ANNEX 5

REPORT OF THE WORKING GROUP ON FISH STOCK ASSESSMENT

(Hobart, Australia, 11 to 22 October 2004)

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[1] The tables and figures relating to Agenda Item 5 appear within the text of this section.

[2] These tables relate to Agenda Items 1–4 and 6–16.
[3] These figures relate to Agenda Items 1–4 and 6–16.

REPORT OF THE WORKING GROUP
ON FISH STOCK ASSESSMENT
(Hobart, Australia, 11 to 22 October 2004)

OPENING OF THE MEETING

1.1 The meeting of WG-FSA was held in Hobart, Australia, from 11 to 22 October 2004. Participants were welcomed by the Convener, Dr S. Hanchet (New Zealand), and the Secretariat's Executive Secretary, Dr D. Miller.

1.2 Dr Hanchet advised the Working Group that Dr M. Belchier (UK) would not be attending this year's meeting due to the recent death of his father. The Working Group expressed its sincere condolences to Dr Belchier and his family.

ORGANISATION OF THE MEETING AND ADOPTION OF THE AGENDA

2.1 The agenda of the meeting was discussed and adopted with the following changes:

- subitem 5.3 was renamed 'Assessment and management advice on other fisheries'
- 'Assessment of risk' was added under item 6
- 'Scientific observer duties' was also added under item 6.

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 the participants. Dr I. Everson (Consultant) assisted with the formatting and restructuring of the report.

Meeting documents

2.4 WG-FSA noted with pleasure that the majority of meeting documents had been submitted by the deadline (24 September 2004). Congratulations were extended to the Secretariat, and in particular Mrs R. Marazas (Website and Information Services Officer) for promptly placing available documents on the Working Group's webpage; approximately 85 documents were available on the website by the Monday following the deadline.

2.5 A number of documents had been submitted after the deadline due to extenuating and other circumstances. In addition, some documents had been revised and resubmitted after the deadline. WG-FSA considered these documents and agreed that all the late and revised documents would be accepted at this meeting. However, WG-FSA emphasised that this action should not be seen as setting a precedent. The Working Group agreed that the established practice of submitting documents well in advance of the meeting should be retained at future meetings.

2.6 WG-FSA reviewed the existing guideline for the submission of meeting documents. It was agreed that the submission of documents to future meetings shall be in accordance with the following rules:

(i) The deadline for the submission of documents is to be set at 0900 h (Hobart time) exactly two weeks prior to the commencement of the meeting (e.g. if WG-FSA-05 starts on 10 October 2005, then the deadline for the submission of documents will be 0900 h (Hobart time) on Monday, 26 September 2005).

(ii) With the exception of Secretariat papers dealing with data (see iii), the deadline will apply to all documents submitted to WG-FSA, including SC-CAMLR and CCAMLR working papers and background papers.

(iii) Secretariat papers dealing with data may be submitted between the deadline and 0900 h on the first day of the meeting.

(iv) Factual corrections to documents will be accepted at any time. However, if such corrections are made after the deadline, then the author(s) must clearly indicate the changes in the revised document(s). Documents with any other type of revision will be considered as new documents and these new documents will be subject to the deadline.

(v) Documents submitted after the deadline and before the start of the meeting may be accepted, subject to prior notification, at the discretion of the Conveners of WG-FSA and WG-IMAF and the Chair of the Scientific Committee.

Report restructure

2.7 Dr Hanchet recalled that in 2003 WG-FSA and the Scientific Committee identified the need to rewrite and restructure the WG-FSA report. The main aims of such a restructure were to provide advice to the Scientific Committee, which was brief, could be easily followed and was available to public scrutiny. Subsequent discussions between the Conveners of WG-FSA and WG-IMAF and the Chair of SC-CAMLR, as well as other WG-FSA members and the Secretariat, defined three phases of work:

- Phase 1 was to prepare a draft structure and format of the report in consultation with all parties involved.

- Phase 2 was to refine the structure of the report format and to develop draft ‘Fishery Reports’ for selected fisheries for presentation to the WG-FSA-SAM meeting in July 2004.

- Phase 3 was to refine these drafts and develop full ‘Fishery Reports’ for all the fisheries being reviewed and, where possible, assessed, and to develop a revised report structure in time for the WG-FSA meeting in October 2004.

Information on the restructure was distributed in SC CIRCS 04/11, 16, 18 and 21.

2.8 In considering the restructure process, several objectives were identified:

(i) to provide clearer documentation
(ii) to provide clearer management advice
(iii) to make the reviews and assessments more transparent
(iv) to make the report shorter.

2.9 Following further consultation, it was agreed to contract Dr Everson (former Convener of WG-FSA) to undertake a major part of the work identified in Phases 1–3. It was also agreed that Dr Everson should attend the meeting so as to assist with the preparation of the report under the new restructured format.

2.10 The main thrust of the restructure was to provide the main part of the WG-FSA report with a greater fishery-specific focus. Initially, this was achieved by a simple reorganisation of the existing information. This provided a clearer document which met the objectives of transparency and clearer documentation and management advice.

2.11 It was acknowledged that this approach would probably fail to meet objective (iv), which was to make the report shorter. An attempt to make the report shorter in the last two years, by inclusion of text in SC-CAMLR background documents, had received some negative feedback from some WG-FSA and Scientific Committee Members and the Secretariat. The main issues were concerned with poor documentation, loss of transparency, additional time for adoption, and additional Secretariat resources required for formatting and photocopying. It was agreed that the questions of report length, and the related issues of format, transparency, resources and translation be considered at this meeting of WG-FSA, and further discussed at SC-CAMLR-XXIII and CCAMLR-XXIII.

2.12 Dr Everson had presented draft plans at WG-FSA-SAM. He had revised these and introduced them at WG-FSA. The Working Group was pleased with the overall plans and, with some modifications, these were accepted for the current meetings.

REVIEW OF AVAILABLE INFORMATION

Data requirements specified in 2003

Development of the CCAMLR database

3.1 The Data Manager, Dr D. Ramm, provided an update on recent developments in managing CCAMLR's data (WG-FSA-04/5 Rev. 1). During the intersessional period, the Secretariat had revised a number of databases used in support of the work of WG-FSA. The revision addressed issues raised by WG-FSA (e.g. SC-CAMLR-XXII, Annex 5, paragraphs 5.108 and 5.123), and this included the simplification of operating procedures, improvements in the user-interface and further developments in data checking routines. Most of this work was undertaken in databases which:

- run the routine fishery-related queries used by WG-FSA
- generate the catch-weighted length frequencies
- extract the length densities used by CMIX.

3.2 Work in 2004 also included further validation of survey data, and improvements to CCAMLR's data form used for submitting data from bottom trawl surveys (form C4). The revised data form, in Microsoft Access format, allows users to either enter data manually using data entry panels, or download processed data to database tables in standard CCAMLR form. A copy of the data form was made available on WG-FSA-04's server.

3.3 In addition in 2003, WG-FSA-SFA discussed the archiving of acoustic data from finfish surveys (WG-FSA-03/14, paragraphs 8.1 to 8.6) and this matter was further discussed by the Scientific Committee (SC-CAMLR-XXII, paragraphs 12.8 to 12.11). The Scientific Committee recommended that the Secretariat liaise with WG-FSA-SFA and current acoustic equipment manufacturers and software developers for advice on data storage and collection, and then develop a draft plan for consideration by the 2004 meeting of WG-FSA-SAM.

3.4 The development of the CCAMLR acoustic database is progressing in two parts:

- the development of a structure for storing data from the CCAMLR-2000 Survey and other acoustic-type data from krill surveys;

- the development of a complementary structure which would meet the acoustic requirements of WG-FSA-SFA.

3.5 While these developments are complementary and may overlap to some extent, the requirements for archiving the CCAMLR-2000 Survey data are well described (SC-CAMLR-XIX, Annex 4, Appendix G, paragraphs 6.1 to 6.4) and this work is nearing completion (WG-EMM-04/18). However, the needs of WG-FSA-SFA are yet to be specified and consultation with the conveners of WG-FSA-SFA during 2004 indicated that the matter of a CCAMLR database for archiving acoustic data from finfish surveys remains in the early stage of conception.

Data processing

3.6 The Working Group noted that all of the fishery and observer data collected so far in the 2003/04 season had been submitted by the time of the meeting. These data included:

- catch and effort reports from 10 fisheries;

- 84 fine-scale catch and effort datasets (typically one dataset per month per vessel);

- logbooks and reports from scientific observers deployed on longliners (44 cruises), finfish trawlers (11 cruises) and a krill trawler (1 cruise), including two outstanding reports received during the meeting.

3.7 All of these data had been received and processed by Mrs L. Millar (Data Administration Officer) and Mr E. Appleyard (Scientific Observer Data Analyst) in time for the meeting. Preliminary validation of these data had also been undertaken, and routine analyses were reported in WG-FSA-04/5 Rev. 1, 04/6 Rev. 1, 04/7 Rev. 1 and 04/8 Rev. 1. The Working Group thanked Mrs Millar and Mr Appleyard for their dedicated efforts in preparing the data for the meeting.

3.8 The Working Group noted that data from the 2003/04 season would be fully validated in 2005. It was also noted that a number of fishery datasets had been submitted after the deadlines agreed by the Commission (CCAMLR-XXIII/BG/8).

Fishery plans

3.9 In 2004, the Secretariat undertook a major reorganisation and reconstruction of the database which holds the time series of information used in the Fishery Plans (WG-FSA-SAM-04/4). This information includes:

- management measures and fishery requirements reported annually in the *Schedule of Conservation Measures in Force*;
- other management information reported in the reports of the Scientific Committee and Commission;
- operational and catch information derived from data submitted to CCAMLR.

3.10 In addition, the layout of the Fishery Plan was revised and information is now presented in three sections:

Section 1: Management measures and fishery requirements
Section 2: Operational aspect (i.e. 'what really happened')
Section 3: Catches derived from STATLANT data, fine-scale data and catch and effort reports.

3.11 WG-FSA endorsed the definition of 'fishery' and 'annual reporting interval' used in the Fishery Plans, whereby:

> A fishery is defined as a fishing operation which targets a discrete species (or species group) in a discrete statistical region (i.e. an area, subarea or division); several types of fishing gear may be used in a fishery, and a fishery may be closed for long-term periods.
>
> The annual reporting interval used in each Fishery Plan reflects the seasonal period defined by the Commission at the time when the relevant measures were in force. Thus the annual interval in each plan captures the requirements, operations and catches of the time and maintains the historic setting in which each fishery has been managed by CCAMLR. Since 2001 (Conservation Measure 32-01), all fisheries are managed by CCAMLR season (1 December to 30 November of the following year) and this corresponds to the reporting period now used in the *Statistical Bulletin*.

Fisheries information

Catch, effort, length and age data reported to CCAMLR

3.12 Ten fisheries were conducted under the conservation measures in force in 2003/04:

- fishery for *Champsocephalus gunnari* in Subarea 48.3
- fishery for *Champsocephalus gunnari* in Division 58.5.2
- fishery for *Dissostichus eleginoides* in Subarea 48.3
- exploratory fishery for *Dissostichus* spp. in Subarea 48.6
- fishery for *Dissostichus eleginoides* in Division 58.5.2
- exploratory fishery for *Dissostichus* spp. in Division 58.4.2
- exploratory fishery for *Dissostichus* spp. in Division 58.4.3b
- exploratory fishery for *Dissostichus* spp. in Subarea 88.1
- exploratory fishery for *Dissostichus* spp. in Subarea 88.2
- fishery for *Euphausia superba* in Area 48.

3.13 In addition, four other managed fisheries were conducted in the Convention Area in 2003/04:

- fishery for *Dissostichus eleginoides* in Division 58.5.1 (French EEZ)
- fishery for *Dissostichus eleginoides* in Subarea 58.6 (French EEZ)
- fishery for *Dissostichus eleginoides* in Subarea 58.6 (South African EEZ)
- fishery for *Dissostichus eleginoides* in Subarea 58.7 (South African EEZ).

3.14 Catches of target species by region and gear reported from fisheries conducted in the CCAMLR Convention Area in the 2003/04 fishing season are summarised in Table 3.1.

3.15 Catch, effort and length data were submitted for all fisheries managed under conservation measures. Data were also submitted from fisheries operating in EEZs, albeit not all in the standard CCAMLR format.

Estimates of catch and effort from IUU fishing

3.16 WG-FSA reviewed estimates of IUU catches in the Convention Area prepared by the Secretariat and based on information submitted by 1 October 2004 (SCIC-04/3). The deterministic method presently used by the Secretariat to estimate IUU fishing effort was the same method as used in previous years. This method used information on the number of vessels sighted/apprehended and reports of port inspections. Ancillary information on fishing trips and catch rates is derived from CCAMLR data on licensed vessels. The estimates of IUU catch in 2003/04 were then pro-rated to the end of the season (30 November 2004).

3.17 Following discussion, WG-FSA agreed that a pro-rated adjustment to the end of the season was inappropriate in subareas and divisions which are extensively covered by sea-ice in late winter/early spring (Divisions 58.4.2, 58.4.3a, 58.4.3b and 58.4.4 and Subarea 88.1). The estimate of IUU catches was revised accordingly (SCIC-04/3 Rev. 2) and is summarised in Table 3.2. The development of standard methods for estimating total removals of toothfish inside and outside the Convention Area including, where applicable, IUU catches, was further discussed under Item 8.

Catch and effort data for toothfish fisheries in waters adjacent to the Convention Area

3.18 Catches of *Dissostichus* spp. in CCAMLR waters which were reported to the Secretariat in STATLANT data and catch and effort reports, and catches outside the Convention Area reported in the CDS for the 2002/03 and 2003/04 seasons are summarised in Table 3.3.

3.19 WG-FSA noted that the catch of *Dissostichus* spp. outside the Convention Area in 2003/04 was taken mostly in Area 41 (6 342 tonnes) and Area 87 (3 701 tonnes). Overall, the CDS-reported catch from areas outside the Convention Area was markedly lower than that reported in previous years. A subgroup on IUU fishing was convened to examine, among other issues, the possible causes for the decline in CDS-reported catches on the high seas outside the Convention Area. The apparent decline in IUU catches in the Convention Area was also examined. The report of the subgroup is discussed under Item 8.

Scientific observer information

3.20 During the 2003/04 fishing season, the Scheme of International Scientific Observation provided observer coverage in all finfish fisheries in the Convention Area.

3.21 For the 2003/04 season, reports and data were submitted by international and national observers from a total of 44 cruises fishing for *Dissostichus* spp. in the Convention Area. Cruises were undertaken in Subareas 48.3 (16), 48.6 (1), 58.6 and 58.7 (2), 88.1 and 88.2 (22), and in Divisions 58.4.2 and 58.4.3b (1) and 58.5.2 (2). Observers were deployed by eight Members: Australia (1), Chile (7), Russia (5), South Africa (14), Spain (1), Ukraine (2), UK (12) and Uruguay (1).

3.22 Trawl cruises fishing for finfish in Subarea 48.3 (6) and in Division 58.5.2 (5) were observed by 11 scientific observers (6 international and 5 national) provided by: Australia (5), South Africa (2), Spain (1) and the UK (3). A single trawl cruise fishing for krill in Area 48 was observed by a single international observer designated by Ukraine.

Research information

Research surveys

Results

3.23 The USA conducted a multi-disciplinary research cruise in the Atlantic sector of the Southern Ocean during the 2004 austral winter as part of the International Collaborative Expedition to collect and study Fish Indigenous to Sub-Antarctic Habitats (ICEFISH) (WG-FSA-04/61). Sampling during the cruise included demersal finfish, benthic invertebrates and information on seafloor composition. Trawling was conducted in the CCAMLR Convention Area at Shag Rocks, South Georgia (Subarea 48.3), the South Sandwich Islands (Subarea 48.4) and Bouvetøya (Subarea 48.6) from 5 to 30 June 2004. A wide contrast in finfish and invertebrate species composition between island groups was observed with the greatest differences between the South Sandwich Islands and Bouvetøya, where the isolation of the latter island likely played a role in the different community structure. A substantially greater number of *Lepidonotothen squamifrons* and rattails (*Macrourus holotrachys*), which were sparse or absent on the shelf areas of South Georgia and the South Sandwich Islands, were observed around Bouvetøya.

3.24 Australia conducted a random stratified trawl survey (*n* = 145) in Division 58.5.2 in the vicinity of Heard Island (200–1 500 m) in May 2004, continuing the time series started in 1990. The 2004 survey included stations in all the shallow strata as well as in four deeper strata (1 000–1 500 m) (WG-FSA-04/76). The increase in total survey area, relative to the 2003 survey, was due to the increase in deeper strata surveyed in 2004. Preliminary assessments of toothfish and icefish using data from the survey are provided in WG-FSA-04/76 and 04/77 respectively.

3.25 The UK completed its ninth fish stock assessment survey in Subarea 48.3 during January and February 2004 (WG-FSA-04/85). A total of 65 demersal trawls were made on the survey and all were used for estimating fish biomass. In addition to the random stratified bottom trawl survey, the research was extended by a week to further investigate the use of acoustic methods for determining icefish biomass.

3.26 As part of the BioRoss research program (WG-FSA-04/60), a survey of the Ross Sea (Subarea 88.1) was conducted from the New Zealand research vessel *Tangaroa* in February March 2004. A total of 52 bottom trawls and five beam trawls were carried out in depths of 50 m to over 1 000 m along five transects in the western Ross Sea between Cape Adare and Cape Hallett (SSRU 881H) and on four seamounts around the Balleny Islands (SSRU 881E). Fifty-seven species of fish were identified from a total fish catch of 4 250 kg. The catch included 126.3 kg of *D. mawsoni* and 2.8 kg of *D. eleginoides*. Eight small (less than 2 kg) specimens of *D. mawsoni* were caught at 183–574 m depth at the Balleny Islands (WG-FSA-SAM-04/7). The survey also provided information on the main by-catch species for the exploratory longline fishery in Subarea 88.1. WG-FSA-SAM-04/7 presented trawl catch data by tow for *M. whitsoni* and *Bathyraja eatonii*. Over 1 000 kg of *M. whitsoni* was caught, with high catch rates in SSRU 881H (up to 10 000 kg km^{-2}).

3.27 Australia provided a simulation approach to the evaluation of recruitment surveys for toothfish for the Heard Island region (Division 58.5.2) (WG-FSA-04/74). Assessments of long-term sustainable yield for this region have been based on data obtained from annual random stratified trawl surveys (RSTS) and from targeted commercial fishing operations via an observer program. Evaluations of both the current RSTS design for Division 58.5.2 and some options for future modifications of the design were investigated using a simulation environment using the program Fish Heaven with data analysis carried out using 'S-plus'. Fish Heaven is a simulation program that uses a spatially explicit, age-structured fish population dynamics model. Recruitment, movement, mortality, growth and fishing (both commercial and research) were simulated for the toothfish for the Heard Island Plateau region. Censuses of fish stocks by age class were compared to population estimates based on simulated RSTS hauls. For a series of 10 years of survey, age-4 recruitment was estimated using 111 RSTS stations, assuming the age of every fish caught in the surveys is known without error and assuming knife-edge fishing selectivity at age 4, using either (i) the age-4-alone RSTS results or (ii) age-4–8 RSTS results using back-projections from each age to age 4 for each of six cohorts.

Future surveys

3.28 Scientific research surveys notified to the Secretariat are placed on the CCAMLR website, and the notifications for 2004/05 received by 24 September 2004 were listed in Table 4 of CCAMLR-XXIII/BG/8 and are given in Table 3.4.

3.29 One notification, submitted by New Zealand on 23 July 2004, was for a longline survey of *D. mawsoni* in Subarea 88.3 where the survey vessel would take no more than 100 tonnes of *D. mawsoni*. The survey vessel would take no more than 35 tonnes of all other species combined.

3.30 The notification by New Zealand falls under paragraph 3 of Conservation Measure 24-01. This requires a response from Members within two months of the circulation of the notification, if they wish to request a review by the Scientific Committee. The proposed research plan was circulated on 4 August 2004 (COMM CIRC 04/73). No comments or advice have been received in advance of the start of WG-FSA-04.

3.31 WG-FSA noted that Subarea 88.3 is currently closed to exploratory fishing based on the poor CPUE experienced during an exploratory fishery for toothfish by Chile in 1998. At that time it was recommended that any future consideration of opening Subarea 88.3 to exploratory fishing should be preceded by a research survey.

3.32 Some members of WG-FSA were concerned at the high maximum catch and suggested that in future it would be useful for survey designs submitted under Conservation Measure 24-01, paragraph 3, to be referred to WG-FSA for review prior to consideration by the Commission.

Combining acoustic and trawl survey data to estimate *C. gunnari* standing stock

3.33 Although no specific meeting had taken place, there was continued interest in developing methods to combine acoustics with trawl survey data to estimate the standing stock of icefish in line with recommendations in paragraph 3.41 of SC-CAMLR-XXII, Annex 5 and discussion at WG-FSA-SAM (WG-FSA-SAM-04/10).

3.34 No acoustic estimates of abundance were available for *C. gunnari* in Subarea 48.3 from the 2004 UK survey (WG-FSA-04/85). However, acoustic data had been collected during the bottom trawl survey and four additional days had been allocated to acoustic survey work in conjunction with pelagic trawling. This short acoustic survey showed that *C. gunnari* of all ages spend time in midwater and reinforced the belief that a bottom trawl survey significantly underestimates *C. gunnari* biomass (WG-FSA-SAM-04/20) corroborating the results of the Russian trawl acoustic survey in 2002 (WG-FSA-02/44, WG-FSA-SAM-04/10).

3.35 Problems with using the 'dB difference method' (Hewitt et al., 2002; Watkins and Brierley, 2003) to distinguish between *E. superba* and *C. gunnari* had been discussed at WG-FSA-SAM and had been described in WG-FSA-SAM-04/20. It was noted from this study that two targeted trawls on 'krill-like' marks ($\Delta SV_{120kHz-38kHz}$ filter 2 dB to12 dB) caught almost entirely *C. gunnari*.

3.36 The Working Group noted that a three-frequency 'dB difference' algorithm has been developed for krill identification (Hewitt et al., 2003; Azzali et al., 2000). The Working Group recommended that further analysis using available datasets from UK and Russian surveys be undertaken and the results reported to WG-FSA-SAM-05 or SG-ASAM-05.

3.37 The Working Group noted that the development of acoustic methods for species identification could be addressed in two ways:

- determination of multi-frequency algorithms for species discrimination
- techniques for validation of acoustic species identification by reference to species composition and size from trawl sampling.

3.38 It was noted that the UK is planning a combined acoustic and pelagic trawl survey of the commercial fishing grounds to the northwest of South Georgia for January 2005. It is hoped that this survey will provide new information on target discrimination, target strength and diurnal migration patterns of *C. gunnari*. Depending on the results from this proposed work in 2005, it may be possible to analyse acoustic data from the 2004 UK survey to produce abundance estimates for *C. gunnari*.

3.39 The Working Group noted that there is parallel work in progress on acoustic delineation of *C. gunnari* and *E. superba* being carried out by WG-EMM and supported the proposal by WG-EMM (Annex 4, paragraph 4.92) to establish a standing SG-ASAM to coordinate the work of WG-FSA and WG-EMM and review issues such as this which are common to both working groups.

Tagging studies

3.40 A number of papers reported ongoing tag–recapture experiments in the CCAMLR Convention Area. At South Georgia, 4 151 *D. eleginoides* have been tagged by the UK since 2000 with 195 recaptures (WG-FSA-04/82). At Heard and McDonald Islands 9 801 *D. eleginoides* have been tagged by Australia since 1998 with 1 934 recoveries, and at Macquarie Island 6 416 fish have been tagged since 1995 with 817 recaptures (WG-FSA-03/70). In McMurdo Sound, over 5 000 *D. mawsoni* have been tagged by the USA since the early 1980s with 15 recaptures (A. de Vries, pers. comm.), with one fish caught in Subarea 88.2 after 18 years, about 1 300 n miles from its release location (WG-FSA-04/34). Further north in the Ross Sea, nearly 4 000 *D. mawsoni* and *D. eleginoides* have been tagged since 2000 with about 50 recaptures (WG-FSA-04/36).

3.41 The Working Group noted that the tagging results have provided an insight into the nature of toothfish movement in the CCAMLR Convention Area (WG-FSA-04/82), and have potential to be used as abundance estimates in some areas (WG-FSA-04/36, 04/75 and 04/82). The Working Group recalled its advice from last year, that it had some concerns over potential biases when using the approach to estimating absolute abundance and reiterated its advice that these be examined through simulation during the intersessional period (SC-CAMLR-XXII, Annex 5, Appendix D, paragraph 8).

3.42 Three papers were presented that developed methods for the estimation of abundance from tag–recapture data (WG-FSA-04/36, 04/75 and 04/82), ranging from Petersen estimates, exact time of release and recapture stock assessment model, and integrated stock assessment model methods. The Working Group recommended that further research be undertaken on the development of robust abundance estimators from tag–recapture data.

3.43 The Working Group noted that there are a number of assumptions that have to be met to achieve an unbiased estimate of abundance using tag–recapture experiments. It would be necessary to quantify initial release mortality, tag loss and tag detection rates, as these can lead to bias in the abundance estimate. There are also issues relating to mixing assumptions, emigration, and immigration. The Working Group recommended that these issues be investigated as tagging programs develop, and by further studies.

3.44 The Working Group discussed the possibility of an experiment to evaluate initial tag-related mortality using acoustic 'mortality' tags. Acoustic mortality tags are designed to detect local movement over a pre-determined time period using an array of deployed hydrophones. The Working Group recommended that a feasibility study, incorporating discussion of the practical application and methods of tag-mortality estimation from resulting data, be developed during the intersessional period.

3.45 The Working Group recommended that tagging of toothfish continue to be a requirement for all new and exploratory toothfish fisheries (Conservation Measure 41-01, Annex C), and encouraged its use in all fisheries where appropriate.

3.46 The Working Group noted that Conservation Measure 41-01/C requires Members to report all relevant tag data and any tag recaptures to the CCAMLR Data Manager within two months of the vessel departing these fisheries.

3.47 The Working Group then went on to discuss revisions to the protocol for tagging and data management. The Working Group agreed that:

(i) NIWA in New Zealand (on behalf of the New Zealand Ministry of Fisheries) offered to act as the repository for all tagging data from the Ross Sea fishery. Tags can be printed with the legend 'RTN TO: NIWA, PO BOX 14-901, WGTN, NEW ZEALAND'. Further, the Working Group recommended that all participants in that fishery return their tag data directly to NIWA at the conclusion of each fishing trip;

(ii) MRAG in the UK offered to act as the repository for all tagging data from the Subarea 48.3 fishery. Further, the Working Group recommended that all participants in that fishery return their tag data directly to MRAG at the conclusion of each fishing trip;

(iii) AAD in Australia offered to act as the repository for all tagging data on the Kerguelen Plateau, including Division 58.5.2. Further, the Working Group recommended that all participants in that fishery return their tag data directly to AAD at the conclusion of each fishing trip;

(iv) The Working Group noted that there may be some conflict between Conservation Measure 41-01/C (requiring Members to report all relevant tag data and any tag recaptures to the CCAMLR Data Manager within two months of the vessel departing these fisheries), and paragraphs (i) to (iii) above;

(v) the Working Group noted that a range of different tags have been used by different nations and vessels within some areas, and recommended that the Commission develop a means for coordinating the issue of tags and recording of tags released. The preferred tagging type is a 'T' bar tag (various colours) manufactured by Hallprint Pty, South Australia. Further, that the Secretariat tagging database be updated to record:

   (a) the tag types, colours, descriptions (including text), and numbers issued to each vessel for each season;

   (b) the tag types, colours, descriptions (including text), and numbers issued to each vessel that were unused at the end of each season;

   (c) the repositories and the Commission work to ensure that the tags used within each area by vessels are unique (i.e. the possibility of duplication in the tags issued is minimised);

(vi) during the intersessional period, the feasibility of using numeric validation schemes (e.g. check-digits) be investigated for use on tags;

(vii) during the intersessional period, the use of slings, holding tanks, or other devices for bringing or holding fish on board, be investigated as to their feasibility to ensure that tagged fish can be released in optimum condition. Where appropriate, the tagging guidelines should be amended accordingly at the next meeting of WG-FSA;

(viii) tagging procedures, including handling details, should follow the guidelines outlined in the tagging protocol. Care should be taken to either tag the fish quickly, or alternatively to store it in a seawater tank, to avoid the possibility of freezing of the eye membrane. Tagging should only be carried out by observers or experienced fishing industry technicians, who have received training in tagging according to the guidelines in the tagging protocol;

(ix) all fish should be double tagged (the Working Group noted that this would likely increase detection rates, be of low additional cost, and allow estimation of the tag loss rate);

(x) for all recaptured tagged fish (i.e. fish caught that have a previously inserted tag) that:

   (a) it should not be re-released, even if it was at liberty for only a short period, except in circumstances where this is specifically prescribed within the experimental design of an individual tagging program;

   (b) it should be biologically sampled (e.g. length, weight, sex, stage and a photograph of each fish), the otoliths recovered, and the resulting data (including otoliths) be returned as part of the submission of tag–recapture data;

   (c) its physical recaptured tags be returned as part of the submission of tag–recapture data;

(xi) the feasibility of a reward system for tag recoveries be considered during the intersessional period;

(xii) the protocol in the *Scientific Observers Manual* be updated to reflect the recommendations of the Working Group. Revision of the protocol will be undertaken and circulated by email. The Working Group recommended that the final version be completed by mid-November and be sent to the Secretariat for inclusion in the observer reports for the coming 2004/05 season. The protocol should be placed on the Secretariat website as soon as possible.

3.48 Observers would be responsible for keeping a record of tag releases and tag recaptures, and in time, electronic worksheets could be set up for automatic storage of the tagging data in their electronic logbooks. Observers would also be responsible for returning the tags and for the extraction of otoliths from tagged fish. The Working Group noted that all otoliths should be stored in the dark, as some may have been marked with strontium chloride or tetracycline for age validation experiments (WG-FSA-03/80).

3.49 Results from the skate tagging program in Division 58.5.2 (WG-FSA-04/68) indicate that skates moved very little between release and recapture, even after extended periods at liberty. The distances travelled ranged between 0.2 to 7 n miles with periods at liberty ranging from 208 to 822 days. Growth rates estimated from recaptured skates were 20 mm per year in total length, 21 mm per year in disk width and 0.14 kg per year in weight. Recapture rates were 2.5% for *B. eatonii* and 0.8% for *B. murrayi* for skates tagged in the trawl fishery and 0.05% for skates tagged in the longline fishery. In Subarea 48.3 (South Georgia), 55 *Amblyraja georgiana*, ranging in size from 21 to 96 cm (TL), were tagged and released during the groundfish research trawl in 2004 (WG-FSA-04/85). The Working Group recalled that WG-FSA-02/42 indicated more substantial movement in Subarea 88.1, where one fish moved 59 km in 38 days and another 72 km. The smallest distance reported was 7 km.

3.50 The Working Group agreed that it was important to continue to tag skates that were cut off from the longline. Recoveries of the skates could provide important information on movement, survivorship and also, if measured on release, growth (paragraph 6.69).

3.51 The Working Group was informed that a tag–recapture program on *D. eleginoides* is being carried out by the National Institute of Fisheries Research and Development (INIDEP, Argentina) from August 2004, within the EEZ of Argentina and in international waters outside the CCAMLR Convention Area. Approximately 500 fish have been tagged to date, and it is expected that about 5 000 fish will be tagged over three years. The objectives of the program are to investigate migration patterns and to provide information for assessment. More information on the program can be found at www.inidep.edu.ar.

Biological parameters

3.52 Six submitted papers provided new biological information of potential use in assessments.

3.53 WG-FSA-04/28 Rev. 1 reported differences in length–mass and other biological parameters for *D. mawsoni* caught north and south of 70°S in Subarea 88.1 based on data from the New Zealand longline vessel *San Aotea II* in the last four fishing seasons. In general, fish in the northern areas were larger, had higher gonadosomatic indices and had a lower condition factor than fish in the southern area. WG-FSA-04/28 Rev. 1 hypothesised that these differences may be due to spawning migration of *D. mawsoni* to the northern seamounts within Subarea 88.1.

3.54 Estimates of age and growth of *A. georgiana* in Subarea 88.1 based on interpretation of caudal thorns were presented in WG-FSA-04/29. Maximum age was estimated to be 14 years, and estimated age at maturity was 6–7 years for males and 8–11 years for females. Age estimates were very uncertain because reading precision was low and because thorn growth may cease in large individuals. The Working Group noted that the relative fast growth rates reported for *A. georgiana* contrasted with the much slower growth by tagged *B. eatonii* in Division 58.5.2 (WG-FSA-04/68).

3.55 WG-FSA-04/67 reported on a preliminary study to validate the annual deposition of growth rings in the otoliths of *D. eleginoides* from Division 58.5.2. As part of the tagging program, fish were injected with strontium chloride, which produces a mark on the otolith. Sixty-nine fish were recaptured after more than a year at liberty and the number of observed annuli, subsequent to the strontium mark, were consistent with the time at liberty. The Working Group agreed that this provided additional validation for toothfish ageing.

3.56 WG-FSA-04/86 used otoliths from pre-recruits and juveniles (trawl survey) and the longline fishery to age *D. eleginoides* from Subarea 48.3, and generated new von Bertalanffy growth parameters. The resulting growth curve had a lower L_∞ and higher k than the curve currently used in assessments. The lower L_∞ was probably the result of sampling fewer large fish. The Working Group agreed that the von Bertalanffy parameters may be appropriate to the growth of young fish and could therefore be used to estimate starting bounds for CMIX analyses, but are not appropriate for projections in the GYM.

3.57 In WG-FSA-04/70 age densities of *C. gunnari* estimated by CMIX were compared with direct ageing from otoliths. Discrepancies were found in the allocation to age classes. The Working Group agreed that there is a need to further investigate the parameters used in CMIX analyses of *C. gunnari* and emphasised the need to develop reliable direct ageing methods.

3.58 WG-FSA-04/10 provided a detailed review of icefish biology, including a review of growth parameters and reproductive parameters.

3.59 At WG-FSA-03 the Working Group asked WG-FSA-SAM to provide advice to the CCAMLR Otolith Network (CON) on what was required for future meetings (SC-CAMLR-XXII, Annex 5, paragraph 12.6). Following discussions at WG-FSA-SAM, the Working Group requested that, for toothfish, CON:

(i) provide all existing age–length data (from otoliths) obtained according to the agreed CON protocols for the active CCAMLR fisheries to the Secretariat;

(ii) if necessary, read additional otoliths from larger fish to provide a suitable sample size (5–10 otoliths per 10 mm length class) of these fish;

(iii) derive age–length keys for different fisheries (and years), including, where possible, estimation of ageing error;

(iv) provide an update on the status of validation of ageing;

(v) provide results of repeat ageing readings (within and between readers) to determine errors in ageing;

(vi) read otoliths from at least one of the trawl surveys in each area to allow the Working Group to develop an age–length key. (This key will be used to evaluate the number of otoliths necessary to carry out the modal decomposition currently being undertaken using CMIX.)

(vii) read otoliths from recaptured tagged fish as appropriate (paragraph 3.47).

3.60 The Working Group also requested that the Data Manager, in consultation with Members, develop further the CCAMLR age database to include the facility for multiple readings and readers, sampling designs (e.g. random or non-random), ring counts as well as ages, source of otoliths and other relevant information, and then to populate the database with the age–length and associated data provided by CON.

PREPARATION FOR ASSESSMENT AND ASSESSMENT TIMETABLE

Report of the Subgroup on Assessment Methods

4.1 The second meeting of WG-FSA-SAM was held at the University of Siena, Siena, Italy, from 5 to 9 July 2004. The Working Group thanked Prof. S. Focardi and his team and the subgroup coordinator, Dr A. Constable (Australia), for such a successful meeting. The meeting was convened by Dr Constable.

4.2 The Working Group noted that the extra day of the meeting and the participation by the Secretariat had greatly helped facilitate the meeting and the preparation of the report.

4.3 The Working Group noted the progress made by WG-FSA-SAM on reviewing methods to estimate recruitment of *D. eleginoides* as requested by the Scientific Committee (SC-CAMLR-XXII, paragraph 4.50; WG-FSA-04/4, paragraphs 2.1 to 2.9), and that submissions on revisions of the recruitment series in Subarea 48.3 have been received by WG-FSA for its meeting this year (WG-FSA-04/82, 04/92). It was noted that the discrepancies in the historical recruitment series for Subarea 48.3 identified at WG-FSA-03 had been identified and resolved. One of the issues now resolved was an unexplained scaling factor which appears to have inflated the density estimates in some of the hauls in some of the surveys used in the CMIX analysis conducted in 1999. It also appears that the 1999 CMIX analyses had used three strata rather than the six that are now used.

4.4 The Working Group also noted that the design of surveys might contribute to increased variation in the recruitment series. This is considered further in paragraph 12.9. The Working Group agreed that further simulation evaluation of survey designs will help identify what is required to robustly estimate the recruitment parameters from a time series of surveys. The Working Group encouraged WG-FSA-SAM to continue examining the issue of survey design.

4.5 The Working Group noted that no further work had been carried out on methods to standardise time series of CPUE (WG-FSA-04/4, paragraphs 2.10 to 2.12). Nevertheless, it noted that it is desirable to establish standard methods, as far as practicable, for use in analysing CPUE from all fisheries in CCAMLR.

4.6 The Working Group was encouraged by the progress made in developing assessments for exploratory fisheries (WG-FSA-04/4, paragraphs 2.13 to 2.20). It noted that an integrated software package, CASAL, provided by New Zealand, may be able to help establish assessments for *D. mawsoni* in Subarea 88.1 in the near future (see also paragraph 4.8).

4.7 The Working Group agreed that Members be requested to submit papers on a long-term management procedure for *C. gunnari* (WG-FSA-04/4, paragraphs 2.21 to 2.25).

4.8 The Working Group noted the substantial progress being made towards the inclusion of acoustic data in the assessments of abundance of *C. gunnari* in Subarea 48.3 (WG-FSA-04/4, paragraphs 2.10 to 2.12).

4.9 The Working Group noted the considerations by WG-FSA-SAM on:

(i) the evaluation of survey designs for *D. eleginoides* and *C. gunnari* (WG-FSA-04/4, paragraphs 3.1 to 3.5);

(ii) the estimation of IUU activities (WG-FSA-04/4, paragraphs 3.9 to 3.11);

(iii) alternative assessment methods for *Dissostichus* spp. including:

- (a) age-structured production models (ASPMs) (WG-FSA-04/4, paragraphs 3.13 to 3.21);
- (b) tagging (WG-FSA-04/4, paragraphs 3.22 to 3.24);
- (c) local depletion experiments (WG-FSA-04/4, paragraphs 3.25 to 3.32);

(iv) plausible operating models for *Dissostichus* spp., including:

- (a) spatial structure of populations (WG-FSA-04/4, paragraphs 3.35 to 3.42);
- (b) growth and mortality (WG-FSA-04/4, paragraph 3.43);
- (c) biomass, egg production and stock-recruitment relationships (WG-FSA-04/4, paragraphs 3.45 and 3.46);
- (d) catch equations and observation models (WG-FSA-04/4, paragraphs 3.47 to 3.50);
- (e) observation models and spatial and temporal distribution of fishing mortality (WG-FSA-04/4, paragraphs 3.51 and 3.52).

4.10 The Working Group noted the consideration by WG-FSA-SAM of the review of the GYM software (WG-FSA-04/4, paragraphs 4.1 to 4.11). Although the purpose of the review is not clearly defined, the Working Group agreed that the primary task, in terms of the software, would be in reference to its 'user-friendliness' and the degree to which users will be able to undertake the existing CCAMLR assessments using the GYM. This is further considered in paragraphs 13.9 to 13.11.

4.11 The Working Group noted that the term 'Generalised Yield Model' now had two meanings, the first of which is in reference to the assessment method for *D. eleginoides*, while the second is in reference to the software used to implement the assessment method. It was noted that the GYM is the current tool to implement the toothfish, icefish and krill assessments. As such, it would be preferable to refer to the assessment of *D. eleginoides* by some other term, such as 'recruitment-based long-term annual yield', which is used in the Standard Method Descriptions (SC-CAMLR-XXI/BG/28). This would mean that the term, GYM, refers to the implementation software for these assessments.

4.12 The Working Group noted the discussion by WG-FSA-SAM of other software, including:

- CMIX (WG-FSA-04/4, paragraphs 4.13 and 4.14)
- AD Model Builder (WG-FSA-04/4, paragraphs 4.15 and 4.19)
- Fish Heaven (WG-FSA-04/4, paragraphs 4.20 to 4.22)
- CASAL (WG-FSA-04/4, paragraphs 4.23 and 4.24).

4.13 The Working Group noted that it had tasked WG-FSA-SAM to develop an assessment timetable for the forthcoming meeting of the Working Group (SC-CAMLR-XXII, Annex 5, paragraph 9.24).

4.14 In this respect, the advice of WG-FSA-SAM on assessments in 2004 was:

(i) The technical and calculation difficulties have been overcome with the survey data of *D. eleginoides* in Subarea 48.3 and, as a result, the assessment of yield for Subarea 48.3 from last year can now be reworked as requested by the Scientific Committee last year (SC-CAMLR-XXII, paragraph 4.73). The subgroup also noted that all other assessments from last year can be undertaken, pending updated data, parameters or other information (WG-FSA-04/4, paragraph 5.2).

(ii) The subgroup had agreed that it is highly desirable for Members to circulate new or revised methods, parameters or other work well before the WG-FSA meeting in order for Members to prepare and review these submissions as much as possible prior to the Working Group meeting. Notwithstanding this, the subgroup agreed that the two-week deadline for submissions to the Working Group was still appropriate (WG-FSA-04/4, paragraph 5.3).

(iii) In reference to the request by WG-FSA for the subgroup to consider the assessment timetable for the coming meeting, the subgroup agreed that WG-FSA should be the body deciding on the assessment timetable and work plan at the Working Group meeting rather than the subgroup. As such, the subgroup agreed to recommend that the Working Group determine the assessment timetable and work plan on the first day of its meeting based on the submission of papers, including subgroup reports, and the agreement of the Working Group to proceed (WG-FSA-04/4, paragraph 5.4).

4.15 The Working Group noted the recommendations of WG-FSA-SAM for future work for developing assessment methods (WG-FSA-04/4, paragraphs 7.1 to 7.10), including:

(i) Recruitment of toothfish –

(a) investigate estimates of error (bias and precision) associated with each observation of each cohort when endeavouring to infer the effects of natural mortality on cohorts (WG-FSA-04/4, paragraph 2.8(iii)(a));

(b) investigate the potential for interannual variations in survey efficiency to influence observed densities of cohorts in each year (WG-FSA-04/4, paragraph 2.8(iii)(b));

(c) an analysis of optimal survey stratification/coverage should be undertaken at South Georgia;

(d) simulation evaluation of alternative survey designs;

(e) simulation analysis of alternative methods of estimating cohort strength, including those that attempt to take account of different catchabilities between surveys (CMIX, age–length key);

(f) development/description of plausible models for toothfish that can be used to develop operating models;

(g) growth of cohorts over time should be investigated, including reference to work on age-determination and the uncertainties in age readings (WG-FSA-04/4, paragraphs 3.6 to 3.8).

(ii) CPUE from toothfish fisheries –

(a) conduct additional research in order to develop a standardised approach to CPUE standardisation in toothfish assessments.

(iii) Assessments for exploratory fisheries –

(a) further develop an integrated stock modelling approach for the assessment of *D. mawsoni* using CASAL (WG-FSA-04/4, paragraph 2.16);

(b) simulation studies should be carried out to determine appropriate spatial and temporal scales for the effort manipulation approach (WG-FSA-04/4, paragraph 2.20);

(c) further simulation studies should be undertaken to determine how assessments for exploratory fisheries can best be used to meet the Commission objectives (WG-FSA-04/4, paragraph 2.20).

(iv) Estimating mortality and total removals of skates and rays –

(a) development of methodologies using some form of controlled, sentinel fishing so that tag and recapture programs may be used to obtain data on rajids in longline fisheries (WG-FSA-04/4, paragraph 2.46).

(v) Parameter estimation –

(a) undertake further work on length-at-age in toothfish (WG-FSA-04/4, paragraph 3.6);

(b) advise CON on the need for age–length data (WG-FSA-04/4, paragraph 3.6);

(c) develop the CCAMLR age database (WG-FSA-04/4, paragraph 3.7);

(d) request submission of papers to WG-FSA-04 dealing with apparent inconsistencies between regions in growth and mortality parameters of toothfish and icefish (WG-FSA-04/4, paragraph 3.8).

(vi) Alternative assessment methods for *Dissostichus* spp. –

(a) request submission of papers to WG-FSA on the following assessment issues:

- estimation of the level of bias and precision in biomass estimates generated from ASPM, tagging and local depletion assessment methods (WG-FSA-04/4, paragraph 3.32);
- investigation of the properties of the ASPM using an alternative likelihood function (WG-FSA-04/4, paragraph 3.21);
- reanalysis of the level of IUU fishing for toothfish in Subarea 48.3 following observed decline in CPUE series between 1995 and 1996;
- investigation of the spatial stratification of CPUE for toothfish in Subarea 48.3 and the potential for space–time interactions at smaller spatial scales;
- investigate an appropriate measure of fishing effort to be used within standardised CPUE series for toothfish in Subarea 48.3;
- comparison of alternative assessment methods for utilising toothfish tagging data within Subarea 48.3, including examination of the properties and assumptions of each method (WG-FSA-04/4, paragraph 3.23);
- consideration of how to use point estimates of biomass derived from alternative methods to calculate estimates of yield (WG-FSA-04/4, paragraph 3.24);

(b) request the Secretariat to compile comments and reviews by WG-FSA of alternative assessment methods in the past, including ASPM, depletion experiments and mark–recapture analyses (WG-FSA-04/4, paragraph 3.15);

(c) the subgroup encouraged Members to further develop operating models for toothfish and their use in evaluation of assessment methods and management procedures and to submit papers elaborating on potential functional forms and/or components of plausible models to WG-FSA-04 and WG-FSA-SAM-05 (WG-FSA-04/4, paragraph 3.53);

(d) investigate the use of an integrated stock modelling approach to the assessment of toothfish using CASAL (WG-FSA-04/4, paragraph 4.23, noting paragraph 5.5(ii)).

(vii) Assessments of *C. gunnari* –

(a) encourage Members to submit papers on the development of long-term management procedures for consideration by WG-FSA at its next meeting (WG-FSA-04/4, paragraph 2.25);

(b) to use the results of acoustic data, the following areas need to be addressed (WG-FSA-04/4, paragraph 2.39(ii)):

- discrimination of *C. gunnari* from other acoustic scatterers;
- further improvements in target strength estimates for *C. gunnari*;
- age-specific patterns in daily vertical distribution of *C. gunnari*;

(c) experimental and simulation studies will be useful in determining the appropriate design of trawl and acoustic surveys, including the use of target trawls, for use in assessments of icefish biomass (WG-FSA-04/4, paragraph 3.2).

(viii) Software –

(a) request the Secretariat to obtain information on the procedures used by RFMOs for adopting assessment software;

(b) task the Convener of WG-FSA, the Coordinator of WG-FSA-SAM and the Data Manager to submit a paper to WG-FSA-04 that develops options on procedures to review and validate software used by CCAMLR;

(c) recompile the FORTRAN version of CMIX so that it may be run under Windows XP (WG-FSA-04/4, paragraph 4.13) and has the flexibility to increase the number of minimisation evaluations able to be performed and that the performance of the new version is validated against the old version;

(d) acquire a single-user licence for AD Model Builder (and add-ons) (WG-FSA-04/4, paragraph 4.19).

(ix) Other work –

(a) request that WG-EMM consider the issues associated with discriminating between *C. gunnari* and krill in acoustic surveys in Subarea 48.3 and whether the estimates of density and abundance of krill in this area may need to be revised (WG-FSA-04/4, paragraph 2.36);

(b) request that the Scientific Committee consider how papers from non-Members be received and utilised by its working groups (WG-FSA-04/4, paragraph 3.54).

4.16 The Working Group thanked WG-FSA-SAM for its report and noted the need to further consider the role of the subgroup into the future.

Status of assessment methods

4.17 The Working Group received a number of papers with elements contributing to assessment methods for this meeting.

4.18 WG-FSA-04/65 reported that a new version of the CMIX program had been compiled with the aim to enable it to run under the most recent version of the Microsoft Windows operating system. The paper outlined the results of comparisons in performance between the new and the old version. The recompiled version of CMIX produces very similar results as compared with the original version and the differences are unlikely to result in significant differences in the estimate of long-term yield of *D. eleginoides*.

4.19 The Working Group agreed that the new version of CMIX could be used for assessments in place of the older version.

4.20 WG-FSA-04/69 presented the application of the bootstrap method to estimate accuracy of mixture distribution parameters. The method allows estimating statistical characteristics of all the parameters in CMIX procedure as well as possible correlation between parameters and bias in estimates. The application of this method to data from the UK survey in 2002 shows that accuracy of mean component length is high (CV ~0.04), but total densities have CV ~0.3–0.5. CV of parameters of linear equations used to calculate the standard deviations of the mixture components is more than 1.0. The calculations show a high correlation between some parameters. Standard errors of densities exceed the values calculated by the original CCAMLR program.

4.21 WG-FSA-04/74 investigated the design of random stratified trawl surveys as a source of information for assessments of long-term sustainable yield using the GYM for *D. eleginoides* in Division 58.5.2. The simulation approach was utilised to investigate the influence of survey design on recruitment estimation of *D. eleginoides*. The implementation includes an operating model that describes population dynamic in time with a habitat model determining the distribution and assumed ontogenetic pattern of movement to deeper water with age. The observational model consisted of 'research vessels' and 'commercial vessels'. The survey is simulated by 'research vessels' according to the specified survey design. The habitat model and observational models were implemented in Fish Heaven, a spatial simulation modelling package.

4.22 The simulations were aimed at evaluating the estimation of age-4 recruitment from direct survey estimates of ages 4 to 8 in consequent years. Optimum allocation of 111 trawl stations gave the average a percentage confidence interval of ±26.8%. Combining data from multiple surveys to estimate age-4 recruitment reduced the percentage confidence interval to ±14% and the option of sampling every second year gave a percentage confidence interval of ±19.8%.

4.23 The improved design of the trawl survey (WG-FSA-04/74) was used during the survey carried out in May 2004 in the Heard Island Plateau (Division 58.2.2). The estimates of age-4 recruitment were used to update recruitment series for a preliminary assessment of toothfish in this division (WG-FSA-04/76). The assessment was based on biological, fishery and simulation parameters identical to those used in the WG-FSA-03 GYM projection with updated catch history.

4.24 Preliminary assessment of *C. gunnari* in Division 58.5.2 based on the survey in the vicinity of Heard Island in May 2004 is presented in WG-FSA-04/77. The distribution of trawl stations between strata was changed according to the results of a review of historical survey data. The assessment was carried out using the method described by de la Mare et al. (1998) and using the GYM for short-term projection as had been done with the assessment of *C. gunnari* in Subarea 48.3.

4.25 WG-FSA-04/78 presented the preliminary assessment results of *C. gunnari* in Subarea 48.3. The assessment was based on the data from the UK trawl acoustic survey carried out in the South Georgia and Shag Rocks area in January–February 2004, but only bottom trawl survey data were used in calculations. The assessment used the standard methods based on bottom trawl survey data (de la Mare et al., 1998) and the GYM for short-term projection.

4.26 WG-FSA-04/91 presented information regarding the last modification of the GYM. This modification corrected a limitation in the use of cohorts more than one year younger than the recruitment age estimated from recruitment surveys. This limitation could result in an error in the alignment of the recruitment series with the fishing series. It was detected during the review of the methods for estimating the time series of recruitments of *D. eleginoides* for WG-FSA in 2004. The error does not affect the assessment in recent years and was corrected with a new version of the GYM now being available. The Working Group agreed that the new version should be used in assessment work this year.

4.27 WG-FSA-04/82 described the results of application of some methods to assess the state of the toothfish stocks in Subarea 48.3, among which three methods are fishery-dependent and one is fishery-independent:

(i) Traditional assessment based on the GYM application which utilised revised estimates of time series of recruitment and revised standardised CPUE series rapidly ran out of fish and resulted in 35 and 42% of the trials' estimates having a vulnerable biomass that is lower than the catch.

(ii) The ASPM model implemented the Brandão et al. (2003) in the AD Model Builder version that maximises a weighted combination of the CPUE trends and catch-length compositions failed to produce satisfactory fits with any weighted factor.

(iii) The tagging analysis based on Petersen estimates (Seber, 1985) gives the estimates of exploitable biomass for 2002, 2003 and 2004.

(iv) The local depletion method was not completed but the preliminary work is preserved, including the examination of the regression of initial CPUE on toothfish density.

4.28 The authors stated that the most consistent assessment appears to be that based on tagging data. The authors scaled the recruitment survey results keeping the CV for recruitment constant so that the median vulnerable biomass in the GYM projection corresponded with the mark–recapture estimates.

4.29 WG-FSA-04/92 investigated some inconsistencies in toothfish recruitment estimates identified at WG-FSA-03 and noted by the Scientific Committee to be considered in reviewing and evaluating the recruitment time series for *D. eleginoides* in Subarea 48.3. These inconsistencies include the problems of how to use the length-at-age information in CMIX analyses, which age groups should be included in the estimation of recruitment, and the influence of variations in catchability and elaboration of the set of decision rules to guide those attempting CMIX analyses. The investigation was carried out using a recompiled version of the CMIX program. The authors highlighted the sensitivity of the results to the length-at-age estimates used to guide the setting of parameters in CMIX. As such, they recommended that length-at-age be quickly resolved for *D. eleginoides* in Subarea 48.3. The investigation of the effects of excluding components and surveys on recruitment resulted in recommendations to exclude fish greater than 650–700 mm and include fish from 150 mm to that upper limit. On the basis of the work, six points were prepared as a checklist for proceeding in the process of estimating the time series of recruitments for toothfish.

New assessment methods

4.30 WG-FSA-04/25 presented two alternative toothfish CPUE analyses for Subarea 88.1 for the 1998 to 2003 seasons which update the preliminary analysis carried out in 2003. Estimates of relative year effect were obtained by GLM with fixed effect only and from a mixed-effect model following Candy (2003). Variables included in the analysis describe 35–46% of variation. Model diagnostics show a reasonable pattern in residuals, but the quantile-quantile plots indicate a deviation from the normal distribution. This suggests that extreme values of catch rate were not modelled well and there may be violations of model assumptions. The CPUE indices showed consistent trends in all models with a slight decline in 2001 and a large decline in 2004.

4.31 WG-FSA-04/36 described the conceptual approach to the new version of integrated assessment CASAL – C++ Algorithmic Stock Assessment Laboratory. It is a generalised stock assessment model, modelled either on age- or length-structured fishery population. Optionally, it also structured population by sex and maturity and takes into account growth. The data can be from different sources: fishery, survey or fishery biomass indices, survey proportion-at-age or proportion-at-size, mark–release observations. It generates either point estimates of the parameters (maximum posterior density or maximum likelihood) or can generate Bayesian posterior distribution using Monte Carlo Markov Chain methods. The projection stock status in the future can be based on deterministic or stochastic recruitment and can generate a number of yield measures commonly used in stock assessments. The CASAL model can be employed as an operating model simulator allowing investigation of model performance and assessing the impact of model misspecification. The model has been applied to the assessment of *D. mawsoni* in the Ross Sea. This is further discussed under Item 12.

4.32 WG-FSA-04/37 presented the further application of the ASPM which had been used to assess the state of the stock of *D. eleginoides* in the Prince Edward Islands vicinity in the last several years. This version of the model allows describing recruitment by the Beverton–Holt stock-recruitment relationship, with annual variations each treated as an estimable parameter and assumed to be lognormally distributed. The likelihood function used standardised CPUE time series and length frequencies of the catches with relative weights. The results obtained with updated data are very similar to the previous estimates and show high sensitivity to the weight multiplier used in the log likelihood objective function.

4.33 WG-FSA-04/75 presented the implementation of the exact time of release and recapture stock assessment models of Tuck et al. (in AD Model Builder) The previous version was applied to the stock of *D. eleginoides* at Macquarie Island. Recently Dr Tuck implemented the maximum likelihood estimation in AD Model Builder software. Now this software has been kindly made available to the Working Group by Dr Tuck. The paper contains descriptions of input and output files with the aim of facilitating usage of this software by members of WG-FSA-04.

Stock structure

4.34 Several papers investigated stock structure of species in different subareas. WG-FSA-04/21 contained the results of genetic structuring of the *D. eleginoides* population in the southwest Atlantic. Mitochondrial DNA data indicate a sharp genetic division between the Patagonian Shelf/North Scotia Ridge and Shag Rocks/South Georgia samples. The authors suggested that toothfish in the extreme west of Subarea 48.3 may not be from the same stock as those around Shag Rocks and South Georgia.

4.35 The same method as in the previous paper, mitochondrial DNA, and another one, introns, were used in WG-FSA-04/32 to determine genetic relationships among *D. mawsoni* from three CCAMLR areas – Subareas 48.1 and 88.1 and Division 58.4.2. It resulted in the recommendation that the Ross Sea *D. mawsoni* be treated as a separate stock unit.

4.36 Population structure of *C. gunnari* in the South Georgia area was investigated in WG-FSA-04/40. Analysis was based on the length and age structure of icefish and on the sample of morphometric measurements of 75 specimens with an average length of 22 to 23 cm, collected from different points of the area. The set of measurements includes 33 parameters. Each record in the sample refers to one of the three subdivisions: Shag Rocks and the western and eastern parts of South Georgia. There was also a sample of icefish otolith morphology data. The results obtained provide the basis to assume that the *C. gunnari* population in the South Georgia area is the major reproductive unit of the area while the shallow Shag Rocks area is a zone of life space extension or the feeding zone.

4.37 The Working Group agreed that *D. eleginoides* in Subarea 48.3 should be separated into three parts for the purposes of assessment and management. It recommended that the assessment only be applied to the area around Shag Rocks/South Georgia and that Maurice Ewing Bank to the north and the North Scotia Ridge in the west be considered as separate areas for which the Working Group does not have any information (Figure 5.5 in TOP 48.3 Fishery Report).

Assessment timetable

4.38 In order to help WG-FSA in its deliberations on the assessment timetable, Dr Constable provided an overview of the possible assessment work, the issues raised by WG-FSA-SAM and the Scientific Committee and the papers available to the meeting.

4.39 The following points were noted concerning the assessments this year:

(i) It was agreed that assessments would be undertaken according to the decision rules adopted by the Commission.

(ii) WG-FSA-SAM had been meeting intersessionally in order for it to review assessment methods prior to implementation by WG-FSA, thereby saving time at the Working Group meeting.

(iii) Evaluation of methods includes:

(a) the validation of the implementing software, scripts or worksheets
(b) examination of the methods to see that the assumptions are met
(c) simulation evaluation of the robustness of consequent advice with respect to CCAMLR objectives.

(iv) It was noted that the Working Group needs to consider what constitutes an adequate evaluation in order for the Working Group to use a method in its assessment work and in developing its advice to the Scientific Committee. This was referred to the general discussion in Item 12.

(v) This year, it was agreed to give attention to validating the implementation of methods submitted in papers to the Working Group as well as testing the assumptions of methods if possible. This would include sensitivity analyses.

4.40 This year, all the assessment work was undertaken with submitted preliminary assessments reviewed independently in consultation with the authors. The outcomes of the assessments were reported in the new Fishery Reports.

ASSESSMENTS AND MANAGEMENT ADVICE

New and exploratory fisheries

5.1 CCAMLR-XXIII/38 addressed the Commission's request that the Secretariat develop a procedure for forecasting closures in SSRUs (CCAMLR-XXII, paragraph 9.20). Key points of relevance to WG-FSA were summarised by Dr Ramm. WG-FSA noted that in 2003/04 the Secretariat had monitored 155 catch limits. A number of difficulties had been encountered while monitoring, and these had resulted in eight instances where catches exceeded their catch limits (over-runs). Factors which contributed to the over-runs included rapid changes in fishing pattern; the late submission of catch and effort reports; difficulties in forecasting closures in SSRUs, time lags and small catch limits, failure to monitor all by-catch species codes, and an unexpected communication problem between the Secretariat, a Member and its flagged vessels. As a result, the Secretariat had identified a number of changes which may improve the monitoring and management of CCAMLR fisheries.

5.2 The Working Group noted that the paper had implications for management which were not within the remit of Working Group. Those aspects of the paper however that would impact on the work of WG-FSA were discussed; particularly the issue of large numbers of vessels fishing in SSRUs which might impact on the ability of the Working Group to adequately interpret CPUE data and also affect the efficacy of the move-on rule to limit by-catch in the fishery.

5.3 The Working Group noted that there were alternative options for managing catch limits in SSRUs that could also be examined, such as:

- improving the forecasting methods for predicting closure
- multi-year catch limits
- open/closed SSRUs.

5.4 SC-CAMLR-XXIII/7 by the Delegation of Ukraine proposes amending a number of conservation measures that relate to exploratory *Dissostichus* spp. fisheries in Subarea 88.1 (Conservation Measure 41-09), Division 58.4.2 (Conservation Measure 41-05) and Division 58.4.1 (Conservation Measure 41-11).

5.5 SC-CAMLR-XXIII/7 stated that the proposed amendment to Conservation Measure 41-09 in Subarea 88.1 is based on the assumption that an error was made in the allocation of catch limits for *Dissostichus* spp. between SSRUs in Subarea 88.1 because 'the historical fishery data used were principally those for the year in which the fishery was conducted only by New Zealand which fished virtually throughout the whole of the Ross Sea because of the abnormally warm summer'.

5.6 The Working Group noted that this was incorrect, pointing out that the analysis to estimate fish density in each SSRU was based on the total catch of *Dissostichus* spp. divided by total effort by all vessels in each SSRU over the history of the fishery using a data extract made by the Secretariat during WG-FSA in 2003 (SC-CAMLR-XXII, paragraph 5.37). Thus, the allocation of catch limits already fulfils suggestion 3 of SC-CAMLR-XXIII/7, namely that one of the main criteria for allocating catch limits between SSRUs should be average CPUE from historical fishery data for all vessels.

5.7 The amendment to Conservation Measure 41-05 proposed in SC-CAMLR-XXIII/7 suggested:

(i) Australia provides a report on the implementation of paragraph 3 of Conservation Measure 41-05;

(ii) the deletion of paragraph 3 of Conservation Measure 41-05 based on the 'triviality of the argument for the protection of benthic communities' and 'taking into consideration the large numbers of vessels and uncertain ice conditions';

(iii) setting a catch limit for each SSRU in Division 58.4.2 of at least 500 tonnes of *Dissostichus* spp., i.e. no less than 2 500 tonnes for the whole division;

(iv) to allow only one vessel from each country to fish in the division during the forthcoming season;

(v) to allow each vessel to harvest no more than 200 tonnes of fish in each SSRU in Division 58.4.2.

5.8 The amendment to Conservation Measure 41-11 proposed in SC-CAMLR-XXIII/7 suggested:

(i) the deletion of paragraph 3 of Conservation Measure 41-11 based on the 'triviality of the argument for the protection of benthic communities' and 'taking into consideration the large numbers of vessels and uncertain ice conditions';

(ii) a catch limit of not more than 150 tonnes of *Dissostichus* spp. be set for each SSRU in Division 58.4.1, i.e. no less than 1 200 tonnes for the whole division;

(iii) to allow only one vessel from each country to fish in the division during the forthcoming season;

(iv) that each vessel be allowed to harvest no more than 70 tonnes of fish in each SSRU in Division 58.4.1.

5.9 Dr Constable noted that Australia had provided a report to WG-FSA this year on its fishing activities in Divisions 58.4.2 and 58.4.3b (WG-FSA-04/66). Additionally, research trawls in Division 58.4.2 by Australia had demonstrated that there were significant benthic communities present in waters shallower than 600 m which would be likely to be negatively impacted on by commercial fishing. In addition, recent video footage taken during a research cruise in Prydz Bay (Division 58.4.2) showed substantial abundance and diversity of benthic communities on the shelf areas.

5.10 For operational reasons related to ice conditions in high latitudes and in order to fulfil requirements in terms of research sets, it may be necessary to have the entire (10°) SSRU either open or closed rather than half the SSRU, consistent with the approach adopted for Division 58.4.1 at CCAMLR-XXII (Conservation Measure 41-11).

New and exploratory fisheries in 2003/04

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

5.12 Fishing occurred only with respect to the following fisheries: Subarea 48.6 north of 60°S (7 tonnes), Divisions 58.4.2 (20 tonnes), 58.4.3b (7 tonnes), Subareas 88.1 (2 166 tonnes) and 88.2 (375 tonnes) (Table 5.1). Fishery Reports have been prepared for Subareas 88.1 and 88.2 as these were the only two areas with significant levels of fishing activity.

Table 5.1: Summary table for exploratory fisheries in 2003/04.

Exploratory fisheries in Area 48 (Atlantic Ocean sector)

Subarea/Division	Member	Number of vessels		Reported catch (tonnes) of *Dissostichus* spp.
		Notified	Fishing	
48.6 north of 60°S	Argentina	2	0	
	Japan	1	1	
	Namibia*	6	0	
	New Zealand*	3	0	
	South Africa*	2	0	
	Spain	1	0	
Total	6	15	1	7
48.6 south of 60°S	Argentina	2	0	
	Namibia*	6	0	
	New Zealand*	3	0	
	South Africa*	2	0	
	Spain	1	0	
Total	5	14	0	0

* Withdrawn

Exploratory fisheries in Area 58 (Indian Ocean sector)

Subarea/Division	Member	Number of vessels		Reported catch (tonnes) of *Dissostichus* spp.
		Notified	Fishing	
58.4.1	Argentina	2	0	
	Australia	1	0	
	Namibia*	1	0	
	USA	2	0	
Total	4	6	0	0
58.4.2	Argentina	2	0	
	Australia	3	1	
	Namibia*	2	0	
	Russia	4	0	
	Ukraine	2	0	
	USA	2	0	
Total	6	15	1	20

(continued)

Table 5.1 (continued)

Subarea/Division	Member	Number of vessels		Reported catch (tonnes) of *Dissostichus* spp.
		Notified	Fishing	
58.4.3a	Argentina	2	0	
	Australia+	3	0	
	Namibia*	2	0	
	Russia	4	0	
	Ukraine	2	0	
	USA	2	0	
Total	6	15	0	0
58.4.3b	Argentina	2	0	
	Australia	3	1	
	Namibia*	2	0	
	Russia	4	0	
	Ukraine	2	0	
	USA	2	0	
Total	6	15	1	7

* Withdrawn + Trawl notification withdrawn

5.13 In most of the active exploratory fisheries, the fishing effort was low and the catches reported were relatively small. As has been the case for the last few years, the notable exception was the exploratory fishery for *Dissostichus* spp. in Subarea 88.1 conducted under Conservation Measure 41-09. A total of 2 166 tonnes of *Dissostichus* spp. was taken against a catch limit of 3 250 tonnes (paragraphs 5.50 to 5.53 and Table 5.2).

5.14 The total catch limit of 375 tonnes was taken solely by New Zealand in the exploratory *Dissostichus* spp. fishery in Subarea 88.2 (paragraph 5.56 and Table 5.3).

5.15 The exploratory fishery in Division 58.4.2 was undertaken by one Australian-flagged vessel which caught 20 tonnes of *Dissostichus* spp. against a catch limit of 500 tonnes. Fishing was carried out in SSRUs D and E (WG-FSA-04/66).

5.16 An exploratory fishery in Division 58.4.3b was undertaken for the first time by one Australian-flagged vessel which caught 7 tonnes of *Dissostichus* spp. against a catch limit of 300 tonnes (WG-FSA-04/66).

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

5.18 As part of Conservation Measure 41-01 all vessels are required to carry out a research plan which includes completing a minimum number of research sets on entering an SSRU. An extract of fine-scale data of vessels fishing in new and exploratory fisheries prepared by the Secretariat during the meeting was analysed by vessel and SSRU. The Working Group welcomed the results from some vessels which exceeded their required quota of research sets. However there were a number of instances (17%) where vessels failed to complete any research sets. There were also many cases where a vessel conducted some research sets but failed to complete the required quota (11%) even though more commercial sets were completed. Thus, in 28% of cases the required number of research sets were not completed as required under Conservation Measure 41-01. The Secretariat noted that it is unable to determine whether the above cases are because research sets were not done or because they were not submitted or specified correctly as research sets. The Working Group reiterated the necessity for submission of data under Conservation Measure 41-01 and urged Members to ensure that the required research sets are completed and data submitted to the Secretariat in a timely manner and accurate format.

5.19 An additional requirement specified in Conservation Measure 41-01 is that each longline vessel fishing in exploratory fisheries for *Dissostichus* spp. is required to tag and release *Dissostichus* spp. at the rate of one toothfish per tonne of green-weight catch throughout the season. Only six vessels out of 26 vessels fishing have reported tagging *Dissostichus* spp. in new and exploratory fisheries. The numbers of toothfish tagged by these six vessels were 4, 11, 9, 4, 49 and 216 respectively. There was not enough time available at the meeting to determine how these tag rates corresponded to the catch weight of *Dissostichus* spp. and whether they fulfilled the requirements of Conservation Measure 41-01. In addition, the Secretariat noted that there was reference to tagging in some observer reports from other vessels but that no tagging data was submitted. The Working Group noted its concern that the tagging requirements, as specified in Conservation Measure 41-01, were not being met by all vessels. It reiterated the importance for Members to conduct tagging and to submit data in accordance with Conservation Measure 41-01.

5.20 The Working Group noted that some sets or hauls reported as commercial data may meet the requirements of a research set/haul if they were separated by the required minimum distance, included the required number of hooks and satisfied the required soak time/effective fishing time. The Working Group suggested that the Secretariat could investigate methods for identifying sets that matched the criteria of the research plan under Conservation Measure 41-01 (e.g. 'Data Loser' (SC-CAMLR-XX, Annex 5, paragraph 4.31) although additional algorithms that incorporated soak time and number of hooks would need to be included). This data could then be used to investigate the spatial distribution of fishing effort/catch rates.

5.21 WG-FSA requested advice from the Scientific Committee regarding presentation of the data on research sets and tagging rates completed by Members as required under the Research and Data Collection Plan in Conservation Measure 41-01.

New and exploratory fisheries in 2004/05

5.22 A summary of new and exploratory fisheries notifications for 2004/05 is given in Table 1 of SC-CAMLR-XXIII/BG/3.

5.23 No notifications have been received from Members for exploratory fisheries in closed areas.

5.24 No notifications have been made for new fisheries.

5.25 Thirteen Members submitted a total of 26 notifications for exploratory fisheries for *Dissostichus* spp. in Subareas 48.6, 88.1, 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b.

Notification for exploratory bottom trawling in Subarea 48.3

5.26 There was one notification for an exploratory bottom trawl fishery for *C. gunnari* in Subarea 48.3. Although not strictly requiring notification under the exploratory fishery measure (Conservation Measure 21-02), WG-FSA welcomed the submission of this proposal for the group's consideration.

5.27 Concern about by-catch of fish species such as *Chaenocephalus aceratus*, *Pseudochaenichthys georgianus*, or *Gobionotothen gibberifrons*, had initially led to the prohibition on the use of bottom trawls in the directed fishery for *C. gunnari* in Subarea 48.3.

5.28 Dr D. Agnew (UK) explained that the motivation behind the proposal for an exploratory bottom trawl fishery in Subarea 48.3 (CCAMLR-XXIII/16) was to find a method of fishing, combining both bottom and midwater trawls that would reduce the impact of the icefish fishery on birds while minimising, as far as possible, impacts on benthos. The proposal formed part of industry initiatives to reduce bird by-catch, including trials of the various mitigation measures detailed in paragraphs 7.218 to 7.220. The icefish fishery in Division 58.5.2 successfully uses bottom trawls with low adverse impacts on benthos, other fish or birds, and the proposal intended to make use of the experience and gear technology currently being employed in that division in application to Subarea 48.3.

5.29 The exploratory fishery would undertake rigorous monitoring of benthic impacts and fish by-catch during bottom trawls and seabird interactions throughout. By-catch of fish would be counted against the catch limits in Conservation Measure 33-01. The proposal analysed the distribution of sensitive benthos (sponges and corals) encountered in the UK bottom trawl surveys, finding that they were most abundant in the east of the South Georgia shelf. The proposal defined an area for the bottom trawl fishery to avoid these concentrations, restricting it to the west and northwest of the shelf.

5.30 Some members felt that it would be very difficult to assign certain fishing areas to a commercial fishery in advance. Any commercial fishery is likely to move to areas where fish concentrations are being found irrespective if it is in the west or the east of the island. Dr Agnew confirmed that the vessel would not be permitted to fish with bottom trawls outside the defined area.

5.31 Some members were concerned that bottom trawling in this area would cause undue damage to by-catch species and benthic communities, at least locally, even if a light ground tackle is used. They advised against any bottom trawl fishery for icefish in Subarea 48.3. These members felt other mechanisms for reducing seabird mortality should be investigated, and that bottom trawling should not be resumed at the current state.

5.32 Dr C. Jones (USA) noted that in his opinion the maps of abundance and composition of benthic invertebrates from the ICEFISH 2004 cruise (WG-FSA-04/61) largely conflicted with the benthos impact maps set out in the UK notification. The ICEFISH cruise demonstrated sponge dominated communities on the northern and eastern shelf areas that were consistent with the results from the UK surveys. The ICEFISH cruise found also that the western part of the shelf in the proposed bottom trawling areas contained areas with high abundance of invertebrate communities that, although dominated by echinoderms, included abundant hexactinellids (glass sponges) and corals. In contrast, the UK fish surveys found sparse to absent 'key benthic species' in this area.

5.33 Dr Agnew commented that the differences between the benthos distribution data presented in CCAMLR-XXIII/16 and WG-FSA-04/61 were probably due to sampling method and survey design. The UK bottom trawl surveys covered a much wider area and undertook more hauls than the ICEFISH 2004 cruise (WG-FSA-04/61), but the latter used gear that fished closer to the seabed.

5.34 Given the fact that the design of the ground tackle and other parts of the front end of the net may have a significant effect on the ability of the net to catch benthos and non-target species, Dr K.-H. Kock (Germany) suggested that in undertaking such an assessment, the involvement of a gear technology specialist would be useful.

5.35 Another reason why some members were opposed to the resumption of bottom trawling in Subarea 48.3 was the potential for negative impacts on fish by-catch. A recently discovered nest-guarding parental care strategy used by *C. aceratus* is presented in WG-FSA-04/26. This species, as well as others that exhibit this strategy of parental care, would be seriously impacted by fishing techniques that damage the seabed, such as bottom trawling at the time *C. aceratus* and possibly other species guard their nests.

5.36 Dr Agnew pointed out that *C. aceratus* spawn in March–May at South Georgia (Kock, 1992) which is likely to be after the experimental bottom trawl fishery. By-catch limits are set for *C. aceratus* in Conservation Measure 33-01.

5.37 The Working Group recognised that in order to assess the likely impact of a future bottom trawl fishery on benthos, it would be necessary for the experimental fishery to obtain information on benthos over a significant part of the proposed area. It recalled the method for exploring the potential impacts of bottom trawling in new and exploratory fisheries undertaken in Division 58.4.2 (Conservation Measure 43-04). The Working Group considered that the rockhopper gear that would be used might not sample benthos efficiently. It recommended that the vessel should undertake experimental work by deploying a trawl that could fish closer to the bottom, such as a beam trawl, in order to better sample benthos. Such work should be sufficient to provide coverage of the area to determine how effectively the rockhopper gear retains by-catch of benthos as well as to indicate the relative abundance of benthos in the areas most likely to be fished into the future compared to other areas.

5.38 Some members recommended that an assessment of the potential for a bottom trawl fishery for icefish in Subarea 48.3 should be made following the conclusion of the experimental fishery. This assessment should consider the potential contribution of bottom trawling to minimising the by-catch of birds in the icefish fishery, as well as the impacts on benthos and mitigation of those impacts. The UK was requested to ensure that the data collected were sufficient to enable this analysis.

5.39 Other members felt that it would be unwise to embark on the reintroduction of any bottom trawling in Subarea 48.3.

Notifications for exploratory *Dissostichus* spp. fisheries

5.40 The numbers of vessels notified for exploratory fisheries for *Dissostichus* spp. in 2004/05 are shown, grouped by subarea or division, in Table 2 of SC-CAMLR-XXIII/BG/3.

All notifications were submitted by the deadline. As was the case last year, there were multiple notifications of exploratory fisheries for *Dissostichus* spp. for several subareas or divisions.

5.41 In 2003, the Commission introduced a cost recovery system in new and exploratory fisheries. It was agreed that a payment of A$8 000 should accompany each notification of a new and exploratory fishery (CCAMLR-XXII, paragraphs 3.16 to 3.23). This payment consists of a fee of A$3 000, representing the recovery of administrative costs, and a sum of A$5 000 to be refunded on commencement of fishing in accordance with the conservation measures in force.

5.42 There have been a very large number of notifications for fishing in Subareas 88.1 (10 notifications for up to 21 vessels), 88.2 (five notifications for up to 10 vessels) and Subareas 48.6 and Divisions 58.4.1, 58.4.2 and 58.4.3b (between 7 and 11 vessels). Depending on the size of the precautionary catch limits, this implies that if all vessels operated simultaneously, the available catch per vessel could be lower than that required for economic viability, especially for those vessels operating in high latitudes where fishing imposes considerable operational difficulties.

5.43 The large number of notifications for exploratory fisheries, if translated into a large number of vessels fishing, may lead to issues with the standardisation of CPUE data for assessments (WG-FSA-04/25; Fishery Report for Subareas 88.1 and 88.2, paragraph 5.68) and may also reduce the effectiveness of the move-on rule for by-catch (paragraphs 6.72 and 6.73).

5.44 The Working Group noted that it is likely that there will be additional administrative problems in determining closure dates for fishing in SSRUs when many vessels are fishing simultaneously in a subarea or division (CCAMLR-XXIII/38).

5.45 WG-FSA-04/18 summarised a proposal by the Delegation of Japan to extend the fishing season for the exploratory fishery for *Dissostichus* spp. in Subarea 48.6 in the 2004/05 season. The fishing season is defined under Conservation Measure 41-04 (2003) as being 'from 1 March to 31 August'. The proposed extension would change this definition to 'from 1 December to 31 August'. This proposal is discussed under Item 7 where it was noted that it does not conflict with the IMAF assessment (paragraphs 7.193 to 7.196 and Table 7.16).

5.46 SC-CAMLR-XXIII/BG/19 proposed conducting an experimental set-up of combined bottom-vertical longlines for the exploratory fisheries for *D. mawsoni* in Subareas 88.1 and 88.2 in order to determine whether *D. mawsoni* occur in the meso- and bathypelagic areas. The Working Group encouraged work of this kind and noted that this experiment should be conducted within the guidelines of existing conservation measures and noted that there may be implications for IMAF depending on the sink rate of lines and whether hooks were set at the surface. In addition, the Working Group noted that if the objective is to estimate the depth range at which *Dissostichus* spp. may be caught, then a series of longlines could be set, each longline with hooks in a particular depth band. If each line has hooks at all depths then fish may follow the 'food trail' up the longline thus confounding results.

Progress towards assessments of new and exploratory fisheries

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

5.48 Given the large number of notifications for the 2004/05 fishing year, the Working Group reiterated the urgent need to develop a means for estimating abundance and providing assessments of stock status for exploratory fisheries.

5.49 WG-FSA-04/36 and WG-FSA-SAM-04/8 detailed methods and approaches that might be used to monitor abundance and estimate precautionary yields. These issues, in relation to progress towards an assessment in Subarea 88.1 and future research requirements, are discussed in detail in the Fishery Report for Subareas 88.1 and 88.2, paragraphs 5.69 to 5.75.

Fishery Report: Exploratory fishery for *Dissostichus* spp. in Subareas 88.1 and 88.2

1. Details of the fishery

1.1 Reported catch

5.50 The number of vessels active in fisheries for *Dissostichus* spp. in Subareas 88.1 and 88.2 during the current year is shown in Tables 5.2 and 5.3 respectively.

Table 5.2: Number of vessels authorised in Conservation Measure 41-09, number of vessels that fished, and the catch of *Dissostichus* spp. in Subarea 88.1 in 2003/04 (source: catch and effort reports).

Member	Vessels authorised in CM 41-09	Number of vessels that fished	Reported catch (tonnes)		
			D. mawsoni	*D. eleginoides*	Total
Argentina	2	2	162	1	163
Japan	1	0	0	0	0
Korea, Rep. of	2	2	114	0	114
New Zealand	6	4	729	1	729
Norway	1	1	98	0	98
Russia	2	2	283	0	283
South Africa	2	1	110	0	110
Spain	2	1	114	0	114
Ukraine	3	3	153	9	162
UK	1	1	16	0	16
USA	2	2	185	1	187
Uruguay	2	2	190	0	191
Total	26	21	2154	12	2166

Table 5.3: Number of vessels authorised in Conservation Measure 41-10, number of vessels that fished, and the catch of *Dissostichus* spp. in Subarea 88.2 in 2003/04 (source: catch and effort reports).

Member	Vessels authorised in CM 41-10	Number of vessels that fished	Reported catch (tonnes)		
			D. mawsoni	*D. eleginoides*	Total
Argentina	2	0	0	0	0
Korea, Rep. of	2	0	0	0	0
New Zealand	6	3	374	<1	375
Norway	1	0	0	0	0
Russia	2	0	0	0	0
South Africa	2	0	0	0	0
Ukraine	3	0	0	0	0
Total	18	3	374	<1	375

5.51 The catch limit for Subarea 88.1 was 3 250 tonnes, and for Subarea 88.2 was 375 tonnes.

5.52 The fishery was active from 1 December 2003 to 31 August 2004 for Subarea 88.1, and 1 December 2003 to 6 March 2004 for Subarea 88.2.

5.53 The fishery saw a steady expansion of effort from 1997/98 to 2000/01, a slight drop in 2001/02, followed by an increase in 2002/03, and an almost three-fold increase in 2003/04. The catch of *D. mawsoni* has shown a steadier increasing trend over the same period, peaking at 2 166 tonnes in Subarea 88.1 and 374 tonnes in Subarea 88.2 for the 2003/04 season. There has been a general trend towards fishing deeper over the course of the exploratory fishery, though in 2003/04 fishing was slightly shallower than 2002/03 (WG-FSA-04/20).

5.54 Although the total catch was about 67% of the catch limit for Subarea 88.1, catch limits in SSRUs B, C, G and H (see Figure 5.2), were exceeded by 1.8, 2.2, 0.1 and 199 tonnes respectively. Heavy ice conditions restricted fishing south of 73°S. Consequently little catch was taken in SSRUs 881J–L. With the southern SSRUs closed from ice, the fishery was effectively closed from mid-March 2004 (WG-FSA-04/20).

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

5.56 In Subarea 88.2, the catch limit of 375 tonnes was fully taken (375 tonnes), and the fishery was closed on 6 March 2004. Fishing was carried out in SSRUs 882A, B, E and G, although no catch was recorded in SSRU 882G. Most of the catch (362 tonnes) was taken in SSRU 882E.

5.57 The historical catches for Subareas 88.1 and 88.2 are given in Tables 5.4 and 5.5.

Table 5.4: Catch history for *Dissostichus* spp. in Subarea 88.1 (source: STATLANT data to 2002/03, and catch and effort data in 2003/04).

Fishing season	Reported catch (tonnes)	Estimated IUU catch (tonnes)	Total (tonnes)	Catch limit
1996/97	<1	0	<1	1980
1997/98	42	0	42	1510
1998/99	297	0	297	2281
1999/00	751	0	751	2090
2000/01	660	0	660	2064
2001/02	1325	92	1417	2508
2002/03	1831	0	1831	3760
2003/04	2166	240	2406	3250

Table 5.5: Catch history for *Dissostichus* spp. in Subarea 88.2 (source: STATLANT data to 2002/03, and catch and effort data in 2003/04).

Fishing season	Reported catch (tonnes)	Estimated IUU catch (tonnes)	Total (tonnes)	Catch limit
1996/97	0	0	0	1980
1997/98	0	0	0	63
1998/99	0	0	0	0
1999/00	0	0	0	250
2000/01	0	0	0	250
2001/02	41	0	41	250
2002/03	106	0	106	375
2003/04	374	0	374	375

1.2 IUU catch

5.58 The total estimated IUU catch in Subarea 88.1 was 240 tonnes in 2003/04. The only previously estimated IUU catch in Subarea 88.1 was 92 tonnes in 2001/02.

5.59 The Working Group noted that caution should be exercised in using the IUU data for Subarea 88.1. The estimates of IUU catch were based on an assumption that two IUU vessels fished for a period of 40 days each in Subarea 88.1, at a catch rate of 3 tonnes per day. The estimates were based on sightings of two unidentified vessels that occurred on one day only (9 February 2004). While the accuracy of the sightings is not in doubt, the Working Group noted that subsequent aerial surveillance of the Ross Sea by New Zealand did not detect any IUU vessel activity.

5.60 There was estimated to be no IUU catch in Subarea 88.2 in 2004, as was the case for previous years.

1.3 Size distribution of the catches

5.61 Mean length and age of *D. mawsoni* in the catch has increased over the course of the fishery, with most fish caught in 2003/04 between 100 and 170 cm TL (WG-FSA-04/84 Rev. 1 and 04/89).

5.62 Mean length and age of the *D. mawsoni* catch have generally increased in the past few years. Smaller fish tended to be caught closer to the shore, in the southern areas, with the larger fish caught on the northern offshore zone of the Ross Sea (WG-FSA-04/20, 04/25, 04/28 Rev. 1, 04/34, 04/84 Rev. 1 and 04/89).

