SC-CAMLR-XXV

SCIENTIFIC COMMITTEE FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES

REPORT OF THE TWENTY-FIFTH MEETING OF THE SCIENTIFIC COMMITTEE

HOBART, AUSTRALIA
23–27 OCTOBER 2006

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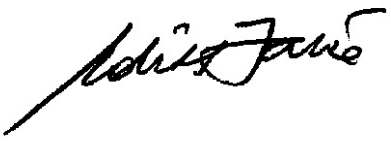

Chair of the Scientific Committee
November 2006

Abstract

This document presents the adopted report of the Twenty-fifth Meeting of the Scientific Committee for the Conservation of Antarctic Marine Living Resources held in Hobart, Australia, from 23 to 27 October 2006. Reports of meetings and intersessional activities of subsidiary bodies of the Scientific Committee, including the Working Groups on Ecosystem Monitoring and Management and on Fish Stock Assessment, are appended.

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REPORT OF THE TWENTY-FIFTH MEETING
OF THE SCIENTIFIC COMMITTEE
(Hobart, Australia, 23 to 27 October 2006)

OPENING OF THE MEETING

1.1 The Scientific Committee for the Conservation of Antarctic Marine Living Resources met from 23 to 27 October 2006 at the CCAMLR Headquarters in Hobart, Tasmania, Australia. The meeting was chaired by Dr E. Fanta (Brazil).

1.2 Representatives from the following Members attended the meeting: Argentina, Australia, Belgium, Chile, European Community, France, Germany, India, Italy, Japan, Republic of Korea, Namibia, New Zealand, Norway, Poland, Russian Federation, South Africa, Spain, Sweden, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America and Uruguay.

1.3 The Chair welcomed to the meeting observers from the People's Republic of China, Mauritius, Netherlands and Peru (Acceding States), Cambodia and Mozambique (non-Contracting Parties), along with observers from ASOC, CCSBT, CEP, COLTO, FAO, IUCN, IWC and SCAR, and encouraged them to participate in the meeting to the extent possible.

1.4 The List of Participants is given in Annex 1. The List of Documents considered during the meeting is given in Annex 2.

1.5 The following rapporteurs were appointed to prepare the report of the Scientific Committee:

- Dr K. Sullivan (New Zealand) – CCAMLR Scheme of International Scientific Observation;
- Drs P. Trathan (UK) and S. Kawaguchi (Australia) – Ecosystem monitoring and management (Advice from WG-EMM);
- Drs P. Penhale (USA) and S. Grant (UK) – Ecosystem monitoring and management (Management of protected areas);
- Dr S. Nicol (Australia) – Krill resources;
- Drs C. Jones (USA) and G. Parkes (UK) – Fish resources (except by-catch);
- Dr E. Marschoff (Argentina) – Crab resources and squid resources;
- Prof. G. Duhamel (France) – Fish and invertebrate by-catch;
- Dr R. Holt (USA) – New and exploratory fisheries;
- Ms K. Rivera (USA) and Mr N. Smith (New Zealand) – Incidental mortality;
- Prof. C. Moreno (Chile) and Dr K. Reid (UK) – Additional monitoring and management issues;
- Dr K.-H. Kock (Germany) – Management under conditions of uncertainty about stock size and sustainable yield;
- Dr A. Constable (Australia) – Scientific research exemption;
- Prof. B. Fernholm (Sweden) – Cooperation with other organisations;
- Dr D. Ramm (Secretariat) – all other matters.

Adoption of Agenda

1.6 The Provisional Agenda had been circulated prior to the meeting (SC-CAMLR-XXV/1). The Scientific Committee agreed to review the Scheme of International Scientific Observation (new Item 2(ii)), consider making *CCAMLR Science* available on the CCAMLR website (under Item 12(ii)) and take an item on the US AMLR Program under 'Other business'. With these changes, the Agenda was adopted (Annex 3).

Dr Geoff Kirkwood (1947–2006)

1.7 The Scientific Committee paused in memory of Dr Geoff Kirkwood (UK), and in recognition of his long and distinguished career in fisheries science and his outstanding contributions to the work of the Scientific Committee and Commission.

1.8 Dr Fanta agreed to communicate the Scientific Committee's condolences to Dr Kirkwood's family. The Scientific Committee noted that the 2006 volume of *CCAMLR Science* will be dedicated to Dr Kirkwood.

Report of the Chair

Intersessional meetings of working groups of the Scientific Committee

1.9 The following meetings of working groups took place in 2006:

(i) The second meeting of SG-ASAM was held in Hobart, Australia, on 23 and 24 March 2006, to consider models of icefish target strength and classification of volume backscattering strength (Annex 6). Dr R. O'Driscoll (New Zealand) convened the meeting which was attended by four participants representing three Members. Two invited experts attended – Dr R. Korneliussen (Norway) and Dr G. Macaulay (New Zealand).

(ii) The twelfth meeting of WG-EMM was held from 17 to 28 July 2006 in Walvis Bay, Namibia (Annex 4). It was convened by Dr Reid and attended by 43 participants (including an observer from IWC), representing 14 Members.

The second Workshop on Management Procedures to Evaluate Options for Subdividing the Krill Catch Limit among Small-scale Management Units was held during the first week of the WG-EMM, from 17 to 21 July 2006 and was co-convened by Ms T. Akkers (South Africa) and Dr C. Reiss (USA) (Annex 4, Appendix D). Forty-one participants attended, representing 12 Members.

(iii) The meeting of WG-FSA was held from 9 to 20 October 2006 in Hobart, Australia, prior to the Scientific Committee meeting (Annex 5). It was convened by Dr S. Hanchet (New Zealand) and attended by 39 participants representing 12 Members.

WG-FSA-SAM met from 10 to 17 July 2006 in Walvis Bay, Namibia, immediately prior to the WG-EMM meeting (WG-FSA-06/6). The meeting was convened by Dr Jones and attended by 17 participants representing seven Members. An invited expert, Dr M. Maunder (IATTC), also attended.

(iv) Ad hoc WG-IMAF conducted its meeting as part of WG-FSA-06 (Annex 5, Appendix D). It was co-convened by Ms Rivera and Mr Smith.

(v) The Second Workshop on Estimating Age of Mackerel Icefish *Champsocephalus gunnari* was hosted by AtlantNIRO, Kaliningrad, Russia from 19 to 23 June 2006 (WG-FSA-06/7). The workshop was chaired by Dr Kock and co-convened by Drs N. Timoshenko and Z. Frolkina (Russia) and was attended by six participants representing four Members.

1.10 In addition to these meetings and workshops, a meeting of JAG was held in conjunction with WG-EMM (CCAMLR-XXV/7). The meeting was held from 17 to 19 July 2006, and was co-convened by Ms R. Tuttle (USA) and Dr D. Agnew (UK) and attended by 10 participants representing seven Members.

CCAMLR Scheme of International Scientific Observation

1.11 Scientific observers appointed under the CCAMLR Scheme of International Scientific Observation were deployed on all vessels targeting finfish in the Convention Area, and some vessels targeting krill. Scientific observers have participated in 54 cruises so far this season, as follows:

- 49 cruises on vessels targeting toothfish or icefish (37 cruises on longliners; nine cruises on trawlers and three cruises on pot vessels);
- five cruises on krill fishing vessels.

Fisheries

1.12 CCAMLR Member countries participated in 13 fisheries under conservation measures in force during the 2005/06 season (1 December 2005 to 30 November 2006). In addition, four other managed fisheries were conducted in national EEZs within the Convention Area in 2005/06. Details are given in CCAMLR-XXV/BG/3. The fisheries targeted toothfish, icefish and krill, and included a number of exploratory fisheries.

1.13 Fifteen Members fished: Argentina, Australia, Chile, France, Japan, Republic of Korea, New Zealand, Norway, Poland, Russia, South Africa, Spain, Ukraine, UK and Uruguay.

1.14 As at 5 October 2006, and subject to various conservation measures in force for 2005/06, Members had reported a total of 105 084 tonnes of krill, 13 704 tonnes of toothfish and 2 434 tonnes of icefish from the Convention Area. A number of other species had been taken as by-catch.

1.15 Fisheries and reported catches are detailed in SC-CAMLR-XXV/BG/1 Rev. 2, CCAMLR-XXV/BG/3 and the 2006 report of WG-FSA (Annex 5).

Representation at meetings of other international organisations

1.16 The Scientific Committee was represented at a number of meetings of other international organisations during the intersessional period. Observers' reports from these meetings were considered under Agenda Item 9.

CCAMLR SCHEME OF INTERNATIONAL SCIENTIFIC OBSERVATION

2.1 In accordance with CCAMLR's Scheme of International Scientific Observation, scientific observers were deployed on all vessels in all finfish fisheries in the Convention Area.

2.2 A total of 37 longline cruises were conducted during the 2005/06 season, with scientific observers (international and national) on board all vessels. Ten cruises were undertaken in Subarea 48.3 by 10 vessels, two cruises were undertaken in Subarea 48.4 by two vessels, two cruises were undertaken by one vessel in Subarea 48.6, six cruises were undertaken by five vessels in Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b, two cruises were conducted by one vessel in Division 58.5.2, two cruises were conducted by one vessel in Subareas 58.6 and 58.7 and 13 cruises were undertaken in Subareas 88.1 and 88.2 by 13 vessels.

2.3 During the 2005/06 fishing season, six vessels conducted nine trawl cruises targeting finfish. All trawlers fishing for finfish carried scientific observers. In total, three national and five internationally designated scientific observers participated in these operations. In addition, five scientific observation programs were conducted by one national and four internationally designated scientific observers on board krill vessels operating in the Convention Area (43% of vessels).

2.4 Three pot cruises were conducted in 2005/06, all targeting *Dissostichus eleginoides*. Two cruises were undertaken in Division 58.5.2 by the Australian-flagged vessel *South Princess*, with national scientific observers on board, and one cruise was undertaken in Subarea 48.3 by the Uruguayan vessel *Punta Ballena* with an international scientific observer on board.

2.5 The Scientific Committee considered and approved recommendations from WG-FSA concerning the following aspects of the CCAMLR Scheme of International Scientific Observation as follows:

(i) Protocols should be developed so that levels of depredation in the *Dissostichus* spp. fisheries in the Convention Area can be estimated (Annex 5, paragraph 3.72), including provision within the logbook for observers to record the number and type of marine mammals observed during tally counts and whether the mammals were observed interacting with the fishing operation (Annex 5, paragraph 11.8).

(ii) The instructions to observers with respect to sampling longlines for by-catch should be simplified as follows (see paragraph 4.229 and Annex 5, paragraph 6.39):

(a) Tally period –

- 25% of hooks should be observed for tally counts each day
- the tally period may be broken up into several periods each day
- tally period to include counts of fish species, fish and invertebrate by-catch, and interactions of birds and mammal with the fishing gear.

(b) Biological data –

- Biological sampling periods and tally periods should be consecutive (the mean weight of by-catch is worked out during the biological sampling period).

(c) Rajids –

- Skate and ray observations should be conducted at least once every 48 hours and, if possible, should cover approximately 10% of the hooks hauled.

(iii) Observers should be thoroughly briefed by technical coordinators, and guidelines for recording by-catch data be followed as closely as possible. In addition, the Scientific Committee reiterated the importance of using the most up-to-date forms (Annex 5, paragraph 6.40).

(iv) Coverage of the krill fishery should be increased to allow for adequate and representative sampling across all trawl fisheries for monitoring of by-catch and efficacy of mitigation measures (Annex 5, paragraph 7.8).

(v) Data collection needs, relative to several areas of seabird and marine mammal interaction and mitigation, required additions or changes to logbooks and cruise reports as detailed in Annex 5, paragraph 7.42.

(vi) Members should increase the level of scientific observer coverage across the krill fishing fleet, and develop objectives for such monitoring to include both the target species and by-catch. To facilitate the correct recording of larval fish by-catch, the Scientific Committee requested the Secretariat to contact all CCAMLR technical coordinators to compile a standard methodology for sampling for fish by-catch and an identification guide for larval/juvenile fish likely to be found in krill trawls (Annex 5, paragraph 10.3).

(vii) Observers should continue to collect and record tag data on their logbook forms, and periodically provide the vessel with the data on request (Annex 5, paragraph 3.42).

(viii) Work should be carried out by Members in the intersessional period to determine whether methods could be developed in which the scheme could be used to determine levels of reporting and detection of tag–recapture events on board fishing vessels (Annex 5, paragraph 11.7).

