.5)	Y	-
Subarea 88.1:									
Lord Auckland (NZL)	A	21/2–26/3/98	Y	Y (8)	Y (200)	Y (6)	Y (3)	Y	-

Table 41: Estimate of seabird by-catch in the unregulated *Dissostichus* spp. fishery in Subareas 58.6 and 58.7 and Divisions 58.5.1 and 58.5.2 in 1997/98. S – summer, W – winter.

Subarea/ Division	Total Unregulated Catch (tonnes)	Split S:W		Unregulated Catch (tonnes)		*Dissostichus* spp. 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
58.6, 58.7	2 690	80	20	2 152	538	0.2	10 760	2 690	1.049	0.017	1.88	0.07	11 287	46	20 229	188
58.6, 58.7	2 690	70	30	1 883	807	0.2	9 415	4 035	1.049	0.017	1.88	0.07	9 876	69	17 700	282
58.6, 58.7	2 690	60	40	1 614	1 076	0.2	8 070	5 380	1.049	0.017	1.88	0.07	8 465	91	15 172	377
58.5.1, 58.5.2	18 825	80	20	15 060	3 765	0.35	43 029	10 757	1.049	0.017	1.88	0.07	45 137	183	80 894	753
58.5.1, 58.5.2	18 825	70	30	13 178	5 648	0.35	37 650	16 136	1.049	0.017	1.88	0.07	39 495	274	70 782	1 130
58.5.1, 58.5.2	18 825	60	40	11 295	7 530	0.35	32 271	21 514	1.049	0.017	1.88	0.07	33 853	366	60 670	1 506

Table 42: Estimates of potential seabird by-catch in unregulated longline fishing in the Convention Area in 1998.

Subarea/ Division	Potential By-catch Level	Summer	Winter	Total
58.6, 58.7	Lower	8 500–11 000	100–50	8 600–11 050
	Higher	15 000–20 000	400–200	15 400–20 200
58.5.1, 58.5.2	Lower	34 000–45 000	350–200	34 350–45 200
	Higher	60 00 –80 000	1 500–1 000	61 500–81 000
Total	Lower	42 500–56 000	450–250	43 000–56 000*
	Higher	75 000–100 000	1 900–1 200	77 000–101 000*

* Rounded to nearest thousand birds

Table 43: Seabird by-catch rates calculated from observer data for domestic owned and operated vessels operating in the tuna longline fishery in New Zealand waters, 1990/91 to 1996/97. Data from WG-FSA-98/25.

Fishing Year	Total No. Hooks*	% Hooks Observed	No. Birds Observed Caught	Birds/ 1 000 Hooks	Standard Error
Northern area:					
1990/91	5 730	0.0	-	-	-
1991/92	279 988	7.0	3	0.133	0.094
1992/93	788 713	0.0	-	-	-
1993/94	1 256 075	0.0	-	-	-
1994/95	1 334 483	4.9	8	0.128	0.057
1995/96	1 531 056	4.2	23	0.400	0.091
1996/97	1 453 929	5.5	82	1.104	0.198
Southern area:					
1990/91	7 340	0.0	-	-	-
1991/92	22 660	0.0	-	-	-
1992/93	52 370	0.0	-	-	-
1993/94	152 665	1.6	0	0.000	
1994/95	789 530	11.0	14	0.159	0.058
1995/96	508 117	19.4	9	0.085	0.032
1996/97	342 547	40.0	4	0.034	0.020

* The total number of hooks do not include 148 160 hooks set during the years 1991/92 to 1996/97 which have invalid longitude values; most of these hooks were set in the northern area.

Table 44: Numbers of seabirds landed dead and returned for identification (699 birds in total), by species and area, for the licensed Japanese, chartered Japanese and New Zealand domestic owned and operated fleets, in tuna longline fisheries in New Zealand waters for 1988/89 to 1996/97. Data from WG-FSA-98/25.

Seabird Species		Number of Birds Returned for Identification						
		Japanese Licensed Vessels		Chartered Japanese Vessels		Domestic NZ Vessels		% Total
		Northern	Southern	Northern	Southern	Northern	Southern	
Albatross species:								
NZ white-capped albatross	*Diomedea cauta steadi*	1	5	6	89	1		15
NZ black-browed albatross	*Diomedea melanophrys impavida*	16	6	47	8	1	1	11
Antipodes I. wandering albatross	*Diomedea exulans antipodensis*	7		33	20			9
Southern Buller's albatross	*Diomedea bulleri bulleri*		17		33		3	8
Auckland I. wandering albatross	*Diomedea exulans gibsoni*	10		15	5		2	5
Southern black-browed albatross	*Diomedea melanophrys melanophrys*	11		17	1	1		4
Wandering albatross	*Diomedea exulans*	3	3		7			2
Salvin's albatross	*Diomedea salvini*	3		9				2
Southern royal albatross	*Diomedea epomophora epomophora*		3		6			1
Grey-headed albatross	*Diomedea chrysostoma*	1	5					1
Northern royal albatross	*Diomedea sanfordi*			1	1			<1
Snowy wandering albatross	*Diomedea exulans exulans*			1	1			<1
Chatham Is. albatross	*Diomedea cauta eremita*			1				<1
Light-mantled sooty albatross	*Phoebetria palpebrata*				39			6
Petrel species:								
Grey petrel	*Procellaria cinerea*	118	1	56	10	4		27
White-chinned petrel	*Procellaria aequinoctialis steadi*		2		47			7
Black petrel	*Procellaria parkinsoni*					4		1
Westland petrel	*Procellaria westlandica*		1					<1
Flesh-footed shearwater	*Puffinus carneipes*					6		1
Sooty shearwater	*Puffinus griseus*				3			<1
Northern giant petrel	*Macronectes halli*			5	1			1
Southern giant petrel	*Macronectes giganteus*	2						<1
Total of all seabird species		172	42	191	271	17	6	100

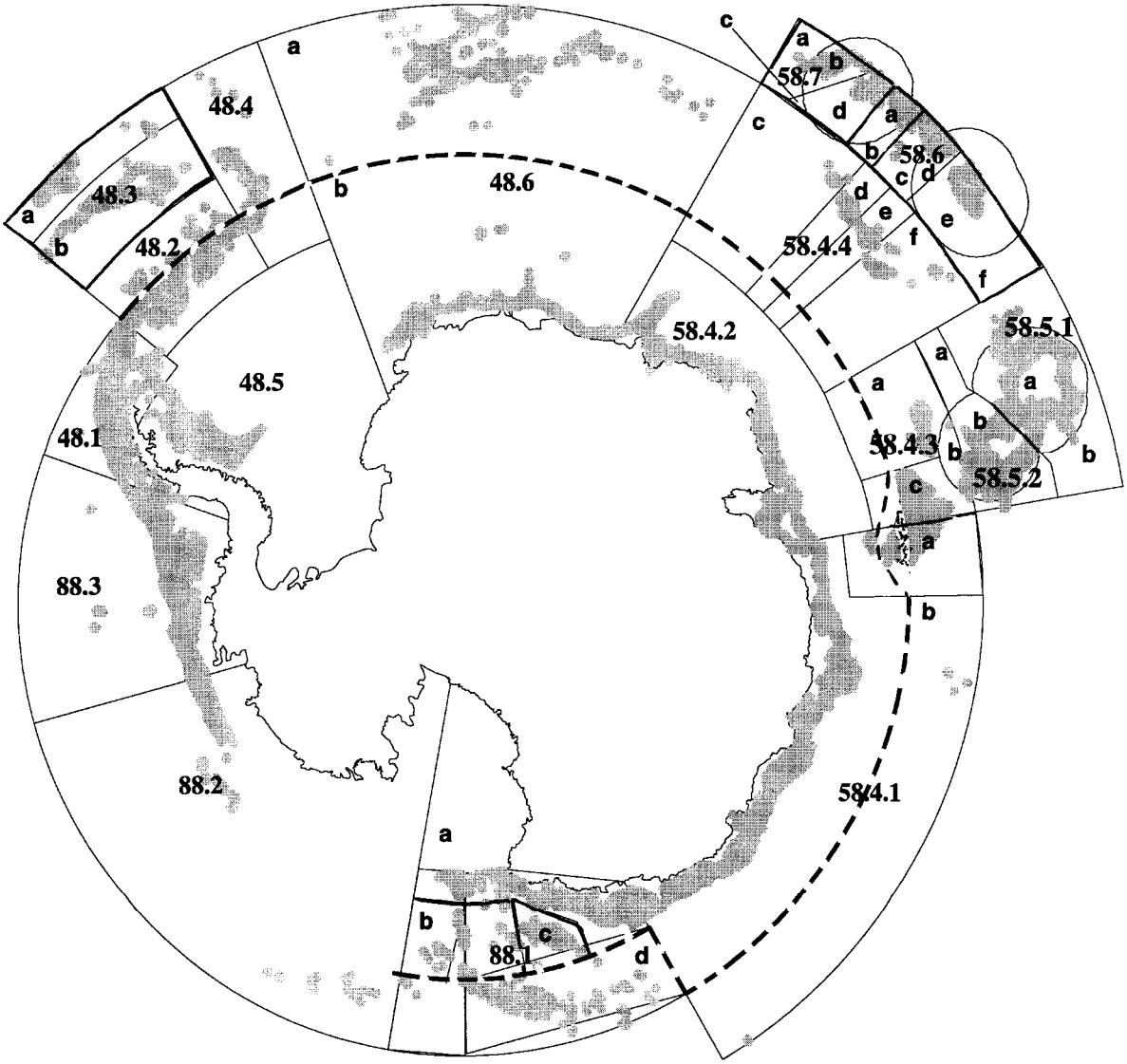


Figure 1: Delineation between *D. eleginoides* and *D. mawsoni* (dashed line), and bathymetric regions used in the analysis of catch limits for new and exploratory fisheries. The shaded patches represent seabed areas between 500 and 1 800 m. Corresponding seabed areas are given in Table 15. EEZ boundaries for Australia, France and South Africa are marked in order to address the new fisheries notified by France and the exploratory fishery notified by South Africa.