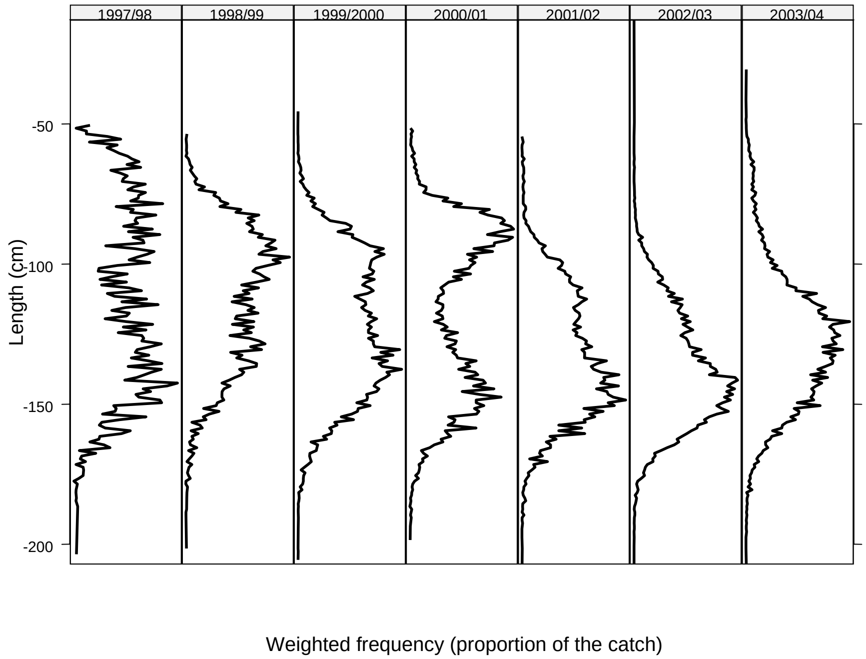


Figure 5.1: Catch-weighted length frequencies for *Dissostichus mawsoni* in Subarea 88.1 (source: observer, fine-scale and STATLANT data reported by 6 October 2004).

2. Stocks and areas

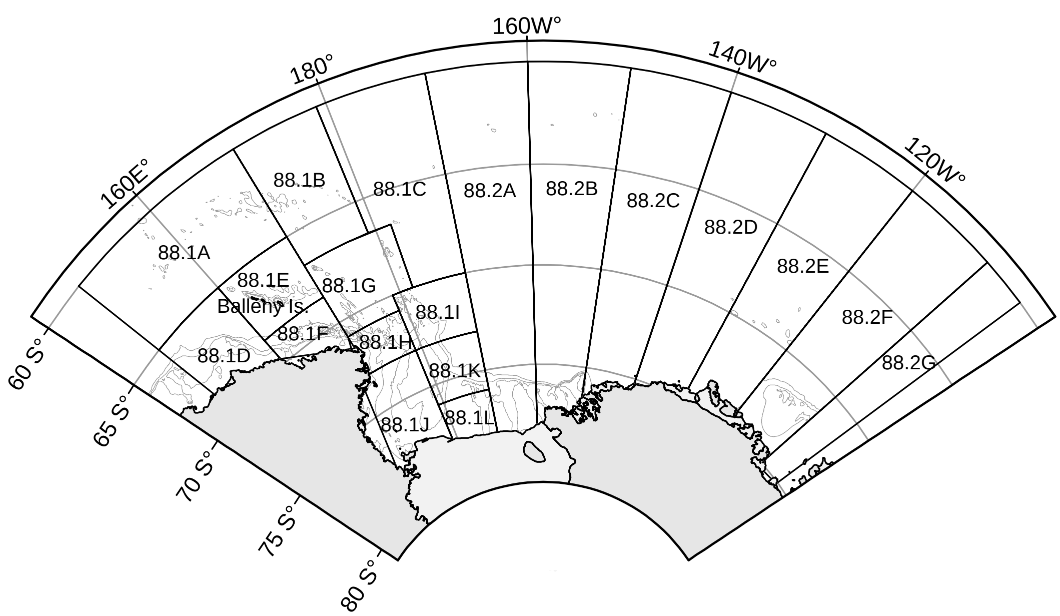


Figure 5.2: The Ross Sea, showing Subareas 88.1 and 88.2, and the subarea SSRUs (depth contours shown are at 500, 1 000 and 2 000 m).

5.63 Analysis of the genetic diversity for *D. mawsoni* from Subareas 48.1 and 88.1 and Division 58.4.2 found weak genetic variation between the three areas (WG-FSA-04/32). The weak genetic differentiation is supported by oceanic gyres, which may act as juvenile retention systems, and by limited movement of adult tagged fish.

5.64 Fully mature female fish were found in Subarea 88.1 in December (three months earlier than in the previous season) and in Subarea 88.2 for the first time. The onset of spawning may occur in December, continuing until at least June in both Subareas 88.1 and 88.2. Spawning is suspected to occur on isolated geographic features north of the main Antarctic shelf areas (WG-FSA-04/28 Rev. 1 and 04/35).

5.65 The Working Group recommended that Subareas 88.1 and 88.2 be treated as a single stock unit for assessment purposes, and that further research be undertaken on the stock structure of *D. mawsoni*.

3. Parameter estimation

3.1 Estimation methods

<u>Standing stock</u>

5.66 There are no estimates of the standing stock.

<u>Population structure</u>

5.67 The age composition of the commercial catch is given in WG-FSA-04/20. In the past three years, the catch composition has been dominated by fish aged 8 to 30 years (range 3 to 48 years).

<u>Standardised CPUE analysis</u>

5.68 A standardised CPUE analysis of the three main fishing grounds in Subarea 88.1 showed no significant trend from 1998/99 to 2002/03, but showed a large decline in 2003/04 (WG-FSA-04/25). The decline in 2003/04 was thought to be related to a combination of extreme ice conditions and effects from a large number of vessels operating in a confined area. The Working Group recommended that further intersessional work be undertaken to incorporate these effects within the CPUE standardisation. The CPUE indices are given in the Table 5.6.

Table 5.6: Standardised CPUE indices (catch/hook) for all vessels in Subarea 88.1 for 1998/99 to 2003/04.

Fishing season	Index	95% CI	CVs
1998/99	1.15	0.97–1.35	0.082
1999/00	1.10	0.99–1.23	0.053
2000/01	0.85	0.76–0.96	0.057
2001/02	1.20	1.08–1.32	0.052
2002/03	1.15	1.04–1.27	0.050
2003/04	0.67	0.61–0.74	0.050

3.2 Parameter values

Fixed parameters

Table 5.7: Parameter values for *Dissostichus mawsoni* in Subarea 88.1.

Component	Parameter	Value		Units
		Male	Female	
Natural mortality	M	0.15–0.2	0.15–0.2	y^{-1}
VBGF	K	0.102	0.095	y^{-1}
VBGF	t_0	0.31	0.50	y
VBGF	L_∞	170.3	184.5	cm
Length to mass	‘*a*’	0.00000986	0.00000617	cm, kg
Length to mass	‘*b*’	3.0335	3.1383	
Maturity	L_{m50}	100	100	cm
Range: 5 to 95% maturity		85–115	85–115	cm

4. Stock assessment

4.1 Calculation of existing catch limits

5.69 Previously, the Working Group used the approach for calculating precautionary catch limits for *Dissostichus* spp. for Subarea 88.1 outlined in SC-CAMLR-XIX, Annex 5, paragraphs 4.20 to 4.33. This approach was based on analogy with *D. eleginoides* in Subarea 48.3, and was scaled by the estimates of mean recruitment in that population, and as such cannot be considered an independent assessment. The Working Group noted that this method was no longer considered appropriate for estimating yields for Subareas 88.1 or 88.2 (SC-CAMLR-XXII, paragraphs 4.186 and 4.189).

5.70 The Working Group recalled that catch limits should be applied separately for each SSRU and should reflect the fishable seabed area and fish density from that SSRU (SC-CAMLR-XXII, Annex 5, paragraph 5.36). The Working Group agreed that there was no new evidence presented to suggest that the SSRU catch limits should be revised.

5.71 There was no stock assessment available for the current year.

4.2 Progress towards assessment

5.72 The Working Group welcomed the development of an integrated assessment model using CASAL for Subarea 88.1 (WG-FSA-04/36). Catch, CPUE, proportions-at-age in the catch, and New Zealand vessels' tag–release and tag–recapture data from Subarea 88.1 were included with an illustrative model using the generalised stock modelling software CASAL.

4.3 Future research requirements

5.73 The Working Group recalled that WG-FSA-03 recommended the development of stand-alone methods to monitor abundance and estimate precautionary yields in Subarea 88.1. The Working Group also noted that WG-FSA-SAM-04 agreed that further development of an integrated stock-modelling approach to the assessment of *D. mawsoni* using CASAL would be desirable. WG-FSA-SAM-04 made the following recommendations:

(i) The model should be further developed, and should investigate methods for addressing problems with the existing fishing selectivity parameterisation.

(ii) Approaches to the validation of the software should be investigated (e.g. the simulation model used to evaluate the assessment of toothfish at Macquarie Island based on a mark–recapture model could be used).

(iii) Operating/simulation model approaches should be developed to investigate the following issues:

- evaluate selectivity versus availability issues;
- number of recaptures required for suitably precise estimates of biomass and yield;
- evaluate potential biases associated with closure of areas between years due to ice;
- tagging protocols (e.g. size, location and number of fish to tag);
- explore consequences of alternative model structural assumptions;
- use of research sets to provide contrast with commercial CPUE;
- alternative tagging estimators (e.g. Macquarie Island approach).

5.74 The Working Group noted that alternative methods of monitoring and assessing toothfish in new and exploratory fisheries were presented at WG-FSA-SAM-04 (WG-FSA-SAM-04/8). The papers recommended that tag–recapture experiments be used in conjunction with experimental manipulation of effort to monitor toothfish – and perhaps as importantly – the wider ecosystem effects of the toothfish fisheries. The papers further noted that simulation studies be carried out to determine the best way to use the effort manipulation.

5.75 The Working Group thanked New Zealand for the work that had gone into the development of an integrated modelling approach, and the examination of alternative approaches for monitoring abundance during the intersessional period.

5. By-catch of fish and invertebrates

5.1 By-catch removals

5.76 Appendix 3 of CCAMLR-XXIII/38 provided summaries of total removals of macrourids, rajids and other species by SSRU in Subarea 88.1. Data on by-catch in the exploratory fishery in Subareas 88.1 and 88.2 were described and analysed in WG-FSA-04/20. History of catch and limits are given for Subareas 88.1 and 88.2 in Tables 5.8 and 5.9 respectively.

Table 5.8: Reported by-catch landings for 1997/98 to 2003/04 in Subarea 88.1.

Fishing season	Macrourids		Rajids		Others	
	Catch	Limit	Catch	Limit	Catch	Limit
1997/98	9		5		1	
1998/99	22		39		5	50
1999/00	74		41		7	50
2000/01	62		9		14	50**
2001/02	154		25		10	50**
2002/03	67	140+#	11	50+	12	20+
2003/04	319	520†	23	163*	23	20

† or 16% of toothfish catch
* or 5% of toothfish catch
\# 50 for SSRU A
** for each SSRU

Table 5.9: Reported by-catch landings for 2000/01 to 2003/04 in Subarea 88.2.

Fishing season	Macrourids		Rajids		Others	
	Catch	Limit	Catch	Limit	Catch	Limit
2000/01	0		0		0	
2001/02	4		0		0	
2002/03	18	50†	0	60*	8	20+
2003/04	37	60†	0	50*	8	20

† or 16% of toothfish catch
* or 5% of toothfish catch
\+ by SSRU

5.77 The Working Group expressed concern that three by-catch limits were exceeded in Subarea 88.1 during the 2003/04 exploratory fishery:

(i) the limit of 124.2 tonnes for *Macrourus* spp. in SSRU 881I was exceeded by 141 tonnes (114%);

(ii) the limit of 20 tonnes for *Macrourus* spp. in SSRU 881E was exceeded by 12.2 tonnes (61%);

(iii) the limit of 20 tonnes for 'all other combined species' in SSRU 881I was exceeded by 1.8 tonnes (9%).

5.2 Assessments of impacts on affected populations

5.78 The estimate of γ for *M. whitsoni* in Subarea 88.1 in 2003 was 0.01439 (SC-CAMLR-XXII, paragraph 4.132). This indicates that *M. whitsoni* has relatively low productivity and thus may be vulnerable to overexploitation.

5.79 Mean standardised catch rates for *M. whitsoni* and *B. eatonii* were calculated from bottom trawls carried out during the BioRoss survey in February–March 2004 (paragraphs 6.7 to 6.15). However, trawl catch rates did not provide good estimates of standing stock for SSRU 881E and H because the small number of tows did not provide a representative sample of the overall area in the depth range 600 to 1 800 m in each SSRU (paragraphs 6.14 and 6.15).

5.80 In 2003, the Scientific Committee encouraged further work to examine more appropriate SSRU by-catch levels in Subarea 88.1 that are more in accordance with the by-catch distribution and abundance (SC-CAMLR-XXII, paragraph 4.199).

5.81 The Working Group explored three options for allocation of macrourid by-catch between SSRUs in Subarea 88.1 based on the current total catch limit of 520 tonnes (paragraphs 6.19 to 6.28):

1. Status quo
2. CPUE proportional limits
3. fixed SSRU limits.

5.82 The Working Group recommended that the Scientific Committee consider these alternative options for managing macrourid by-catch by SSRU in Subarea 88.1.

5.3 Mitigation measures

5.83 The Working Group compared by-catch rates of autoline and Spanish line vessels in Subarea 88.1 (paragraphs 6.60 to 6.64).

5.84 This analysis suggested that use of the Spanish longline system may reduce by-catch rates of macrourids. However, the Working Group noted that catch rates of macrourids were highly variable between SSRUs and a more complete analysis considering the spatial distribution of vessels with different gear types is required. The Working Group recommended that this work be conducted in the intersessional period.

5.85 The current by-catch limits and move-on rules are given in Conservation Measure 33-03.

5.86 The Working Group recommended that, where possible, all rajids should be cut from the line while still in the water, except on the request of the scientific observer (paragraph 6.75).

6. By-catch of birds and mammals

6.1 By-catch removals

5.87 Details of seabird by-catch are reported in paragraph 7.12 and Table 7.3, and summarised in Table 5.10.

Table 5.10: Seabird by-catch limit, reported seabird by-catch, by-catch rate and estimated by-catch for 1997/98 to 2003/04 in Subareas 88.1 and 88.2.

Fishing season	By-catch limit	By-catch rate (birds/thousand hooks)	Estimated by-catch
1997/98		0	0
1998/99		0	0
1999/00		0	0
2000/01		0	0
2001/02	3*	0	0
2002/03	3*	0	0
2003/04	3*	0.0001	1

* Per vessel during daytime setting.

5.88 Ad hoc WG-IMAF assessed the risk level of seabirds in this fishery in Subarea 88.1 as category 2 south of 65°S and category 3 north of 65°S (Table 7.16) and recommended:

- strict compliance with Conservation Measure 25-02 (but with the possibility of exemption to paragraph 4 to allow for daytime setting);
- south of 65°S, no need to restrict longline fishing season;
- north of 65°S restrict longline fishing to the period outside at-risk species' breeding season where known/relevant, unless line sink rate requirement is met at all times;
- daytime setting permitted subject to line sink rate requirements and seabird by-catch limits;
- no offal dumping.

5.89 Ad hoc WG-IMAF assessed the risk level of seabirds in this fishery in Subarea 88.2 as category 1 (Table 7.16) and recommended:

- strict compliance with Conservation Measure 25-02 (but with exemption to paragraph 4 to allow for daytime setting);
- no need to restrict longline fishing season;

- daytime setting permitted subject to line sink rate requirement;
- no offal dumping.

6.2 Mitigation measures

5.90 Conservation Measure 25-02 applies to these areas and in recent years has been linked to an exemption for night setting in Conservation Measure 24-02 and subject to a seabird by-catch limit. Offal and other discharges are regulated under annual conservation measures (e.g. Conservation Measures 41-09 and 41-10).

7. Ecosystem implications/effects

5.91 The Working Group noted that studies on the food-web interactions of macrourids would be useful in understanding the ecosystem effects of by-catch in this fishery.

8. Harvest controls for the 2003/04 season and advice for 2004/05

8.1 Conservation measures

Table 5.11: Summary provisions of Conservation Measure 41-09 for limits on the exploratory fishery for *Dissostichus* spp. in Subarea 88.1 and advice to the Scientific Committee for the 2004/05 season.

Paragraph and topic	Summary of CM 41-09	Advice for 2004/05	Paragraph reference
1. Access (gear)	Limited to vessels from Argentina, Japan, Republic of Korea, New Zealand, Norway, Russia, South Africa, Spain, Ukraine, UK, USA and Uruguay using longlines.	Review	
2. Catch limit	3 250 tonnes for Subarea 88.1 Individual SSRU limits (tonnes): A, D, F – 0 B – 80 C – 223 E – 57 G – 83 H – 786 I – 776 J – 316 K – 749 L – 180		
3. Season	1 December 2003 to 31 August 2004		
4. Fishing operations	In accordance with CM 41-01 (except paragraph 6).		
5. By-catch	Regulated in accordance with CM 33-03.	Review	5.81–5.82
6. Mitigation: seabirds	In accordance with CM 25-02 (except paragraph 4 night setting). CM 24-02 to apply.	Modify CM 24-02	7.111
7. Mitigation	Daylight setting allowed under CM 24-02.	Modify CM 24-02	7.111
8. Mitigation	No offal discharge.		
9. Observers	Each vessel to carry at least two scientific observers, one of whom shall be a CCAMLR observer.		
10. VMS	To be operational in accordance with CM 10-04.		
11. CDS	In accordance with CM 10-05.		
12. Research	Undertake research plan and tagging program as set out in CM 41-01, Annexes B and C.		
13. Data: catch and effort	(i) Five-day reporting system as in CM 23-01 (ii) Monthly fine-scale reporting system as in CM 23-04 on haul-by-haul basis.		
14. Target species	For the purposes of CMs 23-01 and 23-04, the target species is *Dissostichus* spp. and the by-catch is any species other than *Dissostichus* spp.		
15. Data: biological	Monthly fine-scale reporting system as in CM 23-05. Reported in accordance with the Scheme of International Scientific Observation.		
16. Discharge	Prohibition of discharge of: (i) oil (ii) garbage (iii) food waste >25 mm (iv) poultry or parts thereof (v) sewerage within 12 n miles of land.		

17. Additional elements	No live poultry or other living birds to be taken into Subarea 88.1, and any unconsumed dressed poultry is to be removed from Subarea 88.1.		
18. Additional element	Fishing within 10 n miles of Balleny Islands is prohibited.		

Table 5.12: Summary provisions of Conservation Measure 41-10 for limits on the exploratory fishery for *Dissostichus* spp. in Subarea 88.2 and advice to the Scientific Committee for the 2004/05 season.

Paragraph and topic	Summary of CM 41-10	Advice for 2004/05	Paragraph reference
1. Access (gear)	Limited to vessels from Argentina, Republic of Korea, New Zealand, Norway, Russia, South Africa and Ukraine using longlines.	Review	
2. Catch limit	375 tonnes south of 60°S		
3. Season	1 December 2003 to 31 August 2004		
4. Fishing operations	In accordance with CM 41-01 (except paragraph 6).		
5. By-catch	Regulated in accordance with CM 33-03.		
6. Mitigation: seabirds	In accordance with CM 25-02 (except paragraph 4 night setting). CM 24-02 to apply.	Modify CM 24-02	7.111
7. Mitigation	Daylight setting allowed under CM 24-02.	Modify CM 24-02	7.111
8. Mitigation	No offal discharge.		
9. Observers	Each vessel to carry at least two scientific observers, one of whom shall be a CCAMLR observer.		
10. VMS	To be operational in accordance with CM 10-04.		
11. CDS	In accordance with CM 10-05.		
12. Research	Undertake research plan and tagging program as set out in CM 41-01, Annexes B and C.		
13. Data: catch and effort	(i) Five-day reporting system as in CM 23-01 (ii) Monthly fine-scale reporting system as in CM 23-04 on haul-by-haul basis.		
14. Target species	For the purposes of CMs 23-01 and 23-04, the target species is *Dissostichus* spp. and the by-catch is any species other than *Dissostichus* spp.		
15. Data: biological	Monthly fine-scale reporting system as in CM 23-05. Reported in accordance with the Scheme of International Scientific Observation.		
16. Discharge	Prohibition of discharge of: (i) oil (ii) garbage (iii) food waste >25 mm (iv) poultry or parts thereof (v) sewerage within 12 n miles of land.		
17. Additional elements	No live poultry or other living birds to be taken into Subarea 88.2, and any unconsumed dressed poultry is to be removed from Subarea 88.2.		

8.2 Management advice for new and exploratory fisheries

5.92 The Working Group reiterated the necessity for Members fishing in exploratory fisheries to ensure that the required research sets are completed (Conservation Measure 41-01) and submitted to the Secretariat in a timely manner and accurate format. In addition, *Dissostichus* spp. should be tagged and data submitted in accordance with Conservation Measure 41-01.

5.93 The Working Group recommended that tagging be continued as part of the Research and Data Collection Plan (Conservation Measure 41-01), and take account of the revision in the tagging protocol, especially the requirement that all tagged fish be double-tagged.

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

5.95 In a similar way, the Working Group recommended that some SSRUs within exploratory fisheries in Divisions 58.4.1 and 58.4.2 and Subarea 88.1 retain zero catch limits, so that effects of fishing on *Dissostichus* spp. populations can be distinguished from environmental effects.

5.96 The Working Group noted a large number of notifications were received for exploratory fisheries in 2004/05 in Subareas 48.6, 88.1 and 88.2 and Divisions 58.4.1, 58.4.2 and 58.4.3b. Large numbers of vessels fishing in a particular SSRU may lead to difficulties with the standardisation of CPUE data for assessments (paragraph 5.68 and WG-FSA-04/25) and may also reduce the effectiveness of the move-on rule to limit by-catch in the fishery (paragraphs 6.72 and 6.73).

5.97 The Working Group noted the information presented in CCAMLR-XXIII/38 which indicated that there are additional administrative problems in determining closure dates for fishing in SSRUs when many vessels are fishing simultaneously in a subarea or division (paragraph 5.1).

5.98 The Working Group recalled that catch limits should be applied separately for each SSRU and should reflect the fishable seabed area and fish density from that SSRU (SC-CAMLR-XXII, Annex 5, paragraph 5.36). The Working Group noted that there was no new information on which to provide advice on SSRU catch limits for *Dissostichus* spp.

5.99 The Working Group noted that the number of vessels participating in the Subarea 88.1 toothfish fishery had increased substantially in the 2003/04 season, and had the largest number of vessels fishing in any of the CCAMLR statistical areas in this season. The number of vessels has had an impact on several aspects of the Working Group advice. The lack of important assessment information, such as standing stock and recruitment data, and the variable ice influence make this a difficult fishery for which to provide management advice. The Working Group reiterated the urgent need for data that will lead towards a formal assessment, and welcomed the progress with the tagging program and the development of an integrated stock-assessment model.

5.100 The Working Group was unable to provide any new advice on catch limits for *Dissostichus* spp. or any by-catch species in any of the exploratory fisheries.

5.101 The Working Group reiterated the urgent need to develop a means for estimating abundance and providing assessments of stock status for all exploratory fisheries.

5.102 The Working Group recommended that Subareas 88.1 and 88.2 be treated as a single stock unit for assessment purposes, and that further research be undertaken on the stock structure of *D. mawsoni*.

Fishery Report: *Dissostichus eleginoides* South Georgia (Subarea 48.3)

1. Details of the fishery

1.1 Reported catch (time series)

Table 5.13: Catch history for *Dissostichus eleginoides* in Subarea 48.3. Fishing seasons are given (i.e. 1988/89 is 1 December 1988 to 30 November 1989).

Fishing season	Catch limit	Reported catch (tonnes)	IUU Catch (tonnes)	Total extractions (tonnes)
1984/85		521	0	521
1985/86		733	0	733
1986/87		1954	0	1954
1987/88		876	0	876
1988/89		7060	144	7204
1989/90		6785	437	7222
1990/91	2500	1756	1775	3531
1991/92	3500	3809	3066	6875
1992/93	3350	3020	4019	7039
1993/94	1300	658	4780	5438
1994/95	2800	3371	1674	5045
1995/96	4000	3602	0	3602
1996/97	3540	3812	0	3812
1997/98	3330	3201	146	3347
1998/99	3500	3636	667	4303
1999/00	5310	4904	1015	5919
2000/01	4500	4047	196	4243
2001/02	5820	5744	3	5747
2002/03	7810	7534	0	7534
2003/04	4420	4482	0	4482

5.103 During the 2003/04 season the fishery was active from 1 May to 21 August 2004 (Table 5.13).

5.104 The Working Group agreed to define a new area within Subarea 48.3 relevant to the South Georgia and Shag Rocks stock (paragraph 5.107). The revised catches attributed to the South Georgia and Shag Rocks stock are given in Table 5.14.

Table 5.14: Catches from South Georgia and Shag Rocks in Subarea 48.3.

Fishing season	Official catch from Subarea 48.3	Corrected catch from South Georgia and Shag Rocks
1984/85	521	521
1985/86	733	733
1986/87	1954	1954
1987/88	876	876
1988/89	7204	7204
1989/90	7222	7222
1990/91	3531	3531
1991/92	6875	6871
1992/93	7039	7039
1993/94	5438	5438
1994/95	5045	4998
1995/96	3602	3542
1996/97	3812	3812
1997/98	3347	3347
1998/99	4303	4303
1999/00	5919	5911
2000/01	4243	4234
2001/02	5745	5722
2002/03	7528	7513
2003/04	4482	4447

Distribution of the fishery

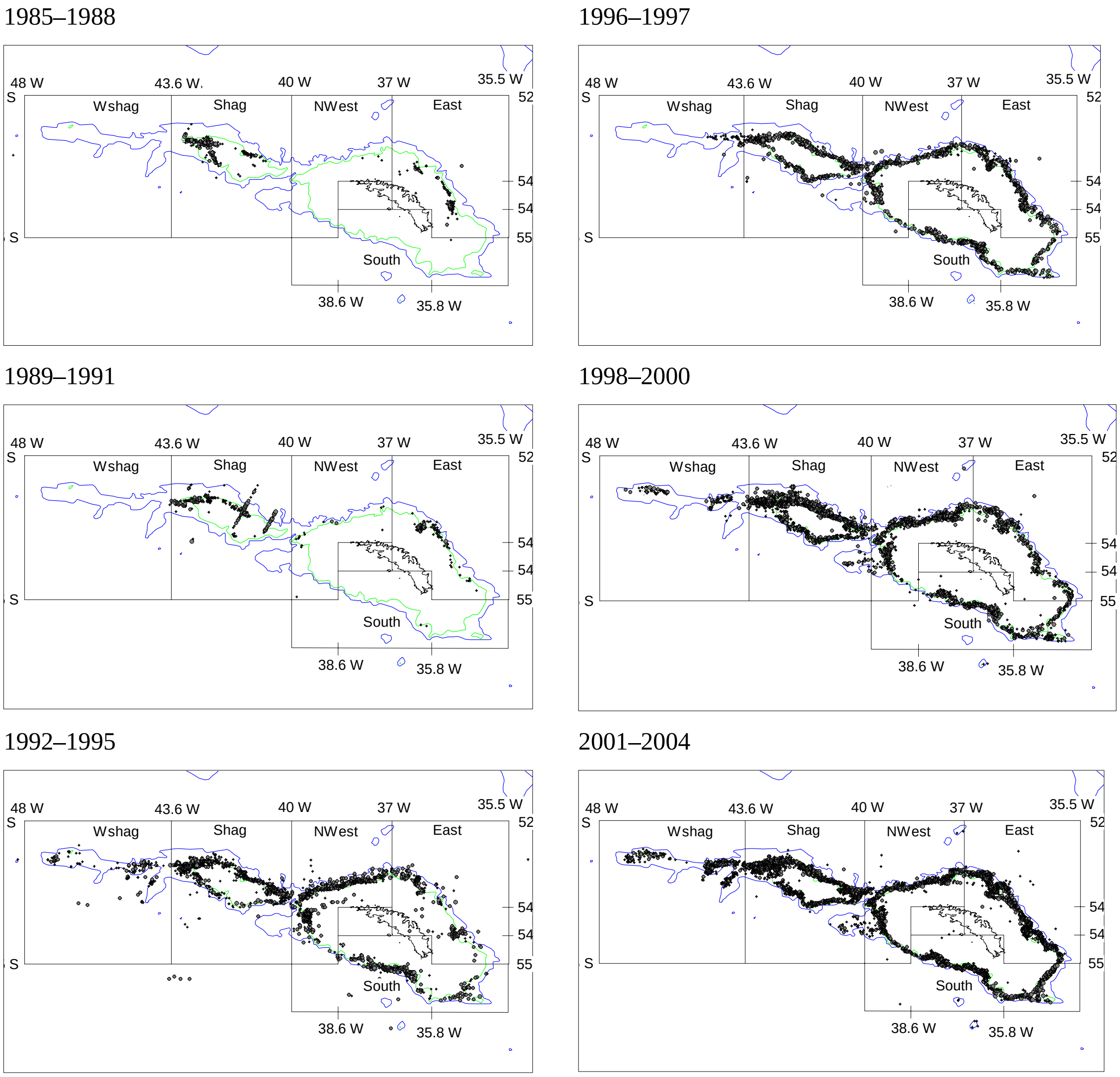


Figure 5.3: Distribution of catches in discrete time periods, graduated by the number of hooks set. Wshag – western Shag Rocks; Shag – Shag Rocks; NWest –northwest South Georgia; East – east South Georgia; South – south South Georgia.

1.2 IUU catch

5.105 The estimated IUU catch from Subarea 48.3 in the 2004 fishing season is zero. Dr Agnew informed the Working Group that the UK had continued to undertake patrols in the area, and apply the model estimating IUU catch described by Agnew and Kirkwood (2002).

1.3 Size distribution of catches (time series)

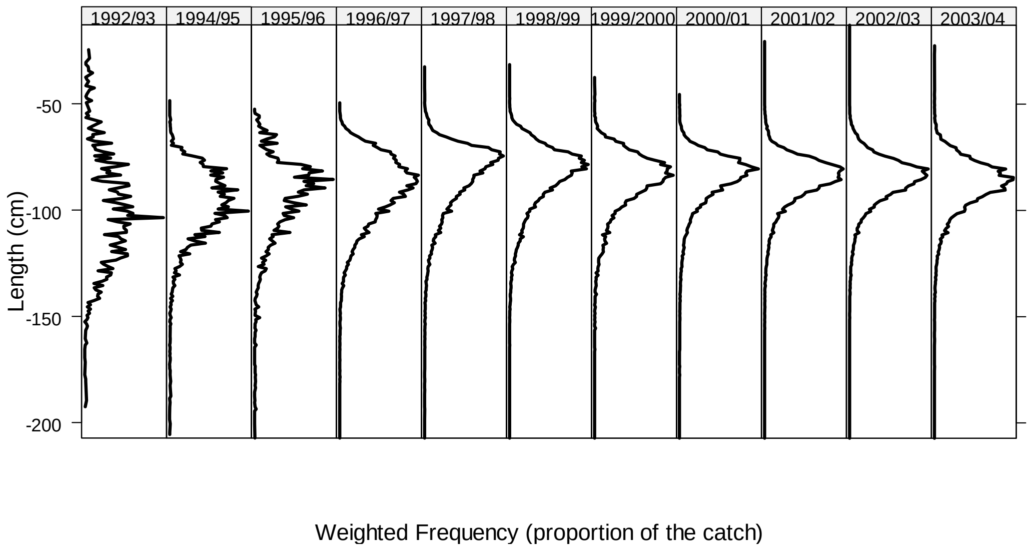


Figure 5.4: Catch-weighted length frequencies for *Dissostichus eleginoides* in Subarea 48.3 derived from observer, fine-scale and STATLANT data reported by 6 October 2004.

2. Stocks and areas

5.106 The fishery is largely restricted to waters adjacent to South Georgia and Shag Rocks in water down to 1 800 m depth. Much of Subarea 48.3 has a water depth in excess of 2 000 m and toothfish are known to occur there, albeit at low density. Toothfish are known to occur in adjacent areas. It has been demonstrated that there is genetic separation of those fish present in Subarea 48.3 from those found on the Patagonian Shelf (FAO Area 41).

5.107 The Working Group considered the information on stock structure provided by WG-FSA-04/21 that indicated that *D. eleginoides* occurring on Burdwood Bank and the North Scotia Ridge could be considered separate from the populations around Shag Rocks and South Georgia. The Working Group agreed to divide Subarea 48.3 into the area relevant to the South Georgia and Shag Rocks population, and other areas, according to Figure 5.5.

5.108 The Working Group agreed that its assessment would only apply to the Shag Rocks and South Georgia stock.

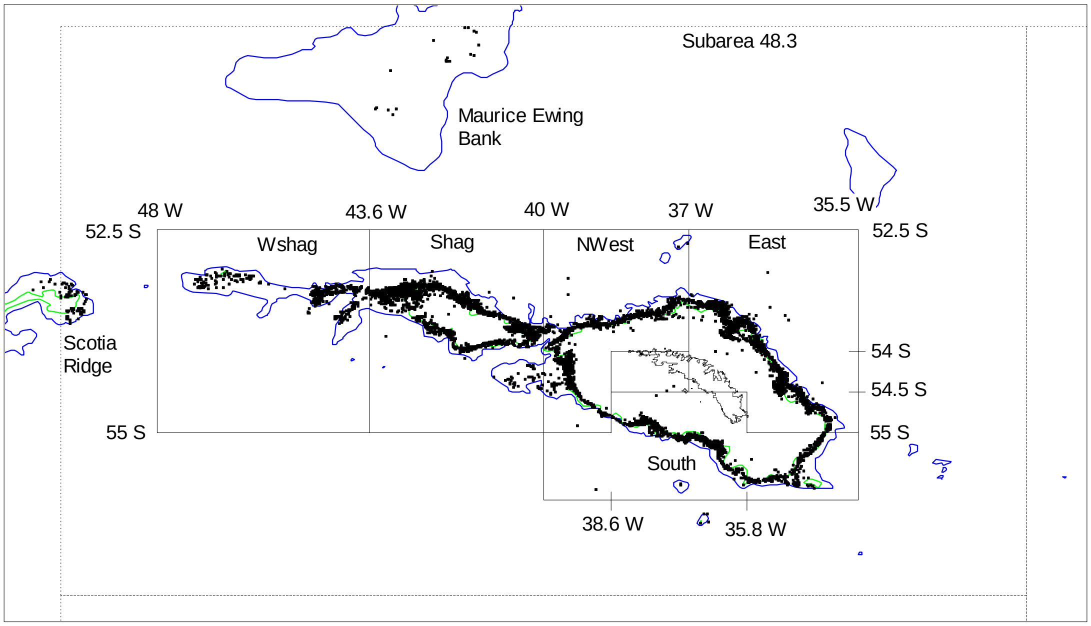


Figure 5.5: Definition of new areas in Subarea 48.3. The South Georgia and Shag Rocks stock is only present in areas Wshag, Shag, NWest, East and South (Table 5.14). See Figure 5.3 for area definitions.

3. Parameter estimation

3.1 Estimation methods

Trends in fishing vulnerability

5.109 The method (WG-FSA-02/64), used in 2002 and 2003, takes specific account of the tendency for the size of fish taken in the longline fishery to be positively correlated with depth fished, and that shifts in effort distribution by depth between years will result in different fishing pressures being placed on fish in different length (or age) classes.

5.110 The method first estimates vulnerabilities-at-length using estimates of length densities by depth zone and region around South Georgia and Shag Rocks obtained from the observer data. These are then converted to vulnerabilities-at-age using the growth curve estimated for Subarea 48.3. The analyses this year incorporated all available data for 2004 and indicated that the ‘deep’ vulnerability curve was most appropriate for the 2004 season (Figure 5.6). The age-specific vulnerabilities were updated for 2004 and projection years in the GYM.

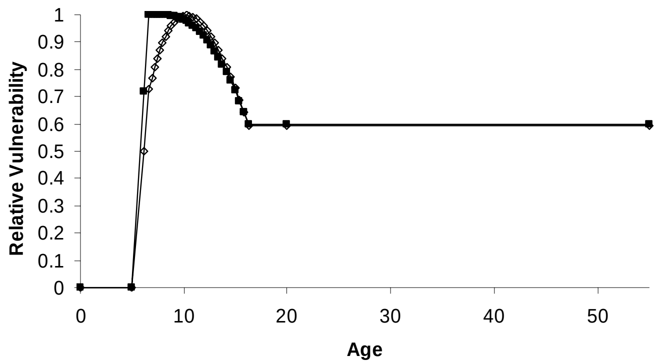
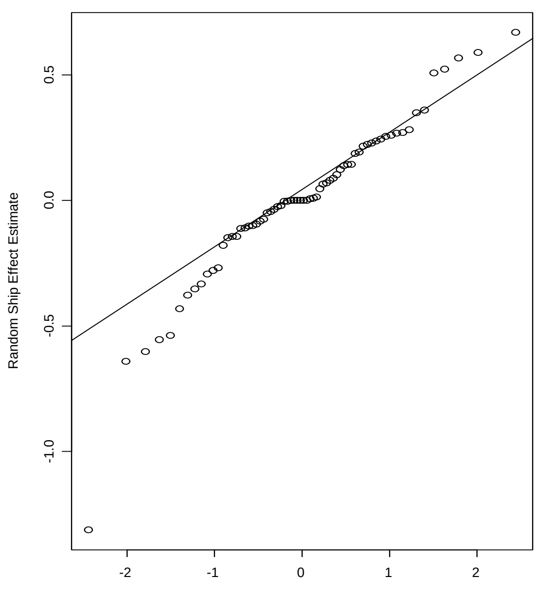


Figure 5.6: Vulnerability functions for Subarea 48.3: 'Deep' pattern (open squares) and 'Shallow' pattern (closed squares).

CPUE standardisation

5.111 WG-FSA agreed that the method used to standardise the CPUE series would be reviewed. Two methods are currently available to the Working Group – the previously used GLM and the GLMM approach described by Candy (2004). Drs Agnew and S. Candy (Australia) reviewed the characteristics of the fits using both methods and, in particular examined the area-by-year interaction. The QQ diagnostic plots for the GLMM model indicated that the random effects assumptions of the GLMM model (Candy, 2004) were reasonable (Figure 5.7). Examination of the area–season random effects indicated that there was not a significant trend in CPUE for the majority areas, although there was a suggestion of a trend for the Shag Rocks areas in the latter part of the series (Figure 5.8). Area interactions with the other main effects were also considered, but none were found to be significant.



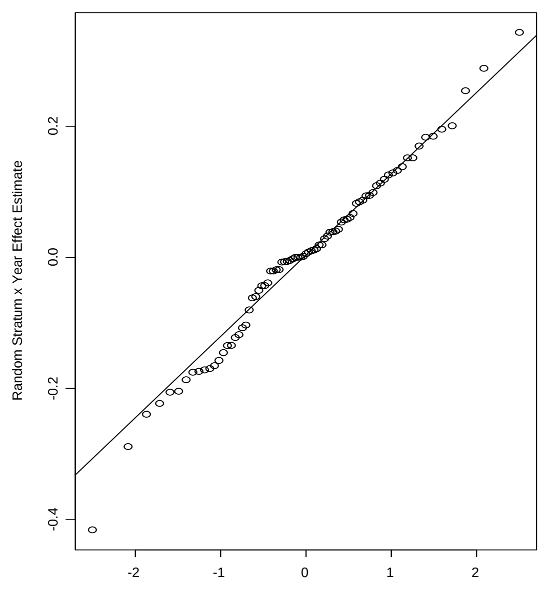


Figure 5.7: QQ diagnostic plots for the random vessel and area-by-season effects for the GLMM for Subarea 48.3.

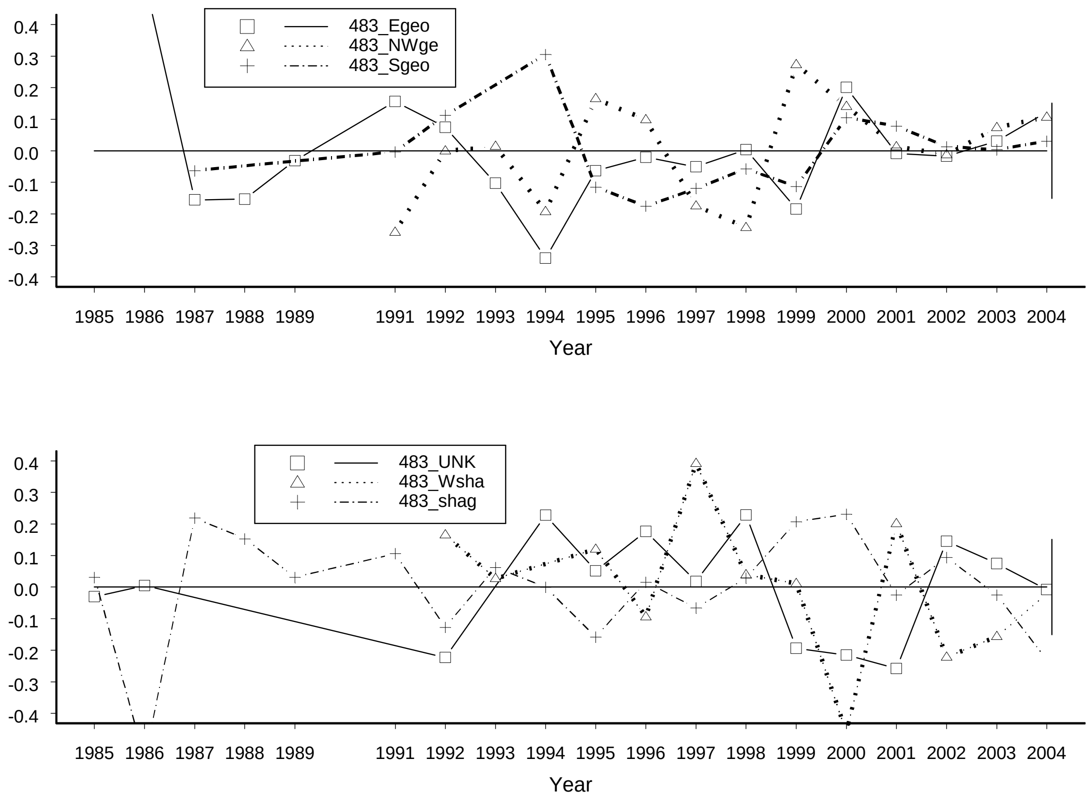


Figure 5.8: Deviation from the standardised CPUE trend by area for Subarea 48.3. Egeo – east South Georgia, NWge – northwest South Georgia, Sgeo – south South Georgia, UNK – unknown location, Wshag – west Shag Rocks, Shag – Shag Rocks.

5.112 On the basis of the outcomes of these analyses, the Working Group agreed that the random-effects GLMM should be used as the method for standardisation of CPUE series for use in GYM assessments for this year and for further development of the ASPM method. The revised series was calculated using the GLMM with area–season as a random effect and area as a fixed effect, with CPUE scaled to the south South Georgia area. The revised series is given in Figure 5.9 along with the equivalent standardisation using the standard GLM used in previous years.

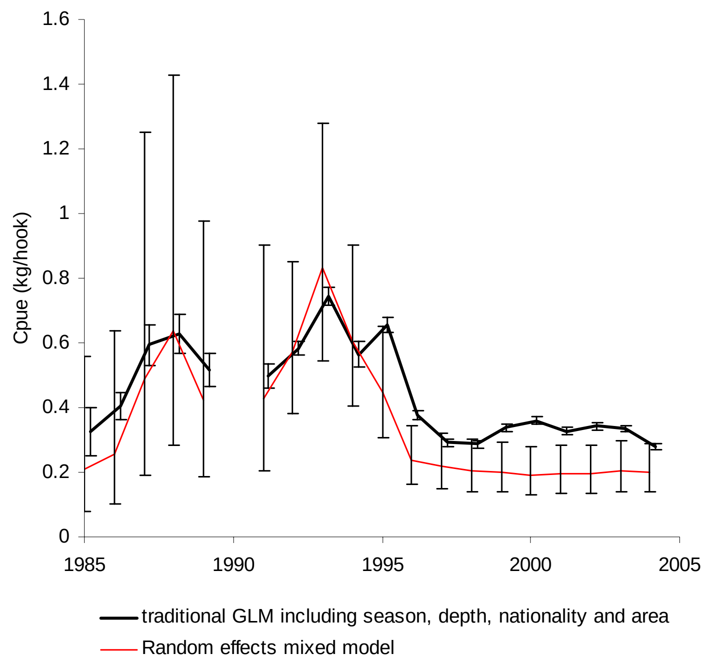


Figure 5.9: Standardised longline CPUE by fishing season for Subarea 48.3 using the GLMM method with a random-effects model (thin line) and the standard GLM method (thick line) previously used by the Working Group. Both series have been standardised for Chilean vessels fishing between depths of 1 000 and 1 500 m in the southern sector of South Georgia.

5.113 In addition, the Working Group examined the spatial variation in catch and effort around South Georgia and Shag Rocks over the period from 1986 to 2004 (Figure 5.3).

Mean size in commercial catch

5.114 Fisheries data (reports of weight and number of fish caught) were analysed in a standard GLM (Figure 5.10). Mean weight declined from 1992 to 1998, increasing gradually thereafter.

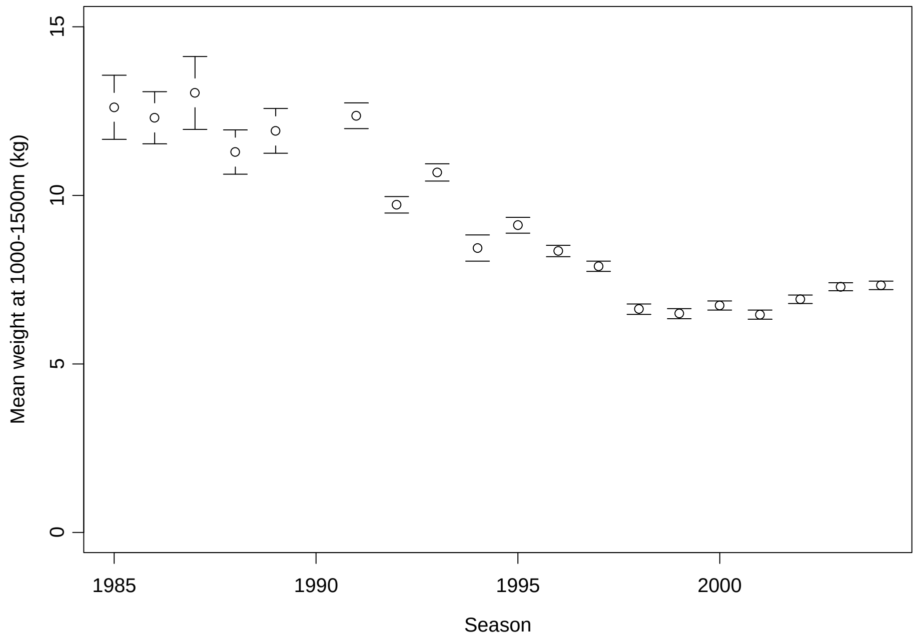


Figure 5.10: Mean weight of toothfish in the catch calculated using a GLM of similar form to that for the standard GLM (paragraphs 5.111 to 5.113), standardised to Chilean vessels fishing between depths of 1 000 and 1 500 m, in the southern sector of South Georgia.

Recruitment

5.115 Estimates of numbers of recruits at age 4 are calculated by applying the CMIX program to length-density data (numbers/km^2 for each length class) from each survey haul, weighted by the proportion of the stratum area in the overall survey and the inverse proportion of the number of survey hauls in the stratum. The data extractions for the 2004 survey were done using six strata: three depth strata (50–150, 150–250 and 250–500 m) each for South Georgia and Shag Rocks (see SC-CAMLR-XXI, Annex 5, paragraph 5.60).

5.116 The Working Group considered the review of approaches to estimating recruitment presented in WG-FSA-04/92 which suggested that a number of issues be considered in the process of estimating and revising the time series of recruitments for toothfish:

(i) Establish what would be a reasonable length for a fish at age 0 (time zero in the year).

(ii) Establish the birthday of the fish in the year (time 0). If this needs to be varied in some years, then the period in the year that would accommodate time 0 will need to be considered.

(iii) Estimate (establish) the lengths-at-age (e.g. from growth parameters) and their variances to be used for validating the observed distributions in the mixture analyses.

(iv) Adjust the t_0 of the growth parameters so that the length-at-age of 0.0 is appropriate and then estimate lengths-at-age for the given survey time (adding a proportion of the year from the birthday to the survey).

(v) Choose the bounds around the estimated mean length-at-age to accommodate a plausible birthday, plausible interannual variation in growth and consistency with other surveys.

(vi) Choose appropriate ranges of the standard deviations of length-at-age to ensure that cohort growth (across all lengths of the cohort) are plausible.

5.117 The Working Group agreed to review the CMIX analyses presented in order to arrive at a revised series of recruitments for Subarea 48.3 based on the recruitment series calculated using the current Subarea 48.3 and Belchier et al. (2004) (in WG-FSA-SAM-04/16) growth parameters presented in WG-FSA-04/92.

5.118 A number of issues associated with the estimation of mean recruitment and the recruitment series for Subarea 48.3 were identified by the Working Group for review during the meeting. These included:

(i) the length range used in the CMIX analyses that are sampled consistently by the surveys;

(ii) individual components that may need to be excluded due to poor fits of the CMIX analyses;

(iii) individual surveys that may need to be excluded due to particularities of the survey resulting in poor coverage of the cohorts of interest.

5.119 In light of the above, Drs C. Davies (Australia) and G. Kirkwood (UK) reviewed the CMIX analyses presented in WG-FSA-04/92 and, on the basis of their review, recommended the following with respect to the estimation of revised recruitment series for Subarea 48.3:

(i) the size range for components to be included in the estimation should be 200–600 mm;

(ii) the 2000 Russian survey should be excluded on the basis of very low densities and less than adequate coverage;

(iii) the CMIX analysis for the 1988 UK survey presented in WG-FSA-04/92 for the Subarea 48.3 growth parameters should be revised to obtain a better fit.

5.120 The recruitment series, mean recruitment and its CV were re-estimated in the GYM (version 5.0.1e, GYUI 5.0.1e build 92) following these revisions. The Working Group agreed that the series generated using the Subarea 48.3 growth parameters would be used as a base-case for this year's assessment and the series estimated using the Belchier et al. (2004) parameters would be used in sensitivity analyses.

Effects of stratification on CMIX estimates of abundance

5.121 Usually, CMIX is used to process trawl survey data by pooling data across strata using a transformation of individual hauls within a stratum in order to have a single pooled dataset, weighted by the area of the stratum and the proportion of hauls within a stratum. Following consideration of the survey design and the distribution of length classes between strata, some checks were undertaken of the total abundances of fish being estimated from the pooled data compared to summing the estimates for individual strata. These were also compared to outcomes from using all the data without assigning them to strata or transforming them in any way.

5.122 The differences in outcomes are illustrated in Tables 5.15 to 5.17.

5.123 These differences might be a function of the transformation to pool the data and the manner in which the proportion of non-zeros in each stratum affect the Aitcheson delta estimator. They might also arise from the non-linear function in the density calculation. It was also noted that a difficulty with using the data without strata is that it assumes the sampling density for a stratum is the same across all strata. If the sampling density is not the same across strata then biases might arise. The Working Group had insufficient time to explore these issues further and recommended that WG-FSA-SAM review this at its next meeting.

Table 5.15: CMIX results from UK surveys in 2002 and 2004 in Subarea 48.3 where data are pooled across strata using the formula to weight individual hauls by the proportion of the total area in the stratum and the inverse proportion of all hauls in that stratum. This analysis was on the basis of six strata.

Index	Age 3	Age 4	Age 5	Age 6	Age 7	Total
2002 Survey:						
Means of mixture components		327.139	444.872	515.692	581.92	
Standard deviations of mixture components		29.3328	24.5213	6.08945	50	
Total density of each mixture component		46.4708	22.2315	4.43781	12.4313	
SD of each mixture component density		8.43531	13.2061	2.79363	2.5423	
Abundance		1904991	911343	181920	509600	3 507 854
2004 Survey:						
Means of mixture components	216.474	334.442	470.818	487.879	650.355	
Standard deviations of mixture components	16.9256	25.6042	35.6371	36.8922	48.8452	
Total density of each mixture component	58.8412	32.8541	6.18E-02	10.7741	4.11461	
SD of each mixture component density	356.29	7.48437	0.396087	1.95942	1.79337	
Abundance	2412095	1346798	2534	441666		4 203 093

Table 5.16: CMIX results from UK surveys in 2002 and 2004 in Subarea 48.3 for each stratum. Strata for which CMIX did not successfully resolve fits are shown.

Survey, Stratum	Index	Age 3	Age 4	Age 5	Age 6	Age 7	Total
2002							
1	Means of mixture components	252.9	333.1	470.9	516.5	629.7	
	Standard deviations of mixture components	8.7	8.7	8.8	8.8	8.8	
	Total density of each mixture component	51.5	403.0	55.6	99.9	33.0	
	SD of each mixture component density	26164.3	912989.0	28281.9	50783.8	16803.7	
	Abundance	75820	593778	81956	147163	48694	947 411
2	Not resolved						
3	Not resolved						
4	Not resolved						
5	Not resolved						
6	Means of mixture components	227.9	334.5	467.5	477.3	645.8	
	Standard deviations of mixture components	20.2	28.4	38.8	39.5	52.6	
	Total density of each mixture component	5.3	2.3	54.3	4.4	3.0	
	SD of each mixture component density	1960.7	903.9	16903.4	1045.3	1295.9	
	Abundance	41995	18508	433125	34728	24010	552 366
	Sum of abundance from 2002 strata 1 and 6	117815	612286	515081	181891	72704	1 499 777
2004							
	Means of mixture components	321.3	436.2	559.8			
1	Standard deviations of mixture components	25.6	25.6	25.6			
	Total density of each mixture component	181.7	37.8	21.3			
	SD of each mixture component density	28.3	17.7	24.9			
	Abundance	267686	55652	31401			354 740
2	Means of mixture components	332	439	521	590	668	
	Standard deviations of mixture components	20	21	21	22	22	
	Total density of each mixture component	198	43	11	9	16	
	SD of each mixture component density	105	12	5	4	22	
	Abundance	369716	79506	20801	15998	30578	516 599
3	Means of mixture components	332.4	438.2	512.0	582.2	709.9	
	Standard deviations of mixture components	21.9	21.9	21.9	21.9	21.9	
	Total density of each mixture component	86.9	142.2	96.2	43.9	2.2	
	SD of each mixture component density	27.8	46.6	32.2	14.3	38.8	
	Abundance	139846	229019	154811	70704	3472	597 852
4	Not resolved						
5	Not resolved						
6	Not resolved						
	Sum of abundance from 2004 strata 1–3	777247	364178	207013	86702	34050	1 469 190

Table 5.17: CMIX results from UK surveys in 2002 and 2004 in Subarea 48.3 assuming no strata.

Index	Age 3	Age 4	Age 5	Age 6	Age 7	Total
2002 Survey:						
Means of mixture components	324.4	440.4	525.7	592.1	675.4	
Standard deviations of mixture components	25.8	25.8	25.8	25.8	25.8	
Total density of each mixture component	124.0	39.4	13.6	10.8	3.6	
SD of each mixture component density	25.3	7.7	4.4	3.3	3.1	
Abundance	5082103	1614505	556603	441895	149572	7 844 678
2004 Survey:						
Means of mixture components	339.4	482.2	565.9	662.5		
Standard deviations of mixture components	23.3	28.6	31.8	35.4		
Total density of each mixture component	69.6	25.9	6.8	6.6		
SD of each mixture component density	152.8	69.1	56.1	40.0		
Abundance	2853310	1061931	279416	269448		4 464 106

Mark–recapture estimates of vulnerable biomass

5.124 WG-FSA-04/82 presented a refinement of a Petersen mark–recapture estimator of toothfish vulnerable biomass in Subarea 48.3 initially considered at WG-FSA-SAM-04 (WG-FSA-SAM-04/17). As requested by the subgroup, the authors revised the estimator and the data inputs to take account of:

- selectivity in the fishery (e.g. Tuck et al. (2003) selectivities were calculated according to Kirkwood (2002) using a deep selectivity pattern for 2002 and 2004 and a shallow pattern for 2003);
- initial tag mortality (assumed to be 10%);
- tag loss rate (calculated from double tag returns to be 6% per year);

and had provided estimates of confidence intervals. WG-FSA-04/82 also investigated the sensitivity of the results to different levels of tag loss rate, natural mortality and initial tag mortality.

5.125 The tagging program in the commercial fishery in Subarea 48.3 was initiated in 2000, hence some tagged fish have now been four years at liberty. Data on distance moved by individual recaptures presented in WG-FSA-04/82 suggested that although most toothfish move less than 50 km at least in the short term, significant numbers were moving several hundred km over several years at South Georgia. WG-FSA-04/82 ignored tags recovered in the same year in which they were released. Since fishing takes place in mid-winter, this equates to a minimum time at liberty of approximately 180 days to allow sufficient time for mixing. All tag return rates reported below utilise this day-at-liberty definition. The paper also reported the results of the Jolly–Seber estimator, but considered that there were not enough time periods of future sampling for it yet to provide a robust estimator of population size.

5.126 In the implementation of the analysis presented in WG-FSA-04/82 tagged fish were treated differently depending on whether they were ever recovered or not. The tagged population at the time of sampling was calculated from two populations of tagged fish:

- the population that was tagged but has never been recaptured. For these a probability of recapture was calculated taking into account natural mortality, tag mortality and tag loss rate;

- the population that was tagged and was later recaptured (i.e. their presence in the tagged population is known at the time of sampling). These were given a probability of recapture of 1.

5.127 The Working Group investigated the effect of treating all tagged fish equally to the various mortality estimates. This reduced the estimates of the tagged population at the time of sampling, and consequently the estimates of vulnerable biomass (from 52 400, 53 800 and 61 800 tonnes to 44 600, 50 800 and 60 300 tonnes for 2002, 2003 and 2004 respectively).

5.128 The overall recovery rate of tags (recovery of tags that were tagged in a previous season expressed as a percentage of the tagged population) was 12, 15 and 7% in 2002, 2003 and 2004 representing 30, 82 and 48 tag recoveries respectively. There was not sufficient time at the meeting to examine the potential source of this variability in recapture rate among years further. However, on the basis of distribution of effort and tag recaptures presented in Figure 5.11 it does not seem to be a result of changes in the distribution of fishing effort.

5.129 The spatial analysis presented in Figure 5.11 indicates that tags were recovered from a much more restricted area in 2002 than in subsequent years and that a large proportion of the returned tags recaptured in 2002 were from a restricted area at Shag Rocks. Following this analysis, the Working Group agreed that it would be important to further investigate the relationship between the distribution of effort and recaptures at a finer spatial scale intersessionally.

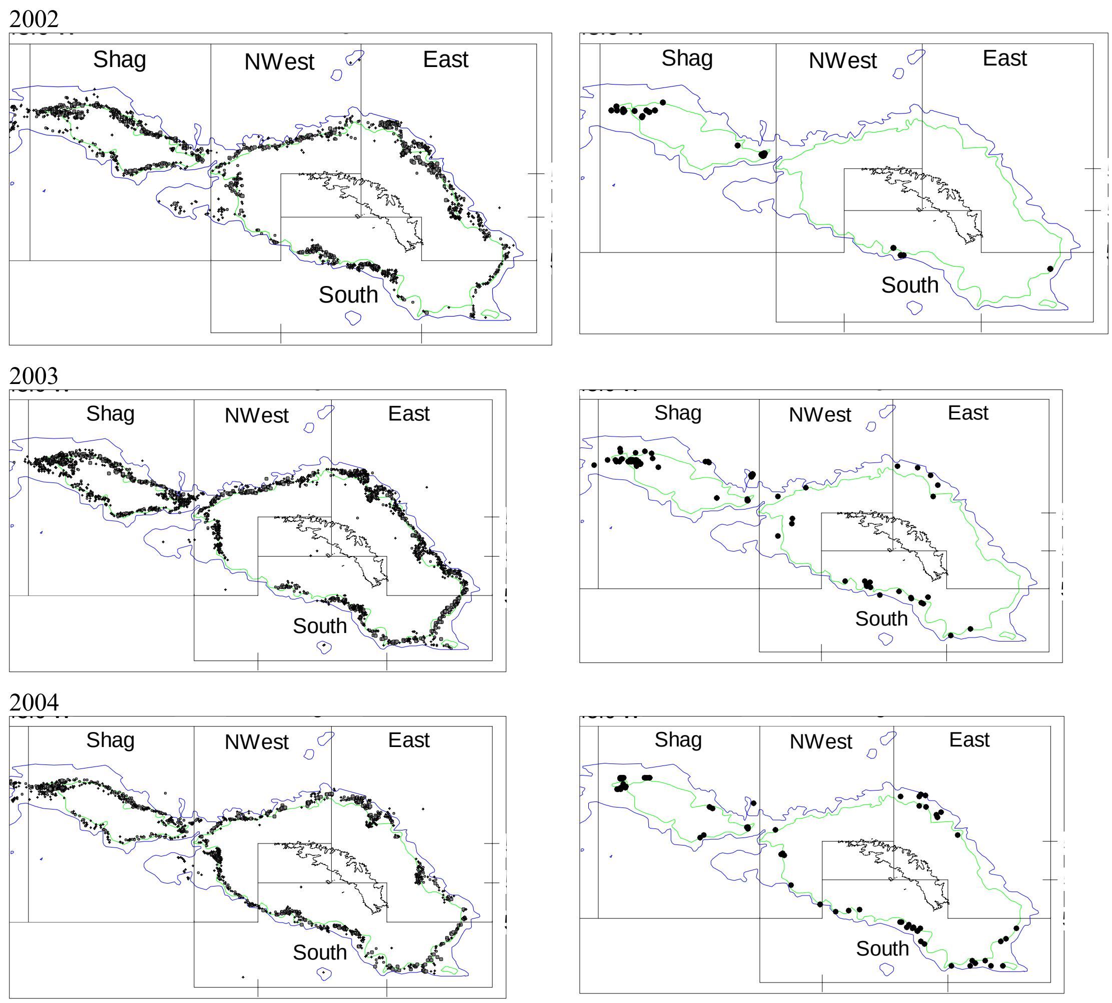


Figure 5.11: Distribution of (a) fishing effort and (b) recaptured tags by year since the commencement of the tagging program in Subarea 48.3. See Figure 5.3 for area definitions.

5.130 Issues of mixing were investigated by calculating Petersen estimates for three separate areas, Shag Rocks (including west Shag Rocks), northwest and east South Georgia and south South Georgia (see Figure 5.3 for area definitions). The distribution of releases by area and year are given in Table 5.18. The distribution of returns indicated movement between each of these three areas (Table 5.19). However, there was a larger proportion of returns within Shag Rocks and south South Georgia than in the northwest and east South Georgia area (Table 5.19). Fish were recorded to move between northwest and east South Georgia and both other areas.

Table 5.18: Distribution of releases of *Dissostichus eleginoides* among areas within Subarea 48.3 (not including 2004).

South Georgia	Number of fish tagged and released				
	2000	2001	2002	2003	Total
Shag Rocks	91	324	186	129	730
Northwest and east	44	7	99	92	242
South		16	116	134	266
Total	135	347	401	355	1238

Table 5.19: Distribution of recaptures of *Dissostichus eleginoides* among areas within Subarea 48.3. Data are pooled over the 2001/02 and 2003/04 fishing seasons.

Tagged at South Georgia	Recovered at South Georgia			Total
	Shag Rocks	Northwest and east	South	
Shag Rocks	112	5	0	117
Northwest and east	2	7	1	10
South	0	2	31	33
Total	114	14	32	160

Table 5.20: Results of Petersen estimates of vulnerable biomass in Subarea 48.3. Estimates were made for three separate areas (rows 1–3) and the whole area combined. The standard error is Bailey's binomial variance calculated according to Seber (1985, p. 61).

South Georgia	No. tags recovered			Exploitable biomass (tonnes)			se		
	2002	2003	2004	2002	2003	2004	2002	2003	2004
Shag Rocks	29	59	26	17 197	17 354	20 599	6 054	4 355	7 630
South	1	15	16	6 146	8 708	10 219	6 955	4 139	4 721
Northwest and east	0	8	6		36 152	38 419		22 407	26 623
Total	30	82	48						

5.131 Estimates of vulnerable biomass for each area and associated standard errors are given in Table 5.20. The level of movement between northwest and east South-Georgia and the other areas, and the relatively low number of tags recovered in this area, created larger variances around the Petersen estimates for northwest and east South-Georgia than for the other areas.

5.132 The results of Petersen estimates considering South Georgia and Shag Rocks as a whole are also presented in Table 5.21. The variance estimate was derived using Bailey's binomial variance (Seber, 1985, p. 61). Confidence intervals were also independently estimated by bootstrapping daily commercial catch and tag recovery data. The bootstrap Petersen estimates were slightly skewed (Table 5.21).

Table 5.21: (a) Petersen estimates and Bailey's binomial variance estimated upper and lower confidence intervals; and (b) bootstrap Petersen estimates of vulnerable biomass.

Fishing season	(a) Analytical estimate			(b) Bootstrap estimate			
	Estimate	Lower 95%	Upper 95%	Mean	Median	Lower 95%	Upper 95%
2001/02	44 615	29 157	60 073	46 890	45 861	33 331	66 801
2002/03	50 777	39 918	61 635	51 328	50 916	41 896	63 556
2003/04	60 270	43 565	76 975	61 573	60 521	47 228	82 023

5.133 Several of the analyses described above highlight sensitivities of estimates of biomass to the number and distribution of recaptures during the early period of a tagging program. For example, in the case of the 2002 estimate most recaptured fish (97%) had only been at liberty for one year. By contrast, 50% of fish recaptured in both 2003 and 2004 had been at liberty for two or more years. Figure 5.11 shows that recaptures were initially concentrated in the Shag Rocks area and have become progressively more widely distributed over 2003 and 2004.

5.134 The Working Group considered the results of the sensitivity analyses and identified a number of issues that would need to be considered in using the estimates of vulnerable biomass in assessments of long-term yield:

(i) the point estimate of vulnerable biomass and the variance measure to be used in projections;

(ii) the extent to which the closed population and mixing assumptions of the Petersen estimator is violated;

(iii) the differences between the estimates obtained using Petersen and Jolly–Seber estimators, and which may be more robust and precautionary.

5.135 Some of these issues were addressed to a degree in the time available during the meeting. The Working Group agreed that future work should focus on further examination of the Petersen, Jolly–Seber and alternative mark–recapture estimators to better understand the properties of the estimators for estimating vulnerable biomass of *D. eleginoides*. The Working Group suggested that a broader review of alternative estimators in use elsewhere, and evaluation of alternative estimators using simulated data to explore the sensitivity of the methods to known violations of the underlying assumptions would be useful.

5.136 In light of the work completed during the meeting, some members thought it appropriate to use the Petersen mark–recapture estimate of vulnerable biomass to guide the GYM projections. Dr P. Gasyukov (Russia) considered that the Working Group had not had sufficient opportunity to review and validate the methods and that it may be premature to use this method, particularly given the relatively early stage of the tagging program. Drs Kirkwood and Agnew pointed out, however, that an assessment using mark–recapture data had been presented at WG-FSA-SAM-04, that they had subsequently implemented the modifications requested by the subgroup, and that the data and spreadsheet implementing the model had been made available to the Working Group at the meeting.

5.137 The Working Group agreed to use the 2003 and 2004 bootstrap estimates of vulnerable biomass to adjust two GYM runs as part of the sensitivity analysis for this year's assessment of long-term yield. This adjustment was to scale the survey recruitment data in order that the median vulnerable biomass in 2004 from tagging corresponded to the estimated biomass from the GYM projections.

<u>ASPM estimate of biomass</u>

5.138 The ASPM, implemented in AD Model Builder initially by Brandão and Butterworth (WG-FSA-03/97) and modified by Agnew and Kirkwood (WG-FSA-04/82), was reviewed by the Working Group and revised to include the point estimates of exploitable biomass from tagging data as a third data source to be used in the fitting procedure (the other two sources being the annual catch–length frequencies and the standardised CPUEs). Each of these observations is compared with model predictions and a joint likelihood is calculated as the weighted sum of the individual likelihoods. This approach allows different weightings to be given to each of the three sets of observations in the fitting procedure.

5.139 Several different combinations of input data and weightings of data series were investigated. Although in the original formulation by Brandão and Butterworth the model is free to estimate fishing selectivity, selectivity was fixed in these runs to the selectivities estimated by the method of Kirkwood (2002). Following the analysis presented in WG-FSA-04/82, deep selectivity was assigned to years 1989–1997 and 2001–2004, and shallow selectivity to 1985–1988 and 1998–2000. The results are shown in Table 5.22 and examples of fits to the different data input series are given in Figure 5.12.

Table 5.22: Results of sensitivity tests of the current ASPM formulation in AD Model Builder. B_0 is the estimated unexploited vulnerable biomass and B_{exp} is the estimated current (2004) vulnerable biomass in thousands of tonnes.

Run number	Sensitivity test	CPUE	Steepness	Length weighting	Tag weighting	B_0 (1985)	B_{exp} (2004)
1	Different weightings on standardised CPUE	Standard GLM	0.6	1	0	114	79
2			0.6	0.1	0	73	36
3			0.6	1	1	91	56
4	Different weightings on standardised CPUE	Random effects GLMM	0.6	1	0	118	84
5			0.6	0.1	0	65	28
6			0.6	10	0	132	98
7	Steepness	Random effects GLMM	0.8	1	0	120	87
8	Tag weighting	Random effects GLMM	0.6	1	1	92	57
9			0.6	0.1	1	88	53
10			0.6	1	0.1	114	80
11	GLM from 1997only	Standard GLM ≥1997	0.6	10	0	135	101
12			0.6	0.1	0	186	152
13	GLMM from 1997 only	GLMM ≥1997	0.6	10	0	137	103
14			0.6	0.1	0	299	266

Figure 5.12(a)

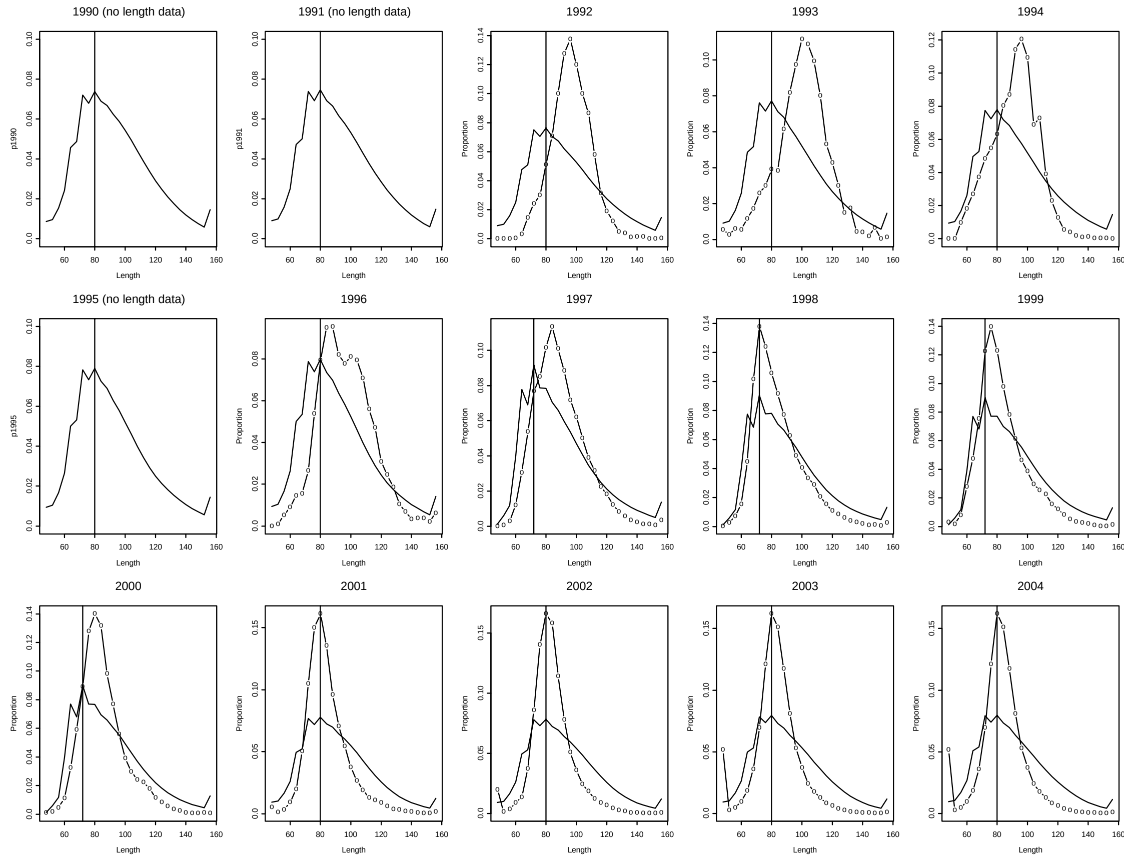


Figure 5.12(b)

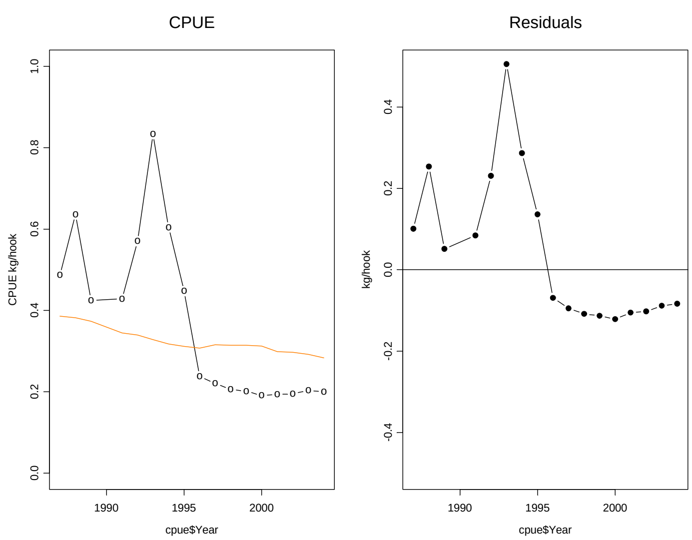


Figure 5.12(c)

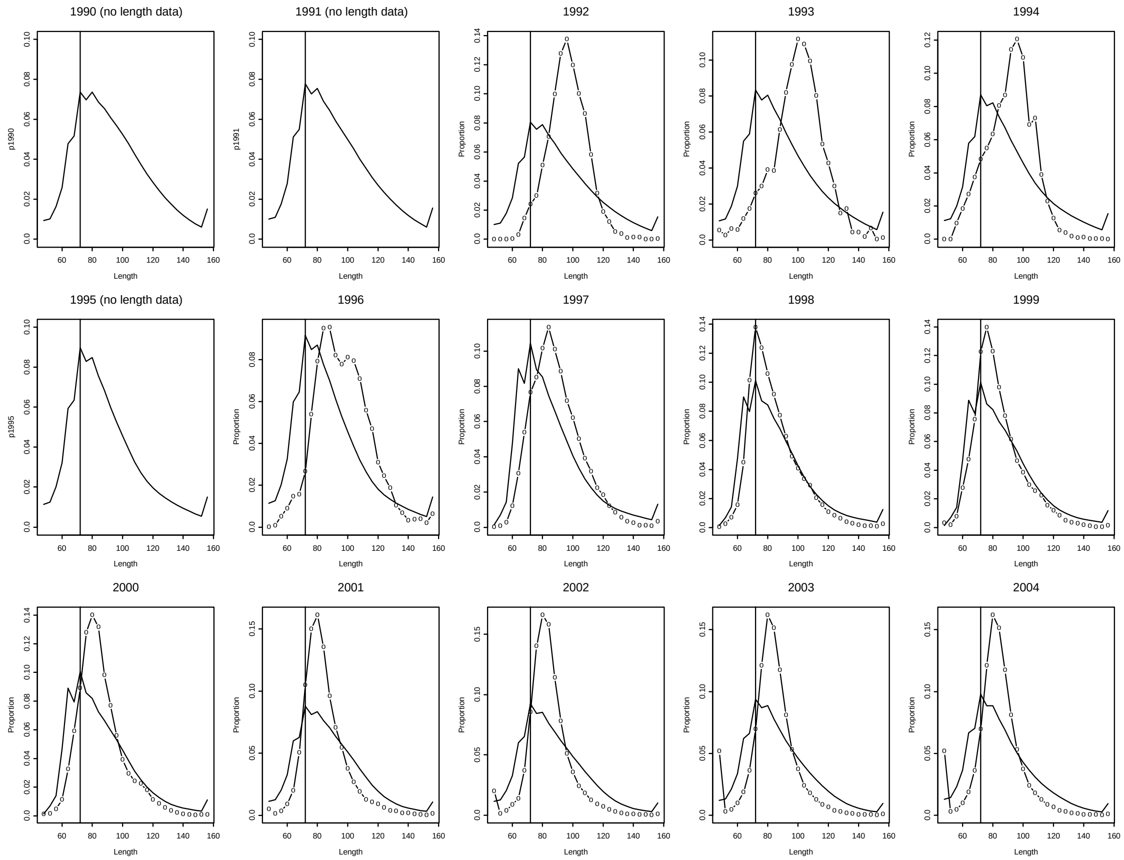


Figure 5.12(d)

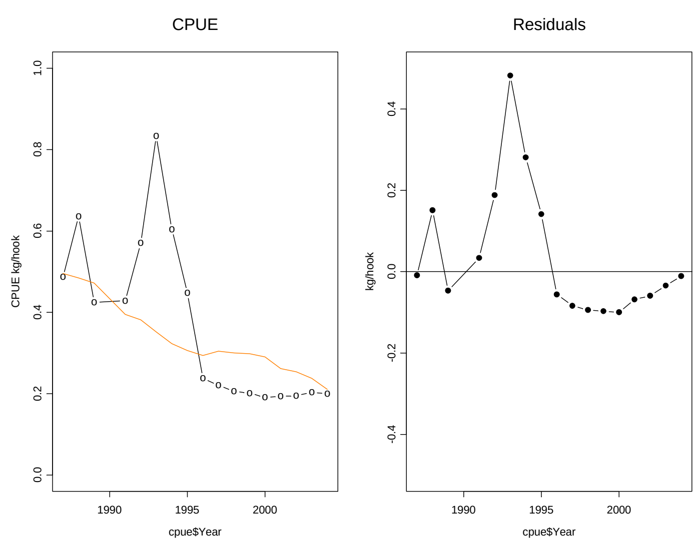


Figure 5.12(e)

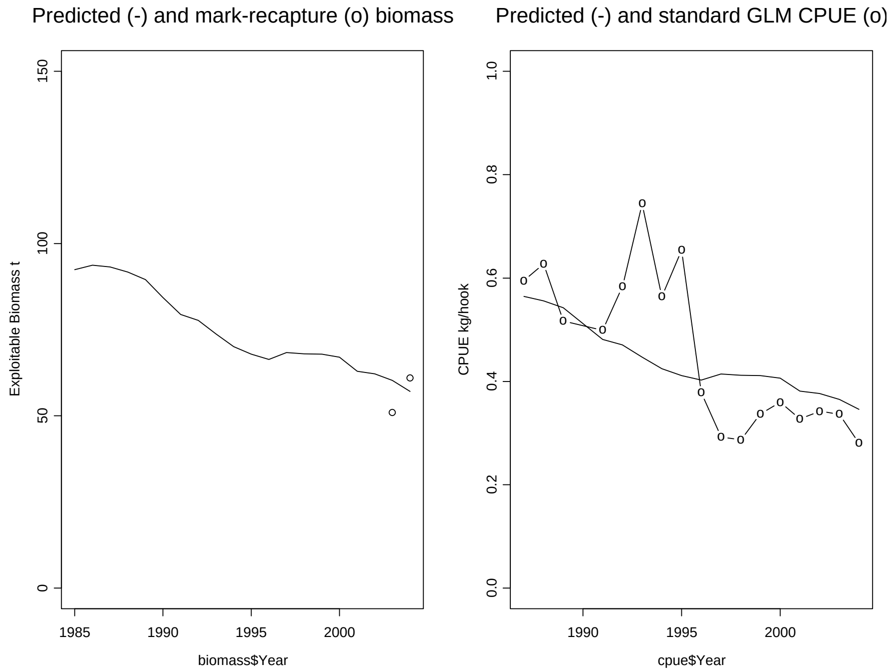


Figure 5.12: Two runs of the AD Model Builder ASPM implementation using the GLMM CPUE series. (a) length composition (-o- = observed, ___ = predicted, with the mode of the predicted identified by a vertical bar) with length composition weighting = 10; (b) CPUE fit (-o- = observed, ___ = predicted) and residuals with length composition weighting = 10; (c) and (d), the same with length composition weighting = 0.1. (run numbers 5 and 6 in Table 5.22), (e) ASPM fit to the standard GLM and tagging data with an equal weighting (1). Exploitable biomass and tag-estimated exploitable biomass (o) is shown (run number 3 in Table 5.22). Note that for the years 1990, 1991 and 1995 there was no observed length-frequency data.

5.140 Reviewing these sensitivity trials, the Working Group noted that the results of the ASPM were highly dependent on the weighting factors used, and the values specified for fixed parameters. None of the fits to the full CPUE series were satisfactory, there being large trends in the residuals. The most significant residual discrepancies are the inability of the model to predict the rapid decline in CPUE over the period from 1995 to 1996, or the relatively constant CPUE since 1997. Although the runs with high weighting on the length composition data were able to predict reasonably accurately the catch composition from about 1997 onwards, the fits to data from the early 1990s were poor. Adjusting the weighting factors to produce a better fit to either the length or CPUE dataset results in a much poorer fit to the other dataset, and no weighting factor produced a satisfactory fit to both length and CPUE data. Inclusion of the tagging estimates of biomass in 2003 and 2004 assisted the model, but did not improve the fit to the CPUE data.

5.141 The Working Group therefore agreed that the ASPM cannot be used at this meeting to provide reliable estimates of stock abundance. However, the revisions to the model and detailed review of the sensitivity trials provided several promising lines of further research, and it is recommended that these be pursued in the intersessional period for review by WG-FSA-SAM.

3.2 Parameter values

Biological parameters

Table 5.23: Parameter values for *Dissostichus eleginoides* in Subarea 48.3.

Component	Parameter	Value	Units
Natural mortality	M	0.132–0.2	y^{-1}
VBGF	K	0.066	y^{-1}
VBGF	t_0	–0.21	y
VBGF	L_∞	1946	mm
Length to mass	‘a’	2.5E-09	mm, kg
Length to mass	‘b’	2.8	
Maturity	L_{m50}	930	mm
Range: 0 to full maturity		780–1080	mm

Time series

Total removals

5.142 Estimated total removals are set out in Table 5.14.

Selectivity-at-age

Table 5.24: Schedule of estimated *Dissostichus eleginoides* relative vulnerabilities-by-age for the seasons 1986–2003 in Subarea 48.3.

Age (years)	Relative vulnerabilities		Age (years)	Relative vulnerabilities	
	1998–2000, 2003	2001–2002, 2004, future projections		1998–2000, 2003	2001–2002, 2004, future projections
0	0.00	0	10.88	0.96	0.99
4.9	0.00	0	11.21	0.95	0.99
6.17	0.72	0.5	11.54	0.94	0.97
6.67	1.00	0.73	11.88	0.92	0.96
6.91	1.00	0.77	12.23	0.91	0.94
7.17	1.00	0.81	12.59	0.89	0.92
7.42	1.00	0.84	12.96	0.87	0.90
7.68	1.00	0.87	13.33	0.84	0.87
7.95	1.00	0.90	13.72	0.82	0.84
8.21	1.00	0.92	14.12	0.79	0.81
8.49	1.00	0.94	14.52	0.76	0.77
8.77	1.00	0.96	14.94	0.72	0.73
9.05	1.00	0.97	15.37	0.68	0.69
9.34	0.99	0.98	15.81	0.64	0.64
9.64	0.99	0.99	16.27	0.60	0.59
9.94	0.98	1.00	20.00	0.60	0.59
10.25	0.98	1.00	55.00	0.60	0.59
10.56	0.97	1.00			

Standardised CPUE

5.143 The standardised CPUE series for the 2004 season was estimated using the GLMM method proposed by Candy (2004). The revised CPUE series is presented in Table 5.25. This revised series was used as the base-case series for the GYM assessment.

Table 5.25: Standardised series of CPUEs in kg/hook for *Dissostichus eleginoides* in Subarea 48.3, from the random effects GLMM standardised for Chilean vessels fishing between depths of 1 000 and 1 500 m in the southern sector of South Georgia used in the GYM assessments for 2004. The years prior to 1989 were not used in the GYM assessments.

Fishing season	CPUE estimate	Upper 95% CI	Lower 95% CI
1984/85	0.2106	0.5576	0.0795
1985/86	0.2564	0.6393	0.1028
1986/87	0.4866	1.2494	0.1895
1987/88	0.6358	1.4297	0.2827
1988/89	0.4249	0.9748	0.1852
1989/90	-	-	-
1990/91	0.4284	0.9035	0.2032
1991/92	0.5701	0.8509	0.3820
1992/93	0.8338	1.2807	0.5428
1993/94	0.6042	0.9002	0.4055
1994/95	0.4478	0.6504	0.3083
1995/96	0.2381	0.3462	0.1637
1996/97	0.2205	0.3229	0.1506
1997/98	0.2059	0.3028	0.1400
1998/99	0.2014	0.2935	0.1381
1999/00	0.1909	0.2782	0.1310
2000/01	0.1934	0.2815	0.1328
2001/02	0.1947	0.2832	0.1338
2002/03	0.2035	0.2981	0.1390
2003/04	0.1997	0.2905	0.1373

Recruitment

5.144 The recruitment series for Subarea 48.3 was revised based on the results of the CMIX analyses completed using the Subarea 48.3 growth parameters (WG-FSA-04/92). The series was also estimated using the growth parameters provided by Belchier et al. (2004) (WG-FSA-04/92).