2.6 Additional issues related to the Scheme of International Scientific Observation are contained in various areas of the WG-FSA report (Annex 5). These include:

(i) depredation (Annex 5, paragraphs 3.66 to 3.72);

(ii) by-catch (Annex 5, paragraphs 6.35 to 6.39);

(iii) incidental mortality in fisheries (Annex 5, paragraphs 7.8 and 7.42 and Appendix D, paragraphs 117 to 124);

(iv) krill trawling (Annex 5, paragraph 10.3);

(v) tagging (Annex 5, paragraph 3.41).

2.7 The Scientific Committee considered the state of the scientific observer program, reviewed the data requirements from the krill and finfish fisheries and identified the need to determine priorities for observers in each fishery.

2.8 The Scientific Committee noted that observers may be involved in tasks for routine monitoring of fishing activities and catches and, under some circumstances, short-term experimental work to address specific questions of interest. The following paragraphs relate to routine monitoring by observers.

2.9 The Scientific Committee noted the following tasks that use observer data from finfish fisheries:

(i) collection of biological samples and data for developing age–length keys, estimating selectivity and total mortality, length-at-age, length–weight relationships and maturity ogives;

(ii) differences between vessels and gear configurations which need to be estimated for use in standardising time series of CPUE as well as for determining how fisheries data should be included in different integrated assessments;

(iii) validation of releases, recaptures and scanning rates in tagging programs, and catch rates, in particular, by-catch species;

(iv) condition of rajids cut from longlines;

(v) accurate recording of incidental mortality of marine mammals and seabirds;

(vi) implementation of mitigation measures for reducing incidental mortality;

(vii) level of depredation in longline fishing (taking of toothfish from longlines by marine mammals).

2.10 The Scientific Committee also noted that WG-FSA had identified a number of inconsistencies in observer data and issues surrounding the observer program, including:

(i) difficulties in implementing the observer program:

  (a) difficulties in some divisions in the implementation of the tagging program, such as differences in understanding the roles of observers and vessel personnel (Annex 5, paragraph 5.42);

  (b) mitigation measures – measurement of sink rates of longlines (Annex 5, Appendix D, paragraphs 118 and 119);

  (c) workload and priorities of observers (Annex 5, paragraphs 6.35 and 11.9);

  (d) complexity of observer requirements (Annex 5, paragraph 6.35);

  (e) inconsistencies in categorisation of the fate of rajids (Annex 5, paragraphs 6.26 and 6.32);

(ii) inconsistent application of observer requirements:

  (a) inconsistency in reporting on netbinding (Annex 5, Appendix D, paragraph 57);

(iii) inconsistencies in comparisons of observer data with other data sources:

  (a) inconsistencies in estimates of by-catch from two sources within observer-derived datasets (Annex 5, paragraph 6.31);

  (b) inconsistencies between observer data and fine-scale data, such as location of catches (Annex 5, paragraph 6.31);

  (c) incomplete recording of by-catch (Annex 5, paragraph 6.40);

  (d) lower than expected by-catch rates in exploratory fisheries (Annex 5, paragraph 5.42);

  (e) differences in by-catch rates between vessels (Annex 5, paragraph 5.15).

2.11 The Scientific Committee noted that the implementation of the observer program and the application of observer requirements could be improved by adopting a standard approach to education and training for observers in these fisheries. It requested that the Secretariat undertake a review of how education and training of observers is undertaken and to work with Members to develop an approach for achieving a common level of education and training amongst observers and how to maintain a high quality and accuracy of observations in these fisheries. The Scientific Committee encouraged Members to work with the Secretariat on this matter. It asked that the Secretariat, at least, work with conveners of the working groups and the Members' technical coordinators to progress this work and to provide a paper for consideration at next year's meeting.

2.12 With respect to the krill fishery, the Scientific Committee noted that the following issues require data from observations (SC-CAMLR-XXIV, paragraph 2.10):

(i) accurate catch rates used in standardising CPUE;

(ii) biological samples and data, particularly length frequencies, for use in determining selectivity and total mortality of krill and for determining the overlap between fisheries and predators at small scales;

(iii) differences between vessels and fishing methods which need to be estimated for use in standardising time series of CPUE as well as for understanding how to include fishery data in integrated assessments;

(iv) by-catch rates of fish larvae;

(v) incidental mortality of marine mammals and seabirds;

(vi) understanding differences between the various vessels/gear configurations.

Review of the scientific observation program

2.13 The Scientific Committee reviewed the coverage of the krill fishery by observers to date. Table 1 summarises this coverage, showing the monthly catch for each Flag State in each subarea for the two most recent seasons, 2003/04 and 2004/05. Since 2000, 33 observer reports have been received by the Secretariat with 15 reports being received from the 2003/04 and 2004/05 seasons combined.

2.14 The Scientific Committee noted that both WG-EMM (Annex 4, paragraph 3.80) and WG-FSA (Annex 5, paragraph 10.3) recommended increased observer coverage across the krill fleet. It also recalled its discussion last year on the deployment of observers on krill vessels (SC-CAMLR-XXIV, paragraphs 2.7 to 2.24), including specific comments indicating the points of disagreement on compulsory deployment of observers on krill fishing vessels.

2.15 The Scientific Committee noted that three main issues are of high priority in the krill fishery at present:

(i) understanding the differences in selectivity between the various krill fishing gear configurations (paragraph 2.9);

(ii) determining the level of by-catch of fish larvae in the krill fishery (paragraph 2.12);

(iii) determining the level of warp strikes by seabirds and incidental mortality of seals (paragraphs 5.31 and 5.32).

2.16 In considering these three issues, the Scientific Committee agreed that there may be differences in by-catch of fish larvae and incidental mortality of seabirds and seals between different trawl methods and gear configurations in this fishery. It therefore agreed that observations from all Members were important for addressing these issues.

2.17 Some Members, however, were of the view that the issues of by-catch of larval fish and the incidental mortality of seabirds and mammals do not outweigh the importance of more direct krill-related observations. They also noted that, at present, the effect of by-catch of larval fish on the dynamics of those stocks has not been assessed and that it would be desirable for the working groups to make this assessment using existing data before focussing on further monitoring of by-catch of larval fish in the krill fishery. Dr M. Naganobu (Japan) noted that Japan has provided information from the scientific observation on krill vessels including the by-catch of larval fish for over 10 years. He further noted that the interaction with seabirds and mammals in the krill fishery is only modest or coming under control.

2.18 Most Members agreed that, as proposed last year (SC-CAMLR-XXIV, paragraph 2.16), a scientific study should be undertaken such that each vessel in the krill fishery should carry an observer at the same time in the same areas to enable a valid comparison of the different methods and that this study could be used to help determine the level of observer coverage that would be required in the future. It was noted from Table 1 that such a study might be undertaken in Subarea 48.2 during March–May when most Members fished in that area.

2.19 Some Members indicated that such an experiment is still unlikely to result in sufficient coverage of the features intended to be monitored, as the level of krill fishery is currently very low. Hence the justification of the cost that will incur is not sufficiently strong. They also noted that, should such a study proceed, the manner in which the study would be funded would need to be considered (for example, see the comments in CCAMLR-XXIV, paragraph 9.7).

2.20 The Scientific Committee agreed that the issue of by-catch of larval fish in the krill fishery could impact on the stock assessment of target species.

2.21 The Scientific Committee noted that there is a need to review the priorities of the observer program to ensure that the expectations and workloads of observers remain achievable. It requested that conveners of the working groups initiate discussions within their groups on priorities within the observer program so that the working groups can provide advice on the matter next year.

Advice to the Commission

2.22 The Scientific Committee recommended that:

(i) WG-FSA's recommendations regarding the work of CCAMLR scientific observers be noted (paragraph 2.5 and Annex 5, paragraph 11.12);

(ii) the deployment of scientific observers on krill fishing vessels should be a high priority to investigate the by-catch of larval fish in the krill fishery (paragraphs 4.7 to 4.10; see also paragraph 11.14);

(iii) the priorities of the observer program be reviewed to ensure that the quality of the data being collected does not deteriorate (paragraph 2.21).

ECOSYSTEM MONITORING AND MANAGEMENT

Advice from WG-EMM

General comments

3.1 Dr Reid, Convener of WG-EMM, reported on the 2006 meeting of WG-EMM which was held from 17 to 28 July 2006 in Walvis Bay, Namibia. Other intersessional activities included the second meeting of SG-ASAM and work by correspondence groups on the design of land-based krill predator surveys and on the subdivision of CCAMLR statistical areas into ecologically based harvesting units. During the meeting the following groups met:

(i) the Second Workshop on Management Procedures
(ii) Subgroup on CEMP Methods
(iii) ad hoc Group on Fishery Dynamics
(iv) subset of the Steering Group for the CCAMLR-IPY-2008 Survey
(v) Steering Committee on the Review of the Structure of the Working Groups of the Scientific Committee.

3.2 These activities were summarised in three documents for consideration by the Scientific Committee:

(i) report of WG-EMM-06 (Annex 4) containing a listing of 'Key points for consideration by the Scientific Committee' at the end of each major agenda item, as well as the report of the Second Workshop on Management Procedures (Annex 4, Appendix D);

(ii) synopses of working papers (SC-CAMLR-XXV/BG/8) considered at the meeting, each containing an abstract and a summary of the findings and/or conclusions as they relate to a particular agenda item;

(iii) report of the Convener of WG-EMM to SC-CAMLR-XXV (SC-CAMLR-XXV/BG/7) containing appropriate references to paragraphs in the report of WG-EMM-06.

3.3 As in recent years, the agenda of WG-EMM-06 was structured to consider the status and trends in the krill fishery (Annex 4, section 3), the status and trends in the krill-centric ecosystem (section 4), the status of management advice arising from these considerations (section 5) and future work (section 6).

3.4 In particular, the Working Group drew the attention of the Scientific Committee to:

(i) the analysis of long-term population data from both the South Shetland Islands and South Orkney Islands that has revealed consistent declines in both Adélie and chinstrap penguin numbers over the last 20 to 30 years (Agenda Item 3);

(ii) the substantial progress in the use of ecosystem models for evaluating management procedures which indicate that a spatially restricted krill fishery (if fishing only occurred in Subarea 48.1, or following the distribution of historical catches) would have considerable negative impacts for regional ecosystems (Agenda Item 3);

(iii) concern about the lack of necessary ship-time to conduct the CCAMLR-IPY-2008 Survey (Agenda Item 13(v));

(iv) development of planning for the CCAMLR-IWC Workshop in 2008 (Agenda Item 13(vi));

(v) the work of the steering committee for the CCAMLR Workshop on Bioregionalisation of the Convention Area (Agenda Item 3);

(vi) the breadth and scope of the potential future work identified by WG-EMM (Agenda Item 3);

(vii) the need for information on fishing methodologies, technology and fishing operations as well as broader observer coverage on all types of krill fishing vessels to provide operational data on fishing selectivity and total mortality, reiterating previous advice to the Scientific Committee (Agenda Item 4);

(viii) the recommendation from the Steering Committee on the Review of the Structure of the Working Groups of the Scientific Committee that, while recognising that present needs are being met, there is a need for the Scientific Committee to undertake a long-term review of its work plans in order for the working groups to appropriately prioritise their meeting schedules (Agenda Item 13).

Status and trends in the krill-centric ecosystem

3.5 The Scientific Committee noted that the analysis of long-term penguin population data from both the South Shetland Islands and South Orkney Islands had revealed consistent declines in both Adélie and chinstrap penguin numbers over the past 20 to 30 years.

3.6 The Scientific Committee recalled that historical analyses had previously indicated that differences in winter sea-ice conditions had opposite effects on these two species; specifically that years of extensive winter sea-ice favoured Adélie penguins, whereas years of reduced winter sea-ice favoured chinstrap penguins. This had led to the expectation that changing regional sea-ice conditions would differentially impact populations of the two species. These new analyses indicated that, as both species now showed population declines, this may reflect the influence of reduction in prey availability linked to large-scale climate forcing.

3.7 The Scientific Committee therefore requested that Members consider what the potential effects of climate change on the Antarctic marine ecosystems might be, and how this knowledge could be used to advise the Commission on management of the krill fishery. It also requested that Members consider how the effects of fishing might be distinguished from the effects of climate change. For example, could a program of experimental fishing be used to help quantify these effects and/or how might simulation studies using ecosystem models be used to understand what the potential effects might be. The Scientific Committee requested that Members provide submissions on this item to the next meeting of WG-EMM.