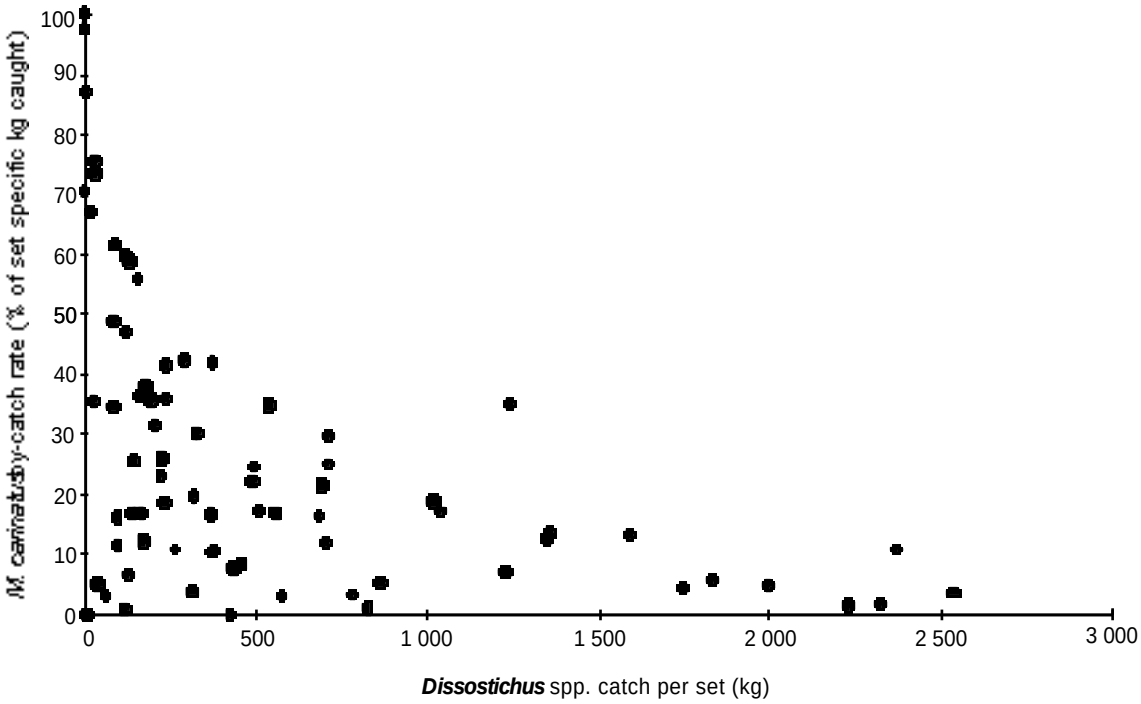


Figure 2: Set-specific by-catch rates of *M. carinatus* versus catches of *Dissostichus* spp. in Subarea 88.1. The data are from New Zealand's exploratory fishing operations during 1997/98.

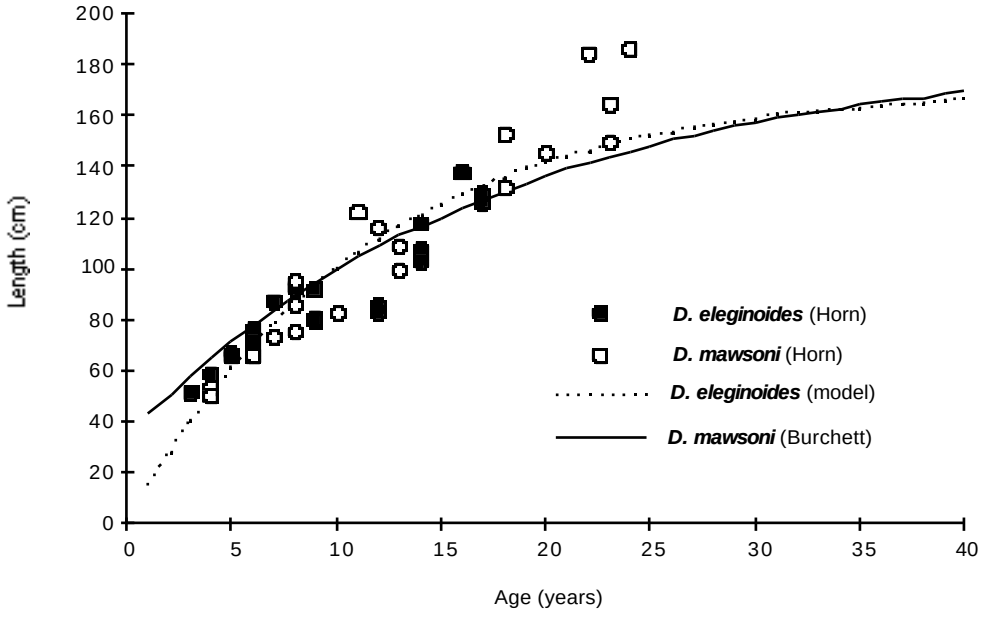


Figure 3: Comparison of growth between *D. eleginoides* and *D. mawsoni*. 'Horn' = data in WG-FSA-98/23; 'model' = growth curve used in the GYM; 'Burchett' = growth curve in Burchett et al. (1984).

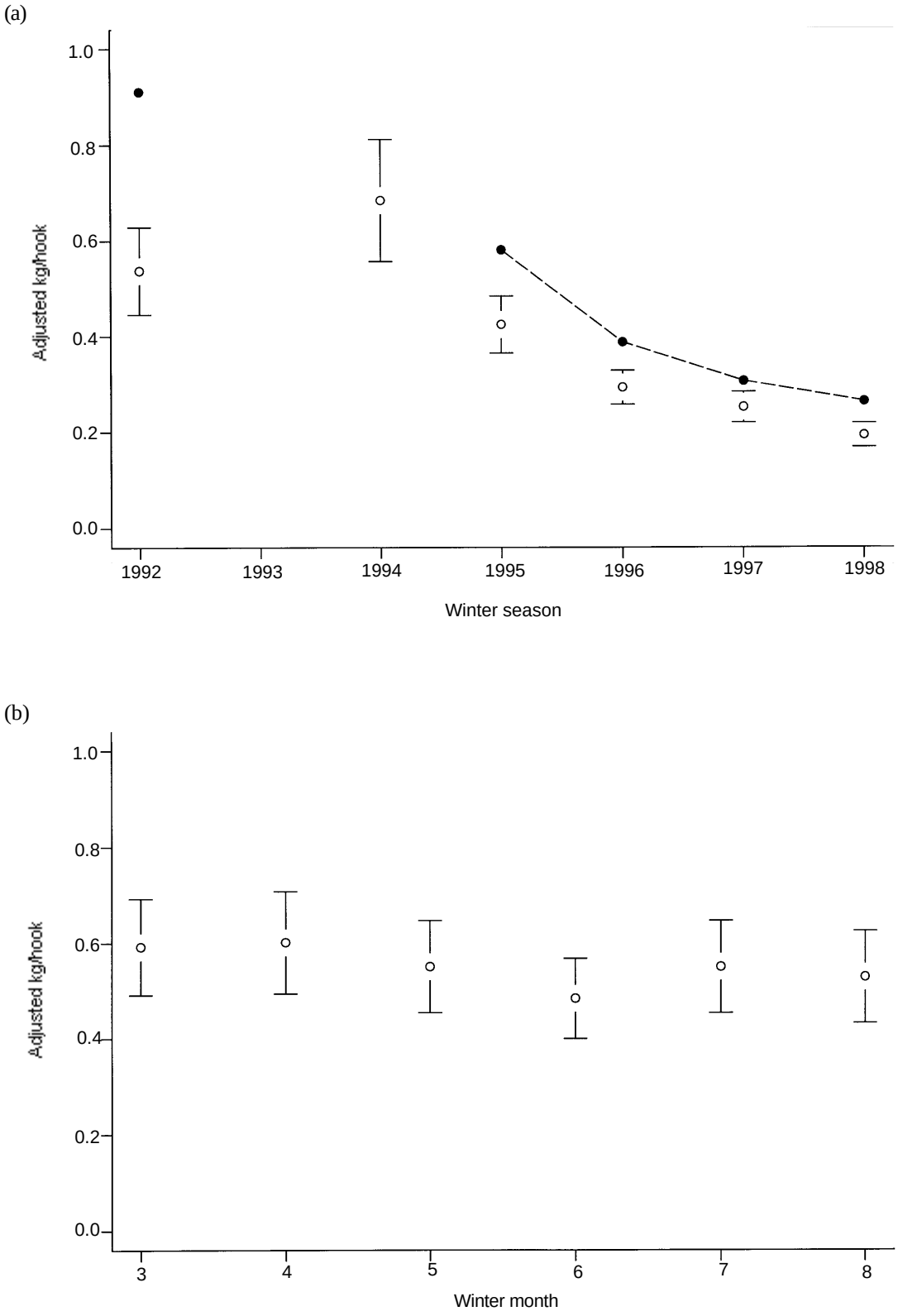
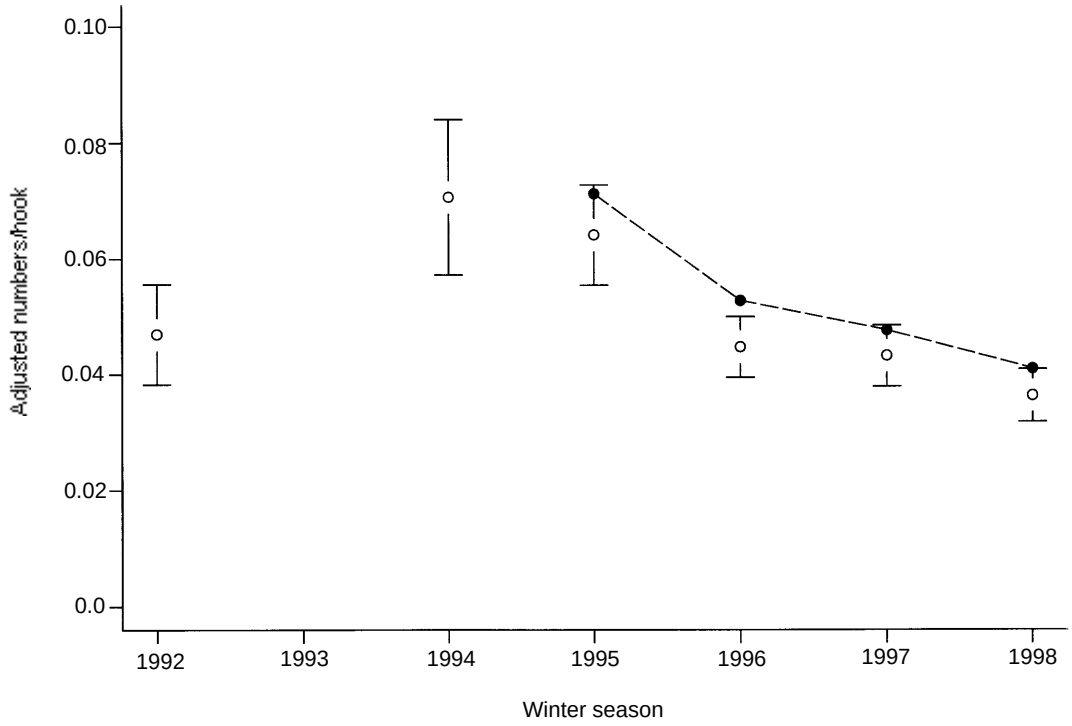


Figure 4: (a) Standardised (open circle) and unadjusted (closed circle) annual CPUEs (kg/hook) for Subarea 48.3 for GLM analysis.
(b) Estimated month effects (with 95% confidence intervals).