5.145 Both of the revised series result in substantially lower estimates of mean recruitment and, in the case of the Belchier et al. (2004) series, a higher CV than those used in the 2002 assessment or the revised estimate used in the 2003 assessment (Table 5.26). The Working Group noted that this reduction in mean recruitment was largely due to the identification of the errors in previous analyses (SC-CAMLR-XXII, Annex 5, paragraphs 5.104 to 5.115), the sources of which had subsequently been rectified (WG-FSA-SAM-04/16).

Table 5.26: Revised recruitment series for Subarea 48.3 based on review of data extractions and CMIX analysis presented in WG-FSA-SAM-04/16 and WG-FSA-04/92, and revisions to CMIX analysis for the 1998 UK survey completed during the meeting. Both series exclude the Russian 2000 survey. The FSA-04 48.3 vB series was used as the base-case for the 2004 long-term yield assessment. The FSA-04 48.3 Belchier et al. (2004) vB series was used in sensitivity analyses. See paragraphs 5.144 and 5.145 for details of revised series.

Split-year	FSA-02	FSA-03 new 02	FSA-04 48.3 vB	FSA-04 Belchier et al. (2004) vB
1986				0.120
1987	1.349	1.349	0.846	0.834
1988	0.845	0.845	0.568	0.558
1989	4.214	4.244	0.017	0.195
1990	9.374	9.374	1.954	1.096
1991	6.7	6.700	1.227	0.005
1992			0.260	2.018
1993	11.799	11.799	5.312	4.633
1994	2.13	2.225	1.259	0.561
1995	1.003	0.984	1.252	0.004
1996	0.691	0.690	1.118	0.258
1997	2.947	2.947	1.794	1.549
1998	1.14	1.140	0.659	0.659
1999			0.124	0.038
2000			0.139	0.148
2001	2.504	1.067	0.664	0.155
2002	4.207	1.066	0.992	0.677
2003	10.694	2.015	1.814	0.074
2004			-	0.840
2005			1.379	0.756
2006			2.47	0.649
Mean	4.257	3.318	1.255	0.754
CV	0.90	1.06	0.949	1.369

4. Stock assessment

4.1 Model structure and assumptions

5.146 The GYM, using input data from Section 3 of this Fishery Report, was used to estimate the constant catch that would satisfy the CCAMLR decision rules. These are:

1. Depletion rule: Determine the catch that results in a probability of the spawning stock biomass falling below 20% of its estimated pre-exploitation level of not more than 10% over the 35-year projection period.

2. Escapement rule: Calculate the catch that results in a median escapement of 50% of the spawning stock biomass in the final year of the 35-year projection;

3. Choose the lower of the two estimates of long-term yield.

Model configuration

5.147 The GYM was run (Table 5.27) according to the configuration detailed in Table 5.42.

Table 5.27: GYM configuration for the assessment of *Dissostichus eleginoides* in Subarea 48.3.

Age structure	Recruitment age	4 years
	Plus class accumulation	35 years
	Oldest age in initial structure	55 years
Simulation specification	Number of runs	10 001
	Depletion level	0.2
	Seed for random number generator	–24 189
Individual trial specifications	Years to remove initial age structure	1
	Observations to use in median SB_0	1001
	Year prior to projection	1983
	Reference start date	01/12
	Increments in year	24
	Years to project stock in simulation	35
	Reasonable upper bound for annual *F*	5.0
	Tolerance for finding *F* in each year	0.000001

5.148 In the Subarea 48.3 recruitment series (Table 5.26) the likelihood method was used to weight each trial projection based using the standardised CPUE series in Table 5.25.

4.2 Model estimates

5.149 In preparation for the assessment, the Working Group considered the preliminary assessment using the GYM provided in WG-FSA-04/82. In particular, it noted that in the initial assessment presented, a large proportion (~40%) of trials did not realise the known catches in the latter part of the known series (WG-FSA-04/82, Figure 6).

5.150 The Working Group considered a range of factors that may contribute to the known catch series not being realised, these included:

(i) the revised estimates of absolute recruitment being biased;

(ii) the nature of the real time series of recruitments immediately prior to the known series;

(iii) the upper end of the range of natural mortality (M) currently used in the assessment being too high; and/or

(iv) the current growth parameters being biased.

5.151 The Working Group noted that the unrealised catches could result from any one or a combination of the above.

4.3 Sensitivity analyses

5.152 The Working Group conducted an initial series of sensitivity analyses using the GYM to explore the potential source of the unresolved catches in the current assessment. The analyses included examining the effect of :

(i) a the range of M used (0.13–0.2 and 0.13–0.165)
(ii) the uses of point estimates of M (0.13, 0.14, 0.15, 0.16, 0.17, 0.18, 0.19, 0.20)
(iii) assuming different values to scale the estimates of recruitment over the known period (1987–2004) of the fishery (1, 2 and 3).

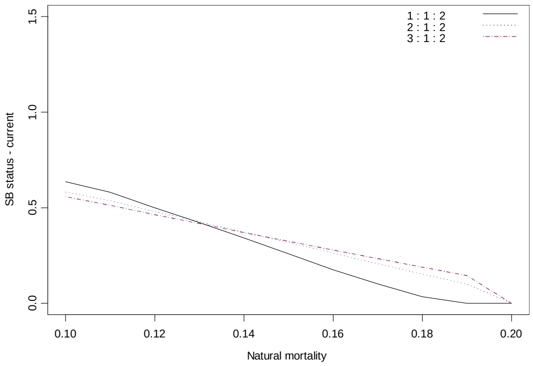
5.153 The base-case for these analyses was: M = 0.13–0.20, and recruitment scaler = 1. The revised Subarea 48.3 recruitment series (Table 5.26), GLMM CPUE series (Table 5.25) and likelihood weighting of trials (Kirkwood and Constable, 2001) were consistently used for all diagnostic analyses.

5.154 The results of the diagnostic analyses are presented in Figure 5.13. The Working Group noted that the estimate of M had a significant effect on the proportion of trials with unresolved catches, and in particular that for values of M less than 0.15 the known catch history was resolved in all trials, whereas the proportion of trials for which the catches were not resolved increased rapidly for values of M greater than 0.16. The Working Group also noted that scaling the estimated recruitment series resulted in 100% of trials resolving the catch series, up to values of M of approximately 0.18 or higher. Above values of 0.18 for M, the proportion of trials with unresolved catches increased markedly and the results for other variables examined were also unrealistic.

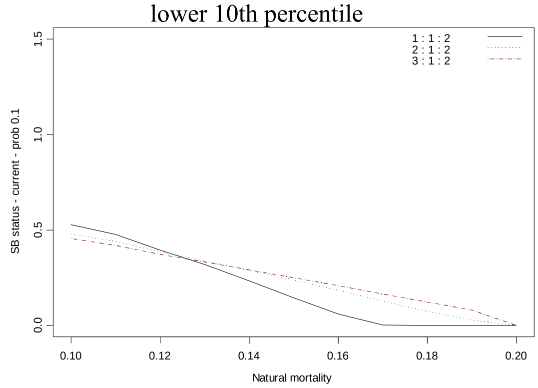
Figure 5.13(a)

Current spawning stock status

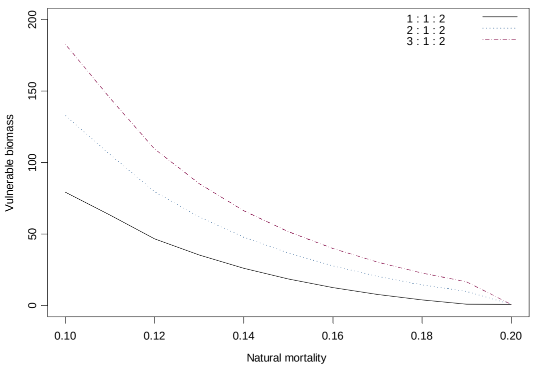
median



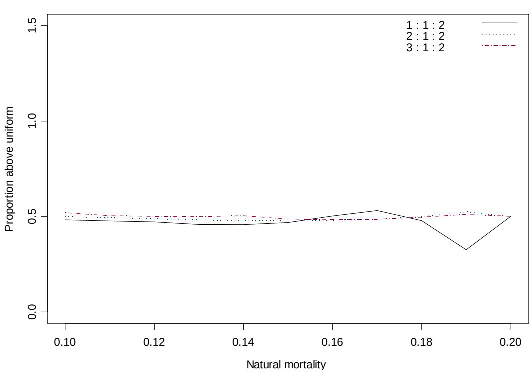
lower 10th percentile



Vulnerable biomass (thousand tonnes)



Proportion of trials
with statistical weight above uniform weight



not resolving known catch series

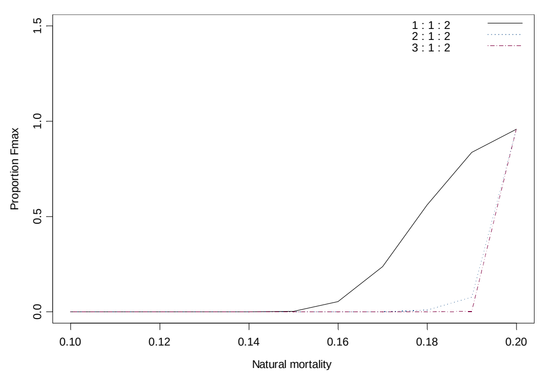
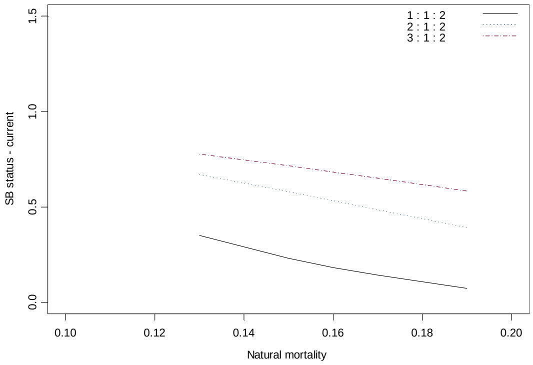


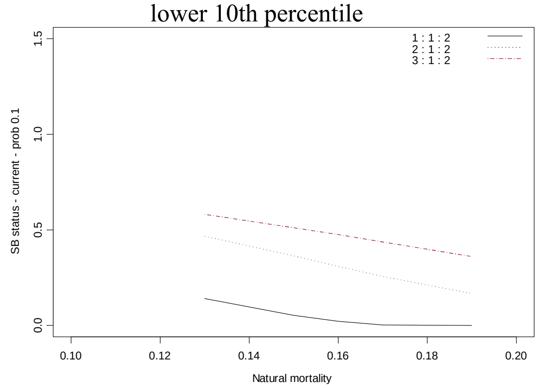
Figure 5.13(b)

Current spawning stock status

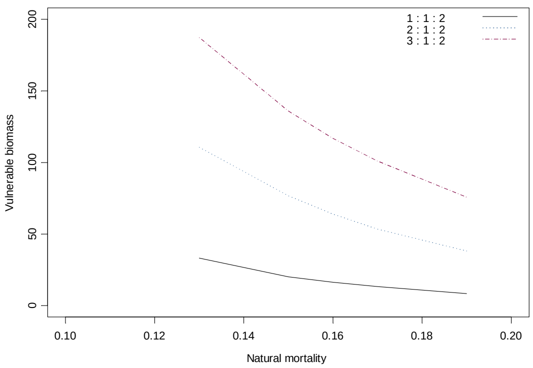
median



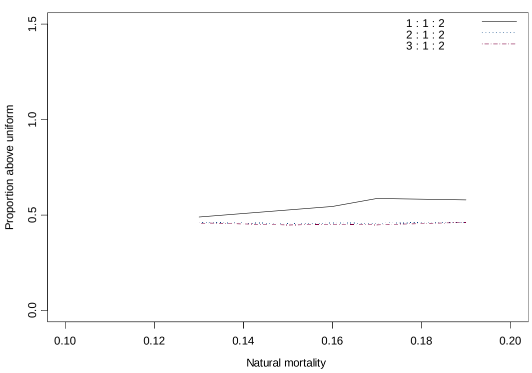
lower 10th percentile



Vulnerable biomass (thousand tonnes)



Proportion of trials
with statistical weight above uniform weight



not resolving known catch series

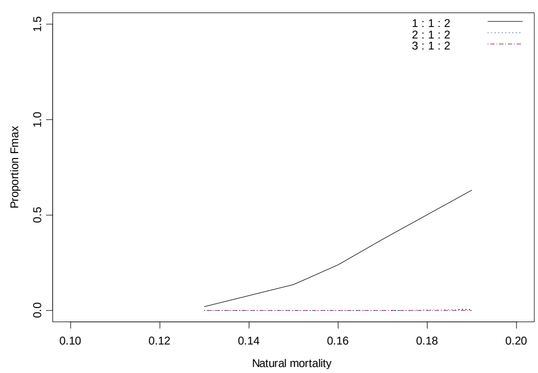


Figure 5.13: Results of initial sensitivity trials using the GYM examining the possible attributes of the stock of *Dissostichus eleginoides* in Subarea 48.3 with different scenarios for recruitment and natural mortality. Values of spawning stock status and vulnerable biomass shown here are the median values for each year. Trials were weighted by the goodness of fit to the standardised CPUE series before the medians were determined.

(a) Recruitment is modelled as a lognormal function with recruitments in 1984–2005 estimated from the surveys. Mean recruitment in years for which no observations were made is modelled as the estimate from the surveys (solid line), 2x the estimate (dotted line) and 3x the estimate (dashed line).

(b) Recruitment is modelled as a lognormal function in all years of the trials. Mean recruitment is modelled as the estimate from the surveys (solid line), 2x the estimate (dotted line) and 3x the estimate (dashed line).

4.4 Discussion of model results

Alternative scenarios for the 2004 assessment

5.155 On the basis of the results of the sensitivity analyses and the considerable uncertainty in the current status of the stock in Subarea 48.3, the Working Group agreed that a range of scenarios should be run for the 2004 assessment for consideration in providing advice for 2004. The factors to be included in the scenarios are given in Table 5.28. The results are presented in Tables 5.29 and 5.30 and Figure 5.14.

Table 5.28: Summary of alternative scenarios examined for *Dissostichus eleginoides* in Subarea 48.3 for the 2004 assessment. The base-case assessment was: M = 0.13–0.20, recruitment scaler = 1 and test values of 500 and 1 500 tonnes.

Factor	Levels	Values
Range of natural mortality	2	(0.13–0.20); (0.155–0.175)
Scaling of recruitment series	4–5	0.5, 1, 1.5, 1.78, 2
Constant catch level*	3–4	500–4 780 tonnes

* The test values for catch level varied among scenarios, including a catch value that resulted in an estimate of vulnerable biomass that approximated the estimate of vulnerable biomass from the Petersen mark–recapture estimate (Table 5.21).

Table 5.29: Results of the alternative scenarios examined for the 2004 assessment of *Dissostichus eleginoides* in Subarea 48.3. M range = range of natural mortality; Rec. = scaler used to multiply estimated densities of recruits (ages 2–4); Year: 1984 = year prior to known series; 2004 = end of 2004/05 season; SB.stat50 = median spawning biomass over the projection period; SB.stat10 = lower 10th percentile of spawning biomass; TB.50 = median total biomass prior to known catch series; VB50 = medium vulnerable biomass at start of know catch series; P.depl. = probability of the spawning stock biomass being below 0.2 of unfished biomass over the projection period; P.Fmax = proportion of trials for which the known catch series was not resolved; P. > wt = proportion of trials with a greater than uniform weight (for CPUE adjustment). All scenarios were run using the revised Subarea 48.3 recruitment series given in Table 5.26 with 2 001 trials per scenario. The base-case (see paragraph 5.153) is shown in bold.

M range	Rec.	Test catch (tonnes)	Year	SB.stat50	SB.stat10	TB.50	VB50	P.depl.	P.Fmax	P. > wt
0.13–0.20	0.5R								0.991	0.395
			1984	1.000	0.791	36.657	0.000			
			2004	0.000	0.000	2.344	0.423			
		1000	2005	0.000	0.000	2.233	0.511			
		1000	2039	0.520	0.211	22.827	16.566	0.991		
		3000	2005	0.000	0.000	2.233	0.480			
		3000	2039	0.000	0.000	2.118	0.413	1.000		
0.13–0.20	**1R**								**0.311**	**0.586**
			1984	**1.023**	**0.810**	**87.155**	**0.000**			
			2004	**0.217**	**0.001**	**25.116**	**15.231**			
		500	**2005**	**0.186**	**0.000**	**23.517**	**14.289**			
		500	**2039**	**0.895**	**0.685**	**77.265**	**53.904**	**0.526**		
		1500	**2005**	**0.182**	**0.000**	**23.517**	**14.247**			
		1500	**2039**	**0.697**	**0.466**	**63.827**	**45.408**	**0.548**		
0.13–0.20	1.5R								0.000	0.463
			1984	1.017	0.806	119.595	0.000			
			2004	0.454	0.260	57.019	36.755			
		500	2005	0.418	0.226	55.457	35.096			
		500	2039	0.931	0.719	109.187	76.459	0.057		
		1500	2005	0.414	0.222	55.457	35.050			
		1500	2039	0.793	0.572	96.849	68.561	0.079		
0.13–0.20	1.78R								0.000	0.459
			1984	1.017	0.806	141.960	0.000			
			2004	0.552	0.385	78.050	50.994			
		3000	2005	0.506	0.338	76.157	48.763	0.020		
		3000	2039	0.655	0.413	99.194	71.261			
		3500	2005	0.504	0.336	76.157	48.740	0.053		
		3500	2039	0.598	0.339	92.895	66.710			
0.13–0.20	2R								0.000	0.456
			1984	1.017	0.806	159.543	0.000			
			2004	0.611	0.457	94.376	61.993			
		1000	2005	0.568	0.416	92.401	59.436	0.000		
		1000	2039	0.901	0.685	141.987	99.583			
		3000	2005	0.562	0.409	92.401	59.345	0.005		
		3000	2039	0.694	0.460	116.580	83.369			
		3500	2005	0.560	0.407	92.401	59.320	0.020		
		3500	2039	0.644	0.400	110.009	79.082			

Table 5.29 (continued)

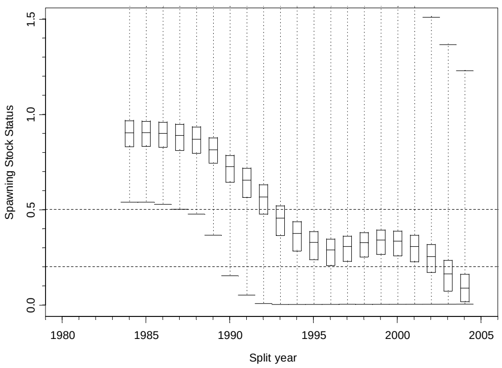
M range	Rec.	Test catch (tonnes)	Year	SB.stat50	SB.stat10	TB.50	VB50	P.depl.	P.Fmax	P. > wt
0.155–0.175	0.5R								1.000	0.542
			1984	0.985	0.773	34.843	0.000			
			2004	0.000	0.000	2.246	0.422			
		1000	2005	0.000	0.000	2.116	0.479	1.000		
		1000	2039	0.495	0.220	21.619	15.732			
		3000	2005	0.000	0.000	2.116	0.454	1.000		
		3000	2039	0.000	0.000	1.978	0.386			
0.155–0.175	1R								0.139	0.544
			1984	1.026	0.813	79.414	0.000			
			2004	0.149	0.027	18.701	10.635			
		500	2005	0.121	0.013	17.069	9.982	0.785		
		500	2039	0.893	0.677	70.402	49.318			
		1500	2005	0.117	0.012	17.069	9.936	0.814		
		1500	2039	0.683	0.449	57.236	40.910			
0.155–0.175	1.5R								0.000	0.458
			1984	1.018	0.805	115.949	0.000			
			2004	0.454	0.352	55.676	36.072			
		500	2005	0.419	0.323	54.026	34.712	0.001		
		500	2039	0.931	0.715	107.001	74.957			
		1500	2005	0.415	0.319	54.026	34.666	0.001		
		1500	2039	0.797	0.575	94.696	67.024			
		3590	2005	0.406	0.311	54.026	34.567	0.134		
		3590	2039	0.487	0.233	66.434	47.725			
0.155–0.175	2R								0.000	0.452
			1984	1.019	0.805	154.879	0.000			
			2004	0.613	0.505	92.762	61.171			
		500	2005	0.573	0.473	90.955	58.835	0.000		
		500	2039	0.950	0.734	145.004	101.459			
		1500	2005	0.570	0.470	90.955	58.790	0.000		
		1500	2039	0.851	0.633	133.134	93.801			
		4780	2005	0.560	0.461	90.955	58.638	0.109		
		4780	2039	0.496	0.248	89.925	64.338			

Table 5.30: Estimates of constant catch that will satisfy the decision rules for each alternative scenario for the 2004 assessment of *Dissostichus eleginoides* in Subarea 48.3. The third part of the decision rule states that the lower of the two catch levels is selected as the estimate of long-term yield. All scenarios were run using the revised Subarea 48.3 recruitment series given in Table 5.26 with 2 001 trials per scenario. See Table 5.29 for description of column heading. The base-case (see paragraph 5.153) is shown in bold.

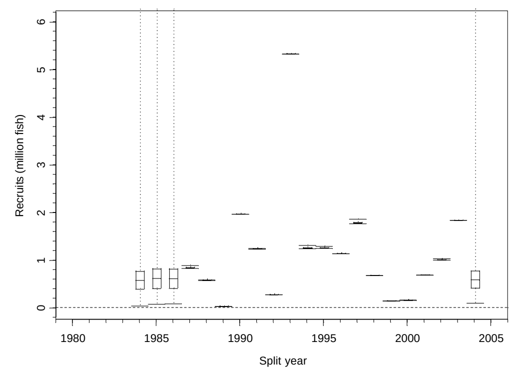
M range	Rec.	SB.stat50	P.depl.	P.Fmax	P. > wt	Escapement rule catch	Depletion rule catch
0.13–0.20	0.5R	0.000	1.000	0.991	0.395	1075.6	0
0.13–0.20	**1R**	**0.697**	**0.548**	**0.311**	**0.586**	**2499**	**0**
0.13–0.20	1.5R	0.793	0.079	0.000	0.463	3626.4	2454.55
0.13–0.20	1.78R	0.598	0.053	0.000	0.459	4347.1	4216
0.13–0.20	2R	0.644	0.020	0.000	0.456	4918.4	6166.67
0.155–0.175	0.5R	0.000	1.000	1.000	0.542	977.79	0
0.155–0.175	1R	0.683	0.814	0.139	0.544	2373	0
0.155–0.175	1.5R	0.487	0.134	0.000	0.458	3503.7	3055.71
0.155–0.175	2R	0.496	0.109	0.000	0.452	4739.1	4509.17

Figure 5.14(a)

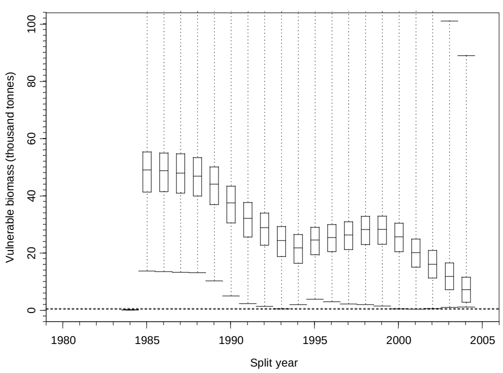
Spawning stock status



Recruitment



Vulnerable biomass



Mean weight of vulnerable fish

Fishing mortality

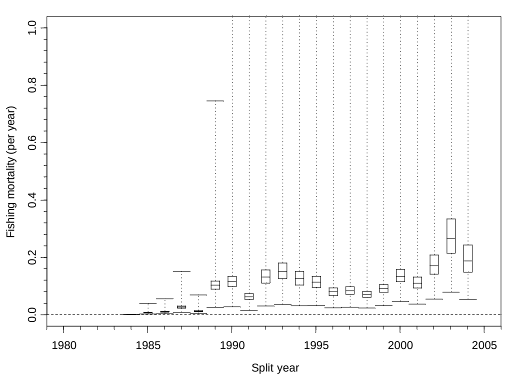
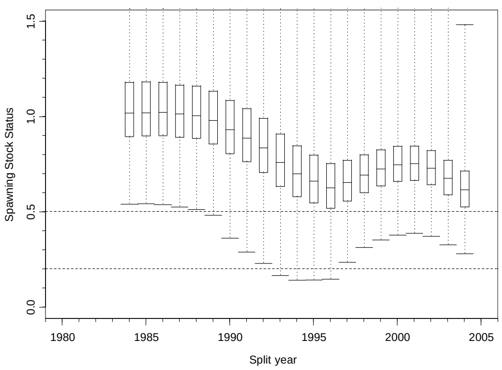
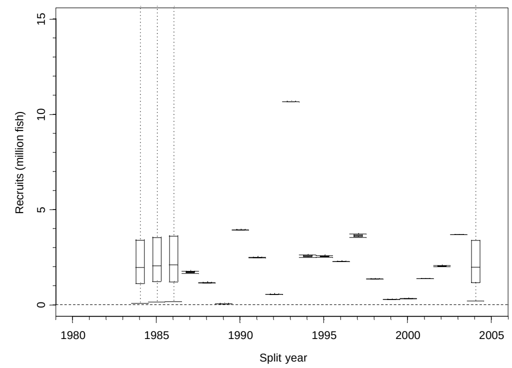


Figure 5.14(b)

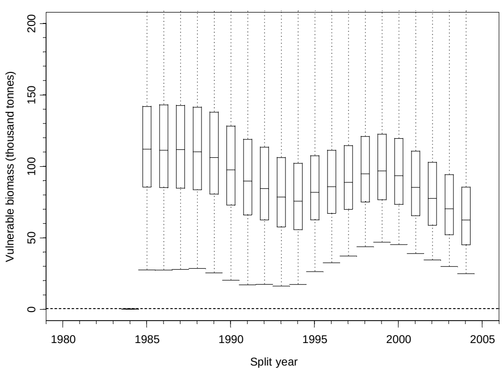
Spawning Stock Status



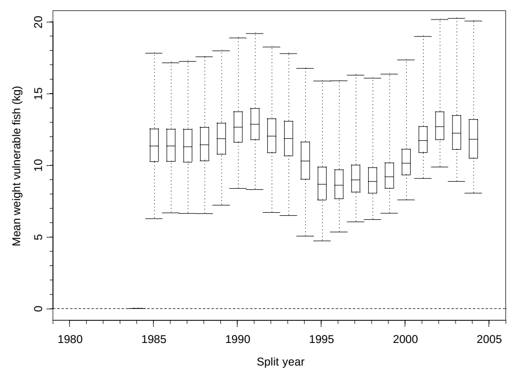
Recruitment



Vulnerable biomass



Mean weight of vulnerable fish



Fishing mortality

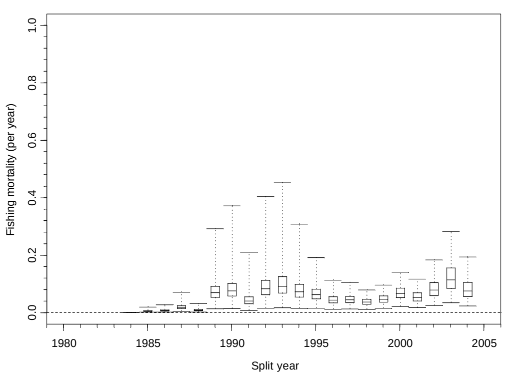


Figure 5.14: Box plots showing the results of trials using the GYM examining the possible attributes of the stock of *Dissostichus eleginoides* in Subarea 48.3 with different scenarios for recruitment for the range of natural mortality between 0.13 and 0.2. The known catch series is taken between 1984 and 2004. Trials were weighted by the goodness of fit to the standardised CPUE series before estimating the values of the box plots. The mid-line in each box is the median. The upper and lower limits to the box are the lower (0.25) and upper (0.75) quartiles. The ends of the whiskers show the minimum and maximum values observed in the trials.

(a) Base case: recruitment is modelled as a lognormal function with recruitments in 1984–2005 estimated from the surveys. Mean recruitment in years for which no observations were made is modelled as the estimate from the surveys.

(b) Recruitment is modelled as a lognormal function with recruitments in 1984–2005 estimated from the surveys. Survey data were scaled by 2x in these projections. Mean recruitment in years for which no observations were made is modelled as the estimate from the surveys.

5. By-catch of fish and invertebrates

5.1 Estimation of by-catch removals

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

Table 5.31: By-catch (tonnes) reported from longline fisheries in Subarea 48.3. GRV – *Macrourus* spp., SRX – rajids.

Fishing season	GRV		SRX		Others	
	Removals	Limit	Removals	Limit	Removals	Limit
1988/89	2		22		0	*
1989/90	0		0		0	*
1990/91	9		26		0	*
1991/92	1		2		0	*
1992/93	2		0		0	*
1993/94	0		12		0	*
1994/95	13		98		11	*
1995/96	40		58		0	*
1996/97	34		44		4	*
1997/98	24		15		2	*
1998/99	21		19		1	*
1999/00	18		12		5	*
2000/01	22		28		3	*
2001/02	53	291	26	291	13	
2002/03	75	390	38	390	19	
2003/04	30	221	6	221	4	

* None specified

Estimated cut-off catch

5.157 Estimates of total mortality for fish cut from longlines in Subarea 48.3 were made in 2003. Sufficient data to repeat these calculations was not available at the 2004 WG-FSA meeting.

5.2 Assessments of impact on affected populations

5.158 No assessments for rajids or macrourids in Subarea 48.3 have yet been undertaken.

5.3 Mitigation measures

5.159 By-catch limits and move-on rules are included in the annual conservation measure established for this fishery (Conservation Measure 41-02). In addition, mitigation measures for rajids consist of cutting rajids off lines at the water surface.

6. By-catch of birds and mammals

5.160 Details of seabird by-catch (taken from Table 7.3) are summarised in Table 5.32. Estimated potential seabird removals in the IUU fishery are summarised in SC-CAMLR-XXIII/BG/23 and Table 7.15.

Table 5.32: Estimated by-catch of seabirds in Subarea 48.3.

Fishing season	By-catch rate (birds/thousand hooks)	Estimated by-catch
1996/97	0.23	5 755
1997/98	0.032	640
1998/99	0.013*	210*
1999/00	0.002	21
2000/01	0.002	30
2001/02	0.0015	27
2002/03	0.0003	8
2003/04	0.001	18

* Excluding *Argos Helena* line-weighting experiment cruise

5.161 Ad hoc WG-IMAF has assessed the level of risk of incidental mortality of seabirds in Subarea 48.3 as category 5 (SC-CAMLR-XXIII/BG/21).

6.1 Mitigation measures

5.162 Conservation Measure 25-02 applies to this subarea.

6.2 Interactions involving marine mammals with longline fishing operations

5.163 No interactions were reported in the 2004 fishing season.

7. Ecosystem effects

5.164 The Working Group did not examine the ecosystem effects of the longline fishery for toothfish in Subarea 48.3.

8. Harvest controls for the 2003/04 season and advice for 2004/05

8.1 Conservation measures

Table 5.33: Summary of provisions of Conservation Measure 41-02 for *Dissostichus eleginoides* in Subarea 48.3 and advice to the Scientific Committee for the 2004/05 season.

Paragraph and topic	Summary of CM 41-02	Advice for 2004/05	Paragraph reference
1. Access (gear)	Longlines and pots only		
2. Catch limit	4 420 tonnes	Review	
3. Season: longline	1 May to 31 August 2004 Extension possible to 14 September 2004 for vessel complying fully with CM 25-02 in 2002/03.		
3. Season: pots	1 December 2003 to 30 November 2004		
3. By-catch: seabirds	During extension period (1–14 September 2004) any vessel catching three (3) seabirds to cease fishing.		
4. By-catch: crabs	By-catch of crabs to be counted against crab catch limit.		
5. By-catch: finfish	Total combined catch of skates and rays ≤221 tonnes Total catch of *Macrourus* spp. ≤221 tonnes		
6. By-catch: any species	Move-on rule		
7. Mitigation	In accordance with CM 25-02.		
8. Observers	Each vessel to carry at least one CCAMLR scientific observer and may include one additional scientific observer.		
9. Data: catch and effort	(i) Five-day reporting system as in CM 23-01 (ii) Monthly fine-scale reporting system as in CM 23-04 on haul-by-haul basis.		
10. Target species	For the purposes of CMs 23-01 and 23-04, *Dissostichus eleginoides* is the target species and the by-catch is any species other than *D. eleginoides.*		
11. Jellymeat	Number and weight of fish discarded, including those with jellymeat condition, to be reported. These catches count towards the catch limit.		
12. Data: biological	Monthly fine-scale reporting system as in CM 23-05. Reported in accordance with the Scheme of International Scientific Observation.		

8.2 Management advice

5.165 In summary the Working Group noted the following points arising from the various analyses undertaken during the meeting:

(i) Size distribution of the catch: in the early 1990s the catch was characterised by a range of fish sizes (approximately 60–145 cm) with a mode just greater than 100 cm. In the late 1990s, the size of fish ranged from 60 to 120 cm with a mode between 70 and 80 cm. In recent years, the mode has increased slightly.

(ii) Distribution of fishing effort: the fishery and assessment relate to the fishing areas around South Georgia/Shag Rocks, not to Maurice Ewing Bank or North Scotia Ridge (Figure 5.5). Fishing has occurred throughout the area, although the pattern has changed over the development of the fishery. During the early period (1989–1996), the fishery expanded across the area from an initial concentration of effort around Shag Rocks. Since 1996 the fishery has extended over the entire area (Figure 5.3).

(iii) Trends in standardised CPUE by area: the main fishing areas have different trends in CPUE. The main trends evident in the data are for Shag Rocks and the southern South Georgia area. At Shag Rocks, the CPUE has been variable over the early period (up to 1995) and then increased through to 1999, after which time it has declined. In the southern South Georgia area, the CPUE declined between 1994 and 1996 and has been increasing more recently.

(iv) Trends in standardised CPUE overall: the CPUE time series is characterised by an early period (1987–1994), a period of rapid decline (1995–1996) and a later period of relatively constant CPUE since 1996. The later period in the GLMM is approximately 35% of the level in the early period. The later period in the GLM is approximately 50% of the level in the early period.

(v) Trends in standardised mean weight of fish in the commercial catch: this time series is similar to the expectation derived from the size distribution of the catch with the mean weight declining from approximately 12 kg in the early period to 6–7 kg in the later period.

(vi) Recruitment: the time series of recruitments estimated from surveys shows the trends in recruitment in the region. The number of survey hauls and their distribution could be improved to increase precision of the estimates for each year. Interannual variation in the performance of the surveys is likely to be a random factor. Such variation will influence the magnitude of the coefficient of variation of the estimated mean recruitment. Improvements in survey design will most likely reduce the CV but may not alter the mean. The estimate of mean recruitment may be influenced (biased) by other factors but there is no direct information at present to estimate bias, if it exists.

(vii) Biomass estimates from mark–recapture data: these estimates are based on 160 recaptures, with variable representation between areas. The most coverage was for Shag Rocks. The tagging program at South Georgia has been expanded in 2004 but the releases are much less than for other areas in the Convention Area. The Working Group explored some of the underlying assumptions of the Petersen method, such as that the tagged population is well mixed with the untagged population and there is a constant recapture rate (tags recaptured / tags in the population) over time, although there may not be a sufficiently long time series to determine if the assumptions are met at this stage. With respect to mixing, a large proportion of the tagged fish have been recaptured less than 20 km from their location of release. The annual recapture rate has been 12% in 2002, 12% in 2003 and 7% in 2004. If the fish are not well mixed and the distribution of release and recapture effort were to vary among years, then estimates of abundance from the tagging experiment could be biased.

(viii) Results of the ASPM: the ability for the ASPM to fit to the data is dependent on a number of assumptions and parameter inputs, including recruitment, growth and mortality rates. It could also be influenced by the selectivity/vulnerability function and the accuracy of the estimates of vulnerability at age/length.

(ix) Sensitivity tests on estimates of current status of the population using the GYM: the problem of realising the known catch series in the GYM projections using the parameters applied in the assessment by WG-FSA last year could be resolved by lowering the range of natural mortality, increasing the starting biomass while retaining the estimated recruitment series, or by increasing the magnitude of recruitment during the known catch series. These trials showed that estimates of vulnerable biomass, along with the known catch series, could be realised by different combinations of these parameters. The respective combinations will influence the status of the stock when the trajectory is passed through a specific vulnerable biomass.

(x) Estimated catch from a recruitment-based long-term annual yield assessment: following the revision of the recruitment series and the application of this in the usual assessment of the past, the resulting long-term annual yield would be zero. If the assessment is undertaken using the lognormal parameters derived from the time series of recruitments but without applying the known catch and recruitment series, then the long-term annual yield would be estimated to be approximately 1 900 tonnes.

5.166 Dr Constable noted that there were a number of issues that remain to be resolved in the assessment for *D. eleginoides* in Subarea 48.3 and that it would be useful to undertake an evaluation of the robustness of the different approaches considered at this meeting to achieving the objectives of the Commission. Dr Constable summarised a number of points for the Working Group to consider in reconciling some of the different outcomes from the work at this meeting. On the basis of those points, Dr Constable also suggested advice on the status of the stock and potential yield in the coming season. The points included:

(i) The early and later periods of the standardised CPUE series provide a strong signal of the abundance of the vulnerable biomass. The standardisation process has aimed to remove variation in CPUE that might arise from different vessels (nationality), depths and seasons. Consequently, the series provides an estimation of the relative trends in abundance of the vulnerable biomass. The series is then used to weight the outcomes of the GYM projections so that those consistent with the CPUE series are given greater weight. The series can be divided into two main periods – an early, high period and a later, lower period. These two periods involve different fishing fleets operating in the area.

(a) If the early phase of each period was the time when the respective fleets were learning about the area, then the values of CPUE from these parts would be expected to represent the general catch density of the area. The ratio of the standardised CPUE at these times would therefore reflect the relative change in abundance of the vulnerable biomass.

(b) After the learning period, the fleets would be expected to focus on areas of greatest catch density. There is potential for the CPUE to become stable if the areas being fished are areas of aggregations of toothfish, even though the overall biomass might be declining. It is not known if this is or is not the case in Subarea 48.3.

(ii) In view of the results of the GYM projections from 1984 to 2004 based on the survey estimates of recruitment (unscaled recruitment series) and those projection results based on a scaling of the recruitment series by a factor of 2:

(a) the relative differences in the standardised CPUE and in the standardised mean weight of fish between the period of the late 1980s compared to the period in the late 1990s are most closely reflected in the relative differences in the respective median values of vulnerable biomass and mean weight of fish in the GYM projections using the unscaled recruitment series;

(b) if the median vulnerable biomass from these GYM projections are examined in the early 1990s and the early 2000s, the GYM projections decline compared to the CPUE series remaining constant in those periods. In this respect, the Working Group would need to undertake a finer-resolution analysis of the fishing effort to determine if hyper-stability in the CPUE series could have arisen;

(c) an alternative interpretation is that the relative difference between the median vulnerable biomass in 1989 compared to 2004 in the 2x scaled recruitment projections is in agreement with the relative differences between those years in the CPUE series. In this case, the decline in mean weight of vulnerable fish in the projections is not matched by the standardised series.

(iii) With respect to the tagging experiment, there has been insufficient time to explore fully whether the assumptions of mixing, and the degree to which the recapture rate is relatively constant, are met. Biases in the estimation of biomass may arise due to the high rate of recaptures less than 20 km from release, the low number of tags in the water and the potential for relative concentrations of fishing effort to have shifted from one year to another during the tagging experiment. A longer time series and a greater number of tags will help identify whether the mixing assumptions and, consequently, constant recapture rates can be satisfied.

(iv) The sensitivity trials of the GYM projections indicate that a combination of parameters other than mean recruitment could improve the fits of the model to the known catch series as well as estimates of the vulnerable biomass, such as those arising from the tagging experiment.

(v) The manner in which advice can be given needs to be based on the precautionary approach and the potential consequences of being incorrect in the interpretation of the data.

(vi) If the unscaled recruitment series is correct, then the sustainable long-term annual yield of a pristine stock might be around 1 900 tonnes. The results of the projections in this case imply that the spawning stock is likely to be nearing depletion. It is not known at what level a reduction in recruitment might arise but the critical level has widely been regarded as 20% of the pre-exploitation median spawning biomass, as reflected in the CCAMLR decision rules.

(vii) If the scaled recruitment series to give the estimate of vulnerable biomass estimated from the tagging experiment is correct, then the fishery might be able to be maintained at the current level.

(viii) The consequences of applying the CCAMLR decision rules and accepting one case when the other is correct are respectively:

(a) unscaled recruitments – the estimate of yield would be zero for the coming year. Once the methods have been resolved and a robust estimate of yield from a new method is obtained then the fishery would be reopened;

(b) scaled recruitment – the fishery would continue with unknown consequences for recruitment and stock recovery and a greater potential for long-term depletion.

(ix) A difficulty with this assessment is the degree to which parameters other than scaling the recruitments could influence the process and result in a different outcome for spawning stock status, such as estimates of growth rate, selectivity and natural mortality.

(x) Given the extent to which the tagging program has increased and the work on evaluating management procedures is under way, it is conceivable that progress could be made in the coming year to resolve some of the issues and use new data from the tagging program to help address the assumptions and to better estimate the magnitude of the vulnerable population.

(xi) On that basis and considering precaution, it would seem prudent to at least ensure the catch would not lead to the probability of depletion increasing by more than a small amount over the next year while the issues are examined in more detail over the coming year. This would protect future options for the fishery and help ensure that the stock status is not appreciably altered in the short term. This method would require estimates of the probability of depletion with no catch in the future. There was insufficient time to undertake that work. The following steps could be followed to help determine whether a nominal catch might lead to an increased probability of depletion:

(a) Table 5.29 presents the status of the spawning stock under alternative scenarios for recruitment, natural mortality and future catch rates. The lower 10th percentile of spawning stock status in specific years shows the spawning stock status for which there is a 10% chance it will be less than or equal to that value in that year. This corresponds to the part of the decision rule that relates to depletion in that a catch is chosen with a 10% chance of depletion below 20% of the median pre-exploitation biomass.

(b) The aim would be for that 10th percentile to not be appreciably reduced over one year. In this respect, the change in value of the lower 10th percentile of spawning stock status between 2004 and 2005 is a guide to the consequence of the nominated catch levels in the scenarios. A large reduction in the 10th percentile would indicate that a catch at that level would be unlikely to retain the status quo.

5.167 Drs Kirkwood and Agnew noted the following points for discussion and suggested possible advice:

(i) Results of a GYM run with 2 000 trials using the standard set of input parameters, the revised standardised CPUE series and the revised recruitment series are shown in Figure 5.14. Examining these results, the following features are apparent:

(a) Diagnostic statistics collected during this run indicate that in over 31% of the trials, the population abundance from 1984 to 2004 was insufficiently large to allow all the known catches to be taken.

(b) Despite the fact that the CPUE likelihood weighting of trials had been applied, the time series of predicted median vulnerable biomass indicate trends that are incompatible with those in the standardised CPUE series:

- There is a severe decline of about 80% in predicted vulnerable biomass from 1999 to 2004. This is a period during which the standardised GLMM CPUE was almost completely flat, and even the standard GLM only shows a 15% decline.

- The relative declines from 1985 to 2004 are also much greater than in the standardised CPUE; 90% in the GYM in Figure 5.14(a) versus 50–60% in the GLM/GLMM.

- By contrast, declines in the scaled runs are much closer to the GLM and GLMM runs (Figure 5.14(b); 50% decline compared to 50–60% decline in GLM/GLMM).

(c) There is no evidence from the plots of fishing distribution for the severe contractions of fishing area that would be expected if hyper-stability was the explanation for these discrepancies.

(d) It was inconceivable, if current vulnerable biomass is only 2 to 3 times higher than the catch level, that major signals would not be seen in the CPUE series.

(e) The estimated vulnerable biomass in 2004 (around 15 000 tonnes) is considerably less than half the lower 95% confidence limit of the mark–recapture abundance estimates for 2003 and 2004.

(f) If the analysis by Dr Gasyukov was correct (paragraph 5.169), the level of recruitment estimated by the survey would be even lower. This would mean that more than 50% of GYM trials, and up to 99% (Table 5.29, 0.5R) would not realise the catch. This is clearly implausible, and serves to emphasise the severe uncertainty surrounding the survey estimates of recruitment and the CMIX procedure.

(g) If there is the possibility that the GYM can be reconciled with current recruitment simply by adjusting natural mortality, growth etc., then confidence in GYM runs must surely be undermined. Following points made by Dr Gasyukov, Drs Agnew and Kirkwood saw no justification for changing these fundamental parameters, and are therefore driven to the conclusion that the explanation for the fact that the unscaled recruitment GYM fails to match other analyses (CPUE, tagging and ASPM) is because surveys are not providing an accurate estimate of recruitment.

(ii) In the view of Drs Agnew and Kirkwood, the most likely reason for these incompatibilities is that the calculated recruitment estimates are downwardly biased estimates of the true absolute recruitment. These incompatibilities also rule out direct use of these GYM results to calculate long-term yields according to the usual CCAMLR decision rules.

(iii) One way of resolving these problems is to treat the calculated recruitment series as providing a relative, rather than absolute, index of actual recruitment. As described in WG-FSA-04/82, this can be done by determining a raising factor for the recruitment series that results in a GYM prediction of current median vulnerable biomass equal to an estimate of current biomass obtained using a different estimation method. As discussed at WG-FSA-SAM-04, this approach would also accommodate use of the CCAMLR decision rules used for setting long-term catch limits.

(iv) In WG-FSA-04/82, three different estimators of current biomass were discussed: mark–recapture, ASPM and a depletion estimator. During this meeting, the mark–recapture and the ASPM estimators were further considered and modified:

(a) The range of estimates of current biomass calculated using the ASPM ranged from 28 000 to 266 000 tonnes, but in all cases the fits to the input data were sufficiently poor that the Working Group agreed that none of the ASPM estimates calculated at this meeting could be considered reliable.

(b) Bootstrapped median estimates of vulnerable biomass using the mark–recapture data for 2003 and 2004 were respectively 51 000 and 60 500 tonnes, with 95% confidence intervals 42 000–63 500 and 47 000–82 000 tonnes.

(v) Sensitivity trials run during the meeting included use of raising factors for the recruitment series used in the GYM of 1.5, 1.78 and 2.0. These produced median vulnerable biomasses in 2004 of 37 000 tonnes, 51 000 tonnes and 62 000 tonnes, corresponding respectively to a biomass lower than the lower confidence limit of the lowest mark–recapture estimate (42 000 tonnes), and approximately the median mark–recapture estimates for 2003 and 2004.

(vi) Application of the CCAMLR decision rules to these three sets of GYM calculations would result in long-term yields of 2 450, 4 200 and 4 900 tonnes. Accordingly, it is believed that an appropriate long-term yield calculated according to the CCAMLR decision rules would be 4 200 tonnes, corresponding to the lower of the two median mark–recapture estimates. Should a greater degree of precaution be desired for the forthcoming year, then a lower catch limit in the range 2 450–4 200 tonnes would be appropriate.

5.168 Dr Gasyukov reminded the Working Group that it has agreed rules of procedure for conducting assessments. These included standard methods and software for assessments, for example, the CMIX program and Excel add-in. In this context he was concerned that a range of methods had been introduced for the assessment of *D. eleginoides* in Subarea 48.3 (tagging estimates of abundance, ASPM estimate of abundance) in response to the outcomes of the review of the recruitment series and initial assessment of the implications. He noted that the current assessment method had been used by the Working Group for 10 years and that it was necessary to more thoroughly investigate and understand the reasons for the observed results before considering alternative methods. He considered it important that the Working Group acknowledge the errors that have affected previous assessments, that these errors had resulted in the catch limit being set at nearly 8 000 tonnes and that in this context it was not a surprise that the stock may be very depleted.

5.169 Dr Gasyukov noted that very few Members had the opportunity, in terms of time and documentation, to appropriately review or verify the application of the alternative methods to the assessment and, therefore, were not in a position to provide advice on their robustness for use in the assessment of *D. eleginoides*. He emphasised that he did not want to discourage the exploration, development and adoption of alternative methods, such as the ASPM and mark–recapture methods, only that the Working Group be afforded appropriate opportunity to review and understand methods before their application to assessments, including the provision of appropriate specifications and documentation for their use. In light of this, he expressed great concern over the use of the mark–recapture estimates of abundance to scale the revised recruitment series so that the median vulnerable biomass from the GYM projections corresponded to the estimates of biomass from the mark–recapture method. He noted that the assessment using the current assessment method and the revised recruitment series indicated a long-term yield in the order of 1 900 tonnes, that the stock may be very depleted and that there was no scientific basis to disregard the current assessment. In addition, he noted that the preliminary examinations of the effect of stratification on the estimates of recruitment from CMIX indicate that the revised series of recruitments may not be correct and that this required urgent investigation.

5.170 Given these issues, Dr Gasyukov urged the Working Group to be precautionary in its advice, and not modify the current assessment approach until there had been the opportunity to better understand the issues that had not been resolved at this meeting, and that resolving these issues should be the priority for the next meeting of WG-FSA-SAM.

5.171 Drs Kock and O. Wöhler (Argentina) indicated that they shared a number of the concerns expressed by Dr Gasyukov with respect to changing the current assessment methods and the use of the mark–recapture estimates of biomass, particularly given the potential for the stock to be depleted. They also considered that the views expressed by Dr Constable were a balanced assessment of the information available to the Working Group.

5.172 Dr R. O'Driscoll (New Zealand) noted that much of the information used for assessments, including CPUE and tagging estimates, are fishery-dependent and would not be available if the fishery is closed.

8.3 Comments from general discussion on assessment of *D. eleginoides* in Subarea 48.3

5.173 The Working Group noted that Shag Rocks and west Shag Rocks are primary recruitment areas and that the CPUE has been declining since 1999 at Shag Rocks. An additional measure might be to establish local-area limits in the defined areas to protect parts of the stock. The Working Group agreed that it might be useful to consider a much lower catch in the area of Shag Rocks and west Shag Rocks to protect recruits but not so low that the tagging experiment could not continue.

5.174 The Working Group considered that more detailed analysis of the spatial pattern of the fishery should be a high priority to investigate the potential for hyper-stability in the standardised CPUE series raised by Dr Constable.

5.175 The Working Group was unable to provide further advice on assessments this year.

Fishery Report: *Dissostichus eleginoides* Kerguelen Islands inside French EEZ (Division 58.5.1)

5.176 Insufficient information was available at the meeting to complete a Fishery Report for this fishery. The Working Group recommended that French scientists be requested to provide the information required during the coming intersessional period.

Standardisation of CPUE

5.177 Haul-by-haul catch and effort data for the French longline fishery inside the French EEZ in Division 58.5.1 (fine-scale data) for the 1998/99 to 2003/04 fishing seasons were examined. These data had been kindly provided by Prof. G. Duhamel (France). GLMMs and LMMs as described in Candy (2004) and WG-FSA-03/34 were used to investigate trends in CPUE (kg/hook) and average weight of caught fish (kg) respectively.

5.178 Figure 5.15 shows the standardised CPUE series for 1998/99 to 2003/04, along with estimated total removals for the period 1995/96 to 2003/04. There is a general decreasing trend in the standardised CPUE.

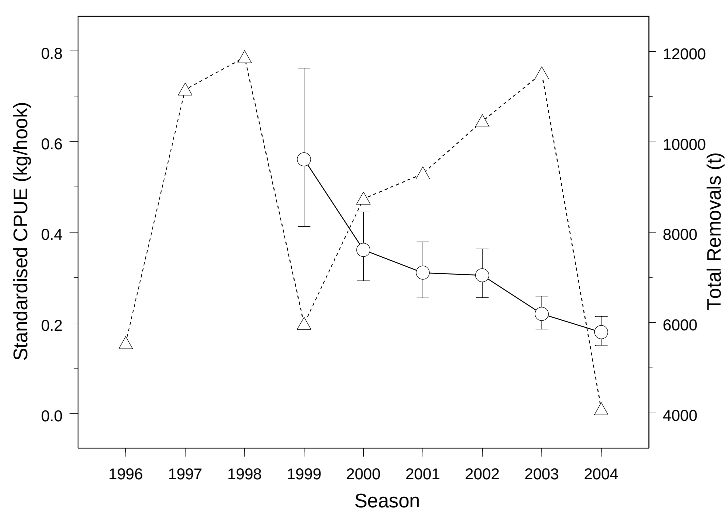


Figure 5.15: Time series of both total removals (dashed line) and standardised CPUE (solid line) obtained from the fitted GLMM. Error bars represent approximate 95% confidence bounds on the estimates.

5.179 With regard to total removals, the Working Group had noted last year that there had been a dramatic increase in total removals since 1998/99. The estimated total removals for 2003/04 are substantially lower than those in 2002/03 (from 11 511 to 4 079 tonnes). Most of this reduction resulted from a lowering of estimated IUU catch from 7 825 tonnes in 2002/03 to 643 tonnes in 2003/04.

5.180 Figure 5.16 shows the corresponding series of standardised average weights in the catch. The decrease in the standardised average weight probably indicates that the older age classes are becoming less numerous in the exploited stock.

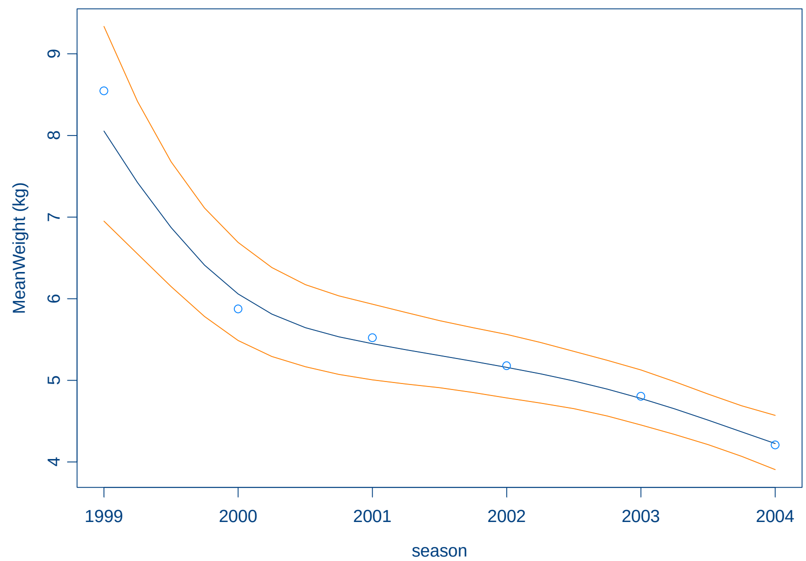


Figure 5.16: Time series of standardised average weight (kg) obtained from the LMM fitted to log(average weight) using a cubic smoothing spline. Error bounds represent approximate 95% confidence bounds on the estimates.

Management advice

5.181 Last year, the Working Group had agreed that it is imperative that steps be taken to substantially reduce total removals from 2002/03 levels. The Working Group welcomed the substantial reduction that had been achieved in 2003/04, but noted that in the absence of a stock assessment it is not possible to determine whether this reduction in catches, if sustained, would allow the declining trends in standardised CPUE or mean lengths to be halted or reversed.

5.182 As for other toothfish fisheries in the CCAMLR Convention Area, the Working Group recommended that tag–recapture experiments be conducted. It also noted that the carrying out of a recruitment survey in the Kerguelen area would be very beneficial for a fuller assessment of toothfish stocks on the Kerguelen Plateau.

5.183 No new information was available on the state of fish stocks in Division 58.5.1 outside areas of national jurisdiction. The Working Group therefore recommended that the prohibition of directed fishing for *D. eleginoides* described in Conservation Measure 32-13 remains in force.

Fishery Report: *Dissostichus eleginoides* Heard Island (Division 58.5.2)

1. Details of the fishery

1.1 Reported catch

5.184 The catch limit of *D. eleginoides* in Division 58.5.2 for the 2003/04 season was 2 873 tonnes (Conservation Measure 41-08) for the period from 1 December 2003 to 30 November 2004. The catch reported for this division as of 1 October 2004 was 2 269 tonnes. Reported catches along with the respective catch limits and number of vessels active in the fishery are shown in Table 5.34. In Division 58.5.2, the fishery was a trawl fishery from the 1996/97 to the 2001/02 season. For the last two seasons the fishery has been prosecuted by both trawlers and longliners. The longline fishery was active from 1 May to 14 September 2004 and the trawl fishery was active from 1 December 2003 to 30 November 2004.

Table 5.34: Catch series of *Dissostichus eleginoides* in Division 58.5.2 from 1989/90 to 2003/04. T – Trawler; LL – longliner; *season will finish on 30 November 2004.

Fishing season	Number vessels	Catch limit (tonnes)	Reported catch (tonnes)			IUU estimate (tonnes)	Total removals (tonnes)
			Total	Trawl	Longline		
1989/90			1	1	0	0	1
1990/91			0	0	0	0	0
1991/92			0	0	0	0	0
1992/93			0	0	0	0	0
1993/94			0	0	0	0	0
1994/95		297	0	0	0	0	0
1995/96		297	0	0	0	3000	3000
1996/97	2	3800	1927	1927	0	7117	9044
1997/98	3	3700	3765	3765	0	4150	7915
1998/99	2	3690	3547	3547	0	427	3974
1999/00	2	3585	3566	3566	0	1154	4720
2000/01	2	2995	2980	2980	0	2004	4984
2001/02	2	2815	2756	2756	0	3489	6245
2002/03	2T + 1LL	2879	2844	2574	270	1512	4356
2003/04	2T + 1LL	2873	2269*	1717*	552	637	2906*

1.2 IUU catch

5.185 Details of the IUU catches attributed to Division 58.5.2 are given in Table 3.3 and questions of the attribution of IUU catches reported in Areas 47 and 51 are considered in paragraphs 8.12 and 8.13.

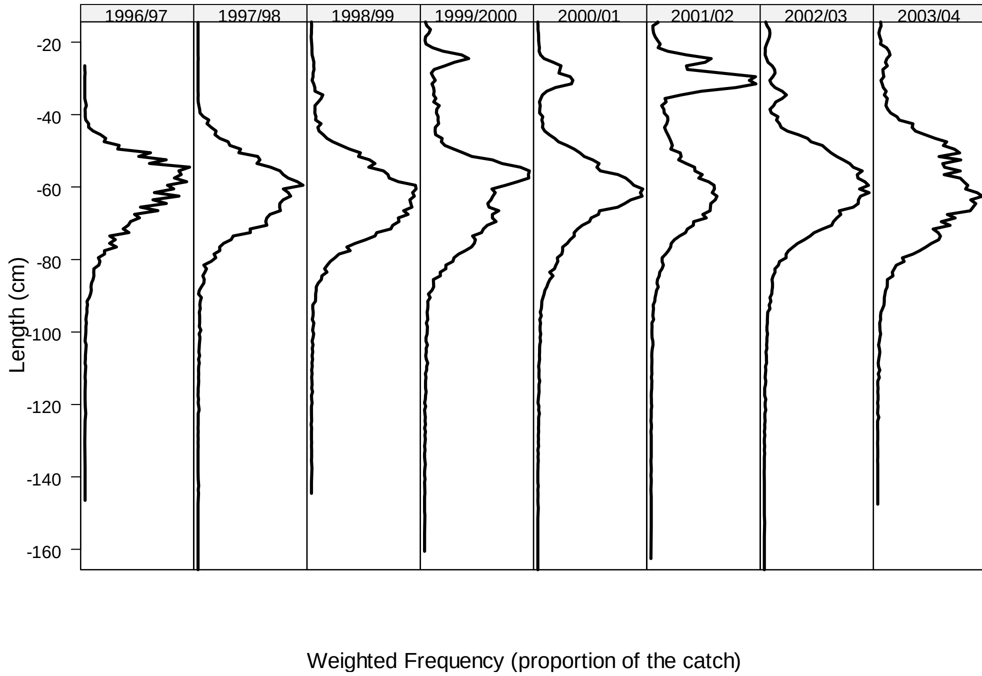


Figure 5.17: Catch-weighted length frequencies for *Dissostichus eleginoides* in Division 58.5.2 derived from observer, fine-scale and STATLANT data from the trawl fishery reported by 6 October 2004.

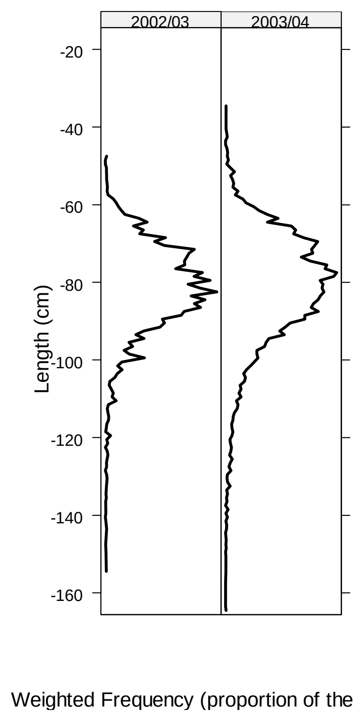


Figure 5.18: Catch-weighted length frequencies for *Dissostichus eleginoides* in Division 58.5.2 derived from observer, fine-scale and STATLANT data from the longline fishery reported by 6 October 2004.

1.3 Size and distribution of catches

5.186 Catch-weighted length frequencies are illustrated in Figures 5.17 (trawl fishery) and 5.18 (longline fishery). The Working Group noted that the modal size of fish caught in the longline fishery was greater than that in the trawl fishery.

2. Stocks and areas

5.187 *D. eleginoides* occurs throughout the Heard Island and the McDonald Islands Plateau, from shallow depths near Heard Island to at least 1 800 m depth around the periphery of the plateau. Annual random stratified trawl surveys conducted since 1997 have shown that younger fish (less than about 600 mm TL) predominate on the plateau in depths less than 500 m, but no areas of local abundance have been discovered. As fish grow, they move to deeper waters, and are recruited to the trawl fishery on the plateau slopes in depths of 450 to 800 m. Here there are several areas of local abundance that constitute the main trawling grounds where the majority of fish caught are between 500 and 750 mm TL (Figure 5.17). Older fish are seldom caught in the trawl fishery, and it is assumed that they move into deeper water (>1 000 m depth) where they are caught by the longline fishery. This fishery mostly operates between 1 000 and 1 200 m depth and catches larger fish than in the trawl fishery (Figure 5.17), but few fish >1 000 mm TL. It is assumed that the largest fish are at depths greater than 1 200 m.

5.188 Genetic studies have demonstrated that the *D. eleginoides* population at Heard Island and McDonald Islands is distinct from those at distant locations such as South Georgia and Macquarie Island (Appleyard et al., 2002), but that within the Indian Ocean sector there appears to be no distinction between fish at Heard, Kerguelen, Crozet or Marion/Prince Edward Islands based on genetic studies (WG-FSA-03/66). This, combined with results from tagging data which show movement of some fish from Heard Island to Kerguelen and Crozet Islands (Williams et al., 2002) suggests that a metapopulation of *D. eleginoides* may exist in the Indian Ocean sector (WG-FSA-03/72).

3. Parameter estimation

3.1 Parameter values

<u>Fixed parameters</u>

5.189 There were no updates to population parameters from last year used in the analysis of long-term annual yield. The input parameters used in the assessment are included in Table 5.35.

Table 5.35: Input parameters for the assessment of *Dissostichus eleginoides* in Division 58.5.2.

Component	Parameter	Value	Units
Natural mortality	M	0.13–0.2	y^{-1}
VBGF	K	0.29	y^{-1}
VBGF	t_0	–2.46*	y
VBGF	L_∞	2465	mm
Length to mass	‘a’	2.59E-09	mm, kg
Length to mass	‘b’	3.2064	
Maturity	L_{m50}	930	mm
Range: 0 to full maturity		780–1 080	mm

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

Recruitment survey

5.190 No report of the Australian research survey was tabled at the meeting, but brief details were available in WG-FSA-04/76. Full details of the survey are desirable for future assessments. Australia undertook a trawl survey of Division 58.5.2 in May 2004 to estimate density of juvenile toothfish (WG-FSA-04/76). The survey used the same strata as used in the 2000–2002 surveys, with all strata being sampled in the 2004 survey. The number of randomly located trawl stations per strata was based on a review of the survey design for estimating abundance of juvenile *D. eleginoides* presented to the 2004 meetings of WG-FSA-SAM (WG-FSA-SAM-04/19) and WG-FSA (WG-FSA-04/76) (Table 5.36). The increase in the total area of the survey between 2003 and 2004 reflects the fact that the 2003 survey did not include the three northern strata (WG-FSA-03/33). The five stations from the Shell Bank strata in the 2004 survey were excluded from the inputs to assessment as operational constraints prevented the random stations from being completed and the resulting stations were not well distributed across the stratum.

Table 5.36: Details of the 2004 Heard Island survey for *Dissostichus eleginoides*.

Name of area	Mean survey date (DOY)	Area (km^2)	Hauls allocated	Hauls completed	Valid hauls
Ground B	137.4	480.8	25	25	25
Gunnari Ridge	143.6	520.7	18	18	13
Plateau deep east	147.5	13 120	30	30	30
Plateau deep northeast	124.4	15 090	7	7	7
Plateau deep southeast	138.4	5 340	5	5	5
Plateau deep west	125.4	13 370	5	5	5
Plateau north	123.8	15 170	10	10	10
Plateau southeast	146.4	10 620	30	30	30
Plateau west	126.6	10 440	10	10	10
Shell Bank	155.8	1 758	5	5	5
All strata		**85 909**	**145**	**145**	**140**

Recruitment estimates

5.191 Survey data was not available from the CCAMLR Secretariat, as it had been submitted in fine-scale format, rather than research-survey format. The data was available directly from the Australian representatives. Length densities were estimated from the Heard Island survey in May 2004 using the CMIX program, with both mean length (estimated from von Bertalanffy growth parameters) and standard deviation of length fixed (Table 5.37). The standard deviations are calculated using a coefficient of variation of length-at-age of 0.12, which is estimated during the fitting of the growth curve to size-at-age. There are no clear modes present in the length-density data and the fitting relies entirely on the growth curve parameters, which are based on size-at-age data. The Working Group noted that, given the lack of defined modes in the length-density data, it would be useful to evaluate the relative benefits of age–length keys as an alternative method for estimating densities of cohorts and that this would best be done using simulated data.

Table 5.37: Input parameters for CMIX analysis of survey data to estimate length densities of *Dissostichus eleginoides* in Division 58.5.2 in May 2004.

Age class	Mean size (mm fixed)	SD (fixed)
2	326	39
3	387	46
4	447	53
5	504	60
6	560	67
7	615	74
8	668	80
9	719	86

Parameter	Value
Minimisation	Yes
Maximum number of function calls	10 000
Minimum reporting frequency	100
Stopping criteria	1.0E-10
Frequency for convergence testing	5
Fit quadratic surface	No
Simplex expansion coefficient	1

5.192 The CMIX analysis indicates that four main age classes were present in the sampled population (ages 4, 5, 6 and 9; Figure 5.19). The 9-year-old cohort was not used to estimate the recruitment series as it was considered not fully sampled by the survey.

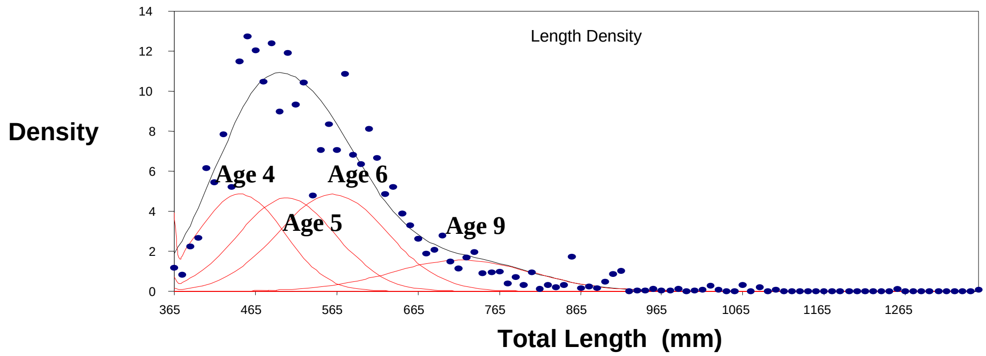


Figure 5.19: Results of CMIX analysis of survey data to estimate length densities of *Dissostichus eleginoides* in Division 58.5.2 in May 2004.

Biomass check

5.193 The estimated length densities from the CMIX program were converted to a biomass estimate using the length–weight relationship, the seafloor area and the mean size at age. This biomass was checked against the Trawl CI estimate from the survey (Table 5.38), and produced a similar estimate of biomass.

Table 5.38: Biomass check for the estimated densities generated by CMIX.

Age	4	5	6	9	
Density (numbers km^{-2})	64.62	70.2726	81.61	33.44	a = 2.59E-09
Area (km^2)	85 909	85 909	85 909	85 909	b = 3.20640
Numbers	5 551 440	6 037 049	7 011 033	2 872 797	
Mean size (mm)	447	504	560	719	
Mean weight (kg)	0.815	1.198	1.679	3.742	
Biomass (tonnes)	4 525.342	7 230.989	11 772.59	10 750.29	34 279.21
Trawl CI					34 733

CPUE series

5.194 The CPUE series was not updated at the 2004 meeting. The series was updated in 2003 (Candy, 2003). The CPUE series is not used in the assessment procedure as the trawl fishery is confined to a relatively small proportion of the area occupied by the stock, and therefore trends in commercial CPUE are not expected to reflect trends in stock status.

Tagging studies

5.195 A tagging study was undertaken at Heard Island from 1998 to 2001 (Williams et al., 2002). There was no time to consider this study in relation to the assessment at the meeting.

Table 5.39: Estimated cohort strengths of *Dissostichus eleginoides* from surveys undertaken in Division 58.5.2 since 1990. Only values in boxes were included in the assessment (see text for details). Observed and expected data are from the mixture analyses, the closeness of which indicates the quality of the fit. The time of the survey is relative to 1 December. Zero density values for age-3 and age-7 fish from the 2004 survey are included in the table and the assessment as 0.001, with standard error (SE) of 0.001.

Survey year	Time	Area (km^2)	Observed	Expected		Density ($n\ km^{-2}$)					
						Age 3	Age 4	Age 5	Age 6	Age 7	Age 8
1990	0.50	97 106	107.2	108.1	Mean	8.080	33.508	20.208	0.827	25.226	
					SE	*5.897*	*13.552*	*11.251*	*11.505*	*14.082*	
1992	0.17	70 271	51.7	51.8	Mean	14.117	13.200	14.501	3.430	0.019	2.117
					SE	*5.156*	*7.036*	*7.845*	*4.473*	*5.449*	*3.342*
1993	0.77	71 555	97.4	114.7	Mean	13.567	38.259	8.191	16.961	3.066	20.884
					SE	*8.804*	*18.172*	*13.483*	*12.606*	*30.294*	*16.333*
1999	0.33	85 428	366.2	357.9	Mean	17.741	16.206	138.11	56.785	60.897	40.323
					SE	*7.862*	*13.323*	*42.657*	*55.348*	*50.870*	*38.189*
2000	0.47	41 144	185.0	179.5	Mean	28.124	21.969	47.817	59.121	7.565	10.989
					SE	*5.298*	*7.996*	*14.885*	*20.578*	*15.142*	*11.383*
2001	0.48	85 169	247.5	252.4	Mean	19.542	34.018	38.172	45.538	32.165	16.738
					SE	*7.798*	*12.849*	*20.534*	*30.762*	*42.367*	*41.086*
2002	0.48	85 910	208.5	204.8	Mean	18.590	29.333	59.400	20.726	53.199	
					SE	*6.722*	*11.475*	*21.202*	*21.993*	*17.117*	
2003	0.42	42 280	116.8	115.6	Mean	15.798	17.298	22.452	45.041		
					SE	*13.552*	*29.967*	*43.976*	*36.105*		
2004	0.43	85 909	242.8	246.0	*Mean*	0.001	64.620	70.727	81.601	0.001	
					SE	*0.001*	*38.548*	*67.242*	*40.211*	*0.001*	

Recruitment series

5.196 The recruitment series was updated with the recruitment estimates from the 2004 survey (Table 5.39). At WG-FSA-03 it was agreed that recruitment data from two trawl surveys (1992 and 2000 in Table 5.39) should be excluded from the GYM. The 1992 survey was excluded because it did not sample below 500 m and the Working Group felt that it did not adequately cover the depth distribution of fish in the age range 3 to 8 years used from other surveys (see WG-FSA-96/38). The 2000 survey was also excluded because of Working Group concerns about the sampling design. The 2000 survey specifically targeted *C. gunnari*, and did not sample strata where *D. eleginoides* were known to occur in greater densities. Thus, it is likely this survey underestimated the density of some cohorts. The Working Group considered that fish younger than age 3 were not adequately sampled by the trawl survey. Cohorts older than age 6 may be underestimated due to fishing on these cohorts. However, the process of mixture analysis can result in incorrectly assigning cohorts at older ages and inclusion of age-7 fish would potentially mitigate this possibility. The Working Group agreed that the 2003 survey did not adequately sample age-7 fish, and so these were not included in the series. The Working Group further agreed to include the estimate of the age-8 cohort from the 1999 survey. The 1999 survey targeted *D. eleginoides*, included intensive sampling in areas where fish ages 5 and above were known to occur, and provided the only estimate of recruitment for this cohort. Estimates of recruitments based on a mean natural mortality rate of 0.165 year^{-1} are provided in Table 5.40.

Table 5.40: Updated recruitment series used in the assessment of *Dissostichus eleginoides* in Division 58.5.2. Based on a natural mortality of 0.165 yr^{-1}.

Year at age 4 birthday	WG-FSA-04
1986	4.3273
1987	0.1207
1988	2.4920
1989	3.7900
1990	1.1200
1991	0.6690
1992	2.7427
1993	0.8248
1994	7.2051
1995	9.2260
1996	7.2946
1997	14.171
1998	6.5321
1999	2.3324
2000	4.5859
2001	3.2006
2002	1.9120
2003	3.0936
Mean	4.2022
CV	0.8464

Fishing vulnerabilities (FV)

5.197 In Division 58.5.2, the fishery was a trawl fishery for the period 1996/97 until the 2001/02 season. For the last two seasons both trawlers and longliners have prosecuted the fishery. Age-based fishing vulnerabilities have been applied since 1996/97 (Table 5.41). Note the same trawl-based vulnerabilities are applied to both the trawl and longline fisheries. This will result in a more conservative estimate of yield than applying longline vulnerabilities.

5.198 In the 1995/96 season a length-based vulnerability function was applied, with vulnerability starting at 550 mm TL, 50% vulnerability at 670 mm TL and full vulnerability at 790 mm TL.

Table 5.41: Fishing vulnerabilities for *Dissostichus eleginoides* in the trawl and longline fishery in Division 58.5.2.

Fishing season	Ages over which FV = 0	Ages over which FV = 1	Ages over which FV = 0
1995/96	Length based (see text)		
1996/97	0–6.9	7–7.9	8–max
1997/98	0–6.0	6.1–10.0	12–max
1998/99	0–5.5	6.0–13.0	15–max
1999/00	0–4.0	4.0–14.0	15–max
2000/01	0–7.9	8.0–14.0	15–max
2001/02	0–7.9	8.0–14.0	15–max
2002/03	0–7.9	8.0–14.0	15–max
2003/04	0–7.9	8.0–14.0	15–max

4. Stock assessment

4.1 Model structure and assumptions

5.199 The GYM, using input data from paragraphs 5.189 to 5.198, was used to estimate the constant catch that would satisfy the CCAMLR decision rules. These are:

1. Depletion rule: Determine the catch that results in a probability of the spawning stock biomass falling below 20% of its estimated pre-exploitation level of not more than 10% over the 35-year projection period.

2. Escapement rule: Calculate the catch that results in a median escapement of 50% of the spawning stock biomass in the final year of the 35-year projection.

3. Choose the lower of the two estimates of long-term yield.

Model configuration

5.200 The GYM was run according to the configuration detailed in Table 5.42.

Table 5.42: GYM model configuration for the assessment of *Dissostichus eleginoides* in Division 58.5.2.

Category	Parameter	Value
Recruitment age	Start	4 years
	Fully selected	8 years
Plus class accumulation		35 years
Oldest age in initial structure		55 years
Simulation specification	Number of runs	10 001
	Depletion level	0.2
	Seed for random number generator	–24 189
Individual trial specification	Years to remove initial age structure	1
	Observations to use in median SB_0	1 001
	Year prior to projection	1985
	Reference start date	01/12
	Increments in year	24
	Years to project stock in simulation	35
	Reasonable upper bound for annual *F*	5.0
	Tolerance for finding *F* in each year	0.000001

4.2 Model estimates

5.201 The constant catch for which there was median escapement of 50% of the median pre-exploitation spawning biomass level at the end of the 35-year projection period was 2 787 tonnes. The yield at which there is a less than 10% chance of spawning biomass dropping to less than 20% of the initial biomass was 3 091 tonnes. Following the third part of the CCAMLR rule, the lower yield of 2 787 tonnes is recommended.

4.3 Sensitivity analyses

5.202 Three sensitivity trials were run at WG-FSA-03 to investigate the effects of the alternative vulnerabilities, and of excluding older age classes from the estimation of the recruitment series (SC-CAMLR-XXII, Annex 5, paragraphs 5.138 to 5.140). In a preliminary assessment, contained in WG-FSA-04/76, the assessment was run with the updated recruitment series and with just ages 3–7 (i.e. excluding the 8 year olds in the 1999 survey) and with the catch series used prior to the 2003 meeting (WG-FSA-03/33). The alternative scenarios produced minor differences in the projected catch.

5. By-catch

5.1 By-catch removals

5.203 By-catch removals for the toothfish fisheries (longline and trawl) are detailed in Table 5.43. By-catch will also arise from the directed fishery for *C. gunnari* in the same division. In trawls targeting *D. eleginoides*, 25 by-catch species were recorded, with the target species comprising of 98.6% of the total catch by weight, followed by *B. eatonii* (0.3%) and *C. gunnari* (0.3%).

Table 5.43: By-catch limits and associated removals (in tonnes) from the toothfish fisheries in Division 58.5.2. OT – otter trawl, LLS – set longlines, LIC – *Channichthys rhinoceratus*, NOS – *Lepidonotothen squamifrons*, GRV – *Macrourus* spp., SRX – rajids.

Fishing season	LIC – OT	LLS	Limit	NOS – OT	LLS	Limit	GRV – OT	LLS	Limit	SRX – OT	LLS	Limit	Other – OT	LLS	Limit
1995/96	0	0		0	0		0	0		0	0		0	0	5%*
1996/97	0	0		0	0		0	0		2	0		5	0	50**
1997/98	0	0	80	0	0	325	0	0		4	0	120	36	0	50
1998/99	0	0	150	8	0	80	1	0		2	0		3	0	50
1999/00	0	0	150	0	0	80	4	0		7	0		4	0	50
2000/01	0	0	150	5	0	80	1	0	50	5	0	50	7	0	50
2001/02	1	0	150	1	0	80	4	0	50	4	0	50	54	0	50
2002/03	0	0	150	0	0	80	1	3	465	8	5	120	5	0	50
2003/04	0	0	150	2	0	80	2	42	360	5	62	120	6	3	50

* 5% move-on rule if individual haul exceeds 5%, limit not specified.
** Move-on rule if catch of any by-catch species exceeds 5% of target species.

5.2 Assessments of impact on affected populations

5.204 No stock assessments of individual by-catch species were undertaken in 2004. By-catch limits of *C. rhinoceratus* and *L. squamifrons* are based on assessments carried out in 1998 (SC-CAMLR-XVII, Annex 5, paragraphs 4.204 to 4.206) and by-catch limits of the grenadier *Macrourus carinatus* are based on assessments carried out in 2002 and 2003 (SC-CAMLR-XXII, Annex 5, paragraphs 5.245 to 5.249).

5.3 Mitigation measures

5.205 The fishery operates under Conservation Measure 33-02.

5.206 The Working Group recommended that, where possible, all rajids should be cut from the line while still in the water, except on the request of the scientific observer (paragraph 6.75).

6. By-catch of birds and mammals

5.207 No seabird mortality has been reported in the two years to date of longline fishing in Division 58.5.2 (paragraph 7.13). In the trawl fishery in this area, six seabirds were killed in 2003. Seabirds were released alive in 2002 (1), 2003 (11) and 2004 (7) (Table 7.18).

5.208 In 2003/04 three fur seals were killed when the *Austral Leader* (trawl fishery) was targeting toothfish.

6.1 Mitigation measures

5.209 Longline fishing is conducted in accordance with Conservation Measures 24-02 and 25-02; trawl fishing in accordance with Conservation Measure 25-03.

5.210 During 2003/04 the longline fishery was restricted to the winter months with day setting of lines prohibited. As part of an adaptive approach to management, and in view of the absence of any seabird by-catch in the 2003/04 fishery, a proposal has been submitted to modify Conservation Measure 25-02 to allow setting by autoline vessels at any time in the day/night cycle (paragraphs 7.84 to 7.86). Ad hoc WG-IMAF has assessed the risk level of seabirds in this fishery in Division 58.5.2 as category 4 (SC-CAMLR-XXIII/BG/21) and supported the proposed recommendations (paragraph 7.86) with respect to autoline vessels in Division 58.5.2:

(i) restrict fishing to the period from 1 May to 14 September;

(ii) use paired streamer lines during all sets of longlines;

(iii) retain on board fish offal and discards;

(iv) be permitted to set longlines at any time in the day/night cycle;

(v) comply with the provisions of Conservation Measure 24-02 or use longlines containing 50 g lead/m integrated weight such that lines sink to 10 m depth at no less than 0.2 m/s, with a preferred average rate of no less than 0.24 m/s;

(vi) abide by all other seabird conservation provisions in Conservation Measure 25-02;

(vii) in the event that three seabirds are caught during daylight setting of lines, vessels must revert to night setting of longlines (as currently applies under Conservation Measure 24-02).

7. Ecosystem implications/effects

5.211 Fishing gear deployed on the seabed can have negative effects on sensitive benthic communities. The potential impacts of fishing gear on the benthic communities in Division 58.5.2 are limited by the small size and number of commercial trawl grounds and the protection of large representative areas of sensitive benthic habitats from direct effects of fishing in an IUCN category Ia marine reserve (SC-CAMLR-XXI/BG/18). The Marine Reserve and associated conservation zone comprises around 17% of the area of the Australian EEZ around Heard Island and McDonald Islands and falls entirely within CCAMLR Division 58.5.2.

5.212 Dr Davies indicated that by-catch of benthos was monitored by observers in the early stages of the development of the fishery and that by-catch of benthos was much lower in areas that have subsequently become the main fishing grounds.

8. Harvest controls for the 2003/04 season and advice for 2004/05

8.1 Conservation measures

Table 5.44: Summary of provisions of Conservation Measure 41-08 for *Dissostichus eleginoides* in Division 58.5.2 and advice to the Scientific Committee for the 2004/05 season.

Paragraph and topic	Summary of CM 41-08	Advice for 2004/05	Paragraph reference
1. Access (gear)	Trawls or longlines		
2. Catch limit	2 873 tonnes west of 79°20'E (see CM 32-14)	Revise catch to 2 787 tonnes	5.201
3. Season: trawl	1 December 2003 to 30 November 2004		
3. Season: longline	1 May to 31 August 2004, with possible extension to 14 September for any vessel that has demonstrated full compliance with CM 25-02 in the 2002/03 season.		
4. By-catch	Fishing shall cease if the by-catch limit of any species, as set out in CM 33-02, is reached.		
5. Mitigation	In accordance with CMs 24-02, 25-02 and 25-03.	Exemption from paragraph 4 of CM 25-02 and modification of CM 24-02	7.86
6. Observers	Each vessel to carry at least one scientific observer and may include one additional CCAMLR scientific observer.		
7. Data: catch and effort	(i) Ten-day reporting system as in Annex 41-08/A (ii) Monthly fine-scale reporting system as in Annex 41-08/A on haul-by-haul basis.		
8. Target species	For the purpose of Annex 41-08/A, the target species is *Dissostichus eleginoides* and the by-catch is any species other than *D. eleginoides*.		
9. Jellymeat	Number and weight of fish discarded, including those with jellymeat condition, to be reported. These catches count towards the catch limit.		
10. Data: biological	Fine-scale reporting system as in Annex 42-02/B. Reported in accordance with the Scheme of International Scientific Observation.		

Fishery Report: *Champsocephalus gunnari* South Georgia (Subarea 48.3)

1. Details of the fishery

1.1 Reported catch

5.213 In Subarea 48.3, a pelagic or semi-pelagic trawl fishery targets *C. gunnari* (Table 5.45). During the 2003/04 season the fishery caught 2 686 tonnes between 9 December 2003 and 25 April 2004. The catch limit for the 2003/04 season was 2 887 tonnes (Conservation Measure 42-01).

Table 5.45: Catch history for *Champsocephalus gunnari* in Subarea 48.3 (source: STATLANT data available from 1977 to 2003; 2004 from catch and effort reports).

Fishing season	Catch (tonnes)	Catch limit (tonnes)	Vessels
1976/77	93 595		-
1977/78	7 472		
1978/79	809		
1979/80	8 795		
1980/81	27 903		
1981/82	54 040		
1982/83	178 824		
1983/84	35 743		
1984/85	628		
1985/86	21 008		
1986/87	80 586		
1987/88	36 054	35 000	
1988/89	3*	0	
1989/90	8 135	8 000	
1990/91	44*	26 000	
1991/92	5*	0	
1992/93	0	9 200	
1993/94	13*	9 200	
1994/95	10*	0	
1995/96	0	1 000	
1996/97	0	1 300	
1997/98	6*	4 520	
1998/99	265	4 840	1
1999/00	4 114	4 036	2
2000/01	960	6 760	6
2001/02	2 667	5 557	7
2002/03	1 986	2 181	5
2003/04	2 686	2 887	6

* Fishery closed, catch information from surveys.

1.2 IUU catch

5.214 There was no evidence of IUU activity in this fishery.

1.3 Size distribution of the catches

5.215 Catch-weighted length frequencies from observer, fine-scale and STATLANT data are presented in Figure 5.20 for 1986 to 2004. These plots include data from both the commercial fishery and research trawl surveys.