Status of management advice

Second Workshop on Management Procedures

3.8 This was the sixth in a series of workshops held by WG-EMM designed to develop a management procedure for krill (Annex 4, Appendix D). The aim of this workshop was to examine how well six candidate methods for subdividing the krill catch limit in Area 48 among SSMUs would meet the objectives of CCAMLR.

3.9 The Scientific Committee recognised that there had been a considerable amount of work undertaken since WG-EMM-05 that had helped develop existing models (KPFM2, EPOC and SMOM), and helped build parameter sets on which the provision of management advice could be based. As with the previous workshop in 2005, the Second Workshop on Management Procedures had focused on the output of KPFM2, and also explored structural uncertainty about allocation options using both KPFM2 and SMOM (Annex 4, paragraph 2.2).

3.10 In simulation trials conducted using KPFM2 it was apparent that, should the fishery take the existing precautionary catch limit entirely from within Subarea 48.1, there would be considerable negative impacts on the ecosystem in that region and, under the assumptions of flux, negative consequences for the ecosystem in the downstream SSMUs in Subareas 48.2 and 48.3 (Annex 4, paragraph 2.4).

3.11 Furthermore, simulation trials using both KPFM2 and SMOM indicated that Fishing Option 1 (following the distribution of the historical fishery) would have greater negative impacts on the ecosystem compared to the other fishing options.

3.12 The Scientific Committee noted that further evaluation of Fishing Options 2, 3 and 4 would require additional work on the development and interpretation of performance measures. It further noted that simulations carried out during the workshop indicated that the performance of these fishing options would be improved if monitoring data were used to regularly review and update the allocation of catches among SSMUs; that is, in a manner analogous to Fishing Option 5 (Annex 4, paragraph 2.6).

3.13 It was recognised that further discussions on performance measures and the means for providing integrated advice to the Commission on the relative merits of different strategies with respect to Article II would help progress this work.

3.14 Some Members expressed their concern that, although substantial progress had been achieved, the Scientific Committee was still unable to provide conclusive advice concerning the six candidate procedures for subdividing the catch limit for krill among SSMUs in Area 48. The Scientific Committee recognised that while evaluating these candidate management options remained a high priority, this presented a very complex task.

3.15 The Scientific Committee agreed that it may be beneficial if a review of the technical modelling issues be added to the agenda of WG-SAM for consideration at its next meeting in order to maintain the momentum that has been developed in this area of work. The Scientific Committee also recommended that an integrated assessment approach for krill, similar to that used by WG-FSA for other species, should be explored by WG-SAM.

3.16 ASOC drew Members' attention to its paper CCAMLR-XXV/BG/26 which supported a flexible approach to the allocation of catch among SSMUs and which emphasised the value of including new data and the importance of incorporating uncertainty.

Existing conservation measures

3.17 The Scientific Committee requested that the requirement to review CEMP site protection under Conservation Measure 91-01 (2004) in respect of Conservation Measures 91-02 and 91-03 (protection of Cape Shirreff and Seal Island respectively) should be clarified and, if required, reviewed at the earliest opportunity.

3.18 The Scientific Committee agreed that results from the Australian krill biomass survey conducted in Division 58.4.2 (SC-CAMLR-XXIV, paragraph 3.8) provided information necessary to update the precautionary catch limit in Conservation Measure 51-03 to 1.49 million tonnes (Annex 4, paragraph 5.35 and SC-CAMLR-XXV/8).

Future work of WG-EMM

Operating models

3.19 The Scientific Committee noted the change of name of the Subgroup on the Development of Operating Models, to Operating Models Subgroup. It also endorsed the list of tasks identified by the subgroup and the development of a newsgroup (Annex 4, paragraphs 6.19 to 6.23).

Workshops outside CCAMLR relevant to the work of WG-EMM

3.20 The Scientific Committee noted the following scientific initiatives that were of relevance to the work of WG-EMM.

3.21 Integrating Climate and Ecosystem Dynamics in the Southern Ocean (ICED) is a multidisciplinary international initiative (under IMBER) to develop a coordinated circumpolar approach to understand climate interactions in the Southern Ocean, the implications for ecosystem dynamics, the impacts on biogeochemical cycles, and the development of management procedures. WG-EMM recognised that a number of CCAMLR scientists have been closely involved with the planning of ICED and encouraged continued close cooperation between the two groups. ICED proposed to hold a workshop on circumpolar ecosystem modelling during the latter part of 2007, the outcomes of which will be of considerable relevance to CCAMLR (Annex 4, paragraph 7.8). The ICED website is www.antarctica.ac.uk/Resources/BSD/ICED/index.htm.

3.22 The Lenfest Ocean Program, a non-profit private organisation that supports scientific research, is considering sponsoring a scientific/technical workshop on krill-based ecosystem dynamics in the southwest Atlantic between April and June 2007. The theme of the workshop will be designed so as to provide outcomes of use to the work of CCAMLR.

3.23 FAO will be conducting a Workshop on Modelling Ecosystem Interactions for Informing an Ecosystem Approach to Fisheries during the second or third quarter of 2007. The FAO workshop is via invitation only, and expressions of interest from Members are welcome (Annex 4, paragraphs 7.14 and 7.16).

3.24 The Scientific Committee looked forward to the outcomes of all these initiatives.

Long-term work plan of WG-EMM

3.25 The Scientific Committee endorsed the long-term work plan of WG-EMM (Annex 4, paragraph 6.41) and noted that the following three actions should have priority status:

(i) facilitate the continued evaluation of management procedures to allocate the precautionary krill catch limit in Area 48 among SSMUs;

(ii) develop SSMU-specific estimates of predator abundance and demand in Area 48;

(iii) consider revising estimates of B_0 and γ in all areas where harvesting occurs, taking account of recent developments in estimating parameters used in assessments, and considering revising estimates of precautionary yield where appropriate.

3.26 The Scientific Committee agreed that a workshop to review estimates of B_0 and precautionary catch limits for krill should be held in conjunction with the WG-EMM meeting in 2007 (Annex 4, paragraph 6.49). The workshop will be convened by Dr Nicol and should consider the following points:

(i) review of parameters used in the assessment, including growth and recruitment variability;

(ii) examine whether integrated approaches could be used to estimate recruitment variability and M from long-term datasets;

(iii) consider the level of krill escapement to provide for predators in the decision rule;

(iv) consider alternative methods for estimating catch limits for krill according to the CCAMLR decision rules and how the different methods might be compared and evaluated for providing advice;

(v) consider sources of uncertainty that may not be able to be included specifically in the estimation of B_0 or the assessment process generally.

3.27 With respect to the workshop in 2007, the Scientific Committee noted the requests from WG-EMM for advice from WG-SAM and SG-ASAM on the most appropriate method for estimating B_0 and associated CV from survey data (Annex 4, paragraph 6.50). This involvement may be facilitated by the establishment of the electronic newsgroup of the Operating Models Subgroup (Annex 4, paragraphs 6.19 to 6.23).

Advice to the Commission

3.28 The Scientific Committee called to the attention of the Commission the following items arising from WG-EMM:

(i) The Australian BROKE-West acoustic krill biomass survey of Division 58.4.2 carried out from January to March 2006 provided an updated estimate for the catch limit of 1.49 million tonnes for Division 58.4.2 (SC-CAMLR-XXV/8).

(ii) Simulation trials using both KPFM2 and SMOM indicated that Fishing Option 1 (following the distribution of the historical fishery) would have greater negative impacts on the ecosystem compared to the other fishing options (Annex 4, paragraph 2.4).

(iii) Although substantial progress had been achieved, the Scientific Committee was still unable to provide further conclusive advice concerning the six candidate procedures for subdividing the catch limit for krill among SSMUs in Area 48 and further work was necessary (Annex 4, paragraph 6.57(xv)).

(iv) A workshop to be held in 2007 and convened by Dr Nicol will review estimates of B_0 and γ and suggest appropriate revision for the precautionary catch limits for krill in Areas 48 and 58 (Annex 4, paragraph 6.57(xv)).

(v) A proposed workshop should be held no later than 2008 to examine data requirements and existing data that provide abundance estimates and associated uncertainty of land-based predator populations (Annex 4, paragraph 6.57(i)).

(vi) The Scientific Committee highlighted its concern regarding the lack of commitment for ship-time for the CCAMLR-IPY-2008 Survey (SC-CAMLR-XXV/BG/5 Rev. 1). It noted that the current situation could be embarrassing to CCAMLR and its Members if the survey were to be cancelled.

(vii) The Scientific Committee noted the advances in planning for the CCAMLR-IWC Workshop in 2008 (SC-CAMLR-XXV/6).

Management of protected areas

3.29 In respect of ATCM Decision 9 (2005), the Scientific Committee recommended that, at least in the near future, all ATCM protected area proposals with marine components should continue to be provided to CCAMLR for review, unless they are clearly not required according to ATCM Decision 9 (Annex 4, paragraphs 5.11 and 5.12). In addition, to avoid potential confusion in the future, the Scientific Committee also recommended that standard terminology be adopted within CCAMLR to distinguish between 'ATCM draft management plans with marine components' and 'marine protected areas (MPAs)' *per se* (Annex 4, paragraph 5.8).

3.30 Co-conveners of the Bioregionalisation Workshop Steering Committee, Drs Penhale and Grant, presented an update on progress towards the 2007 CCAMLR Workshop on Bioregionalisation (SC-CAMLR-XXV/BG/24).

3.31 The Scientific Committee endorsed the Steering Committee's recommendation that its membership be expanded to include the conveners of the four Scientific Committee working groups and Dr W. Dinter (Germany), an additional member nominated by CEP.

3.32 Progress leading to the 2007 Bioregionalisation Workshop included several years of discussion on MPAs at WG-EMM, followed by the 2005 CCAMLR Workshop on MPAs, held in Silver Spring, USA (SC-CAMLR-XXIV, Annex 7). In 2006, the Bioregionalisation Workshop Steering Committee was formed. The 2007 workshop is viewed as a next step in the progression of endeavours leading to the establishment of a system of MPAs harmonised for the protection of the Antarctic marine environment across the Antarctic Treaty System.

3.33 Two separate components of work to be undertaken towards the development of a system of MPAs for the Convention Area were identified:

(i) technical development of methods for bioregionalisation of the Southern Ocean
(ii) consideration of methods for selection and designation of MPAs.

3.34 The focus of the 2007 Bioregionalisation Workshop will be on component (i). The aim of the workshop is to advise on a bioregionalisation of the Southern Ocean, including, where possible, advice on fine-scale subdivision of biogeographic provinces. Work on component (ii) should proceed in parallel, with submission of papers to either the Scientific Committee or its working groups. It is anticipated that further work towards the development of methods for the selection and designation of MPAs will be progressed by the Scientific Committee.

3.35 The Scientific Committee was invited to consider how individuals might contribute in advising on, and undertaking, the tasks outlined in SC-CAMLR-XXV/BG/24 in preparation for the 2007 workshop. These tasks include:

(i) identification and collation of relevant datasets which will be of use in the workshop analysis;

(ii) further development of a program of work to be undertaken during the workshop;

(iii) review of existing bioregionalisation methods and approaches;

(iv) undertaking fine-scale bioregionalisation analysis for areas of interest, particularly areas for which data are available.

3.36 Members were also encouraged to identify experts who might participate in the 2007 Bioregionalisation Workshop.

3.37 Papers addressing the topics identified in paragraph 3.35 should be submitted to the 2007 Bioregionalisation Workshop, in particular to provide reviews and background information on existing bioregionalisation methods and potential data sources.

3.38 Prof. J. Beddington (UK) noted that a bioregionalisation analysis may need to consider the effects of climate change, and that the results may need to be updated if and when new information becomes available.

3.39 Dr Constable noted that the methods adopted to undertake the bioregionalisation should be able to be used in the future to update the bioregionalisation if and when new information becomes available. He also noted that, with respect to climate change, the data from scenarios used by the Intergovernmental Panel on Climate Change could be used to explore how robust the bioregionalisation might be to changes arising from climate change.

3.40 Dr K. Shust (Russia) noted that Russia had considerable expertise in bioregionalisation based on analysis of data on the composition of fish fauna. This work resulted in the identification of eight ichthyo-geographic zones. He noted that other Members might contribute review papers based on biological, oceanographic and climatic data which would provide a basis for bioregionalisation.

3.41 Dr Constable noted that digital maps of existing bioregionalisations would be of particular value to the workshop, to allow comparison of the results of different approaches. Datasets used in the development of existing bioregionalisation work should also be made available to the workshop, in synoptic form where possible, to allow comparison with other datasets.