(a)



(b)

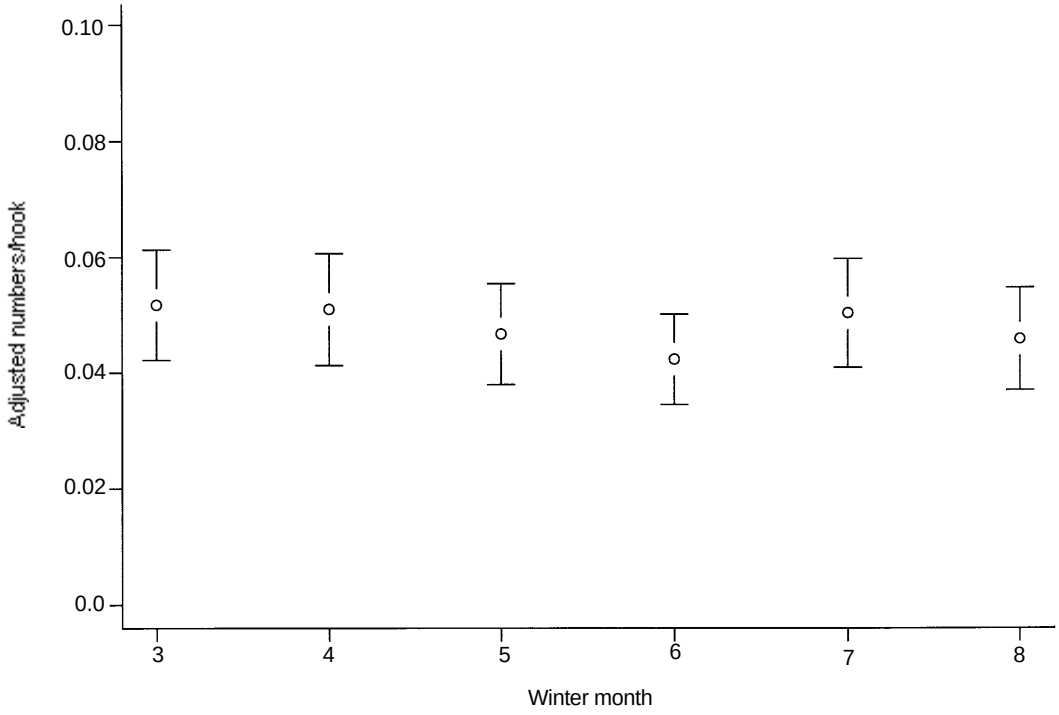


Figure 5: (a) Standardised (open circle) and unadjusted (closed circle) annual CPUEs (numbers/hook) for Subarea 48.3 for GLM analysis.
(b) Estimated month effects (with 95% confidence intervals).

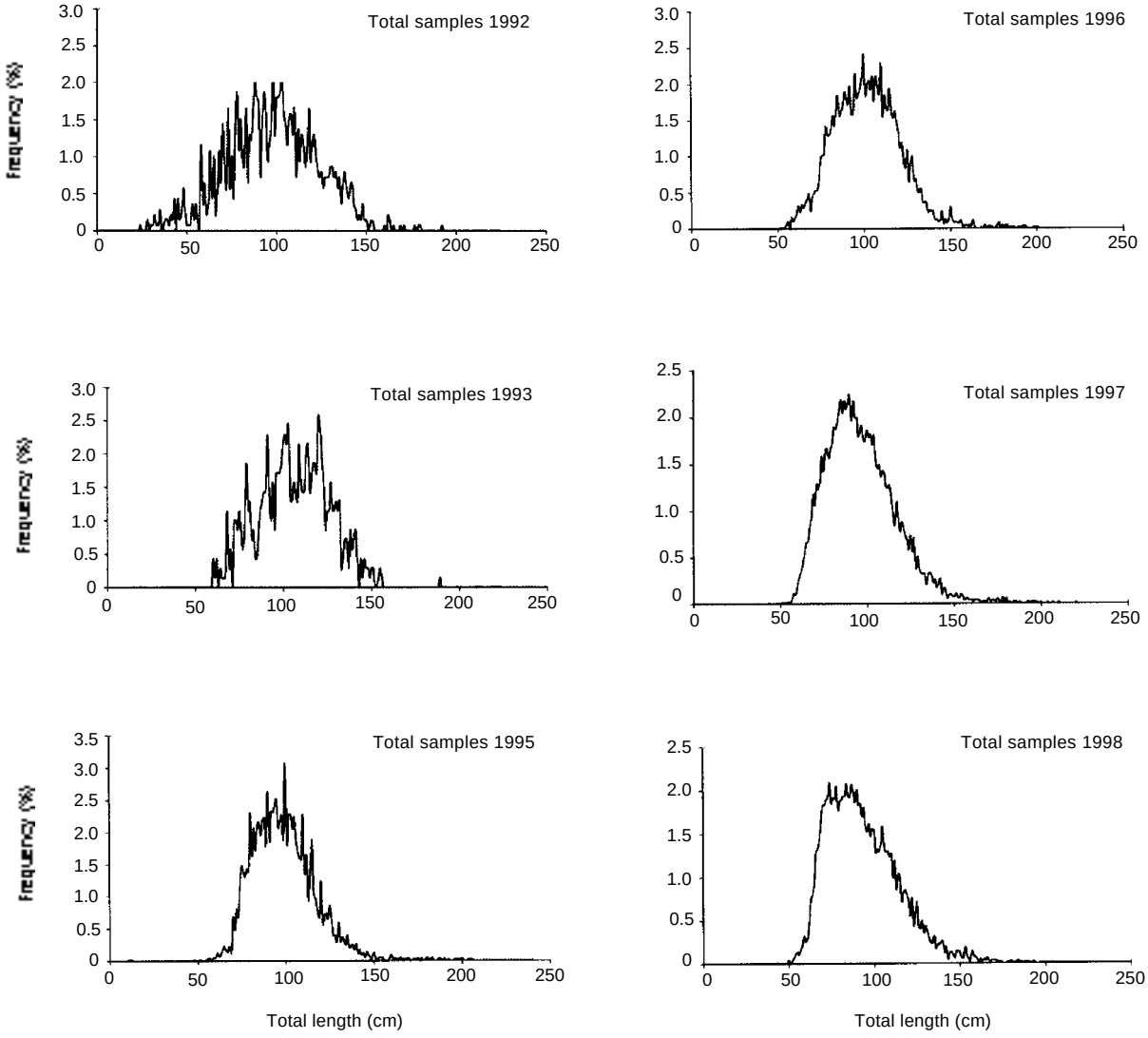


Figure 6: Annual size frequency distributions for *D. eleginoides* in Subarea 48.3.

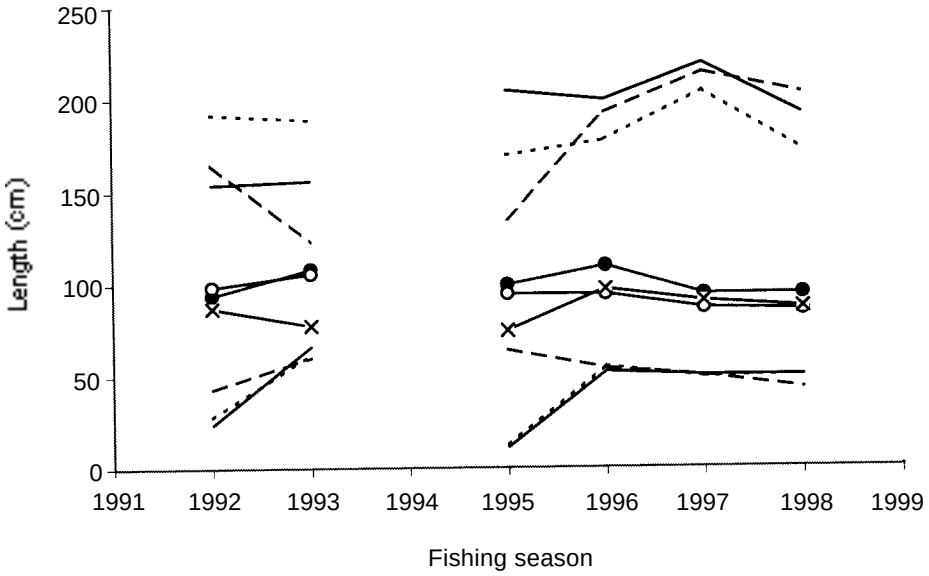


Figure 7: Annual (fishing season) weighted mean length of *D. eleginoides* in the fishery in Subarea 48.3. Minimum and maximum lengths recorded are also shown. Closed circle and solid line – female, open circle and dashed line – male, x and long dashed line – unknown.

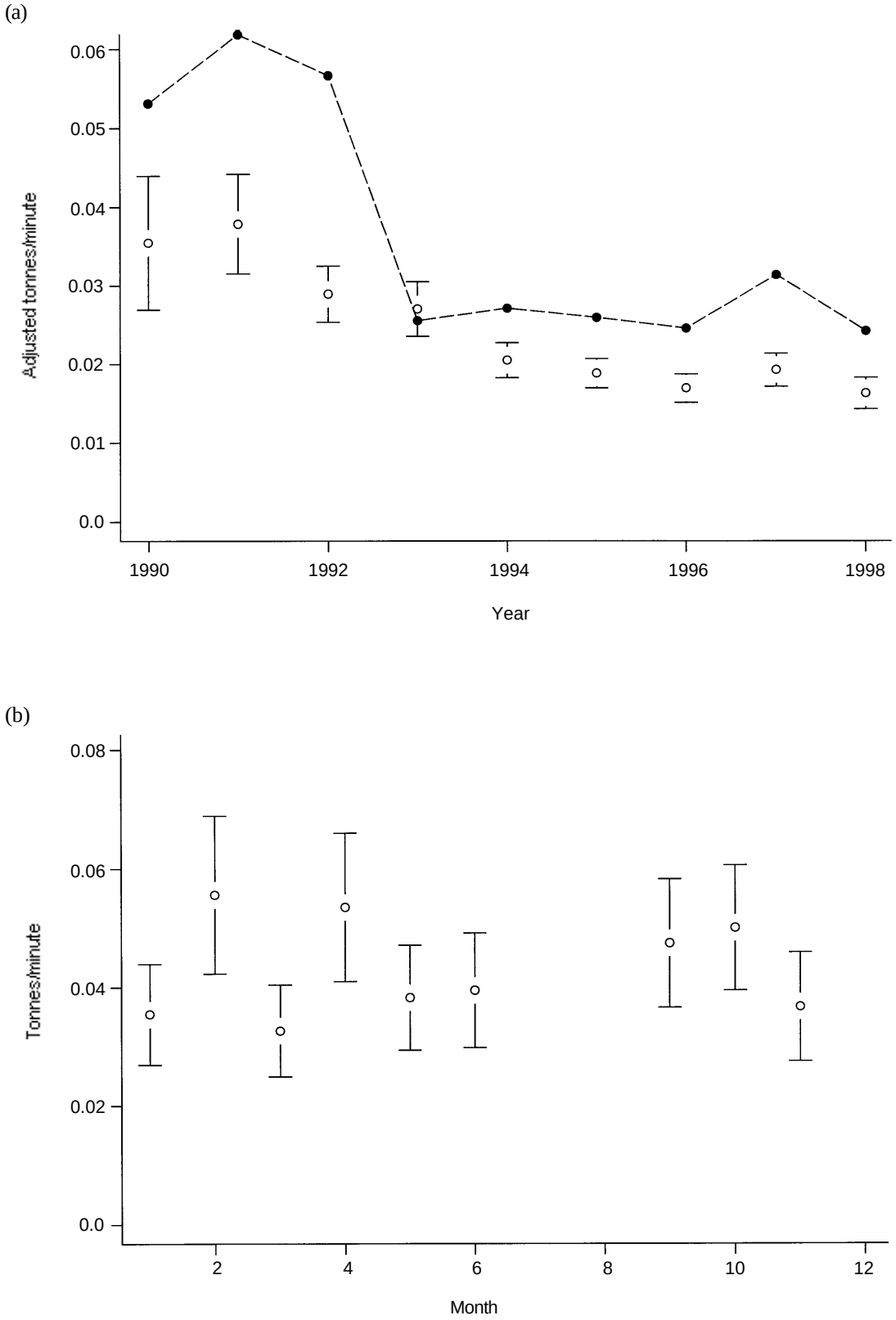


Figure 8: (a) Standardised (open circle) and unadjusted (closed circle) annual CPUEs (tonnes/minute) for Division 58.5.1 for GLM analysis.
(b) Estimated month effects (with 95% confidence intervals).