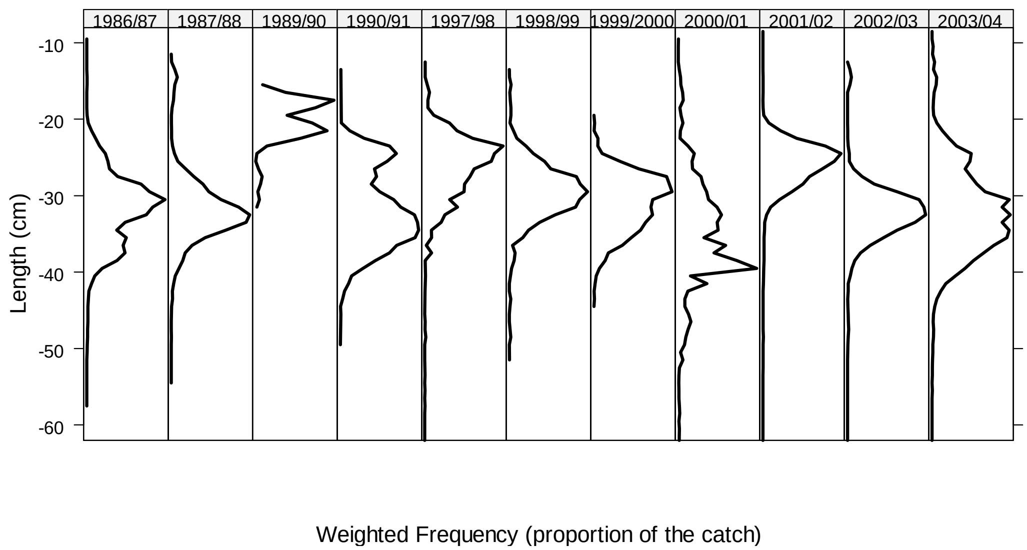


Figure 5.20: Catch-weighted length frequencies for *Champsocephalus gunnari* in Subarea 48.3 derived from observer, fine-scale and STATLANT data reported by 6 October 2004.

2. Stocks and areas

5.216 Within Subarea 48.3 *C. gunnari* is restricted to the shelf area generally shallower than 500 m deep. Differences in length distribution have been noted between Shag Rocks and South Georgia (WG-EMM-03/7, WG-FSA-04/40 and 04/85). These differences are not thought to represent separate stocks. So for purposes of stock assessment it is assumed that there is a single stock present. *C. gunnari* is considered a semi-pelagic species, young (0+ and 1+) fish are found in the pelagic zone, but with increased age (size) fish become more demersal in habit (WG-FSA-02/7).

3. Parameter estimation

3.1 Estimation methods

<u>Standing stock</u>

5.217 During WG-FSA-03, the Working Group agreed to use a combination of bottom trawl and acoustic surveys to estimate the standing stock of *C. gunnari* in Subarea 48.3. The Working Group also agreed that the UK standing stock estimate should be raised by a factor of 1.241 to account for differences in catchability (related to trawl headline height) of the UK and Russian surveys (SC-CAMLR-XXI, Annex 5, paragraphs 5.103 and 5.104).

<u>Acoustic surveys</u>

5.218 No new estimates of standing stock were available from acoustic surveys. The Working Group continues to investigate methods to combine acoustics with trawl survey data to estimate the standing stock of icefish in line with recommendations in WG-FSA-03 (SC-CAMLR-XXII, Annex 5, paragraph 3.41) and discussions at WG-FSA-SAM (WG-FSA-SAM-04/10) (paragraphs 3.33 to 3.39). During the UK survey in Subarea 48.3, four additional days were allocated to acoustic survey work in conjunction with pelagic trawling. This work showed that *C. gunnari* of all ages spend time in midwater and reinforced the belief that a bottom trawl survey significantly underestimates *C. gunnari* biomass (WG-FSA-SAM-04/20), corroborating the results of the Russian trawl-acoustic survey in 2002 (WG-FSA-02/44, WG-FSA-SAM-04/10).

Trawl surveys

5.219 In January 2004 the UK undertook a random stratified bottom trawl survey of the South Georgia and Shag Rocks shelves (WG-FSA-04/85). The survey employed the same trawl gear and survey design as previous UK surveys in Subarea 48.3.

5.220 Following the procedure agreed at WG-FSA-03, estimates of standing stock were obtained using the bootstrap procedure, with the UK survey estimates (within 12 strata; Table 5.46) adjusted by a correction factor of 1.241, applied prior to the bootstrap procedure. An estimate of the lower one-sided 95% CI of biomass was calculated for the assessment and tabled below.

Table 5.46: Seabed areas of survey strata used to estimate biomass within the bootstrap procedure.

Component	Description	Value
Nominal date of survey	Mid-point	23 Jan 2004
Survey timing (days since start of year)		15
Seabed area of survey strata		km^2
1. Shag Rocks	1. 50–150 m	1 473.5
	2. 150–250 m	1 870.5
	3. 250–500 m	1 610
2. Northwest South Georgia	4. 50–150 m	1 816
	5. 150–250 m	2 189
	6. 250–500 m	2 068
3. Northeast South Georgia	7. 50–150 m	1 037
	8. 150–250 m	4 113
	9. 250–500 m	994
4. South South Georgia	10. 50–150 m	6 008
	11. 150–250 m	12 902
	12. 250–500 m	5 141
Bottom trawl survey	Bottom to 6 m	tonnes
Biomass estimates from bootstrap procedure	Mean	139 010
	SE	67 759
	Lower CI	26 165
	Upper CI	287 917
	One-sided lower 95% interval	44 369

Population structure

5.221 The distribution of densities-at-age was derived using the CMIX program, with bounds for means estimated from von Bertalanffy growth parameters (Table 5.47) and the standard deviations linearly related to the means. Initial CMIX runs did not converge using data from the entire length-density distribution, so the CMIX analysis was re-run excluding fish greater than 400 mm from the analysis (age 6+ and over) and using the input parameters detailed in Table 5.47. The results (Table 5.48 and Figure 5.21) indicate a high density of 1+ fish. The Working Group noted that previous surveys had rarely caught 1+ fish, and the bottom trawl survey is considered to underestimate the 1+ age class. As a result, fish from the trawl survey did not provide a reliable estimate of biomass.

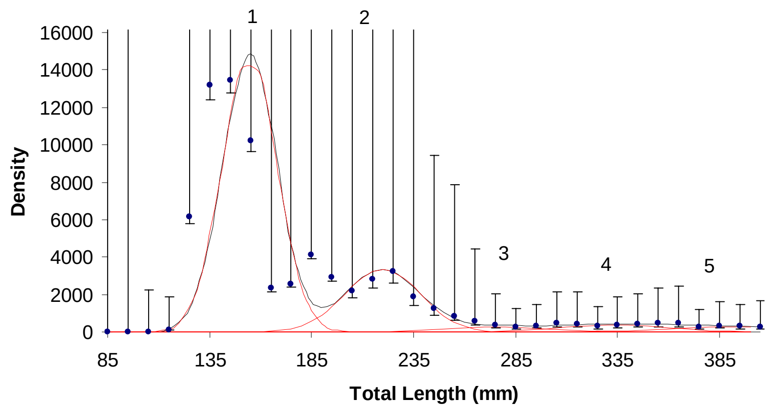


Figure 5.21: CMIX analysis of truncated length-density distribution from the 2004 bottom trawl survey in Subarea 48.3.

Table 5.47: Input parameters for the CMIX analysis of *Champsocephalus gunnari* length density in Subarea 48.3.

Parameter	Value
Size range included	80–410 mm
Survey date	15
Birthday	245
t_0	–0.58
k	0.17
L_∞	557 mm
Proportion between cohorts	0.5
Number of cohorts	5
Bounds on intercept (start, step)	1, 50 (15, 1.0)
Bounds on slope (start, step)	0.0, 0.4 (0.07, 0.01)
No. function calls	1 000
Reporting frequency	100
Stopping criteria	1E-6
Freq. for convergence testing	5
Simplex expansion coefficient	1

Table 5.48: Results generated from CMIX for the truncated length-density distribution.

	Comp. 1	Comp. 2	Comp. 3	Comp. 4	Comp. 5
Mean length (mm)	154.7	219.7	275.0	332.0	392.4
Standard deviations (mm)	12.9	18.0	22.3	26.7	31.4
Total density	49 476	15 284	1 618	2 458	2 236
SD of component density	64 027	10 851	1 238	1 785	1 170
Sum of observed densities = 72 891.8					
Sum of expected densities = 70 424.9					

5.222 The Working Group raised two points of concern over the results of the current mixture analysis. First, the magnitude of the mean length densities of the age 1+ cohort was considerably higher than that observed in the total length-density distribution. This was caused by the relatively poor sampling of the age 1+ cohort in the trawl survey. The large number of hauls with zero catch, a low number of samples, and the presence of high densities within few hauls led to higher mean length densities and very high standard errors.

5.223 Second, the fit to the age 1+ cohort was poor and had a very large standard deviation associated with it (cf. Figure 5.21). High values of length densities within individual length classes from a few hauls in the survey were thought to contribute to this issue. The patchy sampling of the 1+ (and to a lesser extent 2+) fish may be due to several factors, including variable gear selectivity and horizontal and vertical patchiness of fish distribution. These concerns warrant further intersessional investigation of the sensitivity of the recommended yield to the attribution of biomass to the age 1+ cohort.

5.224 The Working Group agreed that age 1+ fish should be excluded from the biomass estimate in the 2004/05 yield calculation. However, since age 1+ could be available to the fishery in the second year of the projection (as age 3+ fish), it was agreed to produce two estimates of yield in 2005/06 to either include or exclude these fish.

5.225 The 1+ fish were subtracted from the standing stock estimate by multiplying the biomass estimate by the proportion (by mass) of 1+ fish calculated in the CMIX output (Table 5.49). Due to the poor fit of the mixture analysis, the allocated biomass for age 1+ fish is believed to be an overestimate. The proportion of age 1+ fish removed from the total biomass can therefore be considered precautionary. The one-sided lower 95% CI of biomass of fish aged between 2+ and 5+, estimated from the 2004 UK bottom trawl survey, was 34 841 tonnes. The initial age structure was also revised to exclude age 1+ fish.

Table 5.49: Calculation of the proportion of biomass-at-age derived for the truncated length-density distribution.

Age	Density %	Mean length (mm)*	Mean weight (kg)	Density (numbers/km^2)	Prop. biomass
1	69.6	131	0.009	48 857	0.215
2	21.5	198	0.039	15 404	0.276
3	2.2	254	0.092	1 769	0.074
4	3.5	301	0.165	2 552	0.193
5	3.2	341	0.252	2 101	0.243

* Derived from VBGF

3.2 Parameter values

Fixed parameters

5.226 As in previous years, the Working Group noted several discrepancies between the length-frequency distributions of *C. gunnari* sampled at Shag Rocks and South Georgia (WG-FSA-04/85). Recent studies have analysed length-frequency data for each area (WG-EMM-03/7). The results indicate that *C. gunnari* at Shag Rocks have a similar growth rate to fish at South Georgia, but are approximately five months older. The Working Group agreed that this information could be helpful in resolving the length-frequency distribution and should be investigated within the intersessional period.

5.227 The fixed parameters remain unchanged from 2003 and are presented in Table 5.50.

Table 5.50: Fixed parameters used in the 2004 assessment of *Champsocephalus gunnari* in Subarea 48.3.

Component	Parameter	Value	Units
Natural mortality	M	0.71	y^{-1}
VBGF	K	0.17	y^{-1}
VBGF	t_0	–0.58	y
VBGF	L_∞	557	mm
	Date ‘0’	245	d
Length to mass	‘a’	5.47E-10	kg, mm
Length to mass	‘b’	3.42	

Removals

Fishing mortality (catches since survey)

5.228 Catches taken after the assessment of biomass from the bottom trawl survey (i.e. 23 January 2004) must be included within the assessment. These are detailed below.

Season	Catch (tonnes)
2003/04	1 114

Initial age structure

Total density of each mixture component

5.229 The proportion of density-at-age was derived from the CMIX program for ages 1+ to 5+. VBGF parameters were selected to calculate mean length at age (Table 5.50).

Selectivity

5.230 A linear selectivity vector was used for *C. gunnari*, starting at 2.5 years and fully selected at age 3. In 2003, the assessment used a linear selectivity vector starting at 2.0 years.

This value had been used because no age 1+ fish had been caught in the previous bottom trawl survey. Sensitivity analysis was used to explore the effect of changing the starting value in the current assessment (paragraph 5.233).

4. Stock assessment

4.1 Model structure and assumptions

5.231 The GYM was used to perform the short-term projection of the *C. gunnari* biomass. Estimates of yield were derived by determining the maximum catch level (fishing mortality) that had a less than 5% chance of reducing the spawning stock biomass to below 75% of the level that would occur in the absence of fishing in the two years following a survey biomass estimate.

Model configuration

Table 5.51: GYM model configuration for the assessment of *Champsocephalus gunnari* in Subarea 48.3.

Category	Parameter	Value
Recruitment age	Start	2.5 years
	Fully selected	3 years
Plus class accumulation		10 years
Oldest age in initial structure		10 years
Maturity	L_{m50}	0 mm***
	Range: 0 to full maturity	0 mm
Spawning season	Set so that the status of the stock is determined at the start of each year.	30 Nov–30 Nov
Simulation specification	Number of runs	1
Individual trial specifications		
	Years to remove initial age structure*	0
	Year prior to projection**	2003
	Reference start date	01/12
	Years to project stock in simulation	2
	Reasonable upper bound for annual *F*	5.0
	Tolerance for finding *F* in each year	0.000001

* Set to 0 since catches were made after the survey, else set to 1.
** GYM requires first year of 2003/04 split-year.
*** Maturity is not used in the short-term projection. It is set to 0 to allow the GYM to monitor the whole population.

4.2 Model results

5.232 A single short-term projection of yield in 2004/05 (Year 1) and 2005/06 (Year 2), excluding age 1+ fish in the initial biomass, was computed. A short-term projection of yield was also derived for 2005/06 (Year 2) using 1+ fish:

	Year 1 (2004/05) (tonnes)	Year 2 (2005/06) (tonnes)
Yield age 2+ fish only	3 574	2 262
Yield including age 1+ fish		5 935

4.3 Sensitivity analyses

5.233 The appearance of age 1+ fish in the trawl survey prompted a review of the selectivity vector employed within the GYM. The effect of changing the starting age of the linear selectivity vector from 2.0 to 2.5 and 2.95 (knife-edge) was examined where all age 1+ fish were included in the assessment. The Working Group agreed to run the assessment using a starting age of 2.5, similar to that used for Division 58.5.2. Further investigation of the properties of the selectivity vector was recommended during the intersessional period.

4.4 Discussion of model results

5.234 The projection of age 2+ fish from 2003/04 gives a projected yield of 3 574 tonnes in the 2004/05 season. This value is considered to be very precautionary since the assessment does not take into account the pelagic component of the population. The Working Group agreed to recommend this catch limit.

4.5 Future research requirements

5.235 The Working Group identified a number of future research requirements for the intersessional period:

(i) The acoustic protocol for assessing *C. gunnari* in Subarea 48.3, including:

- (a) discrimination of *C. gunnari* from other acoustic scatterers
- (b) further improvements in target strength estimates for *C. gunnari*
- (c) age-specific patterns in daily vertical distribution of *C. gunnari*
- (d) combination of trawl and acoustic indices for stock assessment.

(ii) Explore the effect of using alternative growth parameters for Shag Rocks and South Georgia in the assessment.

(iii) Examine in more detail why the mixture analysis had a poor fit to age 1+ fish.

(iv) The proposed age determination workshop for *C. gunnari* in 2005 is expected to benefit the assessment in Subarea 48.3 (paragraphs 9.8 to 9.12).

5. By-catch of fish and invertebrates

5.1 By-catch removals

5.236 The total reported by-catch of fish taken in recent years is indicated in Table 5.52.

Table 5.52: Total reported by-catch (tonnes) for five species between 1998/99 and 2003/04. NOG – *Gobionotothen gibberifrons*, SSI – *Chaenocephalus aceratus*, SGI – *Pseudochaenichthys georgianus*, NOR – *Notothenia rossii*, NOS – *Lepidonotothen squamifrons.*

Fishing season	NOG	Limit	SSI	Limit	SGI	Limit	NOR	Limit	NOS	Limit
1998/99	0	1470	0	2200	0	300	0	300	0	300
1999/00	0	1470	0	2200	0	300	0	300	0	300
2000/01	0	1470	0	2200	4	300	0	300	0	300
2001/02	0	1470	5	2200	5	300	0	300	0	300
2002/03	0	1470	1	2200	5	300	0	300	0	300
2003/04	0	1470	0	2200	2	300	0	300	0	300

5.2 Mitigation measures

5.237 The by-catch limits are set out in Conservation Measure 33-01. Move-on rules are included in the annual conservation measure set for this fishery, e.g. Conservation Measure 42-01.

6. By-catch of birds and mammals

5.238 Details of seabird by-catches this year are reported in paragraphs 7.205 to 7.212.

5.239 Seabird mortality in this trawl fishery is summarised in Table 5.53 (taken from Table 7.18).

Table 5.53: Number of seabirds killed in the trawl fishery in Subarea 48.3. DIC – *Diomedea chrysostoma*, DIM – *Thalassarche melanophrys*, PRO – *Procellaria aequinoctialis,* PWD – *Pachyptila desolata*, MAI – *Macronectes giganteus*.

Fishing season	Trawls observed	DIC	DIM	PRO	PWD	MAI
2000/01	315	5	46	41		
2001/02	431		18	49	1	
2002/03	182	1	7	28		
2003/04	221	1	26	59		1

5.240 The species concerned are all listed as globally threatened; given the increased level and rate of seabird by-catch in 2003/04, consideration of a reduction in by-catch limits at both the vessel level and for the whole icefish trawl fishery in Subarea 48.3 was recommended (paragraphs 7.213 to 7.217).

6.1 Mitigation measures

5.241 Conservation Measure 25-03 applies to this fishery. For discussion of the problems of avoidance of seabird by-catch see SC-CAMLR-XXII, Annex 5, paragraphs 6.237 to 6.240. Further discussion of this year's approaches to mitigation in this fishery are provided in paragraphs 7.218 and 7.219. A proposal for further experiments, requiring relaxation of the current vessel seabird by-catch limit, was supported (paragraph 7.220).

7. Ecosystem implications/effects

5.242 The current pelagic trawl fishery for *C. gunnari* in Subarea 48.3 has minimal impact on the benthic ecosystem. There is a small by-catch of other icefish species, but this is typically much smaller than the catch limits for these species. *C. gunnari* play an important role in the ecosystem of the South Georgia shelf as predators of krill, *Themisto* and other euphausiids, and as prey of fur seals and gentoo penguins (see Everson et al., 1999). Icefish may also be consumed by juvenile toothfish in years of high icefish abundance at Shag Rocks. Estimates of icefish standing stock have been shown to vary with variability in krill abundance at South Georgia, and in years of poor krill availability icefish condition is poorer and larger quantities are likely to be consumed by both fur seals and gentoo penguins, which are normally krill dependent.

8. Harvest controls for the 2003/04 season and advice for 2004/05

8.1 Conservation measures

Table 5.54: Summary of provisions of Conservation Measure 42-01 for *Champsocephalus gunnari* in Subarea 48.3 and advice to the Scientific Committee for the 2004/05 season.

Paragraph and topic	Summary of CM 42-01	Advice for 2004/05	Paragraph reference
1. Access (gear)	Trawling only Bottom trawl prohibited	Review	5.26–5.39
2. Access (area)	Fishing prohibited within 12 n miles of South Georgia from 1 March to 31 May.		
3. Catch limit	2 887 tonnes 722 tonnes between 1 March and 31 May	Revise to 3 574 tonnes	5.232
4. Move-on rule	Move on if >100 kg caught of which >10% by number are <240 mm TL.		
5. Season	1 December 2003 to 30 November 2004		
6. By-catch	By-catch rates as in CM 33-01 to apply, plus move-on rule.		
7. Mitigation	In accordance with CM 25-03.		
8. Seabirds	Any vessel catching 20 seabirds to cease fishing.	Review	7.214–7.217
9. Observers	Each vessel to carry at least one CCAMLR scientific observer and may include one additional scientific observer.		
10. Data: catch and effort	(i) Five-day reporting system as in CM 23-01 (ii) Monthly fine-scale reporting system as in CM 23-04 on haul-by-haul basis.		
11. Target species	*Champsocephalus gunnari* By-catch is any species other than *C. gunnari.*		
12. Data: biological	Monthly fine-scale reporting system as in CM 23-05. Reported in accordance with the Scheme of International Scientific Observation.		
13. Research	20 research trawls to be conducted as described in Annex 42-01/A between 1 March and 31 May.		

Fishery Report: *Champsocephalus gunnari* Heard Island (Division 58.5.2)

1. Details of the fishery

1.1 Reported catch

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

Table 5.55: Catch history for *Champsocephalus gunnari* in Division 58.5.2 (source: STATLANT data available from 1972 to 2003; 2004 from catch and effort reports).

Fishing season	Reported catch (tonnes)	Catch limit (tonnes)	Number vessels
1971/72	5 860		*
1973/74	7 525		*
1974/75	9 710		*
1976/77	15 201		*
1977/78	5 166		*
1989/90	2		*
1991/92	5		*
1992/93	3		*
1993/94	0		*
1994/95	0	311	*
1995/96	0	311	*
1996/97	227	311	1
1997/98	115	900	3
1998/99	2	1 160	1
1999/00	137	916	2
2000/01	1 136	1 150	2
2001/02	865	885	2
2002/03	2 345	2 980	2
2003/04	51	292	2

* No information

1.2 IUU catch

5.244 There was no evidence of IUU activity in this fishery.

1.3 Size distribution of the catches

5.245 Catch-weighted length frequencies from observer, fine-scale and STATLANT data are presented in Figure 5.22 for 1996/97 to 2003/04. These plots include data from both the commercial fishery and research trawl surveys.

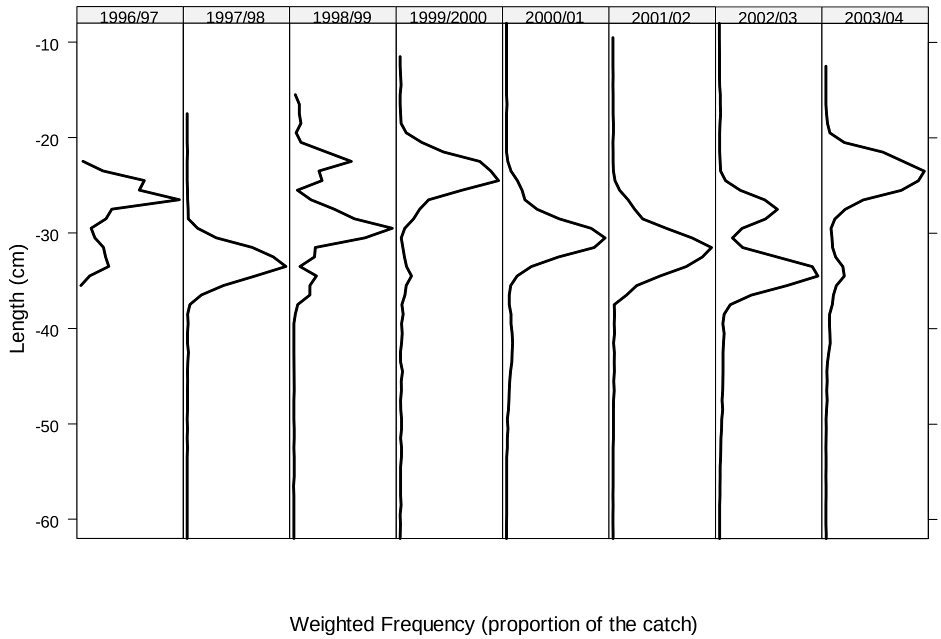


Figure 5.22: Catch-weighted length frequencies for *Champsocephalus gunnari* in Division 58.5.2 derived from observer, fine-scale and STATLANT data reported by 6 October 2004.

2. Stocks and areas

5.246 Within Division 58.5.2 this species is restricted to the shelf area in the vicinity of Heard Island in water generally shallower than 500 m. Previous analyses indicate that stocks on the Heard Plateau and Shell Bank have different size structure and recruitment patterns. The Working Group agreed that in light of this the two areas should be treated as separate stocks for assessment purposes (WG-FSA-97). *C. gunnari* have been absent or present in very low abundances on Shell Bank over recent years. Due to their low abundance observed in the current year, no assessment has been conducted for the Shell Bank stock for the 2004/05 season.

3. Parameter estimation

3.1 Estimation methods

Standing stock

5.247 The results of a bottom trawl survey were briefly summarised in WG-FSA-04/77. This had been undertaken according to the same design as in previous surveys for this region. Estimates of standing stock biomass were made using the bootstrap procedure.

Population structure

5.248 The distribution of densities at age was derived using the CMIX program and fixing the mean length for ages 4 and 5 (Table 5.56). The Working Group noted that the 2004 Australian bottom trawl survey had sampled a large cohort corresponding to age 2+ fish. It is evident that the very strong year class present in the 2003 survey as 1+ fish and in the 2002 juvenile *C. gunnari* survey, has now entered the fishery and dominates the population structure in 2004 (Figure 5.23). This is consistent with the prediction from the 2003 assessment. Details of the fit are presented in Table 5.57.

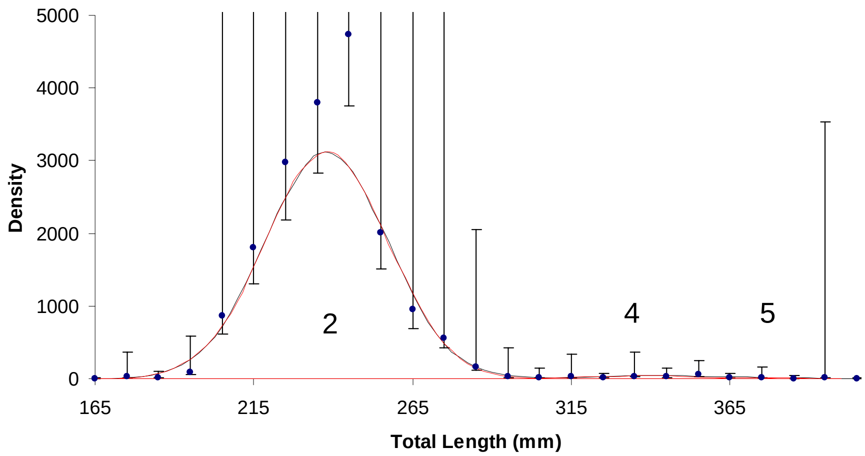


Figure 5.23: Size distribution of *Champsocephalus gunnari* from the 2004 bottom trawl survey in Division 58.5.2 with 95% confidence interval.

Table 5.56: Input parameters for the CMIX analysis of *Champsocephalus gunnari* length density in Division 58.5.2.

Parameter	Value
Size range included	160–410 mm
Means (no VBGF)	Age 2: (214–251 mm) Age 4: 339 mm (fixed) Age 5: 372 mm (fixed)
Standard deviations related linearly to the mean	Yes
Bounds on intercept (start, step)	1, 50 (15, 1.0)
Bounds on slope (start, step)	0.0, 0.4 (0.07, 0.01)
No. function calls	1 000
Reporting frequency	100
Stopping criteria	1E-6
Freq. for convergence testing	5
Simplex expansion coefficient	1

Table 5.57: Results generated from CMIX analyses for *Champsocephalus gunnari* in Division 58.5.2.

	Comp. 1	Comp. 2	Comp. 3
Mean length (mm)	238	339	372
Standard deviations (mm)	19.0	19.0	19.0
Total density (numbers km^{-2})	15 072	185	42
SD of component density	6 027	87	42
Sum of observed densities = 18 242.7			
Sum of expected densities = 15 298.1			
Intercept = 18.99			
Slope = 0.0			

5.249 The Working Group raised a point of concern over the large size distribution of age 2+ fish (200–280 mm), and the complete lack of age 3+ fish within the population. The observed distribution was consistent with previous analyses of cohort structure that indicated few age 2+ in the population during 2003 (WG-FSA-03/32).

Other parameters

5.250 There were no changes to other parameter values.

3.2 Parameter values

Fixed parameters

5.251 The fixed parameters remain unchanged from previous assessments (Table 5.58).

Table 5.58: Fixed parameters used in the 2004 assessment of *Champsocephalus gunnari* in Division 58.5.2.

Component	Parameter	Value	Units
Natural mortality	M	0.4	y^{-1}
VBGF	K	0.323	y^{-1}
VBGF	t_0	0.275	y
VBGF	L_∞	457	mm
Length to mass	‘*a*’	2.629E-10	kg/mm
Length to mass	‘*b*’	3.515	

Standing stock

5.252 Similar to last year, an estimate of standing stock biomass was calculated using the bootstrap procedure. The area of seabed sampled, and an estimate of the one-sided lower 95% CI of biomass was calculated (Table 5.59).

Table 5.59: Seabed areas within three geographic strata used to bootstrap estimates of biomass.

Nominal date of survey – 12 May 2004				
Survey strata	Locality and depth range	Seabed area (km^2)	Biomass (tonnes)	One-sided lower 95% CI (tonnes)
1	Gunnari Ridge	520.7	17 270	5 956
2	Plateau southeast	10 620	6 327	331
3	Plateau west	10 440	250	108
Totals	Plateau and Gunnari Ridge	21 581	23 847	**8 982***

* This value is not the sum of the strata values but is a separate stratified estimate of the total biomass and was used in the assessment.

Removals

5.253 No *C. gunnari* were caught following the survey (5 to 25 May 2004).

Initial age structure

5.254 The proportion of density-at-age was derived from the CMIX program for ages 2+ to 5+. VBGF parameters were selected to calculate mean length-at-age (Table 5.60).

Selectivity

5.255 A linear selectivity vector was used for *C. gunnari*, starting at 2.5 years and fully selected at age 3.

Recruitment

5.256 The short-term projection of *C. gunnari* does not include recruitment data.

Proportion of biomass-at-age

5.257 An estimate of the proportion of biomass-at-age was calculated and presented in Table 5.60. This demonstrates that the age 2+ cohort contributes to both the highest number and biomass of animals within the population.

Table 5.60: Calculation of the proportion of biomass-at-age derived for the truncated length-density distribution.

Age	Density %	Mean length (mm)*	Mean weight (kg)	Density (number/km^2)	Prop. biomass
2	98.5	195	0.029	15 072	0.91
3	0.0	268	0.090	0	0.00
4	1.2	320	0.168	185	0.06
5	0.3	358	0.249	42	0.02

* Obtained from VBGF

4. Stock assessment

4.1 Model structure and assumptions

5.258 The GYM, used routinely for the assessment of long-term yield of other species in the CCAMLR Convention Area, configured to perform the short-term projection, was used.

Model configuration

Table 5.61: GYM model configuration for the assessment of *Champsocephalus gunnari* in Division 58.5.2.

Category	Parameter	Value
Recruitment age	Start	2.5 years
	Fully selected	3 years
Plus class accumulation		10 years
Oldest age in initial structure		10 years
Maturity	L_{m50}	0 mm***
	Range: 0 to full maturity	0 mm
Spawning season	Set so that the status of the stock is determined at the start of each year.	30 Nov–30 Nov
Simulation specification	Number of runs	1
Individual trial specifications		
	Years to remove initial age structure*	1
	Year prior to projection**	2003
	Reference start date	01/12
	Years to project stock in simulation	2
	Reasonable upper bound for annual *F*	5.0
	Tolerance for finding *F* in each year	0.000001

* Set to 1 since no catches were made after the survey, else set to 0.
** GYM requires first year of 2003/04 split-year.
*** Maturity is not used in the short-term projection. It is set to 0 to allow the GYM to monitor the whole population.

Decision rules

5.259 To assess a catch level such that fishing should not, without any substantial risk, specified in this instance as no more than 5% probability:

> reduce the spawning stock biomass to below 75% of the level that would occur in the absence of fishing within the two years following an abundance biomass estimate provided by a survey.

5.260 To achieve this, the one-sided lower 95% confidence bound of the biomass estimate is used as the starting point for the projection.

4.2 Model results

5.261 A single deterministic short-term projection of yield in 2004/05 (Year 1) was calculated for the Heard Plateau and Gunnari Ridge. Yield estimates derived from the short-term projections of 2+ fish for the 2004/05 season are:

	2+ fish
Actual yield in Year 1 (2004/05)	1 864 tonnes
Estimated yield in Year 2 (2005/06)	1 766 tonnes

4.3 Sensitivity analyses

5.262 No specific sensitivity analyses were undertaken at the meeting.

4.4 Discussion of model results

5.263 The projection of age 2+ fish from 2003/04 gives a projected yield of 1 864 tonnes in the 2004/05 season. The Working Group agreed to recommend this catch limit.

4.5 Future research requirements

5.264 The Working Group recommended that outputs from the age determination workshop for *C. gunnari* in 2005 may benefit future assessments in Division 58.5.2 (paragraphs 9.8 to 9.12).

5. By-catch of fish and invertebrates

5.1 By-catch removals

5.265 The total reported by-catch (tonnes) of fish taken in recent years is indicated in Table 5.62.

Table 5.62: Total reported by-catch (tonnes) for four species between 1995/96 and 2003/04. LIC – *Channichthys rhinoceratus*, NOS – *Lepidonotothen squamifrons*, GRV – *Macrourus* spp., SRX – rajids.

Fishing season	LIC	Limit	NOS	Limit	GRV	Limit	SRX	Limit	Other	Limit
1995/96	0		0		0		0		0	5%*
1996/97	2		0		0		1		2	50**
1997/98	5	80	4	325	0		0	120	2	50
1998/99	4	150	0	80	0		0		0	50
1999/00	4	150	0	80	0		0		1	50
2000/01	1	150	0	80	0	50	0	50	0	50
2001/02	3	150	0	80	0	50	1	50	0	50
2002/03	22	150	0	80	0	465	20	120	1	50
2003/04	6	150	0	80	1	360	3	120	1	50

* 5% move-on rule if individual haul exceeds 5%, limit not specified.
** Move-on rule if catch of any by-catch species exceeds 5% of target species.

5.2 Mitigation measures

5.266 Conservation Measure 33-02 currently applies to this fishery. Move-on rules are included in the annual conservation measure established for this fishery (e.g. Conservation Measure 42-02).

6. By-catch of birds and mammals

5.267 In the trawl fishery in Division 58.5.2 six seabirds were killed in 2003. Seabirds were released alive in 2002 (1), 2003 (11) and 2004 (7) (Table 7.18). The provisions of Conservation Measure 25-03 apply to this fishery.

7. Ecosystem implications/effects

5.268 Bottom trawl gear is used to target both *C. gunnari* and *D. eleginoides* in Division 58.5.2. The potential impacts of fishing gear on benthic communities are limited by the small size and number of commercial trawl grounds, a strategy of fishing trawling gear lightly or just off the bottom, and the protection of large areas sensitive to the effects of bottom trawling (see also paragraph 5.211).

8. Harvest controls for the 2003/04 season and advice for 2004/05

8.1 Conservation measures

Table 5.63: Summary of provisions of Conservation Measure 42-02 for *Champsocephalus gunnari* in Division 58.5.2 and advice to the Scientific Committee for the 2004/05 season.

Paragraph and topic	Summary of CM 42-02	Advice for 2004/05	Paragraph reference
1. Access (gear)	Trawling only		
2. Access (area)	Definition of area open for fishing		
3.	Chart illustrating area open (Annex 42-02/A)		
4. Catch limit	292 tonnes	Revise to 1 864 tonnes	5.262
5. Move-on rule	Move on if >100 kg caught of which >10% by number are less than minimum size (1 Dec–30 April = 24 cm, 1 May–30 Nov = 29 cm).		
6. Season	1 December 2003 to 30 November 2004		
7. By-catch	By-catch rates as in CM 33-02 to apply.		
8. Mitigation	In accordance with CM 25-03.		
9. Observers	Each vessel to carry at least one scientific observer and may include one additional CCAMLR scientific observer.		
10. Data: catch and effort	(i) Ten-day reporting system as in Annex 42-02/B (ii) Monthly fine-scale reporting system as in Annex 42-02/B on haul-by-haul basis.		
11. Target species	*Champsocephalus gunnari* By-catch is any species other than *C. gunnari*.		
12. Data: biological	Fine-scale reporting system as in Annex 42-02/B. Reported in accordance with the Scheme of International Scientific Observation.		

Fishery Report: *Dissostichus eleginoides* Prince Edward Islands EEZ (Subareas 58.6 and 58.7)

1. Details of the fishery

5.269 A licensed fishery within the South African EEZ at the Prince Edward Islands started in October 1996. Part of the South African EEZ is outside the CCAMLR Convention Area (Area 51) and part falls within Subareas 58.6 and 58.7 and Division 58.4.4 (Figure 5.24).

5.270 Although the fishery began in 1996, intelligence reports indicated that IUU vessels were operating in the area in 1995 and possibly 1994. Since the start of the licensed fishery, the estimated IUU catch has exceeded the reported catch for most years (Table 5.64). Since the start of the fishery a maximum of five operators have been licensed by South Africa to fish in any one year. During the 2002/03 and 2003/04 fishing seasons, two licensed vessels were active in the fishery.

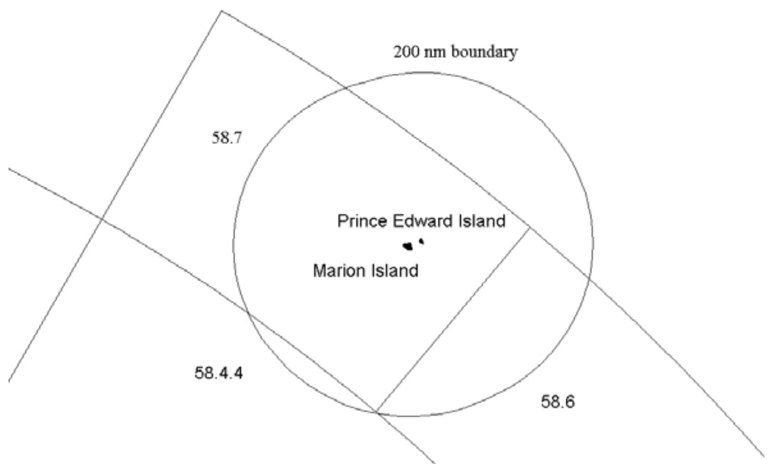


Figure 5.24: Map showing the position of the South African EEZ at the Prince Edward Islands and the boundaries of the relevant CCAMLR areas.

1.1 Reported catch (time series)

5.271 The total annual catches taken in Subarea 58.7 as reported to CCAMLR are presented in Table 5.64.

Table 5.64: Catch history for *Dissostichus eleginoides* in Subarea 58.7 (source: WG-FSA-04/5 Rev. 1 and SCIC-04/3 Rev. 2). Fishing season is from 1 December to 30 November.

Fishing season	Total reported catch (tonnes)	IUU catch (tonnes)	Total removals (tonnes)
1995/96	869	4958	5827
1996/97	1193	7327	8520
1997/98	637	598	1235
1998/99	301	173	474
1999/00	1015	191	1206
2000/01	235	120	355
2001/02	98	78	176
2002/03	219	138	357
2003/04	50	58	108

5.272 The status of the resource within the South African EEZ was assessed in WG-FSA-04/37. For that assessment, the removals from the South African EEZ were estimated (Table 5.65). The reported catch column includes catches taken in the South African EEZ within Subareas 58.7 and 58.6 as well as catches from Area 51 outside the CCAMLR region. In WG-FSA-04/37 the authors noted that the reported catches underestimate total mortality as losses through depredation by cetaceans are not included.

Table 5.65: Catch history for *Dissostichus eleginoides* in the South African EEZ as used in the assessment (source: WG-FSA-SAM-04/12 and WG-FSA-04/37). The limited data for 1996 have been pooled with the 1997/98 season.

Fishing season	Vessels (non-IUU)	Catch limit (tonnes)	Reported landed catch (tonnes)	IUU catch (tonnes)	Total extractions (tonnes)
1996/97	7	2 500	2 921	21 350	24 271
1997/98	4	3 000	1 011	1 808	2 819
1998/99	4	2 750	956	1 014	1 970
1999/00	3	2 250	1 562	1 210	2 772
2000/01	5	2 250	352	352	704
2001/02	2	600	200	306	506
2002/03	2	500	313	256	569
2003/04	2	500	97	156	253

1.2 IUU catch

5.273 The estimated IUU catch in Subarea 58.7 is presented in Table 5.64, whereas the estimated IUU catch from the South African EEZ (as used in the assessment in WG-FSA-04/37) is presented in Table 5.65.

5.274 IUU fishing has occurred since at least 1995 (and possibly 1994), and in most years the estimated IUU catch within the South African EEZ has exceeded the reported catch Table 5.65). The IUU catch in the South African EEZ prior to 2003 (Table 5.65) was estimated as the sum of the IUU catch estimated for Subarea 58.7 and 50% of that estimated for Subarea 58.6 (Brandão et al., 2002). For 2003 and 2004 the IUU catch estimates are based on the number and duration of fishing activities of illegal vessels known or believed to have operated in the South African EEZ and on the average green weight tonnages of vessels operating legally in that area in the corresponding years (WG-FSA-04/37). Note that CCAMLR records indicated only one reported IUU vessel in this area during 2004, whereas other intelligence reports indicated that at least three IUU vessels were seen within the South African EEZ (WG-FSA-04/37).

1.3 Size distribution of catches (time series)

5.275 Annual estimated catch length frequencies are presented in Figure 5.25.

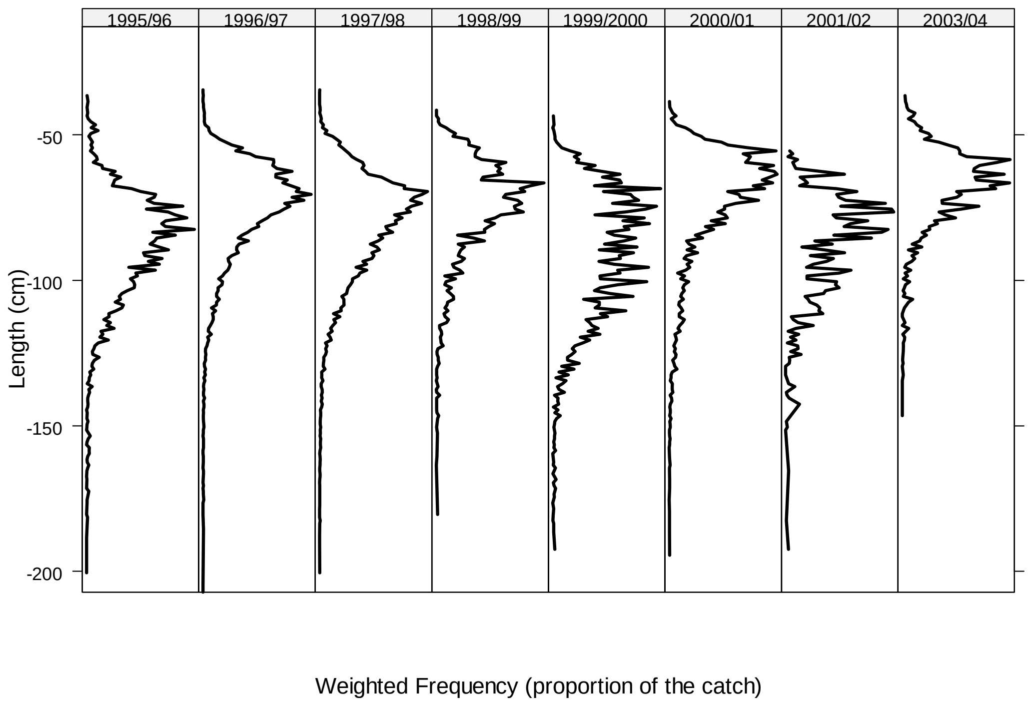


Figure 5.25: Catch-weighted length frequencies for *Dissostichus eleginoides* in Subarea 58.7 derived from observer, fine-scale and STATLANT data reported by 6 October 2004.

2. Stocks and areas

5.276 The South African EEZ around the Prince Edward Islands is mainly in Subarea 58.7 but extends east into Subarea 58.6, south into Division 58.4.4, and north of the Convention Area in to Area 51 (Figure 5.24), however there are currently no fishing grounds in the south of the South African EEZ. The majority of the fishery occurs down to about 1 500 m, but fishing depths in excess of 2 000 m have been recorded.

3. Parameter estimation

3.1 Biological parameters

5.277 None of the parameters used in the assessment were derived specifically from this fishery, rather they have been assumed from work on toothfish in other areas within the CCAMLR Convention Area.

Table 5.66: Parameter values used in the assessment of the toothfish stock in the South African EEZ at the Prince Edward Islands (source: WG-FSA-04/37).

Component	Parameter	Value	Units
Natural mortality	M	0.2	y^{-1}
VBGF	K	0.066	y^{-1}
VBGF	t_0	–0.21	y
VBGF	L_∞	194.6	cm
Length to mass	‘a’	2.5E-05	cm, kg
Length to mass	‘b’	2.8	
Age at maturity	t_m	10	y

Standardised CPUE

5.278 CPUE was standardised by applying the GLM approach described in Appendix 1 of WG-FSA-04/37.

Table 5.67: Standardised longline CPUE by season for *Dissostichus eleginoides* in the South African EEZ at the Prince Edward Islands (source: WG-FSA-04/37).

Fishing season	Standardised CPUE
1996/97	3.628
1997/98	0.976
1998/99	0.851
1999/00	0.505
2000/01	0.306
2001/02	0.325
2002/03	0.409
2003/04	0.263

4. Stock assessment

4.1 Model structure and assumptions

5.279 An ASPM was used to assess the status of the *D. eleginoides* resource in the South African EEZ at the Prince Edward Islands (WG-FSA-04/37). The methodology is thoroughly presented in Appendix 1 of that paper. The Working Group noted that several refinements had been added since WG-FSA-SAM-04/12 was presented at WG-FSA-SAM-04.

4.2 Model estimates

5.280 Estimated exploited biomass and projections under three levels of future catches for the base-case ASPM model from WG-FSA-04/37 are presented in Figure 5.26. Further model estimates are available in WG-FSA-04/37.

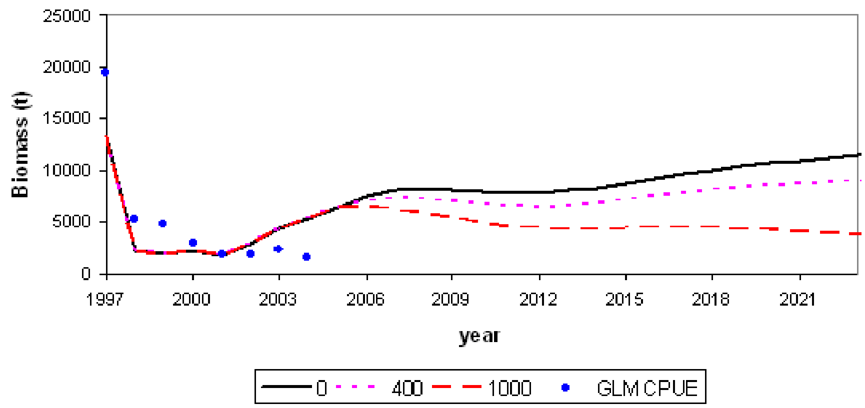


Figure 5.26: GLM-standardised CPUE indices to which the ASPM was fitted (divided by the estimated catchability *q* to express them in biomass units) and estimated exploitable biomass, together with projections under future annual catches of 0, 400 and 1 000 tonnes. Source: WG-FSA-04/37.

4.3 Sensitivity analyses

5.281 Several sensitivity analyses were explored in WG-FSA-04/37 by applying different weightings to the catch-at-length and CPUE data.

4.4 Discussion of model results

5.282 The Working Group considered that the results of the ASPM model were unstable and were very sensitive to the weightings used for the assessment, which were entirely arbitrary. The Working Group also noted that the estimates of yield provided in the paper were not based on the CCAMLR decision rules.

4.5 Future research requirements

5.283 The Working Group encouraged further development of this work. In particular they noted the importance of a full evaluation of the ASPM modelling approach (paragraph 4.15), and requested that the code for the model presented in WG-FSA-04/37 be lodged with the CCAMLR Secretariat.

5.284 The Working Group also noted the development of tagging studies in many other toothfish fisheries in the Convention Area and encouraged South Africa to consider implementing tagging in their EEZ.

5. By-catch of fish and invertebrates

5.1 Estimation of by-catch removals

5.285 Estimated annual by-catch removals for the South African EEZ in Subareas 58.6 and 58.7, but excluding Area 51, are reported in Table 5.68. The Working Group noted that the voluntary submission of fine-scale data was poor for some years and encouraged South Africa to submit more fine-scale data in future.

Table 5.68: Reported by-catch landings from toothfish directed longline fishing by South African vessels fishing in Subareas 58.6 and 58.7. Source: fine-scale and STATLANT data.

Fishing season	*Macrourus* spp.	Rajids	Other species
1995/96	0	0	0
1996/97	0	0	0
1997/98	0	1	1
1998/99	0	0	0
1999/00	203	18	54
2000/01	72	2	7
2001/02	8	0	0
2002/03	no fine-scale data submitted		
2003/04	1	0	0

5.2 Assessments of impact on affected populations

5.286 It was not possible to assess the impacts on affected populations.

5.3 Mitigation measures

5.287 There are no mitigation measures in force.

6. By-catch of birds and mammals

6.1 Estimation of by-catch removals

5.288 Details of seabird by-catch (taken from Table 7.3) are summarised in Table 5.69. Estimated potential seabird removals in the IUU fishery are summarised in SC-CAMLR-XXIII/BG/23 and Table 7.15.

Table 5.69: Estimated by-catch of seabirds in the South African EEZ in Subareas 58.6 and 58.7.

Fishing season	By-catch rate (birds/thousand hooks)	Estimated by-catch
1996/97	0.52	834
1997/98	0.194	528
1998/99	0.034	156
1999/00	0.046	516
2000/01	0.018	199
2001/02	0	0
2002/03	0.003	7
2003/04	0.025	39

5.289 Ad hoc WG-IMAF has assessed the level of risk of incidental mortality of seabirds in the fishery in the South African EEZ at the Prince Edward Islands (in both Subareas 58.6 and 58.7) as category 5 (SC-CAMLR-XXIII/BG/21 and Table 7.17). For new and exploratory fisheries in areas of this risk level category the WG-IMAF recommendations are set out in Table 7.17.

6.2 Mitigation measures

5.290 South Africa has consistently required the application in this area of the mitigation measures recommended by CCAMLR with the exception of a closed season.

6.3 Interactions involving marine mammals with longline fishing operations

5.291 Anecdotal reports indicate that catch losses caused by toothed cetaceans taking fish from lines as they are hauled are substantial.

5.292 WG-FSA-04/8 Rev. 1 reported one seal entangled, but not killed, during the 2003/04 season.

7. Management advice

5.293 The Working Group considered that the results of the ASPM model were unstable and were very sensitive to the weightings used for the assessment, which were entirely arbitrary. The Working Group also noted that the estimates of yield provided in the paper were not based on the CCAMLR decision rules. Therefore the Working Group was unable to provide management advice for the fishery in the South African EEZ at the Prince Edward Islands.

5.294 The Scientific Committee should note the recommendations by ad hoc WG-IMAF with respect to mitigation of seabird mortalities (paragraphs 5.289 and 5.290).

5.295 No new information was available on the state of fish stocks in Subareas 58.6 and 58.7 and Division 58.4.4 outside areas of national jurisdiction. The Working Group therefore recommended that the prohibition of directed fishing for *D. eleginoides*, described in Conservation Measures 32-11, 32-12 and 32-10, remains in force.

Fishery Report: *Dissostichus eleginoides* Crozet Island inside French EEZ (Subarea 58.6)

5.296 Insufficient information was available at the meeting to complete a Fishery Report for this fishery. The Working Group recommended that French scientists be requested to provide the information required during the coming intersessional period.

Standardisation of CPUE

5.297 Haul-by-haul catch and effort data (fine-scale data) for the French longline fishery inside the French EEZ around Crozet Island in Subarea 58.6 for the 1998/99 to 2003/04 fishing seasons were examined. These data were kindly provided by Prof. Duhamel. GLMMs described by Candy (2004) and WG-FSA-03/34 were used to investigate trends in CPUE (kg/hook).

5.298 Figure 5.27 shows the standardised CPUE time series from 1998/99 and 2003/04 along with the total removals time series from 1995/96 to 2003/04. The standardised CPUE rose between 1998/99 and 1999/2000 but then fell steadily. Estimated total removals were very high in 1995/96 and especially 1996/97, but fell to around 3 000 tonnes in 1997/98 and have declined slowly since then to under 1 000 tonnes.

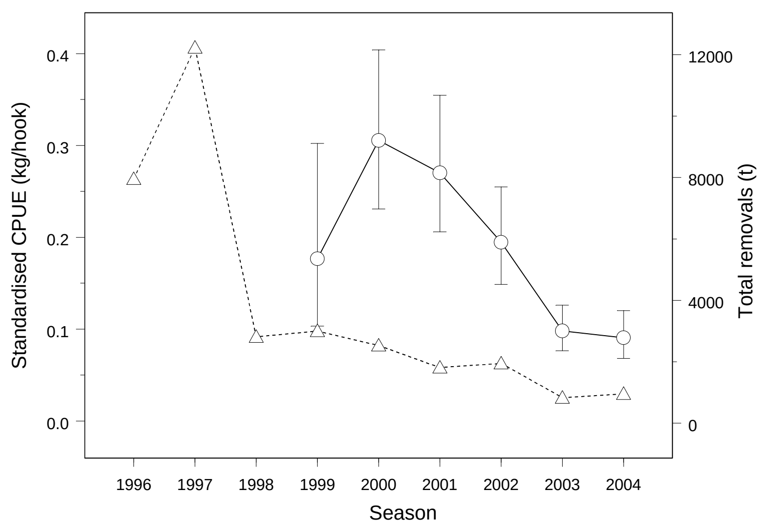


Figure 5.27: Time series of total removals (dashed line) and standardised CPUE (kg/hook) (solid line) obtained from the fitted GLMM. Error bars represent approximate 95% confidence bounds on the estimates.

Management advice

5.299 Estimated total removals have declined steadily over the last seven seasons and are at substantially lower levels than those taken before then. Nevertheless, standardised CPUE has fallen substantially since 1999/2000. In the absence of a stock assessment, the Working Group agreed that it was unable to recommend appropriate levels of catch for this fishery.

5.300 As for other toothfish fisheries in the CCAMLR Convention Area, the Working Group recommended that tag–recapture experiments be conducted. It also noted that conducting a recruitment survey would greatly assist in carrying out a stock assessment.

5.301 No new information was available on the state of fish stocks in Subarea 58.6 outside areas of national jurisdiction. The Working Group therefore recommended that the prohibition of directed fishing for *D. eleginoides*, described in Conservation Measure 32-11, remains in force.

Assessment and management advice for other areas and species in the Atlantic Ocean

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

5.302 CCAMLR closed commercial finfishing in the Antarctic Peninsula (Subarea 48.1) and the South Orkney Islands (Subarea 48.2) after the 1989/90 season. Both subareas should only be reopened to commercial fishing if scientific surveys had demonstrated that the condition of fish stocks had improved to the extent which would allow commercial harvesting.

5.303 The last surveys of the two areas occurred in 2003 (Subarea 48.1) and 1999 (Subarea 48.2). They showed no improvement in the condition of stocks which would give rise to considerations of reopening the two areas for commercial finfishing. No new information has become available since then as no surveys were conducted in the 2003/04 season.

Management advice

5.304 The Working Group recommended that the existing Conservation Measures 32-02 and 32-04 on the prohibition of finfishing in Subareas 48.1 and 48.2 remain in force.

South Sandwich Islands (Subarea 48.4) and Bouvet Island (Subarea 48.6)

5.305 Both subareas exhibit rather limited shelf areas surrounding the islands. They have not been subject to commercial fishing activities with the exception of one exploratory longline cruise around the South Sandwich Islands in 1993 (Ashford et al., 1994). Following results from this cruise, CCAMLR has set a catch limit of 28 tonnes of *Dissostichus* spp. for this subarea (Conservation Measure 41-03).

5.306 New information has been provided on fish stocks in both subareas from the US ICEFISH cruise in June–July 2004 (WG-FSA-04/61). A total of 18 stations with 36 gear deployments were conducted in the South Sandwich Islands, while 14 stations including 47 gear deployments were performed around Bouvet Island. The mouth opening of the various trawls used, however, was too small to provide quantitative estimates for larger fish species caught, such as many nototheniids and channichthyids. Fourteen and 11 species of finfish were caught in the South Sandwich Islands and around Bouvet Island respectively. The two most abundant species in the catches were the small-sized *L. larseni* and *L. nudifrons* in the South Sandwich Islands and *L. larseni* and *L. squamifrons* around Bouvet Island.

Management advice

5.307 No commercial fishing has ever occurred in the two subareas except longlining for *D. eleginoides* in 1994 which led to a catch limit of 28 tonnes. The Working Group recommended that the existing Conservation Measure 41-03 for *D. eleginoides* in Subarea 48.4 remains in force. Trawling, except for scientific purposes, should be prohibited in both subareas.

Electrona carlsbergi (Subarea 48.3)

5.308 The state of the stock was last assessed in 1994. A precautionary catch limit has initially been set at 109 000 tonnes by CCAMLR, since then including provisions for the catch of this species at Shag Rocks, the by-catch of notothenioids in this fishery, data reporting and research (Conservation Measure 43-01). Since the average life span of this species is about five years, the 1994 assessment is no longer applicable. CCAMLR decided to close the fishery on this species in 2003.

Management advice

5.309 Due to the lack of new information on the current status of the stock, the Working Group recommended that the fishery remain closed. It should only be reopened after a new survey on this species is conducted and results have been evaluated by CCAMLR.

Stone crabs (*Paralomis* spp.) (Subarea 48.3)

5.310 Stone crabs were not exploited in the 2002/03 and 2003/04 seasons. No proposal for the harvest of crabs has been received by CCAMLR for the 2004/05 season.

Management advice

5.311 Stone crabs are subject to Conservation Measures 52-01 and 52-02 regulating the fishery and experimental harvest of crabs. The Working Group recommended that these conservation measures should remain in force.

Martialia hyadesi (Subarea 48.3)

5.312 The exploratory fishery on *M. hyadesi* was subject to Conservation Measure 61-01. No new information on the species became available. No new request has been submitted to CCAMLR to continue exploratory fishing on this species in 2004/05.

Management advice

5.313 The Working Group recommended that the existing Conservation Measure 61-01 should remain in force.

FISH AND INVERTEBRATE BY-CATCH

6.1 The long-term status of by-catch taxa has been identified as an issue for urgent attention by the Scientific Committee (SC-CAMLR-XXI, Annex 5, paragraphs 5.151 to 5.153). The key issues that need to be addressed are:

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

6.2 Issues of potential mutual interest and importance to WG-FSA and ad hoc WG-IMAF identified by the Working Group in 2003 (SC-CAMLR-XXII, Annex 5, paragraph 5.231) included:

(i) estimation of by-catch levels and rates;

(ii) assessment of risk, both in terms of geographical areas and population demography;

(iii) mitigation measures;

(iv) scientific observer duties.

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

Assessment of the status of by-catch species or groups

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

Rajidae

6.4 No assessments were undertaken for rajids because there was insufficient biological information available.

6.5 Estimates of age and growth of *A. georgiana* in Subarea 88.1 based on interpretation of caudal thorns were presented in WG-FSA-04/29 (paragraph 3.54). Due to the uncertain and unvalidated age estimates, the Working Group decided that there was insufficient information on which to base an estimate of γ for *A. georgiana*.

Macrourus spp.

6.6 No new estimates of fishing selectivity or other biological parameters were available to update the estimates of γ for macrourids presented in SC-CAMLR-XXII, paragraph 4.132.

M. whitsoni in Subarea 88.1

6.7 The BioRoss research survey provided information on the main by-catch species for the exploratory longline fishery in Subarea 88.1 (paragraph 3.26). WG-FSA-SAM-04/7 presented bottom trawl catch data by tow for *M. whitsoni* and *B. eatonii*. The trawl was a rough-bottom orange roughy otter trawl with 28 m mouth opening, 5 m headline height, and 40 mm codend full inside mesh measurement. Total catches of *M. whitsoni* and *B. eatonii* were 1 075 and 157 kg respectively.

6.8 Mean standardised catch rates for *M. whitsoni* and *B. eatonii* were calculated for SSRUs 881H and E in two depth ranges (50–600 m and greater than 600 m) and are presented in Table 6.1.

6.9 The Working Group noted that the mean catch rate of *M. whitsoni* from depths greater than 600 m in SSRU 881H was an order of magnitude greater than the estimate of the mean density of *Macrourus* spp. from a research trawl survey of BANZARE Bank (Division 58.4.3a) (176 kg/km^2) (van Wijk et al., 2000), which is currently used to estimate B_0 for *M. carinatus* in Division 58.5.2 and *Macrourus* spp. in Division 58.4.3 (SC-CAMLR-XXII, Annex 5, paragraphs 5.249 and 5.252). However, the Working Group pointed out that the sample sizes in Subarea 88.1 were small and that there was considerable variation in catch rates between tows.

6.10 Estimates of B_0 for *M. whitsoni* in SSRUs 881H and E were derived using the mean density estimates from the trawl survey scaled up to the area of seabed in the depth range fished by the exploratory longline fishery (600–1 800 m) in that SSRU presented in WG-FSA-04/20.

6.11 The mean catch rate of *M. whitsoni* from depths greater than 600 m in SSRU 881H was 4 235 kg/km^2 (n = 6, 95% confidence interval 273–8 197 kg/km^2). The area of seabed in SSRU 881H from 600–1 800 m is 19 245 km^2, resulting in a mean biomass estimate of 81 500 tonnes (95% confidence interval 5 250–157 750 tonnes). The mean catch rate of *M. whitsoni* from depths greater than 600 m in SSRU 881E was 103 kg/km^2 (n = 4, 95% confidence interval 3.5–202 kg/km^2). The area of seabed in SSRU 881E from 600–1 800 m is 14 797 km^2, resulting in a mean biomass estimate of 1 520 tonnes (95% confidence interval 50–2 995 tonnes).

6.12 Long-term precautionary yields for *M. whitsoni* in SSRUs 881H and E were estimated using the following equation:

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

6.13 The estimate of γ from the base-case assessment of *M. whitsoni* in Subarea 88.1 in 2003 was 0.01439 (SC-CAMLR-XXII, paragraph 4.132). Applying $\gamma = 0.01439$ gives a mean estimate of yield for *M. whitsoni* in SSRU 881H of 1 170 tonnes (95% confidence intervals 75–2 270 tonnes) and a mean estimate of yield for *M. whitsoni* in SSRU 881E of 22 tonnes (95% confidence intervals 1–43 tonnes).

6.14 The Working Group decided that these estimates of yield for *M. whitsoni* in Subarea 88.1 should not be used for management advice. Trawl catch rates did not provide good estimates of B_0 for SSRUs 881H and E because the small number of tows did not provide a representative sample of the overall area in the depth range 600–1 800 m in each SSRU.

6.15 The Working Group also noted that the relative difference in trawl catch rates between SSRUs 881H and E (much higher catch rates in 881H) were in contrast to the relative catch rates observed in the exploratory longline fishery (higher in 881E) (Table 6.2).

M. carinatus in Division 58.5.2

6.16 There was no new information to update the estimate of precautionary yield for *M. carinatus* of 360 tonnes in Division 58.5.2 (SC-CAMLR-XXII, Annex 5, paragraph 5.258).

Macrourus spp. in Division 58.4.3

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

M. holotrachys in Subarea 48.3

6.18 There are currently no estimates of B_0 for *Macrourus* spp. in Subarea 48.3 or adjacent areas. Therefore the Working Group was not in a position to estimate a precautionary yield.

Management of by-catch limits by SSRU in Subarea 88.1

6.19 The Working Group considered management of by-catch limits for macrourids and rajids by SSRU in Subarea 88.1.

6.20 In the 2003/04 fishing season the by-catch allocation by SSRU was based on the following rule from Conservation Measure 33-03:

- rajids 5% of the catch limit of *Dissostichus* spp. or 50 tonnes whichever is greater
- *Macrourus* spp. 16% of the catch limit of *Dissostichus* spp. or 20 tonnes whichever is greater.

6.21 The Scientific Committee encouraged further work to examine more appropriate SSRU by-catch levels that are more in accordance with the by-catch distribution and abundance (SC-CAMLR-XXII, paragraph 4.199).

6.22 By-catch limits for macrourids were exceeded in SSRUs 881E and I in the 2003/04 fishery, even though total macrourid by-catch was only 69% of the limit (paragraph 5.77).

6.23 WG-FSA-04/20 examined mean rattail CPUE by area in Subarea 88.1 and found considerable variation between SSRUs. Rattail CPUE in SSRUs 881E, G, H, I and K was relatively high (0.018–0.050 kg/hook), whilst mean CPUE in the northern (SSRUs 881A–C) and southern (SSRUs 881J and L) areas was low (less than 0.006 kg/hook). An analogous CPUE analysis was not carried out for rajids in Subarea 88.1 because of uncertainties associated with the reporting of skates which were cut off lines and released (paragraph 6.86).

6.24 WG-FSA-04/20 proposed allocating catch limits as the product of the proportional CPUE and the proportional seabed area in SSRUs which are open for fishing. However, the authors concluded that it is not clear that this approach provides better catch limits than using the existing rule.

6.25 The following sections explore three options for allocation of macrourid by-catch between SSRUs in Subarea 88.1. Indicative catch limits under all three options (Table 6.2) were based on the 2004 total catch limit of 520 tonnes. The Working Group emphasised that it had no additional information to revise scientific advice on the overall catch limit, which is currently set at 16% of the *Dissostichus* spp. catch limit. This was derived from the by-catch limit for *Macrourus* spp. in Division 58.5.2 which was 16% of the catch limit for *Dissostichus* spp. in 2002/03 (CCAMLR-XXI, paragraph 11.53).

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

Option 1 – Status quo

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

Advantages

- Simple – based on the same rule used to estimate overall catch limit.
- Encourages vessels to avoid areas with higher proportions of macrourid by-catch.

Disadvantages

- Not related to by-catch distribution or abundance (although limits are related to seabed area because toothfish limits are partially proportional to seabed area).

Option 2 – CPUE proportional limits

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

Advantages

- Is indicative of by-catch distribution (although this is limited by fishing effort) and abundance (if this is appropriately indexed by CPUE).

- Related to seabed area.

Disadvantages

- Estimates of longline CPUE may not be reliable measures of macrourid abundance.

- Proportional catch limits would vary between years as CPUE changes with the addition of new data.

- Differences in CPUE between SSRUs 881E and H were not consistent with differences in trawl catch rates in the BioRoss trawl survey (Table 6.1).

- Very low catch limits in some SSRUs would be difficult to monitor (CCAMLR-XXIII/38).

Option 3 – Fixed SSRU limits

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

Advantages

- Better reflects underlying rattail distribution (assuming fishery CPUE is an appropriate index of distribution) whilst not being overly restrictive on the fishery.

- Is more consistent with the approach used for rajids where the sum of the individual SSRU catch limits (50 tonnes in each SSRU) is higher than the overall catch limit (163 tonnes).

Disadvantages

- Not related to SSRU seabed area.
- Could lead to rattail catch limits which are higher than toothfish limits.
- Less incentive for by-catch mitigation if catch limits are less restrictive.
- Limits are arbitrary.

6.27 The Working Group discussed these three options. There was general support for moving towards catch limits that were more in accordance with rattail distribution, but the Working Group noted there was still considerable uncertainty about rattail abundance and distribution, population structure of *M. whitsoni* within Subarea 88.1, the role of macrourids in the ecosystem, and the impact of by-catch limits on fishing behaviour.

6.28 The Working Group further noted that fixed catch limits in Option 3 were arbitrary and that, while this type of option may have merit in the future, further information is required to determine appropriate levels for the fixed limits that would be flexible for the fishery while still being suitably precautionary.

Management advice

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

6.30 Estimates of γ calculated for *Macrourus* spp. (SC-CAMLR-XXII, paragraph 4.132) indicated that they have relatively low productivity and thus may be vulnerable to overexploitation.

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

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

6.33 Trawl survey estimates of *M. whitsoni* in Subarea 88.1 did not provide reliable estimates of standing stock because of the small number of tows, which did not provide a representative sample of the overall area.

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

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

6.36 The Working Group suggested that the development of avoidance and mitigation measures for by-catch species be given high priority.

6.37 The Working Group recommended that the Scientific Committee consider alternative options for managing macrourid by-catch by SSRU in Subarea 88.1 (paragraph 6.26).

6.38 The Working Group recommended that, at the next meeting of WG-FSA, time be allocated to discussing issues of potential mutual interest and importance to WG-FSA and WG-IMAF. Such issues should include:

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

(ii) estimation of by-catch levels and rates;

(iii) assessment of risk, both in terms of geographical areas and population demography;

(iv) mitigation measures;

(v) by-catch reporting.

Estimation of by-catch levels and rates

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

6.40 Estimates of total removals derived from fine-scale reports of by-catch by area for the 2003/04 fishing season are presented for longline fisheries in Table 6.3 and trawl fisheries in Table 6.4. Information contained in these tables was based on 5 501 individual haul-by-haul records.

6.41 Present and historical information about levels of by-catch from fine-scale data is also presented by managed fishery in individual Fishery Reports.

6.42 Information on levels of by-catch is also available from observer data and this is discussed in paragraphs 6.81 to 6.90.

6.43 In general, rajid (skate and ray) by-catch during 2003/04 was considerably lower than macrourid by-catch in all areas, with the exception of Division 58.5.2. However it is important to note that the estimates for rajids are conservative and do not include those cut or lost from longlines. By-catch of rajids as a percentage of target catch varied from <1 to 11% across all areas. Macrourid by-catch ranged from <1 to 14.6%, with the highest reported by-catch in Subareas 88.1 and 88.2.

6.44 The Working Group noted that no by-catch was reported from the midwater trawl fishery for *C. gunnari* in Subarea 48.3 in 2003/04.

6.45 Appendix 3 of CCAMLR-XXIII/38 provided summaries of total removals of macrourids, rajids and other species by SSRU in Subarea 88.1.

6.46 Data on by-catch in the exploratory fishery in Subareas 88.1 and 88.2 were described and analysed in WG-FSA-04/20. Catch and effort since 1997/98 were summarised using the new SSRU boundaries. The main by-catch species is *M. whitsoni*, which comprised 4–16% (mean 9%) of the annual catch. By-catch of *M. whitsoni* varies considerably between SSRUs, with relatively low by-catch in the northern (SSRUs 881A–C) and southern (SSRUs 881J and L) areas. There was also wide variation in by-catch percentage between vessels. Length frequencies for *M. whitsoni* were similar in the last three seasons, with most fish between 13 and 30 cm snout–vent length. The next most important by-catch group is skates (mainly *A. georgiana*), which made up 1–9% of the annual catch. The lower recorded by-catch percentage of skates in recent years is due to the release of skates at the surface, which were not included in estimates of total removals.

6.47 WG-FSA-04/66 and 04/68 presented by-catch information from the Australian fisheries in Division 58.5.2, and from exploratory fisheries in Divisions 58.4.2 and 58.4.3b, with estimates of total removals by fishing ground for the 2002/03 and 2003/04 seasons. By-catch in the trawl fisheries in Division 58.5.2 was only 1–2% of the total catch. By-catch percentages in the longline fisheries in Divisions 58.5.2, 58.4.2 and 58.4.3b were higher, ranging from 4–15% of the total catch. The main by-catch species were skates and macrourids in the *D. eleginoides* fishery and skates and *Channichthys rhinoceratus* in the *C. gunnari* fishery. The total landed skate catch in Division 58.5.2 was 34 tonnes in 2002/03 and 26 tonnes in 2003/04. Including skates cut from longlines revised these estimates to 43 tonnes in 2002/03 and 55 tonnes in 2003/04. Data on the by-catch of sleeper sharks (*Somniosus antarcticus*) and porbeagle sharks (*Lamna nasus*) in Division 58.5.2 were included in WG-FSA-04/68.

6.48 The Working Group noted discrepancies between estimates of total removals based on fine-scale data extracted during WG-FSA and those presented in CCAMLR-XXIII/38, WG-FSA-04/20 and 04/68. The discrepancies in Division 58.5.2 were due to the inclusion of the most recent data in the WG-FSA extraction which was not available when WG-FSA-04/68 was prepared. The Working Group recommended that work be carried out during the intersessional period to determine the reason for the other discrepancies.

6.49 The Working Group urged the Secretariat to develop standard methods to summarise by-catch removals by area and species prior to WG-FSA. It also recommended that the by-catch subgroup liaise intersessionally with the Secretariat to try and improve the reporting, transferral and extraction of by-catch data.

Management advice

6.50 The Working Group strongly reiterated the need for accurate reporting of by-catch in all data formats.

6.51 The Working Group recommended that estimates of total removals by area be summarised by the Secretariat for all by-catch species prior to WG-FSA.

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

Assessment of risk, both in terms of geographical areas and population demography

Identification of levels of risk

6.53 The Working Group considered the possibility of producing risk assessments for fish and invertebrate by-catch species in a similar way to the assessment of seabirds.

6.54 The Working Group noted that defining risk was problematic. In particular it was felt that the level of knowledge about marine species in nearly all cases was too low in order to make informed statements about risk to by-catch populations. For example, population status and robustness of populations and sub-populations to human impacts are not generally known.

6.55 The Working Group considered it possible to categorise risk for marine species. Qualitative information on species of interest could be collated that could help categorise the risk for that species. This 'risk categorisation' might include (but not be restricted to):

- consideration of life-history characteristics which would make a species vulnerable to fishing activities. For example, growth rates, age at maturity, habitat range, spawning behaviour, diet, trawl or longline catchability, co-occurrence with exploited species;

- consideration of the overlap between the distribution of the species and fishing or other human activities. The overlap could be considered on a proportional basis if the distribution is known. When the distribution is not known, then it would be noted where overlap exists;

- consideration of any assessments or other information about population status;

- consideration of conservation measures in place to avoid and mitigate by-catch.

6.56 WG-FSA-03/69 presented a risk assessment for the sleeper shark (*S. antarcticus*) in Division 58.5.2. The Working Group prepared a summary table based on this paper as an example of the type of information that might be included in a risk categorisation for other by-catch species (Table 6.5).

6.57 The Working Group encouraged Members to collate information during the intersessional period to allow risk categorisation for other major by-catch species in the CCAMLR Convention Area. It also recommended that alternatives to, and refinements of, this categorisation be considered during the intersessional period.

6.58 The Working Group noted that tables of the type shown in Table 6.5 provided indicators of potential risk, not real and proven risk. The Working Group further noted that the comprehensiveness of the information provided would not equate with the level of risk, pointing out lack of information does not mean lack of risk.

Management advice

6.59 The Working Group encouraged Members to collate information to allow risk characterisation for major by-catch species in the CCAMLR Convention Area.

Consideration of mitigation measures

Estimates of by-catch by vessel

6.60 The Working Group analysed by-catch by vessel in 2003/04 from fine-scale data in an effort to relate by-catch to fishing method. Understanding why some vessels catch more or less by-catch may yield information that could be used to develop mitigation and avoidance measures for by-catch.

6.61 Individual vessel by-catch information was extracted from fine scale (haul-by-haul) data. Because trawl gear configuration was relatively consistent across all vessels, only by-catch from longline vessels was considered.

6.62 A comparison of longline vessels from all areas revealed a contrasting gear configuration in Subarea 88.1, where 11 vessels used an autoline configuration and 10 vessels used the Spanish-system configuration.

6.63 There was little difference in mean relative by-catch of skates and rays between autoline and Spanish-system gear configuration in Subarea 88.1 (Figure 6.1a). However, mean relative level of *Macrourus* spp. by-catch appeared to be substantially higher for autoline longline systems (Figure 6.1b).

6.64 This analysis suggested that use of the Spanish longline system may reduce by-catch rates of *Macrourus* spp. However, before this conclusion could be reached, the Working Group felt it was important to examine the spatial vessel/gear-type patterns and by-catch rates in greater detail, as catch rates of *Macrourus* spp. were highly variable between SSRUs (see Table 6.2). The Working Group recommended that this work be conducted in the intersessional period.

Release of rajids

6.65 At WG-FSA-03, the Working Group recommended that, wherever possible, vessels should cut all rajids from their lines whilst still in the water, except on the request of the observer during the observer's biological sampling period (SC-CAMLR-XXII, Annex 5, paragraph 5.297).

6.66 WG-FSA-SAM noted that there may be some degree of conflict between the above advice and the need for accurate estimates of recaptures of marked animals in areas where tag and recapture programs are being developed as progress towards rajid assessments (WG-FSA-04/4, paragraph 2.45). The Working Group recognised that it might be difficult to detect tagged rays if they are cut off at the sea surface rather than being brought on board.

6.67 The Working Group suggested that in some fisheries, and in some sea states, it might be possible to identify tags reliably when rays break the surface. Tagged animals could then be retained and untagged fish released. However, the Working Group noted that the detection probability was still likely to be lower than 100%, and it would be important to undertake some experiments to determine detection probability.

6.68 If the detection probability of tagged rajids at the sea surface is low, the Working Group suggested that it may be necessary for a relaxation of the requirement to cut all rajids from the line on specified vessels and/or for specified time periods.

6.69 At WG-FSA-02, the Working Group noted that information was required on (SC-CAMLR-XXI, Annex 5, paragraph 5.195):

- the vulnerability of rajids to capture
- methods for adequately assessing survivorship of animals released
- methods for handling rajids that maximise survivorship

- methods for adequately documenting the biological characteristics, including size, of rajids hooked but not landed.

6.70 No new information on the survivorship or vulnerability of rajids was available at WG-FSA-04. The Working Group noted that survivorship of skates and rays cut off longlines is still very uncertain and encouraged Members to undertake further survivorship experiments in the future.

6.71 Dr Agnew informed the Working Group that the UK was continuing with its program of research on rajids at South Georgia. This program includes assessment of discard survivorship, species distribution, abundance, growth and maturity. These studies are on-going, and a report to WG-FSA-05 is likely.

Impact of vessel competition on move-on rule

6.72 Conservation Measure 33-03, paragraph 4 ('move-on rule'), requires fishing vessels in new and exploratory fisheries to move to another location at least 5 n miles distant if the by-catch of any one species is equal to or greater than 1 tonne. The fishing vessel shall not return to any point within 5 n miles of the location where the by-catch exceeded 1 tonne for a period of at least five days.

6.73 The Working Group noted that, where there are a large number of vessels operating within a new and exploratory fishery, another vessel might immediately move into the area vacated by a vessel forced to shift location because of by-catch. This behaviour might reduce the effectiveness of the 'move-on rule' to mitigate by-catch. This issue should be drawn to the attention of the Scientific Committee and Commission.

Management advice

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

6.75 The Working Group recommended that vessels be advised that, where possible, they should cut all rajids from their lines whilst still in the water, except on the request of the observer during the observer's biological sampling period.

6.76 The Working Group noted that a relaxation of the above requirement to cut all rajids from lines whilst still in the water may be necessary so that tag and recapture programs could be conducted in longline fisheries if the detection probability of tagged rajids at the sea surface is low.

6.77 The Working Group requested that Members and observers, where feasible, provide a report to the Secretariat on methods or strategies of fishing that minimise non-target fish by-catch.

6.78 The Working Group recommended that the Scientific Committee note the potential impact of competition between vessels in new and exploratory fisheries on by-catch mitigation (paragraph 6.73).

By-catch reporting

6.79 In order to adequately assess by-catch levels and rates, it is necessary to have accurate reporting of information on the total removals of by-catch taxa at a fishery level.

Information from scientific observers

6.80 Observer by-catch data was extracted by the Secretariat by fishery for the 2003/04 fishing season. While progress had been made since this dataset was examined last year, the quality of observer data for by-catch remained highly variable and significant problems still remain.

6.81 The observers' logbooks and forms were revised to improve by-catch data collection and distributed by the Secretariat to technical coordinators in February 2003. An analysis of observer reports from the 2003/04 season showed that the use of updated forms by observers has increased.

6.82 However, difficulties remain with the reporting, extraction and analysis of observer data which made the calculation of total removals at a fishery level not possible in some cases. The most common recurring problem was incomplete fields, particularly those that are necessary for estimates of total removals. For example, the field specifying whether a haul was observed as 'Y' or 'N' was left blank in a large number of instances. Similarly, the percentage of hauls/sets observed for landed by-catch and for the by-catch cut or lost from longlines was often not recorded. Thus estimates of total removals could not be routinely scaled up to fishery level. Further, some observers are scaling the catch to 100% before entering the data and then leaving the percentage observed unchanged, leading to over-inflated estimates. For the most part however, estimates of by-catch from observer data are underestimates. As observer data is the most detailed dataset available and the only dataset where information on cut-off by-catch can be obtained, the Working Group emphasised the need for accurate and consistent reporting.

6.83 Incomplete recording may be due to uncertainty by observers about by-catch data recording protocols. The Working Group recommended that observers be thoroughly briefed by technical coordinators, and guidelines for recording by-catch data be followed as closely as possible. In addition, the Working Group reiterated the importance of using the most up-to-date forms.

Reporting of cut-offs of rajids

6.84 The revised observers' logbooks and forms distributed by the Secretariat to technical coordinators in February 2003 included fields that specify discard methods (landed then discarded, retained, cut off, shaken off or gaffed, lost at surface or dropped off), and a field which indicates release condition as assessed by the observer (alive and likely to survive, injured and unlikely to survive, dead).

6.85 Information about rajids cut or lost from longlines was extracted from observer data for the 2003/04 fishing season (Table 6.6). There were only 149 records from longline fisheries on the CCAMLR observer database. The Working Group noted with concern that this represented a very limited number of observations, given the estimate of rajid by-catch within the Convention Area was almost 100 tonnes (Table 6.3).

6.86 The Working Group further noted that some Members have collected data on rajid cut-offs using their own national databases. For example, WG-FSA-04/68 presented estimates of cut-off skates and rays for the longline fisheries in Division 58.5.2 and for the exploratory longline fishery in Division 58.4.3b. The Working Group welcomed this information, and encouraged other Members to submit any available information on by-catch cut-offs from other fisheries to WG-FSA.

6.87 The Working Group requested that Members collecting data in a non-standard format work with the Secretariat intersessionally to ensure that all by-catch data is adequately transferred to the CCAMLR database.

Management advice

6.88 The Working Group noted that information on cut-offs is still not uniformly and accurately recorded and therefore it is still not possible to calculate estimates of cut-offs for all fisheries.

6.89 The Working Group reiterated the importance of collecting observer information on by-catch and requested that observers pay particular attention to:

(i) recording the percentage of a haul/set observed for landed/discarded by-catch
(ii) recording the percentage of a haul/set observed for cut-offs
(iii) recording the numbers of fish that are observed to be cut or lost from longlines.

INCIDENTAL MORTALITY OF MAMMALS AND SEABIRDS ARISING FROM FISHING

Intersessional work of ad hoc WG-IMAF

7.1 The Secretariat reported on the intersessional activities of ad hoc WG-IMAF according to the agreed plan of intersessional activities for 2003/04 (SC-CAMLR-XXII, Annex 5, Appendix E). The report contained records of all activities planned and results of their completion and is available on the IMAF page of the CCAMLR website.

7.2 The Working Group thanked the Science Officer for his work on the coordination of IMAF activities and the technical coordinators for their extensive support. It also thanked the

Scientific Observer Data Analyst for his work on the processing and analysis of data submitted to the Secretariat by international and national observers during the course of the 2003/04 fishing season.

7.3 The Working Group concluded that most tasks planned for 2003/04 had been successfully implemented. The list of current intersessional tasks was reviewed and a number of changes were agreed in order to consolidate specific tasks in future plans. The Working Group agreed that the plan of intersessional activities for 2004/05, compiled by the Convener and Science Officer, be appended to its report (Appendix D).

7.4 The Working Group especially welcomed to the meeting Mrs T. Neves (Brazil) and Ms P. Toschik (USA) who were attending the meeting for the first time. The Working Group continued to appreciate Mr M. McNeill's (New Zealand) expert advice on operational aspects of fishing and encouraged analogous input from other Members, including in relation to trawl fisheries. Members were asked to review their representation on WG-IMAF intersessionally, to suggest additional members and to facilitate the attendance of their representatives at the meetings.

Incidental mortality of seabirds during regulated longline fishing in the Convention Area

7.5 Data were available from all 44 longline cruises conducted within the Convention Area during the 2003/04 season (details in WG-FSA-04/6 Rev. 1).

7.6 The Working Group noted that the proportion of hooks observed was similar to, or higher than, last year for Subareas 48.3 (28% (range 18–50) compared with 25% (range 17–63)) and 88.1 and 88.2 (61% (range 30–99) compared with 52% (range 35–62)), and with generally greater consistency across vessels. Only for one cruise (*Koryo Maru No. 11* (18%)) was the proportion of hooks observed lower than 20%; this compares with four such cruises last year.

7.7 As usual, the total observed seabird catch rate was calculated using the total number of hooks observed and the total seabird mortality observed (Table 7.1). The estimated total catch of seabirds by vessel was calculated using each vessel's observed catch rate multiplied by the total number of hooks set.

Subarea 48.3

7.8 The total estimated seabird mortality was 18 birds (Tables 7.1 and 7.2) compared with 8, 27 and 30 birds in the last three years (Table 7.3). The overall catch rate was 0.001 birds/thousand hooks compared to 0.0003 and 0.0015 in the previous two years (Table 7.3). The five birds observed killed (all at night) comprised one grey-headed albatross, one black-browed albatross and three southern giant petrels (Table 7.4).

7.9 This represents a slight increase in by-catch total and rate compared with last year but values are still the second lowest yet recorded for this area.

South African EEZ in Subareas 58.6 and 58.7

7.10 The total estimated seabird mortality was 39 birds (Tables 7.2 and 7.3) compared with seven, zero and 199 bird mortalities in the last three years (Table 7.3). The overall catch rate was 0.025 birds/thousand hooks compared to 0.003, zero and 0.018 in the previous three years (Table 7.3). Of the 11 birds observed killed, 10 (all at night) were giant petrels and one (in daytime) was a white-chinned petrel (Table 7.4).