3.42 Prof. Moreno noted the importance of including data on the distribution of fishing effort, in order to identify areas that might be considered in the development of a system of MPAs.

3.43 The Scientific Committee congratulated the Bioregionalisation Workshop Steering Committee on its progress to date, noting its contribution to the aim to establish a harmonised regime for the protection of the Antarctic marine environment across the Antarctic Treaty System (CCAMLR-XXIV, paragraph 4.12).

3.44 Dr Constable presented SC-CAMLR-XXV/BG/7 on the outcomes of an independent Experts Workshop on Bioregionalisation of the Southern Ocean, held in Hobart, Australia, in September 2006. This workshop was hosted by WWF-Australia and the Antarctic Climate and Ecosystems Cooperative Research Centre (Hobart), and supported by Peregrine Adventures. The workshop was attended by 23 experts in their independent capacity. Members of the Bioregionalisation Workshop Steering Committee were invited to participate in the workshop, however only a few members were able to attend.

3.45 The aim of the Experts Workshop was to develop a proof of concept for a bioregionalisation of the Southern Ocean, to assist the Scientific Committee in its work on this topic.

3.46 The workshop addressed three main areas:

(i) data to be incorporated in a bioregionalisation (using physical and environmental data, including sea-ice, oceanographic characteristics and surface chlorophyll, as the primary input);

(ii) development of a statistical method for bioregionalisation, based on an approach previously presented at WG-EMM (Annex 4, paragraph 5.17), work by CEP (Environmental Domains analysis), and work by Australia and New Zealand for their respective EEZs;

(iii) expert review of the bioregionalisation outcomes based on existing knowledge of the Southern Ocean.

3.47 A method was agreed which incorporated aspects of the four approaches listed in paragraph 3.46(ii). This method integrates a statistical approach with expert knowledge, and was successful in bringing together appropriate datasets. The ease with which additional data can be included using this method was also noted.

3.48 The primary regionalisation results corresponded with existing knowledge of frontal systems in the Southern Ocean, and also identified other features, such as the Weddell Gyre, the Scotia Arc and the Kerguelen Plateau. A secondary regionalisation introduced data on sea-ice and chlorophyll, and highlighted the heterogeneity of the coastal, shelf and seasonal sea-ice areas.

3.49 The workshop made substantial progress towards a method that could be used to undertake a bioregionalisation of the Convention Area, and established a proof of concept. Further work should focus on the introduction of other (particularly biological) datasets, and finer-scale analysis for particular areas of interest.

3.50 Dr Naganobu noted that the results of the Experts Workshop were important not only for fisheries management but also for Southern Ocean science.

3.51 The Scientific Committee congratulated the experts' group on its efforts, and welcomed the outcomes of the Experts Workshop. It was noted that this type of review has relevance not only for the work of the Scientific Committee, but also in a wider context.

3.52 Dr H.-C. Shin (Republic of Korea) enquired how temporal variation could be incorporated into a bioregionalisation. Dr Constable responded that the use of average values over long time series (e.g. for synoptic satellite data) was the approach used at the Experts Workshop for incorporating a temporal component into the analysis, but that variation over both short and longer time-scales should be considered further. He noted that temporal characteristics can be incorporated into a bioregionalisation in other forms such as through measures of variability or as proportions of time that particular conditions might be met.

3.53 Dr Grant introduced SC-CAMLR-XXV/BG/19 on the potential for the achievement of MPAs using CCAMLR conservation measures. This paper noted that it is important for the Scientific Committee to identify the most appropriate tools for the achievement of MPA objectives. These could include existing area-based conservation and management tools such as closed areas, as well as other geographically defined regulations. It was further noted that ongoing efforts to define appropriate tools for the development of protected areas will contribute to component (ii) of the work identified in paragraph 3.33, which should proceed in parallel to the bioregionalisation work.

3.54 ASOC introduced SC-CAMLR-XXV/BG/30 on achieving a network of MPAs in the Convention Area. ASOC welcomed the discussions on MPAs and bioregionalisation, and expressed its desire to continue participating in work on this topic.

3.55 Belgium expressed its keen interest in supporting the efforts of CCAMLR towards the creation of a network of MPAs and noted that bioregionalisation is a crucial step in the

process. In this regard, Belgium offered to host the 2007 Bioregionalisation Workshop in Brussels during the first or second week in August. The Scientific Committee welcomed and endorsed Belgium's offer and looked forward to a productive workshop.

Advice to the Commission

3.56 The Scientific Committee endorsed the Steering Committee's recommendation that its membership be expanded to include the conveners of the Scientific Committee working groups and Dr Dinter, an additional member nominated by CEP.

3.57 The Scientific Committee welcomed and endorsed Belgium's offer to host the Bioregionalisation Workshop in Brussels, in August 2007.

Interactions between WG-EMM and WG-FSA

3.58 In order to address some of the issues regarding interactions between WG-EMM and WG-FSA identified by the working groups, the conveners of those working groups proposed a one-day workshop in 2007 (to coincide with the meetings of WG-SAM and WG-EMM). The aim of this workshop would be to consider the development of ecosystem models to examine the effects of fisheries in fish-based ecosystems. The Scientific Committee agreed that, in the spirit of encouraging interactions between the working groups, this workshop would be co-convened by the two working group conveners.

3.59 It was recognised that information about fish-dependent predators, such as Antarctic shags (*Phalacrocorax bransfieldensis*), would be extremely useful. For example, shags have declined in numbers in the South Shetland Islands over the past 17 years, this is thought to be related to changes in the availability of their main prey, demersal fish (Casaux and Barrera-Oro, 2006). Dr E. Barrera-Oro (Argentina) suggested that these changes are likely to be related to the effects of the commercial fishery in the late 1970s.

HARVESTED SPECIES

Krill resources

Status and trends

2005/06 season

4.1 Seven vessels from five Member countries fished for krill in the 2005/06 season. One vessel from Malta commenced fishing but was re-flagged to Poland during the season. A small amount of krill by-catch was reported by a UK-flagged vessel fishing for icefish.

4.2 A total catch of 105 084 tonnes of krill was reported to the Secretariat by 5 October 2006 (Table 2). Compared to the catch reported at the same time last season it appears that the total catch for the 2005/06 season will be at a similar level to that reported in the 2004/05 season (127 035 tonnes) (Table 3).

4.3 Fine-scale data had been received from all Members fishing for krill in 2004/05 and the historical series of haul-by-haul data for the Japanese krill fishery had also been received by the Secretariat. The Secretariat was requested to liaise with Members to ascertain whether haul-by-haul catch and effort data were available for seasons where aggregated data had been submitted in past seasons (Annex 4, paragraphs 3.3 to 3.5).

2006/07 season

4.4 Notifications of intentions to fish for krill in the 2006/07 season were received from eight Members (Table 4; see also paragraphs 15.10 to 15.16). All vessels except the *Saga Sea* (Norway) will use conventional trawls. The Chilean vessel (*Ocean Dawn*) will also conduct scientific research.

4.5 Most vessels fishing for krill in 2006/07 will carry scientific observers collecting data in accordance with the CCAMLR Scheme of International Scientific Observation (Table 4). The Scientific Committee reiterated the importance of these scientific observations for providing information on issues such as larval fish by-catch and for validating haul-by-haul data for use in developing CPUE indices (paragraph 11.14).

4.6 A list of reports from scientific observers is produced annually for WG-EMM (see WG-EMM-06/5, Appendix 1).

Advice from WG-EMM

4.7 There are indications that the krill fishery is in the process of expanding and the Scientific Committee noted that fine-scale information on the fishery will be necessary for management (paragraphs 15.10 to 15.16). There is also an urgent requirement for further information on the by-catch of larval and juvenile fish in the krill fishery (Annex 4, paragraph 3.36).

4.8 A standardised methodology for the routine collection of data on the incidence of larval and juvenile fish in krill catches by scientific observers was urgently needed (Annex 5, paragraphs 10.3 and 10.8). The Scientific Committee recognised that there was a need to develop a practical method for examining larval fish by-catch in the short term, but in the longer term a more quantitative approach would be needed.

4.9 Dr Shust reported that a Russian manual for assessing larval and juvenile fish in krill by-catch has been developed in the past. Dr Shust agreed to have the protocol translated and submitted to WG-EMM and WG-FSA. He also noted the utility of comparing data collected 20 years ago around South Georgia with current information on larval and juvenile fish by-catch in the krill fishery. Dr Naganobu pointed out that Japan had also been collecting information on fish by-catch in the krill fishery for more than 10 years and had regularly reported analyses of these data to WG-EMM.

4.10 Dr Kawaguchi agreed to convene a correspondence group to develop an interim standardised protocol for the assessment of the incidence of larval fish in krill catches to be implemented in the current season if possible. An identification guide for fish larvae will also

be developed for use on board by observers. This correspondence group would include both krill and fish scientists, and the technical coordinators with expertise in the scientific observation scheme.

4.11 The Scientific Committee noted the discussions on the need to obtain information (e.g. by-catch, krill demographics and CPUE) from the continuous fishing system for krill in both working groups (Annex 4, paragraphs 3.51 to 3.64; Annex 5, paragraphs 14.17 to 14.22). The Scientific Committee noted that this information might not be available using the same techniques used in conventional trawling operations but acknowledged that this information has also proved difficult to obtain from conventional fisheries in the past.

4.12 In 2005, the Scientific Committee noted that the trawl fishery for krill using the continuous fishing system may have a potentially negative impact on the pelagic ecosystem, particularly through the by-catch of larval and juvenile krill and fish. The Scientific Committee also recognised that the fishery using this method would not be considered a new or exploratory fishery if there were an adequate description of the fishing selectivity, a characterisation of the haul (or catch rate) and information on the location of krill catches (SC-CAMLR-XXIV, paragraphs 4.8 and 4.9).

4.13 WG-EMM considered these issues at its meeting in July 2006 but the discussion was inconclusive because the trawler which used the continuous fishing system in the 2005/06 season had only been fishing for a few weeks prior to the deadline for submission of papers to WG-EMM. All data required from the vessel had been submitted within applicable deadlines. The issue was referred to WG-FSA where it was considered in October 2006. Although data from continuous and conventional trawls were analysed and presented to WG-FSA, the Working Group concluded that there were currently insufficient data from both continuous and conventional trawls to allow a robust comparison between the two methods (Appendix E, paragraph 4.21). The Working Group also identified the need for the development of standard methods for data collection of larval fish by-catch (Annex 5, paragraph 10.3) and a more systematic observer program on all krill vessels. The Scientific Committee was unable to resolve the abovementioned problem due to inadequate data (Annex 5, Appendix E, paragraph 4.8).

4.14 The Russian Delegation indicated that fishing for krill using the continuous fishing system is a new type of krill fishery and that there are concerns over the data collection from this fishery and its effects on the ecosystem. This fishing operation may be problematic for studying krill demography and for larval fish and juvenile krill by-catch. The patchy nature of krill distribution may mean that conventional haul-by-haul data are more reliable than data obtained from continuous fishing systems. It may take some time to obtain sufficient information to allow this method to be assessed in terms of its safety for the ecosystem. Nevertheless, the fishery using the new technique continues at a proposed scale comparable with that of the traditional krill fishery. The catch of krill by this method exceeded 48 000 tonnes in the 2004/05 season, but was only 8 770 tonnes in 2005/06. Norway notified 100 000 tonnes of krill per vessel for the forthcoming season. The catch from this type of operation was only going to increase, so these problems would remain and protocols for obtaining comparable data from continuous fishing systems were urgently needed.

4.15 The Russian Delegation also noted that although krill fishing using the continuous fishing system has already been conducted for three seasons, no adequate data on its selectivity and assessment of its impact on krill, fish larvae and juveniles have been obtained.

This situation causes particular concern because there might be considerable potential for this type of fishing to impact on other elements of the ecosystem either through by-catch, particularly of fish and krill larvae, or through incidental mortality of juvenile krill, small pelagic hydrobionts, birds or marine mammals (SC-CAMLR-XXIV, paragraph 4.9).

4.16 The Scientific Committee noted that reports had been submitted from scientific observers on board the *Atlantic Navigator* and the *Saga Sea* which included by-catch data from the krill fishery (WG-FSA-06/57). The Norwegian Delegation also indicated that further information on larval fish by-catch caught by the continuous fishing system would be presented to the working groups and that improved CPUE data would be available from the *Saga Sea* in future because of a new catch-weighing technology which had been installed.