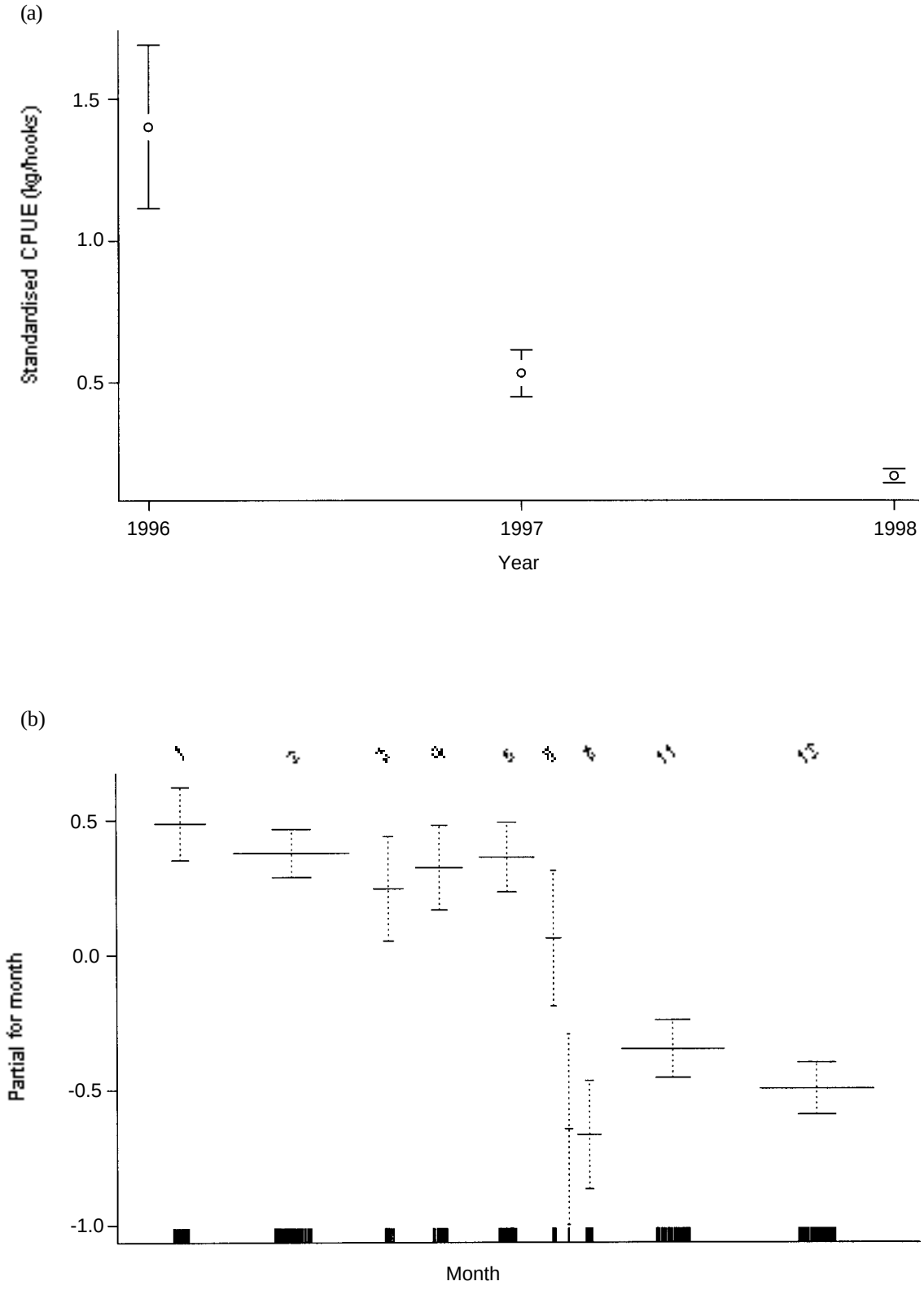


Figure 9: (a) Standardised annual CPUEs (kg/hook) for Subarea 58.7 for GLM analysis.
(b) Estimated month effects (with 95% confidence intervals).

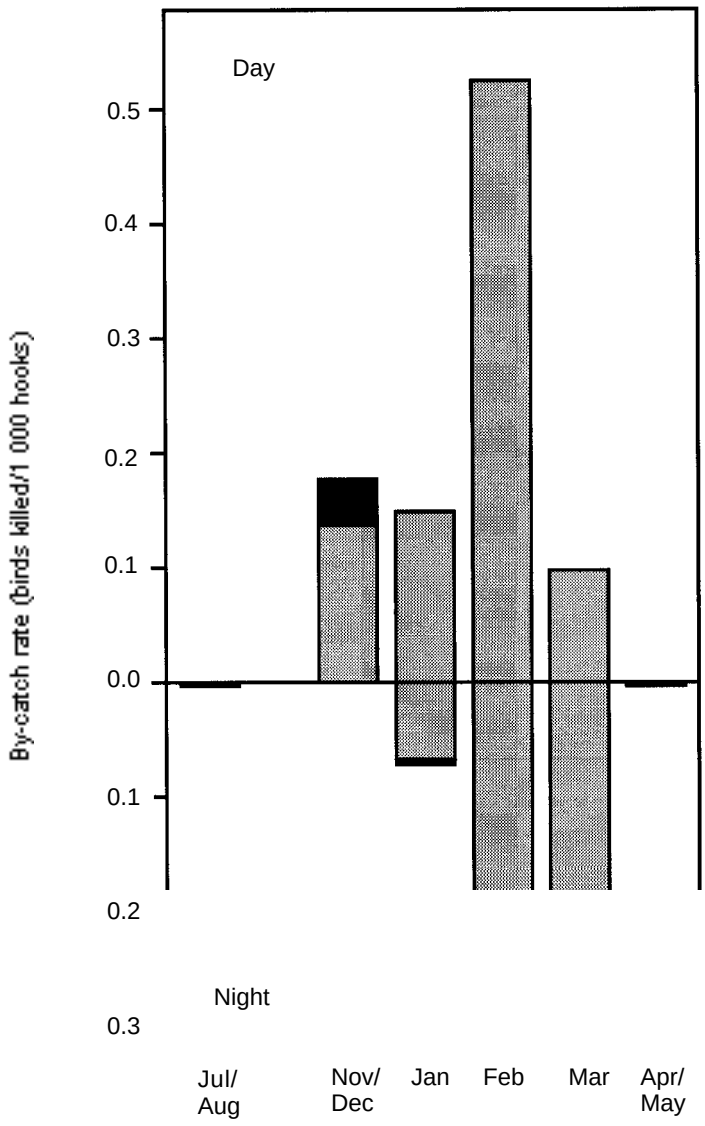


Figure 10: Seasonal differences in seabird by-catch in the longline fishery for *D. eleginoides* at the Prince Edward Islands, 1997/98. Data for day and night sets are shown: pale shading – white-chinned petrels, dark shading – all other species combined. Each period of one to two months represents at least 500 000 hooks set. Data from WG-FSA-98/42.