7.11 Values this year represent increases over the previous two years and although the total estimated seabird by-catch level is only 20% of that in 2001, the by-catch rate is very similar to that year.

Subareas 88.1 and 88.2

7.12 After seven successive years of zero seabird by-catch in the fishery in Subarea 88.1, a single southern giant petrel was observed killed this year. For the third successive year there was no incidental mortality of seabirds in Subarea 88.2.

Subarea 48.6 and Divisions 58.4.2, 58.4.3b and 58.5.2

7.13 This was the first year that longline fishing had been conducted in Subarea 48.6 and Divisions 58.4.2 and 58.4.3b, and the second such year for Division 58.5.2. No incidental mortalities of seabirds were observed in fishing operations.

7.14 Dr Constable suggested that it would be very useful to estimate the mean level of seabird by-catch for vessels fully compliant with mitigation measures in each part of the Convention Area. This would provide an appropriate basis for identifying vessels which report values significantly different from these levels. This should assist identifying the reasons or circumstances involved.

French EEZs in Subarea 58.6 and Division 58.5.1

7.15 The Working Group welcomed the participation of Dr T. Micol as a French representative to ad hoc WG-IMAF for a second year, allowing presentation and discussion of the French fishery results.

2001/02 and 2002/03 fishing seasons

7.16 The requested French data for 2001/02 and 2002/03 had been submitted to the Secretariat in tabulated form analogous to the summaries prepared by the Secretariat for the rest of the Convention Area (WG-FSA-04/6 Rev. 1). These tables are appended as Tables 7.5 to 7.8.

7.17 The total reported seabird mortality in 2001/02 for Subarea 58.6 and Division 58.5.1 was 1 243 and 10 814 birds respectively (Tables 7.5 and 7.6). The corresponding catch rates (reported birds/total hooks set) were 0.167 birds and 0.936 birds/thousand hooks.

7.18 The total reported seabird mortality in 2002/03 for Subarea 58.6 and Division 58.5.1 was 720 and 13 926 birds respectively (Tables 7.7 and 7.8). The corresponding catch rates (reported birds/total hooks set) were 0.109 and 0.518 birds/thousand hooks.

7.19 For Subarea 58.6, the annual by-catch rates decreased from 0.167 in 2001/02 to 0.109 in 2002/03, a decrease of 53%. For Division 58.5.1, the annual by-catch rates decreased from 0.936 in 2001/02 to 0.518 in 2002/03, a decrease of 45%.

7.20 In respect of incidental mortality of seabirds, it was emphasised that the totals of 12 057 birds killed in 2001/02 (1 243 birds in Subarea 58.6 and 10 814 in Division 58.5.1) and 14 646 birds killed in 2002/03 (720 in Subarea 58.6 and 13 926 in Division 58.5.1) represent the numbers of birds reported killed.

7.21 The reported totals of birds killed in these two years are based on retention of all birds brought on board each vessel, rather than on subsampling by observing seabird by-catch on a proportion of the hooks set and extrapolating to derive the total estimated seabird mortality. However, Dr Micol indicated that observers were used to make checks, which confirmed that virtually all birds brought on board were retained.

7.22 Intersessionally, France commissioned an analysis of the 2001/02 and 2002/03 data from the French research group led by Dr H. Weimerskirch, which is reported in WG-FSA-04/11. Findings show that the mortality was mainly of white-chinned petrels (93%), followed by grey petrels (5%), the former mainly caught in October and between January and April, the latter mainly between April and November. Fishing effort varied by area, as did catch rates of seabirds, with higher catch rates around Kerguelen (Division 58.5.1) than in the Crozet area (Subarea 58.6), with fishers setting more hooks in the Kerguelen area. Autoline vessels caught many times more birds than vessels using the Spanish system. The multivariate analysis showed that not one single factor was responsible for the by-catch mortality of seabirds. However, a significant part of the mortality of white-chinned and grey petrels is explained by season, area and method of fishing. Recommendations were made to allow continued reduction of seabird mortality. These were chiefly for fishing closures in the highest-risk periods for seabirds (February–March and October–November), using night setting, improved line weighting, using only white lines and redistributing fishing effort between the Crozet (lower risk) and Kerguelen (higher risk) areas.

2003/04 fishing season

7.23 In the first part of the 2003/04 season (until the end of February) the recording and reporting of by-catch was done in the same way as in previous years (paragraph 7.7). On cruises from March onwards, however, observers recorded by-catch on a proportion of the hooks set. These two datasets are shown separately in Table 7.9.

7.24 The total reported seabird mortality for Subarea 58.6 and Division 58.5.1 was 242 and 2 069 birds respectively (Table 7.9). The corresponding by-catch mortality rates were 0.080 and 0.127 birds/thousand hooks.

7.25 The Working Group noted that there was considerable variation between vessels in the levels of reported seabird by-catch. Thus in Subarea 58.6, 157 birds (65% of the total) were reported from cruise 2 of ship 5. In Division 58.5.1, 1 615 birds (78% of the total) were taken on one cruise each by ship 1 (700 birds), ship 2 (109 birds), ship 4 (144 birds), ship 5 (164 birds), ship 6 (349 birds) and ship 7 (149 birds). The Working Group requested analysis of the 2003/04 by-catch data to try to identify the factors responsible for the poor performance of these vessels, particularly in relation to interactions between timing and area of fishing and the nature of mitigation in use. It requested France to report the results of this analysis to the next meeting of the Working Group.

7.26 The reported seabird by-catch in Subarea 58.6 comprised 96% white-chinned petrels and 4% grey petrels; in Division 58.5.1 it comprised 94% white-chinned petrels and 5% grey petrels (Table 7.10).

7.27 For 3 of 18 cruises in Subarea 58.6 and 11 of 25 cruises in Division 58.5.1, the data on birds observed killed can be converted to estimates of total seabird by-catch mortality using reported data on the proportion of hooks observed. The mean proportions of hooks observed in Subarea 58.6 and Division 58.5.1 were 23.0% (n = 9; range 5.8–34.9%) and 24.7% (n = 11; range 6.0–33.4%). For the three cruises in Subarea 58.6, the observed by-catch of eight birds converts to an estimate of 100 birds killed (0.026 birds/thousand hooks). For the 11 cruises in Division 58.5.1, the observed by-catch of 334 birds converts to an estimate of 1 597 birds killed (0.125 birds/thousand hooks).

7.28 For the 2003/04 fishing season, therefore, probably the most accurate representation of seabird by-catch is given by combining the number of birds reported killed during the first half of the fishing season with the number of birds estimated killed in the second half of the season. On this basis, the totals for Subarea 58.6 and Division 58.5.1 would be 342 and 3 666 birds killed respectively, totalling 4 008 birds overall (Table 7.11).

7.29 Compared to last year, this represents reductions in seabirds killed of 42.5% (66.4% if reported data only are used) in Subarea 58.6, 73.7% (85.1% if reported data only are used) for Division 58.5.1 and 72.6% overall (84.2% if reported data only are used).

7.30 Similar comparison of by-catch rates indicated reductions of 26.6% for Subarea 58.6 (76.1% if estimated data only are used), 75.5% for Division 58.5.1 (75.9% if estimated data only are used) and 73.0% overall (85.7% if estimated data only are used).

7.31 All data available to the Working Group for seabird by-catch in the French EEZs in Subarea 58.6 and Division 58.5.1 are summarised in Table 7.11. The only statistics that can be compared directly across all years are the number of birds reported killed and the by-catch rates calculated on this basis. It was noted, however, that this would somewhat underestimate by-catch levels and rates for 2003/04 compared to other years.

7.32 Dr Micol indicated that for the 2004/05 fishing season data on seabird by-catch would be collected by observers on the basis of observing a proportion of the hooks set.

7.33 The Working Group agreed that this would be preferable and encouraged France to ensure that:

(i) this was done on every vessel
(ii) an appropriate proportion (not less than 25%) of hooks were observed on every vessel.

7.34 The Working Group noted that no data for 2000/01 appear to have been tabled at, or reported to, CCAMLR. It requested that France supply these data so that a comprehensive conspectus of the seabird by-catch history in this fishery is possible.

Mitigation measures

7.35 Last year, the Working Group emphasised the potential benefits of a testing program to evaluate the efficacy of existing and potential mitigation measures used in the French EEZs (SC-CAMLR-XXII, Annex 5, paragraph 6.25). Dr Micol summarised various efforts, including some collaborative projects and ad hoc experiments on the efficacy of different mitigation technologies (WG-FSA-04/87 and 04/88).

(i) Line weighting – collaboration was conducted between France and Australia (Dr G. Robertson) on the sink rate of integrated weighted lines (IWLs) and externally weighted lines in the French fishery. Dr Robertson indicated that insufficient reliable data were collected to perform a statistical analysis, but higher sink rates observed than those expected could be linked to the direction of propeller rotation. It was recommended that more trials should be conducted.

(ii) An exchange of personnel between New Zealand and France was initiated. Mr McNeill, member of the Working Group and New Zealand fishing industry representative, visited fishing companies and French administration at La Réunion Island (WG-FSA-04/52). He reported that there was discussion of mitigation strategies with French fishers, mainly in relation to IWLs. Many mitigation options were being used, including the use of several streamer lines (up to nine). Large-scale deployment of IWLs had yet to be adopted, although some French fishers had already undertaken preliminary trials. Issues that French fishing companies needed to assess before adopting IWLs voluntarily included: ease of usage, gear loss potential, higher relative cost of the lines, fitting through existing gear set-ups. Strengthening of magazine supports in some vessels would be necessary to handle the heavier lines. However, France is encouraging fishers to adopt IWLs.

(iii) Streamer lines – fishers used streamer lines in various numbers and configurations and these were found to be very useful in reducing seabird mortality. Significant reductions in seabird by-catch were achieved in the 2003/04 year compared with previous years. In part, increasing fishers' awareness of the issue and possible solutions played a role in achieving reductions in seabird mortality.

(iv) Colour of hookline – in 2002/03, vessels were equipped with either white or black hooklines. Those using white lines experienced significantly lower rates of seabird by-catch (WG-FSA-04/11).

(v) A former IUU vessel was converted into a patrol ship by France and a new system of satellite monitoring of vessels was established. This new system, linked to French navy vessels patrolling the zone, contributed to the deterrence of IUU vessels, with only one detected and arrested during the last year (to June 2004). Dr Micol noted that IUU fishing is presumably the most important mortality factor affecting seabirds and that combating IUU fishing is concomitantly saving birds.

(vi) France and French fishing companies were funding a study on population status of white-chinned and grey petrels on Kerguelen and Crozet, starting in November 2004.

7.36 The Working Group commended these initiatives, which it noted had already resulted in substantial reductions in by-catch rates and estimated total numbers of birds killed. Nevertheless these rates and totals still remained at levels which are a cause of serious concern and threat to the populations involved.

7.37 Mr McNeill commended the high level of feedback from the administration to vessel captains, companies and observers, particularly the monthly reporting of all birds killed for the zone and for the particular vessel, in order to encourage vessels to reduce their seabird by-catch.

7.38 Last year, Dr Micol provided a summary of the mitigation methods and measures used to reduce seabird by-catch on the vessels operating in the French EEZs (SC-CAMLR-XXII, Annex 5, paragraph 6.20(i–viii)). Based on an analysis of historical fishery and by-catch data, technical recommendations were made for changes to fishing practices.

7.39 In 2004, revisions to appropriate measures were made by the French authorities, reflecting recommendations from the analytical study and mitigation research. Thus, in addition to the existing requirements on offal discharge, night-setting, line weighting and streamer lines, the following revisions were enacted:

(i) at least two streamer lines, adhering to the provisions of Conservation Measure 25-02, must be used;

(ii) fishery closure during February (part of chick-rearing period of white-chinned petrels);

(iii) use of white-coloured hooklines.

7.40 Dr Micol also reported that the line-weighting regime was revised to require 8 kg/120 m on autoliners.

7.41 A variety of sanction measures, related to the daily reporting of seabird by-catch by individual vessels during fishing, was established. Vessels exceeding area-specific and time-bound seabird by-catch limits were sent a warning message in the first instance, and if seabird by-catch continued, vessels were required to move to a new subarea and to recommence fishing over 100 n miles from their current fishing location. Finally, subareas where upper limits for seabird by-catch had been reached would be closed to further fishing.

Recommendations to reduce seabird by-catch

7.42 The Working Group recognised the importance of the major reduction in seabird by-catch since the last fishing season. Given the annual review of seabird avoidance regulations by French authorities, the associated changes to improve the effectiveness of these requirements, and the apparent commitment to a mitigation research program, the Working Group expected that the necessary continued improvements are possible.

7.43 The Working Group discussed the need to provide incentives to fishers to further improve performance. Once fishers had adopted effective mitigation strategies, the Working Group suggested consideration could be given to reopening areas or seasons that have been restricted, particularly those in which fish catches are high and most profitable. This could even include daytime setting in appropriate cases, through a controlled experimental approach. This could have the advantage of a net decrease in fishing effort, with commensurably reduced risk to seabirds, where mitigation was fully effective. It was also recognised that closing the fishery in Division 58.5.1 between September and April, as in Subarea 48.3, would potentially greatly increase by-catch mortality of grey petrels, a globally threatened species.

7.44 Reduced seabird by-catch will be achieved through a suite of measures which have essentially constituted best practice in the Convention Area. This best practice includes: line weighting, night setting, use of streamer lines of a prescribed standard and performance, prohibition of offal discharge during the set, and fishery closures during times of high risk to breeding seabirds.

7.45 The Working Group recommended the following:

(i) Continue to undertake research programs and appropriate experiments to implement measures to further reduce seabird mortality to achieve levels and rates similar to those reported for other parts of the Convention Area.

(ii) Line weighting: use of IWL and weighting regimes that will ensure that longlines sink at >0.25 m/s. This sink rate can be achieved by compliance with the line sink rate requirements of Conservation Measure 25-02 (attachment to longlines of 5 kg weights at 50–60 m intervals) for autoliners.

(iii) Comply with the standards for streamer lines in Conservation Measure 25-02. However, paired streamer lines should be mandatory given the relatively high levels of seabird mortality that persist in the French EEZs. Where more than two sets of streamer lines are to be used, appropriate experiments should be conducted to demonstrate the utility of the additional streamer lines.

(iv) Maintain strict prohibitions on the discharge of offal at the set.

(v) Observer coverage and duties should be sufficient to ensure that at least 25% of hooks are observed on every vessel.

(vi) Maintain fishery closures in high-risk periods during seabird breeding seasons.

Implementation of Conservation Measures 25-02 and 25-03

7.46 Data from observer reports relating to compliance with these conservation measures in 2003/04 were provided in WG-FSA-04/6 Rev. 1 and 04/8 Rev. 1 and are summarised in Tables 7.1 and 7.12. Comparison with similar data from previous years is provided in Table 7.13. Observers did not provide all the required data on streamer line design for six cruises, so full assessments were not possible in these cases.

Streamer lines

7.47 Several specifications in Conservation Measure 25-02 had changed from the previous season, notably attachment height, line spacing and branched streamer length. Overall compliance with streamer line design has declined from 92% (34 of 37 cruises) last year to 64% (28 of 44 cruises) this year. The cruises where streamer lines did not comply failed on attachment height (7 cruises), total length (4 cruises) and branched streamer lengths (12 cruises) (Table 7.12). Although all vessels complied with the branched streamer spacing (a maximum of 5 m), one vessel only used two branched streamers. The conservation measure requires vessels to attach branched streamers along the whole aerial extent of the streamer line.

7.48 Two vessels failed on three different streamer line specifications (*Volna* and *Viking Bay*). Three other vessels failed on two specifications (*Mellas*, *Simeiz* and *Sonrisa*).

7.49 Vessels fishing in Subareas 48.6, 58.6, 58.7 and Divisions 58.5.2, 58.4.2 and 58.4.3b, used streamer lines on all sets. In Subarea 48.3, seven vessels undertook sets without using a streamer line. Of these, one vessel (*Isla Camila*) undertook more than 20 sets without a streamer line and the remaining vessels (*Polarpesca I*, *Tierra del Fuego*, *Ibsa Quinto*, *Jacqueline*, *Isla Alegranza* and *Argos Georgia*) less than five sets. In Subareas 88.1 and 88.2, six vessels (*Antarctic III*, *Arnela*, *No. 707 Bonanza*, *Punta Ballena*, *America I* and *South Princess*) undertook some sets (five or less) without using a streamer line.

Offal discharge

7.50 In Subarea 88.1, one vessel, the *Arnela*, was observed discharging offal during 4% of sets. Additionally, the *Arnela* logbook indicated offal was discharged during 24% of its hauls while fishing in Subareas 88.1 and 88.2. Offal discharge is prohibited in these subareas. This is the first year offal discharge has been reported in these subareas, other than one incident in 2002/03, and is particularly concerning because this could result in local seabirds learning to follow vessels.

7.51 With two exceptions, observer reports for other areas indicate full compliance with the requirements to hold offal on board or to discharge on the opposite side to where the line was hauled. In Subarea 48.3, the *Argos Helena* was observed discharging offal during one set and in Subarea 58.6, offal was discharged during setting on 6% of sets of the *Koryo Maru No. 11*.

Discard of hooks

7.52 Observers on board eight vessels reported that fishing gear, snoods and hooks, were occasionally being disposed of at sea. Observers reported hooks being present in discards on eight vessels; on seven of these this was reported as a rare event. However, the report for the *Jacqueline* indicated that this was a daily occurrence.

Night setting

7.53 In Subareas 58.6 and 58.7, 83% of sets occurred at night, down from 98 and 99% in the past two years. The *Koryo Maru No. 11* undertook 23 day sets (32%) and the *South Princess* 7 day sets (3%). In Division 58.5.2, 99% of sets occurred at night. In Subarea 48.3, 98% of sets occurred at night. Only one vessel, *Argos Georgia*, undertook a substantial number of day sets (55 sets, 19%).

7.54 In Subareas 48.6, 88.1, 88.2 and Divisions 58.4.2 and 58.4.3b, vessels fished under Conservation Measure 24-02, which contained exemptions to night setting south of 60°S for vessels which demonstrated a consistent minimum line sink rate of 0.3 m/s (paragraph 7.56).

Line weighting – Spanish system

7.55 This year there was 87% compliance (13 of 15 cruises) with the required line-weighting regime in Subarea 48.3. This compared to full compliance in the previous year. The two vessels that did not comply (*Ibsa Quinto* and *Paloma V*) used 7 kg every 40 m and 9 kg every 96 m respectively. Conservation Measure 25-02 requires either 6 kg every 20 m or 8.5 kg every 40 m. The single Spanish-system vessel fishing in Subareas 58.6 and 58.7 fully complied.

7.56 In Subareas 48.6 and 88.1, vessels fishing south of 60°S in daylight were required to use line weights to achieve a consistent minimum line sink rate of 0.3 m/s (Conservation Measure 24-02). All vessels met this requirement. The Working Group noted that the sink rates on the *Arnela* and *No. 707 Bonanza* were considerably higher than sink rates on other vessels using the same weighting regime (Figure 7.1). There was no obvious reason for this.

Line weighting – autoline system

7.57 In Subareas 48.6, 88.1, 88.2 and Division 58.4.2, vessels fishing south of 60°S in daylight were required to use line weights to achieve a consistent minimum line sink rate of 0.3 m/s (Conservation Measure 24-02). All vessels met this requirement. The Working Group noted that the sink rate achieved using the line weighting regime on the *Antarctic III* seemed high (Figure 7.1). WG-FSA-98/44 reported that weights of 6 kg used at spacings above about 70 m are unlikely to result in a measurable increase in sink rate of the line as compared to an unweighted line. The observer reported the vessel used 10 kg every 270 m.

General

7.58 The Working Group expressed concern that compliance with streamer line specifications had dropped considerably since last year. The lower level of compliance may in some cases be due to lack of awareness of the changes to Conservation Measure 25-02. The majority of the vessels that failed to fully comply this year would have complied under the previous specifications. However, the vessels that fully complied this year have demonstrated that the changes are practical and able to be implemented. The Working Group requested that vessel operators be reminded of the new specifications.

7.59 The majority of vessels that are still undertaking day sets in areas where this is prohibited have fished in the Convention Area for a number of years, and are familiar with Conservation Measure 25-02. The Working Group noted its disappointment that these vessels were still not fully complying with this requirement.

7.60 However, the Working Group was encouraged by the high compliance relating to offal discharge, line weighting and line sink rate requirements. The Working Group encouraged the few remaining non-compliant vessels to fully implement these measures.

7.61 The Working Group noted that if compliance with Conservation Measure 25-02 is interpreted strictly (i.e. 100% in all elements of the conservation measure), 13 of 40 vessels (33%) fully complied with all measures at all times throughout the Convention Area. This compares to 48% last year. The fully compliant vessels were the *Burdwood*, *Isla Sofía*, *Janas* (Australia), *Janas* (New Zealand), *Eldfisk*, *Gudni Olafsson*, *San Aotea II*, *Yantar*, *Piscis*, *American Warrior*, *Frøyanes*, *Avro Chieftain* and *San Liberatore*. As was noted last year, some vessels failed to comply by small margins, and the Working Group recommended that vessels should be advised to exceed the standards to prevent compliance failure.

Implementation of Conservation Measure 25-03

7.62 Conservation Measure 25-03 prohibits the discharge of offal during the shooting or hauling of trawl gear. Four of eight vessels fishing in Subarea 48.3 were observed discharging offal during net shooting or hauling: *Betanzos* (9% shots and hauls), *Robin M Lee* (12% shots), *Dongsan Ho* (9% hauls) and *InSung Ho* (3% shots) (Table 7.14). This level of compliance is not as high as 2003, when only two vessels discharged offal during shooting or hauling of nets.

7.63 Dr L. Pshenichnov (Ukraine) observed that the definition of offal in conservation measures, particularly in Conservation Measure 25-02 and conservation measures applying to new and exploratory fisheries, would be improved if it was indicated that offal included discarded bait and fish by-catch (except as specified in measures relating to the live release of skates and rays).

Research into and experiences with mitigation measures

Streamer lines

7.64 The streamer line requirement was changed substantially in 2003 (Conservation Measure 25-02) to reflect the importance of the aerial extent (which supports individual branched streamers of the streamer line) as a key component to streamer line effectiveness.

7.65 The Working Group noted that information on the aerial extent of the streamer line and on the number of streamer lines deployed, was not collected consistently by fishery observers in 2003/04. It also noted that the degree to which recommended practices within the appendix of the conservation measure were followed in 2003/04 could not be determined. These included the recommendations that efforts be made to maintain the towed object directly behind the streamer line attachment point to the vessels such that the aerial extent be maintained over the hookline and that branched streamers extend to the water in the absence of wind and swell.

7.66 The Working Group recommended that steps be taken to ensure that information on the aerial extent and the number of streamer lines deployed be collected consistently in the future (see SC-CAMLR-XXII, Annex 5, paragraphs 10.26 and 10.27). This information is fundamental to monitoring the proper deployment of streamer lines and to future improvements to the conservation measure.

7.67 The Working Group noted that it intended to revise Conservation Measure 25-02 as soon as adequate data on the aerial extent of streamer lines becomes available from the fishery.

Dyed bait and stealth gear

7.68 Mrs Neves reported that a subset of pelagic fishers in Brazil has been voluntarily using blue-dyed bait together with streamer lines for the past three years and that blue-dyed bait will be among the proposed mitigation measures required under Brazil's NPOA. A pilot study showed no birds were caught and fish catch was highest when blue-dyed bait and a streamer line were used, compared to four albatrosses killed when no mitigation was used. SEAP (Special Secretariat of Aquaculture and Fisheries of the Presidency of the Republic) is planning more extensive research on the efficacy of blue-dyed bait and streamer lines in 2005.

7.69 The Working Group recollected that research in the Japanese southern bluefin tuna fishery found that blue-dyed bait was more effective than a streamer line at reducing seabird by-catch and suggested that the combination of both measures could substantially reduce the incidental catch of seabirds in tuna longline fisheries. This research also reported that, with the exception of southern bluefin tuna on one vessel, tuna catch was unaffected when blue-dyed bait was used.

7.70 The Working Group noted that dying bait at sea is very difficult and the lack of commercially available dyed bait greatly limits wide adoption of dyed bait as a seabird mitigation measure in pelagic fisheries.

7.71 Acknowledging that research results on the effect of dyed bait on seabirds, target catch and other protected species such as turtles have yielded mixed results across fisheries, Mr B. Baker noted that Australia is hoping to fund a study to assess the reflectance spectrum of dyes currently used to camouflage baits, and therefore to assess how the various dyes appear to seabirds. Because birds are particularly sensitive to UV wavelengths (light beyond the scope of human vision) and many dyes are active in the UV range, baits that appear white to humans may in fact appear very differently to seabirds. Thus dyes thought to be cryptic may in fact be conspicuous, suggesting that the successes and failures of dyed bait to date may be due to other mechanisms. Spectroradiometric techniques can also be used to quantify the rate of absorption and retention of dyes and to assess the appearance of the dyed baits at various depths in the water column. This research could rapidly advance the efficacy of dyed bait and stealth gear and possibly other mitigation applications to seabird conservation in fisheries.

7.72 WG-FSA-04/88 provided data showing that the rate of seabird by-catch (primarily white-chinned petrels) was significantly less on three of four vessels when white hooklines were used compared to black hooklines. Based on these results, white hooklines were required in Subarea 58.6 and Division 58.5.1 in 2003/04. The Working Group noted that these results were not intuitive and remain difficult to explain.

Line weighting

7.73 WG-FSA-04/72 presented important evidence, complementary to that in WG-FSA-03/23, on the effectiveness of longlines containing 50 g lead/m integrated weight and a single streamer line in reducing the mortality of white-chinned petrels (*Procellaria aequinoctialis*) and sooty shearwaters (*Puffinus griseus*) – while not affecting fish catch – in the New Zealand ling (*Genypterus blacodes*) autoline fishery. White-chinned petrels and sooty shearwaters are two of the most difficult seabird species in the world to deter from baited hooks and are considered a worst-case scenario from a gear performance perspective. Information presented in WG-FSA-04/72 strongly supports inclusion in Conservation Measure 24-02 of provisions that autoline vessels use IWLs in the Convention Area.

7.74 IWLs sinking instantly when set and at an average of 0.24 m/s (range 0.2–0.3 m/s) to 20 m depth – compared to unweighted (normal) longlines (UWLs; average 0.11 m/s; range 0.06–0.15 m/s) – reduced white-chinned petrel mortality by 98% in 2002 and 93% in 2003. The reduction in mortality of sooty shearwaters in 2003 was 60%. Catch rates of white-chinned petrels were 0.005 birds/thousand hooks and 0.011 birds/thousand hooks in 2002 and 2003 respectively. Sink profiles through the water column, and sink rates to 20 m depth of IWLs were very similar to sink profiles for autolines deployed under the provisions of Conservation Measure 24-02 (Figure 7.2).

7.75 Catch rates of ling by UWL (208 ± 71 kg/thousand hooks) and IWL (197 ± 81 kg/thousand hooks) were similar ($\chi^2 = 0.09$; d.f. = 1; P = 0.767; n = 52 pairs of UWLs and IWLs). Similarly, catch rates of all non-target fish species were not affected by IWLs. It was noted, however, that sample sizes for differences between IWLs and UWLs in catch rates of fish species were small. Compared to UWLs with external weights attached in accordance with Conservation Measure 24-02, IWLs may increase catch rates of *D. eleginoides* by up to one-third (WG-FSA-03/23).

7.76 The effectiveness of IWLs (in combination with streamer lines) in reducing mortality of white-chinned petrels has also been demonstrated in 2003/04 by France in Division 58.5.1, further demonstrating that very large reductions in seabird mortality can be achieved by use of IWLs by autoline vessels in the Convention Area.

7.77 Operationally, there are considerable advantages to IWLs. IWLs coil more uniformly and run through magazine racks more efficiently than UWLs. Compared to UWLs with external weights attached (necessary to comply with the provisions of Conservation Measure 24-02), IWLs are less time consuming to haul since there are no line weights to retrieve and stow. This also has implications for crew safety, since there are no external weights to be manually delivered from hauling to setting positions on vessels, which can be a hazardous practice in rough sea conditions.

7.78 Disadvantages to IWLs include the additional weight (magazine supports may have to be strengthened on some vessels), the higher purchase price than UWLs and the fact that currently there is only one international manufacturer producing IWLs with the specifications of the line used in the experiments reported here.

7.79 The Working Group acknowledged the importance of this new information and its relevance to modifications to Conservation Measure 24-02 to permit the use of IWLs by autoline vessels in the Convention Area in the 2004/05 fishery.

Proposed line-weighting trial in Subareas 88.1 and 88.2

7.80 WG-FSA-03/17 sought permission to conduct an IWL-weighting trial in Subareas 88.1 and 88.2. The trial sought to determine the difference, if any, between IWLs and UWLs in the catch rates of *D. eleginoides* and non-target fish species. The purpose of the trial was to gather information of relevance to line-weighting provisions for autoline vessels in the Convention Area and to aid in the promulgation of integrated weight gear in autoline fisheries outside the Convention Area. The trial was supported by the provisions of Conservation Measure 24-03.

7.81 For a variety of reasons, principally the large extent of sea-ice in Subareas 88.1 and 88.2 in the 2002/03 season and the number of seamounts on the fishing grounds (not conducive to conducting the trial), the trial could not be undertaken. Since it is not intended to conduct the trial in the 2004/05 season, it is not necessary to maintain Conservation Measure 24-03 and the Working Group recommended that it should lapse.

Underwater setting

7.82 Dr Robertson informed the Working Group of cooperative research by Dr H. Sakai, a mechanical engineer from Tokyo University of Marine Science and Technology and currently on sabbatical at the Australian Antarctic Division, who is developing an underwater setting device designed for high-seas tuna fisheries. The device uses a conveyor belt concept whereby a baited hook attached to a traditional snood is impaled on a pin, transported down the vertical plane of the conveyor, and released subsurface from the pin at a depth 3 to 4 m below the surface – beyond the propeller wash of a typical Japanese longline vessel.

7.83 The Working Group encouraged this work and noted that Dr Sakai's design differs from that of the previous underwater setting device trialled in multiple pelagic fisheries, which has had limited adoption in pelagic fisheries.

Proposed removal of the night-setting requirement in Division 58.5.2

7.84 WG-FSA-04/73 sought support to allow line-setting operations by autoline vessels fishing in Division 58.5.2 to occur at any time of the day/night cycle. The proposal formed part of an adaptive approach to management, which considers the risk status of the fishery, knowledge on the effectiveness of mitigation measures, mitigation performance record of the vessel, seabird mortality levels and assessment of the likely effects of individual mitigation measures to total mitigation response.

7.85 Since the introduction of longline fishing in Division 58.5.2 in 2002, seabird by-catch mitigation requirements have exceeded those required by CCAMLR. Evidence from Subarea 48.3, where both the hooking effort and number and abundance of longline-vulnerable seabird species is far greater than in Division 58.5.2, suggested that winter fishing with appropriate mitigation presents a very low risk to seabirds. This is supported by the results of the first two years of longline fishing in Division 58.5.2: a total of 2.2 million hooks have been set and no seabirds caught during line-setting operations. Possible reasons why seabirds have not been caught are the very low abundance of longline-vulnerable seabird species on the fishing grounds between May and September, night setting, the requirement for a minimum line sink rate, the use of paired streamer lines and no offal discharge. Evidence from IWL experiments presented in WG-FSA-04/72 suggested that the absence of seabird mortality in Division 58.5.2 is due to the low incidence of longline-vulnerable seabirds in winter, the minimum line sink rate and the use of streamer lines. Removal of the night-setting requirement is unlikely to result in an increased risk to seabirds in Division 58.5.2.

7.86 The Working Group supported the proposed recommendations that autoline vessels fishing in Division 58.5.2:

- restrict fishing to the period from 1 May to 14 September (as currently required);
- use paired streamer lines during all sets of longlines (as currently required);
- retain on board fish offal and discards (as currently required);
- be permitted to set longlines at any time in the day/night cycle;
- comply with the provisions of Conservation Measure 24-02 or use longlines containing 50 g lead/m integrated weight such that lines sink to 10 m depth at no less than 0.2 m/s, with a preferred average rate of no less than 0.24 m/s;
- abide by all other seabird conservation provisions in Conservation Measure 25-02;
- in the event that three seabirds are caught during daylight setting of lines, vessels must revert to night setting of longlines (as currently applies under Conservation Measure 24-02).

7.87 However, the Working Group noted that it would be premature at this stage to carry forward these provisions to other subareas and divisions until the effect of this adaptive approach to the management of seabird by-catch in Division 58.5.2 is known.

Research requirements

7.88 The Working Group expressed concern about the lack of empirical information on the effectiveness of certain mitigation measures that are routinely recommended to reduce seabird mortality in fisheries operating both inside and outside the Convention Area. Particularly important is the need to undertake manipulative experiments on the effectiveness of streamer lines in deterring from baited hooks deep-diving species such as white-chinned petrels, grey petrels and *Puffinus* species of shearwaters. These taxa include many globally threatened species to which information on the effectiveness of streamer lines and other mitigation measures would be especially relevant.

7.89 The Working Group also highlighted the importance of conducting experiments in a manner that allowed quantification of the contribution to by-catch reduction of measures used both singly and in concert – that is by adopting experimental designs aimed at de-coupling the effects of mitigation treatments. The Working Group believed that the results of such experiments should be applicable to a large number of fisheries operating in both northern and southern hemispheres, and would provide relevant fisheries management authorities with much-needed confidence in attempts to decisions regarding seabird-safe longline fishing practices.

7.90 The Working Group encouraged researchers to consider these points when conducting research on Convention Area seabirds and mitigation measures applicable to this area.

Revision of Conservation Measures 24-02 and 25-02 (2003)

7.91 The Working Group in its 2003 review of Conservation Measure 25-02 noted that changes to the measure were likely to be proposed in 2004 to make line-weighting prescriptions mandatory for autoline vessels (SC-CAMLR-XXII, Annex 5, paragraph 6.93). Such recommendations were dependent on the outcomes of trials of IWLs within New Zealand waters (paragraphs 7.73 to 7.79) and in Subareas 88.1 and 88.2 (paragraphs 7.80 and 7.81), and the collation of existing information describing weighting regimes for standard autoline gear.

7.92 The Working Group considered proposing changes to Conservation Measure 25-02 to accommodate line-weighting provisions for autoline vessels (both external weighting and IWLs), but recognised that no additional information on various external weighting regimes for autoline vessels had been provided and suggested that a revision of Conservation Measure 25-02 in 2004 would be premature.

7.93 The Working Group recommended that research be undertaken in 2004/05 on the sink rate of externally weighted autolines to allow a more informed revision of Conservation Measure 25-02 in 2005, with the intention of combining Conservation Measures 24-02 and 25-02, if possible. Research to explore relating the current values of line sink rate to values that include both vessel speed and sink rate is also planned. This would allow more flexible prescriptions to be developed for the conservation measure.

7.94 The Working Group recognised, however, that the results of the New Zealand trial (WG-FSA-04/72) proved that IWLs (50 g/m) are highly effective as a seabird by-catch mitigation method (in areas of high risk of seabird by-catch) without affecting fishing efficiency. The Working Group agreed that IWLs should be endorsed as a viable alternative to the provisions of Conservation Measure 24-02, which currently requires the attachment of external weights to UWLs.

7.95 The Working Group recommended that Conservation Measure 24-02 be revised, via the addition of an extra protocol, to accommodate the use of IWLs as an alternative line-weighting option. In reviewing the entire conservation measure, the Working Group recommended additional changes be made at the same time based on tabled papers and other available information to simplify implementation of line-weighting regimes in the Convention Area.

Experimental trials

7.96 Conservation Measure 24-02 was initially adopted to allow experimental line-weighting trials. The measure is now applied in most new and exploratory fisheries in high latitudes to allow daytime setting, subject to line sink rate targets being met and specified seabird by-catch limits. The measure has also been adopted in some mid-latitude fisheries to extend fishing seasons.

7.97 The Working Group recommended that Conservation Measure 24-02 now be considered part of the suite of tools available for mitigating seabird by-catch in the Convention Area, rather than confined to new and exploratory fisheries or to experimental contexts.

Longline sink rate testing prior to entering the CCAMLR Convention Area

7.98 The requirement to set five longlines with four sample points on each longline to ensure fishers' ability to comply with this measure prior to entering the Convention Area is an unnecessary burden given the constant line sink rate monitoring regime in place in the fishery. However, some pre-fishery longline sink rate testing is recommended to ensure vessels are fully able to comply with CCAMLR requirements prior to entering the fishery.

7.99 Accordingly, the Working Group proposed that these requirements be made clear in all conservation measures and that the requirement for five pre-fishery test lines be reduced to setting two pre-fishery longlines with four sample points on each longline.

7.100 The length of the longline used determines the likely minimum line sink rate (WG-FSA-01/44). The Working Group recommended that line sink rate tests should be undertaken on longlines of the maximum length planned to be used during fishing in the Convention Area.

7.101 The placement of a TDR or bottle immediately adjacent to a weight on externally weighted longlines will give a rapid line sink rate result. The slowest sink rates are recorded midway between attached weights. As the target is a minimum line sink rate of 0.3 m/s (for externally weighted lines), line sink rate tests should always involve placement of TDR or bottle midway between attached weights.

7.102 Noting that fishing gear may be lost during line sink rate testing and not replaced prior to entry to the fishery, and that not all gear on board a vessel may be used during longline sink rate testing, the Working Group recommended that longline gear of the same specifications be required rather than specifying the same longline gear.

7.103 The Working Group noted that one distinct advantage of the bottle-test method was the ability to calculate an answer immediately after the test and provide that result to the fishing vessel to allow modification of practice at the time of the set if required. Text to clarify this aspect of the bottle test is recommended.

Longline sink rate monitoring whilst fishing in CCAMLR waters

7.104 The Working Group recommended that one sink rate test every 24 hours is sufficient to monitor ongoing compliance of the longline sink rate during the voyage, in conjunction with the four sample points on one longline every seven days.

7.105 The Working Group reiterated that the 0.3 m/s longline sink rate for externally weighted longlines was a minimum requirement rather than a target.

7.106 The Working Group recommended that longline sink rate tests be reported to the relevant national agency daily, and to CCAMLR at the end of the fishing season.

Protocol for IWL

7.107 The use of IWLs requires that line sink rate standards be reduced to 0.2 m/s for this type of gear only. As IWLs begin to sink immediately, and have a linear sink profile, an IWL sink rate of 0.2 m/s is assumed to be of equivalent conservation benefit to a UWL achieving a sink rate of 0.3 m/s by attaching external weights.

7.108 The Working Group recommended the addition of a new protocol for vessels monitoring longline sink rate with either TDRs or bottle tests. The new protocol applies to IWLs with integrated weights of no less than 50 g/m and designed to sink instantly with a linear profile at greater than 0.2 m/s without the addition of external weights.

7.109 The Working Group noted that either longline sink rate test method could be used on IWLs and recommended that the new protocol be worded to allow both bottle testing and TDR testing.

7.110 In the conduct of longline sink rate tests for IWLs, the Working Group noted that as no external weights are attached, tests can be undertaken anywhere on the middle one-third of the longline, and the requirement to test midway between weights is not relevant.

7.111 Taking account of the foregoing information and suggestions, the Working Group prepared a draft revision of Conservation Measure 24-02.

Incidental mortality of seabirds during unregulated longline fishing in the Convention Area

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

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

7.114 As no information is available on seabird by-catch rates from the unregulated fishery, estimates have been made by bootstrapping the observed catch rates from fishing operations in 1996/97. The fleet in 1996/97 implemented relatively few mitigation measures and has been considered to provide the best estimate the Working Group has of likely rates in the unregulated fishery. The method used to prepare estimates of the incidental mortality of seabirds during IUU fishing within the Convention Area is described in full in SC-CAMLR-XXIII/BG/23 and in SC-CAMLR-XXII, Annex 5, paragraphs 6.112 to 6.117.

7.115 The Working Group agreed that the following values should be applied to the toothfish removals data to estimate seabird by-catch in IUU *Dissostichus* spp. fisheries in the Convention Area in 2004, and also agreed that these values should be used to generate similar estimates for previous years. The resulting median and 95% confidence intervals for seabird by-catch rates (birds/thousand hooks) for the unregulated fishery are shown below. It should be noted that where by-catch rates are not available for a regulated fishery within a statistical area, the rate for an adjacent area of similar level of risk (SC-CAMLR-XXIII/BG/23) has been used. Thus, because a regulated fishery has never existed in Division 58.4.3 the rate applied is that for Division 58.4.4.

Subarea/Division	Season	Lower 95%	Median	Upper 95%
48.3	Summer	0.39	0.741	11.641
	Winter	0	0	0.99
58.6, 58.7, 58.5.1, 58.5.2	Summer	0.45	0.55	1.45
	Winter	0.01	0.01	0.07
58.4.3, 58.4.4	Summer	0.27	0.33	0.87
	Winter	0.006	0.006	0.042
88.1	Summer	0.27	0.33	0.87
	Winter	Not applicable, access not possible in winter		

7.116 The estimates of potential unregulated seabird by-catch in the Convention Area in 2003/04 and comparison with estimates for previous years are provided in detail in SC-CAMLR-XXIII/BG/23.

7.117 The overall estimated total for the whole Convention Area in 2003/04 indicates a potential seabird by-catch in the unregulated fishery of 5 311 (95% confidence interval 4 352–14 166) seabirds. The values for this and previous years are summarised in respect of different parts of the Convention Area in Table 7.15.

7.118 In comparison with estimates for previous years, calculated in identical fashion, the value for 2003/04 is the lowest reported since estimates started in 1996. The 2003/04 value is about 30% of the values for 2003 (SC-CAMLR-XXIII/BG/23). This presumably reflects a commensurate reduction in toothfish removals or changes in the areas from where IUU fishing occurs.

7.119 Based on the data since 1996 (SC-CAMLR-XXIII/BG/23), an estimated total of 176 063 (95% confidence interval 143 289–516 934) seabirds have been killed by these vessels. Of these:

(i) 39 457 (95% confidence interval 31 904–125 492) were albatrosses, including individuals of four species listed as globally threatened using the IUCN threat classification criteria (BirdLife International, 2004);

(ii) 6 974 (95% confidence interval 5 695–19 557) were giant petrels, including one globally threatened species;

(iii) 110 404 (95% confidence interval 90 001–317 264) were white-chinned petrels, a globally threatened species.

7.120 As in previous years, it was emphasised that these values 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.

7.121 Nevertheless, even taking this into account, the Working Group endorsed its conclusions of recent years that:

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

(ii) although considerably reduced from previous years, such levels of mortality probably still continue to be unsustainable for some of the populations of albatrosses and giant and white-chinned petrels breeding in the Convention Area.

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

Incidental mortality of seabirds during longline fishing
outside the Convention Area

7.123 Chile, New Zealand and Uruguay were the only countries submitting new information about incidental mortality of seabirds outside the Convention Area.

7.124 Chile presented the results of the incidental mortality assessment, conducted in 2002, for its *D. eleginoides* industrial fishery (WG-FSA-04/13). The total number of birds estimated killed was 2 162 (0.343 birds/thousand hooks), most of which (96%) were black-browed albatrosses presumed to breed in the Chilean EEZ. The vessels involved in the assessment used no mitigation measures. Although part of this fleet also fishes in Subarea 48.3 during winter, they relax their mitigation measures in Chile presumably, in part, because they are not mandatory there. In addition, the greater depth of the fishing grounds in Chile (up to 2 000 m) is stated to impose serious restrictions for the line-weighting regime and to preclude applying the same regime as required in the Convention Area (Conservation Measure 25-02). Consequently, further development on mitigation measures in Chile is required. In view of these results, Chile is elaborating its NPOA-Seabirds in order to reduce the present levels of incidental mortality (WG-FSA-04/14).

7.125 Chile also presented an assessment of the incidental mortality of seabirds in its domestic fleet (boats <18 m long) fishing for austral hake and *D. eleginoides* in the southern Chilean EEZ (WG-FSA-04/54). The impact of the domestic austral hake fishery is minimal, capturing 23 birds in 1999 with an overall catch rate of 0.030 birds/thousand hooks. During 2002, the domestic *D. eleginoides* fishery caught a total of 437 birds, with an overall catch rate of 0.047 birds/thousand hooks. All birds caught were white-chinned petrels, doubtless from populations breeding in the Convention Area.

7.126 Uruguay presented a report on an exploratory fishery conducted in its EEZ between August and November 2001 (WG-FSA-04/38), as was encouraged last year (SC-CAMLR-XXII, Annex 5, paragraph 6.130). During this short exploratory fishery 2 175 birds were killed. The fishing gear used was a modification of the traditional bottom Spanish longline, using floats attached to the mother line, resulting in a zigzag configuration on the sea bottom. This configuration greatly increased the time that hooks remain near the surface, resulting in very high seabird mortality rates (>3 birds/thousand hooks), mainly of white-chinned petrels (50%), presumably from the South Georgia population. Vessels fished during day and night and streamer lines were used in only 8% of the sets. This fishery no longer exists in Uruguay; however, this kind of gear configuration is possibly used in other South American countries, with potential high levels of incidental seabird mortality. The Working Group encouraged the assessment and development of appropriate mitigation for such fisheries, which have the potential to kill many birds from the Convention Area.

7.127 New Zealand presented an assessment of incidental seabird mortality in four major commercial fishing operations in its EEZ for the seasons 2000/01, 2001/02 and 2002/03 (WG-FSA-04/55 to 04/57). Incidental mortality rates were different for each fishery. Pelagic longlining for tuna has low overall seabird mortality (54 and 136 birds in 2000/01 and 2002/03 respectively) and catch rates (0.026 and 0.048 birds/thousand hooks in 2000/01 and 2002/03 respectively) throughout the study period, presumably reflecting high compliance with mitigation measures. Demersal longlining for ling has substantially reduced its catch from 2 367 in 2000/01 to 543 in 2002/03, reflecting a significant reduction in the overall bird catch rate (up to 0.218 in 2000/01 and <0.08 birds/thousand hooks in 2002/03) due to a substantial increase in their line-weighting regime. Trawl fisheries, particularly for squid, are still presenting high mortality rates (0.097 and 0.058 birds per trawl in 2000/01 and 2002/03 respectively) and overall catches (1 651 birds in 2000/01 and 1 110 birds in 2002/03). Most of the birds caught breed in New Zealand waters; however, a high proportion of the birds caught each year were white-chinned petrels (27–52%) and grey petrels (13–19%, but 1% in 2001/02), species known to breed in the Convention Area.

7.128 Mrs Neves reported on the high levels of incidental seabird mortality in Brazilian waters, involving more than 10 000 albatrosses and petrels per year during the late 1990s, including three species that breed in the Convention Area (wandering albatross, white-chinned petrel and southern fulmar). These estimates only relate to incidental mortality arising from the domestic demersal and pelagic fleets. Additionally, a chartered foreign longline fleet operates off the Brazilian coast, of which fishing effort is much higher than that of the domestic fleet. SEAP (Special Secretariat of Aquiculture and Fisheries of the Presidency of the Republic) is already coordinating a National Observers Program that includes 100% coverage of the chartered fleet. Mrs Neves also mentioned that mitigation measures, such as blue-dyed baits and streamer lines, should be adopted as an obligation, in agreement with Brazil's NPOA-Seabirds which is ready for signature.

7.129 Brazil was requested to provide the Working Group with data on the above topic, particularly in respect of by-catch rates for seabird species breeding in the Convention Area.

Research into the status and distribution of seabirds

7.130 Following last year's renewed request for information summarising national research on seabirds (albatrosses and *Macronectes* and *Procellaria* petrels) vulnerable to longline fisheries interactions, papers were presented by Australia (WG-FSA-04/81), New Zealand (WG-FSA-04/53) and the USA (WG-FSA-04/22). Reference to research on albatrosses by

Chile was included in WG-FSA-04/12 and 04/13, and research by Uruguay in WG-FSA-04/39 and by the UK in WG-FSA-04/71. Of countries known to be conducting relevant research, no reports were received from Argentina, France, South Africa and the UK.

7.131 Previously, the USA's research summary included details of current research into methods to monitor and mitigate seabird by-catch. This initiative was considered by the Working Group as an important contribution to its work. Consequently, as in previous years, all Members were requested to include details of mitigation research in their annual research summaries to update the Working Group on the current status of relevant mitigation research programs (SC-CAMLR-XXI, Annex 5, paragraph 6.111). As the USA again was the only Member to provide this information, the Working Group reiterated the request for inclusion of mitigation research in national research reports.

7.132 In order to compare assessments of levels of fishing effort and seabird by-catch with seabird population dynamics and foraging ranges, Members have been requested to provide any new or outstanding details of seabird population and foraging studies on an annual basis. As in previous years, only Australia and New Zealand provided this information (WG-FSA-04/53 and 04/81), so the review of the level of information available for each population that was previously forecast (SC-CAMLR-XXI, Annex 5, paragraph 6.113) remains outstanding.

7.133 Information on population dynamics and foraging studies provided to date has been summarised in SC-CAMLR-XXIII/BG/22, which updates SC-CAMLR-XXII/BG/18. All Members were again requested to provide more comprehensive and representative national research reports so that appropriate assessments can be undertaken.

7.134 Last year the Working Group recommended, in order to streamline and achieve more complete and representative reporting, that the group would review the report templates and that the Secretariat would forward a reminder to all Members to submit reports during the intersessional period (SC-CAMLR-XXII, Annex 5, paragraph 6.137). Australia was the only Member to submit substantive revisions to the report templates. Provision of seabird population status and foraging range information was restricted to Australia and New Zealand (WG-FSA-04/53 and 04/81 respectively). Consequently, comprehensive application of the revised formats remains outstanding. All Members are again requested to provide comprehensive and contemporary information so that assessments encompassing the Convention Area can be undertaken.

7.135 The most recent assessments of the global conservation status of albatrosses, giant petrels and *Procellaria* petrels were reflected in SC-CAMLR-XXII/BG/18. This summary shows the current status of the 20 seabird species that have been identified as being at risk from longline fisheries in the Convention Area. The conservation status of these species is unchanged from that summarised last year (SC-CAMLR-XXII, Annex 5, paragraph 6.144) and comprises two species that are Critically Endangered, five species that are Endangered, nine Vulnerable species and four species currently listed as Near-Threatened.

7.136 In order to monitor these threatened species and more effectively mitigate the threats they face, the Working Group has previously encouraged Members to undertake a range of activities and initiatives with respect to increasing the understanding of albatross and petrel population status and distribution (SC-CAMLR-XXII, Annex 5, paragraph 6.146).

7.137 Observations of seabird and marine mammals observed during toothfish longline fishing operations in Subareas 88.1 and 88.2 from 2000 to 2002 are summarised in WG-FSA-04/42. Few birds were seen diving on baits during fishing, although a greater number attended the haul. The presence of species in proximity to vessels was noted by SSRU, following the CCAMLR protocol of observing abundance within a 500 m^2 area behind the vessel. Albatross species observed within the Convention Area included some species not previously seen at these southern latitudes (northern giant petrel and sooty albatross). The Working Group considered the utility of these seabird abundance data, and concluded that except for specific operations, and involving highly trained observers, error in the seabird identifications and application of methodology made the data gathered using these protocols difficult to interpret. It was recommended that when a need to gather seabird abundance data is identified, a review of appropriate recording methods be undertaken. Until then, this task could be removed from observer duties, until such time as new data collection protocols are available.

7.138 Records of seabird species occurring in Uruguayan waters and the South Atlantic Ocean collected between 1994 and 2003 were reported in WG-FSA-04/39. Twenty-two species were identified in the Atlantic Ocean, in an area between 20°–55°S and 30°–60°W. These records provide useful information of the presence of seabirds including those vulnerable to fishery interactions, in waters adjacent to the Convention Area.

7.139 WG-FSA-04/46 described the distribution of seabirds on the Alaskan fishing grounds derived from post-haul seabird counts conducted in the course of longline fish stock assessment surveys. The protocol consists of counting all birds by species within a 50 m hemisphere at the stern of the vessel immediately prior to, or immediately after, the last hook is hauled, when seabirds are most aggregated and easily enumerated. This simple protocol takes no more than 10 minutes to complete and is easily learned and performed by observers with minimal seabird experience. These data yield estimates of the seabird species present or absent in specific areas at specific times and the relative distribution of the common species on the fishing grounds. These data, however, are not comparable with traditional ship transect abundance estimates, and are of limited use for measuring change in seabird populations.

7.140 The Working Group acknowledged that the current CCAMLR observer protocol for enumerating seabirds within a 500 m square at the stern of the vessel is difficult to perform by fisheries observers. These data are collected inconsistently by CCAMLR observers, and the resulting data have yet to be analysed or used. The simpler post-haul protocol may yield consistent data useful for CCAMLR management purposes.

7.141 WG-FSA-04/12 presented data on grey-headed albatross diet at Diego Ramírez Islands, Chile. The report supplied evidence that during the breeding season this albatross population has minimal interaction with fishing operations in southern Chile, feeding mostly on *M. hyadesi* which is distributed at the Antarctic Polar Front. This is further supported by the at-sea distribution and high survival of breeding grey-headed albatrosses at Diego Ramírez Islands presented in WG-FSA-02/18.

7.142 The areas used by grey-headed and Campbell albatrosses during foraging flights in the chick-rearing period from Campbell Island are described in WG-FSA-04/59. A small number of individuals of both species were satellite-tracked during trips to the Polar Front, where both species fed on *M. hyadesi*. Campbell albatrosses travelled into Subareas 88.1 and 88.2, whereas grey-headed albatrosses foraged in Subarea 88.1 and passed just north of Subarea 88.2. The findings confirm that these albatrosses, breeding at Campbell Island, should be considered in the risk assessments for CCAMLR areas in the Ross Sea.

7.143 The foraging areas of black-browed and grey-headed albatrosses breeding on Macquarie Island are reported in WG-FSA-04/49 with respect to overlap with local MPAs. This recognises that MPAs are often established to protect threatened top-order predators, but there are few data that can be used to evaluate their effectiveness in achieving this purpose. The spatial extent of the MPAs around Macquarie Island appears to adequately cover much of the foraging distribution of Macquarie Island black-browed albatrosses during the breeding season; however most of this was in the EEZ not covered by the Macquarie Island Marine Park. Grey-headed albatrosses spent significantly more time in waters outside these areas and are at higher risk from fisheries activities and other threats. Both species foraged in waters inside the Convention Area, black-browed and grey-headed albatrosses spending 5 and 12% of their respective foraging time in Subarea 88.1. Further information on albatross movements is required to assess the efficacy of MPAs in protecting foraging habitats outside the breeding season.

7.144 Prof. J. Croxall (UK) reported that the BirdLife International Seabird Conservation Programme has established a GIS database for archiving and analysing satellite and geolocation tracking data for albatrosses and petrels. The first global procellariform tracking workshop was held in South Africa in September 2003 and a meeting to finalise the workshop report was held in Uruguay in August 2004. The final report will be published in November 2004. Of considerable interest to CCAMLR will be the consolidated information on the pelagic distribution of albatross and petrel populations and the extent to which these data can be used to quantify the marine areas used by these birds and the location of fishing effort. This information will also assist in the identification of RFMOs with prime responsibility for the management of fisheries with significant risk of incidental by-catch of albatrosses and petrels.

7.145 It was recommended that the Working Group request BirdLife International to analyse the data for all southern hemisphere species to determine the proportion of time that each relevant species (and source population where appropriate and feasible) spends in each part (area, subarea, division, subdivision as appropriate) of the Convention Area. Such information should contribute substantially to clarifying distribution in relation to the risk assessments for the Convention Area in respect of longline fisheries (e.g. SC-CAMLR-XXIII/BG/21).

7.146 The population dynamics of Campbell and grey-headed albatrosses breeding at Campbell Island were described for 1984 to 1996 (WG-FSA-04/58). During this period, the Campbell albatross population trends increased at rates of 1–2% at different colonies. In a preceding era, declines in this population were noted by comparing counts of photographs from the 1940s–1990s, and ground counts from 1984–1996. These declines coincided with mortality of this species in the longline fishing activities for tuna in the New Zealand zone, where the species was caught. The Working Group noted that the survival rates reported for adult Campbell albatrosses (94.5%) are considerably higher (by 3%) than survival rates reported for the closely related black-browed albatross.

7.147 Grey-headed albatrosses at Campbell Island were found to be in decline during the period from 1984 to 1996, at rates of 3.0–4.8% per annum in different colonies. Comparison of historical photo-count data for this species showed that decreases in breeding numbers to around 11–25% of initial counts during the period from the 1940s to the 1990s had occurred.

7.148 Trends in breeding numbers and survival of black-browed and grey-headed albatrosses breeding on Macquarie Island are described in WG-FSA-04/48. Population dynamics and trends of both populations appear to have remained relatively stable since the 1970s. There is no conclusive evidence of survival varying over time and it is unlikely that these populations have been impacted significantly by extra mortality due to fisheries activities. This is in contrast to most other populations of these species and may be attributed to their foraging ranges not overlapping significantly with areas of high fisheries activities. However, both species forage in areas of both legal and illegal fishery operations. Due to their extremely small population size (45 pairs and 95 pairs breeding each year for black-browed and grey-headed albatrosses respectively (WG-FSA-04/81)), these populations remain extremely vulnerable to any increase in mortality rate.

7.149 The wandering albatross is a globally threatened species and the Macquarie Island breeding population is particularly vulnerable as it comprises fewer than 20 breeding pairs (WG-FSA-04/50). Demographic trends and population numbers show that the population status has varied significantly during the 1900s. Breeding numbers declined from a peak in 1964 to near extinction levels in the mid-1980s. Underlying this decline was a significant decrease in juvenile survival and, to a lesser extent, adult survival. These survival changes were coincident with changes in fishing effort in the eastern Indian Ocean. Breeding numbers slowly increased on Macquarie Island through the 1980s, reaching a total of 19 pairs in the mid-1990s, and the population remains at this level today. Trends in population numbers and survival are most similar to those observed in Indian Ocean populations. The very small population size of wandering albatrosses on Macquarie Island makes the population extremely vulnerable to any activities that elevate mortality rates.

7.150 Black-browed albatrosses breeding at Gonzalo Island in southern Chile have been surveyed on six occasions since 1980 (WG-FSA-04/13). The census results suggest a decrease in the population between 1980 and 1997, followed by an increase in numbers from 1997 to 2002. The most recent population estimate in 2002 would indicate an increase in numbers from 2001 estimates that exceeds the maximum natural rate of increase. The Working Group considered the data and suggested that while they illustrate broad population trends (and a clear increase in numbers between 1999 and 2001), differences in survey methodology between some of the years confound other annual estimates of rates of population change.

7.151 South Georgia is an important breeding location for four albatross species. Surveys of all known breeding sites of three of these species (wandering, black-browed and grey-headed albatrosses) were carried out at South Georgia in the 2003/04 breeding season (WG-FSA-04/71). In total an estimated 1 553 pairs of wandering albatrosses, 75 500 pairs of black-browed albatrosses and 47 800 pairs of grey-headed albatrosses were breeding at South Georgia in the 2003/04 season. A combination of ground counts and boat-based digital photography provided comprehensive population estimates for remote and inaccessible locations that were both time and cost effective. The Working Group welcomed the application of the new survey methodologies and endorsed their use at other sites.

7.152 Comparison of population trends reported for Bird Island and for other South Georgia colonies show that the trends at Bird Island colonies are representative for the South Georgia region. Populations of all three species have declined since the 1980s. Black-browed albatrosses have decreased by 4% per annum from 1989 to 2003, and grey-headed albatrosses have decreased by 2.9% per annum from 1990 to 2003. The decline in wandering albatrosses is even more pronounced, 30% (1.8% per annum) since the previous comprehensive survey in 1984. The magnitude of these population decreases is alarming, given the long time span and the consistent downward pattern. Of particular concern is the acceleration since 1997 in the rate of decrease of wandering albatrosses at Bird Island which now averages 4.5% per annum. If these sustained population declines are not halted or reversed, the long-term survival of the populations of these albatross species at South Georgia is in jeopardy.

7.153 Prof. Croxall informed the Working Group that Prof. H. Caswell and Dr C. Hunter (USA) have been holding discussions and a workshop to consider the development of new population models for albatrosses. The first steps towards developing a basic life-cycle model to use as a framework for parameter estimation and demographic analyses for albatrosses and petrels took place at a meeting of a group of procellariiform biologists and statisticians from France, New Zealand, UK and the USA, held at Woods Hole Oceanographic Institute (USA) in September 2004. A further meeting is scheduled for 2005 to further develop and apply the demographic analyses.

7.154 The Working Group noted that the Third International Albatross and Petrel Conference was held in Montevideo, Uruguay, in August 2004. Oral and poster sessions conducted during the meeting included molecular ecology and systematics, general biology and behaviour, population dynamics, population dynamics and status, feeding ecology and foraging areas, and incidental mortality and mitigation. A volume of abstracts of the oral and poster presentations was made available for consultation by the Working Group. Members of the Working Group welcomed the staging of the conference, and encouraged publication of the presentations and asked the organisers and/or sponsors to facilitate access to an electronic version of the abstracts volume.

International and national initiatives relating to incidental mortality of seabirds in relation to longline fishing

Agreement on the Conservation of Albatrosses and Petrels (ACAP)

7.155 This Agreement came into force on 1 February 2004 (WG-FSA-04/51) and the first meeting of the six Parties (Australia, New Zealand, Ecuador, Spain, South Africa and the UK) that have currently ratified the Agreement will take place in Hobart, Australia, from 10 to 12 November 2004. A scientific meeting will precede the Meeting of Parties on 8 and 9 November for the purpose of providing early advice on recent scientific developments of relevance to the conservation of albatrosses and petrels, and to advise on priority activities to implement the ACAP Action Plan.

7.156 The Working Group noted that CCAMLR had been invited to attend the meeting as an official observer and that the Secretariat, assisted by the Convener of WG-IMAF, had tabled a paper reviewing CCAMLR's work of potential relevance to ACAP (CCAMLR-XXIII/BG/23). The Working Group looked forward to the development of close links between ACAP and CCAMLR, particularly in respect of the many elements of mutual interest to the two bodies.

7.157 The Working Group again encouraged Members of CCAMLR to ratify ACAP and to support the active participation of scientists and fishers concerned with, and working on, the conservation of albatrosses and petrels. The Working Group also encouraged Parties to ACAP to establish its advisory committee and commence implementation of its Action Plan as soon as possible.

7.158 The Working Group recognised that some of the data and information currently compiled and maintained by CCAMLR (e.g. on the status, population trends and distribution of albatrosses and petrels) would be of considerable interest and relevance to the work of ACAP. Indeed, some such data might better be maintained on a global or southern hemisphere basis by ACAP, providing that Members of CCAMLR could enjoy unrestricted access and use. Those attending the first Meeting of Parties of ACAP with experience of CCAMLR were encouraged to bring these issues to the early attention of ACAP.

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

7.159 FAO submitted a status report on the implementation of IPOA-Seabirds (WG-FSA-04/15), reporting the information summarised last year in SC-CAMLR-XXII, Annex 5, paragraph 6.173. New and updated information is available on the FAO's webpage at www.fao.org/figis/servlet/static?dom=org&xml=ipoa_seabirds.xml. FAO intends to prepare a technical paper, based on its Fisheries Circular No. 937, that will mainly focus on a review of the various studies carried out to test the performance and efficacy of mitigation measures.

7.160 Last year the Commission noted summaries of progress with certain FAO NPOA-Seabirds (SC-CAMLR-XXII, Annex 5, paragraph 6.174; SC-CAMLR-XXII, paragraphs 5.31 and 5.32) and concurred that progress with implementation was still very slow (CCAMLR-XXII, paragraph 5.15).

7.161 The Working Group noted the following new information regarding the status of development of NPOA-Seabirds:

(i) Mr J. Arata reported on the status of Chile's NPOA-Seabirds (WG-FSA-04/14). The NPOA is in development by a collaborative working group including representatives from the fishing industries, scientists and government agencies. A set of suitable mitigation measures has been identified and evaluations are being conducted on the efficacy of streamer lines and line weighting regimes. The draft NPOA will be available at www.fip.cl.

(ii) Mrs Neves reported that Brazil's NPOA-Seabirds has been completed. The preliminary version was prepared by Instituto Albatroz, a non-governmental organisation dedicated to the albatross conservation issue, and BirdLife International – Programa do Brasil, and supported by FAO. This version was submitted to 34 scientists, governmental and non-governmental representatives, and vessel owners, for discussion during a national workshop in April 2004.

Brazil's NPOA-Seabirds identifies several procellariform species known to be incidentally taken in Brazilian longline fisheries, including three that breed in the Convention Area (wandering albatross, white-chinned petrel and southern fulmar). Several mitigation measures are identified for use by Brazilian longline vessels (streamer lines, blue-dyed bait and night setting). The NPOA-Seabirds establishes a goal of reducing the by-catch of the migratory species to 0.001 birds/thousand hooks.

The final version of Brazil's NPOA will be available at www.projetoalbatroz.com.br/planacao and final approval and signature by IBAMA (Brazilian Institute of the Environment) and by SEAP (Special Secretariat of Aquaculture and Fisheries of the Presidency of the Republic) is planned for November 2004.

(iii) New Zealand's NPOA was finalised in April 2004 and is available at www.doc.govt.nz.

(iv) The Falkland/Malvinas Plans of Action for both longlines and for squid and finfish trawl fisheries were finalised and implemented in 2004.

(v) Although not a member of FAO, Taiwan has indicated that it is preparing an NPOA-Seabirds.

7.162 In December 2003, the South American Workshop on Implementation of NPOA-Seabirds and Conservation of Albatrosses and Petrels was held in Futrono, Chile, and jointly sponsored by FAO and BirdLife International (SC-CAMLR-XXIII/BG/7). Participants from CCAMLR nations included: Argentina, Brazil, Chile, New Zealand, Norway, Peru, Spain, UK, USA and Uruguay. South American participants reported on progress of seabird by-catch assessments of longline fisheries, mitigation measures in use or being evaluated, and development of NPOAs. Several of the reports reflected the by-catch of albatross and petrel species from the Convention Area. Workshop recommendations addressed fishery assessments, mitigation research and a continued collaboration between FAO and BirdLife International, including holding a third workshop in 2005.

7.163 The Working Group commended this South American regional group for its collaborative efforts, which represent a successful initiative to address the issue in an effective and meaningful manner.

7.164 The Working Group was encouraged that some progress has occurred on NPOA development and continued to highlight the need for nations and fishing entities to develop and implement effective NPOAs for fisheries that interact with seabirds from the Convention Area.

RFMOs, tuna commissions and international governmental organisations

7.165 For several years the Commission has tried to collaborate with those RFMOs with responsibilities for areas adjacent to the Convention Area where seabirds from the Convention Area, are, or may be, killed, in order to promote the adoption by these RFMOs of appropriate mitigation measures for the fisheries actually or potentially involved (CCAMLR-XXII, paragraph 5.17). The Working Group recollected its earlier advice, endorsed by the Commission, that the greatest threats confronting the conservation at sea of albatrosses and petrels breeding in the Convention Area are the levels of mortality likely to be associated with IUU longline fishing inside the Convention Area, and with longline fishing for species other than *Dissostichus* in areas adjacent to the Convention Area (CCAMLR-XX, paragraph 6.33).

7.166 Intersessionally, the CCAMLR Secretariat requested Members (particularly those nominated as CCAMLR observers) to provide feedback on discussions concerning seabird by-catch and potential cooperation and data exchange (COMM CIRC 04/54). Information was received on CCSBT, IATTC and ICCAT.

7.167 The CCAMLR Observer reported on the fifth meeting of the CCSBT ERSWG held in Wellington, New Zealand, in February 2004 (WG-FSA-04/33 Rev. 1). The meeting was attended by member countries of CCSBT (Australia, Japan, Republic of Korea, New Zealand and Fishing Entity of Taiwan) and Indonesia attended as an observer. The meeting involved sharing of information on national projects relating to mitigation research, data collection and education. The report of the meeting is pending approval from the Commission, which will be meeting from 19 to 22 October 2004. The CCAMLR Observer noted that there would be items of relevance to CCAMLR in the papers tabled, in particular data on incidental capture of seabirds that breed in the CCAMLR Convention Area. The Working Group requested the CCAMLR Secretariat obtain and circulate copies of the report and papers tabled at the meeting from the CCSBT Secretariat.

7.168 The CCAMLR Observer to ICCAT (European Community) briefly referenced the ICCAT Resolution on Incidental Mortality of Seabirds (02-14) in its submitted report (CCAMLR-XXIII/BG/25), but no substantive discussion on this topic occurred at ICCAT's annual meeting in Dublin, Ireland, in November 2003.

7.169 Ms K. Rivera reported that the USA will sponsor a booth on by-catch at the 2004 annual meeting of ICCAT in New Orleans, USA, in November. Information about the incidental mortality of seabirds and sea turtles in longline fisheries will be provided as well as effective and practicable mitigation methods that have been identified for each.

7.170 The IATTC Secretariat conveyed that although no discussion of seabirds occurred at its 2004 annual meeting, seabird by-catch was discussed at the meeting of the IATTC's Bycatch Working Group in Kobe, Japan, in January 2004. The minutes of the Bycatch Working Group indicated that the USA explained its efforts with regard to mitigating the effects on seabirds of fisheries around Hawaii, and proposed that the pertinent provisions of the IATTC by-catch resolution should also apply to seabirds. Japan, Spain and the Fishing Entity of Taiwan reported on their efforts to reduce seabird mortality associated with longline fisheries in the Pacific.

7.171 As a result of an examination two years ago of fisheries data provided by IOTC, the Working Group noted that the pelagic longline effort by Japan and Taiwan in the Indian Ocean south of 40°S overlaps with the foraging distribution of several albatross species that breed in the Convention Area (SC-CAMLR-XXI, Annex 5, paragraph 6.146).

7.172 Thus, the CCAMLR Secretariat sent a request in November 2002, via the IOTC Secretariat, to delegations at the annual IOTC meeting which represented countries that are also CCAMLR Members. The request was to ensure that the issue of seabird by-catch be included for consideration by IOTC. The request was repeated in June 2004 (COMM CIRC 04/54). No response to this has been received to date.

7.173 The Working Group continued to be discouraged by the lack of progress on the seabird by-catch issue at pertinent RFMOs.

Other international organisations and initiatives, including non-governmental organisations

7.174 A status report of Southern Seabird Solutions' activities was received (WG-FSA-04/35) detailing some of its activities, such as: its establishment as a charitable trust, fostering exchange of crew and technologies between fleets in different countries (e.g. New Zealand and France); hosting national and regional fishers' forums to enable fishers from different fleets to exchange ideas and information; developing and testing new mitigation technologies; establishing similar groups to Southern Seabird Solutions in other countries; and producing various outreach materials to build awareness of the issue and solutions (e.g. 'Fishing the Seabird Smart Way' video).

7.175 The Working Group again commended the work of Southern Seabird Solutions as it recognised the value of this group to aiding in reductions of seabird by-catch of birds breeding in the Convention Area. The Working Group encouraged active participation in Southern Seabird Solutions by CCAMLR Members.

7.176 Prof. Croxall reported that the BirdLife International Global Seabird Programme has several ongoing activities of note that relate to albatrosses and petrels that breed in the Convention Area:

(i) a review of the environmental performance of RFMOs, including CCAMLR, in respect of by-catch mitigation, especially albatrosses;

(ii) a report analysing global data on the distribution of albatrosses and petrels as revealed by remote-recording and a review of implications of marine conservation;

(iii) publication of the report from the technical workshop co-hosted with FAO in Chile in December 2003 (SC-CAMLR-XXIII/BG/7) and further development of NPOA initiatives;

(iv) publication of results of a technical workshop for Asian nations, particularly distant-water fleets, in Taiwan in January 2004;

(v) a variety of projects collecting observer data on seabird by-catch and trialling mitigation techniques, particularly in southern America and Africa.

7.177 The Working Group commended BirdLife International for these numerous activities and was encouraged by continued work to address the critical areas of South American fisheries and the distant-water fleets of Asian nations, both of which relate to the foraging distributions of albatrosses and petrels breeding in the Convention Area.

7.178 The Third International Conference on Albatrosses and Petrels was held in Montevideo, Uruguay, in August 2004 (paragraph 7.154). Many of the conference participants were from CCAMLR nations.

7.179 The Working Group noted the forthcoming workshop at the Fourth International Fisheries Observer Conference in Sydney, Australia, on 8 November 2004 – 'Development of Best Practices for the Collection of Longline Data to Facilitate Research and Analysis to Reduce By-catch'. The workshop will focus on identifying important elements for programs that collect data on protected species' interactions, including seabirds. Such data collection is critical in efforts to accurately monitor levels of by-catch in fisheries and in the development of effective programs to reduce such interactions. The Working Group encouraged the participation by CCAMLR nations at this workshop and conference and feedback to CCAMLR of relevant information.

Incidental mortality of seabirds in relation to new and exploratory fisheries

Assessment of risk in CCAMLR subareas and divisions

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

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

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

7.182 Comprehensive assessments on the potential risk of interaction between seabirds and longline fisheries for all statistical areas in the Convention Area are carried out each year and have been combined into a background document for use by the Scientific Committee and Commission (last year this was SC-CAMLR-XXII/BG/17).

7.183 This year new data derived from a satellite tracking study was provided on the at-sea distribution of grey-headed and Campbell albatrosses that breed on Campbell Island (WG-FSA-04/59). In addition, all references to the Amsterdam albatross were deleted from the assessments as there is no empirical evidence to support the occurrence of this species within the Convention Area. This information was used to update the assessment of potential risk of interaction between seabirds and longline fisheries for Subareas 88.1 and 88.2. The revised assessments incorporating new information made available at the meeting (with changes/additions underlined) have been issued as SC-CAMLR-XXIII/BG/21.

New and exploratory longline fisheries operational in 2003/04

7.184 Of the 29 proposals last year for new and exploratory longline fisheries in 16 subareas and divisions, only 15 were actually undertaken: by Australia in Division 58.4.2; by Australia in Division 58.4.3b; by Japan in Subarea 48.6; by Argentina, Republic of Korea, New Zealand, Norway, Russia, South Africa, Spain, Ukraine, UK, USA and Uruguay in Subarea 88.1; and by New Zealand in Subarea 88.2.

7.185 No seabird by-catch was reported to have been observed in fisheries in Divisions 58.4.2 and 58.4.3b and Subareas 48.6 and 88.2 and only one incident of an individual seabird by-catch was reported observed in Subarea 88.1. Clearly the strict adherence in Subareas 48.6 and 88.2 and Divisions 58.4.2 and 58.4.3b to the specific requirements set out in Conservation Measure 24-02 with respect to line-weighting regimes, combined with fishing in an area of average-to-low and average risk, has proven successful in achieving zero incidental by-catch of seabirds. The less than 100% compliance reported from Subarea 88.1 this year does not appear to be linked to the observed mortality, as the vessel involved was reported as fully compliant with Conservation Measures 24-02 and 25-02.

New and exploratory longline fisheries proposed for 2004/05

7.186 The Working Group reviewed the risk assessment framework used historically for providing advice on new and exploratory fishery proposals (SC-CAMLR-XXII/BG/17). Several inconsistencies in the approach were noted; in particular subareas with identical risk levels have had different seabird by-catch mitigation requirements applied in the conservation measures.

7.187 As part of the review of the risk assessment framework, the Working Group considered its historical advice on observer coverage levels and suggested observer coverage levels appropriate for monitoring by-catch and mitigation in relation to risk assessment level.

7.188 The Working Group emphasised that reported values for observer coverage of incidental seabird mortality during hauling and setting must reflect the number of hooks directly observed by scientific observers (not the number of hooks hauled whilst the observer is working).

7.189 Recently, where one observer is used, coverage of 60–80% of the set and 20–30% of the haul is generally achieved; where two observers are used, coverage of 85–100% of the set and 35–45% of the haul is generally achieved. In general, in areas where risk of incidental mortality is assessed as average to high (risk levels 3–5), the Working Group agreed that higher levels of observer coverage of both the haul and set would usually be appropriate. The recommended levels of observer coverage, related to assessed risk level, are incorporated into Table 7.16.

7.190 The Working Group confirmed the general approach, updated the framework to standardise the application of mitigation measures across subareas that are assessed as having the same risk level, and incorporated an assessment of recommended levels of observer coverage. The updated framework is set out in Table 7.17. The standardisation is also incorporated into SC-CAMLR-XXIII/BG/21 (the update of SC-CAMLR-XXII/BG/17).

7.191 In respect of the actual levels of risk adopted in SC-CAMLR-XXII/BG/17, no changes were suggested in SC-CAMLR-XXIII/BG/21. Some minor changes to distributional information have been corrected (see paragraph 7.183). It was noted that the risk levels published last year for Divisions 58.4.1 and 58.4.2 (SC-CAMLR-XXII, Annex 5, Table 6.9) were incorrect and should have been levels 2 and 3 respectively.

7.192 Thirty-five applications for new and exploratory longline fisheries, submitted by 13 countries, were received by CCAMLR in 2004. The areas for which these proposals were received were:

Subarea 48.6	Japan, Republic of Korea, New Zealand
Division 58.4.1	Chile, Republic of Korea, New Zealand, Spain, Ukraine
Division 58.4.2	Chile, Republic of Korea, New Zealand, Spain, Ukraine
Division 58.4.3a	Australia, Republic of Korea, Spain
Division 58.4.3b	Australia, Chile, Japan, Republic of Korea, Spain
Subarea 88.1	Argentina, Australia, New Zealand, Norway, Russia, South Africa, Spain, Ukraine, UK, Uruguay
Subarea 88.2	Argentina, New Zealand, Norway, Russia.

7.193 All the areas listed above were assessed in relation to the risk of seabird incidental mortality according to the approach and criteria set out in SC-CAMLR-XXIII/BG/21. A summary of risk level, risk assessment, the Working Group's recommendations relating to mitigation measures, including fishing season and any inconsistencies between these and the proposals for new and exploratory longline fisheries in 2004, is set out in Table 7.16.

7.194 The only obvious inconsistency needing resolution is:

- The UK proposals for Subareas 88.1 and 88.2 note the intention to comply with the provisions of Conservation Measure 24-02 to permit day setting of longlines, and deploy streamer lines in accordance with the appendix to Conservation Measure 25-02. However, the status of compliance with Conservation Measure 25-02 is unclear, as is the intent to seek derogation to the night-setting requirements of this conservation measure by implementing the provisions of Conservation Measure 24-02, as approved last year in Conservation Measure 41-09.

7.195 The UK confirmed that it was its intention to comply with all necessary CCAMLR conservation measures, including Conservation Measure 25-02 in full, together with any such modifications as were adopted by the Commission.

7.196 Dr M. Naganobu indicated that Japan wished to maintain its proposal to fish in Subarea 48.6 from December to August inclusive (despite the fishing season last year having been restricted to 1 March to 31 August north of 60°S (Conservation Measure 41-04)) and noted that this extension to the fishing season would not conflict with the advice provided by ad hoc WG-IMAF.

7.197 In previous years, fishing proposals in high-latitude exploratory fisheries in subareas with average or less risk (risk levels 1–3) have obtained an exemption from the requirement of Conservation Measure 25-02 to set longlines at night (SC-CAMLR-XXII, Annex 5, paragraph 6.208). Such exemptions were given providing that vessels complied fully with measures specified in Conservation Measure 24-02, designed to ensure that a line sink rate of at least 0.3 m/s was achieved during daytime fishing operations. Any vessel catching a total of three (3) seabirds was to immediately revert to night setting in accordance with Conservation Measure 25-02.

7.198 Also in recent years, fishing proposals in high-latitude exploratory fisheries in divisions with average risk (risk level 3) have obtained an exemption from the requirement to fish during a specified season where this is recommended (e.g. Conservation Measure 41-06). Such exemptions were given providing that vessels complied fully with measures specified in Conservation Measure 24-02, designed to ensure that a line sink rate of at least 0.3 m/s was achieved during daytime fishing operations. Additionally, should a total of three (3) seabirds be caught by a vessel operating under the exemption, the vessel would cease fishing immediately and not be permitted to fish during the protected season for the remainder of the fishing year.

7.199 In reviewing the risk assessment framework, the Working Group suggested that in future, such exemptions should be considered within the risk assessment framework and should apply automatically on the basis of assessed risk level, rather than on a case-by-case basis as in the past. Advice on risk levels to which these exemptions should apply is noted in Table 7.16.

7.200 Setting of longlines within the Convention Area during daylight hours using currently approved fishing gear still represents a risk for seabirds, even in areas of low to average risk. In all instances where the provisions of Conservation Measure 24-02 are applied, there remains the need for continued review of performance with respect to incidental mortality of seabirds during fishing operations. The Working Group recommended that any vessel operating under the provisions of this conservation measure, and which catches a total of three (3) seabirds, as defined in SC-CAMLR-XXII, Annex 5, paragraphs 6.214 to 6.217, shall revert to night setting in accordance with Conservation Measure 25-02. Similar provisions were specified for the 2003/04 season in Conservation Measures 41-04, 41-05, 41-09, 41-10 and 41-11.

7.201 With respect to the prescription of a seabird by-catch level, the Working Group noted the successful implementation of the definition of the status of birds ‘caught’ (SC-CAMLR-XXII, Annex 5, paragraphs 6.214 to 6.217). The Working Group recommended the continued use of the definition and requested feedback from scientific observers on the ability to apply this definition whilst at sea.

7.202 The Working Group recommended that reference to this definition be appended to each conservation measure which specifies maximum permitted levels of seabird by-catch. Failure to do so last year clearly created some confusion (e.g. COMM CIRC 04/18), which may have resulted in incorrect categorisation and reporting of the status of birds caught and released alive.

Other incidental mortality

Interactions involving marine mammals with longline fishing operations

7.203 One southern elephant seal (*Mirounga leonina*) mortality was observed on the *Janas* (Australia), fishing in Division 58.5.2. One incidental mortality of a whale was observed, possibly a minke whale (*Balaenoptera acutorostrata*) although its identification has yet to be confirmed. The whale was entangled in the mainline of the *Piscis* in Subarea 88.1 (WG-FSA-04/6 Rev. 1).

7.204 Interactions between seabirds and marine mammals and observed fishing operations for toothfish were reported for Subareas 88.1 and 88.2 for the years 2000 to 2002 (WG-FSA-04/42). Marine mammal captures were limited to two cetaceans (humpback whale and another small cetacean) that were tangled in lines. Both were released alive. These data had previously been reported to the Working Group.

Interactions involving marine mammals and seabirds with trawl fishing operations

Data for 2003/04

7.205 Marine mammals captured in icefish trawl fisheries for 2003/04 were summarised in WG-FSA-04/7 Rev. 1. In Subarea 48.3, no marine mammal captures were observed. In Division 58.5.2, three Antarctic fur seals were reported dead, recovered from the codend.

7.206 Eight trawl vessels targeting icefish were observed in the CCAMLR Convention Area in 2003/04 (WG-FSA-04/7 Rev. 1). 100% of vessels were observed. In Subarea 48.3, 87 seabirds were killed and 136 were released alive. The birds involved were mainly white-chinned petrels (68%) and black-browed albatrosses (24%). In Division 58.5.2, seven seabirds were caught and all were released alive (Table 7.18).

7.207 In Subarea 48.3, the Working Group noted that for four of the six vessels, mortalities of seabirds were 16–18 birds, close to the per-vessel limit of 20 birds. This was due to the active management of the fishery, whereby vessels received daily reports as they approached this limit.

7.208 In reviewing performance of vessels between years, the Working Group noted that the *Argos Vigo* consistently had a higher seabird by-catch rate than others (Table 7.18). Other vessels that had notably high by-catch rates in at least one year include *Sil, InSung Ho, Dongsan Ho, Robin M Lee* and *Betanzos*.

7.209 The Working Group noted that seabird mortality totals and rates of capture had substantially increased since the previous year. In the 2004 season, 87 birds were killed, more than double the 42 seabirds killed in 2003. Previously 68 birds were observed killed in 2002 and 92 in 2001. When scaled to fishing operation and catch limit in Subarea 48.3, it appeared that seabird mortality rates had increased. In 2004, 30 birds were killed per 1 000 tonnes (catch limit 2 887 tonnes), compared to 18 birds per 1 000 tonnes (catch limit 2 181 tonnes) in 2003, 12 birds per 1 000 tonnes (catch limit 5 557 tonnes) in 2002, and 14 birds per 1 000 tonnes in 2001 (catch limit 6 760 tonnes).

7.210 When expressed as the number of birds killed per trawl observed, a similar pattern emerges. In 2004, the mean number of birds killed per trawl was 0.37 birds (238 trawls), compared to 0.20 birds in 2003 (182 tows), 0.16 birds in 2002 (431 trawls) and 0.29 birds in 2001 (315 trawls).

7.211 The Working Group noted with concern that birds caught were likely to be breeding individuals, due to the timing of the fishery. This would therefore have a greater effect on populations of the species concerned, due to the disruption of breeding pairs, and likely death of chicks, as well as the removal of breeding-age individuals from the population.

7.212 The Working Group also noted that the 87 birds observed killed in trawling operations in Subarea 48.3 in 2004 is a substantially higher number than the 18 birds estimated killed in longline fishing operations in the same subarea in 2004.

7.213 The Working Group noted that the species concerned are all listed as globally threatened. The species reported killed include black-browed albatrosses (Endangered) and grey-headed albatrosses and white-chinned and southern giant petrels (Vulnerable). More black-browed albatrosses were killed in 2004 than in the previous three years, and a greater number of white-chinned petrels were killed in 2004 than in all years. The black-browed albatross population at South Georgia is currently decreasing at a rate of 4% per annum (WG-FSA-04/71).