4.17 The Scientific Committee acknowledged that the use of the continuous fishing system in the krill fishery presented some unique challenges to recording effective fishing effort, catch and collection of biological data and by-catch data. The Scientific Committee has not yet defined a single effective measure of CPUE in conventional trawl or continuous fishing systems; nor is such a measure of CPUE used in stock assessments or management decision rules. Until such time as these issues have been addressed, all krill fisheries should provide information appropriate to the current management system (Annex 4, paragraphs 3.77 to 3.79).

4.18 The Scientific Committee noted the repeated requests for information on fishing methodologies, technology and fishing operations and the lack of response from most fishing nations. In particular, operational data were needed on fishing selectivity and total mortality. The Scientific Committee reiterated its request for detailed information from fishing nations so that their operations can be better understood and thus appropriately managed (Annex 4, paragraph 3.81).

Advice to the Commission

4.19 The Commission's attention was drawn to the increased interest being shown in the krill fishery as indicated by the projected catches for the 2006/07 season of 368 000 tonnes compared to a projection last year of 250 000 tonnes (Table 4; see also paragraphs 15.10 to 15.16). The Scientific Committee still had inadequate information from the fishery on which to base management advice (Annex 4, paragraphs 3.79 to 3.81).

4.20 The Scientific Committee drew the Commission's attention to the conclusion of WG-EMM which indicated a need for systematic scientific observation of all krill fishing activities (Annex 4, paragraph 3.8) and that of WG-FSA which recommended an increase in the levels of scientific observation across the krill fishing fleet (Annex 5, paragraphs 11.12(iv) and (vi)).

4.21 The Scientific Committee endorsed the estimation of γ using the biomass and CV estimates from the 2006 Australian survey in Division 58.4.2 (SC-CAMLR-XXV/8) and recommended a revised precautionary catch limit for krill in this division of 1.49 million tonnes per year.

Fish resources

Data requirements

4.22 The Scientific Committee noted the following work completed by the Secretariat during the intersessional period (Annex 5, paragraphs 3.1 to 3.4):

(i) revision to data collection forms;

(ii) development of a manual documenting procedures for extraction and mathematical manipulation of data used by WG-FSA;

(iii) development of an electronic reference library of relevant meeting documents;

(iv) initial validation of CASAL assessments;

(v) processing of data;

(vi) extending the time series of catch-weighted length-frequency data for *D. eleginoides* in Subarea 48.3;

(vii) development of ageing and tagging databases.

4.23 The Scientific Committee also noted the work undertaken by Mr A. Dunn (New Zealand) and the Secretariat to validate tagging data held in the observer database using position data from the fine-scale data from Subareas 88.1 and 88.2. A number of discrepancies and errors in reporting east/west positional data about longitude 180º had been detected and rectified (Annex 5, paragraph 3.5).

4.24 The Scientific Committee discussed the potential for using VMS data to provide a timely and efficient validation of positions of tag releases in the observer data as well as validating data submitted on the fine-scale data forms. Such a validation should be undertaken by the Secretariat. The Data Manager reported that while the VMS data are held in a separate database, in principle a routine could be developed to access these data and compare them with the position information in the fine-scale and observer data. In the event that mismatches are discovered between the datasets, further investigations could be undertaken with the originators of the data to identify and rectify any errors as quickly as possible.

4.25 Noting the sensitive nature of the VMS data and the rules of access, the Scientific Committee requested that the Commission consider the feasibility of tasking the Secretariat with conducting such a data validation. The Scientific Committee also urged Flag States and scientific observers to check the reported positions in the data, especially near longitudes 0° (Subarea 48.6) and 180° (Subarea 88.1).

Status and trends

Fishing activity in the 2005/06 season

4.26 Under the conservation measures in force in 2005/06, fishing took place in 13 fisheries targeting icefish (*C. gunnari*), toothfish (*D. eleginoides* and/or *D. mawsoni*) and krill (*Euphausia superba*):

- fishery for *C. gunnari* in Subarea 48.3
- fishery for *C. gunnari* in Division 58.5.2
- fishery for *D. eleginoides* in Subarea 48.3
- fishery for *D. eleginoides* in Subarea 48.4
- fishery for *D. eleginoides* in Division 58.5.2
- exploratory fishery for *Dissostichus* spp. in Subarea 48.6
- exploratory fishery for *Dissostichus* spp. in Division 58.4.1
- exploratory fishery for *Dissostichus* spp. in Division 58.4.2
- exploratory fishery for *Dissostichus* spp. in Division 58.4.3a
- 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 *E. superba* in Area 48.

4.27 In addition, four other managed longline fisheries targeting toothfish were conducted in the Convention Area in 2005/06:

- fishery for *D. eleginoides* in the French EEZ in Division 58.5.1
- fishery for *D. eleginoides* in the French EEZ in Subarea 58.6
- fishery for *D. eleginoides* in the South African EEZ in Subarea 58.6
- fishery for *D. eleginoides* in the South African EEZ in Subarea 58.7.

4.28 Catches of target species by region and gear reported from fisheries conducted in the Convention Area in the 2005/06 fishing season are summarised in Annex 5, Table 1 (see also Table 2).

4.29 Estimates of catches from IUU fishing for *Dissostichus* spp. inside the Convention Area in 2005/06 are provided in Annex 5, Table 2. The Scientific Committee endorsed the use of these estimates in stock assessments undertaken by WG-FSA at its 2006 meeting.

4.30 Combined total catches (reported and IUU) for *Dissostichus* spp. in the 2004/05 and 2005/06 seasons, both within the Convention Area and in adjacent areas, are provided in Annex 5, Table 3. Further discussion of IUU catches is provided under Agenda Item 7 (paragraphs 7.5 to 7.7).

4.31 The Scientific Committee noted the consideration by WG-FSA and ad hoc WG-IMAF of two papers describing longline fishing methods used in exploratory fisheries (Annex 5, paragraphs 3.14 to 3.16). These methods have the potential to reduce incidental mortality and by-catch through rapid deployment of lines and rapid sink rates and variable adjustable height of hooks above the sea floor.

4.32 The Scientific Committee recommended that Members be urged to conduct statistical evaluation of new methods to reduce incidental mortality and by-catch using rigorous

experimental design, to assess the performance of new gear, its selectivity and impact on ecosystem components (Annex 5, paragraphs 3.17 and 6.52 to 6.54). The Scientific Committee also encouraged Members where possible to collaborate to obtain comparative data from vessels fishing side-by-side. Further discussion of incidental mortality is reported under Agenda Item 5.

Inputs for stock assessments

4.33 The Scientific Committee welcomed the review by WG-FSA of all available research data for updating stock assessments of fish in the Convention Area including catch-at-length/age data from fisheries, research surveys, CPUE analyses, tagging studies, biological parameters, stock structure and depredation (Annex 5, paragraphs 3.25 to 3.73). The Scientific Committee agreed that where possible all available data should be used in the current assessments.

4.34 In particular, the Scientific Committee noted the important contribution of three research surveys conducted in 2005/06 in Division 58.5.2 (by Australia), Subarea 48.3 (by the UK) and Subarea 48.1 (by the USA) to the analyses conducted by WG-FSA (Annex 5, paragraphs 3.27 to 3.29).

4.35 The Scientific Committee welcomed the continuing work on tagging toothfish and noted the significant contribution of the results of tagging studies to the assessments of both exploratory and assessed fisheries. In 2005/06, 4 451 toothfish were tagged in exploratory fisheries (Annex 5, Tables 7 and 8) and 113 tagged fish were recaptured. Toothfish were tagged at an average rate greater than the required one fish per tonne of green weight caught, although some Flag States in some SSRUs failed to achieve the required level (see Fishery Reports: Annex 5, Appendices F to K). In established fisheries, 4 660 toothfish were tagged in Subarea 48.3, 144 in Subarea 48.4, 1 825 in Division 58.5.2, 1 240 in Subarea 58.6 and at least 500 during a survey in Division 58.5.1 carried out just prior to the meeting. The Scientific Committee recognised the substantial contribution of the fishing industry, Flag States and scientific observers to the success of the tagging program. Several amendments to Conservation Measure 41-01, Annex C, were proposed to clarify the roles and responsibilities of the vessel and observers in implementing the program in exploratory fisheries (paragraph 4.37).

4.36 The Scientific Committee noted a number of other key issues addressed by WG-FSA:

(i) clarification of responsibility for provision of tag data to the Secretariat (Annex 5, paragraph 3.43);

(ii) time-stamped photographic record of all returned tags (Annex 5, paragraph 3.45);

(iii) future coordination of tagging programs (Annex 5, paragraphs 3.46 and 3.47);

(iv) consideration of low recapture rate of tags in Subarea 88.1 (Annex 5, paragraphs 3.48 to 3.52).

Management advice (tagging program)

4.37 The Scientific Committee recommended that Conservation Measure 41-01, Annex C, be amended to clarify the roles and responsibilities of the vessel and observers, as follows:

> 1. The responsibility for ensuring the progress of tagging, tag recovery and correct reporting shall lie with the Flag State. The CCAMLR scientific observer, in cooperation with the fishing vessel, shall normally be expected ~~required~~ to undertake the tagging program.
>
> 3. All relevant tag data and any data recording tag recaptures shall be reported electronically in the CCAMLR format[1] to the Executive Secretary (i) by the vessel every month along with its monthly C2 reports, and (ii) by the observer as part of the data reporting requirements for observer data ~~within three months of the vessel departing the exploratory fisheries~~.
>
> [1] In accordance with the CCAMLR Tagging Protocol for exploratory fisheries which is available from the Secretariat and at www.ccamlr.org.

4.38 In exploratory fisheries for toothfish species, for a single trial year (2006/07) observers should take a photographic record of all tags recovered and forward these photographs to the Secretariat.

4.39 The Scientific Committee recommended that the Secretariat should take responsibility for coordinating the tagging programs in new and exploratory fisheries starting from the 2007/08 season. All tags used by Members in exploratory fisheries should be purchased from the Secretariat for use in the 2007/08 season onwards.

4.40 The Scientific Committee requested that SCAF identify start-up funds required by the Secretariat in 2007 to coordinate the tagging program (paragraph 10.8). These funds will be recovered to the maximum extent possible through sale of tags and tagging kits to Members undertaking exploratory fisheries. The Data Manager provided a preliminary estimate of the funds needed to initiate the program. Approximately A$100 000 would be required to cover the cost of the advance purchase of tags to establish and maintain the required inventory, and the anticipated increase in the Secretariat's workload to administer the program.

4.41 Dr Holt noted that it would be unlikely that all the allocated funds would be recovered through the sale of tags and tagging kits due to the costs inherent in maintaining an inventory. The Scientific Committee further noted that the required inventory of tags would not be very large and one possibility was that the Secretariat recover funds through the establishment of an advance ordering system, thereby reducing the necessary financial outlay.

4.42 The Scientific Committee agreed that the requirement for tagging in those SSRUs in Subareas 88.1 and 88.2 which are closed but carry a 10-tonne research exemption for a single vessel in a single season, should be increased from one fish per tonne of green weight caught to a minimum of three fish per tonne and a target of 10 fish per tonne.

4.43 The Scientific Committee will keep under review the conduct of the tagging program and report its findings to the Commission, particularly with regard to vessels' crew taking

over responsibility from scientific observers for tagging and tag recovery. The Scientific Committee agreed that any changes in tagging procedure by the vessel should be documented and reported to the Secretariat.

Biological parameters

4.44 The Scientific Committee noted the following new information on biological parameters provided to WG-FSA:

(i) a review of biological parameters for skates in the Ross Sea (Annex 5, paragraph 3.57);

(ii) age/length-at-maturity of *D. eleginoides* in Subarea 48.3 (Annex 5, paragraph 3.58);

(iii) an estimate of natural mortality of *D. eleginoides* from tag data in Subarea 48.3 (Annex 5, paragraph 3.60).

Depredation

4.45 The Scientific Committee recalled its advice from last year's meeting regarding the need to develop a system to quantify the interactions between marine mammals and longline fisheries (SC-CAMLR-XXIV, paragraph 3.77). Several papers on depredation by marine mammals were considered by WG-FSA (Annex 5, paragraphs 3.66 to 3.73). The Scientific Committee noted that there remained some differences in the methods used to estimate depredation and recommended that standard protocols be developed within the Scheme of International Scientific Observation so that levels of depredation in the *Dissostichus* spp. fisheries in the Convention Area can be estimated.