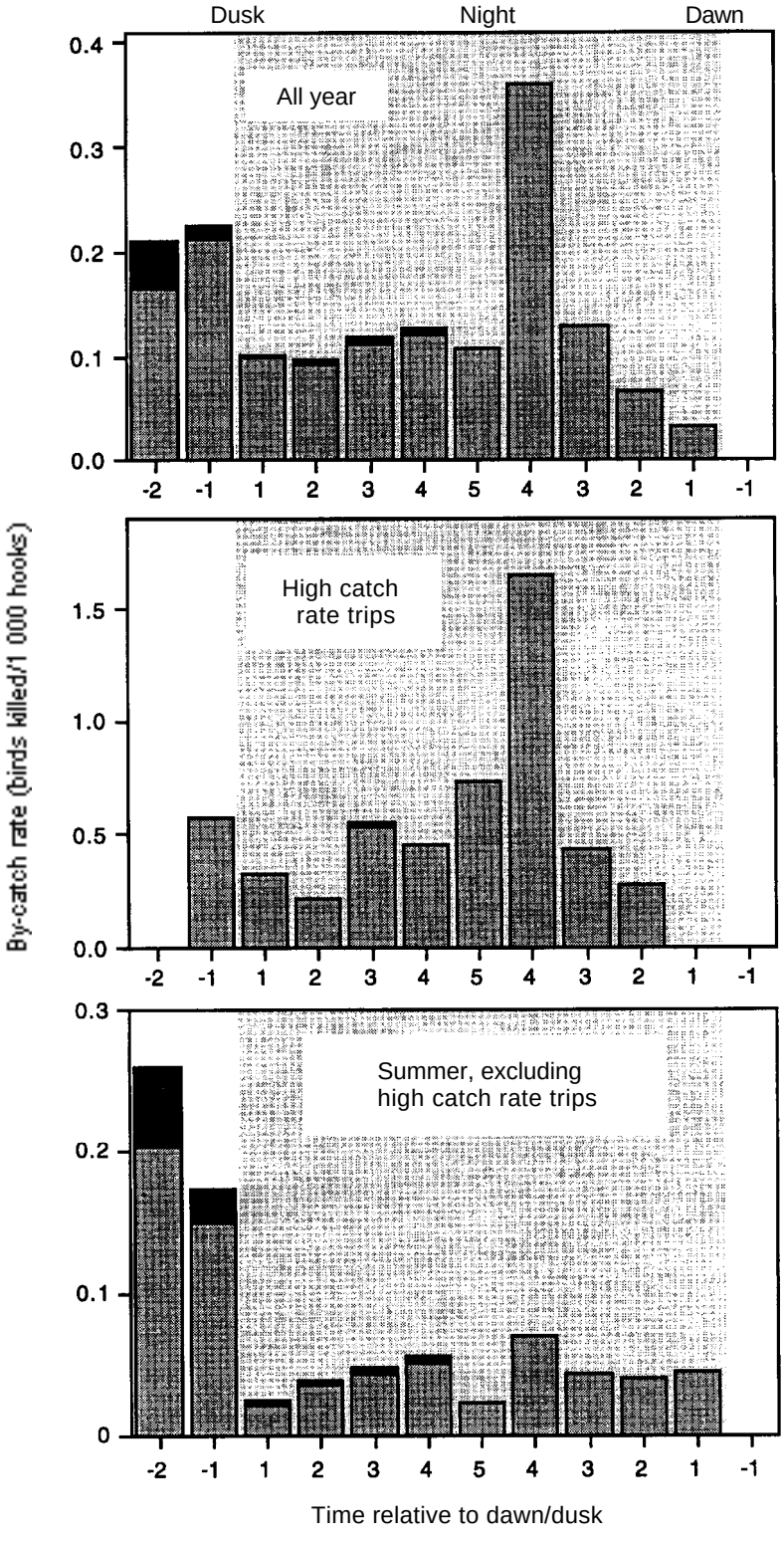
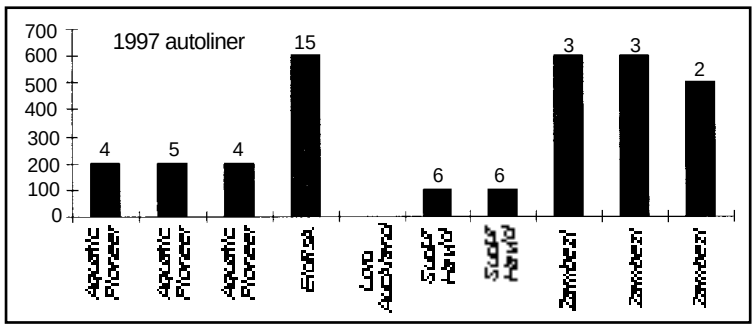
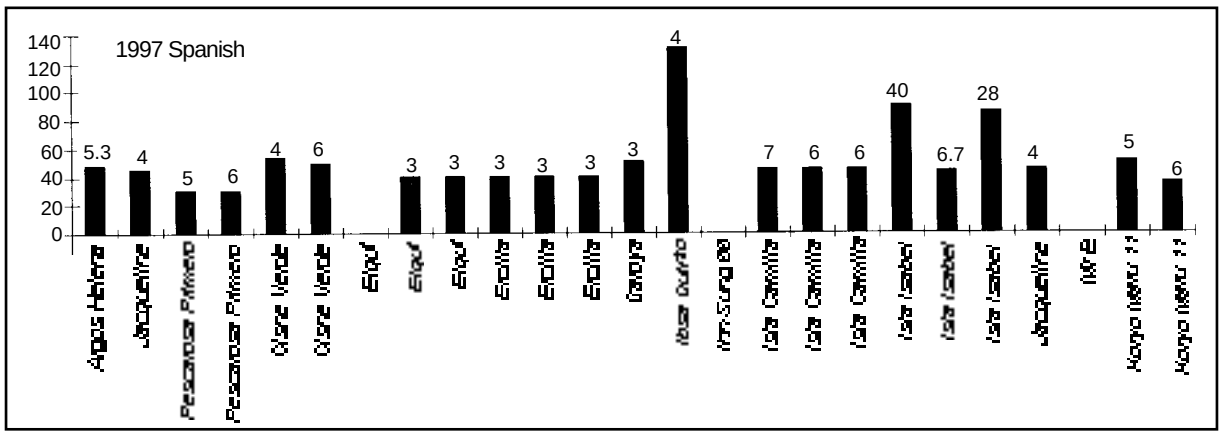
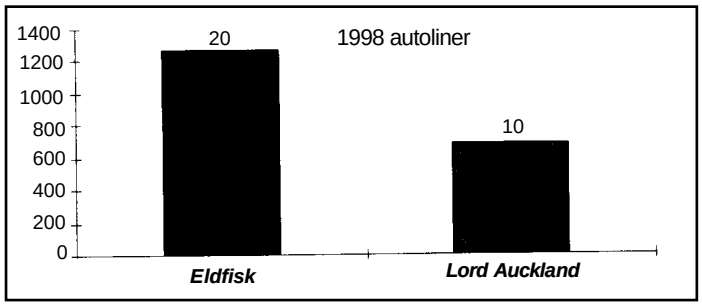


Figure 11: Seabird by-catch rate as a function of time of setting relative to local nautical dawn/dusk. Data for the whole of 1997/98 are presented, as well as two trips in February/March with high catch rates (>0.3 birds per 1 000 hooks) and comparative data from other summer trips (November to March). The shaded areas represent night sets; positive values are hours after dusk/before dawn; negative values hours before dusk/after dawn. Pale bars – white-chinned petrels, dark bars – all other species combined. Data from WG-FSA-98/42.







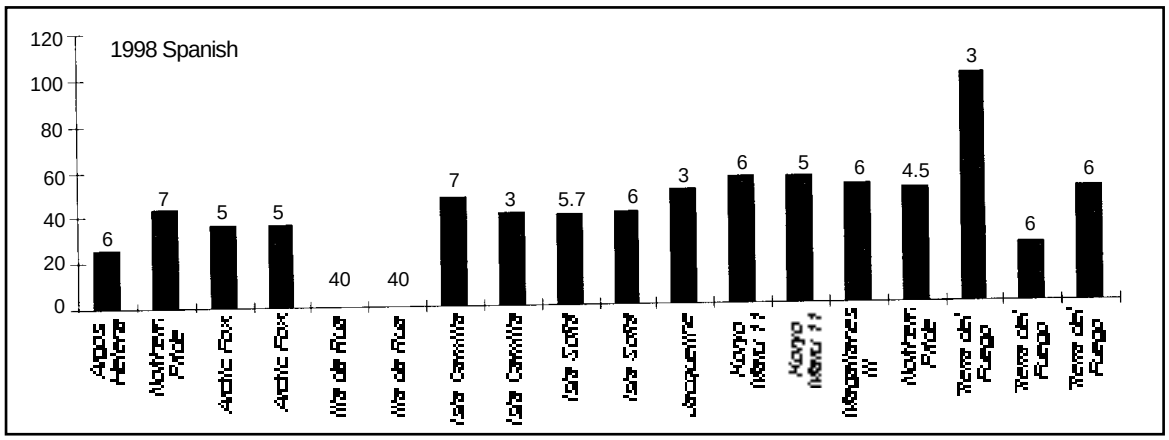


Figure 12: Summary of line weight spacings (y-axis in metres) and weights used (numbers over bars in kilograms) by Spanish and autoline vessels in the 1997 and 1998 fishing seasons. Conservation Measure 29/XVI requires a weighting regime 6 kg/20 m on longlines for Spanish system vessels.

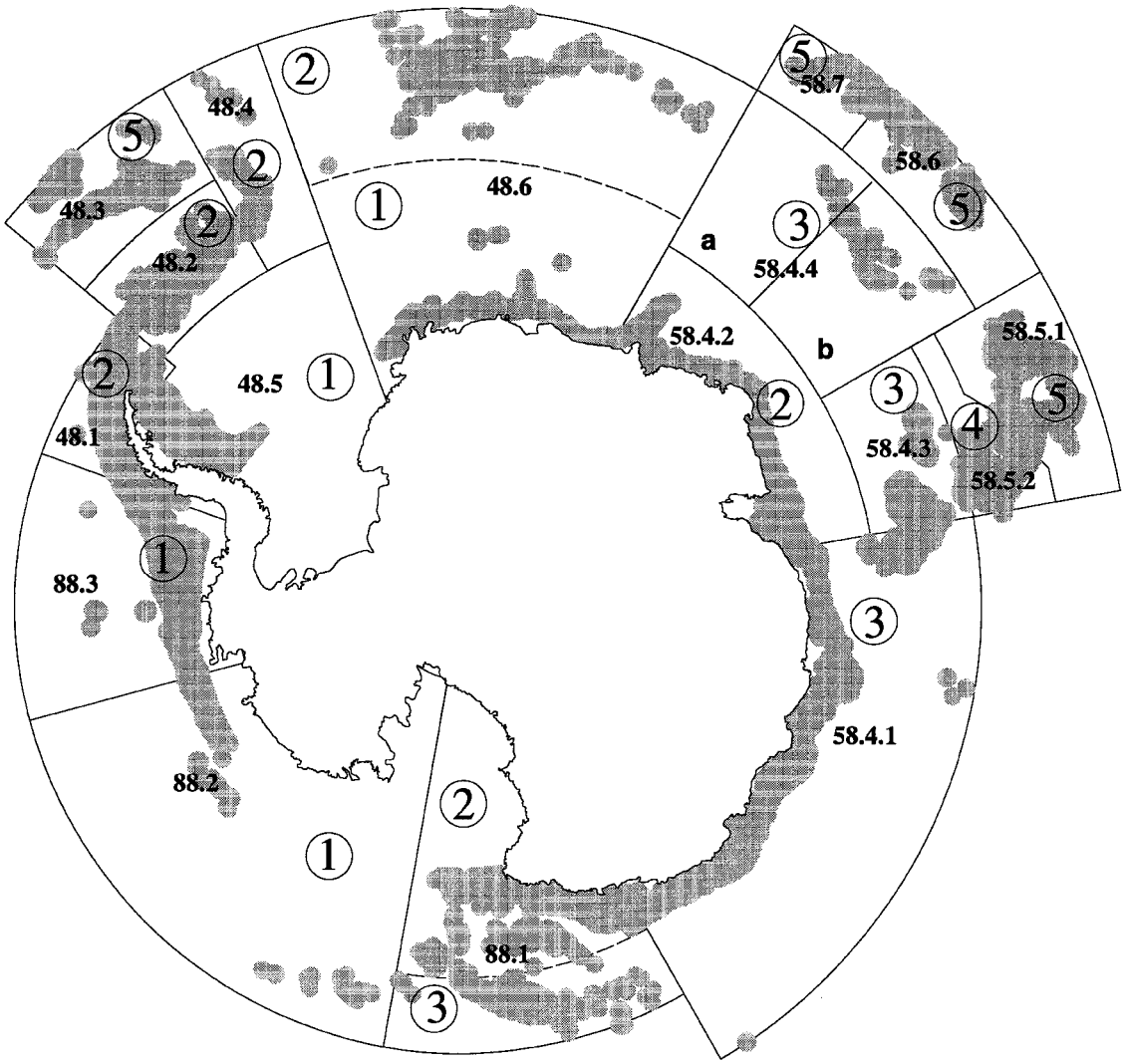


Figure 13: Assessment of the potential risk of interaction between seabirds, especially albatrosses, and longline fisheries within the Convention Area. 1 – low, 2 – average to low, 3 – average, 4 – average to high, 5 – high. Shaded patches represent seabed areas between 500 and 1 800 m.