7.214 Given these factors, the Working Group recommended a reduction in by-catch limits, at both the vessel level and for the wider icefish trawl fishery in Subarea 48.3. The following options were proposed:

(i) To reduce the per-vessel limit of seabirds from 20 birds killed per vessel to 10 birds killed per vessel.

or

(ii) To set vessel limits based on the threatened status of the seabird species. The Working Group recommended setting a limit for globally Endangered species (including black-browed albatrosses) at three (3) birds, and a second limit of five (5) birds for species listed as Vulnerable (including grey-headed albatrosses and white-chinned petrels). A limit for non-listed species would be set at 12, resulting in maintenance of the 20 bird limit per vessel.

and

(iii) To introduce an annual seabird mortality limit that would apply to all vessels in the icefish fishery in Subarea 48.3. It was noted that similar limits had been effectively employed to limit by-catch of skates, where the subarea limit was lower than the sum of the total of the individual vessel limits for vessels fishing in an area. The Working Group recommended a limit of 15 birds for Endangered species, and 25 birds for Vulnerable species. A total limit for each subarea would be 100 birds.

7.215 Means of employing area-specific total by-catch limits within a fishery were discussed, with recognition of the desirability of allowing increased fishing access to vessels that were shown to perform better than others in limiting seabird mortalities.

7.216 In further discussion Dr Agnew observed that while supportive of the aims of paragraph 7.214, the considerable current difficulties of devising effective mitigation of seabird by-catch in this fishery in Subarea 48.3 meant that options (i) and (ii) above could have the effect of prematurely and unnecessarily closing the fishery to many vessels, including those with good past records. He indicated, however, that option (iii), coupled with sensitive management of its application, might be an appropriate response to consider at this stage. He believed that all three options should be considered as alternatives rather than suggesting that option (iii) should be regarded as additional or complementary to options (i) and (ii).

7.217 Drs Constable and R. Holt (USA), while recognising the potential difficulties posed for the management of this fishery by some of the options set out in paragraph 7.214, nevertheless felt that all of these options should be retained for further discussion at the Scientific Committee.

Mitigation measures and experiences

7.218 All vessels in the icefish fishery in Subarea 48.3 used a variety of mitigation measures in attempts to reduce the number of bird mortalities. These included:

(i) Streamer lines – a variety of different streamer lines (paired and single) were trialled, with one vessel also trialling the Brady bird baffler. Observers reported that these devices were of little use in reducing seabird activity around the codend, with some reporting birds being tangled in the streamers or being attracted to them. The main problem reported by observers was the fact that the effective coverage was not far enough to get to the codend, which can be up to 50 m away from the stern of the vessel. There were also problems with the streamers being tangled in the trawl warps.

(ii) Acoustic devices – bells and strings of cans were used to scare birds away from the vessel during shooting and hauling, but were found to be ineffective.

(iii) Water jets – high-pressure water jets were used on several occasions, but were only effective up to 5 m from the stern of the vessel. This distance is not far enough to prevent birds from landing on the codend. It was also noted that increasing the pressure of the water jet could also harm birds or force them onto the net.

(iv) Net weights – several observers reported the use of weights, ranging from a few kilograms on the codend up to 500 kg on each wing of the net, to reduce the amount of time the net was at the surface during shooting and hauling, and thereby reducing the opportunities for birds to get caught in the mesh. It was not clear how effective these experiments had been.

(v) Net cleaning – most observers felt that cleaning the net before shooting was one of the most effective methods of reducing birds from being attracted to the net.

7.219 Specific measures trialled on the *Robin M Lee* in 2003/04 in Subarea 48.3 were reported in WG-FSA-04/80. Three birds were killed, entangled during the shooting of the net following the use of fish oil to deter birds, some of which fell onto the net before deployment. Measures to avoid birds becoming entangled during setting and hauling were examined. Tori lines with an aerial extent of 140 m were recommended, to enable coverage of the zone where large meshes are exposed at the surface during setting. The large meshes (200–800 mm) are considered to pose greatest risk to seabirds. Binding of the body of the net at 2 m intervals down the net using biodegradable string was trialled, to mitigate seabird entanglements during shooting of the net. This was used with the intention of increasing the net sink rate as it reduces open mesh available for seabirds to become entangled in. The bindings were designed to break when trawl doors opened, but in the four sets made the bindings were insufficiently strong to avoid the net opening at the surface. Recommendations on deployment of the method in the future were made.

7.220 A proposal was submitted to test these mitigation techniques in Subarea 48.3 in 2004/05, requiring relaxing of the restriction on seabird mortality to 40 birds for the vessel (Appendix to WG-FSA-04/80). The Working Group supported the proposal.

7.221 WG-FSA-04/79 reported the results of the first attempt to compare the effectiveness of mitigation measures to reduce seabird mortalities resulting from strikes with warp cables on a factory trawler. Both streamer lines and a warp scarer were significantly more effective at reducing the rate of seabird contacts with warp cables (0.29 and 0.93 heavy contacts per hour respectively) than the Brady bird baffler and a control of no deterrent (9.71 and 17.46 heavy contacts per hour respectively). Seabird mortalities resulting from strikes reflect this same hierarchy (control 0.70; Brady bird baffler 0.14 birds/haul; warp scarer 0.06 birds/haul; and streamer lines 0 birds/haul). The steamer line deterrent performed marginally better than the warp scarer. Economic aspects of the deterrent devices were also discussed with minimal costs identified for warp scarers and streamer lines.

7.222 Dr E. Melvin (USA) reported that in a limited trial in the Alaskan pelagic trawl fishery in the Bering Sea, approximately 1 000 gallons of pollock oil was discharged into the starboard discharge plume for 15 minutes to determine if seabirds avoided fish oil. The fish oil appeared to eliminate seabirds from the starboard sector of the vessels out beyond 100 m for at least 30 minutes post application. This approach should be further tested in carefully designed experiments as a mitigation alternative provided potential detrimental effects to seabirds can be ruled out. The Working Group cautioned that further ad hoc trials of fish oil should be discouraged.

7.223 The USA submitted an annotated bibliography of research on trawl operations and seabird interactions and of cooperative research programs between fishing operators and researchers to address seabird mortalities in trawl fisheries (WG-FSA-04/47). The Working Group commended the initiative, noting that a similar review of research on longline mitigation would be useful. The Working Group encouraged the development of an internet-based bibliographic summary of research on mitigation of seabird mortality.

7.224 The Working Group noted that the UK had submitted a proposal to conduct exploratory bottom trawling for icefish in Subarea 48.3 (CCAMLR-XXIII/16) in order to mitigate the effects of trawl fishing using current fishing gear (see SC-CAMLR-XXII, Annex 5, paragraphs 6.242 and 6.243).

Interactions involving marine mammals and krill fishing operations

2002/03 season

7.225 Last year, anecdotal reports indicated that some trawlers fishing for krill frequently caught Antarctic fur seals, some of which were killed (SC-CAMLR-XXII, Annex 5, paragraphs 6.226 and 6.229). Further evaluation for Subarea 48.3 required reports from scientific observers, which were unavailable at that time.

7.226 In Subarea 48.3 in 2002/03, international observers were present on 6 of 9 (66%) of krill fishing cruises.

7.227 Observers on board two vessels reported incidental mortalities of Antarctic fur seals: *Dongsan Ho* – 25 dead, 4 released alive; *Top Ocean* – 2 dead, 11 released alive. The observer on board the *Dongsan Ho* attributed the high seal mortality to a lack of experience as the vessel was new to the fishery. In an attempt to reduce the seal mortality, diamond-shaped holes were cut across the net and the winch speed was increased during shooting to allow the net to drop vertically through the water. The two dead seals from the *Top Ocean* drowned during the same haul, which occurred when the net could not be retrieved in time due to a mechanical malfunction (WG-FSA-04/7 Rev. 1).

7.228 Overall, for Area 48 in 2002/03, combining data from scientific observers and Reports of Members' Activities, 114 fur seals were caught, 53 being killed and 61 released alive.

2003/04 season

7.229 During the 2003/04 season, one krill trawl operation was observed in Area 48 on the US-flagged vessel *Top Ocean* by a Ukrainian international scientific observer. A total of 683 trawls was conducted, with 521 (76%) being observed (WG-FSA-04/7 Rev. 1).

7.230 A total of 142 fur seals was observed killed and 12 seals were released alive. The vessel used several different net configurations described in the observer's cruise report in an attempt to reduce seal by-catch.

7.231 In addition, the UK deployed scientific observers for short periods (2–4 weeks) between June and August on 6 of 9 vessels fishing for krill in Subarea 48.3 (WG-FSA-04/83). This report, chiefly focusing on entrapment mitigation issues, indicated that a minimum of 292 fur seals were entrapped (185 on *Top Ocean*, 83 on *InSung Ho*, 13 on *Nitake Maru*, 11 on *Atlantic Navigator*, none on *Esperanza* and *Konstruktor Koshkin*).

7.232 Some inconsistencies were identified in the information submitted to CCAMLR from the vessel *Top Ocean*. In particular, the number of seals reported as entrapped was inconsistent among the Captain's cruise report, the Captain's daily log, the CCAMLR observer's daily log and the observations of the UK observer.

7.233 The international observer was on board the vessel *Top Ocean* from 21 February to 21 September 2004. Trawling for krill was conducted in Subarea 48.3 from 8 to 15 June and 23 June to 2 August 2004. The UK observer was present on the vessel in Subarea 48.3 from 20 June to 20 July 2004.

7.234 The international observer reported that fur seals were always present in association with the vessel in Subarea 48.3; however no seal entrapments were reported on trawls occurring from 8 to 15 June 2004. Of the 142 observed Antarctic fur seal mortalities on the *Top Ocean*, 138 were reported between 23 June and 2 August 2004, coincident with the presence of the UK observer.

7.235 Mitigation measures were introduced on the vessel on 3 July 2004, including several modifications of the two trawl nets. The international observer's summary report indicated that only three seal mortalities were observed after successful implementation of the mitigation measures. However, the daily log of this observer indicated that 34 seals were killed between 3 July and 2 August 2004. Notes in the mitigation section of the CCAMLR observer's summary report refer to seal mortality on trawls that were not included in the daily log of the observer.

7.236 Due to the unknown extent of incidental mortality associated with the krill trawl fisheries, the Working Group recommended that the Commission require an observer on board krill trawl vessels to guide future management efforts. The Working Group noted that reliable data on seal incidental mortality can only be obtained through scientific observers. Current observer data are inconsistent and inadequate for this purpose. It is essential that observer data forms are completed in an accurate, consistent and comprehensive manner, in particular the sections addressing incidental mortality.

7.237 The Working Group noted that it would be helpful if the UK submitted the original data collected by its observers in 2004 to the CCAMLR Secretariat.

Mitigation

7.238 As recommended by the Working Group in the 2003 report of WG-FSA (SC-CAMLR-XXII, Annex 5, paragraph 6.230), some Members investigated and documented the use of mitigation devices to reduce seal entrapment in krill trawl nets. The Working Group commended these parties for their efforts and requested them to continue reporting on the efficacy of seal-exclusion devices.

7.239 In 2002/03, Japan tested two seal-exclusion methods (NISSUI and MARUHA) on two krill trawl ships, described in WG-FSA-04/17. The NISSUI system consisted of an escapement panel with large mesh size (1.6 m^2), fitted on the top of the net with an area of 6 x 4 m; a sloping panel of 300 mm mesh was fitted below the escapement panel. The MARUHA net system consisted of an escapement hatch (1.5 x 2.1 m) in the top of the net; a sloping panel made of 150–200 mm mesh was fitted below the hatch. Both systems allow fish to pass through to the codend, while guiding large organisms to the escapement panel or hatch in the top of the net. In the description of the seal-exclusion devices, a recommendation was made that the wings of the trawl net are put to one side and the mouth of the trawl net is closed when setting or hauling. There were no records of seal entanglements in the 2002/03 krill fishing season on either vessel.

7.240 Dr Naganobu indicated that the NISSUI and MARUHA systems had both proved very effective on vessels in the Japanese krill fishery; he encouraged other vessels fishing for krill to consider using these systems.

7.241 The UK submitted a report from scientific observers on krill fishing vessels around South Georgia (WG-FSA-04/83). Various methods were tested to mitigate seal mortality associated with krill trawls, including physical barriers, physical barriers with escape hatches, prefabricated seal-exclusion devices and modification of gear configuration. Several of the tested methods were effective at reducing or preventing seal mortality on individual vessels after the exclusion methods were implemented, as compared to seal entrapments recorded before the exclusion measures were implemented.

7.242 The Working Group recommended that the information on various seal-exclusion devices described in WG-FSA-04/17 and 04/83 be combined into a single document describing each of the methods tried, including information regarding their success. This paper should be distributed to CCAMLR Members and other interested organisations to encourage further testing of the effectiveness of the various methods for preventing seal mortality or injury associated with krill trawl fishing.

7.243 Given the increasing evidence of seal entrapment in krill fisheries, and the apparent efficacy of some of the seal-exclusion methods tested this year, the Working Group recommended that krill fishing vessels employ gear modifications that reduce seal entrapment, mortality and injury. At this time, a particular design cannot be recommended due to the lack of sufficient data on any specific method. The Working Group advised Members to exercise caution in design and implementation of seal-exclusion devices based on experiences with marine mammal exclusion devices used outside CCAMLR waters, as it is possible that animals escaping from the net through some exclusion devices are seriously injured. The Working Group discouraged use of seal-exclusion devices that would allow moribund animals to fall out of the bottom of the net, as this would lead to inaccurate estimates of seal incidental mortality.

Other business

7.244 Prof. Croxall and Mr Baker were retiring as Convener and Deputy Convener respectively at the end of the present meeting. They were thanked for all their work for ad hoc WG-IMAF over many years. The Working Group recommended that Ms Rivera and Mr N. Smith (New Zealand) should be appointed as Co-conveners of WG-IMAF.

Advice to the Scientific Committee

General

7.245 The plan of intersessional work (Appendix D) summarises requests to Members and others for information of relevance to the work of the Working Group (paragraphs 7.1 to 7.3). Members are particularly invited to review the membership of the Working Group, to suggest additional members and to facilitate attendance of their representatives at meetings (paragraph 7.4).

Incidental mortality of seabirds during regulated longline fishing in the Convention Area in 2004

7.246 (i) For Subarea 48.3, the total estimated seabird by-catch in 2004 was 18 birds at a rate of 0.001 birds/thousand hooks, a slight increase compared with last year but values are still the second lowest yet recorded for this area (paragraphs 7.8 and 7.9 and Tables 7.1 to 7.3).

(ii) Within the South African EEZ in Subareas 58.6 and 58.7, the total estimated seabird by-catch was 39 birds at a rate of 0.025 birds/thousand hooks, increased values over the previous two years. The total estimated seabird by-catch rate is only 20% of that in 2001 (paragraphs 7.10 and 7.11 and Tables 7.1 to 7.3).

(iii) A single seabird was observed killed in Subarea 88.1 after seven successive years of zero incidental mortality. No incidental mortality of seabirds was observed in Subarea 88.2 (for the third successive year) (paragraph 7.12), nor in Subarea 48.6, Divisions 58.4.3b, 58.5.2 (first year of longline fishing in these areas) and 58.4.2 (for the second successive year) (paragraph 7.13 and Tables 7.1 to 7.3).

(iv) These totals represent slight increases in the estimated seabird by-catch in parts of the Convention Area, compared with the data reported in the last two years (paragraph 7.9 and Table 7.3).

7.247 Historical data from longline fishing in the French EEZs in Subarea 58.6 and Division 58.5.1 was received for the 2001/02 and 2002/03 fishing seasons (paragraphs 7.16 to 7.19 and Tables 7.5 to 7.8). The reported totals of birds killed in these two years are based on retention of all birds brought on board each vessel, rather than on subsampling by observing some proportion of the total hooks set (paragraphs 7.20 and 7.21).

(i) In Subarea 58.6 (Crozet) in 2001/02, 1 243 birds were reported killed during setting of 7.4 million hooks, at a rate of 0.167 birds/thousand hooks. In 2002/03, 720 birds were reported killed during the setting of 6.6 million hooks, at a rate of 0.109 birds/thousand hooks, a decrease in annual by-catch rate of 53% (paragraphs 7.16 to 7.19).

(ii) In Division 58.5.1 (Kerguelen) in 2001/02, 10 814 birds were reported killed during setting of 11.5 million hooks, at a rate of 0.936 birds/thousand hooks. In 2002/03, 13 926 birds were reported killed during the setting of 26.9 million hooks, at a rate of 0.518 birds/thousand hooks, a decrease in annual by-catch rate of 45% (paragraphs 7.16 to 7.19).

7.248 Intersessionally, by-catch data analysis, collaborative interactions and experiments formed the basis for technical recommendations for changes to fishing practices (paragraphs 7.35 and 7.36).

(i) France commissioned an analysis of the 2001/02 and 2002/03 data (paragraph 7.22). Findings included: seabird mortality was mainly of white-chinned petrels (93%) in October and between January and April, followed by grey petrels (5%) caught between April and November; higher seabird catch rates occurred around Kerguelen, the more heavily fished area; autoline vessels caught many times more birds than vessels using the Spanish system; and a significant part of the mortality of white-chinned and grey petrels is explained by season, area and method of fishing.

(ii) Collaborative interactions and mitigation experiments (paragraph 7.35) included: testing of IWLs, technical exchange of mitigation information, evaluation of coloured hookline, and initiation of a study on the population status of white-chinned and grey petrels on Kerguelen and Crozet.

7.249 In 2004, existing fishing practices (on offal discharge, night setting, line weighting, and streamer lines) were revised to further require: use of two streamer lines that adhere to the provisions of Conservation Measure 25-02, fishery closure during February, use of white-coloured hookline and a line-weighting regime of 8 kg/120 m on autoliners (paragraphs 7.39 and 7.40).

7.250 Data from the 2003/04 fishing season were also submitted to CCAMLR (paragraphs 7.23 to 7.30) with data to February 2004 reported as for the two previous years. From March onward, data were recorded as by-catch observed on a proportion of the hooks set. Combining the totals of birds reported killed during the first half of the fishing season with the number of birds estimated killed in the second half of the season indicates that 342 birds and 3 666 birds were killed in Subarea 58.6 and Division 58.5.1 respectively (paragraph 7.28 and Tables 7.9 and 7.10). Compared to last year this represents reductions in birds killed of 42.5% (66.4% if reported data only are used) in Subarea 58.6 and 73.7% (85.1% if reported data only are used) for Division 58.5.1 (paragraph 7.29 and Table 7.11).

7.251 Whereas the changes in fishing regulations and practices and subsequent reductions in number of birds killed and by-catch rates are substantial, continued improvements are possible and necessary as these rates and totals still remain at levels which are a cause of serious concern and threat to the populations involved (paragraphs 7.36 and 7.42 to 7.44). It is recommended that:

(i) IWL and weighting regimes that will ensure that longlines sink at >0.25 m/s be used (paragraph 7.45(ii));

(ii) standards for streamer lines as outlined in Conservation Measure 25-02 be complied with (paragraph 7.45(iii));

(iii) observer coverage and duties should be sufficient to ensure that at least 25% of hooks are observed on every vessel (paragraph 7.45(v));

(iv) fishery closures in high-risk periods during seabird breeding seasons be maintained (paragraph 7.45(vi));

(v) France supply 2000/01 data so that a comprehensive conspectus of the history of seabird by-catch in this fishery is possible (paragraph 7.34);

(vi) France conduct an analysis to evaluate vessel-specific factors contributing to high levels of by-catch (paragraph 7.25).

Implementation of Conservation Measures 24-02,
25-02, 25-03, 41-09 and 41-10

7.252 Reported compliance with the streamer line component of Conservation Measure 25-02 dropped considerably since last year, possibly due to lack of awareness of the changes to the measure. The majority of the vessels that failed to fully comply this year would have complied under the previous specifications (paragraph 7.58). Vessel operators should be reminded of the new specifications. Also, it is of concern that for the first time since a single incident in 2002/03, two vessels in Subareas 88.1 and 88.2 failed to comply with the offal discharge prohibition. Compliance with Conservation Measure 25-02 is summarised as follows:

(i) Streamer lines – compliance with streamer line design was 64% compared with 92% last year (paragraph 7.47). Vessels in Subareas 48.6, 58.6, 58.7 and Divisions 58.4.2, 58.4.3b and 58.5.2 used streamer lines on all sets; in Subarea 48.3, seven of 16 vessels undertook sets without using a streamer line; and in Subareas 88.1 and 88.2, six vessels undertook some sets without using a streamer line (paragraph 7.49 and Table 7.12).

(ii) Offal discharge – in Subareas 88.1 and 88.2, two vessels did not comply with requirements to not discharge offal (Conservation Measures 41-09 and 41-10). One vessel in Subarea 48.3 and one vessel in Subarea 58.6 were observed discharging offal during the set (paragraphs 7.50 and 7.51 and Table 7.13).

(iii) Discard of hooks – fishing gear, snoods and hooks, were occasionally being disposed of at sea on eight vessels. Hooks were present in discards on eight vessels, a daily occurrence on one of them (paragraph 7.52).

(iv) Night setting – in Subareas 58.6 and 58.7 compliance was 83%, compared to 98 and 99% in the past two years; in Division 58.5.2 compliance was 99%; in Subarea 48.3 compliance was 98% (paragraph 7.53).

(v) Line weighting (Spanish system) – in Subarea 48.3 compliance was 87% compared to 100% last year; the single Spanish-system vessel fishing in Subareas 58.6 and 58.7 fully complied (paragraph 7.55).

(vi) Line weighting (autoline system) – the requirement to achieve a line sink rate of 0.3 m/s when fishing in daylight in Subareas 48.6, 88.1 and 88.2 and Division 58.4.2 was met by all vessels (paragraph 7.57 and Figure 7.1).

7.253 In relation to overall compliance with Conservation Measure 25-02, 13 of 40 vessels (33%) fully complied with all measures at all times throughout the Convention Area, compared to 48% last year (paragraph 7.61). Some vessels failed to comply by small margins and it was re-emphasised that vessels should be advised to exceed the standards to prevent compliance failure.

7.254 With respect to Conservation Measure 25-03, four of eight vessels did not comply with the prohibition of discharge of offal during the shooting and hauling of gear. This level of compliance is not as high as 2003, when only two vessels discharged offal (paragraph 7.62 and Table 7.14).

Revision of Conservation Measures 24-02 and 25-02 and related matters

7.255 With respect to future improvements to Conservation Measure 25-02:

(i) consistently collected data on the aerial extent of the streamer line is a key requirement for improving this element of the conservation measure (paragraph 7.66);

(ii) research on the sink rate of externally weighted autolines is essential to allow mandatory line-weighting regimes for autoliners to be included in the conservation measure (paragraph 7.93 and Figure 7.2).

7.256 However, with respect to Conservation Measure 24-02, the success of trials of IWLs, reducing white-chinned petrel by-catch by 98% in 2002 and 92% in 2003 in New Zealand areas comparable to the highest risk levels in the Convention Area (paragraph 7.74), coupled with successful trials in Division 58.5.1 (paragraph 7.76) enables a protocol for using IWLs in new and exploratory fisheries to be added to the conservation measure (paragraphs 7.94 and 7.95).

7.257 The rationale for this new element of Conservation Measure 24-02 and other proposed changes to the measure are described in paragraphs 7.95 to 7.110.

7.258 The Working Group supported a request for exemption from night-setting requirements for autoline vessels operating in Division 58.5.2 in 2005, subject to the conditions proposed in paragraph 7.86.

Assessment of incidental mortality of seabirds during IUU longline fishing in the Convention Area

7.259 The methods used to estimate seabird by-catch associated with IUU fishing were the same as revised and adopted last year. IUU removals were reported for the first time from Division 58.4.3 and this was allocated the same seabird by-catch rate as Division 58.4.4 (paragraphs 7.113 to 7.115).

7.260 The much lower estimates of IUU toothfish removals are directly reflected in the estimates of IUU seabird by-catch which, at 5 311 birds (95% confidence interval 4 352–14 166 birds) is the lowest ever reported for the Convention Area and 30% less than the value for 2003 (paragraph 7.117 and Table 7.15). Full data, including all historical data, are provided in SC-CAMLR-XXIII/BG/23.

7.261 Nevertheless, the Working Group concluded that even these reduced levels of IUU seabird by-catch were of substantial concern and likely unsustainable for some of the populations concerned (paragraph 7.121). The Commission was encouraged to continue to take action in respect of seabird mortality caused by IUU fishing (paragraph 7.122).

Incidental mortality of seabirds during longline fishing outside the Convention Area

7.262 New data on mortality of seabirds outside the Convention Area relevant to fisheries and/or seabirds within the Convention Area was presented as follows:

(i) In 2002 the Chilean domestic fishery for *D. eleginoides* caught 437 seabirds at a rate of 0.047 birds/thousand hooks; all were white-chinned petrels doubtless from breeding populations in the Convention Area (paragraph 7.125).

(ii) Chilean longline vessels which operate both in Subarea 48.3 and in the Chilean EEZ relax seabird mitigation matters in the latter, partly because regulations are not mandatory and partly because they appear unable to use the CCAMLR line-weighting provisions in the areas where they fish domestically (paragraph 7.124).

(iii) An exploratory longline fishery in Uruguay using modified Spanish-system gear killed 2 175 seabirds, including seabirds from the Convention Area, at very high by-catch rates; although the fishery in Uruguay is discontinued, similar fishing practices may be used elsewhere in the region (paragraph 7.126).

(iv) New Zealand summarised seabird by-catch data from major fisheries within its EEZ between 2000/01 and 2002/03. By-catch rates in tuna fisheries were low (0.026–0.048 birds/thousand hooks) due to good compliance with mitigation measures; rates in ling fisheries improved from 0.218 to <0.08 birds/thousand hooks due to increased line-weighting requirements. Squid trawl fishery by-catch rates ranged from 0.058 to 0.097 birds/trawl. Although most birds caught originated from New Zealand, some white-chinned and grey petrels were probably from the Convention Area (paragraph 7.127).

(v) Brazil was requested to supply details of by-catch rates in fisheries in its EEZ, especially as they affect bird species breeding in the Convention Area (paragraphs 7.128 and 7.129).

Research into the status and distribution of seabirds at risk

7.263 In response to the revised reporting format devised intersessionally, national research summaries and details of data on status, trends and distribution (at sea) of albatross and petrel populations had been received only from Australia, New Zealand and the USA (paragraph 7.130). Reports from other Members were essential to enable the linking of data on fishing effort and seabird by-catch with population dynamics and foraging range. Argentina, France, South Africa and the UK were particularly urged to make relevant data available as soon as possible (paragraphs 7.130 to 7.134).

7.264 There had been no changes since last year to the global conservation status (as reviewed annually by BirdLife International on behalf of IUCN) of albatross and petrel species of relevance to the Convention Area (paragraph 7.135).

7.265 New data on foraging range and areas of grey-headed, black-browed and Campbell albatrosses are summarised in paragraphs 7.141 to 7.143. Data in a global review by BirdLife International of remote-recorded at-sea distributions of albatrosses and petrels will be of considerable relevance to CCAMLR and BirdLife is requested to provide results from appropriate analyses (paragraphs 7.144 and 7.145).

7.266 Data on long-term population trends of Campbell (1–2% per annum increase) and grey-headed (3–5% per annum decrease) albatrosses at Campbell Island, of grey-headed, black-browed and wandering albatrosses (all stable but very small populations) at Macquarie Island and of black-browed albatrosses in southern Chile (increasing 1999 to 2001) are reported (paragraphs 7.146 to 7.150). Summary data are incorporated into SC-CAMLR-XXIII/BG/22.

7.267 A comprehensive survey of all colonies of black-browed, grey-headed and wandering albatrosses throughout South Georgia indicated:

(i) continuing declines for all species;

(ii) that trends at the Bird Island colonies monitored annually are representative of the overall South Georgia population;

(iii) that the rate of decline in wandering albatrosses may be increasing (paragraphs 7.151 and 7.152).

International and national initiatives relating to incidental mortality of seabirds in relation to longline fishing

7.268 Information was reported on current international initiatives under the auspices of:

(i) ACAP – now in force; CCAMLR attending inaugural meeting as observer, tabling paper summarising work of relevance to ACAP and hoping to develop close links (paragraphs 7.155 to 7.158);

(ii) FAO (NPOA-Seabirds) – noting the adoption of plans by New Zealand and Falkland/Malvinas Islands, the completion of a draft plan by Brazil and progress towards plans by Chile and Taiwan (paragraphs 7.161 to 7.163);

(iii) RFMOs – recollecting renewed attempts last year for more effective collaboration (SC-CAMLR-XXII, paragraph 5.28), progress with the main tuna commissions was regarded as discouraging (paragraphs 7.165 to 7.173);

(iv) NGOs – new initiatives with Southern Seabird Solutions and BirdLife International of considerable interest to CCAMLR were commended and Members urged to collaborate (paragraphs 7.174 to 7.177);

(v) the potential importance of feedback to CCAMLR from the forthcoming Fourth International Fisheries Observer Conference was noted (paragraph 7.179).

Incidental mortality of seabirds in relation to new and exploratory fisheries

7.269 Of the 29 applications for exploratory longline fisheries for 2003/04, 15, relating to Divisions 58.4.2 (1), 58.4.3b (1) and Subareas 48.6 (1), 88.1 (11) and 88.2 (1) were undertaken (paragraph 7.184).

7.270 Only in Subarea 88.1 was any seabird by-catch (1 bird) reported and this cannot be attributed to any failure of compliance with the suite of mitigation measures employed, which remain highly effective at avoiding seabird by-catch in these areas (paragraph 7.185).

7.271 The assessment of potential risk of interactions between seabirds and longline fisheries for all statistical areas in the Convention Area was reviewed, revised, and provided as advice to the Scientific Committee and Commission as SC-CAMLR-XXIII/BG/21. There were no changes this year to levels of risk (paragraphs 7.181 to 7.183 and 7.191 and Figure 7.3).

7.272 However, a substantial review of the summary presentation of advice to simplify and improve consistency was undertaken and incorporated into SC-CAMLR-XXIII/BG/21 and is summarised in Table 7.16 (paragraphs 7.186 to 7.190).

7.273 The 35 proposals by 13 Members for new and exploratory fisheries in seven subareas/divisions of the Convention Area in 2004/05 were addressed in relation to the advice in SC-CAMLR-XXIII/BG/21 and Table 7.17. The results, summarised in Table 7.16, indicate that, with the single potential inconsistency resolved at the meeting, all are in conformity with advice relating to incidental mortality of seabirds (paragraphs 7.194 and 7.195).

7.274 Issues relating to:

(i) exemptions from setting longlines at night;

(ii) exemptions in respect of recommended closed seasons;

(iii) maintaining maximum permitted seabird by-catch levels as in Conservation Measure 24-02, with reversion to the provisions of Conservation Measure 25-02 when these are reached;

(iv) including reference to the definition of birds caught (as adopted last year) in all relevant conservation measures;

are addressed in SC-CAMLR-XXIII/BG/21 and/or in paragraphs 7.197 to 7.202.

Interactions involving marine mammals and seabirds and trawl finfish fishery operations

7.275 Three Antarctic fur seals were reported killed in the icefish fishery in Division 58.5.2. The only seabird mortality observed in trawl fishing operations in 2003/04 was in the icefish fishery in Subarea 48.3 where 87 seabirds were killed and another 136 released alive (paragraph 7.206 and Table 7.18).

7.276 In this fishery, following reduction in total birds killed in each of the last three years, values had more than doubled in 2004. Mortality rates were nearly double those last year (paragraphs 7.209 and 7.210 and Table 7.18).

7.277 Despite extensive attempts to devise and improve mitigation measures for use in this fishery, limited success was reported (paragraphs 7.218 and 7.219).

7.278 Taking into account the increase in by-catch, the status of the birds killed and the continued difficulties with mitigation, the Working Group made various suggestions as to how the situation might be improved, including:

(i) a reduction in the vessel seabird by-catch limit;

(ii) an overall seabird by-catch limit for all vessels in this fishery;

(iii) supporting an application for further trials of mitigation measures in 2004/05, including a relaxation of the vessel seabird by-catch limit (paragraphs 7.211 to 7.217).

Interactions involving marine mammals and krill fishing operations

7.279 Revised data for 2002/03 indicate that a minimum of 114 Antarctic fur seals were caught in krill fishing operations in Area 48, 53 of which were killed and 61 released alive (paragraph 7.228).

7.280 Data for 2003/04 comprise a report from Area 48 of the international scientific observer on the *Top Ocean* which records 154 seals entrapped, of which 142 were killed and reports from UK observers on six vessels (including *Top Ocean*) in Subarea 48.3 which indicated entrapment of 292 seals (paragraphs 7.229 to 7.231).

7.281 A variety of mitigation devices, including those developed by Japan in recent years and tested in 2002/03, were used on vessels fishing for krill (paragraphs 7.238 to 7.241). Each device either greatly reduced or eliminated entrapment of fur seals (paragraphs 7.239 to 7.241).

7.282 The Working Group recommended that:

(i) information on all devices should be combined and circulated to CCAMLR Members and other interested parties (paragraph 7.242);

(ii) every vessel fishing for krill should employ a device for excluding seals or facilitating their escape from the trawl net (paragraph 7.243);

(iii) observers should be required on krill trawl vessels to collect reliable data on seal entrapment and on the effectiveness of devices used to mitigate this (paragraph 7.236);

(iv) noting experiences on the *Top Ocean* this year (paragraphs 7.232 to 7.235), data forms should be completed accurately, consistently and comprehensively by all observers (paragraph 7.236);

(v) the UK be requested to submit their observer data to the Secretariat (paragraph 7.237).

Other

7.283 Ms Rivera and Mr Smith should be appointed a Co-conveners of WG-IMAF, following the retirements of Prof. Croxall and Mr Baker.

ILLEGAL, UNREGULATED AND UNREPORTED (IUU) FISHING IN THE CONVENTION AREA

8.1 WG-FSA identified the following issues on IUU fishing:

(i) development of standard methods for estimating total removals of toothfish inside and outside the Convention Area including, where applicable, CCAMLR, national and IUU catches;

(ii) review of compliance-related estimates of IUU catches in the Convention Area and estimates of total toothfish removals for both inside and outside the Convention Area.

8.2 With respect to the first issue, the Working Group suggested that intersessionally further work could be done on the practical application and development of models to all fishing grounds with adequate levels of Monitoring Control and Surveillance (MCS) activities.

8.3 Two models were considered, the Agnew–Kirkwood model originally presented in WG-FSA-02/4 and a model described in WG-FSA-04/63. Similar to the Agnew–Kirkwood model, the new model uses the distribution of observed IUU activity and the pattern of observational effort to provide an estimate of the level of IUU activity that occurred. Simulation studies presented in WG-FSA-04/63 have indicated that the two methods produce quantitatively similar results in cases where there are more than zero observations. The study indicated that the new model could be developed to produce a distribution of estimated catch as well as a point estimate.

8.4 The Working Group also considered that the existing compliance-data-based methodology could be further improved if each of the compliance-related reports used for the calculation of IUU catches be accompanied with additional information to aid in the interpretation of the estimated IUU catch. In particular, an estimate of the level of observation directed to IUU activity would aid in understanding the number of vessels sighted and reported.

8.5 The Working Group recommended that SCIC be asked to develop a measure of the proportion of fishable time and fishable area which could be considered to be under effective monitoring for IUU activity. This measure would include the proportions of fishable season and region that are monitored by fishery patrols, the fishery and remote observation.

8.6 WG-FSA further recommended that SCIC be asked to consider whether qualitative information could be provided for each of the regions suitable so that they can be classified as either unmonitored, slightly monitored or heavily monitored with an indication as to whether the level of monitoring has increased or decreased significantly from the previous year.

8.7 With reference to paragraph 8.1(ii), the Working Group investigated possible causes in the observed drop in IUU catch estimates for toothfish in the Convention Area in relation to the decrease of CDS-reported catches from high seas outside the Convention Area.

8.8 Among possible reasons for declining CDS-reported catches from outside the Convention Area, in particular in Areas 47, 51 and 57, the Working Group considered:

(i) stocks may have become depleted;

(ii) re-flagging of fishing vessels to Flags which are not parties to the CDS, i.e. resulting in fewer CDS reports received;

(iii) impact of CCAMLR measures on the reduction of IUU fishing and continued monitoring of the world trade in toothfish.

8.9 The Working Group also considered that possible reasons for declining estimates of IUU catches in the Convention Area could include:

(i) shifting of IUU fishing activity to areas outside of fishing grounds where licensed vessels operate and surveillance is most intense, e.g. BANZARE Bank area, which results in fewer observations used to estimate IUU catches;

(ii) inadequacy of current level of MCS activities in distant parts of the Convention Area;

(iii) impact of CCAMLR measures on the reduction of IUU fishing and continued monitoring of the world trade in toothfish.

8.10 Based on the information available, the Working Group found it impossible to identify which of these reasons were most likely responsible for the decline. It decided to use estimates of total removals of toothfish, including estimates of IUU catches in the Convention Area, as contained in Tables 3.2 and 3.3. WG-FSA noted that if additional data justifying the revision of the abovementioned estimates were available at the 2005 meeting of WG-FSA, these estimates should be revised.

8.11 WG-FSA further considered whether new information on toothfish distribution and catches on high seas outside the Convention Area could be used to verify catches previously reported via CDS from these areas but considered by the Scientific Committee, in particular for Area 51, as most likely to have been taken illegally from inside the Convention Area (SC-CAMLR-XX, paragraphs 2.12 and 2.13).

8.12 WG-FSA has in the past expressed some doubt over whether Areas 47, 51 and 57 could support the level of catches apparently reported from them, given that there is limited seabed area within the relevant depth ranges for toothfish. The only information from Area 51 that the Working Group had to make an assessment of this problem is WG-FSA-04/19, which reported that average CPUE in Area 51 was 0.042 kg/hook which would equate to a daily catch rate of less than 0.4 tonnes/day (setting a maximum of 10 000 hooks/day). Catch rates reported in CDS data for 2003 for Areas 47, 51 and 57 are an order of magnitude higher than this, about 3 tonnes/day with a range from 2 to 6 tonnes per day. For comparison, estimated catch rates in the IUU fisheries in Divisions 58.5.1, 58.5.2 and Subareas 58.6 and 58.7 are between 2 and 5 tonnes per day (Table 3.2).

8.13 IUU catches in the Convention Area estimated previously by WG-FSA with the same method are presented in Table 8.1. From the table, the total IUU catch from the Indian Ocean sector over the period from 2000 to 2004 during which the CDS was in operation, is 39 307 tonnes. The total catch reported in CDS data from Areas 51 and 57 for this period is 38 672 tonnes. If Area 47 is included, the total rises to 44 632 tonnes. Thus it would seem that if it is the case that catches from these areas were predominantly taken from within the Convention Area, they may have been already included in the current estimates of IUU fishing used by the Working Group.

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

New biological information

9.1 In addition to information which was pertinent to the assessment of stocks and which had been dealt with in Fishery Reports and/or section 3, a large number of papers contained substantial biological information on target and non-target species which was not directly relevant to the assessments. This information, however, helped considerably in further improving biological understanding of these species. Papers addressed the following subject areas:

(i) diet of *D. eleginoides* (WG-FSA-04/43) and *D. mawsoni* (WG-FSA-04/31 and 04/89);

(ii) diet (WG-FSA-04/44), ageing methods (WG-FSA-04/70) and population biology (WG-FSA-04/40 and 04/41) of *C. gunnari*;

(iii) the *D. mawsoni* fishery in the Ross Sea, including spawning information (WG-FSA-04/34), population biology (WG-FSA-04/89) and population genetics (WG-FSA-04/32) of *D. mawsoni*; new information on by-catch species (WG-FSA-04/27 and 04/89); ichthyoplankton sampling (WG-FSA-04/30); and a marine biodiversity initiative (WG-FSA-04/60);

(iv) biology of icefish species (WG-FSA-04/26, 04/89 and 04/90).

In addition, WG-FSA-04/10 provided a detailed review of icefish biology.

9.2 The Working Group welcomed the submission of papers dealing with biology and ecology of target and non-target species and encouraged Members to continue to provide this information. Information relevant to target species will be incorporated into species profiles.

9.3 The Working Group noted that submitted papers also contained valuable data on by-catch species that is not carried forward in CCAMLR documentation.

Matters arising from biology and ecology papers

9.4 In WG-FSA-04/30 a new seven-stage maturity-scale system was proposed for *D. mawsoni* to extend the five-stage maturity scale of Kock and Kellermann (1991) widely in use in CCAMLR. The Working Group felt that the data presented were still insufficient to reach such a far-ranging conclusion and change a maturity scale which is easy to use even by less-experienced workers and provides sufficient data for the purpose of CCAMLR.

9.5 WG-FSA-04/70 compared age estimates in *C. gunnari* derived from CMIX analysis and by direct ageing of otoliths. Considerable differences in age estimates between the two methods were revealed. Differences could be due to the growth parameter used to seed CMIX or errors in ageing from otoliths. To address this issue, a proposal to hold an age determination workshop on *C. gunnari* in Russia in 2005 was tabled (paragraphs 9.8 to 9.12).

Species profiles

9.6 The Working Group thanked Dr Everson for his work in preparing and maintaining the species profiles for *C. gunnari* and toothfish. The Working Group noted that the profiles are a valuable tool in preparing for assessments and considered it important that they are updated annually with new information either presented to, or generated by, the Working Group.

9.7 The Working Group recommended that the species profiles be annually updated in time for the meeting of WG-FSA-SAM. Dr M. Collins (UK) agreed to coordinate the updating of the toothfish profile. The Working Group recorded that a coordinator is needed for updating the icefish profile.

Age Determination Workshop on *Champsocephalus gunnari*

9.8 The first workshop on the determination of age in Antarctic fish held in Moscow in 1986 was unable to resolve the major uncertainties surrounding the age determination in *C. gunnari*. A subsequent exchange of otoliths between different laboratories revealed considerable differences between readers which could not be reconciled at that time (Kock, 1989) and age estimates remained questionable.

9.9 Given that a considerable amount of new information has been brought to bear on the life cycle of the species in the last 15 years, in particular on fish living in the northern parts of its distributional range in the Atlantic and Indian Ocean sectors, and that ageing techniques have become much more developed and sophisticated since then, the Working Group recommended that a second workshop be held on the age determination of the species preferably in June 2005 at a venue yet to be decided. Countries (contact person in brackets) which are likely to participate are: Australia (Mr R. Williams), Germany (Dr K.-H. Kock), Russia (VNIRO: Dr K. Shust; AtlantNIRO: Dr Zh. Frolkina), Spain (Dr García Santamaría), Ukraine (Dr L. Pshenichnov), UK (Dr M. Belchier) and the USA (Dr J. Ashford). Other Members are invited to participate.

9.10 The workshop will require material from as much of the geographical length range of the species as possible. In addition to the otoliths, ancillary information, such as length compositions of smaller fish exhibiting distinct peaks which could be related to age, should be brought to the workshop. This material could aid in the identification of the first age classes.

9.11 A timetable will be developed for tasks to be completed before, during and after the workshop. In order to be most efficient it is envisaged that not more than 12–15 scientists familiar with the reading of otoliths of Antarctic fish, in particular icefish, take part in the workshop. In preparation for the workshop, AtlantNIRO offered to interested scientists to circulate 50 recently collected otoliths of *C. gunnari* prepared in the 'Russian' way for age reading well in advance of the workshop, in order to:

- familiarise scientists with the specifics of icefish otoliths
- develop protocols for the preparation of otoliths for age determination
- develop protocols for reading icefish otoliths.

A similar kind of preparation had proven to be successful in the 'Workshop on Estimating Age in Patagonian Toothfish' in Norfolk, Virginia, USA, 23 to 27 July 2001 (SC-CAMLR-XX, Annex 5, Appendix H).

9.12 The workshop is considered to be a first step in reconciling difficulties inherent in the age determination of *C. gunnari*. As a second step it is envisaged that a regular exchange of otoliths among interested laboratories would be established. This procedure has proven to be successful in the case of *Dissostichus* spp. following results from the Norfolk workshop. If the workshop and the subsequent exchange of otolith material prove to be successful, a manual will be prepared which describes how otoliths of *C. gunnari* might be aged in a standard fashion. It is envisaged that *C. gunnari* will become part of the CCAMLR otolith exchange network.

CONSIDERATIONS OF ECOSYSTEM MANAGEMENT

Interactions with WG-EMM

10.1 To satisfy the requirements of CCAMLR Article II.3(b) and (c), an ecosystem-directed approach to management is needed.

10.2 Thus, during WG-EMM-04, a Workshop on Plausible Ecosystem Models for Testing Approaches to Krill Management was held at the University of Siena, Siena, Italy, from 12 to 16 July 2004, being convened by Dr Constable (Annex 4, Appendix D).

10.3 Specifications that could be used to develop the modelling framework in which plausible models of the Antarctic marine ecosystem could be simulated, and scenarios that could be explored are to:

(i) develop several ecosystem models that can relate to each other
(ii) seek the input from different experts
(iii) interact with WG-FSA and ad hoc WG-IMAF.

10.4 The workshop noted that the attributes of Antarctic marine ecosystem models would vary with:

(i) the target species (krill, icefish, toothfish, squids or crabs);

(ii) the by-catch species;

(iii) the feeding habits of target species, their predators and related species;

(iv) the environmental characteristics (oceanographic features, feeding grounds, climate, geographical features);

(v) fisheries (fishing method, fishers' behaviour).

10.5 Conceptual representations of ecosystems would have to consider:

(i) a flexibility of the framework taking into consideration how each taxon might be influenced by the rest of the ecosystem;

(ii) detailed or general representation of different taxa to simulate, respectively, local-scale effects of fishing, or the effects on a wider area or wider temporal scale;

(iii) structural uncertainties related to lack of data;

(iv) information on a food-web model.

10.6 The workshop recognised the lack of expertise to develop models centred on target species other than krill, and requested that WG-FSA review current information with a view to develop models centred on toothfish and icefish (Annex 4, Appendix D, paragraph 7.3).

10.7 However, WG-EMM agreed that priority should be given to the development of ecosystem models centred on krill, and their predator–prey interactions, including those involving icefish. Demersal and bathypelagic species such as *Dissostichus* spp., *Macrourus* spp., skates and rays may need to be considered in the future.

Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM)

10.8 The Working Group supported the proposal by WG-EMM to establish a standing Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM) to advise the Scientific Committee on protocols to be used in acoustic surveys and analyses (Annex 4, paragraph 4.92). The terms of reference for this group are set out in paragraph 13.7.

New information on icefish diet reported to WG-FSA-04

10.9 The feeding habits of Channichthyidae and their interactions with predators were reviewed (WG-FSA-04/10). Young icefish are pelagic or migrate in the water column feeding mainly on krill and other euphausiids and fish. Adult icefish can be grouped with respect to their diet in three groups:

(i) those that depend on krill or other euphausiids during all their life, such as *C. gunnari*, taking fish only to a small extent;

(ii) species that feed on krill and benthic and mesopelagic fish;

(iii) and species that feed primarily on various notothenioids and less often on mesopelagic fish.

10.10 The proportion of food items varies with size, age, geographical region and season. Feeding interactions of *C. gunnari* were studied around the South Georgia region, in Subarea 48.3 (WG-FSA-04/41), based on trawling, acoustic and juvenile fish surveys carried out from 1986 to 2002. They showed a strong relationship between krill distribution and vertical migration, and the icefish distribution pattern. Juvenile and adult icefish use pelagic foraging areas, but the proportions of the different food items that are taken in varied: in the south the proportion was 70% krill, 15% juvenile *C. gunnari*, and 2% *Lepidonotothen larseni* and amphipods, while in the northeast krill was slightly lower (60%), and the amphipod proportion was higher (15%), with low proportions of myctophids and juvenile *C. gunnari* (2%). The lowest proportion of krill was obtained in the northwest (50%), and a high proportion of myctophids (35%) and amphipods (40%) was recorded. There is also a significant variability between the stomach content of fish of different sizes in different strata (near-bottom icefish 25–29 cm take 60% krill and 35% amphipods, while 33–35 cm icefish feed on 90% krill; in pelagic waters they feed on 95% krill).

10.11 In the same region (Subarea 48.3) the diet patterns of *C. gunnari* between South Georgia and Shag Rocks were compared (WG-FSA-04/44). The main food items were reported to be *E. superba* and five other Euphausiacea, six species of pelagic amphipods, mainly *T. gaudichaudii*, *Antarctomysis* sp., copepods, decapods, Channichthyidae, *L. larseni*, *Patagonotothen guntheri* and nototheniid larvae, and seven species of Myctophidae. A greater proportion of fish, mainly *P. guntheri*, was taken at Shag Rocks by the age 4+ *C. gunnari*.

Ecosystem effects of trawling

10.12 The relationship between the icefish (*C. aceratus*) and the sea floor benthic community (macrobenthic organisms serpulid polychaetes, crinoids, sea stars, anemones, sabellid polychaetes, brittle stars), with respect to nesting behaviour and parental care in Subarea 48.6, was described in WG-FSA-04/26. The authors pointed out that given the vulnerability of spawning grounds and their associated macrofauna to damage by bottom trawling and the associated impact on recruitment to adult fish populations, appropriate management of icefish fisheries should exclude, or severely restrict, fishing techniques that damage the seabed.

10.13 Studies on the composition of benthic communities and benthopelagic species composition in different regions are important for ecosystem-based models with respect to target species. WG-FSA-04/61 studied the composition of demersal fish and benthic communities in Subareas 48.3, 48.4 and 48.6, obtained during the ICEFISH cruise by trawling (paragraph 3.23). Differences were detected in faunal composition between island groups such as South Sandwich where different icefish were present, and Bouvetøya where no icefish were found.

Available information on ecosystem interactions

10.14 In response to the request of WG-EMM to concentrate efforts initially on icefish, it was noted that a great deal of relevant information is contained in the species profiles, the by-catch data and those derived from ad hoc WG-IMAF on marine birds that interact with fisheries. Dr S. Kasatkina (Russia) pointed out that there is extensive data in WG-FSA and WG-EMM background papers (e.g. WG-CEMP-92/50, 93/13, 94/32, 94/33, 95/87, 96/11, 96/32, 96/43, WG-EMM-99/27, WG-FSA-92/12, 92/26, 93/17, 93/18, 93/24, 94/27, 95/36, 97/38, 97/35, 99/63, 99/64, 99/65, 03/54, 03/55, 03/61, 03/74), and in *CCAMLR Science* that is directed to icefish biology and its interaction with the ecosystem (e.g. *CCAMLR Science,* Vol. 1, p. 129; Vol. 2, pp. 1, 21, 35; Vol. 3, p. 111; Vol. 5, pp. 63, 79, 103, 245; Vol. 6, p. 117; Vol. 7, pp. 1, 75; Vol. 8, pp. 107, 119, 133; Vol. 9, p. 49; Vol. 10, pp. 1, 15). Dr Kock noted that there was a large body of information on icefish in the South Georgia ecosystem that could be used for such work.

10.15 Information on various species of icefish in the diet of toothfish is reported in papers WG-FSA-04/31, 04/43 and 04/88 (see also section 9).

10.16 Ecosystem interactions involving by-catch species can be found in section 6.

10.17 WG-FSA encouraged Members to submit papers on interactions between krill and icefish, and icefish with other species to the next WG-EMM meeting.

10.18 The Working Group agreed that Members specialising in icefish research should be invited to send experts to participate in the next workshop on plausible ecosystem models. To address small-scale spatial and temporal interactions it was suggested that a joint acoustic and trawl survey be undertaken to collect synoptic data on biology of target and by-catch species. This would help to better understand the icefish–krill system.

10.19 The Working Group requested that Members consider how knowledge of ecosystem interactions involving icefish might contribute to the development of a long-term management procedure for icefish (paragraph 4.15(vii)) and what requirements there might be for monitoring.

10.20 Dr Constable reported that the Australian Antarctic Division has undertaken ecosystem research in the vicinity of Heard and McDonald Islands in January 2004. This intensive study involved estimating the distribution and abundance of *C. gunnari* and Myctophidae, their food items and their predators as well as studying the oceanography, primary production and zooplankton. Acoustic methods were used to estimate abundance of krill, fish and zooplankton and will be used to help understand how to differentiate between krill swarms and icefish. The study also aimed to determine the dependence of land-based predators (fur seals, macaroni penguins, king penguins) on their prey including icefish, by investigating the foraging activities of these predators. This year fur seals were found to be dependent on icefish. The study will be used to develop a food-web model of the system.

10.21 Dr Shust pointed out that there is enough data that would allow taking into consideration the differences between the ecosystem of the Atlantic Ocean sector and the Pacific Ocean sector, with regard to food chains. In Subareas 88.1 and 88.2, high latitude and depths have to be taken into account, while this is not the case in Subareas 48.1, 48.2 and 48.3.

Interaction with other organisations

10.22 Dr E. Fanta (Brazil) drew members' attention to the International Polar Year for which the SCAR Life Sciences Standing Scientific Group is planning a Circum-Antarctic Census of Marine Life for the 2007/08 season. The Working Group noted that many national Antarctic programs will be undertaking surveys and research cruises at that time, which might be integrated with CCAMLR surveys to the mutual benefit of both programs.

Advice to the Scientific Committee

10.23 The Working Group recommended that the Scientific Committee support the proposal by WG-EMM, endorsed by WG-FSA, to establish a standing Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM).

10.24 The Working Group recommended that an icefish-centred ecosystem monitoring program, coordinated with the krill-centred monitoring program be developed.

10.25 The Working Group encouraged Members to carry out ecosystem-based research activities in any areas where icefish populations occur. Key areas that may form the core of the program could be South Georgia and Heard and McDonald Islands.

10.26 The Working Group considered that data derived from the icefish ecosystem monitoring program, and the results of research activities, could provide data for an ecosystem model centred on icefish that would be related to other Antarctic marine ecosystem models.

SCHEME OF INTERNATIONAL SCIENTIFIC OBSERVATION

General Matters

11.1 Current observation requirements as detailed in conservation measures are summarised in Table 11.1.

11.2 Information collected by scientific observers was summarised in WG-FSA-04/6 Rev. 1, 04/7 Rev. 1 and 04/8 Rev. 1.

11.3 WG-FSA noted that the quality and quantity of observer data collected continued to improve. The Working Group commended all the observers that worked in the CCAMLR Convention Area in 2003/04 for their hard work.

11.4 At the same time, WG-FSA noted some continued problems related to inconsistent completion of data fields by observers (WG-FSA-04/6 Rev. 1, paragraph 11) and the lack of records in some sections of the forms (e.g. fish by-catch data).

11.5 The observer logbook forms and cruise report format have been updated as required and distributed to all Members and technical coordinators on 15 March 2004 (COMM CIRC 04/27). All but two of the logbooks were submitted using the electronic versions of the forms; however, several of them used old versions.

11.6 Some aspects of the observer duties were removed from the manual in 2003 taking into account data usage. Tasks removed concerned observation on meteorological conditions, and observations of birds and marine mammals during night setting.

11.7 The Working Group reiterated the advice of the Scientific Committee (SC-CAMLR-XXI, paragraph 2.3) that all technical coordinators ensure that only the current versions of cruise reports and logbook forms be used, and should ensure that observers are aware of the correct data fields when recording data. In particular, observers need to be reminded to familiarise themselves with changes to the cruise reports, logbooks and associated instructions, and that all data fields requested need to be completed.

11.8 In 2003 the Working Group discussed the topic on observer safety (SC-CAMLR-XXII, Annex 5, paragraphs 10.9 and 10.10). Discussions at WG-FSA-03 were drawn to the attention of the Scientific Committee that had agreed that it did not have primary competency to comment on this issue and, therefore, referred it to the Commission (SC-CAMLR-XXII, paragraph 2.7). The Commission noted the issue (CCAMLR-XXII, paragraph 4.5) and consequently Resolution 20/XXII was adopted.

11.9 No comments were received from scientific observers on safety issues during the 2003/04 season. However, the Working Group acknowledged the resolution adopted by the Commission last year, and suggested that action continue to be taken to ensure observer safety at sea.

Implementation of the observer program

11.10 The Working Group considered the following issues:

(i) the collection of data during the 2003/04 season and amendments which were identified as important by WG-FSA and ad hoc WG-IMAF;

(ii) the proposed review of the *Scientific Observers Manual*;

(iii) the work priorities of scientific observers on board fishing vessels;

(iv) the current list of research priorities identified in the past by the Scientific Committee.

11.11 The Working Group made a number of recommendations as described below.

Data collected during the 2003/04 season

11.12 Data collected by scientific observers during the 2003/04 season were used in stock assessments, by-catch estimation and analyses of seabird mortality arising from fishing operations. The types of data collected by observers are reviewed in WG-FSA-04/64. In order to improve quality and completeness of data collected by scientific observers, the Working Group considered several datasets received from observers during 2003/04.

Streamer lines

11.13 In 2003 data were requested from observers on the aerial extent of streamer lines to monitor the effects of changes in Conservation Measure 25-02 (SC-CAMLR-XXII, Annex 5, paragraphs 10.26 and 10.27). Limited data were collected during the various 2003/04 fisheries and the Working Group reiterated the need to collect this data during 2004/05.

11.14 The Working Group noted that some data reported by observers on the number of streamer lines deployed while line setting actually related to the number of streamers attached to the streamer line and noted that the requirement to report data on the number of streamer lines should be clarified by technical coordinators when briefing observers.

11.15 In reviewing the implementation of Conservation Measure 25-02, the following additional specifications for data needed were agreed:

(i) recording the aerial extent of the streamer line to the nearest metre, this distance is the length of the streamer line measured from the stern of the vessel to the point at which the streamer line first touches the surface of the water;

(ii) recording the presence or absence of a towed object attached to the outboard end of the streamer line;

(iii) recording if individual branched streamers extend to the water in the absence of wind and swell;

(iv) recording if the towed object is maintained immediately astern of the attachment point of the streamer line to the vessel;

(v) recording if the aerial extent of the streamer line is maintained above the hookline during line setting.

Conversion factors

11.16 The Working Group noted that for longliners (WG-FSA-04/6 Rev. 1, Table 5) the main processing method for *Dissostichus* spp. was headed, gutted and tailed (HGT) with some observers also recording CF data for headed and gutted (HAG) product. CFs for filleted

(FLT) and headed, gutted and tailed (HGT) *M. whitsoni* were reported by three observers. For trawlers (WG-FSA-04/7 Rev. 1, Table 5) the only processing method for *D. eleginoides* was HGT. For *C. gunnari* and *P. georgianus* the processing method was always whole (WHO).

Hooks in offal

11.17 The Working Group noted that data on hooks in offal are currently requested in the cruise report, but not the electronic logbook. To allow a more informed response to the issue of hooks in offal, the Working Group recommended that observers collect summary information about hooks in offal in the same format as that used for fishing gear in the electronic logbook form L8.

By-catch

11.18 Discussions of the Working Group related to by-catch and observer data are presented in paragraphs 6.50, 6.78, 6.81 to 6.86 and 6.90 of this report.

Tagging programs

11.19 Discussions of the Working Group related to tagging programs and observer data are presented in paragraphs 3.47(xii) and 3.48.

Sub-sampling methods for observers

11.20 In 2003, the intersessional subgroup on longline sub-sampling methods for observers had identified four key targets for the observer sub-sampling methodology that were not currently available. Consequently the Working Group recommended that observers collect the required additional data so that a more robust sub-sampling methodology could be developed during the intersessional period (SC-CAMLR-XXII, Annex 5, paragraphs 10.29 and 10.30).

11.21 The Working Group also recommended that the system of sampling a fixed number of fish per fishing event be reviewed during the intersessional period as it may result in inconsistent use of sampling units (SC-CAMLR-XXII, Annex 5, paragraph 10.31). Furthermore, the Working Group recommended that observer experience with any sub-sampling method be reported in observer cruise reports (SC-CAMLR-XXII, Annex 5, paragraph 10.33).

11.22 It was noted that observers have reported no data on any of the above matters during the 2003/04 season and no action has been reported by any Member on the development of sub-sampling methodologies. Therefore, the Working Group reiterated its recommendations encouraging observers and Members to provide the needed information and to undertake the studies leading to the development of adequate methods for longline sub-sampling.

Estimating seabird abundance

11.23 During the meeting the Working Group reviewed the application of one current research priority – estimation of seabird abundance at sea (see also paragraph 7.137).

11.24 WG-FSA-04/46 described the distribution of seabirds on the Alaskan fishing grounds derived from post-haul seabird counts conducted in the course of longline fish stock assessment surveys. The protocol consists of counting all birds by species on the water and in the air within a 50 m radius of the vessel's stern immediately prior to, or immediately after, the last hook is hauled, when seabirds are most aggregated and easily enumerated. This simple protocol takes no more than 10 minutes to complete and is easily learned and performed by observers with minimal seabird experience. These data yield estimates of the seabird species present or absent in specific areas at specific times and the relative distribution of the common species on the fishing grounds. These data, however, are not comparable with traditional ship transect abundance estimates, and are of limited use for measuring change in seabird populations.

11.25 The Working Group acknowledged that the current CCAMLR observer protocol for enumerating seabirds within 500 m of the stern of the vessel is difficult to perform by fisheries observers, these data are collected inconsistently by CCAMLR observers, and the resulting data have yet to be analysed or used by the Commission. The simpler post-haul protocol may yield consistent data useful for CCAMLR management purposes.

11.26 The Working Group recommended that until such time as a standardised protocol could be developed, any requirement for observers to quantify seabird abundance during the set and haul be removed from the manual. In particular, the data collection associated with the L4 IMAF form in the electronic logbooks will need revision.

Seabird captures in longline fisheries

11.27 The Working Group noted that observer data describing interactions involving seabirds with longline fishing operations do not currently include the activity within the fishing event when the capture occurs. To help better understand and mitigate interactions involving seabirds with longline fishing operations, these data are required, and the Working Group recommended that they be collected in 2004/05.

Seabird captures in trawl fisheries

11.28 The Working Group noted that observer data describing interactions involving seabirds with trawl fishing operations do not currently include the activity within the fishing event when the capture occurs. To help better understand and mitigate interactions involving seabirds with trawl fishing operations, these data are required, and the Working Group recommended that they be collected in 2004/05.

11.29 Additional data are to be collected on the stage during the fishing operation that the seabird was caught. The stages of interest are: during net setting, during the haul, during net retrieval, or, not able to be determined. The period of the tow could be defined as the time from the start of the net fishing (net at fishing depth and mouth of net open) to the end of the net fishing (beginning of net being retrieved from fishing depth). Haul can be defined as the period from the end of fishing until the time when the trawl doors are at the quarters, and net retrieval as the time from the end of haul to the codend being hauled on deck. This may be best achieved by adding to the electronic logbook form T6 a column for these data to be associated with each seabird capture. Useful descriptions of the trawl fishing method to help clarify data recording are contained in SC-CAMLR-XXII/BG/28.

Electronic monitoring

11.30 WG-FSA-04/23 reported on a pilot study in Alaska, which identifies electronic monitoring as a practical approach for assessing seabird interactions with trawl third-wire cables (also called netsonde or net monitor cables). The approach may also be able to be used for monitoring seabird interactions with trawl warp cables. The authors noted that the approach could potentially be used to measure compliance with seabird by-catch mitigation measures.

11.31 WG-FSA-04/24 reported on a feasibility study in Alaska, in a fishery where observers cannot usually be placed on vessels due to small vessel size, which found that electronic monitoring systems could be used to evaluate compliance with the use of some seabird by-catch mitigation measures. The authors noted that one of the key limitations is the inability of the current technology to identify seabirds to the species level, although identification to small seabird/large seabird classifications was possible.

11.32 Participants indicated that other electronic monitoring systems were in various stages of development and that some showed promise in being able to identify seabirds to the species level.

11.33 The Working Group noted that key issues yet to be resolved in utilising electronic monitoring systems include how to robustly analyse the large volumes of data collected (even where time-lapse data are collected), and how to move monitoring from post-trip analyses to real-time analyses.

11.34 The Working Group noted that electronic monitoring is a rapidly evolving field of technical research and that its greatest future utility appeared to be in monitoring compliance with conservation measures.

Review of the *Scientific Observers Manual*

11.35 Based on a recommendation received from WG-FSA, the Scientific Committee and the Commission agreed that there should be a major review of the *Scientific Observers Manual* (SC-CAMLR-XXII, Annex 5, paragraph 10.45; SC-CAMLR-XXII, paragraph 2.10 and CCAMLR-XXII, paragraphs 4.5 and 6.17(iv)). The review refers to consideration of the manual format, structure and contents.

11.36 WG-FSA noted that a timeframe for the review has not yet been identified. It was also noted that after a review is completed, the Scientific Committee would need to consider provision to the Secretariat of necessary funds for the translation, production and distribution of the revised manual.

11.37 The Secretariat consulted intersessionally with technical coordinators and members of WG-FSA and WG-EMM in order to clarify potential shortcomings of the current manual and to elaborate a plan of work on the proposed review (WG-FSA-04/16). Several reasons for the proposed review of the manual were identified in the consultation. In general, the key need was that following extensive development and additions over many years, the manual is now due for an overhaul of its structure and contents (as it is also done periodically for other CCAMLR manuals and guidelines).

11.38 WG-FSA recommended that in order to accomplish the proposed review, the Scientific Committee and its working groups should first review research priorities for different fisheries, target and by-catch species and the types of data to be collected to allow research priorities to be met. An initial assessment of data collected by observers, an assessment of whether the collected data are used and the source of the data request are given in Table 11.2. This initial review needs additional input from other working groups and technical coordinators. The next stage of the review would be to determine whether existing data collection and recording protocols meet the identified data collection requirements. This phase should include development of clear guidance on prioritisation of observer tasks where requested data collection exceeds the time available to the observer at sea. The final stage of the review would be consideration of the most appropriate structure, format and contents of the manual.

11.39 WG-FSA also agreed that in future, proposals for adding data collection tasks for scientific observations should be submitted in a standard format including a description of the data collection objectives, data collection protocols and data usage.

11.40 At this meeting, WG-FSA was not able to undertake the review of the manual and estimated that the proposed review of the manual could require more than one intersessional period. The Secretariat was requested to arrange for intersessional work in consultation with Mr Smith and Dr E. Balguerías (Spain), technical coordinators of national observer programs and, as required, with other members of WG-FSA/ad hoc WG-IMAF and WG-EMM. The Working Group noted that additional resources, possibly including external consultants, may be needed to undertake the review in a comprehensive and timely manner.

11.41 In the absence of agreed terms of reference for the revision of the *Scientific Observers Manual*, the Working Group noted the key reasons put forward for the review outlined in WG-FSA-04/16, paragraph 7, and agreed that the Secretariat would continue to address these in 2004/05.

11.42 The Working Group noted that additional resources, possibly including input from contracted consultants outside the Secretariat, may be required to ensure that the revision is undertaken in a comprehensive and timely manner.

11.43 The Secretariat advised that such consultant input could be estimated at comprising approximately 20 working days in 2005/06 and would cost about A$7 200. This would be additional to the A$20 000 allocated in the 2004/05 budget for Secretariat involvement in the manual's revision. That money will be utilised for text compilation, formatting and translation, as well as the time of key Secretariat personnel.

11.44 It was drawn to the Working Group's attention that the two activities outlined in paragraph 11.43 may not coincide. In the absence of a clear directive from the Commission on procedures for the carry-over of funds for multi-year tasks under the current accrual budgeting procedure, the Working Group understood that the sequence of events potentially envisaged above may not be feasible.

11.45 However, the Working Group recognised, and advised the Scientific Committee, that should it be possible to allocate both budgetary amounts identified above to the 2005 and 2006 financial years, then there would be a strong need to develop clear terms of reference for any work to be undertaken by a contracted consultant. These terms of reference would need to be developed by the Working Group in consultation with the Scientific Committee Chair and the Executive Secretary.

11.46 Results of intersessional work conducted in 2004/05 should be reported by the Secretariat to the 2005 meetings of WG-EMM and WG-FSA/ad hoc WG-IMAF.

Current research and observer work priorities

11.47 WG-FSA noted that it had requested WG-FSA-SAM to identify data which are essential for stock assessment purposes in order to help prioritise observer workload (SC-CAMLR-XXII, Annex 5, paragraph 10.11). Due to the overall workload at the recent meeting of WG-FSA-SAM and the current meeting of WG-FSA, it was not possible to undertake this task.

11.48 The Working Group noted that this task still needed to be completed and could usefully be incorporated into the proposed process for review of the *Scientific Observers Manual*.

11.49 The Working Group noted that the current list of priorities in the *Scientific Observers Manual* does not relate specifically to new and exploratory fisheries, and that a list of observer priorities for new and exploratory fisheries is required.

11.50 The Working Group noted that a current list of priorities does not exist for incidental mortality of seabirds and marine mammals associated with fishing and that a list of observer priorities for incidental mortality associated with fishing is required. However, recommended levels of observer coverage required to monitor potential incidental mortality in new and exploratory fisheries have been identified by the Working Group in 2004 (paragraphs 7.187 to 7.190).

11.51 The Working Group noted that a current list of priorities does not exist for fish and invertebrate by-catch sampling and that a list of observer priorities for fish and invertebrate by-catch sampling is required.

11.52 The Working Group noted that a section for observer priorities is contained within each of the new Fishery Reports, and encouraged Members to develop that section of the Fishery Report in the intersessional period.

Observer conference

11.53 Dr Fanta called the attention of the Working Group to the Fourth International Fisheries Observer Conference to be held from 8 to 11 November 2004 in Sydney, Australia.

11.54 The conference will discuss the role of observer programs for management, compliance and scientific purposes within the broader context of fisheries monitoring systems. It will address some of the key issues related to the delivery of observer programs, from the perspective of governments, service providers, the fishing industry and observers. It will also explore the current applications, limitations and future uses of scientific data, and data collection from observer programs.

11.55 The Working Group noted that the discussions and output from the conference should be of interest for the implementation of the CCAMLR Scheme of International Scientific Observation (see also paragraph 7.179). It noted that the Secretariat had prepared a paper describing the scheme and the CCAMLR experience with observers (WG-FSA-04/64); it supported the participation of Secretariat staff in the conference to present the paper, and to report back to CCAMLR on matters of interest in the future implementation of the scheme.

Information relevant to SCIC

11.56 The Working Group had attempted to verify, by crosschecking cruise reports and electronic logbooks, observer information in Secretariat papers WG-FSA-04/6, 04/7 and 04/8 relating to monitoring the implementation of conservation measures. The review resulted in the issuing of revisions to all three papers.

11.57 However, unlike previous years, this year the Working Group has not comprehensively assessed all CCAMLR scientific observer reports to compile and analyse additional data on compliance with relevant conservation measures. While this was mainly due to the large volume of observer reports received this year, the Working Group felt it was inappropriate for it to carry out this type of analysis. WG-FSA recommended that SCIC could take initial responsibility for this function in future, given its role and expertise in relation to compliance matters.

11.58 Observer information on the monitoring of the implementation of conservation measures is contained in two sources:

(i) Secretariat papers WG-FSA-04/6 Rev. 1, 04/7 Rev. 1 and, in particular, 04/8 Rev. 1;

(ii) discussions of ad hoc WG-IMAF, in particular paragraphs 7.46 to 7.63.

11.59 The Working Group also noted that the information and advice in CCAMLR-XXIII/BG/8 and SC-CAMLR-XXIII/BG/1 was relevant to SCIC.

11.60 The Working Group noted recent developments in electronic monitoring (paragraphs 11.31 to 11.35) and suggested that SCIC consider electronic monitoring as a potential additional tool for monitoring compliance with conservation measures in future.

Advice to the Scientific Committee

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

(i) only current versions of cruise reports and logbook forms be used for reporting to CCAMLR, and electronically wherever possible (paragraph 11.7);

(ii) recording of hooks in offal and the fate of such material on a daily basis in longline fisheries (paragraph 11.17);

(iii) reporting of experience with sub-sampling methods (paragraph 11.22);

(iv) discontinuation of requirements to quantify seabird abundance during the set and haul of longlines, and requirement be removed from the manual (paragraph 11.26);

(v) collection of data in longline fisheries describing whether seabirds are caught during the set or the haul in form L5(vi) (paragraph 11.27);

(vi) collection of data in trawl fisheries describing when during the trawl fishing activity seabirds are caught (paragraph 11.29);

(vii) incorporation of the definition of dead seabirds contained in SC-CAMLR-XXII, Annex 5, paragraphs 6.214 to 6.217 (paragraph 7.201);

(viii) clarification of instructions on hooks observed for seabird by-catch to ensure only hooks directly observed for seabird by-catch, as distinct from hooks hauled whilst the observer is in the fish factory, are recorded in logbooks (paragraph 7.188);

(ix) reporting of longline sink rate test data for longline fisheries from testing during fishing in the Convention Area in the electronic logbook form L10 (paragraph 7.106);

(x) accurate reporting of by-catch data (paragraph 6.50);

(xi) reporting on methods or strategies of fishing that minimise non-target fish by-catch (paragraph 6.77);

(xii) collecting accurate information on cut-offs of rajids (paragraph 6.89);

(xiii) incorporation of instructions for tagging and reporting on tag releases and tag recaptures (paragraphs 3.47(viii) and 3.48);

(xiv) tagging protocol in the manual to be updated to reflect the recommendations on tagging (paragraph 3.47(xii)).

11.62 The Working Group recalled the recommendation made by the Scientific Committee at its meeting last year requesting Members to undertake additional analyses of CFs to improve estimates of total removals from all fisheries (SC-CAMLR-XXII, paragraph 2.5). No action has been taken on this matter during the intersessional period and the Working Group therefore reiterated its request encouraging Members to initiate these studies to improve estimates of total removals from all fisheries (paragraph 11.17).

11.63 The Working Group recommended that all changes to the content and format of the *Scientific Observers Manual* should be coordinated through the technical coordinators. Further, technical coordinators should ensure that scientific observers are made aware of changes to the content and format of the *Scientific Observers Manual* prior to deployment.

11.64 The Working Group suggested that action continue to be taken to ensure observer safety at sea (paragraph 11.9).

11.65 The Working Group recommended that the proposed intersessional review of the *Scientific Observers Manual* be undertaken, including a review of observer priorities, and that additional resources be sought to undertake this task (paragraphs 11.40 to 11.45).

11.66 The Working Group recommended the participation of Secretariat staff in the Fourth International Fisheries Observer Conference to be held from 8 to 11 November 2004 in Sydney, Australia, and noted the importance of feedback from that conference on the implementation of the CCAMLR Scheme of International Scientific Observation (paragraph 11.55).

11.67 The Working Group suggested that the Scientific Committee inform SCIC of the information identified by WG-FSA as relevant to its business, and that it may wish to further investigate electronic monitoring as a potential additional tool for monitoring compliance with conservation measures in future (paragraphs 11.56 to 11.60).

FUTURE ASSESSMENTS

12.1 The Working Group considered future assessment work in light of the discussion and outcomes of this year’s meeting. It agreed that there is an urgent need to evaluate methods for assessing sustainable yield of *D. eleginoides* in Subarea 48.3. In that respect and in light of the need to develop an assessment method for *D. mawsoni* in Subarea 88.1, it also agreed that WG-FSA-SAM should meet during the intersessional period and focus on evaluating assessment methods for *Dissostichus* spp.

12.2 In order to better understand the requirements from WG-FSA-SAM and to improve the efficiency of the work of WG-FSA, the Working Group considered what was required to be done before an assessment method would be used by WG-FSA to help provide advice on harvest strategies, including catch limits, to the Scientific Committee. It noted the discussion under Item 4 on the main parts of evaluating methods (paragraph 4.39(iii)). Following a general discussion, the Working Group requested that WG-FSA-SAM consider the process required for the Working Group to agree on the use and implementation of assessment methods in the work of the Working Group.

12.3 With respect to the role of WG-FSA-SAM, the Working Group agreed that it would be desirable for it to correspond regularly in order to develop and agree on the use of assessment methods by WG-FSA by the end of its intersessional meeting. In that respect, the Working Group did not consider it appropriate to have to discuss and agree on, during the course of its meeting, the use of methods unless it was generally understood and agreed that developments between the time of the WG-FSA-SAM meeting and WG-FSA would achieve consensus on the first day and the process of implementation was agreed.

12.4 The Working Group agreed that WG-FSA-SAM should consider the following topics as priority for evaluating assessment methods for *Dissostichus* spp. at its intersessional meeting:

(i) implementation of assessments with respect to CCAMLR decision rules
(ii) fishery-independent recruit surveys
(iii) use of mark–recapture data in assessments
(iv) catch-at-age estimation
(v) standardisation of CPUE
(vi) integrated assessment procedures
(vii) spatially explicit assessment models.

12.5 It recognised that each of these topics could form a substantial amount of work on their own. However, it encouraged Members to make submissions on these topics with the view to evaluating them for use by the Working Group to deliver advice on harvest strategies to the Scientific Committee.

12.6 With respect to the implementation of assessments, the Working Group noted that three main software packages would be useful to explore for delivering components of, or all of, the assessment procedures – AD Model Builder (Otter Research, 2000), CASAL (Bull et al., 2004) and the GYM (Constable and de la Mare, 2003). Other forms of implementing software, including spatially explicit models, such as Fish Heaven (Ball and Williamson, 2002), would be useful to have available for evaluation work. The Working Group agreed that assessments with the potential to integrate a variety of data sources would be useful to explore at the coming meeting, such as that which can be achieved in CASAL.

12.7 An important part of the evaluation work will be to continue the evaluation of survey designs and to further explore the means of estimating the abundance of recruits from these surveys, including the use of CMIX, age–length keys and other approaches. The Working Group noted the need to review the means by which data from stratified random surveys are pooled to give estimates of abundance.

12.8 The Working Group also agreed that a spatial analysis of the distribution of the fishing effort in Subarea 48.3 is important and requested WG-FSA-SAM begin this process and to examine more closely the following issues:

(i) the number of tags required in the tagging experiment and an exploration of assumptions of mixing and recapture rates;

(ii) the potential for the CPUE series to be hyper-stable.

12.9 The Working Group agreed that assessment methods other than those listed above could be explored if they were sufficiently mature for evaluation by WG-FSA-SAM. These could include the use of depletion experiments in assessments as well as methods for estimating length-at-age relationships.

12.10 The Working Group agreed that the work of WG-FSA-SAM should be supported by representatives from each of the main laboratories working on assessment methods for WG-FSA. Nominated representatives are: Dr Constable (Australia), Mr A. Dunn (New Zealand), Drs Gasyukov, Jones and Kirkwood. As Convener, Dr Hanchet undertook to consult with these representatives to find a new coordinator for WG-FSA-SAM (paragraph 13.4(i)).

FUTURE WORK

Intersessional work

13.1 Future work identified by the Working Group is summarised in Table 13.1 and Appendix D (ad hoc WG-IMAF), together with the persons or subgroups identified to take the work forward and references to sections of this report where the tasks are described. The Working Group noted that these summaries contain only those tasks identified at the meeting, and do not include ongoing tasks undertaken by the Secretariat, such as data processing and validation, publications and routine preparations for meetings.

13.2 The Working Group reviewed the activities of subgroups that had worked during the intersessional period. These subgroups, with the support of the Secretariat, had produced valuable work and information that had contributed to the assessments and review of information available at the meeting. WG-FSA agreed that the activities of several of these groups should be extended during the 2004/05 intersessional period. Where possible, each subgroup would focus on a small number of key issues. The subgroups would also provide a conduit for information on a wide range of related research. In addition, other tasks were specifically assigned to the Secretariat and/or Members.

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

13.4 The subgroups, and their coordinators listed in brackets, for the intersessional period are:

(i) WG-FSA-SAM (Dr Jones). This subgroup will interact and coordinate activities in the middle of the year (as detailed in Item 12);

(ii) a subgroup to review, and where necessary assess, the biology and demography of species considered by the Working Group (Drs Collins and Kock);

(iii) a subgroup on by-catch (Ms E. van Wijk (Australia) and Dr O'Driscoll);

(iv) a subgroup to identify, in conjunction with the SCAR EVOLANTA Program, up-to-date information on stock identity for species within the Convention Area (Dr Fanta);

(v) a subgroup on otolith exchange (CON) (Dr Belchier);

(vi) a subgroup on tagging (Mr Dunn, Drs Davies and Belchier);

(vii) a subgroup on scientific observers (Mr Smith and Dr Balguerías);

(viii) a subgroup on ecosystem interactions (Drs Fanta and Kock).

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

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

Proposed terms of reference for SG-ASAM

13.7 The Working Group recommended that the Scientific Committee should consider the following terms of reference for SG-ASAM, which extend the terms of reference proposed by WG-EMM (Annex 4, paragraph 4.93):

(i) to develop, review and update as necessary, protocols on:

  (a) the design of acoustic surveys to estimate biomass of nominated species;

  (b) the analysis of acoustic survey data to estimate the biomass of nominated species, including estimation of uncertainty (bias and variance) in those estimates;

  (c) the archiving of acoustic data, including data collected during acoustic surveys, acoustic observations during trawl surveys, and in situ target strength measurements;

(ii) to evaluate results of acoustic surveys carried out in the CCAMLR Convention Area during the previous year;

(iii) to estimate target strength and its statistical characteristics for key species in the CCAMLR Convention Area;

(iv) to use data from acoustic surveys to investigate ecological interactions and produce information for ecosystem monitoring and management.

13.8 An immediate issue for WG-FSA to be addressed by SG-ASAM is the acoustic protocol for assessing *C. gunnari* in Subarea 48.3, including:

(i) discrimination of *C. gunnari* from other acoustic scatterers
(ii) further improvements in target strength estimates for *C. gunnari*
(iii) age-specific patterns in daily vertical distribution of *C. gunnari*
(iv) combination of trawl and acoustic indices for stock assessment.

External review of GYM

13.9 In the interests of continuing the development and review of its assessment tools, WG-FSA requested last year that the Data Manager supervise an independent external review of the GYM software and manual (SC-CAMLR-XXII, Annex 5, paragraph 9.18). The amount of funds required to conduct the external review in 2004 was unknown to WG-FSA, however, experience relative to obtaining invited experts to WG-EMM indicated that the cost could be approximately US$3 000 (SC-CAMLR-XXII, Annex 5, paragraph 9.19).

13.10 WG-FSA noted that the Secretariat had called for expressions of interest for the review in March 2004. However, no formal feedback or expressions of interest had been received and the review could not be conducted. This matter had been considered at the meeting of WG-FSA-SAM (WG-FSA-04/4, paragraphs 4.1 to 4.12). The subgroup had agreed that the scope of the review required clearer definition and that the funds set aside for a review in 2004 may have been inadequate.

13.11 As a result, WG-FSA recommended that the Scientific Committee retain the funds for the review of the GYM until WG-FSA-SAM can further consider the scope of the review and a costing can be better estimated. Developments would be reviewed by WG-FSA at its 2005 meeting, with a view of undertaking a review in 2006.

Meeting of WG-FSA-SAM

13.12 WG-FSA agreed that full consideration of the intersessional work of WG-FSA-SAM would require more than a five-day meeting in 2005. However, the practicality of holding a meeting in association with WG-EMM and limits on participants' time meant that the 2005 meeting could only be held over five days.

13.13 WG-FSA agreed that the participation of an invited expert at the 2005 meeting of WG-FSA-SAM would provide advice on the evaluation assessment methods. It was also recognised that such an expert would provide advice at WG-EMM's workshop scheduled in the week following the meeting of WG-FSA-SAM. WG-FSA requested the Coordinator of WG-FSA-SAM to liaise with the conveners of the WG-EMM workshop to identify a suitable person.

13.14 WG-FSA recommended that the Scientific Committee request funding for an invited expert.

13.15 The Secretariat was requested to work with the WG-FSA Convener and the coordinator of WG-FSA-SAM to review, as possible, topics of relevance to the intersessional meeting of the subgroup.

13.16 The Working Group requested that the Secretariat participate in the next intersessional WG-FSA-SAM meeting in the same manner as last year through the attendance at the meeting by the Data Manager, Dr Ramm, and by one other Secretariat staff member to assist with preparing the report in the last two days of the meeting.

13.17 The Working Group requested that the coordinator of WG-FSA-SAM, with the assistance of the representatives of the subgroup, develop a work program to help with preparation for the meeting, including the following timetable:

- mid-November – circulate to members of the Working Group and the Scientific Committee, a draft plan of work leading to the meeting of WG-FSA-SAM and a draft agenda for discussion;
- mid-February – assess progress on the work plan, determine a preliminary agenda for the WG-FSA-SAM meeting based on expected completion of contributions to the subgroup, and circulate a progress report;
- mid-May – update the progress report and circulate, where possible, the outcomes of work for consideration by WG-FSA-SAM;
- mid-June – deadline for submission of papers.

OTHER BUSINESS

14.1 Dr Fanta announced that from 25 to 29 July 2005 the IXth SCAR International Antarctic Biology Symposium will be held in Curitiba, Brazil. Information can be found at www.pucpr.br/scarbiologysymposium.

14.2 It is an event that takes place every four years, and congregates Antarctic biologists, from senior to young scientists, and students. Keynotes will give the state of the art of Antarctic biology, and the papers presented orally or as posters will be published in *Polar Biology*.

14.3 The theme of the Symposium is: 'Evolution and biodiversity in the Antarctic' therefore providing space for all aspects of Antarctic biology. Dr Fanta is the local organiser of the event, and welcomes scientists of CCAMLR to present their research results. Dr S. Nicol (Australia) was invited as one of the keynote speakers to bring CCAMLR's view on ecosystem models, monitoring and management to the meeting. This event will allow a closer cooperation between the SCAR and the CCAMLR communities.

Rules for the submission of meeting papers

14.4 WG-FSA noted the guidelines for the submission of papers to the Scientific Committee (SC-CAMLR-XXIII/5 Rev. 1). With respect to last year's request from the Committee (SC-CAMLR-XXII, paragraphs 12.32 and 12.33), the Working Group was unable to offer any comment as it was felt that the guidelines were a matter for consideration by the

Scientific Committee. However, WG-FSA agreed that it would be beneficial to have all guidelines relating to the submission of documents to the Scientific Committee and its working groups collated into a single reference document.

14.5 WG-FSA considered the Secretariat's proposal for dealing with published papers submitted to meetings (SC-CAMLR-XXIII/5 Rev. 1, Annex 1). WG-FSA recommended that the status quo should be retained.