4.46 The Scientific Committee noted that a general research program for WG-SAM was needed to consider the implications of depredation for the stock assessment. The Scientific Committee further noted the conclusions of WG-FSA that:

(i) interpreting depredation as pure removals from the population would have little effect, but when included in CPUE calculations, it may become influential;

(ii) depredation is likely to be a learning process, and that the assumptions that the rate remains constant over time will not apply;

(iii) the selectivity of the depredation needs to be quantified;

(iv) a depredation conference occurred recently, and that the proceedings from this could form a useful background for WG-SAM discussions.

General biology and ecology

4.47 The Scientific Committee noted WG-FSA's work in the area of biology and ecology. The following were the main points of discussion:

(i) consideration of papers on biology and ecology (Annex 5, paragraphs 9.1 and 9.2);

(ii) identification of three key areas where papers would be requested for WG-FSA-07; including reproduction of toothfish, stock structure in toothfish and taxonomy in Antarctic skates (Annex 5, paragraph 9.3);

(iii) development and publication of species profiles – noting that a species profile for *D. mawsoni* had been completed in the intersessional period (Annex 5, paragraphs 9.4 to 9.6);

(iv) further work by the CCAMLR Otolith Network (Annex 5, paragraphs 9.7 and 9.8);

(v) the successful workshop on the ageing of *C. gunnari* in Kaliningrad, Russia, in June 2006 (Annex 5, paragraphs 9.9 to 9.17);

(vi) discussion on the presence of exploitable stocks of sharks in the Convention Area (Annex 5, paragraphs 9.18 to 9.20).

4.48 With regard to the publication of species profiles (paragraph 4.47(iii)), the Scientific Committee noted that these profiles were constructed specifically for use by the Scientific Committee and its working groups. As such, they contain much useful information on the biology of the exploited species, but some of this information is from unpublished sources, and may be used in very specific ways in the assessments. Making these data freely available by publishing the species profiles raises the concern that the data may be misinterpreted and potentially used in assessments without the full knowledge and understanding of the limitations to their applicability. The Scientific Committee also noted that the species profiles are being continually updated with new information. A publication, however, would quickly become out of date with respect to the current assessments being undertaken by the working groups. However, the Scientific Committee noted that updated versions of the species profiles could be posted on the CCAMLR website.

4.49 The Scientific Committee agreed to review the options for publication at next year's meeting once the species profiles are complete.

Sharks

4.50 The Scientific Committee noted the advice of WG-FSA that there are three species of shark which could occur in commercial quantities in the Convention Area, but their potential for exploitation has not yet been assessed (paragraphs 11.18 and 11.19).

Developments in assessment methods

4.51 The Scientific Committee noted the substantial progress made on assessment methods by WG-FSA-SAM[1] at its intersessional meeting held at the Pelican Bay Hotel, Walvis Bay, Namibia, from 10 to 14 July 2006. Results of this subgroup meeting are summarised in Annex 5, paragraphs 4.7 to 4.22. The Scientific Committee noted that WG-FSA had identified future work priorities for WG-FSA-SAM, and endorsed the recommendations for the development and evaluation of assessment methods as set out in Annex 5, paragraphs 12.4 to 12.14. The Scientific Committee further noted the conclusion of WG-FSA-SAM that the participation of an invited assessment expert (Dr Maunder) was valuable to the work of WG-FSA-SAM.

4.52 WG-FSA-SAM discussed at its intersessional meeting a number of elements contributing to assessment methods. The Scientific Committee noted WG-FSA-SAM was tasked to examine three priority areas of work: (i) estimation of parameters; (ii) continued development and evaluation of methods; and (iii) review of stock assessment methods for WG-FSA-06.

4.53 The Scientific Committee noted recommendations for revision of parameter estimates adopted by WG-FSA-06, including a natural mortality (M) value of 0.13, a steepness (h) value of 0.75, and a recruitment variability (σ_R) value of 0.60 be used for *Dissostichus* spp. when no other data are available.

4.54 The Scientific Committee agreed that the default parameters recommended by WG-FSA represented expert advice. However, it was recognised that these parameters may be further refined as a result of future work.

4.55 Dr Constable noted the increasing stability in the results, in terms of catch limits, of annual assessments of toothfish fisheries in Subarea 48.3 and Division 58.5.2 and questioned the need to conduct automatically a new assessment every year. Conducting full assessments on a longer time interval would benefit WG-FSA by freeing up time to progress more strategic issues relating to the further development of management procedures (Annex 5, paragraph 12.4).

4.56 In supporting this position, Prof. Beddington noted that the assessment of the yield of toothfish involved a projection over 30 years. In view of the stability of the results of annual assessments it is therefore reasonable to set catch limits for multiple years without the need to undertake revised assessments every year.

4.57 There was, however, the option for WG-FSA to undertake an assessment in any given year if new or refined methods of assessment recommended by WG-SAM become available, parameters used in the assessment are revised significantly, or the fishery status changes in an unexpected way (e.g. an unexpected drop in the catch rates reported from the fishery).

4.58 Dr Holt noted that while there would be benefits in adopting this approach, the current stability in the assessment results had only been evident for two years, and WG-FSA should be prepared to undertake a full assessment at its meeting in 2007.

[1] Now WG-SAM (see paragraph 13.12).

4.59 The Scientific Committee agreed that providing management advice for multiple years without the need for interim assessments would allow additional time for progress on other high-priority issues such as Management Strategy Evaluations (MSEs), which provide a mechanism for measuring efficacy of methods towards achieving management objectives. The Committee recommended that simulation experiments be conducted to examine the robustness of the assessment outputs to changes in input data and model assumptions and provide further insight into consequences of such an assessment timetable on the management of the target species and the fishery. This topic was discussed further under Agenda Item 13.

4.60 The Scientific Committee thanked participants of WG-FSA-SAM for their effort and the considerable progress made in advancing methods for the assessment of toothfish stocks.

4.61 The Scientific Committee noted that several assessments undertaken by WG-FSA this year were initially based on preliminary assessment working papers that were subsequently reviewed independently by WG-FSA. These are set out in Annex 5, paragraphs 4.25 to 4.45. In most cases, issues that had been raised at WG-FSA-SAM had been examined and incorporated into preliminary stock assessments for consideration by WG-FSA.

4.62 With regard to the assessment of *D. eleginoides* in Subarea 48.3, the Scientific Committee noted that papers using two approaches (CASAL and ASPM) had been discussed. The Scientific Committee noted the decision reached last year (SC-CAMLR-XXIV, paragraphs 4.55 to 4.57), and the requests by WG-FSA (SC-CAMLR-XXIV, Annex 5, paragraph 12.13) and WG-FSA-SAM (WG-FSA-06/6, paragraph 2.75) that tag data be included in the ASPM. Because tag data cannot currently be incorporated into the ASPM, the Scientific Committee endorsed the view of WG-FSA that only the integrated assessment using CASAL be used to provide management advice for the 2006/07 fishing season for *D. eleginoides* in Subarea 48.3.

4.63 The Scientific Committee noted that WG-FSA examined two assessment approaches for *D. mawsoni* in the Ross Sea (Subarea 88.1 and SSRUs 882A and B) – CASAL and TSVPA (Annex 5, paragraphs 4.35 to 4.42). The CASAL integrated assessment updated the 2005 assessment using new parameter estimates along with revised catch, CPUE, catch-at-age and tag–recapture data. The TSVPA assessment method has been used by ICES and was applied to the Ross Sea fishery using, primarily, catch-at-age data and the time series of standardised CPUE. The TSVPA estimates of spawning stock biomass were very large, and input data used for the analysis should be verified for possible errors. It was requested that these issues be explored in the intersessional period and the method be reviewed by WG-SAM for potential future use in assessing the Ross Sea toothfish fishery. The Scientific Committee also recommended that the incorporation of tag data into this approach be explored. The Scientific Committee endorsed the recommendation of WG-FSA that the integrated assessment using CASAL be used to provide management advice for the 2006/07 fishing season for *Dissostichus* spp. in the Ross Sea.

4.64 With regard to the assessment of *D. eleginoides* in Division 58.5.2, the Scientific Committee noted that two potential approaches (GYM and CASAL) were available. The Scientific Committee agreed that the CASAL approach offered an advantage over the GYM, as the integrated approach can allow for the inclusion of more of the available data in the assessment process. The Scientific Committee endorsed the view of WG-FSA that only the integrated assessment using CASAL be used to provide management advice for the 2006/07 fishing season for *D. eleginoides* in Division 58.5.2.

4.65 The Scientific Committee agreed that assessments of *C. gunnari* in Subarea 48.3 and Division 58.5.2 use the short-term projection approach, as has been previously employed.

Assessments and management advice

Assessed fisheries

4.66 All assessment work at WG-FSA was undertaken by primary authors of preliminary assessments, and reviewed independently. Tasks of independent reviewers are listed in WG-FSA-06/6, paragraph 6.3. The outcomes of the assessments were reported in the Fishery Reports (Annex 5, Appendices L to R). Fishery Reports that have been revised or developed as a result of analyses and deliberations during the course of WG-FSA are:

(i) Subarea 48.3 – *D. eleginoides* and *C. gunnari*
(ii) Division 58.5.1 – *D. eleginoides*
(iii) Division 58.5.2 – *D. eleginoides* and *C. gunnari*
(iv) Subareas 58.6 and 58.7 – *D. eleginoides* (South African EEZ)
(v) Subarea 58.6 – *D. eleginoides* (French EEZ)
(vi) Subarea 88.1 and SSRU 882E – *Dissostichus* spp. (paragraphs 4.193 to 4.211).

The Fishery Reports are available in electronic format only and can be downloaded from the 'Publication' section of the CCAMLR website (www.ccamlr.org).

Dissostichus eleginoides at South Georgia (Subarea 48.3)

4.67 The Fishery Report for *D. eleginoides* in Subarea 48.3 is contained in Annex 5, Appendix L.

4.68 The catch limits for *D. eleginoides* in the 2005/06 season for areas A, B and C were 0, 1 067 and 2 489 tonnes respectively, with an overall catch for SGSR of 3 556 tonnes. The total declared catch was 3 534 tonnes. There was no recorded IUU catch for the 2005/06 season. Catches in areas A, B and C were 10, 983 and 2 541 tonnes respectively.

4.69 The Scientific Committee endorsed the assessment undertaken by WG-FSA (Annex 5, paragraphs 5.76 to 5.83).

4.70 The Scientific Committee noted the following details of the assessment carried out by WG-FSA:

(i) The standardised GLMM CPUE analyses were updated. Standardised CPUE (for the whole SGSR fishery) showed a slight increase between 2005 and 2006. The CPUE data display high levels of variability up to 1995, and lower variability from 1996 to the present, the apparent discontinuity arising during a period of major and rapid change in the structure of the fleet and management of the fishery. Major changes occurring between 1993 and 1996 include changes in the spatial distribution of fishing, a change in the nationalities fishing, the

introduction of 100% observer coverage and a shift to night setting and a winter fishery. The three periods of the fishery (1985–1992, 1993–1996, 1997–2006) therefore have very different characteristics. Interpreting the CPUE as a single series was not possible. Accordingly, the two-fleet CASAL model developed by WG-FSA last year was used for the basic assessment model this year.

(ii) A single CASAL assessment model was used, which was structurally similar to that presented at WG-FSA-05. A simple update of that assessment (which included both low M = 0.13 and low L_∞ = 152.8 cm) resulted in a reduced estimate of B_0, principally due to the influence of the 2006 tag returns. Revisions were made to some input parameters, following the advice of WG-FSA-SAM-06, including new parameter values for steepness, recruitment variability and maturity at age. The data and parameters used in the assessment model, as well as the structure of the model are outlined in Annex 5, Appendix L, Table 8.

(iii) Stock status and the long-term yield were calculated using the MCMC samples for the assessment model, as was done last year, with the appropriate long-term yield being 3 554 tonnes. The critical decision rule was the requirement that spawning biomass at the end of a 35-year projection period should be at least 50% of initial spawning biomass. This rule was implemented following the new recommended procedure outlined in the fishery reports for the assessments for toothfish in Subarea 48.3, the Ross Sea and Division 58.5.2.

Management advice

4.71 The Scientific Committee recommended that the catch limit for toothfish in Subarea 48.3 (SGSR stock) should be 3 554 tonnes for the 2006/07 fishing season.

4.72 The catch limits for management areas A, B and C should be adjusted in a pro-rata manner to 0, 1 066 and 2 488 tonnes respectively. By-catch limits for skates/rays and macrourids should remain at the level of 5%, that is 177 and 177 tonnes respectively.