APPENDIX A

AGENDA

Working Group on Fish Stock Assessment
(Hobart, Australia, 12 to 22 October 1998)

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 1997
      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
      3.2.2 Scientific Observer Information
      3.2.3 Research Surveys
      3.2.4 Mesh/Hook Selectivity and Related Experiments Affecting Catchability

   3.3 Status of Fisheries
      3.3.1 Resumption of Closed or Lapsed Fisheries
      3.3.2 General Scheme

   3.4 Fish and Squid Biology/Demography/Ecology
   3.5 Decision Rules and Biological Reference Points
   3.6 Developments in Assessment Methods and Scheme for Validating Models
   3.7 Consideration of Management Areas and Stock Boundaries

4. Assessments and Management Advice

   4.1 New and Exploratory Fisheries
      4.1.1 New Fisheries in 1997/98
      4.1.2 New Fisheries Notified for 1998/99
      4.1.3 Exploratory Fisheries in 1997/98
      4.1.4 Exploratory Fisheries Notified for 1998/99

   4.2 Other Fisheries
      4.2.1 Antarctic Peninsula (Subarea 48.1)
      4.2.2 South Orkney Islands (Subarea 48.2)
      4.2.3 South Georgia (Subarea 48.3) – Finfish
      4.2.4 South Georgia (Subarea 48.3) – Crabs
      4.2.5 South Sandwich Islands (Subarea 48.4)
      4.2.6 Antarctic Coastal Areas (Divisions 58.4.1 and 58.4.2)
      4.2.7 Ob and Lena Banks (Division 58.4.4)
      4.2.8 Kerguelen Islands (Division 58.5.1)
      4.2.9 Heard Island (Division 58.5.2)
      4.2.10 Pacific Ocean Sector (Area 88)
      4.2.11 Crozet Islands (Subarea 58.6) and Prince Edward and Marion Islands (Subarea 58.7)

   4.3 General By-catch Provisions

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 Research into the Status of Seabirds

    7.2 Incidental Mortality of Seabirds during Longline Fishing
        7.2.1 Regulated Fisheries in the Convention Area in 1997/98
        7.2.2 Unregulated Fisheries in the Convention Area in 1997/98
        7.2.3 Fisheries outside the Convention Area in 1997/98
        7.2.4 New and Exploratory Fisheries Notified for 1998/99

    7.3 Research into, and Experience with, Mitigating Measures
    7.4 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
    9.3 Convenership of WG-FSA and Coordinator of Ad Hoc WG-IMALF
    9.4 Workshop on *C. gunnari*

10. Other Business

11. Adoption of Report

12. Close of Meeting.

APPENDIX B

LIST OF PARTICIPANTS

Working Group on Fish Stock Assessment
(Hobart, Australia, 12 to 22 October 1998)

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APPENDIX C

LIST OF DOCUMENTS

Working Group on Fish Stock Assessment
(Hobart, Australia, 12 to 22 October 1998)

WG-FSA-98/1	Provisional Agenda and Annotation to the Provisional Agenda for the 1998 Meeting of the Working Group on Fish Stock Assessment (WG-FSA)
WG-FSA-98/2	List of participants
WG-FSA-98/3	List of documents
WG-FSA-98/4	Data and resources available to WG-FSA-98 Secretariat
WG-FSA-98/5	Secretariat work in support of WG-FSA Secretariat
WG-FSA-98/6	Comparison of seabed areas Secretariat
WG-FSA-98/7	Introduction to the CCAMLR intranet Secretariat
WG-FSA-98/8	Inventory of CCAMLR datasets Secretariat
WG-FSA-98/9	Scientific observations of trawl operations during the 1997/98 season Secretariat
WG-FSA-98/10	A summary of observations on board longline vessels operating within the CCAMLR Convention Area Secretariat
WG-FSA-98/11	Fish by-catch in krill fisheries Secretariat
WG-FSA-98/12	Fishery data reporting requirements for 1999 Secretariat
WG-FSA-98/13	About the fecundity of Patagonian toothfish (*Dissostichus eleginoides*) in Subarea 48.3 (around South Georgia) M.M. Nevinsky and A.N. Kozlov (Russia)
WG-FSA-98/14	Surface areas of seabed within the 500 m isobath for regions within the South Shetland Islands (Subarea 48.1) C.D. Jones, S.N. Sexton and R.E. Cosgrove III (USA)
WG-FSA-98/15	Results from the 1998 bottom trawl survey of Elephant Island and the lower South Shetland Islands (Subarea 48.1) C.D. Jones (USA), K.-H. Kock and S. Wilhelms (Germany)

WG-FSA-98/16 Rev. 1	Do the males of *Dissostichus eleginoides* grow faster, or only mature before females? C.A. Moreno (Chile)
WG-FSA-98/17	Standing stock biomass of eight species of finfish around Elephant Island and the lower South Shetland Islands (Subarea 48.1) from the 1998 US AMLR bottom trawl survey C.D. Jones (USA), K.-H. Kock and S. Wilhelms (Germany)
WG-FSA-98/18	Validation of the Generalised Yield Model Secretariat
WG-FSA-98/19	Seabird observations in Subareas 48.1, 48.2 and 88.3 and proposal for a new streamer line design A. Gonzalo Benavides and P.M. Arana (Chile)
WG-FSA-98/20	Fishing with pots in the Antarctic region (CCAMLR Statistical Subareas 48.1, 48.2 and 88.3) P. Arana and R. Vega (Chile)
WG-FSA-98/21	Introduction to the Generalised Yield (GY) model: a user guide A.J. Constable and W.K. de la Mare (Australia)
WG-FSA-98/22	Modifications to the Generalised Yield (GY) model since WG-FSA-97 A. Constable (Australia)
WG-FSA-98/23	Estimates of age for samples of *Dissostichus eleginoides* and *Dissostichus mawsoni* from CCAMLR Subarea 88.1 P. Horn (New Zealand)
WG-FSA-98/24	Report on progress in developing underwater setting devices for pelagic longline vessels J. Molloy (New Zealand)
WG-FSA-98/25	Annual review of by-catch in southern bluefin tuna and related tuna longline fisheries in the New Zealand 200 n mile Exclusive Economic Zone S.J. Baird, M. Francis, L. Griggs and H. Dean (New Zealand)
WG-FSA-98/26	Otolith and body size relationships in the mackerel icefish I. Everson, B. Bendall and A. Murray (United Kingdom)
WG-FSA-98/27	Size at sexual maturity of Patagonian toothfish I. Everson and A. Murray (United Kingdom)
WG-FSA-98/28	Research underway on New Zealand seabirds vulnerable to fisheries interactions Delegation of New Zealand
WG-FSA-98/29	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)

WG-FSA-98/30	Seabird interactions with longline fishing in the AFZ: 1997 seabird mortality estimates and 1988–1997 trends N. Brothers, R. Gales and T. Reid (Australia)
WG-FSA-98/31	Seabird mortality in the Japanese tuna longline fishery around Australia, 1988–1995 R. Gales, N. Brothers and T. Reid (Australia) (*Biological Conservation*, 0 (1998) 1–20)
WG-FSA-98/32	The influence of environmental variables and mitigation measures on seabird catch rates in the Japanese tuna longline fishery within the Australian Fishing Zone, 1991–1995 N. Brothers, R. Gales and T. Reid (Australia) (*Biological Conservation*, in press)
WG-FSA-98/33	Foraging movements of the shy albatross *Diomedeacauta* breeding in Australia; implications for interactions with longline fisheries N. Brothers, R. Gales, A. Hedd and G. Robertson (Australia) (*Ibis*, 140: 446–457)
WG-FSA-98/34 Rev. 2	Comments of the Working Group on Fish Stock Assessment on the FAO International Plan of Action on the Reduction of Incidental Catch of Seabirds in Longline Fisheries Secretariat
WG-FSA-98/35	Examination of the CCAMLR toothfish GLM G.P. Kirkwood and D.J. Agnew (United Kingdom)
WG-FSA-98/36	Progress in Australian initiatives for the conservation of albatrosses G.B. Baker, N. Montgomery and A. McNee (Australia)
WG-FSA-98/37	Review of biological characteristics of the Antarctic toothfish (*Dissostichus mawsoni*) and its distribution in Antarctic waters Secretariat
WG-FSA-98/38	Information on longline fisheries to the north of the Convention Area Secretariat
WG-FSA-98/39	Preliminary results of investigations into the stock structure of Patagonian toothfish (*Dissostichus eleginoides*) around Macquarie Island A. Reilly, B. Ward and R. Williams (Australia)
WG-FSA-98/40	Determination of Patagonian toothfish *Dissostichus eleginoides* age, growth and population characteristics based on otoliths J.M. Kalish and T.A. Timmiss (Australia)
WG-FSA-98/41	Register of collections of otolith and scales of *Dissostichus eleginoides* R. Williams (Australia)
WG-FSA-98/42	Seabird by-catch in the Patagonian toothfish longline fishery at the Prince Edward Islands: 1997–1998 P.G. Ryan and M.G. Purves (South Africa)

WG-FSA-98/43	Seabirds and the Patagonian toothfish longline fishery: fishing methods and operational issues G. Robertson (Australia)
WG-FSA-98/44	Seabirds and the Patagonian toothfish longline fishery: longline sink rates and implications for seabird conservation G. Robertson (Australia)
WG-FSA-98/45	Priorities for seabird research in the Patagonian toothfish longline fishery G. Robertson (Australia)
WG-FSA-98/46	Task group on reporting forms and instructions for scientific observations on board longline fishing vessels Secretariat
WG-FSA-98/46 ADDENDUM	Task group on reporting forms and instructions for scientific observations on board longline fishing vessels Secretariat
WG-FSA-98/47	Study on stratification scheme efficiency when trawl surveying off South Georgia R.S. Gasiukov and R.S. Dorovskikh (Russia)
WG-FSA-98/48	Informe de la campaña de investigación biológico-pesquera de palangre de fondo en aguas del Atlántico sur-oriental y en los sectores Atlántico e índico de la CCRVMA (Subárea 48.6 y División 58.4.4) (Report of the longline research cruise in the southeast Atlantic and in the CCAMLR Subarea 48.6 and Division 58.4.4) L.J. López Abellán y J.F. González Jiménez
WG-FSA-98/49	Brief review of the biology of *Dissostichus mawsoni* A.L. DeVries and J.T. Eastman (USA)
WG-FSA-98/50	Calculation of seabed areas for Subarea 88.1 Delegation of New Zealand
WG-FSA-98/51	Longline sink rates on a bottom autoline vessel in New Zealand: draft N.W. McL. Smith (New Zealand)
WG-FSA-98/52	Criteria for aging the otoliths of *Dissostichus eleginoides* from South Georgia (Subarea 48.3) and an analysis of aging precision J. Ashford (United Kingdom) and S. Wischniowski (Canada)
WG-FSA-98/53	A summary of the commercial fishery for mackerel icefish *Champsocephalus gunnari* in Subarea 48.3 during the 1997/98 season G. Parkes, A. King and C. Jones (United Kingdom)
WG-FSA-98/54	A revised estimate of short-term yield for the mackerel icefish (*Champsocephalus gunnari*) off Heard Island based on a trawl survey in 1998 A. Constable and D. Williams (Australia)