ADOPTION OF THE REPORT

15.1 The report of the meeting and associated background documents SC-CAMLR-XXIII/BG/21, BG/22 and BG/23 were adopted.

CLOSE OF MEETING

16.1 In closing the meeting, the Convener thanked all participants and subgroup coordinators for developing the work of WG-FSA. On behalf of WG-FSA, Dr Hanchet also thanked outgoing conveners Dr Constable (WG-FSA-SAM) and Prof. Croxall and Mr Baker (WG-IMAF) for providing expertise and direction to those aspect of the Working Group's agenda. Dr Hanchet also thanked the Secretariat staff for a successful meeting and for their contribution to the work of WG-FSA. The Working Group noted that Mr Williams (past convener) was retiring in 2005; Mr Williams was thanked for his significant contribution to the understanding of Antarctic fish and fisheries.

16.2 The Working Group welcomed Dr Jones in his new role as Coordinator of WG-FSA-SAM, and Ms Rivera and Mr Smith in their new roles as co-conveners of WG-IMAF.

16.3 Dr Holt, on behalf of WG-FSA, thanked Dr Hanchet for his work in his first year as Convener and for his leadership. Dr Holt also thanked Mrs C.-P. Martí, Spanish Representative to the Commission, for taking the time to participate in the meeting. WG-FSA had also greatly appreciated Dr Everson's contribution to the restructuring of the meeting and reformatting the report. Dr Everson's initiative has resulted in a significant improvement in the way WG-FSA conducts its work and the presentation of results and advice to the Scientific Committee.

16.4 The meeting was closed.

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Table 3.1: Total reported catches (tonnes) of target species in fisheries conducted in the Convention Area in the 2003/04 season. Source: catch and effort reports submitted by 24 September 2004.

Target species	Region	Fishery	Gear	Fishing season		Conservation measure	Catch (tonnes) of target species		Catch (% limit)
				Start	End		Total	Limit	
Champsocephalus gunnari	48.3		Trawl	01-Dec-03	30-Nov-04	42-01 (2003)	2 685	2 887	93
	58.5.2		Trawl	01-Dec-03	30-Nov-04	42-02 (2003)	51	292	17
Dissostichus spp.	48.3		Longline	01-May-04	21-Aug-04	41-02 (2003)	4 482[1]	4 420	101
	48.3		Pot	01-Dec-03	21-Aug-04	see above			
	48.4		Longline	01-May-04	21-Aug-04	41-03 (1999)	0	28	0
	48.6 north of 60°S	Exploratory	Longline	01-Mar-04	31-Aug-04	41-04 (2003)	7	455	1
	48.6 south of 60°S	Exploratory	Longline	15-Feb-04	15-Oct-04	see above			
	58.4.1	Exploratory	Longline	01-Dec-03	30-Nov-04	41-11 (2003)	0	800	0
	58.4.2	Exploratory	Longline	01-Dec-03	30-Nov-04	41-05 (2003)	20	500	4
	58.4.3a	Exploratory	Longline	01-May-04	31-Aug-04	41-06 (2003)	0	250	0
	58.4.3a	Exploratory	Trawl	01-Dec-03	30-Nov-04	see above			
	58.4.3b	Exploratory	Longline	01-May-04	31-Aug-04	41-07 (2003)	7	300	2
	58.4.3b	Exploratory	Trawl	01-Dec-03	30-Nov-04	see above			
	58.5.1 (French EEZ)		Longline	ns	ns	ns	3 436[2]	ns	-
	58.5.2		Longline	01-May-04	30-Nov-04	41-08 (2003)	2 269	2 873	73
	58.5.2		Trawl	01-Dec-03	30-Nov-04	see above			
	58.6 (French EEZ)		Longline	ns	ns	ns	441[2]	ns	-
	58.6 (South Africa EEZ)		Longline	ns	ns	ns	55	ns	-
	58.7 (South Africa EEZ)		Longline	ns	ns	ns	50	ns	-
	88.1	Exploratory	Longline	01-Dec-03	31-Aug-04	41-09 (2003)	2 166	3 250	67
	88.2 south of 65°S	Exploratory	Longline	01-Dec-03	06-Mar-04	41-10 (2003)	375	375	100
Euphausia superba	48		Trawl	01-Dec-03	30-Nov-04	51-01 (2002)	87 133[3]	4 000 000	2
	58.4.1		Trawl	01-Dec-03	30-Nov-04	51-02 (2002)	0	440 000	0
	58.5.2		Trawl	01-Dec-03	30-Nov-04	51-03 (2002)	0	450 000	0
Lithodidae	48.3		Pot	01-Dec-03	30-Nov-04	52-01 (2003)	1	1 600	0
Macrourus spp.	58.4.3a	Exploratory	Trawl	01-Dec-03	30-Nov-04	43-02 (2003)	0	26	0
	58.4.3b	Exploratory	Trawl	01-Dec-03	30-Nov-04	43-03 (2003)	0	159	0
Martialia hyadesi	48.3	Exploratory	Jig	01-Dec-03	30-Nov-04	61-01 (2003)	0	2 500	0
four species[4]	58.4.2	Exploratory	Trawl	01-Dec-03	30-Nov-04	43-04 (2003)	0	2 000	0

[1] Revised total following correction advised on 10 September 2004 (previous total was 4 488 tonnes, e.g. CCAMLR-XXIII/38).
[2] Catches to August 2004.
[3] One Vanuatu-flagged vessel fished; no data have been submitted.
[4] *Chaenodraco wilsoni*, *Lepidonotothen kempi*, *Trematomus eulepidotus* and *Pleuragramma antarcticum.*
ns Not specified by CCAMLR.

Table 3.2: Estimated effort, catch rates and total catches from IUU fishing for *Dissostichus* spp. in the Convention Area in the 2003/04 season. Detailed calculations are in SCIC-04/3 Rev. 2 (see also SC-CAMLR-XXII, Annex 5, Table 3.3).

Region	Estimated number of IUU vessels				Estimated IUU fishing effort					Estimated IUU catch	
	Sighted[1]	Otherwise reported[2]	Extrapolated[3]	Total	Trip duration (days)[4]	Trips per vessel	Total days fished to 1-Oct-04	Total days fished to 30-Nov-04 (A)	Mean catch rate (tonnes/day) (B)[5]	To 1-Oct-04	To 30-Nov-04 (A x B)
48.3				0		1.0	0	0	3.1	0	0
58.4.2	3	1	0	4	41	1.5	246	246	0.8	197	197[7]
58.4.3	4	1	0	5	41	1.5	308	308	0.8	246	246[7]
58.4.4			0	0	40	2.5	0	0	1.1	0	0[7]
58.5.1	2		0.4	2.4	30	1.9	114	137	4.7	536	643
58.5.2	2		0.4	2.4	30	2.0	118	142	4.5	531	637
58.6	4[6]	1	1	6	40	1.0	200	240	1.9	380	456
58.7		1	0.2	1.2	40	1.5	60	72	0.8	48	58
88.1		2	0	2	40	1.0	80	80	3.0	240	240[7]
88.2	0	0								0	0
								Total IUU catch		2 177	2 477
								Adjusted Total IUU catch[8]			2 622

1 From reports of vessel sightings submitted by Members.
2 From information reported via other sightings, port inspections or fishing vessels/traders.
3 Calculated pro rata for 1 October to 30 November 2004.
4 Estimates of the duration of fishing trips for IUU vessels have been agreed and used by WG-FSA for a number of years.
5 Mean catch rates per day have been taken from the five-day catch and effort database, where available. CDS data have been used otherwise.
6 On 11 October 2004, based on information submitted by South Africa, one more vessel was added to Subarea 58.6.
7 Based on expert advice received from WG-FSA-04, ice conditions prevent any fishing in Divisions 58.4.2 and 58.4.4 and Subarea 88.1 during October and November. Therefore, estimations for the period 1 December to 1 October next year are representative for the whole fishing season, i.e. to 1 December 2004.
8 According to a report submitted by Mauritius, the *Lugalpesca* transhipped 145 tonnes of undocumented toothfish during December 2003. WG-FSA noted that no information was available to allocate the catch to any specific area. Therefore, the catch was added to the overall total.

Table 3.3: Reported catch (tonnes) of *Dissostichus* spp. and estimated catch from IUU fishing in the Convention Area, and catch reported in the CDS in areas outside the Convention Area in the 2002/03 and 2003/04 seasons.

2002/03 season

Inside	Subarea/Division	Reported catch	IUU catch	Total CCAMLR	*Catch limit*
	48.3	7 528	0	7 528	*7 810*
	48.4	0			*28*
	48.6	0			*910*
	58.4.2	117	113	230	*500*
	58.4.3 (a and b)	0			*550*
	58.4.4	0	128	128	*0**
	58.5.1	5 291	7 825	13 116	*0**
	58.5.2	2 844	1 512	4 356	*2 879*
	58.6	571	354	925	*0**
	58.7	219	138	357	*0**
	88.1	1 831	0	1 831	*3 760*
	88.2	106	0	106	*375*
	Total inside	18 507	10 070	28 577	
Outside	**Area**	**CDS catch EEZ**	**CDS catch high seas**	**Total outside CCAMLR**	
	41	6 633	3 368	10 001	-
	47	0	3 852	3 852	-
	51	0	3 629	3 629	-
	57	0	871	871	-
	81	38	1	39	-
	87	5 511	234	5 745	-
	Total outside	12 182	11 955	24 137	-
Global total				52 714	

2003/04 season (to October 2004)

Inside	Subarea/Division	Reported catch	IUU catch	Total CCAMLR	*Catch limit*
	48.3	4 482	0	4 482	*4 420*
	48.4	0			*28*
	48.6	7			*910*
	58.4.2	20	197	217	*500*
	58.4.3 (a and b)	7	246	253	*550*
	58.4.4	0	0	0	*0**
	58.5.1	3 436	643	4 079	*0**
	58.5.2	2 269	637	2 906	*2 873*
	58.6	496	456	952	*0**
	58.7	50	58	108	*0**
	88.1	2 166	240	2 406	*3 250*
	88.2	374	0	374	*375*
	Area unknown	0	145	145	-
	Total inside	13 307	2 622	15 922	

(continued)

Table 3.3 (continued)

Outside	Area	CDS catch EEZ	CDS catch high seas	Total outside CCAMLR	
	41	3 698	2 644	6 342	-
	47	0	797	797	-
	51	0	108	108	-
	57	0	18	18	-
	81	0	0	0	-
	87	3 522	179	3 701	-
	Total outside	7 220	3 746	10 966	-
Global total				26 888	

Reported catch: 2002/03 from STATLANT data; 2003/04 catch and effort reports to 24 September 2004, except data for France reported to August 2004.
IUU catch: From SCIC-04/3 Rev. 2
CDS estimate: Data submitted to the CDS by 10 October 2004. The allocation between EEZ and high seas is based on the Secretariat's knowledge of vessel activity such as licence information, vessel size and trip duration.
Catch limits agreed by the Commission.
* Outside EEZs

Table 3.4: Research surveys notified by Members and estimated catch of species listed in Conservation Measure 24-01.

Member	Survey				Estimated catch (tonnes)	Comment*			
	Vessel	Period	Region	Purpose		a	b	c	d
Germany	RV *Polarstern*	Nov–Dec 2005	48.1	Survey on the abundance of demersal fish fauna, probably in the Elephant Island area. Continued work on seabirds, cephalopods and seals.				√	
Japan	MS *Shirase*	14 Nov 2004–13 Apr 2005	58	Physical, chemical and biological oceanography with emphasis on primary production research.					√
	RTV *Umitaka Maru*	Jan–Feb 2005	58.5.1	Marine science observations.					√
	RV *Hakuho Maru*	Dec 2004–Jan 2005	88.1	Survey will include marine geochemistry and dynamics of the ocean bio-system.					√
	RV *Kaiyo Maru*	Dec 2004–Jan 2005	88.1	Survey will include oceanographic observations, biological sampling, acoustic and sighting surveys.					√
New Zealand	*Avro Chieftain*	23 Jan–31 Apr 2005	88.3	Characterise the fishery, in particular selectivity and CPUE analysis and tag–recapture and tag data analysis.	<135		√		
UK	FPRV *Dorada*	Jan 2005	48	Investigate the utility of acoustic methods for assessing mackerel icefish stocks.				√	
	RRS *James Clark Ross*	Late 2004 – early 2005	48	Three krill surveys as part of the BAS Variability Project.				√	

* a – including no more than 10 tonnes of *Dissostichus* spp.
b – including no more than 100 tonnes of *Dissostichus* spp.
c – not specified by Member
d – not applicable

Table 6.1: Catch rates of *Macrourus whitsoni* and *Bathyraja eatonii* in bottom trawls during the BioRoss survey.

Species	Area	Depth range (m)	No. of trawls	Catch rate (kg/km^2)		
				Mean	SD	Range
M. whitsoni	SSRU 881E	85–574	13	12	22	0–71
		764–1 444	4	103	99	0–199
	SSRU 881H	130–556	24	39	108	0–460
		636–866	6	4 235	4 852	0–10 351
B. eatonii	SSRU 881E	85–574	13	0	0	0–0
		764–1 444	4	0	0	0–0
	SSRU 881H	130–556	24	99	182	0–568
		636–866	6	255	288	0–629

Table 6.2: Estimated seabed area between 600 and 1 800 m, *Macrourus* spp. CPUE by SSRU (over all years of fishery), 2003/04 *Macrourus* spp. catch, and indicative catch limits (assuming a total catch limit of 520 tonnes) under the three different by-catch management strategies discussed.

SSRU	Area (km^2)	*Macrourus* spp. CPUE (kg/hook)	2003/04 *Macrourus* spp. catch† (tonnes)	2003/04 catch limit (tonnes)	Proportional catch limit (tonnes)	Fixed catch limit (tonnes)
A						
B	4 318	0.005	0	20	3*	20
C	4 444	0.006	1	36	3*	20
D						
E	14 797	0.050	32	20	93	150
F						
G	7 110	0.028	16	20	25	150
H	19 245	0.018	43	126	43	150
I	30 783	0.049	266	124	188	150
J	43 594	0.005	0	51	26	20
K	24 695	0.045	0	120	140	150
L	16 807	0.000	0	29	0*	20
Total	165 793		358			

† From CCAMLR-XXIII/38, Appendix 3.
* Very low catch limits could be replaced with a catch limit of 20 tonnes for ease of monitoring.

Table 6.3: By-catch (tonnes) estimates from longline fisheries for the 2003/04 season. This table provides information for all rajids and *Macrourus* spp., and is derived from fine-scale (haul-by-haul) data. TOA – *Dissostichus mawsoni*, TOP – *Dissostichus eleginoides*.

	Subarea/Division									
	48.3	48.6	58.4.2	58.4.3b	58.5.2	58.6	58.7	88.1	88.2	Total
Total rajid	5.88		0.04	0.11	61.71			22.62	0.09	90.46
Total *Macrourus* spp.	29.94	0.27	0.63	0.13	42.33	0.06	0.44	318.80	36.55	429.15
Target TOA			19.65	6.27				2165.05	374.49	2565.46
Target TOP	4571.31	6.57	0.13	0.53	551.75	45.81	29.23	12.26	0.02	5217.60
Total rajid as % of target	0.13		0.20	1.67	11.18			1.04	0.02	1.16
Total *Macrourus* spp. as % of target	0.65	4.05	3.18	1.92	7.67	0.13	1.51	14.64	9.76	5.51

Table 6.4: By-catch (tonnes) estimates from trawl fisheries for the 2003/04 season. This table provides information for all rajids and *Macrourus* spp., and is derived from fine-scale (haul-by-haul) data. TOP – *Dissostichus eleginoides*, ANI – *Champsocephalus gunnari*.

	Division 58.5.2		Total
Target species:	ANI	TOP	
Total rajids	2.92	4.85	7.77
Total *Macrourus* spp.	0.75	2.14	2.88
Target TOP	143.41	1578.61	1722.01
Target ANI	50.38	0.31	50.69
Total rajids as % of target	1.51	0.31	0.44
Total *Macrourus* spp. as % of target	0.38	0.14	0.16

Table 6.5: An example of a proposed risk categorisation, using information on sleeper sharks (*Somniosus* spp.) in Division 58.5.2 presented in WG-FSA-03/69.

Life history characteristics	
Geographical distribution	*Somniosus* spp. have been reported in the southern hemisphere from the South American continental shelf from Uruguay to Patagonia, South Africa, New Zealand, south of Tasmania, Macquarie Island and around Heard and McDonald Islands. Tagging of *S. pacificus* in Alaska suggests that sleeper sharks may have relatively small home ranges.
Depth distribution	Occurs in deep water and on continental shelves and slopes. Fishery by-catch occurs at 415–759 m at Heard and McDonald Islands.
Age/growth	No age estimates are available. Probably long-lived and very slow growing. Tagging studies of *S. microcephalus* around Greenland have shown that this species may be one of the slowest growing cartilaginous fishes with annual growth rates of around 1 cm. Maximum length around 600 cm, possibly greater.
Reproduction	Very little information available. Probably ovoviviparous. Size-at-maturity may be greater than 400 cm.
Diet	In the Tasman Sea and around Macquarie Island, cephalopods occurred in 80% of stomachs of *S. antarcticus*, fish in 47%, marine mammals in 33%, birds in 7% and other items in 13%.
Vulnerability to fishing	
Overlap between distribution and fishing	Uncertain because distribution records are limited by the spread of fishing effort. Occurs as by-catch in trawl and longline fisheries for *Champsocephalus gunnari* and *Dissostichus* spp. in Division 58.5.2.
Co-occurrence with exploited species	Overlap in geographical and depth distribution with *C. gunnari* and *Dissostichus* spp. Documented as feeding on these species.
Trawl or longline catchability	Highly skewed sex ratio in catches of *S. antarcticus* around Heard and Macquarie Islands. Females predominate in catches by 4:1 at Macquarie Island and by 5:1 at Heard and McDonald Islands.
Catch	Average catch of about eight sharks per year in Division 58.5.2. Catches of *Somniosus* spp. reported to FAO from the northern hemisphere ranged from 19 to 157 tonnes. CPUE of *Somniosus* spp. caught as by-catch in Prince William Sound ranged from 1 to 21 sharks per hundred hooks.
Population status	No information.
Conservation measures and mitigation	Animals tagged and released where possible.
Category*	3

(continued)

Table 6.5 (continued)

***Explanation of the status categories** (based on Castro et al., 1999)

Category 1: Exploited species that cannot be placed on any of the subsequent categories, because of lack of data.

Category 2: Species pursued in directed fisheries, and/or regularly found in by-catch, whose catches have not decreased historically, probably due to their higher reproductive potential.

Category 3: Species that are exploited by directed fisheries or by-catch, and have a limited reproductive potential, and/or other life history characteristics that make them especially vulnerable to overfishing, and/or that are being fished in their nursery areas.

Category 4: Species in this category show substantial historical declines in catches and/or have become locally extinct.

Category 5: Species that have become rare throughout the ranges where they were formerly abundant, based on historical records, catch statistics, or experts' reports.

Table 6.6: Available information on the fate of rajids from observer data for all fisheries.

		Number	%
Longline records		149	
	Cut off line	114	77
	Lost at surface or dropped off	16	11
	Unknown	19	13

Table 7.1: Reported and observed incidental mortality of seabirds in the longline fisheries for *Dissostichus* spp. in Subareas 48.3, 58.6, 58.7, 88.1, 88.2 and Divisions 58.4.2 and 58.5.2 during the 2003/04 season. Sp – Spanish method; Auto – autoliner; N – night-time setting; D – daytime setting (including nautical dawn and dusk); O – opposite side to hauling; S – same side as hauling; * – information obtained from cruise report.

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks (thousands)			No. of birds caught						Observed seabird mortality (birds/thousand hooks)			Streamer line in use %		Offal discharge during	
			N	D	Total	%N	Obs.	Set	% observed	Dead N	Dead D	Alive N	Alive D	Total N	Total D	N	D	Total	N	D	Set (%)	Haul (%)
Subarea 48.3																						
Globalpesca I	8/5–18/7/04	Sp	43	1	44	98	194.1	387.0	50	0	0	0	0	0	0	0	0	0	100	100		O (0)
Isla Camila	1/5–30/6/04	Sp	115	1	116	99	147.7	524.3	28	0	0	0	0	0	0	0	0	0	75	100		O (1)
Isla Santa Clara	1/5–23/7/04	Sp	175	2	177	99	285.2	1144.7	24	1	0	1	0	2	0	0.004	0	0.004	100	100		O (100)
Isla Sofía	1/5–4/7/04	Sp	136	0	136	100	264.7	771.6	34	0	0	0	0	0	0	0	0	0	100			O (82)
Polarpesca I	1/5–14/8/04	Sp	295	4	299	99	309.3	1412.7	21	0	0	0	0	0	0	0	0	0	99	100		O (98)
Tierra del Fuego	3/5–14/8/04	Sp	178	0	178	100	254.0	1095.0	23	0	0	0	0	0	0	0	0	0	98			O (99)
Ibsa Quinto	2/5–25/6/04	Sp	57	0	57	100	329.8	1308.1	25	0	0	1	0	1	0	0	0	0	96			O (100)
Viking Bay	1/5–13/7/04	Sp	145	0	145	100	204.9	789.9	25	0	0	5	0	5	0	0	0	0	100			O (82)
Argos Georgia	2/5–15/8/04	Sp	233	55	288	81	595.6	1227.6	48	0	0	0	0	0	0	0	0	0	100	98		O (99)
Argos Helena	2/5–16/8/04	Auto	352	0	352	100	461.0	1736.4	26	1	0	6	0	7	0	0.002	0	0.002	100		(<1)	O (3)
Burdwood	5/5–17/8/04	Sp	194	0	194	100	423.2	1483.7	28	3	0	0	0	3	0	0.007	0	0.007	100*			O (3)
Jacqueline	3/5–7/7/04	Sp	54	0	54	100	268.4	970.5	27	0	0	0	0	0	0	0	0	0	98			O (98)
No. 22 InSung	1/5–19/8/04	Sp	202	3	205	99	406.5	1890.1	21	0	0	0	0	0	0	0	0	0	100	100		O (99)
Isla Alegranza	2/5–23/7/04	Sp	139	0	139	100	333.7	1302.4	25	0	0	2	0	2	0	0	0	0	98			O (96)
Paloma V	21/7–19/8/04	Sp	53	0	53	100	143.6	509.8	28	0	0	0	0	0	0	0	0	0	100			O (96)
Koryo Maru No. 11	12/5–20/8/04	Sp	181	1	182	99	321.4	1723.5	18	0	0	0	0	0	0	0	0	0	100	100		O (86)
Total						98	4943.1	18277.3	28							0.001	0	0.001				
Subarea 48.6																						
Shinsei Maru No. 3	7/3–21/3/04	Sp	12	17	29	41	40.4	173.8	23	0	0	0	0	0	0	0	0	0	100	100		O (0)
Total						41	40.4	173.8	23							0	0	0				
Divisions 58.4.2, 58.4.3b																						
Eldfisk	30/11/03–24/1/04	Auto	0	70	70	0	125.0	319.7	39	0	0	0	0	0	0	0	0	0		100		O (0)
Total						0	125.0	319.7	39							0	0	0				
Division 58.5.2																						
Janas	30/4–24/6/04	Auto	141	0	141	100	291.0	881.6	33	0	0	0	0	0	0	0	0	0	100			O (0)
Janas	20/7–10/9/04	Auto	133	3	136	98	244.9	716.7	34	0	0	0	0	0	0	0	0	0	100	100		O (0)
Total						99	535.9	1598.3	34							0	0	0				
Subareas 58.6, 58.7, Area 51																						
Koryo Maru No. 11	19/2–30/3/04	Sp	50	23	73	68	263.8	700.8	37	0	1	10	1	10	2	0	0.012	0.004	100	100	(6)	O (91)
South Princess	19/5–7/7/04	Auto	231	7	238	97	175.4	637.6	27	10	0	0	0	10	0	0.058	0	0.057	100	100		S (0)
Total						90	439.2	1338.4	32							0.028	0.012	0.025				

(continued)

Table 7.1 (continued)

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks (thousands)			No. of birds caught						Observed seabird mortality (birds/thousand hooks)			Streamer line in use %		Offal discharge during	
			N	D	Total	%N	Obs.	Set	% observed	Dead N	Dead D	Alive N	Alive D	Total N	Total D	N	D	Total	N	D	Set (%)	Haul (%)
Subareas 88.1, 88.2																						
Antarctic II	7/2–4/3/04	Auto	11	69	80	14	141.9	275.5	51	0	0	0	0	0	0	0	0	0	18	93		(0)
Antarctic III	1/1–3/3/04	Auto	8	174	182	4	510.6	550.7	92	0	0	0	0	0	0	0	0	0	100	100		(0)
Arnela	29/12/03–3/3/04	Sp	0	119	119	0	331.4	923.8	35	0	0	0	0	0	0	0	0	0		98	(4)*	O (24)
Argos Helena	21/2–7/3/04	Auto	0	36	36	0	73.2	154.4	47	0	0	0	0	0	0	0	0	0		100		(0)
No. 707 Bonanza	10/1–3/3/04	Sp	2	83	85	2	791.8	795.8	99	0	0	0	0	0	0	0	0	0	50	98		(0)
No. 829 Yeon Seong	30/1–3/3/04	Sp	8	38	46	17	399.6	506.3	78	0	0	0	0	0	0	0	0	0	100	100		(0)
Gudni Olafsson	27/12/03–10/2/04	Auto	0	76	76	0	221.4	509.0	43	0	0	0	0	0	0	0	0	0		100		(0)
San Aotea II	12/12/03–21/2/04	Auto	0	134	134	0	241.1	641.2	37	0	0	0	0	0	0	0	0	0		100		(0)
Volna	15/12/03–9/3/04	Sp	1	104	105	1	332.8	802.4	41	0	0	0	0	0	0	0	0	0	100	100		(0)
Yantar	15/12/03–9/3/04	Sp	1	116	117	1	928.8	994.7	93	0	0	0	0	0	0	0	0	0	100	100		(0)
Mellas	2/1–3/3/04	Sp	20	72	92	22	445.0	490.3	90	0	0	0	0	0	0	0	0	0	100	100		(0)
Simeiz	15/12/03–7/3/04	Sp	4	106	110	4	802.9	862.4	93	0	0	0	0	0	0	0	0	0	100	100		(0)
Sonrisa	10/2–4/3/04	Auto	0	10	10	0	55.6	62.6	88	0	0	0	0	0	0	0	0	0		100		(0)
Piscis	12/1–7/3/04	Sp	16	82	98	16	646.3	781.4	82	0	1	0	0	0	1	0	0.002	0.002	100	100		(0)
Punta Ballena	11/1–3/3/04	Auto	3	68	71	4	134.0	438.9	30	0	0	0	0	0	0	0	0	0	67	94		(0)
America I	12/12/03–5/3/04	Sp	7	101	108	6	368.0	627.3	58	0	0	0	1	0	1	0	0	0	100	94		(0)
American Warrior	8/1–3/3/04	Auto	0	118	118	0	232.0	689.0	33	0	0	0	0	0	0	0	0	0		100		(0)
South Princess	15/12/03–4/3/04	Auto	1	199	200	1	313.6	755.2	41	0	0	0	0	0	0	0	0	0	100	99		(0)
Frøyanes	23/1–4/3/04	Auto	3	128	131	2	319.5	609.5	52	0	0	0	0	0	0	0	0	0	100	100		(0)
Avro Chieftain	1/12/03–19/3/04	Auto	19	165	184	10	495.3	977.4	50	0	0	0	0	0	0	0	0	0	100	100		(0)
Janas	12/12/03–24/2/04	Auto	0	118	118	0	321.9	648.8	49	0	0	0	0	0	0	0	0	0		100		(0)
San Liberatore	1/2–6/3/04	Auto	1	113	114	1	261.5	505.4	51	0	0	0	0	0	0	0	0	0	100	100		(0)
Total						5	8368.2	13602.0	61							0	<0.001	<0.001				

Table 7.2: Estimated total seabird mortality for those vessels where seabird mortalities were observed in Subareas 48.3, 58.6, 58.7, 88.1 and 88.2 during the 2003/04 season.

Vessel	Hooks observed (thousands)	Hooks set (thousands)	Percentage of hooks observed	% Night sets	Estimated number of birds caught dead		
					Night	Day	Total
Subarea 48.3							
Isla Santa Clara	285.2	1144.7	24	99	5	0	5
Argos Helena	461	1736.4	26	100	3	0	3
Burdwood	423.2	1483.7	28	100	10	0	10
Subtotal					18	0	18
Subareas 58.6, 58.7							
Koryo Maru No. 11	263.8	700.8	37	68	0	3	3
South Princess	175.4	637.6	27	97	36	0	36
Subtotal					36	3	39
Subareas 88.1, 88.2							
Piscis	646.3	781.4	82	16	0	1	1
Subtotal					0	1	1
Total					54	4	58

Table 7.3: Total estimated seabird by-catch and by-catch rate (birds/thousand hooks) in longline fisheries in Subareas 48.3, 58.6, 58.7, 88.1 and 88.2 from 1997 to 2004.

Subarea	Year							
	1997	1998	1999	2000	2001	2002	2003	2004
Subarea 48.3								
Estimated by-catch	5 755	640	210*	21	30	27	8	18
By-catch rate	0.23	0.032	0.013*	0.002	0.002	0.0015	0.0003	0.001
Subareas 58.6, 58.7								
Estimated by-catch	834	528	156	516	199	0	7	39
By-catch rate	0.52	0.194	0.034	0.046	0.018	0	0.003	0.025
Subareas 88.1, 88.2								
Estimated by-catch	-	0	0	0	0	0	0	1
By-catch rate	-	0	0	0	0	0	0	0.0001

* Excluding *Argos Helena* line-weighting experiment cruise.

Table 7.4: Species composition of birds killed in longline fisheries in Subareas 48.3, 58.6, 58.7, 88.1 and 88.2 during the 2003/04 season. N – night setting; D – daylight setting (including nautical dawn and dusk); DIC – grey-headed albatross; DIM – black-browed albatross; MAH – northern giant petrel; MAI – southern giant petrel; PRO – white-chinned petrel; PRX – petrels unidentified; () – % composition.

Vessel	Dates of fishing	No. birds killed by group						Species composition (%)				
		Albatrosses		Petrels		Total		DIC	DIM	MAH	MAI	PRO
		N	D	N	D	N	D					
Subarea 48.3												
Isla Santa Clara	1/5–23/7/04	1	0	0	0	1	0		1 (100)			
Argos Helena	2/5–16/8/04	1	0	0	0	1	0	1 (100)				
Burdwood	5/5–17/8/04	0	0	3	0	3	0				3 (100)	
Subareas 58.6, 58.7												
Koryo Maru No. 11	19/2–30/3/04	0	0	0	1	0	1					1 (100)
South Princess	19/5–7/7/04	0	0	10	0	10	0			4 (40)	6 (60)	
Subareas 88.1, 88.2												
Piscis	12/1–7/3/04	0	0	0	1	0	1				1 (100)	
Total (%)		2	0	13	2	15	2	1 (6)	1 (6)	4 (23)	10 (59)	1 (6)

Table 7.5: Reported and observed incidental mortality of seabirds in the longline fisheries for *Dissostichus* spp. in Subarea 58.6 and Division 58.5.1 during the 2001/02 season (September to August). Sp – Spanish method; Auto – autoliner; N – night-time setting; D – daytime setting (including dawn and dusk); NC – not collected.

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks (thousands)			Hooks baited (%)	No. of birds caught						Observed* seabird mortality (birds/1 000 hooks)			Streamer line in use %		Offal discharge during haul (%)
											Dead		Alive		Total							
			N	D	Total	%N	Obs.	Set	% Observed		N	D	N	D	N	D	N	D	Total	N	D	
Subarea 58.6																						
Ship 1	3/7–24/7/02	Auto	42	0	42	100	NC	495.0	NC	NC	2	0	NC	0	2	0	0.004	0	0.004	100	0	(0)
Ship 2	15/4–14/5/02	Auto	108	0	108	100	NC	502.0	NC	NC	77	0	NC	0	77	0	0.153	0	0.153	100	0	(0)
Ship 3	11/9–26/9/01	Auto	36	0	36	100	NC	347.3	NC	NC	1	0	NC	0	1	0	0.003	0	0.003	100	0	(0)
Ship 3	20/3–18/5/02	Auto	119	0	119	100	NC	1 348.2	NC	NC	152	0	NC	0	152	0	0.113	0	0.113	100	0	(0)
Ship 5	4/10–18/10/01	Auto	27	0	27	100	NC	318.1	NC	NC	34	0	NC	0	34	0	0.107	0	0.107	100	0	(0)
Ship 5	6/5–26/6/02	Auto	131	0	131	100	NC	1 155.2	NC	NC	60	0	NC	0	60	0	0.052	0	0.052	100	0	(0)
Ship 7	29/11–2/12/01	Auto	5	0	5	100	NC	50.0	NC	NC	11	0	NC	0	11	0	0.220	0	0.220	100	0	(0)
Ship 7	11/3–27/3/02	Auto	29	0	29	100	NC	308.0	NC	NC	388	0	NC	0	388	0	1.260	0	1.260	100	0	(0)
Ship 7	21/6–14/7/02	Auto	54	0	54	100	NC	512.0	NC	NC	6	0	NC	0	6	0	0.012	0	0.012	100	0	(0)
Ship 8	24/1–29/3/02	Auto	207	0	207	100	NC	1 206.0	NC	NC	314	0	NC	0	314	0	0.260	0	0.260	100	0	(0)
Ship 9	25/9–30/9/01	Sp	5	0	5	100	NC	61.3	NC	NC	0	0	NC	0	0	0	0.000	0	0.000	100	0	(0)
Ship 9	7/12–25/12/01	Sp	18	0	18	100	NC	252.0	NC	NC	11	0	NC	0	11	0	0.044	0	0.044	100	0	(0)
Ship 9	22/2–19/3/02	Sp	28	0	28	100	NC	336.0	NC	NC	186	0	NC	0	186	0	0.554	0	0.554	100	0	(0)
Ship 9	14/5–18/5/02	Sp	6	0	6	100	NC	50.4	NC	NC	0	0	NC	0	0	0	0.000	0	0.000	100	0	(0)
Ship 9	1/6–15/7/02	Sp	60	0	60	100	NC	491.4	NC	NC	1	0	NC	0	1	0	0.002	0	0.002	100	0	(0)
Total						100	NC	7 432.8	NC		1 243	0	NC	0	1 243		0.167	0	0.167			
Division 58.5.1																						
Ship 1	18/3–26/5/02	Auto	132	0	132	100	NC	1 575.5	NC	NC	1 318	0	NC	0	1 318	0	0.837	0	0.837	100	0	(0)
Ship 2	17/5–8/6/02	Auto	61	0	61	100	NC	423.8	NC	NC	106	0	NC	0	106	0	0.250	0	0.250	100	0	(0)
Ship 2	28/6–28/7/02	Auto	80	0	80	100	NC	603.5	NC	NC	91	0	NC	0	91	0	0.151	0	0.151	100	0	(0)
Ship 3	30/9–3/11/01	Auto	74	0	74	100	NC	795.9	NC	NC	1 213	0	NC	0	1 213	0	1.524	0	1.524	100	0	(0)
Ship 3	14/12/01–14/1/02	Auto	56	0	56	100	NC	764.4	NC	NC	28	0	NC	0	28	0	0.037	0	0.037	100	0	(0)
Ship 5	21/10–6/12/01	Auto	116	0	116	100	NC	1 079.0	NC	NC	447	0	NC	0	447	0	0.414	0	0.414	100	0	(0)
Ship 5	25/4/01–2/5/02	Auto	19	0	19	100	NC	173.9	NC	NC	13	0	NC	0	13	0	0.075	0	0.075	100	0	(0)
Ship 5	11/1–18/3/02	Auto	151	0	151	100	NC	1 501.7	NC	NC	4 811	0	NC	0	4 811	0	3.204	0	3.204	100	0	(0)
Ship 7	4/12/01–31/1/02	Auto	81	0	81	100	NC	1 059.0	NC	NC	1 292	0	NC	0	1 292	0	1.220	0	1.220	100	0	(0)
Ship 7	1/4–15/5/02	Auto	93	0	93	100	NC	688.0	NC	NC	966	0	NC	0	966	0	1.404	0	1.404	100	0	(0)
Ship 8	22/9–27/11/01	Auto	237	0	237	100	NC	1 331.4	NC	NC	338	0	NC	0	338	0	0.254	0	0.254	100	0	(0)
Ship 8	16/5–17/6/02	Auto	112	0	112	100	NC	662.4	NC	NC	93	0	NC	0	93	0	0.140	0	0.140	100	0	(0)
Ship 9	2/10–17/11/01	Sp	46	0	46	100	NC	535.5	NC	NC	62	0	NC	0	62	0	0.116	0	0.116	100	0	(0)
Ship 9	24/3–22/4/02	Sp	41	0	41	100	NC	360.5	NC	NC	36	0	NC	0	36	0	0.100	0	0.100	100	0	(0)
Total						100	NC	11 554.3	NC		10 814	0	NC	0	10 814		0.936	0	0.936			

* The number of observed hooks has not been collected and the rates given are from the total number of hooks set.

Table 7.6: Species composition of birds killed in longline fisheries in Subarea 58.6 and Division 58.5.1 during the 2001/02 season (September to August). PRO – white-chinned petrel; MXB – giant petrel; PCI – grey petrel; DAC – cape petrel; PTZ – unidentified petrel; DIC – grey-headed albatross; DIM – black-browed albatross; ALZ – unidentified albatross; EUC – macaroni penguin; EDJ – king penguin; PYP – gentoo penguin; UNK – unknown; () – % composition.

Vessel	Dates of fishing	No. birds killed by group								Species composition (%)											
		Petrels		Albatrosses		Penguins		Total		PRO	MXB	PCI	DAC	PTZ	DIC	DIM	ALZ	EUC	EDJ	PYP	UNK
		N	D	N	D	N	D	N	D												
Subarea 58.6																					
Ship 1	3/7–24/07/02	2	0	0	0	0	0	2	0			2 (100)									
Ship 2	15/4–14/05/02	59	0	18	0	0	0	77	0	33(42.9)	20 (26.0)	6 (7.8)			17 (22.1)						1 (1.3)
Ship 3	11/9–26/09/01	1	0	0	0	0	0	1	0	1 (100)											
Ship 3	20/3–18/05/02	152	0	0	0	0	0	152	0	152 (100)											
Ship 5	4/10–18/10/01	34	0	0	0	0	0	34	0	34 (100)											
Ship 5	6/5–26/06/02	56	0	0	0	0	0	60	0		38 (63.3)	16 (26.7)		2 (3.3)							4 (6.7)
Ship 7	29/11–02/12/01	11	0	0	0	0	0	11	0	3(27.3)	8 (72.7)										
Ship 7	11/3–27/03/02	388	0	0	0	0	0	388	0	388 (100)											
Ship 7	21/6–14/07/02	6	0	0	0	0	0	6	0		1 (16.7)	4 (66.7)	1 (16.7)								
Ship 8	24/1–29/03/02	312	0	2	0	0	0	314	0	312(99.4)							2 (0.6)				
Ship 9	25/9–30/09/01	0	0	0	0	0	0	0	0												
Ship 9	7/12–25/12/01	11	0	0	0	0	0	11	0	11 (100)											
Ship 9	22/2–19/03/02	179	0	5	0	2	0	186	0	179(96.2)					4 (2.2)	1 (0.5)			1 (0.5)	1 (0.5)	
Ship 9	14/5–18/05/02	0	0	0	0	0	0	0	0												
Ship 9	1/6–15/07/02	1	0	0	0	0	0	1	0			1 (100)									
Division 58.5.1																					
Ship 1	18/3–26/05/02	1304	0	14	0	0	0	1318	0	1271(96.4)		33 (2.5)			14 (1.1)						
Ship 2	17/5–08/06/02	106	0	0	0	0	0	106	0		5 (4.7)	101(95.3)									
Ship 2	28/6–28/07/02	91	0	0	0	0	0	91	0		12 (13.2)	79 (86.8)									
Ship 3	30/9–03/11/01	1213	0	0	0	0	0	1213	0	1212(99.9)		1 (0.1)									
Ship 3	14/12/01–14/01/02	28	0	0	0	0	0	28	0	28 (100)											
Ship 5	21/10–06/12/01	447	0	0	0	0	0	447	0	447 (100)											
Ship 5	25/4/01–02/05/02	12	0	1	0	0	0	13	0			11 (84.6)		1 (7.7)			1 (7.7)				
Ship 5	11/1–18/03/02	4797	0	14	0	0	0	4811	0	4790(99.6)	1 (0.02)	5 (0.1)	1 (0.02)		1 (0.02)	13 (0.3)					
Ship 7	4/12/01–31/01/02	1286	0	4	0	1	0	1292	0	1286(99.5)						4 (0.3)		1 (0.1)			1 (0.1)
Ship 7	1/4–15/05/02	965	0	1	0	0	0	966	0	949(98.2)	3 (0.3)	13 (1.3)					1 (0.1)				
Ship 8	22/9–27/11/01	338	0	0	0	0	0	338	0			338 (100)									
Ship 8	16/5–17/06/02	92	0	0	0	0	0	93	0	8 (8.6)		84 (90.3)									1 (1.1)
Ship 9	2/10–17/11/01	62	0	0	0	0	0	62	0	62 (100)											
Ship 9	24/3–22/04/02	36	0	0	0	0	0	36	0	36 (100)											
Total (%)		11989	0	59	0	3	0	12057	0	11202 (92.9)	88 (0.7)	694 (5.8)	2 (0.02)	3 (0.02)	36 (0.3)	18 (0.15)	4 (0.3)	1 (0.01)	1 (0.01)	1 (0.01)	7 (0.06)

Table 7.7: Reported and observed incidental mortality of seabirds in the longline fisheries for *Dissostichus* spp. in Subarea 58.6 and Division 58.5.1 during the 2002/03 season (September to August). Sp – Spanish method; Auto – autoliner; N – night-time setting; D – daytime setting (including dawn and dusk); NC – not collected.

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks (thousands)			Hooks baited* (%)	No. of birds caught						Observed † seabird mortality (birds/1 000 hooks)			Streamer line in use %		Offal discharge during haul (%)
			N	D	Total	%N	Obs.	Set	% Observed		Dead		Alive		Total							
											N	D	N	D	N	D	N	D	Total	N	D	
Subarea 58.6																						
Ship 1	25/9–10/12/02	Auto	145	0	145	100	NC	1553.4	NC	-	231	0	NC	0	231	0	0.149	0	0.149	100	0	(0)
Ship 2	9/9–3/10/02	Auto	82	0	82	100	NC	412.5	NC	-	36	0	NC	0	36	0	0.087	0	0.087	100	0	(0)
Ship 2	13/1–3/2/03	Auto	67	0	67	100	NC	424.1	NC	-	95	0	NC	0	95	0	0.224	0	0.224	100	0	(0)
Ship 2	26/2–10/3/03	Auto	45	0	45	100	NC	315.0	NC	-	158	0	NC	0	158	0	0.502	0	0.502	100	0	(0)
Ship 2	14/7–30/7/03	Auto	43	0	43	100	NC	323.8	NC	90.00	1	0	NC	0	1	0	0.003	0	0.003	100	0	(0)
Ship 3	5/12/02–10/2/03	Auto	127	0	127	100	NC	1454.8	NC	-	73	0	NC	0	73	0	0.050	0	0.050	100	0	(0)
Ship 5	13/4–30/5/03	Auto	103	0	103	100	NC	1027.8	NC	-	44	0	NC	0	44	0	0.043	0	0.043	100	0	(0)
Ship 6	13/12/02–3/1/03	Auto	50	0	50	100	NC	292.4	NC	-	53	0	NC	0	53	0	0.181	0	0.181	100	0	(0)
Ship 7	3/4–13/5/03	Auto	86	0	86	100	NC	789.3	NC	90.25	29	0	NC	0	29	0	0.037	0	0.037	100	0	(0)
Total						100	NC	6593.0	NC		720	0	NC	0	720	0	0.109	0	0.109			
Division 58.5.1																						
Ship 1	13/1–29/03/03	Auto	160	0	160	100	NC	2250.0	NC	85.01	2 028	0	NC	0	2 028	0	0.901	0	0.901	100	0	(0)
Ship 1	7/5–17/07/03	Auto	191	0	191	100	NC	1792.8	NC	86.20	274	0	NC	0	274	0	0.153	0	0.153	100	0	(0)
Ship 2	6/10–06/11/02	Auto	101	0	101	100	NC	730.8	NC	-	1 366	0	NC	0	1 366	0	1.869	0	1.869	100	0	(0)
Ship 2	25/11/02–09/01/03	Auto	126	0	126	100	NC	1077.4	NC	-	98	0	NC	0	98	0	0.091	0	0.091	100	0	(0)
Ship 2	13/3–06/05/03	Auto	153	0	153	100	NC	1300.5	NC	-	357	0	NC	0	357	0	0.275	0	0.275	100	0	(0)
Ship 2	28/5–11/07/03	Auto	120	0	120	100	NC	1073.8	NC	90.00	23	0	NC	0	23	0	0.021	0	0.021	100	0	(0)
Ship 3	1/9/02–30/10/03	Auto	129	0	129	100	NC	1356.6	NC	-	145	0	NC	0	145	0	0.107	0	0.107	100	0	(0)
Ship 3	19/3–18/06/03	Auto	200	0	200	100	NC	2090.5	NC	-	1 391	0	NC	0	1 391	0	0.665	0	0.665	100	0	(0)
Ship 4	19/10/02–11/01/03	Sp	123	0	123	100	NC	768.4	NC	-	107	0	NC	0	107	0	0.139	0	0.139	100	0	(0)
Ship 4	15/2–04/05/03	Sp	138	0	138	100	NC	999.1	NC	-	307	0	NC	0	307	0	0.307	0	0.307	100	0	(0)
Ship 4	4/6–30/08/03	Sp	202	0	202	100	NC	1101.1	NC	-	27	0	NC	0	27	0	0.025	0	0.025	100	0	(0)
Ship 5	10/9–13/11/02	Auto	141	0	141	100	NC	1386.0	NC	-	710	0	NC	0	710	0	0.512	0	0.512	100	0	(0)
Ship 5	19/12/02–04/03/03	Auto	167	0	167	100	NC	1854.0	NC	-	285	0	NC	0	285	0	0.154	0	0.154	100	0	(0)
Ship 5	1/6–07/07/03	Auto	75	0	75	100	NC	832.5	NC	-	131	0	NC	0	131	0	0.157	0	0.157	100	0	(0)
Ship 6	1/9–10/11/02	Auto	190	0	190	100	NC	1094.2	NC	-	1 469	0	NC	0	1 469	0	1.343	0	1.343	100	0	(0)
Ship 6	5/1–20/02/03	Auto	113	0	113	100	NC	818.2	NC	-	2 079	0	NC	0	2 079	0	2.541	0	2.541	100	0	(0)
Ship 6	2/4–14/06/03	Auto	214	0	214	100	NC	1453.1	NC	-	174	0	NC	0	174	0	0.120	0	0.120	100	0	(0)
Ship 6	26/7–30/08/03	Auto	77	0	77	100	NC	607.2	NC	-	120	0	NC	0	120	0	0.198	0	0.198	100	0	(0)
Ship 7	4/9–07/11/02	Auto	124	0	124	100	NC	1289.7	NC	91.60	859	0	NC	0	859	0	0.666	0	0.666	100	0	(0)
Ship 7	15/12/02–23/02/03	Auto	159	0	159	100	NC	1642.5	NC	-	1 909	0	NC	0	1 909	0	1.162	0	1.162	100	0	(0)
Ship 7	16/5–23/06/03	Auto	76	0	76	100	NC	854.1	NC	89.41	10	0	NC	0	10	0	0.012	0	0.012	100	0	(0)
Ship 7	9/8–02/09/03	Auto	55	0	55	100	NC	512.1	NC	-	57	0	NC	0	57	0	0.111	0	0.111	100	0	(0)
Total						100	NC	26884.4	NC		13 926	0	NC	0	13 926	0	0.518	0	0.518			

* Data from a sample of hooks.

† The number of observed hooks has not been collected and the rates given are from the total number of hooks set.

Table 7.8: Species composition of birds killed in longline fisheries in Subarea 58.6 and Division 58.5.1 during the 2002/03 season (September to August). PRO – white-chinned petrel; MXB – giant petrel; PCI – grey petrel; DAC – cape petrel; PTZ – unidentified petrel; DIC – grey-headed albatross; DIM – black-browed albatross; EUC – macaroni penguin; PVF – unidentified penguin; UNK – unknown; () – % composition.

Vessel	Dates of fishing	No. of birds killed by group								Species composition (%)									
		Albatrosses		Petrels		Penguins		Total		PRO	MXB	PCI	DAC	PTZ	DIC	DIM	EUC	PVF	UNK
		N	D	N	D	N	D	N	D										
Subarea 58.6																			
Ship 1	25/9–10/12/02	0	0	231	0	0	0	231	0	227 (98.3)	4 (1.7)								
Ship 2	9/9–3/10/02	0	0	31	0	0	0	36	0	19 (52.8)	3 (8.3)	9 (25.0)							5 (13.9)
Ship 2	13/1–3/2/03	1	0	93	0	1	0	95	0	93 (97.9)						1 (1.1)		1 (1.1)	
Ship 2	26/2–10/3/03	2	0	156	0	0	0	158	0	156 (98.7)						2 (1.3)			
Ship 2	14/7–30/7/03	0	0	1	0	0	0	1	0			1 (100)							
Ship 3	5/12/02–10/2/03	0	0	71	0	1	0	73	0	70 (95.9)	1 (1.4)						1 (1.4)		1 (1.4)
Ship 5	13/4–30/5/03	0	0	44	0	0	0	44	0	25 (56.8)	8 (18.2)	11 (25.0)							
Ship 6	13/12/02–3/1/03	9	0	44	0	0	0	53	0	19 (35.8)	25 (47.2)					9(17.0)			
Ship 7	3/4–13/5/03	0	0	29	0	0	0	29	0	29 (100)									
Division 58.5.1																			
Ship 1	13/1–29/3/03	0	0	2028	0	0	0	2028	0	2028 (100)									
Ship 1	7/5–17/7/03	0	0	274	0	0	0	274	0	1 (0.4)		273 (99.6)							
Ship 2	6/10–6/11/02	3	0	1363	0	0	0	1366	0	1363 (99.8)					1 (0.1)	2 (0.1)			
Ship 2	25/11/02–9/1/03	4	0	93	0	0	0	98	0	93 (94.9)						4 (4.1)			1 (1.0)
Ship 2	13/3–6/5/03	2	0	355	0	0	0	357	0	350 (98.0)	1 (0.3)	4 (1.1)			1 (0.3)	1 (0.3)			
Ship 2	28/5–11/7/03	0	0	23	0	0	0	23	0	22 (95.7)			1 (4.3)						
Ship 3	1/9/02–30/10/03	0	0	145	0	0	0	145	0	144 (99.3)		1 (0.7)							
Ship 3	19/3–18/6/03	12	0	1379	0	0	0	1391	0	1176 (84.5)	1 (0.1)	200 (14.4)	2 (0.1)		5 (0.4)	7 (0.5)			
Ship 4	19/10/02–11/1/03	0	0	107	0	0	0	107	0	107 (100)									
Ship 4	15/2–4/5/03	0	0	307	0	0	0	307	0	299 (97.4)		8 (2.6)							
Ship 4	4/6–30/8/03	0	0	27	0	0	0	27	0			27 (100)							
Ship 5	10/9–13/11/02	0	0	710	0	0	0	710	0	704 (99.2)		6 (0.8)							
Ship 5	19/12/02–4/3/03	0	0	284	0	0	0	285	0	284 (99.6)									1 (0.4)
Ship 5	1/6–7/7/03	0	0	131	0	0	0	131	0			130 (99.2)		1 (0.8)					
Ship 6	1/9–10/11/02	16	0	1412	0	0	0	1469	0	1432 (97.5)	13 (0.9)		4 (0.3)		1 (0.1)	15 (1.0)			4 (0.3)
Ship 6	5/1–20/2/03	23	0	2056	0	0	0	2079	0	2055 (98.8)	1 (0.04)				2 (0.1)	21 (1.0)			
Ship 6	2/4–14/6/03	0	0	174	0	0	0	174	0	172 (98.9)	1 (0.6)	1 (0.6)							
Ship 6	26/7–30/8/03	2	0	119	0	0	0	120	0	4 (3.3)	1 (0.8)	113 (94.2)	1 (0.8)		1 (0.8)				
Ship 7	4/9–7/11/02	0	0	856	0	0	0	859	0	857 (99.8)			1 (0.1)						1 (0.1)
Ship 7	15/12/02–23/2/03	1	0	1908	0	0	0	1909	0	1908 (99.9)						1 (0.1)			
Ship 7	16/5–23/6/03	0	0	10	0	0	0	10	0			10 (100)							
Ship 7	9/8–2/9/03	0	0	57	0	0	0	57	0	4 (7.0)		52 (91.2)	1 (1.8)						
Total (%)		75	0	14518	0	2	0	14646	0	13641 (93.10)	59 (0.40)	846 (5.78)	10 (0.07)	1 (0.01)	11 (0.08)	63 (0.43)	1 (0.01)	1 (0.01)	13 (0.09)

Table 7.9: Reported and observed incidental mortality of seabirds in the longline fisheries for *Dissostichus* spp. in Subarea 58.6 and Division 58.5.1 during the 2003/04 season (September to August). Sp – Spanish method; Auto – autoliner; N – night-time setting; D – daytime setting (including nautical dawn and dusk); NC – not collected.

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks (thousands)			Hooks baited* (%)	No. of birds caught						Observed seabird mortality (birds/1 000 hooks)			Streamer line in use %		Offal discharge during haul (%)
			N	D	Total	%N	Obs.	Set	% Observed		Dead		Alive[#]		Total							
											N	D	N	D	N	D	N	D	Total	N	D	
Subarea 58.6																						
Ship 1	14/1–25/2/04	Auto	69	0	69	100	NC	680.4	NC	NC	12[†]	0	0	0	12	0	0.018	0	0.018	100	0	(0)
Ship 2	7/9–28/9/03	Auto	61	0	61	100	NC	466.9	NC	NC	11[†]	0	4	0	15	0	0.024	0	0.024	100	0	(0)
Ship 2	2/2–9/2/04	Auto	25	0	25	100	NC	156.3	NC	NC	32[†]	0	0	0	32	0	0.205	0	0.205	100	0	(0)
Ship 3	24/11–17/12/03	Auto	38	0	38	100	NC	467.3	NC	82.00	4[†]	0	7	0	11	0	0.009	0	0.009	100	0	(0)
Ship 4	24/1–31/1/04	Sp	15	0	15	100	NC	84.4	NC	100.00	5[†]	0	0	0	5	0	0.059	0	0.059	100	0	(0)
Ship 5	13/9–1/10/03	Auto	43	0	43	100	NC	410.4	NC	NC	3[†]	0	0	0	3	0	0.007	0	0.007	100	0	(0)
Ship 5	3/2–26/2/04	Auto	52	0	52	100	NC	455.5	NC	NC	157[†]	0	35	0	192	0	0.345	0	0.345	100	0	(0)
Ship 6	1/2–23/2/04	Auto	86	0	86	100	NC	418.5	NC	NC	9[†]	0	1	0	10	0	0.022	0	0.022	100	0	(0)
Ship 7	25/11–7/12/03	Auto	18	0	18	100	NC	261.5	NC	94.00	9[†]	0	3	0	12	0	0.034	0	0.034	100	0	(0)
							NC	3401.0	NC		242	0	50	0	292	0	0.080					
Ship 1	15/7–25/7/04	Auto	24	0	24	100	45.2	221.9	20.4	NC	0	0	4	0	4	0	0.000	0	0.000	100	0	(0)
Ship 2	2/5–17/5/04	Auto	40	0	40	100	69.0	273.0	25.3	88.92	0	0	1	0	1	0	0.000	0	0.000	100	0	(0)
Ship 2	29/7–4/8/04	Auto	19	0	19	100	41.2	125.0	33.0	90.00	0	0	0	0	0	0	0.000	0	0.000	100	0	(0)
Ship 3	17/6–16/7/04	Auto	62	0	62	100	191.7	588.0	32.6	88.41	2	0	0	0	2	0	0.010	0	0.010	100	0	(0)
Ship 4	13/8–31/8/04	Sp	37	0	37	100	62.4	260.6	23.9	100.00	0	0	0	0	0	0	0.000	0	0.000	100	0	(0)
Ship 4	20/4–29/4/04	Sp	18	0	18	100	32.9	132.8	24.8	100.00	0	0	0	0	0	0	0.000	0	0.000	100	0	(0)
Ship 5	17/7–20/7/04	Auto	9	0	9	100	22.5	64.5	34.9	89.22	0	0	0	0	0	0	0.000	0	0.000	100	0	(0)
Ship 7	7/6–29/6/04	Auto	56	0	56	100	27.1	469.9	5.8	95.00	1	0	0	0	1	0	0.037	0	0.037	100	0	(0)
Ship 7	9/3–27/3/04	Auto	50	0	50	100	26.7	412.7	6.5	95.00	5	0	0	0	5	0	0.186	0	0.185	100	0	(0)
							518.7	2548.3	20.4		8	0	5	0	13	0	0.026					
Division 58.5.1																						
Ship 1	24/9–14/12/03	Auto	200	0	200	100	NC	1927.8	NC	NC	700[†]	0	0	0	700	0	0.363	0	0.363	100	0	(0)
Ship 1	1/3–7/4/04	Auto	83	0	83	100	NC	922.5	NC	NC	68[†]	0	0	0	68	0	0.074	0	0.074	100	0	(0)
Ship 2	30/9–11/11/03	Auto	108	0	108	100	NC	1033.8	NC	NC	109[†]	0	5	0	114	0	0.105	0	0.105	100	0	(0)
Ship 2	29/11/03–29/1/04	Auto	161	0	161	100	NC	1321.3	NC	90.00	61[†]	0	0	0	61	0	0.046	0	0.046	100	0	(0)
Ship 3	4/9–21/10/03	Auto	89	0	89	100	NC	1099.4	NC	86.00	46[†]	0	3	0	49	0	0.042	0	0.042	100	0	(0)
Ship 3	21/12/03–31/1/04	Auto	81	0	81	100	NC	1078.4	NC	84.00	37[†]	0	1	0	38	0	0.034	0	0.034	100	0	(0)
Ship 4	19/10/03–19/1/04	Sp	170	0	170	100	NC	1313.2	NC	100.00	144[†]	0	15	0	159	0	0.110	0	0.110	100	0	(0)
Ship 5	3/10–7/12/03	Auto	161	0	161	100	NC	1536.3	NC	NC	58[†]	0	0	0	58	0	0.038	0	0.038	100	0	(0)
Ship 5	13/1–31/1/04	Auto	48	0	48	100	NC	408.1	NC	NC	86[†]	0	27	0	113	0	0.211	0	0.211	100	0	(0)
Ship 5	1/3–28/3/04	Auto	72	0	72	100	NC	700.4	NC	NC	164[†]	0	5	0	169	0	0.234	0	0.234	100	0	(0)
Ship 6	1/9–18/10/03	Auto	122	0	122	100	NC	1058.4	NC	79.00	349[†]	0	0	0	349	0	0.330	0	0.330	100	0	(0)
Ship 6	3/12/03–29/1/04	Auto	138	0	138	100	NC	1211.4	NC	NC	31[†]	0	0	0	31	0	0.026	0	0.026	100	0	(0)
Ship 7	1/9–27/10/03	Auto	102	0	102	100	NC	1314.6	NC	93.00	67[†]	0	0	0	67	0	0.051	0	0.051	100	0	(0)
Ship 7	10/12/03–31/1/04	Auto	94	0	94	100	NC	1264.2	NC	91.00	149[†]	0	2	0	151	0	0.118	0	0.118	100	0	(0)
							NC	16189.7	NC		2069	0	58	0	2217	0	0.127					

(continued)

Table 7.9 (continued)

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks (thousands)			Hooks baited*	No. of birds caught						Observed seabird mortality (birds/1 000 hooks)			Streamer line in use %		Offal discharge during haul (%)
											Dead		Alive#		Total							
			N	D	Total	%N	Obs.	Set	% Observed	(%)	N	D	N	D	N	D	N	D	Total	N	D	
Division 58.5.1 (continued)																						
Ship 1	14/5–11/7/04	Auto	114	0	114	100	298.6	1241.9	24.0	NC	14	0	4	0	18	0	0.047	0	0.047	100	0	(0)
Ship 2	4/3–28/4/04	Auto	146	0	146	100	288.3	1211.6	23.8	92.40	119	0	6	0	125	0	0.413	0	0.413	100	0	(0)
Ship 2	6/6–26/7/04	Auto	118	0	118	100	280.9	1029.6	27.3	89.40	31	0	33	0	64	0	0.110	0	0.110	101	0	(0)
Ship 3	11/3–15/5/04	Auto	122	0	122	100	398.3	1587.6	25.1	95.05	79	0	4	0	83	0	0.198	0	0.198	100	0	(0)
Ship 3	19/7–10/8/04	Auto	47	0	47	100	141.1	422.1	33.4	88.82	12	0	0	0	12	0	0.085	0	0.085	100	0	(0)
Ship 4	9/3–16/4/04	Sp	62	0	62	100	120.2	515.5	23.3	100.00	25	0	30	0	55	0	0.208	0	0.208	100	0	(0)
Ship 4	2/5–28/6/04	Sp	88	0	88	100	161.2	530.4	30.4	100.00	5	0	25	0	30	0	0.031	0	0.031	100	0	(0)
Ship 4	23/7–9/8/04	Sp	27	0	27	100	50.6	215.8	23.4	100.00	0	0	0	0	0	0	0.000	0	0.000	100	0	(0)
Ship 5	7/5–14/7/04	Auto	152	0	152	100	454.5	1481.1	30.7	89.72	2	0	0	0	2	0	0.004	0	0.004	100	0	(0)
Ship 6	7/4–28/6/04	Auto	199	0	199	100	429.4	1730.7	24.8	79.45	27	0	12	0	39	0	0.063	0	0.063	100	0	(0)
Ship 7	30/3–4/6/04	Auto	140	0	140	100	92.5	1549.8	6.0	95.30	20	0	1	0	21	0	0.216	0	0.216	100	0	(0)
							2715.6	11516.1	23.6		334	0	115	0	449	0	0.125					

* Data from a sample of hooks.

† The number of observed hooks has not been collected and the values given are from the total number of hooks set (birds reported).

\# Seabirds caught during hauling (thus during the day) and released alive.

Table 7.10: Species composition of birds killed in longline fisheries in Subarea 58.6 and Division 58.5.1 during the 2003/04 season (September to August). N – night-time setting; D – daytime setting (including nautical dawn and dusk); PRO – white-chinned petrel; MAH – northern giant petrel; PCI – grey petrel; DAC – cape petrel; PND – petrel non-determined; () – % composition.

Vessel	Dates of fishing	No. birds killed by group						Species composition (%)				
		Albatrosses		Petrels		Total		PRO	MAH	PCI	DAC	PND
		N	D	N	D	N	D					
Subarea 58.6												
Ship 1	14/1–25/2/04	0	0	12	0	12	0	12 (100.0)*				
Ship 1	15/7–25/7/04	0	0	0	0	0	0					
Ship 2	7/9–28/9/03	0	0	11	0	11	0	3 (27.3)*		7 (63.6)*		1 (9.1)*
Ship 2	2/2–9/2/04	0	0	32	0	32	0	32 (100.0)*				
Ship 2	2/5–17/5/04	0	0	0	0	0	0					
Ship 2	29/7–4/8/04	0	0	0	0	0	0					
Ship 3	24/11–17/12/03	0	0	4	0	4	0	4 (100.0)*				
Ship 3	17/6–16/7/04	0	0	2	0	2	0			2 (100.0)		
Ship 4	24/1–31/1/04	0	0	5	0	5	0	5 (100.0)*				
Ship 4	20/4–29/4/04	0	0	0	0	0	0					
Ship 4	13/8–31/8/04	0	0	1	0	1	0			1 (100.0)		
Ship 5	13/9–1/10/03	0	0	3	0	3	0	3 (100.0)*				
Ship 5	3/2–26/2/04	0	0	157	0	157	0	157 (100.0)*				
Ship 5	17/7–20/7/04	0	0	0	0	0	0					
Ship 6	1/2–23/2/04	0	0	9	0	9	0	9 (100.0)*				
Ship 7	25/11–7/12/03	0	0	9	0	9	0	9 (100.0)*				
Ship 7	9/3–27/3/04	0	0	5	0	5	0	5 (100.0)				
Division 58.5.1												
Ship 1	24/9–14/12/03	0	0	700	0	700	0	699 (99.9)*		1 (0.1)*		
Ship 1	1/3–7/4/04	0	0	68	0	68	0	68 (100.0)*				
Ship 1	14/5–11/7/04	0	0	14	0	14	0			14 (100.0)		
Ship 2	30/9–11/11/03	0	0	109	0	109	0	106 (97.2)*	2 (1.8)*	1 (0.9)*		
Ship 2	29/11/03–29/1/04	0	0	61	0	61	0	61 (100.0)*				
Ship 2	4/3–28/4/04	0	0	119	0	119	0	117 (98.3)		2 (1.7)		
Ship 2	6/6–26/7/04	0	0	31	0	31	0			31 (100.0)		
Ship 3	4/9–21/10/03	0	0	46	0	46	0	39 (84.8)*		7 (15.2)*		
Ship 3	21/12/03–31/1/04	0	0	37	0	37	0	37 (100.0)*				
Ship 3	11/3–15/5/04	0	0	79	0	79	0	74 (93.7)		5 (6.3)		
Ship 3	19/7–10/8/04	0	0	12	0	12	0			12 (100.0)		
Ship 4	19/10/03–19/1/04	0	0	144	0	144	0	143 (99.3)*	1 (0.7)*			
Ship 4	9/3–16/4/04	0	0	25	0	25	0	25 (100.0)				
Ship 4	2/5–28/6/04	0	0	5	0	5	0			5 (100.0)		
Ship 4	23/7–9/8/04	0	0	0	0	0	0					
Ship 5	3/10–7/12/03	0	0	58	0	58	0	58 (100.0)*				
Ship 5	13/1–31/1/04	0	0	86	0	86	0	86 (100.0)*				
Ship 5	1/3–28/3/04	0	0	164	0	164	0	162 (98.8)*		2 (1.2)*		
Ship 5	7/5–14/7/04	0	0	2	0	2	0			2 (100.0)		
Ship 6	1/9–18/10/03	0	0	349	0	349	0	322 (92.3)*		21 (6.0)*	6 (1.7)*	
Ship 6	3/12–29/12/03	0	0	31	0	31	0	31 (100.0)*				
Ship 6	7/4–28/6/04	0	0	27	0	27	0	21 (77.8)		6 (22.2)		
Ship 7	1/9–27/10/03	0	0	67	0	67	0	49 (73.1)*		18 (26.9)*		
Ship 7	10/12/03–31/1/04	0	0	149	0	149	0	149 (100.0)*				
Ship 7	30/3–4/6/04	0	0	20	0	20	0	18 (90.0)		2 (10.0)		
Total (%)		0	0	2654	0	2654	0	2504 (94.3)	3 (0.1)	140 (5.3)	6 (0.2)	1 (0.0)

* The number of observed hooks has not been collected and the values given are from the total number of hooks set.

Table 7.11: Annual reports of seabirds killed and the associated by-catch rates (number of birds killed per thousand hooks) in the longline fisheries for *Dissostichus* spp. in the French EEZs in Subarea 58.6 and Division 58.5.1. Data for the 1998/99 and 1999/2000 seasons are from WG-FSA-01/21, Appendix 1. In 2003/04, the number of birds estimated killed is based on the proportion of hooks observed (see paragraph 7.23). na – not applicable.

2003/04

Area	Number of birds reported killed	Number of birds estimated killed	Hook effort			By-catch rate		Total birds killed
			Reported cruises	Estimated cruises		Birds reported/ thousand hooks	Birds estimated/ thousand hooks	
				Total	Observed			
Subarea 58.6	242	100	3 401.0	2 548.3	518.7	0.080	0.026	342
Division 58.5.1	2 069	1 597	16 189.7	11 516.1	2 715.6	0.127	0.125	3 666
Total	**2 311**	1 697	19 590.7	14 064.4	2 234.3	0.118	0.106	**4 008**

2002/03

Area	Number of birds reported killed	Number of birds estimated killed	Total	Hook effort (thousands)	By-catch rate (birds reported/thousand hooks)
Subarea 58.6	720	na	720	6 593	0.109
Division 58.5.1	13 926	na	13 926	26 884.4	0.518
Total	14 646	na	**14 646**	**33 477.4**	0.437

2001/02

Area	Number of birds reported killed	Number of birds estimated killed	Total	Hook effort (thousands)	By-catch rate (birds reported/thousand hooks)
Subarea 58.6	1 243	na	1 243	7 432.8	0.167
Division 58.5.1	10 814	na	10 814	11 554.3	0.936
Total	12 057	na	**12 057**	**18 987.1**	0.635

(continued)

Table 7.11 (continued)

1999/2000

Area	Number of birds reported killed	Number of birds estimated killed	Total	Hook effort (thousands)	By-catch rate (birds reported/thousand hooks)
Subarea 58.6	360	na	360	1 931	0.186
Division 58.5.1	1 897	na	1 897	6 167.4	0.308
Total	2 257	na	**2 257**	**8 098.4**	0.279

1998/99

Area	Number of birds reported killed	Number of birds estimated killed	Total	Hook effort (thousands)	By-catch rate (birds reported/thousand hooks)
Subarea 58.6	1 326	na	1 326	1 789.0	0.741
Division 58.5.1	4 967	na	4 967	1 682.5	2.95
Total	6 293	na	**6 293**	**3 471.5**	1.81

Table 7.12: Compliance, as reported by observers, of streamer lines with the minimum specifications set out in Conservation Measure 25-02 (2003) during the 2003/04 season. Y – yes; N – no; - – no information; A – autoliner; Sp – Spanish.

Vessel name	Dates of fishing	Fishing method	Compliance with CCAMLR specifications	Compliance with details of streamer line specifications				Length of streamers (m)	Streamer line in use %	
				Attachment, height above water (m)	Total length (m)	No. streamers per line	Spacing of streamers per line (m)		Night	Day
Subarea 48.3										
Globalpesca I	8/5–18/7/04	Sp	N	N (5)	-	-	Y (3)	-	100	100
Isla Camila	1/5–30/6/04	Sp	N	Y (7)	Y (150)	10	Y (5)	N (1–6)	75	100
Isla Santa Clara	1/5–23/7/04	Sp	Y	Y (7)	Y (185)	8	Y (5)	Y (1–7.7)	100	100
Isla Sofía	1/5–4/7/04	Sp	Y	Y (7.4)	Y (150)	9	Y (5)	Y (1–6.5)	100	
Polarpesca I	1/5–14/8/04	Sp	Y	Y (7)	Y (151)	7	Y (5)	Y (1–7)	99	100
Tierra del Fuego	3/5–14/8/04	Sp	Y	Y (7)	Y (153)	5	Y (5)	Y (1–6.5)	98	
Ibsa Quinto	2/5–25/6/04	Sp	Y	Y (7)	Y (157)	6	Y (5)	Y (1–6.5)	96	
Viking Bay	1/5–13/7/04	Sp	N	N (6.3)	N (83)	50	Y (1.5)	N (0.8)	100	
Argos Georgia	2/5–15/8/04	Sp	N	Y (7)	Y (150)	5	Y (5)	N (1.5–5)	100	98
Argos Helena	2/5–16/8/04	A	Y	Y (7.7)	Y (160)	7	Y (5)	Y (1–7.5)	100	
Burdwood	5/5–17/8/04	Sp	Y	Y (7)	Y (150)	-	Y (5)	Y (1–6.5)	100	
Jacqueline	3/5–7/7/04	Sp	Y	Y (7.9)	Y (157)	29	Y (5)	Y (1–7.2)	98	
No. 22 InSung	1/5–19/8/04	Sp	Y	Y (7.1)	Y (200)	9	Y (5)	Y (1–6.5)	100	100
Isla Alegranza	2/5–23/7/04	Sp	Y	Y (7.7)	Y (167)	7	Y (5)	Y (1–6.5)	98	
Paloma V	21/7–19/8/04	Sp	Y	Y (7)	Y (150)	11	Y (5)	Y (1–6.5)	100	
Koryo Maru No. 11	12/5–20/8/04	Sp	N	Y (8)	Y (150)	2	Y (5)	N (5)	100	100
Subarea 48.6										
Shinsei Maru No. 3	7/3–21/3/04	Sp	N	Y (7)	Y (158)	5	Y (5)	N (2–5)	100	100
Subareas 58.6, 58.7										
Koryo Maru No. 11	19/2–30/3/04	Sp	N	N (5)	Y (177)	6	Y (5)	Y (1–6.5)	100	100
South Princess	19/5–7/7/04	A	Y	Y (7)	Y (150)	14	Y (5)	Y (1–6.5)	100	100
Subareas 88.1, 88.2										
Antarctic II	7/2–4/3/04	A	Y	Y (7)	Y (200)	6	Y (5)	-	18	93
Antarctic III	1/1–3/3/04	A	N	N (6)	Y (150)	5	Y (5)	-	100	100
Arnela	29/12/03–3/3/04	Sp	N	N (6.5)	Y (180)	12	Y (5)	Y (1–6.6)		98

(continued)

Table 7.12 (continued)

Vessel name	Dates of fishing	Fishing method	Compliance with CCAMLR specifications	Compliance with details of streamer line specifications				Length of streamers (m)	Streamer line in use %	
				Attachment, height above water (m)	Total length (m)	No. streamers per line	Spacing of streamers per line (m)		Night	Day
Argos Helena	21/2–7/3/04	A	Y	Y (7)	Y (150)	7	Y (5)	Y (1–7.5)		100
No. 707 Bonanza	10/1–3/3/04	Sp	N	Y (7.5)	Y (150)	36	Y (4)	N (1–4)	50	98
No. 829 Yeon Seong	30/1–3/3/04	Sp	N	Y (7)	Y (150)	10	Y (5)	N (1–4)	100	100
Gudni Olafsson	27/12/03–10/2/04	A	Y	Y (7)	Y (150)	15	Y (5)	Y (1.5–8)		100
San Aotea II	12/12/03–21/3/04	A	Y	Y (7.6)	Y (150)	11	Y (5)	Y (1–7.5)		100
Volna	15/12/03–9/3/04	Sp	N	N (5)	N (130)	5	Y (2)	N (1–3)	100	100
Yantar	15/12/03–9/3/04	Sp	Y	Y (7)	Y (150)	6	Y (5)	Y (1–6.5)	100	100
Mellas	2/1–3/3/04	Sp	N	Y (7)	N (125)	12	Y (5)	N (1–5)	100	100
Simeiz	15/12/03–7/3/04	Sp	N	N (5.2)	Y (150)	9	Y (4)	N (1–4)	100	100
Sonrisa	10/2–4/3/04	A	N	Y (7.4)	N (70)	30	Y 5)	N (1–3.5)		100
Piscis	12/1–7/3/04	Sp	Y	Y (7)	Y (150)	7	Y (5)	-	100	100
Punta Ballena	11/1–3/3/04	Sp	Y	Y (11)	Y (150)	28	Y (5)	-	67	94
America I	12/12/03–5/3/04	Sp	Y	Y (7.3)	Y (155)	6	Y (5)	Y (2–6.5)	100	94
American Warrior	8/1–3/3/04	A	Y	Y (9)	Y (150)	11	Y (5)	Y (2–6.5)		100
South Princess	15/12/03–4/3/04	A	N	Y (7)	Y (158)	10	Y (3)	N (2–5.2)	100	99
Frøyanes	23/1–4/3/04	A	Y	Y (7)	Y (150)	11	Y (5)	Y (1–7)	100	100
Avro Chieftain	1/12/03–19/3/04	A	Y	Y (7)	Y (150)	40	Y (2.5)	Y (1–7)	100	100
Janas	12/12/03–24/2/04	A	Y	Y (7.2)	Y (150)	19	Y (5)	Y (2–8)		100
San Liberatore	1/2–6/3/04	A	Y	Y (10)	Y (150)	14	Y (4.5)	Y (1–8)	100	100
Division 58.5.2										
Janas	30/4–24/6/04	A	Y	Y (7)	Y (150)	19	Y (4.5)	Y (1–6.5)	100	
Janas	20/7–10/9/04	A	Y	Y (7)	Y (150)	15	Y (5)	Y (1–7)	100	100
Divisions 58.4.2, 58.4.3b										
Eldfisk	30/11/03–24/1/04	A	Y	Y (7)	Y (150)	17	Y (4.5)	Y (1–6.5)		100

Table 7.13: Summary of scientific observations relating to compliance with Conservation Measure 25-02 (2003), based on data from scientific observers from the 1996/97 to the 2003/04 season. Values in parentheses are % of observer records that were complete. na – not applicable.

Subarea/time	Line weighting (Spanish system only)				Night setting (% Night)	Offal discharge (%) opposite haul		Streamer line compliance (%)										Total catch rate (birds/thousand hooks)	
	Compliance %		Median weight (kg)	Median spacing (m)				Overall		Attached height		Total length		No. of streamers		Distance apart		Night	Day
Subarea 48.3																			
1996/97	0	(91)	5.0	45	81	0	(91)	6	(94)	47	(83)	24	(94)	76	(94)	100	(78)	0.18	0.93
1997/98	0	(100)	6.0	42.5	90	31	(100)	13	(100)	64	(93)	33	(100)	100	(93)	100	(93)	0.03	0.04
1998/99	5	(100)	6.0	43.2	80[1]	71	(100)	0	(95)	84	(90)	26	(90)	76	(81)	94	(86)	0.01	0.08[1]
1999/00	1	(91)	6.0	44	92	76	(100)	31	(94)	100	(65)	25	(71)	100	(65)	85	(76)	<0.01	<0.01
2000/01	21	(95)	6.8	41	95	95	(95)	50	(85)	88	(90)	53	(94)	94	94	82	(94)	<0.01	<0.01
2001/02	63	(100)	8.6	40	99	100	(100)	87	(100)	94	(100)	93	(100)	100	(100)	100	(100)	0.002	0
2002/03	100	(100)	9.0	39	98	100	(100)	87	(100)	91	(100)	96	(100)	100	(100)	100	(100)	<0.001	0
2003/04	87	(100)	9.0	40	98	100	(100)	69	(94)	88	(100)	93	(94)	[7]		100	(100)	0.001	0
Subarea 48.6																			
2003/04	100	(100)	7.0	20	41[6]	No discharge		0	(100)	100	(100)	100	(100)	[7]		0	(100)	0	0
Divisions 58.4.2, 58.4.3b																			
2002/03	Auto only		na	na	24[5]	No discharge		100	(100)	100	(100)	100	(100)	100	(100)	100	(100)	0	0
2003/04	Auto only		na	na	0[5]	No discharge		100	(100)	100	(100)	100	(100)	[7]		100	(100)	0	0
Division 58.4.4																			
1999/00	0	(100)	5	45	50	0	(100)	0	(100)	100	(100)	0	(100)	100	(100)	100	(100)	0	0
Division 58.5.2																			
2002/03	Auto only		na	na	100	No discharge		100	(100)	100	(100)	100	(100)	100	(100)	100	(100)	0	0
2003/04	Auto only		na	na	99	No discharge		100	(100)	100	(100)	100	(100)	[7]		100	(100)	0	0
Subareas 58.6, 58.7																			
1996/97	0	(60)	6	35	52	69	(87)	10	(66)	100	(60)	10	(66)	90	(66)	60	(66)	0.52	0.39
1997/98	0	(100)	6	55	93	87	(94)	9	(92)	91	(92)	11	(75)	100	(75)	90	(83)	0.08	0.11
1998/99	0	(100)	8	50	84[2]	100	(89)	0	(100)	100	(90)	10	(100)	100	(90)	100	(90)	0.05	0
1999/00	0	(83)	6	88	72	100	(93)	8	(100)	91	(92)	0	(92)	100	(92)	91	(92)	0.03	0.01
2000/01	18	(100)	5.8	40	78	100	(100)	64	(100)	100	(100)	64	(100)	100	(100)	100	(100)	0.01	0.04
2001/02	66	(100)	6.6	40	99	100	(100)	100	(100)	100	(100)	100	(100)	100	(100)	100	(100)	0	0
2002/03	0	(100)	6.0	41	98	50	(100)	100	(100)	100	(100)	100	(100)	100	(100)	100	(100)	<0.01	0
2003/04	100	(100)	7.0	20	83	100	(100)	50	(100)	50	(100)	100	(100)	[7]		100	(100)	0.03	0.01

(continued)

Table 7.13 (continued)

Subarea/time	Line weighting (Spanish system only)			Night setting (% Night)	Offal discharge (%) opposite haul	Streamer line compliance (%)					Total catch rate (birds/thousand hooks)	
	Compliance %	Median weight (kg)	Median spacing (m)			Overall	Attached height	Total length	No. of streamers	Distance apart	Night	Day
Subareas 88.1, 88.2												
1996/97	Auto only	na	na	50	0 (100)	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0
1997/98	Auto only	na	na	71	0 (100)	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0
1998/99	Auto only	na	na	1[3]	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0
1999/00	Auto only	na	na	6[4]	No discharge	67 (100)	100 (100)	67 (100)	100 (100)	100 (100)	0	0
2000/01	1 (100)	12	40	18[4]	No discharge	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0
2001/02	Auto only	na	na	33[4]	No discharge	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0
2002/03	100 (100)	9.6	41	21[4]	1 incidence of offal dumping	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0
2003/04	89 (100)	9	40	5[4]	24% by 1 vessel	59 (100)	82 (100)	86 (100)	[7]	100 (100)	0	<0.01

[1] Includes daytime setting – and associated seabird by-catch – as part of line-weighting experiments on *Argos Helena* (WG-FSA-99/5).
[2] Includes some daytime setting in conjunction with use of an underwater-setting funnel on *Eldfisk* (WG-FSA-99/42).
[3] Conservation Measure 169/XVII allowed New Zealand vessels to undertake daytime setting south of 65°S in Subarea 88.1 to conduct a line-weighting experiment.
[4] Conservation Measures 210/XIX, 216/XX and 41-09 (2002, 2003) permit daytime setting south of 65°S in Subarea 88.1 if they could demonstrate a sink rate of 0.3 m/s.
[5] Conservation Measure 41-05 (2002, 2003) permits daytime setting in Division 58.4.2 if the vessel can demonstrate a sink rate of 0.3 m/s.
[6] Conservation Measure 41-04 (2003) permits daytime setting in Subarea 48.6 if the vessel can demonstrate a sink rate of 0.3 m/s.
[7] Conservation Measure 25-02 (2003) was updated and the requirement for a minimum of five streamers per line was removed.

Table 7.14: Offal discharge observed during net shooting and hauling operations in finfish trawl fisheries in the CCAMLR Convention Area during the 2003/04 season.

Vessel name	Cruise dates	Offal discharged during (%)	
		Net shooting	Net hauling
Subarea 48.3			
Betanzos	26/12/03–22/2/04	8 (9)	8 (9)
Argos Vigo	12/1–29/1/04	0	0
Robin M Lee	14/4–1/5/04	1 (12)	0
Sil	25/1–29/2/04	0	0
Dongsan Ho	6/1–30/1/04	0	3 (9)
Insung Ho	28/12/03–27/1/04	1 (3)	0
Division 58.5.2			
Austral Leader	13/10–19/12/03	0	0
Austral Leader	14/3–12/5/04	0	0
Austral Leader	25/7–23/9/04	0	0
Southern Champion	22/1–23/3/04	0	0
Southern Champion	18/4–30/6/04	0	0

Table 7.15: Estimated total potential seabird by-catch in the IUU *Dissostichus* spp. fishery in the Convention Area from 1996 to 2004. Lower and upper refer to 95% confidence limit.

Subarea/ Division	Year	Estimated total potential seabird by-catch		
		Lower	Median	Upper
48.3	2004	0	0	0
	1996–2003	1 811	3 441	56 031
58.5.1	2004	895	1 092	2 915
	1996–2003	46 988	57 332	153 081
58.5.2	2004	596	727	1 941
	1996–2003	31 857	38 870	103 787
58.4.3	2004	522	636	1 699
58.4.4	2004	0	0	0
	1996–2003	2 866	3 497	9 338
58.6	2004	1 611	1 966	5 249
	1996–2003	43 277	52 803	140 989
58.7	2004	369	450	1 202
	1996–2003	12 106	14 770	39 439
88.1	2004	360	440	1 160
	1996–2003	32	39	104
Totals	2004	4 352	5 311	14 166
	1996–2003	138 937	170 752	502 768
Total		143 289	176 063	516 934

Table 7.16: Summary of IMAF risk assessment in relation to proposed new and exploratory longline fisheries in 2004/05 (five-point risk scale as defined in SC-CAMLR-XXIII/BG/21).

Area	Risk scale	Mitigation requirements	Proposal assessment
48.6 north of ca. 55°S	2 – average to low	• Strict compliance with standard seabird by-catch conservation measure. • No need for restriction of longline fishing season. • Daytime setting permitted subject to line sink rate requirements and seabird by-catch limits. • No offal dumping at any time.	Proposals from Japan (WG-FSA-04/18 and CCAMLR-XXIII/18), Republic of Korea (CCAMLR-XXIII/20) and New Zealand (CCAMLR-XXIII/25) do not conflict with the IMAF assessment.
48.6 south of ca. 55°S	1 – low	• Strict compliance with standard seabird by-catch conservation measure. • No need for restriction of longline fishing season. • Daytime setting permitted subject to line sink rate requirement. • No offal dumping at any time.	Proposals from Japan (CCAMLR-XXIII/18), Republic of Korea (CCAMLR-XXIII/20) and New Zealand (CCAMLR-XXIII/25) do not conflict with the IMAF assessment.
58.4.1	2 – average to low	• Strict compliance with standard seabird by-catch conservation measure. • No need for restriction of longline fishing season. • Daytime setting permitted subject to line sink rate requirements and seabird by-catch limits. • No offal dumping at any time.	Proposals from Chile (CCAMLR-XXIII/12), Republic of Korea (CCAMLR-XXIII/21), Spain (CCAMLR-XXIII/15), New Zealand (CCAMLR-XXIII/26) and Ukraine (CCAMLR-XXIII/30) do not conflict with the IMAF assessment.
58.4.2	3 – average	• Strict compliance with standard seabird by-catch conservation measure. • Restrict longline fishing to April to September (outside the October to March giant petrel breeding season) unless line sink rate requirements are met at all times. • Daytime setting permitted subject to strict line sink rate requirements and seabird by-catch limits. • No offal dumping at any time.	Proposals from Chile (CCAMLR-XXIII/13), Republic of Korea (CCAMLR-XXIII/22), Spain (CCAMLR-XXIII/15), New Zealand (CCAMLR-XXIII/26) and Ukraine (CCAMLR-XXIII/31) do not conflict with the IMAF assessment.
58.4.3a	3 – average	• Strict compliance with standard seabird by-catch conservation measure. • Restrict longline fishing to May through August (outside the September to April albatross, giant petrel and white-chinned petrel breeding season) unless line sink rate requirements are met at all times. • Daytime setting permitted subject to strict line sink rate requirements and seabird by-catch limits. • No offal dumping at any time.	Proposals from Australia (CCAMLR-XXIII/9), Spain (CCAMLR-XXIII/15) and the Republic of Korea (CCAMLR-XXIII/23) do not conflict with the IMAF assessment.