Dissostichus eleginoides at Kerguelen Islands (Division 58.5.1)

4.73 The Fishery Report for *D. eleginoides* in Division 58.5.1 is contained in Annex 5, Appendix M.

4.74 The catch of *D. eleginoides* reported for this division to 31 August 2006 was 3 045 tonnes. Only longlining is currently permitted in the fishery. The estimated IUU catch for the 2005/06 season was zero inside the French EEZ. Some IUU fishing may occur outside the EEZ as reported in WG-FSA-06/11 Rev. 2.

4.75 No stock assessment for this fishery was carried out by WG-FSA at this year's meeting. The Scientific Committee noted the following details from the report of WG-FSA (Annex 5, paragraphs 5.88 to 5.90):

(i) GLMM analyses show a general decreasing trend in the standardised CPUE up until 2003 followed by a period up to the current year for which the CPUE estimates are relatively constant. The trend in decreasing standardised average weight with fishing season continued for the 2005/06 season and probably indicates that the older age classes are less numerous in the exploited stock.

(ii) A survey was carried out between 30 August and mid-October 2006, the results of which will be presented to WG-FSA in 2007. This survey included more than 200 trawls and more than 500 tagged fish. Prof. Duhamel noted that the data from this survey are still being compiled and will be reported to the Secretariat in due course.

(iii) By-catch is important for this fishery and the majority of the catch is processed but no stock assessment is available for evaluation of the impact on affected populations.

Management advice

4.76 As at last year's meeting, the Scientific Committee encouraged the estimation of biological parameters for Kerguelen. The Scientific Committee reiterated its advice from last year that a preliminary stock assessment could be carried out by WG-FSA if CPUE, catch-weighted length frequencies and biological parameters were available.

4.77 The Scientific Committee welcomed the information regarding the recent survey and fish tagging and looked forward to receiving the results at next year's meeting.

4.78 As is the practice for other longline fisheries in the Convention Area, the Scientific Committee recommended that, where possible, all unprocessed rajids should be cut from the line while still in the water, except on the request of the observer. Avoidance of fishing in zones of specific high rates of abundance in by-catch should also be considered.

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

Dissostichus eleginoides at Heard Island
(Division 58.5.2)

4.80 The Fishery Report for *D. eleginoides* in Division 58.5.2 is contained in Annex 5, Appendix N.

4.81 The catch limit of *D. eleginoides* in Division 58.5.2 west of 79°20'E for the 2005/06 season was 2 584 tonnes (Conservation Measure 41-08) for the period from 1 December 2005 to 30 November 2006. The catch of *D. eleginoides* reported for this division as of 5 October

2006 was 1 825 tonnes. Of this, 1 097 tonnes (60%) was taken by trawl and the remainder by longline. The estimated IUU catch for the 2005/06 season, 112 tonnes, was the lowest since IUU fishing began in 1995/96.

4.82 The Scientific Committee noted that WG-FSA had adopted a new assessment this year based on the CASAL model. The Scientific Committee welcomed this development particularly because it can enable the use of all available information in undertaking the assessment. The Scientific Committee noted several differences in the application of the model in assessing this fishery (Annex 5, paragraph 5.98) and recommended that WG-FSA further consider the issues outlined in Annex 5, paragraph 5.103.

4.83 The Scientific Committee noted the following details additional from the report of WG-FSA (Annex 5, paragraphs 5.96, 5.97 and 5.100):

(i) The length-at-age vector from 2005 was revised using a two-segment linear model as discussed in 2005. The new vector better estimates the size of young fish. Young fish (<6 years old) are fast-growing. Fish older than six years are slower growing than previously estimated. Natural mortality was assumed to be 0.13 $year^{-1}$ as for the other toothfish assessments.

(ii) Additional length-at-age samples for fish of age >20 years can be obtained from the longline fishery. The Scientific Committee encouraged the collection of these data in order to improve the ability of the growth model to accurately predict mean length-at-age for these older fish.

(iii) The CASAL assessment used abundance-at-length estimated from the surveys, catch-at-length from the fisheries and standardised CPUE time series to estimate current and initial population size and year-class strengths since 1981. These results were then used in projections to estimate the long-term annual yield that satisfies the CCAMLR decision rules for toothfish.

4.84 The long-term annual yield for *D. eleginoides* was estimated to be 2 427 tonnes giving 50% escapement with a probability of depletion of 0.06.

4.85 The Scientific Committee noted the successful progress in developing an integrated assessment of *D. eleginoides* in CASAL and endorsed the program of further work to refine this assessment proposed by WG-FSA (Annex 5, paragraphs 5.103 to 5.105).

Management advice

4.86 The Scientific Committee recommended that the catch limit for toothfish in Division 58.5.2 west of 79°20'E should be 2 427 tonnes for the 2006/07 fishing season.

D. eleginoides at Prince Edward and Marion Islands (Subareas 58.6 and 58.7) inside the EEZ

4.87 The Fishery Report for *D. eleginoides* at Prince Edward and Marion Islands (Subareas 58.6 and 58.7) inside the South African EEZ is contained in Annex 5, Appendix P.

4.88 The catch limit of *D. eleginoides* in the South African EEZ for the 2005/06 season was 450 tonnes for the period from 1 December 2005 to 30 November 2006. The catch reported for Subareas 58.6 and 58.7 as of 5 October 2006 was 46.6 tonnes, all of which was taken by longlines. The IUU catch for the 2005/06 season was assumed to be equal to the IUU catch in the previous year, estimated to be 156 tonnes.

4.89 Cetacean depredation of longline catches is reported to be significant, implying that total removals are greater than just the estimated fishery catches. It was noted that the pot fishery which avoided cetacean depredation was discontinued.

4.90 The CPUE series was updated for the meeting and the biological parameters altered to match those used in Subarea 48.3.

4.91 An augmented ASPM that used catches, standardised CPUE, and catch-at-length data was used to estimate a long-term annual yield. The results from the model were only slightly sensitive to whether or not cetacean depredation was included in the calculations and whether or not year-specific weights were used with the CPUE indices. The model estimated the spawning biomass of the resource to be between 36 and 44% of its average pre-exploitation level, although significant uncertainties remain in the assessment.

Management advice for *D. eleginoides* at Prince Edward and Marion Islands (Subareas 58.6 and 58.7) inside the EEZ

4.92 The Scientific Committee noted that the advice on the appropriate levels of future catch provided in WG-FSA-06/58 was not based on the CCAMLR decision rules. Therefore it was unable to provide management advice for the fishery in the South African EEZ at the Prince Edward Islands. The Scientific Committee recommended that CCAMLR decision rules be used in estimating yields for this fishery and that the concerns of WG-FSA over the sensitivity of the ASPM to weightings used for different data sources be noted.

4.93 The Scientific Committee also noted the recommendations by ad hoc WG-IMAF with respect to mitigation of seabird mortalities (SC-CAMLR-XXIII, Annex 5, paragraphs 5.289 and 5.290).

D. eleginoides at Prince Edward Islands (Subarea 58.7) outside the EEZ

4.94 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 Scientific Committee therefore recommended that the prohibition of directed fishing for *D. eleginoides*, described in Conservation Measures 32-10, 32-11 and 32-12, remain in force.

D. eleginoides at Crozet Islands (Subarea 58.6) inside the EEZ

4.95 The Fishery Report for *D. eleginoides* at Crozet Island (Subarea 58.6) inside the French EEZ is contained in Annex 5, Appendix O.

4.96 The catch of *D. eleginoides* reported in Appendix O for this subarea to 31 August 2006 was 641 tonnes. Only longlining is currently permitted in this fishery. The estimated IUU catch for the 2005/06 season was zero inside the French EEZ. Some IUU fishing may occur outside the EEZ as reported in WG-FSA-06/11 Rev. 2.

4.97 Depredation on toothfish catches by killer whales (*Orcinus orca*) is becoming a major problem for this longline fishery.

4.98 GLM analyses show a general decreasing trend in standardised CPUE to 2002/03, with a subsequent slight increase in 2003/04 and 2004/05 and a substantial increase for the 2005/06 season. The trend of decreasing standardised average weight from 1998/99 to 2004/05 showed a slight upturn in 2005/06.

4.99 During the season, 1 240 toothfish were tagged by observers on board commercial vessels. The Scientific Committee encouraged France to continue with its tagging program.

4.100 By-catch removals are important for the longline fishery and the majority of the catch is processed but no stock assessment is available for evaluation of the impact on affected populations.

Management advice for *D. eleginoides* at Crozet Islands (Subarea 58.6) inside the EEZ

4.101 The Scientific Committee encouraged the estimation of biological parameters for *D. eleginoides* at Crozet Island. It also noted that a preliminary stock assessment could be carried out if CPUE, catch-weighted length frequencies and biological parameters were available.

4.102 Estimated total removals have declined steadily over the last eight seasons and are at substantially lower levels than those taken before then. Standardised CPUE has fallen substantially from 1999/2000 to 2002/03 but has since increased. In the absence of a stock assessment, the Scientific Committee agreed that it was unable to recommend appropriate levels of catch for this fishery.

4.103 The Scientific Committee recommended that, where possible, all unprocessed rajids should be cut from the line while still in the water, except on the request of the observer. Avoidance of zones of specific high by-catch abundance should also be considered.

Management advice for *D. eleginoides* at Crozet Islands (Subarea 58.6) outside the EEZ

4.104 No new information was available on the state of fish stocks in Subarea 58.6 outside areas of national jurisdiction. The Scientific Committee therefore recommended that the prohibition of directed fishing for *D. eleginoides*, described in Conservation Measure 32-13, remain in force.

C. gunnari at South Georgia (Subarea 48.3)

4.105 The Fishery Report for *C. gunnari* at South Georgia (Subarea 48.3) is contained in Annex 5, Appendix Q.

4.106 In the 2005/06 fishing season the catch limit set for *C. gunnari* in Subarea 48.3 was 2 244 tonnes. During the 2005/06 season the fishery caught 2 171 tonnes. The fishery opened on 15 November 2005 and was closed on advice of the Secretariat on 30 September 2006.

4.107 In January 2006, the UK undertook a random stratified bottom trawl survey of the South Georgia and Shag Rocks shelves. The raw swept-area biomass estimates from surveys suggest that icefish stock size was between 20 000 and 50 000 tonnes throughout the 1990s (with the exception of the very large stock seen in 1990), and has steadily increased since 2000 to about 117 000 tonnes in 2006.

4.108 The catch-weighted length frequencies obtained from the commercial fishery and trawl surveys indicated that the population was dominated by a strong cohort of fast-growing 2+ fish that were considerably larger (23.6 cm TL compared with 19.8 cm TL) than expected.

4.109 The Scientific Committee agreed that a short-term assessment should be implemented in the GYM, using the one-sided bootstrap lower 95% confidence bound of total biomass from the 2006 survey.

4.110 Most input parameters for the assessment remained unchanged from 2005 except for an update of the length–weight parameters derived from the latest survey data and a change of selectivity function. A linear selectivity vector was used for *C. gunnari*, starting at and being fully selected by 2 years. This is a greater selectivity on 2-year-olds than is usually chosen (normally a selectivity of 0.5 on 2-year-old fish is assumed). Full selectivity was assumed this year because the fish were larger than usual for 2-year-olds.

4.111 Some concern was expressed that the fishery had been catching 2-year-old fish, which are not generally assumed to be mature. Mesh size regulations and a move-on rule for large catches of fish smaller than 24 cm applies in this fishery, and should protect most 2-year-old fish (which normally have a modal length of about 20 cm). In 2005/06 the fish were larger than usual, which resulted in them being selected by the fishery. Concern was expressed that the fishery might also catch significant numbers of 2-year-old fish in the 2006/07 fishing season, if they were again unusually large. There is no information on the abundance or size of these recruits. On the other hand, if next year's recruits are normal-sized the fishery will, as usual, only partially select them.

4.112 The issue of future fishing on cohorts that have not been assessed, and for which there is no other estimate of recruitment, was raised in 2005 and remains a point of uncertainty in setting catch levels for icefish stocks (SC-CAMLR-XXIV, Annex 5, Appendix L, paragraph 30). The Scientific Committee recommended that more work be directed at understanding this issue.

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

4.113 The Scientific Committee recommended that the catch limit for *C. gunnari* should be revised to 4 337 tonnes in 2006/07 and 2 885 tonnes in 2007/08 based on the outcome of the short-term assessment.