WG-FSA-98/55	Pooled-length density data for assessments of yield from by-catch species around Heard Island D. Williams and A. Constable (Australia)
WG-FSA-98/56	Withdrawn
WG-FSA-98/57	Trends in relative abundance of fjord *Notothenia rossii*, *Gobionotothen gibberifrons* and *Notothenia coriiceps* in trammel net catches at Potter Cove, South Shetland Islands E. Barrera-Oro, E.R. Marschoff and R.J. Casaux (Argentina)
WG-FSA-98/58	Depth distribution and spawning pattern of *Dissostichus eleginoides* over the winter period in Subarea 48.3 D.J. Agnew, K. Kerkieta, L. Heaps, C. Jones, J. Pearce and A. Watson (United Kingdom)
WG-FSA-98/59	Withdrawn
WG-FSA-98/60	A protocol for randomised sampling of longlines in the Southern Ocean fishery for *Dissostichus eleginoides*: system of international scientific observation, CCAMLR J.R. Ashford (United Kingdom), G. Duhamel (France) and M. Purves (South Africa)

Other Documents

WG-EMM-98/11	Monitoring changes in coastal fish populations by the analysis of pellets of the Antarctic shag Phalacrocorax bransfieldensis: a new proposed standard method R. Casaux and E. Barrera-Oro (Argentina)
SCOI-98/8	CCAMLR scientific observers: an account of a training experience Delegation of Chile
CCAMLR-XVII/9 Rev. 1	Notification of France's intention to initiate new fisheries Delegation of France
CCAMLR-XVII/10	Notification of South Africa's intention to initiate new fisheries Delegation of South Africa
CCAMLR-XVII/11	Notification of Australia's intention to initiate an exploratory fishery Delegation of Australia
CCAMLR-XVII/12	Notification of Spain's intention to initiate an exploratory fishery Delegation of Spain
CCAMLR-XVII/13 Rev. 1	Notification of New Zealand's intention to continue an exploratory fishery Delegation of New Zealand

CCAMLR-XVII/14	Notification of South Africa's intention to initiate an exploratory fishery Delegation of South Africa
CCAMLR-XVII/18	European Community discussion paper on a unified regulatory framework for CCAMLR based on stages of fishery development Delegation of the European Community
CCAMLR-XVII/19	Notification of Uruguay's intention to initiate a new fishery Delegation of Uruguay
CCAMLR-XVII/BG/3	Multilateralfisheries conservation and management arrangements: the use of trade measures Secretariat
CCAMLR-XVII/BG/4 Rev. 1	Implementation of conservation measures in 1997/98 Secretariat
CCAMLR-XVII/BG/17	Functionality of a full-sized marine mammal exclusion device Delegation of New Zealand
CCAMLR-XVII/BG/25	Beach litter accumulation and retention at sub-Antarctic Marion Island: trends in relation to longline fishing activity Delegation of South Africa
CCAMLR-XVII/BG/26	Marine pollutants and fishing gear associated with seabirds at sub-Antarctic Marion Island, 1996–1998: trends in relation to longline fishing activity Delegation of South Africa
SC-CAMLR-XVII/BG/1 Rev. 1	Catches in the Convention Area 1997/98 Secretariat
SC-CAMLR-XVII/BG/4	Report of the CCAMLR Observer to the Third Meeting of the Commission for the Conservation of Southern Bluefin Tuna's Ecologically Related Species Working Group CCAMLR Observer (K. Truelove, Australia)
SC-CAMLR-XVII/BG/5	International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries Submitted by FAO
SC-CAMLR-XVII/BG/7 Rev. 1	Results of the *Dissostichus* spp. new fisheries projects in the Antarctic region (CCAMLR Statistical Subareas 48.1, 48.2 and 88.3) Delegation of Chile
SC-CAMLR-XVII/BG/8	Survey and monitoring of black petrels on Great Barrier Island 1997 Delegation of New Zealand
SC-CAMLR-XVII/BG/9	Light-mantled sooty albatross on Campbell Island, 1995–96: a pilot investigation Delegation of New Zealand

SC-CAMLR-XVII/BG/13	Southern royal albatross *Diomedea epomophora* census on Campbell Island, 4 January – 6 February 1996, and a review of population figures Delegation of New Zealand
SC-CAMLR-XVII/BG/14	Correspondence with the Secretariat of the Convention on Biological Diversity Secretariat

APPENDIX D

DRAFT REPORT ON CONVERSION FACTORS

DRAFT REPORT ON CONVERSION FACTORS

Some difficulties occur in the WG-FSA assessments of stocks when it is necessary to validate the catch report because of the use of different and unvalidated conversion factors between the processed and the whole fish (green weight). To resolve the problem, tests must be executed on board factory vessels and a clear observers protocol be provided.

2. Mr R. Williams (Australia) tabled the protocol in use on board Australian trawlers and experienced participants proposed amendments to produce a draft standard protocol for evaluation prior to the next CCAMLR meeting.

PROTOCOL FOR ESTIMATING CONVERSION FACTORS

3. Make a detailed description of each processed product (e.g. whole, gutted, headed/gutted, headed/gutted/tailed, fillets with skin, fillets without skin and bones, collars, etc.) on a written form and a drawing of the cutting lines with position and angles on a diagram of the fish.

4. Explain the categories of the products (e.g. small, medium, large, etc.) and the methods of processing the fish (e.g. hand-cut, cut with Baader machine, etc.).

5. Conduct experiments once a week to obtain a series of conversion factors between product weight and green weight. This timing minimises bias caused by, for example, variation in GSI index with time and fishing ground effect while minimising disturbance of the factory process.

Method for Each Experiment (standardised report form to be decided)

6. (i) **Size of sample**: minimum of 25 fish or 200 kgs for *Dissostichus eleginoides*, 100 kgs or 400 fish for *Champsocephalus gunnari*.

(ii) **Size range of fish**: take a sample that covers the range of lengths of the fish caught. If necessary, use size categories (e.g. small, medium, large) and report the range of length in each group.

(iii) **Ancillary data:** include information on the vessel and nationality and fishing method (longliner/trawler, autoline/Spanish system) and the haul/set number (to cross reference to the area of fishing, the fine-scale square, the length frequency distribution).

Method

7. Weigh a convenient sized batch of whole fish, depending on the capacity of the scales (compensated for ship's motion). Pass the batch through the factory processing system (with the help of the factory manager). Recover the processed fish and weigh the product(s). Repeat until sample is completely analysed. Record the number of fish in the sample, their length range, the green weight and processed weight on a suitable form, together with details of the type of cuts used to process the fish.

8. To help the WG-FSA an example of a form in use in the Australian fishery is given in Attachment 1.

APPENDIX E

MEMBERSHIP OF WG-IMALF

(as at October 1998)

Argentina:
- Dr E. Marschoff

Australia:
- Mr N. Brothers
- Dr R. Gales
- Dr G. Robertson
- Dr A. Constable
- Mr B. Baker
- Ms B. Dettmann
- Ms N. Montgomery
- Ms K. Maguire

Brazil:
- Dr E. Fanta

Chile:
- Prof. C. Moreno
- Dr R. Schlatter

France:
- Prof. G. Duhamel
- Dr H. Weimerskirch

Germany:
- Dr K.-H. Kock

New Zealand:
- Dr M. Imber
- Mr B. Weeber
- Ms J. Dalziell
- Ms J. Molloy

South Africa:
- Mr J. Cooper
- Dr P. Ryan

United Kingdom:
- Prof. J. Croxall

Secretariat:
- Dr E. Sabourenkov

APPENDIX F

INTERSESSIONAL WORK PLAN FOR AD HOC WG-IMALF

PLAN OF IMALF INTERSESSIONAL WORK FOR 1998/99

The Secretariat will coordinate the intersessional work of the IMALF group. An interim review of work will be conducted in June 1999 and advised to ad hoc WG-IMALF at the time of WG-EMM (July 1999). The outcome of the intersessional work will be reviewed in August/September 1999 and reported to WG-FSA in October 1999.

	Task/Topic	Reference	Members' Assistance	Start/ Completion Deadlines	Action
1.	**Planning and coordination of work:**				
1.1	Circulation of CCAMLR-XVII reports on IMALF matters.			1 Dec 1998	Circulate all relevant sections of CCAMLR-XVII 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 1998	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 1998	Commend technical coordinators and all observers for their effort in the 1997/98 fishing season.
1.4	Membership of WG-IMALF.	7.4	Members	Nov 1998/ 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.
1.5	Education and training of fishing companies and fishermen on issues of incidental mortality of seabirds.	3.79, 9.18(iv), (xiv)	Members	Dec 1998/ Aug 1999	Urge Members to improve education and training of fishers on issues of incidental mortality of seabirds; advise that some form of a CCAMLR workshop on the matter might be possible; report to IMALF-99.
1.6	Protection for observers on board against adverse weather conditions.	9.19(ii)	Technical coordinators	Jan 1999	Request technical coordinators to pass on the request to vessel owners and captains regarding the necessity to provide as much protection as possible for observers against adverse weather conditions.
1.7	Publication of the booklet *Fish the Sea Not the Sky* and other materials on IMALF activities on the proposed CCAMLR website.	3.78, 9.18(iii)		Jan-Feb 1999	Publish the booklet in 1999 on the CCAMLR website, in accordance with the website development plan.
1.8	Distribution of the booklet *Fish the Sea Not the Sky*.	3.78, 9.18(iii)	Technical coordinators	Jan 1999	Send copies of the booklet to technical coordinators, request scientific observers to pass on copies of the book to vessels/crews.