(continued)

Table 7.16 (continued)

Area	Risk scale	Mitigation requirements	Proposal assessment
58.4.3b	3 – average	• Strict compliance with standard seabird by-catch conservation measure. • Restrict longline fishing to May to August (outside the September to April albatross, giant petrel and white-chinned petrel breeding season) unless line sink rate requirements are met at all times. • Daytime setting permitted subject to strict line sink rate requirements and seabird by-catch limits. • No offal dumping at any time.	Proposals from Australia (CCAMLR-XXIII/10), Chile (CCAMLR-XXIII/14), Japan (CCAMLR-XXIII/19), Spain (CCAMLR-XXIII/15) and the Republic of Korea (CCAMLR-XXIII/24) do not conflict with the IMAF assessment.
88.1 north of 65°S	3 – average	• Strict compliance with standard seabird by-catch conservation measure. • No need for restriction of longline fishing season, but line sink rate requirements to be met at all times. • Daytime setting permitted subject to strict line sink rate requirements and seabird by-catch limits. • No offal dumping at any time.	Proposals from Argentina (CCAMLR-XXIII/8), Australia (CCAMLR-XXIII/11), Norway (CCAMLR-XXIII/6), Spain (CCAMLR-XXIII/15), New Zealand (CCAMLR-XXIII/27), Russia (CCAMLR-XXIII/28), South Africa (CCAMLR-XXIII/34), Ukraine (CCAMLR-XXIII/29) and Uruguay (CCAMLR-XXIII/32) do not conflict with the IMAF assessment. The UK (CCAMLR-XXIII/17) confirmed intention to conform with IMAF assessment in all respects.
88.1 south of 65°S	2 – average to low	• Strict compliance with standard seabird by-catch conservation measure. • No need for restriction of longline fishing season. • Daytime setting permitted subject to line sink rate requirements and seabird by-catch limits. • No offal dumping at any time.	Proposals from Argentina (CCAMLR-XXIII/8), Australia (CCAMLR-XXIII/11), Norway (CCAMLR-XXIII/6), Spain (CCAMLR-XXIII/15), New Zealand (CCAMLR-XXIII/27), Russia (CCAMLR-XXIII/28), South Africa (CCAMLR-XXIII/34), Ukraine (CCAMLR-XXIII/29) and Uruguay (CCAMLR-XXIII/32) do not conflict with the IMAF assessment. The UK (CCAMLR-XXIII/17) confirmed intention to conform with the IMAF assessment in all respects (see paragraph 7.195).
88.2	1 – low	• Strict compliance with standard seabird by-catch conservation measure. • No need for restriction of longline fishing season. • Daytime setting permitted. • No offal dumping at any time.	Proposals from Norway (CCAMLR-XXIII/6), Argentina (CCAMLR-XXIII/8), New Zealand (CCAMLR-XXIII/27) and Russia (CCAMLR-XXIII/28) do not conflict with the IMAF assessment.

Table 7.17: Summary of IMAF assessment of risk to seabirds posed by new and exploratory longline fisheries in the Convention Area (see also Figure 7.3).

Risk level	Mitigation requirements	Observer coverage
1 – low	• Strict compliance with standard seabird by-catch conservation measure.[1] • No need for restriction of longline fishing season. • Daytime setting permitted subject to line sink rate requirements.[2] • No offal dumping.	20% of hooks hauled 50% of hooks set
2 – average to low	• Strict compliance with standard seabird by-catch conservation measure.[1] • No need for restriction of longline fishing season. • Daytime setting permitted subject to line sink rate requirements and seabird by-catch limits.[3] • No offal dumping.	25% of hooks hauled 75% of hooks set
3 – average	• Strict compliance with standard seabird by-catch conservation measure.[1] • Restrict longline fishing to period outside at-risk species breeding season where known/relevant, unless line sink rate requirements are met at all times. • Daytime setting permitted subject to strict line sink rate requirements and seabird by-catch limits.[3] • No offal dumping.	40% of hooks hauled[4] 95% of hooks set
4 – average to high	• Strict compliance with standard seabird by-catch conservation measure.[1] • Restrict longline fishing to the period outside any at-risk species breeding season. • Strict line sink rate requirements at all times. • No daytime setting permitted. • No offal dumping.	45% of hooks hauled[4] 95% of hooks set
5 – high risk	• Strict compliance with standard seabird by-catch conservation measure.[1] • Restrict longline fishing to period outside at-risk species breeding season. • Closed areas as identified. • Strict line sink rate requirements at all times. • No daytime setting permitted. • Strict seabird by-catch limits in place. • No offal dumping.	50% of hooks hauled[4] 100% of hooks set

[1] Conservation Measure 25-02 with the possibility of exemption to paragraph 4 as provided by Conservation Measure 24-02.
[2] Changes required to Conservation Measure 25-02 (2003), paragraph 4.
[3] Requires text similar to Conservation Measure 41-09 (2003), paragraphs 6 and 7.
[4] This is likely to require the presence of two observers.

Table 7.18: Seabird mortality totals and rates (BPT: birds/trawl) and species composition of by-catch, recorded by observers in the CCAMLR Convention Area trawl fisheries over the last four seasons. DIC – grey-headed albatross; DIM – black-browed albatross; PRO – white-chinned petrel; PWD – Antarctic prion; DAC – cape petrel; MAI – southern giant petrel.

Season	Area	Vessel	Cruise dates	Trawls observed	BPT	Dead						Total dead	Alive (combined)
						DIC	DIM	PRO	PWD	DAC	MAI		
2001	48.3	*Argos Vigo*	1/2–10/2/01	58	0.64	1	25	11				37	22
		Betanzos	26/11/00–26/2/01	157	0.34	2	21	30				53	16
		Saint Denis	6/12/00–18/1/01	100	0.02	2						2	2
		Total		315	0.29	5	46	41				92	40
2002	48.3	*Argos Vigo*	15/12/01–30/1/02	35	0.49		6	11				17	8
		Robin M Lee	15/12/01–15/2/02	74	0.26		4	15				19	25
		Insung Ho	31/12/01–18/2/02	81	0.26		3	17	1			21	18
		Bonito	15/12/01–9/2/02	67	0.06		2	2				4	1
		Zakhar Sorokin	20/12/01–5/2/02	174	0.04		3	4				7	0
		Total		431	0.16		18	49	1			68	52
	58.5.2	*Austral Leader*	28/3–8/5/02	34	0							0	1
		Total		34	0							0	1
2003	48.3	*Betanzos*	7/12/02–5/3/03	107	0.14	1	1	13				15	11
		Sil	16/12/02–18/1/03	48	0.35		3	14				17	1
		Insung Ho	31/12/02–18/1/03	27	0.15		3	1				4	3
		Total		182	0.20	1	7	28				36	15
	58.5.2	*Austral Leader*	10/4–10/5/03	117	0.03		1	1		2		4	0
		Southern Champion	24/1–20/3/03	44	0.02			1				1	7
		Southern Champion	24/4–18/5/03	277	0.004		1					1	0
		Southern Champion	4/6–15/7/03	301	0							0	4
		Total		739	0.008		2	2		2		6	11
2004	48.3	*Argos Vigo*	12/1–29/1/04	17	1.06		2	16				18	4
		Betanzos	26/12/03–22/2/04	87	0.22		1	18				19	76
		Robin M Lee	14/4–1/5/04	8	0.38			3				3	0
		Sil	25/1–29/2/04	69	0.25	1	3	13				17	22
		Dongsan Ho	6/1–30/1/04	28	0.46		8	4			1	13	4
		Insung Ho	28/12/03–27/1/04	29	0.59		12	5				17	30
		Total		221	0.37	1	26	59			1	87	132
	58.5.2	*Austral Leader*	14/3–12/5/04	366	0							0	1
		Southern Champion	22/1–23/3/04	55	0							0	6
		Total		421	0							0	7

Table 8.1: Estimates of IUU toothfish catches (tonnes) in the CCAMLR Convention Area from the 1996/97 to the 2003/04 fishing seasons.

Fishing season	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Estimated IUU catch	32 673	15 106	5 868	7 644	8 802	11 857	10 070	2 622*
Total reported and IUU catches	45 130	28 518	19 531	25 214	22 598	27 198	26 877	15 929
IUU as % of total catch	72.4	53.0	30.0	30.3	39.0	43.6	37.5	16.5

* Estimated as of 1 October 2004. The estimation will be revised next year in order to take into account any new compliance-related information received for the period to the end of the 2003/04 fishing season, i.e. to 30 November 2004.

Table 11.1: Current observation requirements.

Observer coverage requirement:

Each vessel participating in this fishery shall have at least one scientific observer appointed in accordance with the CCAMLR Scheme of International Scientific Observation, and where possible one additional scientific observer, on board throughout all fishing activities within the fishing period.

Target species	Subarea/Division	Conservation measure
Toothfish	48.3 48.4 58.4.3a 58.4.3b	41-02 41-03 41-06 41-07
Icefish	48.3	42-01
Macrourus spp.	58.4.3a 58.4.3b	43-02 43-03
Chaenodraco wilsoni, *Lepidonotothen kempi*, *Trematomus eulepidotus* and *Pleuragramma antarcticum*	58.4.2	43-04
Crabs	48.3	52-01, 51-02
Squid	48.3	61-01

Observer coverage requirement:

Each vessel participating in this fishery shall have at least one scientific observer, and may include one appointed in accordance with the CCAMLR Scheme of International Scientific Observation, on board throughout all fishing activities within the fishing period.

Target species	Subarea/Division	Conservation measure
Toothfish	58.5.2	41-08
Icefish	58.5.2	42-02

Observer coverage requirement:

Each vessel participating in this fishery shall have at least two scientific observers, one of whom shall be an observer appointed in accordance with the CCAMLR Scheme of International Scientific Observation, on board throughout all fishing activities within the fishing period.

Target species	Subarea/Division	Conservation measure
Toothfish	48.6 58.4.1 58.4.2 88.1 88.2	41-04 41-11 41-05 41-09 41-10

Table 11.2: Initial assessment of data collected by observers, use of collected data and references to examples of use of the observer data.

Data collected by observers	Usage	References to report paragraphs and working papers (2002–2004)
Finfish fishing		
Fish hook removal	√	6.37–6.39, 6.57, 6.108, Table 10.1 (FSA-03)
Haul seabird deterrent	√	6.9, 6.100 (FSA-03)
Vessel and observation program details		
Vessel details	√	WG-FSA-04
Total number of sets undertaken during the observation program		
Total number of sets observed	√	WG-FSA-04
Total number of hooks set	√	6.7 (FSA-03)
Total number of hooks observed	√	6.6 (FSA-03)
Longline description	√	5.280 (FSA-03)
Offal discharge	√	6.37, 6.260 (FSA-03)
Line weighting	√	6.42–6.44, 6.260 (FSA-03)
Streamer line description	√	6.35, 6.260 (FSA-03) Factual data being forwarded to SCIC
Daily work schedule (optional)		
Daily setting observations		
Setting information	√	5.89 (FSA-03)
Alterations to line-setting course		
Details of longline setting	√	5.89, 6.260 (FSA-03)
Extreme environmental conditions (optional)		
Estimated seabird and marine mammal abundance (optional)		
Seabird activity for day setting only (optional)		
Daily hauling observations		
Hauling information	√	5.267 (FSA-03)
Extreme environmental conditions		
Marine mammal interaction with longline	√	6.219–6.223 (FSA-03)
Seabird by-catch	√	6.7, 6.115 (FSA-03)
Catch composition	√	5.267 (FSA-03)
Finfish biological data collection		
Scale/otolith/both	√	CON (WG-FSA-02/51)
Total length (cm)	√	5.89 (FSA-03)
Snout–anus length (cm)		
Wingspan skate/rays (cm)		
Weight (kg)	√	WG-FSA-04/5
Sex	√	WG-FSA-04
Maturity stage		
Gonad weight (grams)		
Conversion factors (fish processing)	√	3.26 (FSA-03)
Finfish and invertebrate by-catch data collection		
% hauls/sets observed for landed by-catch	√	WG-FSA-04
Fate of by-catch (discarded/retained)	√	WG-FSA-04
Numbers of individuals	√	WG-FSA-04
Weight by individuals	√	WG-FSA-04

(continued)

Table 11.2 (continued)

Data collected by observers	Usage	References to report paragraphs and working papers (2002–2004)
Skate and ray (and macrourids) cut-offs form	√	10.12–10.15 (FSA-04)
% hooks observed for cut-offs	√	
Number of individuals cut-off	√	
Tag–release and recapture data	√	FSA-04
TDR and bottle test	√	Conservation Measure 24-02
Finfish maturity and age determination (trawl fishery only)	√	5.93 (FSA-03)
Sightings of fishing vessels	√	Estimates of IUU catches, estimates of IUU seabird by-catch, risk assessment of proposed new and exploratory fisheries
Waste disposal	√	Factual data forwarded to SCIC
Krill fishing		
Marine mammal entanglement	√	3.23 (EMM-04)
Trawl details		
Krill trawl depth	√	3.18 (EMM-04)
Sea-surface temperature	√	3.26 (EMM-04)
By-catch	√	3.26 (EMM-04)
Krill biological data collection		
Length (mm)	√	3.26 (EMM-04)
Sex		
Maturity stage		
Feeding colour		
Pot fishery		
Observed interaction with birds or marine mammals	√	
Incidental mortality of seabirds or marine mammals	√	
Catch composition	√	WG-FSA-01/42, Table 4; WG-FSA-02/14, Table 3
Conversion factors	√	
Paralomis spp. biological data collection		
Length	√	5.142 (FSA-02), SC-CAMLR-XXI/BG/27
Carapace width	√	5.142 (FSA-02), SC-CAMLR-XXI/BG/27
Chelae length	√	5.142 (FSA-02), SC-CAMLR-XXI/BG/27
Weight	√	5.142 (FSA-02), SC-CAMLR-XXI/BG/27
Sex	√	5.142 (FSA-02), SC-CAMLR-XXI/BG/27
Maturity stage	√	5.142 (FSA-02), SC-CAMLR-XXI/BG/27
Rhizocephalan parasites		5.142 (FSA-02), SC-CAMLR-XXI/BG/27
Retained/discarded/damaged		5.142 (FSA-02), SC-CAMLR-XXI/BG/27

Table 13.1: List of tasks identified by WG-FSA for the 2004/05 intersessional period. Tasks identified by ad hoc WG-IMAF are listed in Appendix E. The paragraph numbers (Ref.) refer to this report; E – established practice; Priority: 1 – high priority; 2 – general request; Subgroups: WG-FSA-SAM – Subgroup on Assessment Methods; SGbiology – Subgroup on Biology, Ecology and Demography; SGBycatch – Subgroup on Fish By-catch; CON – CCAMLR Otolith Network.

	Task	Ref.	Priority	Action required	
				Members/Subgroups	Secretariat
	Organisation of the meeting				
1.	Submit papers to WG-FSA-05 in accordance with the deadline.	2.6	1	Members to implement	Coordinate and implement
2.	Circulate list of documents with agenda items at start of meeting.	E	1	Convener to implement	Assist
	Review of available information				
3.	Load fishery surveys reported to CCAMLR.	E	1		Implement
4.	Further develop routine validation procedures for database extractions.	E	1		Implement
5.	Update catch tables in Fishery Reports.	E	1		Implement
6.	Update estimates of reported catches, catches from IUU fishing and total removals by season and area within the Convention Area.	E	1	Members to provide information on IUU fishing by 1 October	Implement
7.	Update estimates of catches reported in CDS data by season and area outside the Convention Area.	E	1		Implement
8.	Update information on scientific observations.	E	1		Implement
9.	Prepare catch-weighted length-frequency plots for Fishery Reports.	E	1		Implement
10.	Provide accurate and consistent data on by-catch.	E	1	Members to implement	Coordinate and implement
11.	Continue tagging rajids.	3.50		Members to implement	
12.	Advise CON on requirements for meeting of WG-FSA-SAM-05.	3.59	1	SAM coordinator to advise, CON to implement	Remind
13.	Develop further the CCAMLR age database, and populate the database with the age–length and associated data provided by CON.	3.60	1	CON convener to liaise with Secretariat	Implement

(continued)

Table 13.1 (continued)

	Task	Ref.	Priority	Action required	
				Members/Subgroups	Secretariat
	Preparation for assessments				
14.	Future work for development of assessment methods recommended by WG-FSA-SAM-04.	4.15	1	WG-FSA-SAM convenor to remind, Members to implement	
	Assessments and management advice				
15.	Submit fine-scale data from the South African longline fishery in Subareas 58.6 and 58.7.	Table 5.66	2	South Africa to implement	Remind
16.	Submit survey data from Division 58.5.2 in CCAMLR format (form C4).	5.190	1	Australia to implement	Remind
17.	Provide information necessary to develop Fishery Reports for the French fisheries in Division 58.5.1 and Subarea 58.6.	5.176, 5.296	1	France to implement	Remind
18.	Conduct tag–recapture experiments in Subarea 58.6 and Division 58.5.1.	5.182, 5.300	1	France to implement	Remind
19.	Review and provide additional information for Fishery Reports.	E	1	Members to implement	
20.	Develop methods to monitor completion of research sets.	5.20	1		Implement
21.	Submit toothfish tag data and correctly identify research sets in new and exploratory fishery data.	5.92	1	Members to implement	
	Fish and invertebrate by-catch				
22.	Conduct research towards generating population parameters and estimates of standing stock for macrourids and rajids.	6.35	1	Members to implement	
23.	Develop avoidance and mitigation measures for by-catch species.	6.36	2	Members to implement	
24.	Investigate discrepancies in by-catch catches reported in the fine-scale data and catch and effort reports submitted to CCAMLR.	6.48	2	SGBycatch to implement	Coordinate
25.	Develop standard methods to summarise by-catch removals by area.	6.51	2		Implement
26.	Improve the reporting, transferral and extraction of by-catch data.	6.49	1	SGBycatch to implement	Coordinate and implement

(continued)

Table 13.1 (continued)

	Task	Ref.	Priority	Action required	
				Members/Subgroups	Secretariat
27.	Report by-catch accurately in all data formats.	6.50	1	Members to implement	
28.	Collate information to allow risk characterisation for major by-catch species.	6.57	1	SGBycatch to implement	
29.	Vessels should cut all rajids off lines whilst still in the water, except on request of observer during biological sampling period.	6.65	1	Members to implement	
30.	Members collecting by-catch data in non-standard format should ensure that all data are transferred to CCAMLR database.	6.87	2	Members to implement	Coordinate
	Evaluation of threats arising from IUU activities				
31.	Further develop models for estimating IUU catch.	8.2, 8.3	1	Members to implement	
32.	Provide more detail in compliance-related reports.	8.4–8.6	1	SCIC and Members to provide data	Coordinate
	Biology, ecology and demography of target and by-catch species				
33.	Update the toothfish species profiles.	9.6	1	SGBiology to implement	Assist
34.	Update the icefish species profiles.	9.6	1	SGBiology to implement	Assist
35.	Convene a workshop on the age determination of icefish.	9.8–9.12	1	Members to coordinate and implement	Assist
	Consideration of ecosystem management				
36.	Submit papers on interactions between krill, icefish, and other species to next WG-EMM meeting.	10.17	2	Members to implement	
37.	Encourage specialists in icefish research to participate in the next Workshop on Plausible Ecosystem Models.	10.18	1	Members to implement	
38.	Development of long-term management procedures for icefish within an ecosystem context.	10.19, 4.15(vii)	1	Members to implement	

(continued)

Table 13.1 (continued)

	Task	Ref.	Priority	Action required	
				Members/Subgroups	Secretariat
39.	Establish a standing Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM) to advise on protocols to be used in acoustic surveys and analyses.	10.23	1	Members to implement	Assist
40.	Carry out ecosystem-based research in areas where icefish populations occur.	10.26	1	Members to implement	
	Scheme of International Scientific Observation				
41.	Collect data on the aerial extent of streamer lines.	11.15	2	Technical coordinators to implement	
42.	Collect summary information on hooks occurring in offal.	11.17	2	Technical coordinators to implement	
43.	Review longline sub-sampling methods.	11.20–11.22	1	Members to implement	
44.	Document more clearly events involving seabird captures.	11.27–11.29	2	Technical coordinators to implement	
45.	Review of the *Scientific Observers Manual*.	11.35–11.46	1	Members to implement	Assist
46.	Develop list of observer priorities for all Fishery Reports.	11.52	1	Members to implement	Remind
47.	Present paper at Fourth International Fisheries Observer Conference, and report back to CCAMLR on matters of interest to the future implementation of the scheme.	11.55	1		Implement
	Future assessments				
48.	Correspond regularly in order to develop plan for evaluation of assessment methods by start of WG-FSA-SAM-05.	12.3	1	SAM coordinator to implement	
49.	Make submissions on the prioritised topics given in paragraph 12.4 for evaluation at WG-FSA-SAM-05.	12.4	1	Members to implement	
50.	Explore the application of AD Model Builder, CASAL and GYM in delivering components for the assessment procedures.	12.6	1	Members to implement	

(continued)

Table 13.1 (continued)

	Task	Ref.	Priority	Action required	
				Members/Subgroups	Secretariat
51.	Evaluate survey designs and further explore the means of estimating the abundance of recruits from surveys, including the use of CMIX, age–length keys and other approaches.	12.7	1	Members to implement	
52.	Spatial analysis of distribution of fishing effort in longline fisheries.	12.8	1	Members to implement	
53.	Evaluation of biomass estimates from depletion experiments and methods for estimating length-at-age relationships.	12.9	2	Members to implement	

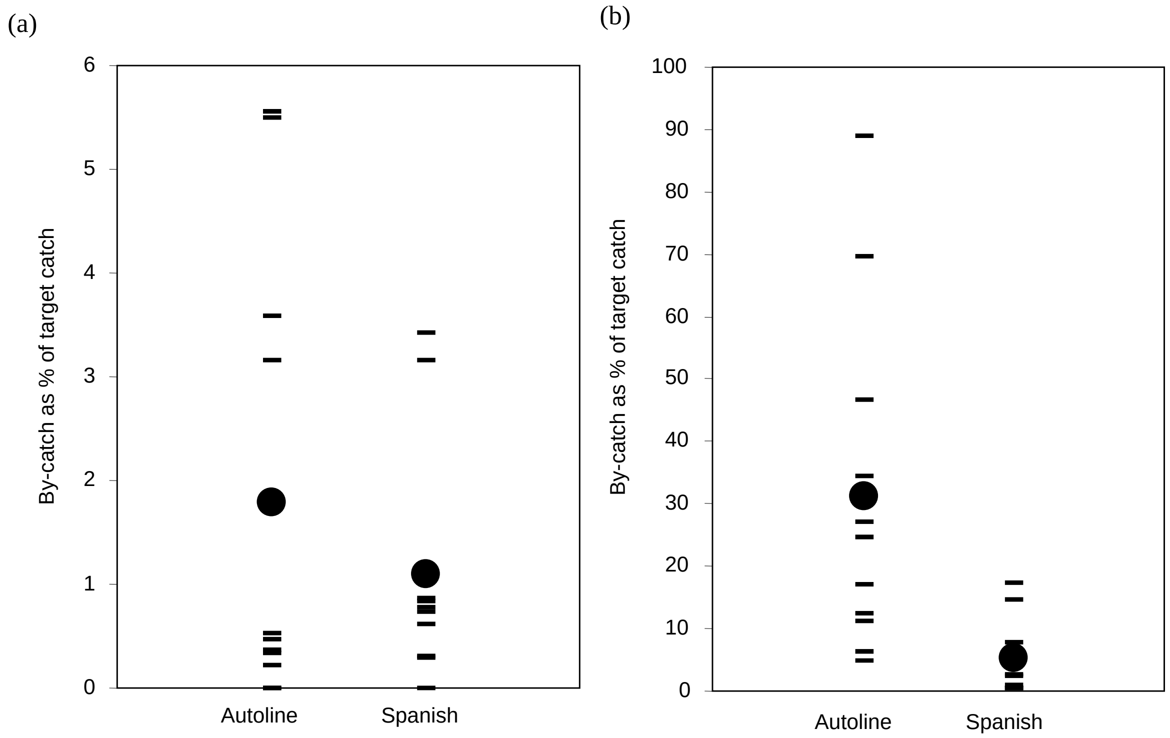

Figure 6.1: By-catch from fine-scale (haul-by-haul) data in Subarea 88.1 expressed as a percentage of target catch for autoline and Spanish system longline gear: (a) rajids (combined skates and rays), and (b) *Macrourus* spp. Each mark represents an individual vessel, with black dots representing the mean for all vessels combined.

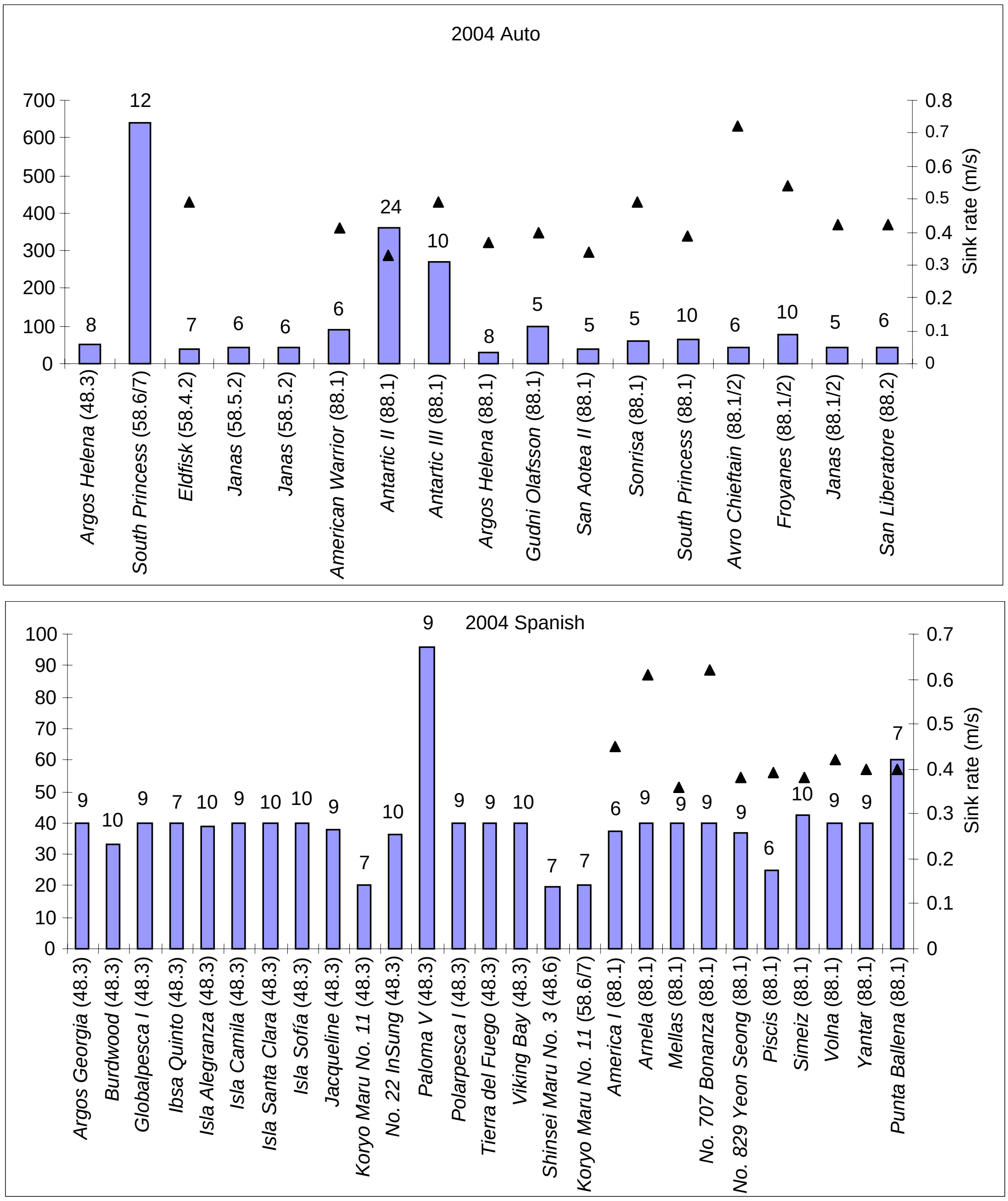

Figure 7.1: Longline weight spacing (y-axis in metres) and weights used (kilograms) by Spanish and autoline systems during the 2003/04 season. ▲ – sink rate (m/s).

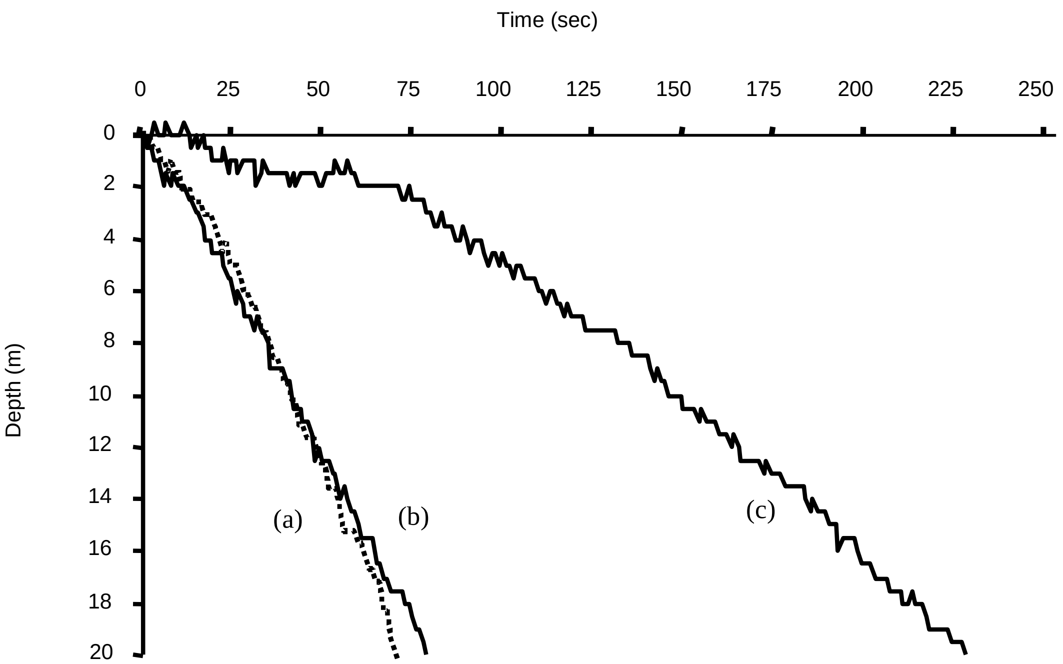

Figure 7.2: Examples of typical sink profiles to 20 m depth of: (a) 11.5 mm diameter UWLs with external weights attached (6 kg/42 m) and set in accordance with the requirements of Conservation Measure 24-02; (b) 9 mm diameter IWL; and (c) 9 mm diameter UWL. Lines were set from the FV *Janas* and sink profiles were determined with time-depth recorders. Sink rate to 20 m depth of UWLs + external weights was 0.29 m/s, slightly less than the 0.3m/s required by Conservation Measure 24-02. Sink rates of IWLs and UWLs shown were 0.25 m/s and 0.1 m/s respectively.

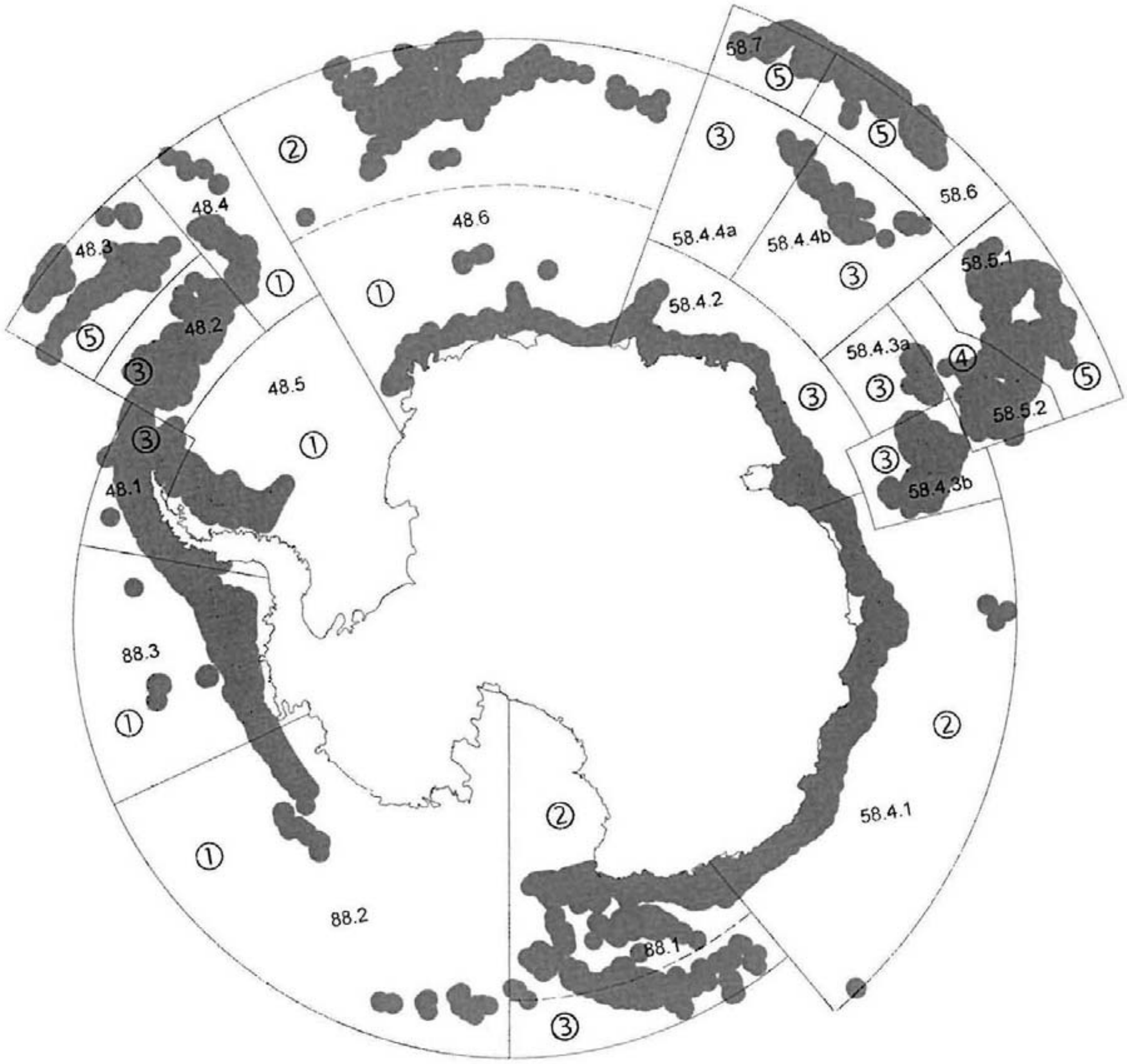

Figure 7.3: Assessment of the potential risk of interaction between seabirds, especially albatrosses, and longline fisheries within the Convention Area. 1: low, 2: average to low, 3: average, 4: average to high, 5: high. Shaded patches represent seabed areas between 500 and 1 800 m.

APPENDIX A

AGENDA

Working Group on Fish Stock Assessment
(Hobart, Australia, 11 to 22 October 2004)

1. Opening of the meeting

2. Organisation of the meeting and adoption of the agenda

   2.1 Organisation of meeting
   2.2 Report restructure

3. Review of available information

   3.1 Data requirements specified in 2003
      3.1.1 Development of the CCAMLR database
      3.1.2 Data processing
      3.1.3 Fishery plans
      3.1.4 Other

   3.2 Fisheries information
      3.2.1 Catch, effort, length and age data reported to CCAMLR
      3.2.2 Estimates of catch and effort from IUU fishing
      3.2.3 Catch and effort data for toothfish fisheries in waters adjacent to the Convention Area
      3.2.4 Scientific observer information

   3.3 Research information
      3.3.1 Research surveys
      3.3.2 Tagging studies
      3.3.3 Other

   3.4 Biological information

4. Preparation for assessments and assessment timetable

   4.1 Report from the Subgroup on Assessment Methods

   4.2 Status of assessment methods
      4.2.1 Current assessment methods
      Recruitment based long-term yield assessment
      Short-term projections
      4.2.2 New assessment methods
      ASPM (with projection)
      Other methods

4.3 Data to implement assessment methods

4.4 Stock structure assumptions and management boundaries
 4.4.1 Stock structure
 4.4.2 Management boundaries

4.5 Assessment timetable

5. Assessments and management advice

5.1 New and exploratory fisheries in 2003/04 and notifications for 2004/05
 5.1.1 New and exploratory fisheries in 2003/04
 5.1.2 New and exploratory fisheries notified for 2004/05
 5.1.3 Progress towards assessments of new and exploratory fisheries
  5.1.3.1 Update Fishery Report for Subarea 88.1

5.2 Update Fishery Reports for the following assessed fisheries
 5.2.1 *Dissostichus eleginoides* South Georgia (Subarea 48.3)
 5.2.2 *Dissostichus eleginoides* Kerguelen Islands (Division 58.5.1)
 5.2.3 *Dissostichus eleginoides* Heard Island (Division 58.5.2)
 5.2.4 *Champsocephalus gunnari* South Georgia (Subarea 48.3)
 5.2.5 *Champsocephalus gunnari* Heard Island (Division 58.5.2)
 5.2.6 *Dissostichus eleginoides* Prince Edward and Marion Islands (Subarea 58.7) and Crozet Islands (Subarea 58.6)

5.3 Assessment and management advice on other fisheries
 5.3.1 Antarctic Peninsula (Subarea 48.1) and South Orkney Islands (Subarea 48.2)
 5.3.2 South Sandwich Islands (Subarea 48.4)
 5.3.3 *Electrona carlsbergi* South Georgia (Subarea 48.3)
 5.3.4 Crabs (*Paralomis spinosissima* and *P. formosa*) (Subarea 48.3)
 5.3.5 *Martialia hyadesi* (Subarea 48.3)

6. Fish and invertebrate by-catch

6.1 Assessments of the status of by-catch species or groups
6.2 Assessments of the expected impact of target species fisheries on by-catch species or groups
6.3 Assessment of risk
6.4 Consideration of mitigation measures
6.5 Scientific observer duties
6.6 Advice to the Scientific Committee

7. Incidental mortality of mammals and seabirds arising from fishing (ad hoc WG-IMAF Report)

8. Evaluation of the threats arising from IUU activities (Fish + IMAF)

   8.1 Review of historical trends in IUU activity
   8.2 Evaluation of future threats of IUU activity
   8.3 Advice to the Scientific Committee

9. Biology, ecology and demography of target and by-catch species

   9.1 Review information available to the meeting
   9.2 Update species profiles
   9.3 Identify gaps in the knowledge

10. Considerations of ecosystem management

   10.1 Interactions with WG-EMM
   10.2 Ecological interactions (e.g. multi-species, benthos etc.)

11. Scheme of International Scientific Observation

   11.1 Summary of information extracted from observer reports and/or provided by technical coordinators

   11.2 Implementation of observer program
      11.2.1 *Scientific Observers Manual*
      11.2.2 Sampling strategies
      11.2.3 Priorities
      11.2.4 Observer coverage specified in the current conservation measures

   11.3 Information relevant to SCIC

   11.4 Advice to the Scientific Committee

12. Future Assessments

13. Future Work

   13.1 Data requirements
   13.2 Organisation of intersessional activities in subgroups
   13.3 Plans for WG-FSA-05

14. Other business

15. Adoption of the report

16. Close of the meeting.

APPENDIX B

LIST OF PARTICIPANTS

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(Hobart, Australia, 11 to 22 October 2004)

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APPENDIX C

LIST OF DOCUMENTS

Working Group on Fish Stock Assessment
(Hobart, Australia, 11 to 22 October 2004)

WG-FSA-04/1	Provisional Agenda and Provisional Annotated Agenda for the 2004 Meeting of the Working Group on Fish Stock Assessment (WG-FSA)
WG-FSA-04/2	List of participants
WG-FSA-04/3	List of documents
WG-FSA-04/4	Report of the Subgroup on Assessment Methods (Siena, Italy, 5 to 9 July 2004)
WG-FSA-04/5 Rev. 1	Fishery-related information for WG-FSA-04 Secretariat
WG-FSA-04/6 Rev. 1	A summary of observations on board longline vessels operating within the CCAMLR Convention Area Secretariat
WG-FSA-04/7 Rev. 1	Summary of observations on board trawlers operating in the Convention Area during the 2003/04 season Secretariat
WG-FSA-04/8 Rev. 1	A summary of scientific observations related to Conservation Measures 25-01 (1996), 25-02 (2003) and 25-03 (2003) Secretariat
WG-FSA-04/9	Withdrawn
WG-FSA-04/10	Antarctic icefishes (Channichthyidae) – a unique family of fishes – a review K.-H. Kock (Germany)
WG-FSA-04/11	Etude de la mortalité accidentelle des oiseaux dans la pêcherie à la palangre dans les secteurs de Crozet et Kerguelen en 2001–2003 K. Delord, N. Gasco, H. Weimerskirch and T. Micol (France) (*CCAMLR Science*, submitted)

WG-FSA-04/12 Diet of grey-headed albatrosses at the Diego Ramírez Islands, Chile: ecological implications
J. Arata (Chile), G. Robertson (Australia), J. Valencia (Chile), J.C. Xavier (UK) and C.A. Moreno (Chile)
(*Antarctic Science*, 16 (3): 263–275 (2004))

WG-FSA-04/13 Seabird by-catch update on industrial Patagonian toothfish fishery in southern Chile
J. Arata, C.A. Moreno and R. Hucke-Gaete (Chile)

WG-FSA-04/14 Chilean NPOA-Seabirds: first steps
C.A. Moreno and J. Arata (Chile)

WG-FSA-04/15 Note from the FAO Secretariat for the 25th COFI-Meeting; status report on the implementation of IPOA-Seabirds
FAO Secretariat

WG-FSA-04/16 CCAMLR Scheme of International Scientific Observation: review of the *Scientific Observers Manual*
Secretariat

WG-FSA-04/17 Mitigation measures of fur seal entanglement by Japanese krill vessels
Delegation of Japan

WG-FSA-04/18 Proposal for extension of fishing season on the exploratory fishery for *Dissostichus* spp. in Statistical Subarea 48.6 in the 2004/05 season
Delegation of Japan

WG-FSA-04/19 Preliminary analyses of data collected during experimental fishing for Patagonian toothfish in international waters of the southwest Indian Ocean (Area 51)
L.J. López Abellán (Spain)
(*CCAMLR Science*, submitted)

WG-FSA-04/20 A characterisation of the toothfish fishery in Subareas 88.1 and 88.2 from 1997/98 to 2003/04
S.M. Hanchet, M.L. Stevenson, N.L. Phillips and P.L. Horn (New Zealand)

WG-FSA-04/21 Genetic structuring of Patagonian toothfish populations in the southwest Atlantic Ocean: the effect of the Antarctic Polar Front and deep-water troughs as barriers to genetic exchange
P.W. Shaw, A.I. Arkhipkin and H. Al-Khairulla (United Kingdom)
(*Molecular Ecology*, in press (2004))

WG-FSA-04/22	United States research under way on seabirds vulnerable to fisheries interactions Delegation of the USA
WG-FSA-04/23	Electronic monitoring of seabird interactions with trawl third-wire cables on trawl vessels – a pilot study H. McElderry, J. Schrader, D. McCullough, J. Illingworth, S. Fitzgerald and S. Davis (USA) (*NOAA Technical Memorandum – NMFS-AFSC-147*)
WG-FSA-04/24	Using digital video monitoring systems in fisheries: applications for monitoring compliance of seabird avoidance devices and seabird mortality in Pacific halibut longline fisheries R.T. Ames, G.H. Williams and S.M. Fitzgerald (USA) (*NOAA Technical Memorandum – NMFS*, accepted)
WG-FSA-04/25	Standardised CPUE analysis of the Antarctic toothfish fishery in CCAMLR Subarea 88.1 from 1988/89 to 2003/04 N.L. Phillips, R.G. Blackwell and S.M. Hanchet (New Zealand)
WG-FSA-04/26	Nesting behaviour of the icefish *Chaenocephalus aceratus* at Bouvetøya Island, Southern Ocean (CCAMLR Subarea 48.6) H.W. Detrich III, C.D. Jones, S. Kim (USA), A.W. North (United Kingdom), A. Thurber (USA) and M. Vacchi (Italy)
WG-FSA-04/27	An exploratory analysis of skate speciation using DNA identification techniques P.J. Smith and S.M. McVeagh (New Zealand)
WG-FSA-04/28 Rev. 1	Geographical differences in the condition, reproductive development, sex ratio and length distribution in Antarctic toothfish (*Dissostichus mawsoni*) from the Ross Sea, Antarctica (CCAMLR Statistical Subarea 88.1) J.M. Fenaughty (New Zealand) (*CCAMLR Science*, submitted)
WG-FSA-04/29	Age and growth of the Antarctic skate (*Amblyraja georgiana*) in the Ross Sea M.P. Francis and C. Ó Maolagáin (New Zealand) (*CCAMLR Science*, submitted)
WG-FSA-04/30	Report on the identification of fish eggs and larvae taken in the Ross Sea, Subarea 88.1, autumn/winter 2003 M. van der Poest Clement and M. Lamare (New Zealand)
WG-FSA-04/31	Stomach contents of the Antarctic toothfish (*Dissostichus mawsoni*) from the western Ross Sea, Antarctica D.W. Stevens (New Zealand)

WG-FSA-04/32	Genetic analysis of Antarctic toothfish samples from the Southern Ocean to explore potential stock boundaries P.J. Smith, S.M. McVeagh (New Zealand) and P.M. Gaffney (USA) (*CCAMLR Science*, submitted)
WG-FSA-04/33 Rev. 1	Summary of the Ecologically Related Species Working Group meeting J. Molloy (New Zealand)
WG-FSA-04/34	Information on the spawning of *Dissostichus mawsoni* from Subareas 88.1 and 88.2 in the 2003/04 season G.J. Patchell (New Zealand)
WG-FSA-04/35	Southern Seabird Solutions – an update J. Molloy (New Zealand)
WG-FSA-04/36	Development of an Antarctic toothfish (*Dissostichus mawsoni*) stock model for CCAMLR Subarea 88.1 for the years 1997/98 to 2003/04 A. Dunn, D.J. Gilbert, S.M. Hanchet and B. Bull (New Zealand)
WG-FSA-04/37	Updated ASPM assessment of the toothfish (*Dissostichus eleginoides*) resource in the Prince Edward Islands vicinity A. Brandão and D.S. Butterworth (South Africa)
WG-FSA-04/38	Mortalidad incidental de aves en la pesquería de cherna con palangre semipelágico Y.H. Marín, A. Stagi and J. Chocca (Uruguay)
WG-FSA-04/39	Aves marinas registradas en el océano Atlántico sur y sudoccidental durante el período 1994–2003 Y.H. Marín, L.C. Barea, J.F. Chocca y A. Stagi (Uruguay)
WG-FSA-04/40	Population structure of icefish (*Champsocephalus gunnari*) in the South Georgia area (Antarctic) Zh.A. Frolkina and I.A. Trunov (Russia) (*CCAMLR Science*, submitted)
WG-FSA-04/41	On the problem of icefish (*Champsocephalus gunnari*) (Channichthyidae) and krill (*Euphausia superba*) interaction in the South Georgia area S.M. Kasatkina and Zh.A. Frolkina (Russia)
WG-FSA-04/42	Summary of the seabird and marine mammal observations during observed toothfish (*Dissostichus* spp.) longline fishing operations in CCAMLR Subareas 88.1 and 88.2 S.J. Baird (New Zealand)

WG-FSA-04/43	The diet of juvenile toothfish (*Dissostichus eleginoides*) on the South Georgia and Shag Rocks shelf (CCAMLR Subarea 48.3) M.A. Collins, K.A. Ross and M. Belchier (United Kingdom)
WG-FSA-04/44	Patterns in the diet of mackerel icefish (*Champsocephalus gunnari*) on the South Georgia and Shag Rocks shelf (CCAMLR Subarea 48.3) M.A. Collins, R. Mitchell, G. Tarling and M. Belchier (United Kingdom)
WG-FSA-04/45	An interlaboratory comparison of ages estimated for *Dissostichus eleginoides* from the Argentine Sea, southwest Atlantic Ocean M.C. Cassia (Argentina), P.L. Horn (New Zealand) and J.R. Ashford (USA)
WG-FSA-04/46	The distribution of seabirds on the Alaskan longline fishing grounds: 2002 data report E. Melvin, K. Dietrich, K. Van Wormer and T. Geernaert (USA) (*Washington Sea Grant Program*, WSG-TA 04-02)
WG-FSA-04/47	Annotated bibliography: seabird interactions with trawl fishing operations and cooperative research K. Dietrich and E. Melvin (USA) (*Washington Sea Grant Program*, WSG-TA 04-02)
WG-FSA-04/48	Trends in breeding numbers and survival of black-browed (*Thalassarche melanophrys*) and grey-headed albatrosses (*T. chrysostoma*) breeding on Macquarie Island A. Terauds, R. Gales and R. Alderman (Australia) (*Wildlife Research*, CSIRO Publishing Australia, submitted)
WG-FSA-04/49	Foraging areas of black-browed and grey-headed albatrosses breeding on Macquarie Island in relation to marine protected areas A. Terauds, R. Gales, G.B. Baker and R. Alderman (Australia) (*Polar Biology*, submitted)
WG-FSA-04/50	Population and survival trends of wandering albatrosses (*Diomedea exulans*) breeding on Macquarie Island A. Terauds, R. Gales, R. Alderman and G.B. Baker (Australia)
WG-FSA-04/51	Update on the Agreement on the Conservation of Albatrosses and Petrels (ACAP) B. Baker and T. Hewitt (Australia)
WG-FSA-04/52	IMAF report – Southern Seabirds Solution visit to Reunion Island M. McNeill (New Zealand)
WG-FSA-04/53	Review of national research on seabirds in New Zealand S.M. Waugh and A. Connell (New Zealand)

WG-FSA-04/54 Seabird mortality in the artisanal austral hake and Patagonian toothfish longline fisheries in southern Chile
C.A. Moreno, P. Rubilar, J. Arata, R. Hucke-Gaete (Chile) and G. Robertson (Australia)

WG-FSA-04/55 Estimation of the incidental capture of seabird species in commercial fisheries in New Zealand waters, 2000/01
S.J. Baird (New Zealand)
(*Fisheries Assessment Report*, New Zealand Ministry of Fisheries)

WG-FSA-04/56 Estimation of the incidental capture of seabird species in commercial fisheries in New Zealand waters, 2001/02
S.J. Baird (New Zealand)
(*Fisheries Assessment Report*, New Zealand Ministry of Fisheries)

WG-FSA-04/57 Estimation of the incidental capture of seabird species in commercial fisheries in New Zealand waters, 2002/03
S.J. Baird (New Zealand)
(*Fisheries Assessment Report*, New Zealand Ministry of Fisheries)

WG-FSA-04/58 Population dynamics of black-browed and grey-headed albatrosses *Diomedea melanophrys* and *D. chrysostoma* at Campbell Island, New Zealand, 1942–96
S.M. Waugh (New Zealand), H. Weimerskirch (France), P.J. Moore and P.M. Sagar (New Zealand)
(*Ibis*, 141: 216–225 (1999))

WG-FSA-04/59 Exploitation of the marine environment by two sypatric albatrosses in the Pacific Southern Ocean
S.M. Waugh (New Zealand), H. Weimerskirch, Y. Cherel (France), U. Shankar (New Zealand), P.A. Prince (United Kingdom) and P.M. Sagar (New Zealand)
(*Mar. Ecol. Prog. Ser*., 177: 243–254 (1999))

WG-FSA-04/60 BioRoss – New Zealand funded marine biodiversity research in the Ross Sea region
J. Burgess (New Zealand)

WG-FSA-04/61 Observations of demersal fish, benthic communities and seafloor composition of the Southern Ocean Atlantic sector from the ICEFISH 2004 cruise
C.D. Jones, S.J. Lockhart and D.F. Doolittle (USA)

WG-FSA-04/62 Withdrawn

WG-FSA-04/63 An alternative method for estimating the level of illegal fishing using simulated scaling methods on detected effort
I. Ball (Australia)
(*CCAMLR Science*, submitted)

WG-FSA-04/64	Scientific observations in CCAMLR fisheries – past, present and future Secretariat (*CCAMLR Science*, submitted)
WG-FSA-04/65	Testing the performance of a recompiled version of CMIX to decompose length-density distributions of Patagonian toothfish (*Dissostichus eleginoides*) T.D. Lamb, W.K. de la Mare, A.J. Constable and C.R. Davies (Australia)
WG-FSA-04/66	The Australian exploratory toothfish fishery in CCAMLR Division 58.4.2 and Subdivision 58.4.3b in season 2003/04 D. Erceg and E. van Wijk (Australia)
WG-FSA-04/67	Progress towards validation of ageing of *Dissostichus eleginoides* using otoliths K. Krusic-Golub and R. Williams (Australia)
WG-FSA-04/68	By-catch in Australian fisheries in Divisions 58.5.2, 58.4.2 and 58.4.3 during the 2002/03 and 2003/04 fishing seasons E. van Wijk and R. Williams (Australia)
WG-FSA-04/69	Alternative method of parameters accuracy calculation in CMIX procedure applied to toothfish recruitment estimation P.S. Gasyukov (Russia) (*CCAMLR Science*, submitted)
WG-FSA-04/70	A comparison of two different methods to age mackerel icefish (*Champsocephalus gunnari*) at South Georgia P. Gasyukov (Russia), K.-H. Kock (Germany) and Zh.A. Frolkina (Russia)
WG-FSA-04/71	Report on the status of wandering, black-browed and grey-headed albatrosses at South Georgia S. Poncet (United Kingdom),G. Robertson (Australia), R. Phillips (United Kingdom), K. Lawton (Australia), B. Phalan, J. Croxall and P. Trathan (United Kingdom)
WG-FSA-04/72	Report on the effectiveness of integrated weight (fast sinking) longlines in reducing the mortality of white-chinned petrels and sooty shearwaters in autoline longline fisheries G. Robertson (Australia), N. Smith (New Zealand), B. Wienecke and S. Candy (Australia)
WG-FSA-04/73	Proposal for the removal of night setting requirement for autoline vessels fishing in Division 58.5.2 G. Robertson and B. Baker (Australia)

WG-FSA-04/74	A simulation approach to the evaluation of recruitment surveys for *D. eleginoides* for the Heard Island Plateau region (Division 58.5.2) S.G. Candy, C.R. Davies and A.J. Constable (Australia)
WG-FSA-04/75	Description of an AD Model Builder implementation of the exact time of release and recapture stock assessment model of Tuck et al. (2003) S.G. Candy, A.J. Constable and D. Erceg (Australia)
WG-FSA-04/76	Preliminary assessment of long-term yield of Patagonian toothfish (*Dissostichus eleginoides*) for the Heard Island Plateau region (CCAMLR Division 58.5.2) based on a random stratified trawl survey in May 2004 C.R. Davies, T. Lamb, A.J. Constable and R. Williams (Australia)
WG-FSA-04/77	Preliminary assessment of mackerel icefish (*Champsocephalus gunnari*) for the Heard Island Plateau region (Division 58.5.2) based on a survey in May 2004 C.R. Davies, T. Lamb, A.J. Constable and R. Williams (Australia)
WG-FSA-04/78	Preliminary assessment of mackerel icefish (*Champsocephalus gunnari*) in Subarea 48.3 based on a UK survey in January 2004 R.C. Wakeford, D.J. Agnew, M.B. Collins and G.B. Parkes (United Kingdom)
WG-FSA-04/79	Trials to test mitigate devices to reduce seabird mortality caused by warp cable strike on factory trawlers B.J. Sullivan, P. Brickle, T.A. Reid, D.G. Bone and D.A.J. Middleton (United Kingdom)
WG-FSA-04/80	Mitigation trials to reduce seabird mortality in pelagic trawl fisheries (Subarea 48.3) B.J. Sullivan, G.M. Liddle and G.M. Munro (United Kingdom)
WG-FSA-04/81	Research under way in Australia on seabirds vulnerable to fisheries interaction R. Gales, G. Robertson, B. Baker, A. Terauds, R. Alderman and K. Lawton (Australia)
WG-FSA-04/82	Assessment of the status of the toothfish stock in Subarea 48.3 D.J. Agnew and G.P. Kirkwood (United Kingdom)
WG-FSA-04/83	Seal mitigation measures on trawl vessels fishing for krill in CCAMLR Subarea 48.3 J. Hooper, J.M. Clark, C. Charman and D. Agnew (United Kingdom) (*CCAMLR Science*, submitted)

WG-FSA-04/84 Rev. 1	Comparison of the catches and biological characteristics of *Dissostichus mawsoni* in Subarea 88.1 in seasons of 2002/03 and 2003/04 K.V. Shust, N.V. Kokorin and A.F. Petrov (Russia)
WG-FSA-04/85	Fish stock assessment survey in Subarea 48.3, 2004 M. Belchier, M. Purves, M. Collins, S. Hawkins, T. Marlow, R. Mitchell, J. Szlakowski and J. Xavier (United Kingdom)
WG-FSA-04/86	The age structure and growth rate of Patagonian toothfish (*Dissostichus eleginoides*) at South Georgia M. Belchier (United Kingdom)
WG-FSA-04/87	Etat des mesures mises en œuvre par les armements à la pêche français impliqués dans la pêcherie palangrière de légine des TAAF, pour maîtriser la mortalité accidentelle d'oiseaux (France)
WG-FSA-04/88	Mesures adoptées par la France dans les zones 58.6 (Crozet) et 58.5.1 (Kerguelen) afin de réduire la mortalité aviaire – 2003/04 (France)
WG-FSA-04/89	Observer notes (Subarea 88.1) V.G. Prutko (Ukraine)
WG-FSA-04/90	Some peculiarities of *Chionobathyschus dewitti* biology in the Ross Sea L.K. Pshenichnov (Ukraine)
WG-FSA-04/91	Modifications to the Generalised Yield Model in 2004, version GYM501E.EXE A.J. Constable (Australia)
WG-FSA-04/92	Theoretical considerations for estimating the density of cohorts and mean recruitment of Patagonian toothfish (*Dissostichus eleginoides*) based on research trawl survey data C.R. Davies, E.M. van Wijk and A.J. Constable (Australia)

Other Documents

CCAMLR-XXIII/6	Notification of Norway's intention to conduct an exploratory fishery for 2004/05 in Subareas 88.1 and 88.2 Delegation of Norway
CCAMLR-XXIII/8	Notification of Argentina's intention to conduct exploratory fisheries for *Dissostichus* spp. in CCAMLR areas Delegation of Argentina

CCAMLR-XXIII/9	Notification of Australia's intention to conduct an exploratory longline fishery in Division 58.4.3a for *Dissostichus* spp. Delegation of Australia
CCAMLR-XXIII/10	Notification of Australia's intention to conduct an exploratory longline fishery in Division 58.4.3b for *Dissostichus* spp. Delegation of Australia
CCAMLR-XXIII/11	Notification of Australia's intention to conduct an exploratory longline fishery in Statistical Subarea 88.1 for *Dissostichus* spp. Delegation of Australia
CCAMLR-XXIII/12	Notification of Chile to conduct an exploratory longline fishery in Division 58.4.1 for *Dissostichus* spp. Delegation of Chile
CCAMLR-XXIII/13	Notification of intention to conduct an exploratory longline fishery in Division 58.4.2 for *Dissostichus* spp. Delegation of Chile
CCAMLR-XXIII/14	Notification of intention to conduct an exploratory longline fishery in Division 58.4.3b for *Dissostichus* spp. Delegation of Chile
ADDENDUM CCAMLR-XXIII/12 CCAMLR-XXIII/13 CCAMLR-XXIII/14	Notification of Chile to conduct an exploratory longline fishery in Division 58.4.1 (CCAMLR-XXIII/12), Division 58.4.2 (CCAMLR-XXIII/13) and Division 58.4.3b (CCAMLR-XXIII/14) for *Dissostichus* spp. Delegation of Chile
CCAMLR-XXIII/15	Notification of Spain's proposal to conduct exploratory fisheries for toothfish (*Dissostichus* spp.) in CCAMLR Subarea 88.1 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b in the 2004/05 season Delegation of Spain
CCAMLR-XXIII/16	Notification of the intention to conduct an exploratory bottom trawl fishery for icefish in Subarea 48.3 Delegation of the United Kingdom
CCAMLR-XXIII/17	Notification by the United Kingdom of its intention to participate in the exploratory fishery for *Dissostichus* spp. in CCAMLR Subarea 88.1 during the 2004/05 season Delegation of the United Kingdom
CCAMLR-XXIII/18	Notification of exploratory fisheries for *Dissostichus* spp. in the 2004/05 season (Subarea 48.6) Delegation of Japan

CCAMLR-XXIII/19	Notification of exploratory fisheries for *Dissostichus* spp. in the 2004/05 season (Division 58.4.3.b) Delegation of Japan
CCAMLR-XXIII/20	Notification by the Republic of Korea of its intention to conduct an exploratory fishery for *Dissostichus* spp. in the 2004/05 season (Subarea 48.6) Delegation of the Republic of Korea
CCAMLR-XXIII/21	Notification by the Republic of Korea of its intention to conduct an exploratory fishery for *Dissostichus* spp. in the 2004/05 season (Division 58.4.1) Delegation of the Republic of Korea
CCAMLR-XXIII/22	Notification by the Republic of Korea of its intention to conduct an exploratory fishery for *Dissostichus* spp. in the 2004/05 season (Division 58.4.2) Delegation of the Republic of Korea
CCAMLR-XXIII/23	Notification by the Republic of Korea of its intention to conduct an exploratory fishery for *Dissostichus* spp. in the 2004/05 season (Division 58.4.3a) Delegation of the Republic of Korea
CCAMLR-XXIII/24	Notification by the Republic of Korea of its intention to conduct an exploratory fishery for *Dissostichus* spp. in the 2004/05 season (Division 58.4.3b) Delegation of the Republic of Korea
CCAMLR-XXIII/25	New Zealand notification to undertake exploratory fishing for *Dissostichus* spp. in CCAMLR Subarea 48.6 in the 2004/05 season Delegation of New Zealand
CCAMLR-XXIII/26	New Zealand notification to undertake exploratory fishing for *Dissostichus* spp. in CCAMLR Divisions 58.4.1 and 58.4.2 in the 2004/05 season Delegation of New Zealand
CCAMLR-XXIII/27	New Zealand notification to undertake exploratory fishing for *Dissostichus* spp. in CCAMLR Subareas 88.1 and 88.2 in the 2004/05 season Delegation of New Zealand
CCAMLR-XXIII/28	Notification by Russia of its intention to continue an exploratory fishery for *Dissostichus* spp. in CCAMLR Subareas 88.1 and 88.2 Delegation of Russia

CCAMLR-XXIII/29	Notification by Ukraine of its intention to continue an exploratory fishery for *Dissostichus* spp. in CCAMLR Subarea 88.1 for the 2004/05 season Delegation of Ukraine
CCAMLR-XXIII/30	Notification by Ukraine of its intention to continue an exploratory fishery for *Dissostichus* spp. in CCAMLR Division 58.4.1 for the 2004/05 season Delegation of Ukraine
CCAMLR-XXIII/31	Notification by Ukraine of its intention to continue an exploratory fishery for *Dissostichus* spp. in CCAMLR Division 58.4.2 for the 2004/05 season Delegation of Ukraine
CCAMLR-XXIII/32	Notification of an exploratory fishery in Subarea 88.1 Delegation of Uruguay
CCAMLR-XXIII/34	Notification of exploratory fisheries for *Dissostichus* spp. in the 2004/05 season Delegation of South Africa
CCAMLR-XXIII/38	Monitoring CCAMLR fisheries: proposed changes and improvements Secretariat
CCAMLR-XXIII/BG/8	Implementation of fishery conservation measures in 2003/04 Secretariat
CCAMLR-XXIII/BG/9	Summary of current conservation measures and resolutions in force 2003/04 Secretariat
CCAMLR-XXIII/BG/23	CCAMLR and seabirds in the Antarctic marine ecosystem Secretariat (To be submitted to the First ACAP Conference of Parties)
SC-CAMLR-XXIII/5 Rev. 1	Draft rules for the submission of meeting papers to the Scientific Committee Secretariat
SC-CAMLR-XXIII/7	On the management of exploratory toothfish fisheries: the need to amend a number of conservation measures Delegation of Ukraine
SC-CAMLR-XXIII/BG/1	Catches in the Convention Area in the 2002/03 and 2003/04 seasons Secretariat

SC-CAMLR-XXIII/BG/3	Summary of notifications of new and exploratory fisheries in 2004/05 Secretariat
SC-CAMLR-XXIII/BG/7	Observer Report on FAO/Birdlife South American Workshop on Implementation of NPOA-Seabirds and Conservation of Albatrosses and Petrels (Valdivia, Chile, 2 to 6 December 2003) CCAMLR Observer (C.A. Moreno, Chile)
SC-CAMLR-XXIII/BG/19	On experimental approach to extend boundaries of exploratory fishery on Antarctic toothfish (*D. mawsoni*) in the Ross Sea (Subareas 88.1 and 88.2) in the meso- and bathypelagial layers Delegation of Russia
SC-CAMLR-XXIII/BG/20	Structure and distribution of the slope fish community in the vicinity of the sub-Antarctic Prince Edward Archipelago Delegation of South Africa
SCIC-04/3	Estimation of IUU catches of toothfish inside the Convention Area during the 2003/04 fishing season Secretariat
WG-FSA-SAM-04/1	Agenda
WG-FSA-SAM-04/2	List of participants
WG-FSA-SAM-04/3	List of documents
WG-FSA-SAM-04/4	Further development of the fishery plans Secretariat
WG-FSA-SAM-04/5	Update on the external review of the Generalised Yield Model (GYM) software and manual CCAMLR Secretariat
WG-FSA-SAM-04/6	Reorganisation of the WG-FSA report CCAMLR Secretariat
WG-FSA-SAM-04/7	Feasibility of trawl surveys to estimate abundance of juvenile toothfish in Subarea 88.1 R.L. O'Driscoll, B.A. Wood and S.M. Hanchet (New Zealand)
WG-FSA-SAM-04/8	Approaches to monitoring and assessing toothfish in new and exploratory fisheries, with particular reference to Subarea 88.1 S.M. Hanchet and R.L. O'Driscoll (New Zealand)

WG-FSA-SAM-04/9	Application of the bootstrap method in assessment of target strength regression parameters on the basis of *in situ* measurements P.S. Gasyukov and S.M. Kasatkina (Russia)
WG-FSA-SAM-04/10	Revision of icefish (*C. gunnari*) stock estimate in the South Georgia area on the basis of the Russian acoustic trawl survey 2002 S.M. Kasatkina and P.S. Gasyukov (Russia)
WG-FSA-SAM-04/11	On the catchability of bottom trawl in relation to icefish (*C. gunnari*) S.M. Kasatkina and V.F. Ivanova (Russia)
WG-FSA-SAM-04/12	Variants of the ASPM assessment of the toothfish (*Dissostichus eleginoides*) resource in the Prince Edward Islands vicinity which attempt to reconcile CPUE and catch-at-length data A. Brandão and D.S. Butterworth (South Africa)
WG-FSA-SAM-04/13	Development of a population model for the assessment of Antarctic toothfish (*Dissostichus mawsoni*) in the Ross Sea A. Dunn, D.J. Gilbert, S.M. Hanchet and B. Bull (New Zealand)
WG-FSA-SAM-04/14	Estimating the level of illegal fishing using simulated scaling methods on detected activity I. Ball (Australia)
WG-FSA-SAM-04/15	Technical specifications of Fish Heaven: version 2.1.5 I. Ball (Australia)
WG-FSA-SAM-04/16	Survey estimates of recruitment of toothfish in Subarea 48.3 D.J. Agnew, J. Moir-Clark, R.C. Wakeford, M. Collins, M. Belchier (United Kingdom)
WG-FSA-SAM-04/17	Alternative assessment methods for toothfish at South Georgia D. Agnew, A. Payne and G. Kirkwood (United Kingdom)
WG-FSA-SAM-04/18	Estimating toothfish biomass in Subarea 48.3 using local depletions D. Agnew and J. Pearce (United Kingdom)
WG-FSA-SAM-04/19	Considerations on the design and evaluation of surveys for estimating recruitment of Patagonian toothfish (*Dissostichus eleginoides)* with preliminary outcomes for the Heard Island plateau region (Division 58.5.2) C.R. Davies, S. Candy and A.J. Constable (Australia)

WG-FSA-SAM-04/20	Does the current South Georgia groundfish survey accurately estimate the standing stock of mackerel icefish? M. Collins, J. Xavier, K. Reid, M. Belchier, C. Goss and D. Agnew (United Kingdom)
WG-EMM-04/18	Development of the acoustic survey database Secretariat
	An initial evaluation of CCAMLR management procedures for the *Dissostichus eleginoides* fisheries C. Holt, A.J. Benson and W.K. de la Mare (Simon Fraser University, Canada)

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Proposed structure of the report of the 2004 meeting of WG-FSA (prepared by Inigo Everson)

ANI 483 structure
ANI 5852 structure
TOP 483 structure
TOP 5852 structure
By-catch structure
New and exploratory activity this season
New and exploratory structure
Observer program structure
Report outline for 2004

APPENDIX D

INTERSESSIONAL WORK PLAN
FOR AD HOC WG-IMAF FOR 2004/05

INTERSESSIONAL WORK PLAN FOR AD HOC WG-IMAF FOR 2004/05

The Secretariat will coordinate the intersessional work of the IMAF group. An interim review of work will be conducted in June 2005 and advised to ad hoc WG-IMAF at the time of WG-EMM (July 2005). The outcome of the intersessional work will be reviewed in September 2005 and reported as a tabled paper to WG-IMAF in October 2005.

[1] In addition to work coordinated by the Science Officer (Secretariat)   * SODA: Scientific Observer Data Analyst

	Task/Topic	Paragraphs of WG-FSA report	Members' assistance[1]	Start/ Completion deadlines	Action
1.	**Planning and coordination of work:**				
1.1	Circulate materials on IMAF matters as contained in reports of current meetings of CCAMLR.	Standing request		Dec 2004	Place all relevant sections of CCAMLR-XXIII on IMAF page of CCAMLR website and notify IMAF group members, technical coordinators and (via them) scientific observers.
1.2	Circulate papers submitted to WG-FSA on IMAF matters.	Standing request		Dec 2004	Circulate the list of papers submitted to WG-FSA on IMAF matters and advise that copies of papers are available on the CCAMLR website.
1.3	Acknowledge work of technical coordinators and scientific observers.	Standing request		Dec 2004	Commend technical coordinators and all observers for their efforts in the 2003/04 fishing season.
1.4	Review new and exploratory fishery notifications.	Standing request	B. Baker, N. Smith	At submission deadline	Transmit electronic copies of notifications and adopted 2004 table to Mr Baker and Mr Smith to prepare initial draft of IMAF table.
1.5	Prepare agenda for WG-IMAF-05.		Science Officer, Co-Conveners	By 31 Aug 2004	Science Officer to forward electronic version of last year's annotated agenda to Co-Conveners for revision prior to distribution to WG-IMAF.
1.6	Membership of WG-IMAF.	Standing request	Members	Nov 2004/ as required	Request nomination of new members to IMAF, especially Members not currently involved, and request all Members to send their representatives to the next IMAF meeting.
1.7	Submission of papers for WG-IMAF-05.		Members, IMAF members, SODA*	By 0900 26 Sep 2005	Submit papers specifically relevant to agenda items. Request observer and compliance papers from Secretariat at least one week prior to the meeting.

	Task/Topic	Paragraphs of WG-FSA report	Members' assistance[1]	Start/ Completion deadlines	Action
1.8	Allocation of submitted papers to agenda items and assignment of rapporteuring tasks.	Standing request	Co-Conveners	Before meeting	Prepare list and post on website.
1.9	Preparation for meeting with WG-FSA-05 to discuss issues of mutual interest.	6.38	Co-Conveners, WG-FSA Convener, IMAF members	By 30 Sep 2005	IMAF internal discussions on five topics identified in paragraph 6.38, prior to meeting with WG-FSA-05.
2.	**Members' research and development activities:**				
2.1	Update information on national research programs on albatrosses, giant petrels and white-chinned petrels, using the revised report templates, in relation to: (i) status and trends of populations (ii) foraging range and distribution (iii) genetic profiles (iv) number and nature of by-catch specimens and samples.	Standing request 7.132–7.134	Members, IMAF members, technical coordinators, nominated scientists Dr Gales	Nov 2004/ Sep 2005	Secretariat to provide the revised report templates. Explicit reminder to IMAF members in July 2005.
2.2	Risk assessment of seabird by-catch in the Convention Area.	Standing request	IMAF members	Nov 2004/ Sep 2005	Further work as appropriate to update SC-CAMLR-XXIII/BG/22 for the Scientific Committee. Circulate any new tabled papers relating to seabird at-sea distributions to Co-Conveners, Prof. Croxall and Dr Gales – and to other WG-IMAF members as requested. Liaise with BirdLife International (via Prof. Croxall) in respect of outputs from seabird range workshop.
2.3	Quinquennial review of status and trends in marine mammal and bird populations.	SC-CAMLR-XXIII/2, 6(ii)	IMAF members		Plan with WG-FSA for the five-year review of status and trends of populations.

	Task/Topic	Paragraphs of WG-FSA report	Members' assistance[1]	Start/ Completion deadlines	Action
2.4	Information on the development and use of fisheries-related methods of the avoidance of incidental mortality of seabirds. In particular, information is sought on the following: • seabird capture rates in relation to dyed and artificial bait, snoodline and mainline colour, bait depth and sink rates; • optimum configuration of line-weighting regimes and equipment; • experiences with IWLs; • automated methods for adding and removing weights to and from the line; • line-setting devices for autoline vessels; • underwater longline setting devices; • feasibility of using video recording of line hauling operations for observations on seabird incidental catch; • tests of/experiences with paired streamer lines and boom-and-bridle arrangements.	Standing request	Members, IMAF members, technical coordinators	Nov 2004/ Sep 2005	Request information, collate responses for WG-IMAF-05.
2.5	Methods for preventing seal mortality or injury associated with krill trawl fishing.	7.238, 7.242	Members as appropriate, IMAF members	As soon as report available	Further testing of, and continued reporting on, effectiveness of various mitigation methods and devices; report to WG-IMAF-05.
2.6	Current information on seal mitigation methods.	7.242, 7.282	Secretariat	Nov 2004	Combine into a single document the information on various seal-excluding devices; distribute to CCAMLR Members and other interested organisations.
2.7	Continued experimental trials of mitigation measures in French EEZs.	7.45	France, IMAF scientists	As soon as possible	Report results to WG-IMAF-05.
2.8	Experimental design.	7.89, 7.90	Members as appropriate, IMAF members		Design experiments aimed at decoupling the effects of mitigation treatments.

	Task/Topic	Paragraphs of WG-FSA report	Members' assistance[1]	Start/ Completion deadlines	Action
3.	**Information from outside the Convention Area:**				
3.1	Information on longline fishing effort in the Southern Ocean to the north of the Convention Area.	Standing request	Members, non-Contracting Parties, international organisations	Sep 2005	Request information intersessionally from those Members known to be licensing fishing vessels in areas adjacent to CCAMLR (e.g. Argentina, Australia, Brazil, Chile, New Zealand, South Africa, UK, Uruguay). Review situation at WG-IMAF-05. Request information from other parties – Members and non-Contracting Parties (e.g. People's Republic of China, Japan, Republic of Korea, Taiwan) and international organisations (especially CCSBT, ICCAT, IOTC) – known to be fishing, or collecting data on fishing, in areas adjacent to the Convention Area. Review at WG-IMAF-05.
3.2	Information on incidental mortality outside the Convention Area of seabirds breeding within the area.	Standing request	Members, IMAF members	Sep 2005	Repeat request to all IMAF members, especially to those relevant to item 3.1 above. Review at WG-IMAF-05.
3.3	Reports on use and effectiveness of mitigating measures outside the Convention Area.	Standing request	Members, non-Contracting Parties, international organisations	Sep 2005	Request information on use/implementation of mitigating measures, especially provisions in Conservation Measures 25-02 and 25-03, as under item 3.1 above. Review responses at WG-IMAF-05.
3.4	Reports on nature of observer programs, including observer coverage.	Standing request	Technical coordinators, Members, non-Contracting Parties, international organisations	Sep 2005	Request information intersessionally from those Members known to be licensing fishing vessels in areas adjacent to CCAMLR (e.g. Argentina, Australia, Brazil, Chile, New Zealand, South Africa, Uruguay, UK). Review situation at WG-IMAF-05. Request information from other parties – Members and non-Contracting Parties (e.g. People's Republic of China, Japan, Republic of Korea, Taiwan) and international organisations (especially CCSBT, ICCAT, IOTC) – known to be fishing, or collecting data on fishing, in areas adjacent to the Convention Area. Review at WG-IMAF-05.

	Task/Topic	Paragraphs of WG-FSA report	Members' assistance[1]	Start/ Completion deadlines	Action
4.	**Cooperation with international organisations:**				
4.1	2004 meeting of CCSBT-ERSWG; invite CCSBT to attend WG-IMAF.	Standing request 7.167	Science Officer, CCSBT Secretariat	As required	CCAMLR Secretariat to obtain and circulate copies of the report and papers tabled at the 2004 meeting from the CCSBT Secretariat. Invite and nominate observers as decided by the Scientific Committee.
4.2	Cooperation with IATTC, ICCAT and IOTC on specific issues regarding incidental mortality of seabirds.	Standing request	Co-Conveners, Science Officer	Nov 2004/ Sep 2005	Brief CCAMLR observers on desired feedback on IMAF matters (seabird by-catch levels and mitigating measures).
4.3	Collaboration and interaction with all tuna commissions (CCSBT, IATTC, ICCAT, IOTC, WCPFC) and RFMOs with responsibility for fisheries in areas where Convention Area seabirds are killed.	7.165	Relevant Members, CCAMLR observers	Nov 2004 and at specific meetings	Request information on: (i) annual data on distribution level of longline fishing effort; (ii) existing data on levels of seabird by-catch; (iii) mitigating measures currently in use and whether voluntary or mandatory; (iv) nature and coverage of observer program. Support regulations for use of mitigating measures at least as effective as Conservation Measure 25-02.
4.4	Progress with NPOAs in respect of FAO IPOA-Seabirds.	Standing request 7.160	Relevant Members, IMAF members	By Sep 2004	Solicit reports to CCAMLR on progress for information and make review.
4.5	Assist Japan in improving its NPOA and use of mitigating measures.	SC-XX 4.58, 4.66, CC-XX 6.29 6.180	Members, IMAF members	As feasible	Await response to CCAMLR by Japan. Discuss progress at WG-IMAF-05.
4.6	Support for ACAP and attendance at MOP1.	7.157, 7.158	Members as appropriate; Australia		Support establishment of Advisory Committee, implementation of its action plan, and coordinating activities between CCAMLR and ACAP. Report to WG-IMAF-05.
4.7	IUCN Red List: Seabirds	Standing request	Secretariat	Aug 2004	Obtain from BirdLife International, circulate to IMAF members and table for SC-CAMLR-XXIV, any revisions to the conservation status of albatross, *Macronectes* and *Procellaria* species.

	Task/Topic	Paragraphs of WG-FSA report	Members' assistance[1]	Start/ Completion deadlines	Action
4.8	BirdLife International (BLI)	Standing request 7.144, 7.145, 7.265		Sep 2005	Request information from BLI about its activities of relevance to IMAF, in particular its Seabird Program and 'Save the Albatross Campaign'. BLI submission of reports on global tracking and RFMO evaluation to WG-IMAF-05.
4.9	Southern Seabird Solutions	7.174	Ms Molloy	Sept 2005	Report on progress to WG-IMAF-05.
4.10	Third International Albatross and Petrel Conference	7.154	Secretariat	As soon as possible	Request conference organisers and/or sponsors to facilitate access to an electronic version of the abstracts volume.
4.11	Fourth International Fisheries Observer Conference	7.179	Science Officer, SODA*, Members, IMAF members	Sept 2005	Provide feedback to CCAMLR of relevant information; report at WG-IMAF-05.
5.	**Data acquisition and analysis:**				
5.1	Preliminary analyses of data from the current fishing season.	Standing request	Technical coordinators	Sep–Oct 2005	Standing request: summarise and analyse current year data at a level adequate to facilitate assessment at WG-IMAF-05.
5.2	Acquisition from EEZs and elsewhere as appropriate, of seabird incidental mortality data for trawl fisheries.	Standing request	Members, especially France	Nov 2004/ Sep 2005	Request Members for appropriate data.
5.3	Acquisition of original data in CCAMLR format on seabird incidental mortality for French EEZs in Subarea 58.6 and Division 58.5.1 for 2000/01 and 2004/05.	7.34, 7.251(v)	France	As soon as possible for 2001/02	Request France to submit reports and data logbooks prepared by national observers for the current and past fishing seasons, preferably using CCAMLR reporting formats.
5.4	Analysis of 2003/04 vessel-specific by-catch information.	7.25, 7.251(vi)	France	As soon as possible	Request analysis of the 2003/04 by-catch data to identify factors contributing to high levels of by-catch.
5.5	Status report on implementation of IMAF recommendations regarding mitigation research programs, observer coverage, and implementation of mitigation measures.	7.45, 7.251	France, IMAF members	Sept 2004	Report to WG-IMAF-05.
5.6	Provision of data by Brazil on by-catch of Convention Area seabirds in Brazilian waters.	7.128	Brazil	As soon as possible	Report to WG-IMAF-05.

	Task/Topic	Paragraphs of WG-FSA report	Members' assistance[1]	Start/ Completion deadlines	Action
5.7	Observations on krill trawl vessels.	7.231, 7.237	UK	As soon as possible	Submit original data collected by UK observers in 2004 on six of the nine vessels fishing for krill in Subarea 48.3.
5.8	Estimates of IUU take of seabirds.		SODA*, IMAF members, Co-Conveners	Before start WG-IMAF-05	Review IUU seabird by-catch estimation method to take account of intersessional work recommended by WG-FSA and prepare 2005 estimates of IUU seabird by-catch using revised methods.
6.	**Scientific observer issues:**				
6.1	Preliminary analysis of data from 2004/05 fisheries.	Standing request	SODA*	IMAF meeting	Produce draft tables equivalent to Tables 7.1 to 7.14 of this report at least one week before WG-IMAF-05.
6.2	Changes to current seabird data collection:	11.63	IMAF, technical coordinators		IMAF follow through with the Secretariat and technical coordinators to ensure that these changes are incorporated into observer forms and into training/briefing protocols used by technical coordinators.
	(i) better information on when seabirds are caught on longlines;	11.27			
	(ii) better information on when seabirds are caught in trawls;	11.28, 11.29			
	(iii) several specifications relating to streamer lines (aerial extent, number of streamer lines, line deployed over hookline etc);	11.15			
	(iv) hooks in offal;	11.17			
	(v) remove requirement for seabird abundance data;	11.26 7.201			
	(vi) append definition of bird 'caught';	7.188			
	(vii) number of hooks directly observed.				
6.3	Reporting of line sink rate test results.	7.106	IMAF members, technical coordinators	Nov 2004	Reported daily to relevant national agencies and to CCAMLR at end of fishing season.
6.4	Vessel operators reminded of streamer line specifications in Conservation Measure 25-02.	7.58, 7.61	Members, technical coordinators	Nov 2004	Vessel operators advised to exceed standards to prevent compliance failures.

	Task/Topic	Paragraphs of WG-FSA report	Members' assistance[1]	Start/ Completion deadlines	Action
6.5	Definition of 'caught' bird.	7.201, 7.202	IMAF members, technical coordinators, Secretariat	Nov 2004	Request feedback from observers on ability to apply this definition. Secretariat to append this definition (SC-CAMLR-XXII, Annex 5, paragraphs 6.214 to 6.217) to each conservation measure that specifies a maximum permitted level of seabird by-catch.
6.6	Review of *Scientific Observers Manual* and address identified issues: (i) review seabird data collection and protocols; (ii) determine if data collections meet data requirements; (iii) prioritise seabird-related observer tasks.	11.35–11.46, 11.50, 11.65	IMAF/FSA observer subgroup, technical coordinators	Nov 2004	Report, as necessary, to WG-IMAF-05.
7.	**Conservation Measure 25-02:**				
7.1	Revise measure	7.93	IMAF members		Review, especially line-weighting provisions for autoliners, at WG-IMAF-05.
7.2	Research areas: (i) evaluate sink rates of external weighted autolines; (ii) relationship of line sink rate to values that include both vessel speed and sink rate; (iii) integrated-weight line efficacy; (iv) methods for monitoring individual vessel compliance.		IMAF members		Continue research to allow a more informed revision of Conservation Measure 25-02 in 2005, with the intention of combining Conservation Measures 24-02 and 25-02, if possible.