	Task/Topic	Reference	Members' Assistance	Start/ Completion Deadlines	Action
1.9	Awareness of CCAMLR conservation measures in force and the booklet *Fish the Sea Not the Sky* on board longline vessels.	9.19(iii)	Technical coordinators	Dec 1998/ Aug 1999	Request feedback information from technical coordinators.
1.10	Submission of scientific observers data from the 1998/99 fisheries.		Technical coordinators	Dec 1998/ as required	Liaise with technical coordinators, as necessary, on data submission for the 1998/99 season.
2.	**Members' research and development activities:**				
2.1	Information on national research programs into status of albatrosses, giant petrels and white-chinned petrels.	7.8, 9.18(v)	Members	Nov 1998/ Sep 1999	Circulate the 1998 summary prepared by New Zealand and request similar summaries from Argentina, Australia, Chile, France, New Zealand, South Africa, UK, USA; collate responses for IMALF-99.
2.2	Regular updates on population status of albatrosses and petrels.		All Members	Nov 1998/	Same as above with a specific reminder to France; collate responses for IMALF-99.
2.3	GYM analysis of seabird interactions with longline fisheries.		New Zealand	Nov 1998	Request New Zealand report when work is completed.
2.4	Information on the use of underwater longline setting devices in fisheries conditions.		Members	Nov 1998/ Sep 1999	Request information on underwater setting development from all named Members (Australia, New Zealand, Norway, South Africa); collate responses for IMALF-99.
2.5	Regular 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 1998/ Sep 1999	Standing item, request reports of work, collate responses for IMALF-99.
2.6	National research into optimum configuration of line-weighting regimes and equipment.	9.18(x)	Members	Nov 1998/ Sep 1999	Request Members to report on research undertaken; collate responses for IMALF-99.
2.7	Development of automated methods for adding and removing weights to and from the line.	7.150, 7.151	Technical coordinators	Nov 1998/ Sep 1999	Request technical coordinators to interact and collaborate on the matter with fishing companies; review the situation at IMALF-99.
2.8	Video recording of line-hauling operations.	9.18(xiii)	Members	Nov 1998/ Sep 1999	Request reports, collate responses for IMALF-99.
2.9	Information on the experimental longline hake fishery in South Africa.		South Africa	Nov 1998	Re-request report from South Africa.
2.10	Information on the performance of natural and artificial bait in relation to their attractiveness to seabirds.			As required	Request again a report from 'Mustad '(Norway), also other companies/groups involved in testing artificial bait.

	Task/Topic	Reference	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 'Mustad' (Norway).
2.12	Risk assessment of seabird by-catch in the Convention Area.	9.18(ix), 7.105	Members	Nov 1998/ Aug 1999	Intersessional work led by Mr J. Cooper (South Africa) and Dr E. Woehler (SCAR), to improve basis for assessing risk of seabird by-catch by statistical areas; review results at WG-FSA.
3.	**Information from outside the Convention Area:**				
3.1	Information on longline fishing effort in the Southern Ocean to the north of the Convention waters.	7.121, 7.136	Members, non-Contracting Parties, int. organisations	As required	Request information intersessionally from those Members known to be licensing fishing in areas adjacent to CCAMLR (e.g. Argentina, Chile, UK [in respect of Falkland/Malvinas Islands], South Africa, New Zealand, Australia and France; review situation at IMALF-99.
3.2	Information on incidental mortality outside the Convention Area of seabirds breeding within the area.	7.122–7.134 7.135	Members	As required	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, int. organisations	Nov 1998/ as required	Request information on use/implementation of provisions of Conservation Measure 29/XVI, review responses at IMALF-99.
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 1998/ Sep 1999	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.*
4.2	Consultation with IMALF members on issues of relevance to the work of task group.		Members/ Task Group	Nov 1998/ 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 1999	Update the manual as recommended by WG-FSA, circulate replacement pages.

	Task/Topic	Reference	Members' Assistance	Start/ Completion Deadlines	Action
5.	**Cooperation with international organisations:**				
5.1	Participation at the 1999 meeting of CCSBT ERSWG; invite CCSBT to attend WG-FSA.		CCSBT Secretariat	Jan–Feb 1999/ Jul 1999	Standing request.
5.2	Cooperation with the Secretariat of the Convention on CMS on CCAMLR work on albatross conservation.		CMS Secretariat, South Africa	Sep 1999	Follow up the 1998 CCAMLR advice to the Secretariat of the Convention on CMS on CCAMLR work on albatross conservation.
5.3	Cooperation with the Secretariat of CBD on interactions between albatrosses and longline fisheries.		CBD Secretariat	3 months before CBD meeting	Follow up the 1998 CCAMLR advice to CBD of interactions between albatrosses and longline fisheries.
5.4	Cooperation with ICCAT and IOTC on specific issues regarding incidental mortality of seabirds.		CCAMLR observers	Nov 98	Remind observers of desired feedback on IMALF matters.
5.5	Cooperation with FAO with respect to the International Plan of Action on seabird interaction with longline fishing (IPOA) after its consideration at the COFI meeting in Feb 1999.	7.178, also 7.137	CCAMLR observer at COFI	Mar 1999	Provide report (including FAO documents relevant to IPOA) to the Secretariat for circulation to IMALF for information and consideration.
6.	**Data acquisition and analysis:**				
6.1	Comprehensive analyses of data from the 1997/98 fisheries.	9.18(i), (vi)	Dr Baker, Members	Dec 1998/ Aug 1999	Complete 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-99 for comments.
6.2	Preliminary analyses of data from 1998/99 fisheries.	7.18		Sep–Oct 1999	Summarise current year data at a level adequate to undertake a preliminary assessment at IMALF-99.
6.3	Acquisition of EEZ data.	9.18(vii)	France	Nov 1998/ Sep 1999	Discuss with French scientists how basic observer data, consistent with CCAMLR logbook data, can be acquired.
6.4	Analysis of Subareas 58.6/58.7 EEZ data.	9.18(viii)	South Africa	Nov 1998/ Sep 1999	Request South Africa to undertake analysis and report to IMALF-99, and to implement a requirement for national scientific observers to record the proportion of hooks observed.
6.5	Development of electronic forms and formats for the submission of the observer data.	3.62–3.64	Members	Nov 1998/ as required	Request Members to provide details of their national electronic data-entry programs; start developing standard CCAMLR program; report to WG-FSA-99.

APPENDIX G

1998 ASSESSMENT SUMMARIES

Assessment Summary: *Dissostichus eleginoides*, Subarea 48.3

Source of Information: This report

Year:	1993	1994	1995	1996	1997	1998	Max[2]	Min[2]
Recommended TAC			-	4000	5000	3540		
Agreed TAC	3350	1300	2800	4000	5000	3300		
Landings	2990	604	6171[4]	3871[5]	3924[6]	3328		
Survey Biomass	3353*		14923[*a]				2012[*b]	
	2460[+]		4831[+a]				67259[+b]	
Surveyed by		UK[a]						
		Arg[b]						
Stock Biomass[3]	11000-17000							
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: 121/XVI, 122/XVI and 124/XVI

Catches: 3 328 tonnes in 1997/98 (1 April to 22 August). No unreported catches in 1997/98.

Data and Assessment: Revised standardisation of CPUE using GYM.
Assessment of long-term annual yield using GYM.
Exploratory analysis of length frequency data for trends in length at capture.

Fishing Mortality:

Recruitment:

State of Stock: GYM results similar to 1997 assessment, but CPUE has declined every year since 1993.

Forecast for 1998/99: Catch limit derived from GYM is 3 550 tonnes. Catch Limit may be less than this figure to allow for uncertainty resulting from sustained decline in standardised CPUEs being more rapid than median fishable biomass predicted by the GYM.

Assessment Summary: *Dissostichus eleginoides*, Division 58.5.1

Source of Information: This report

Year:	1993	1994	1995	1996	1997	1998	Max[2]	Min[2]	Mean[2]
Recommended TAC									
Agreed TAC									
Landings	2722	5083	5534	4869	4683	4742	7492	121	
Landings[4]	2944	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: Trawl: 3 624 tonnes reported by France for French vessels. Longline: 1 118 tonnes reported by France for Ukrainian (997 tonnes) and French (121 tonnes) vessels.

Data and Assessment: Total including unreported catches estimated to be 16 560 tonnes. Standardisation of CPUE data from trawl fishery.
Estimation of long-term annual yield using GYM.

Fishing Mortality:

Recruitment:

State of Stock: Long-term annual yield from GYM (6 900 tonnes) is higher than most catches in the catch history, except for 1992, 1997 and 1998 (including unreported catches).

Forecast for 1998/99: 1998/99 catch limit for trawlers 3 400 tonnes with 1 000-tonne limit for the eastern sector. October to December 1998 catch limit for longliners is 500 tonnes. 1998/99 volume will not exceed 1 400 tonnes.

Assessment Summary: *Dissostichus eleginoides*, Division 58.5.2

Source of Information: This report

Year:	1993	1994	1995	1996	1997	1998	Max[2]	Min[2]	Mean[2]
Recommended TAC		297	297	297	3800	3700			
Agreed TAC				297	3800	3700			
Landings	0	0	0	0	1861[4]	3264[5]			
Landings[6]					18960	7200			
Survey Biomass		11880							
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 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: 131/XVI – Catch limit 3 700 tonnes

Catches: 3 264 tonnes up to time of WG-FSA meeting, expected to rise to 3 700 tonnes by end of Commission meeting. Unreported catches in 1997/98 estimated to be 3 500 tonnes.

Data and Assessment: Estimation of long-term annual yield using GYM.

Fishing Mortality:

Recruitment:

State of Stock: Long-term annual yield from GYM is 3 690 tonnes, similar to 1997, but total catches, with unreported catches continue to exceed this level.

Forecast for 1998/99:

Assessment Summary: *Champsocephalus gunnari*, Subarea 48.3

Source of Information: This report

Year:	1993	1994	1995	1996	1997	1998	Max[2]	Min[2]
Recommended TAC	9200-15200	0			4520	4840		
Agreed TAC	9200		1000	1300	4520			
Landings	0	13	10	0	5			
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 123/XVI

Catches: 5 tonnes by trawler *Betanzos* in December 1997/January 1998.

Data and Assessment: Short-term yield calculation based on UK survey data, September 1997.

Fishing Mortality: 0.143 if catch limit is taken.

Recruitment:

State of Stock: Uncertain

Forecast for 1998/99: Catch limit forecast is 4 840 tonnes, mainly on 3+ and 4+ year classes, but some doubt as to survival of these year classes.

Assessment Summary: *Champsocephalus gunnari*, Division 58.5.1

Source of Information: This report

Year:	1993	1994	1995	1996	1997	1998	Max[2]	Min[2]	Mean[2]
Recommended TAC						0			
Agreed TAC									
Landings (Kerguelen)	0	12	3936		<1		25852	0	
Landings (Combined)									
Survey Biomass					3890[a]				
					1837[b]				
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: No commercial catch in 1997/98.

Data and Assessment: No new data, but indications that 4+ year class has disappeared and that 1+ year class is strong.

Fishing Mortality:

Recruitment: May be high in 1999/2000 if current 1+ year class is confirmed as abundant.

State of Stock: Possibly increasing.

Forecast for 1998/99: No fishing in 1998/99, but pre-recruit survey envisaged.

Assessment Summary: *Champsocephalus gunnari*, Division 58.5.2

Source of Information: This report

Year:	1993	1994	1995	1996	1997	1998	Max[2]	Min[2]	Mean[2]
Recommended TAC		311			900	1160			
Agreed TAC		311	311		900				
Landings	0	0		216	115				
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: 130/XVI – Catch limit 900 tonnes

Catches: 115 tonnes caught in 1997/98 fishing season.

Data and Assessment: Survey in June 1998 and short-term yield calculation.

Fishing Mortality: 0.139 if catch limit is taken.

Recruitment: Fished stock comprises chiefly year classes 3+ and 6+. Year class 2+ due to recruit this year appears not to be strong.

State of Stock: Likely to decline after 1998/99 unless good recruitment of current year 2+ occurs.

Forecast for 1998/99: Catch limit of 1 160 tonnes.