4.114 All other components of Conservation Measure 42-01 should remain in force with an appropriate pro rata catch limit for catch taken in the period 1 March to 31 May (1 084 tonnes).

C. gunnari at Heard and McDonald Islands (Division 58.5.2)

4.115 The Fishery Report for *C. gunnari* at Heard and McDonald Islands (Division 58.5.2) is contained in Annex 5, Appendix R.

4.116 The catch limit of *C. gunnari* in Division 58.5.2 for the 2005/06 season was 1 210 tonnes for the period from 1 December 2005 to 30 November 2006. The catch reported for this division as of 5 October 2006 was 263 tonnes (see also Table 2).

4.117 Catch-weighted length frequencies in the 2005/06 season were dominated by a single year class of 4+ fish. This cohort was observed to dominate the population in the survey undertaken in May–June 2006.

4.118 The short-term assessment was implemented in the GYM, using the one-sided bootstrap lower 95% confidence bound of total biomass from the 2006 survey. All other parameters were the same as in previous years.

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

4.119 The Scientific Committee recommended that the catch limit for *C. gunnari* in 2006/07 be no more than 42 tonnes.

4.120 The Scientific Committee noted the issues raised by WG-FSA relative to providing advice to the Commission on Conservation Measure 42-02 for *C. gunnari* in Division 58.5.2:

(i) Prior patterns in population dynamics of *C. gunnari* in Division 58.5.2 are such that the dominant 4+ age class is unlikely to be available to the fishery in 2006/07. The Scientific Committee noted that WG-FSA supported a scenario where projected yields were estimated only for classes <4+. As these year classes are low in abundance, the estimated yield is low, at 42 tonnes in the

coming season, and 44 tonnes in the 2007/08 season. Yield in the second year is slightly increased due to the recruitment to the fishery in 2007/08 of the small 1+ age class evident in the 2006 survey. In considering this scenario, the Scientific Committee noted that a low yield estimate was not unexpected, as:

(a) the catch limit for 2005/06 was set in 2005 with the expectation that the dominant 4+ cohort would be unavailable to the fishery in 2006/07;

(b) the absence of any indication of a strong 1+ or 2+ year class in the 2006 survey indicates that yields are likely to be low in future until a cohort as large as the 1+ cohort detected in the 2003 survey becomes evident.

(ii) A catch limit as low as 42 tonnes may be difficult to target commercially without over-catch. There is also a small risk that the trawl fishery for *D. eleginoides* in Division 58.5.2 might take *C. gunnari* as by-catch. However, the Scientific Committee noted that the by-catch of *C. gunnari* in the trawl fishery targeting *D. eleginoides* in Division 58.5.2 has never been large (<0.1 tonnes in 2005/06).

4.121 The remaining provisions of Conservation Measure 42-02, Annex B, should be carried forward to the 2006/07 season.

4.122 The Scientific Committee recommended that further work on developing a management procedure for *C. gunnari* is a high priority.

Other finfish fisheries

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

4.123 The Scientific Committee recalled that the Commission had closed commercial finfishing in the Antarctic Peninsula and South Shetland Islands (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.

4.124 The Scientific Committee noted that Argentina reported on a long-term study conducted on juvenile *Notothenia rossii*, on *Gobionotothen gibberifrons* and *N. coriiceps* in Potter's Cove (King George Island, Subarea 48.1) from 1983 to 2006. The abundance of *N. coriiceps* fluctuated with no apparent trend while *N. rossii* declined following fishing in Subarea 48.1 in 1979/80 until the late 1990s and has been steadily increasing in abundance since then. Abundance of *G. gibberifrons* has been declining steadily over the years. Their numbers have remained close to zero for several years. Dr Barrera-Oro further noted that the situation in the South Shetland Islands is different to regions along the central Antarctic Peninsula (Danco Coast), particularly for *G. gibberifrons*. In the latter regions, there is evidence that *G. gibberifrons* is one of the most abundant species, and this is likely related to the fact that this area has remained outside the effect of the commercial fishery.

4.125 The USA conducted a bottom trawl survey in the region of the northern Antarctic Peninsula part of Subarea 48.1 including the previous fishing grounds for icefish (*Chaenodraco wilsoni*) exploited between 1978 and 1987. The Scientific Committee noted that biomass of all finfish species in that region of Subarea 48.1 is currently not at a level which would allow a reopening of the fishery.

4.126 The last survey of the South Orkney Islands occurred in 1999. No improvement in the condition of the stocks was observed which would give rise to considerations of reopening the area for commercial finfishing. No new information has become available since then as no survey was conducted in the 2005/06 season.

Management advice (Subareas 48.1 and 48.2)

4.127 The Scientific Committee recommended that Conservation Measures 32-02 and 32-03 on the prohibition of taking finfish in Subareas 48.1 and 48.2 respectively, should remain in force.

D. eleginoides at South Sandwich Islands (Subarea 48.4)

4.128 During the 2004/05 season, one UK-flagged vessel started a tagging program on *D. eleginoides* in Subarea 48.4. Two vessels from the UK and New Zealand fished in the area in 2005/06 and continued the tagging program. *Dissostichus eleginoides* formed 99% of the toothfish caught. A total of 134 *D. eleginoides* and 10 *D. mawsoni* were tagged over the northern shelf. The UK proposed to continue the mark–recapture experiment in Subarea 48.4 over the 2006/07 and 2007/08 fishing seasons in order to assist in the assessment of the toothfish population structure and size in accordance with Conservation Measure 41-03.

4.129 The Scientific Committee welcomed this proposal and recalled comments of WG-FSA from last year (SC-CAMLR-XXIV, Annex 5, paragraphs 5.143 to 5.145).

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

4.130 The Scientific Committee recommended that the mark–recapture program for *Dissostichus* spp. continue over the next three to five years in Subarea 48.4 with a catch limit for *D. eleginoides* of 100 tonnes per season (Conservation Measure 41-03), noting the comments in SC-CAMLR-XXIV, Annex 5, paragraphs 5.143 to 5.145, and the need to ensure that the experiment is not affected by other fishing activities.

Electrona carlsbergi (Subarea 48.3)

4.131 No new information was made available to WG-FSA for *E. carlsbergi* in Subarea 48.3 on which to base an assessment.

Management advice for *E. carlsbergi* (Subarea 48.3)

4.132 The Scientific Committee noted that Conservation Measure 32-17 remains in force.

C. gunnari at Kerguelen Islands (Division 58.5.1)

4.133 No new information has been provided to the Scientific Committee on icefish in Division 58.5.1.

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

4.134 The Scientific Committee recommended that the fishery for *C. gunnari* within the French EEZ of Division 58.5.1 should remain closed in the 2006/07 season until information on stock status is obtained from a survey.

New and exploratory fisheries in 2005/06 and notifications for 2006/07

4.135 In 2005 the Commission agreed to seven exploratory longline fisheries for *Dissostichus* spp. in the 2005/06 season (Conservation Measures 41-04, 41-05, 41-06, 41-07, 41-09, 41-10 and 41-11), and no new fisheries had been notified for 2005/06. Activities in the exploratory fisheries are outlined below and summarised in Annex 5, Table 4.

4.136 Notifications for exploratory fisheries in 2006/07 are summarised in Annex 5, Table 5. Twelve Members submitted paid notifications for exploratory longline fisheries for *Dissostichus* spp. in Subareas 48.6, 88.1 and 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b. There were no notifications for new fisheries, and no notifications were received for fisheries in closed areas.

4.137 The Scientific Committee did not attempt to determine whether the notifications for exploratory fisheries satisfied the requirements of the notification procedure (Conservation Measure 21-02) (paragraphs 11.5 and 11.6).

4.138 Under Conservation Measure 41-01, 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 caught throughout the season. In 2005/06, 4 451 *Dissostichus* spp. were reported to have been tagged and released in exploratory fisheries (Annex 5, Table 7), and 113 tags were recovered (Annex 5, Table 8). The number of individual *Dissostichus* spp. tagged and released, total reported catch and tagging rate in each subarea and division for vessels operating in the exploratory fisheries are shown in Table 5.

Progress towards assessments of new and exploratory fisheries

4.139 The Scientific Committee noted for the second year that substantial progress had been made in assessing stocks of *Dissostichus* spp. in Subareas 88.1 and 88.2 (see Annex 5, paragraphs 5.54 to 5.62 and Appendix F) to develop management advice.

4.140 For the other subareas and divisions in which exploratory fisheries are conducted, the Scientific Committee was unable to develop management advice based on assessments of yield and was therefore unable to provide any new advice on catch limits for these fisheries. The reported catches in these fisheries are summarised in Annex 5, Table 9.

4.141 Given the large number of notifications for 2006/07, the Scientific Committee reiterated the urgent need to develop a means for estimating abundance and providing assessments of stock status in exploratory fisheries other than in Subareas 88.1 and 88.2.

General management advice for new and exploratory fisheries

4.142 The Scientific Committee reiterated the necessity for Members fishing in exploratory fisheries for *Dissostichus* spp. to conduct the fishery-based research outlined in Conservation Measure 41-01, and submit data to the Secretariat in a timely manner.

4.143 In addition, the Scientific Committee reiterated the importance for Members to conduct tagging and to submit data as part of the Research and Data Collection Plan (Conservation Measure 41-01). Members are also urged to emphasise to their vessels the need to inspect captured fish for tags and submit accurate tag–recapture data to the Secretariat in a timely manner (Annex 5, paragraphs 3.5 and 3.6).

4.144 The Scientific Committee noted that there are significant differences in the tagging rates achieved by different Members in some areas, and not in others (Table 5). It is important to understand whether this is due to operational constraints which might suggest differences in mark–recapture model parameters, or to other reasons.

4.145 In some cases the differences in tagging rates may be attributed to operational constraints, as was the case with one Chilean-flagged vessel noted by Prof. Moreno. The vessel was damaged by sea-ice and had to withdraw prematurely from the fishery, thus not achieving the required tagging rate.

4.146 The Scientific Committee noted that large toothfish, which are taken in some fisheries, may be difficult to tag and release unharmed and that this may result in low tagging rates in those regions. Fish which remain near the surface after being released may experience heavy bird predation. It was emphasised that great care should be taken to release all tagged fish in good condition and with a high probability of survival. If a fish is tagged and released in poor condition or is injured or eaten on release, that tag number should be recorded as released but lost, and the tag data should be removed from the database.

4.147 The Scientific Committee recognised that IUU fishing would remove tagged fish but it noted that the assessments using CASAL accounted for tagged and untagged fish in all catches in the same proportion as existed in the region, and the resultant yield calculations would not be affected.

4.148 However, the removal of tagged fish by IUU fishing using alternative gear such as trammel nets, which may have different selectivity than longlines or trawls employed by the regulated fisheries, may affect yield calculations. The Scientific Committee agreed that WG-FSA should consider what these effects might be.

4.149 With the exception of Subareas 88.1 and 88.2, the Scientific Committee was unable to provide any new advice on catch limits for *Dissostichus* spp. or any by-catch species in any of the exploratory fisheries.

4.150 For the other areas and divisions in which exploratory fisheries are conducted, the Scientific Committee reiterated the urgent need to develop a means for estimating abundance and providing assessments of stock status for all exploratory fisheries. In this context, it noted that with the continuing tagging programs in a number of areas, in the medium to long term it may be possible to obtain mark–recapture estimates of abundance provided that sufficient tags are deployed and recovered each year.

4.151 The Scientific Committee recommended that the tagging rate for *Dissostichus* spp. in exploratory fisheries be increased to (Annex 5, paragraphs 3.56 and 5.49; see also paragraph 11.8):

- a minimum of three fish per tonne and a target of 10 fish per tonne in those SSRUs in Subareas 88.1 and 88.2 which are closed but carry a 10-tonne research exemption for a single vessel in a single season;

- a minimum of three fish per tonne in exploratory fisheries in Divisions 58.4.1 and 58.4.2.

Dissostichus spp. (Subarea 48.6)

4.152 One vessel (Japan) fished in the exploratory fishery in Subarea 48.6 in 2005/06. The precautionary catch limit for *Dissostichus* spp. was 900 tonnes and the total catch was 137 tonnes. Information on this fishery is summarised in Annex 5, paragraphs 5.16 to 5.20 and Appendix G.

4.153 The fishery operated predominantly in SSRU A and the main species caught was *D. eleginoides* over the course of the fishery, although 46% of the catch in 2005/06 was *D. mawsoni*. The Scientific Committee noted that there is uncertainty in the spatial distribution of the two species of *Dissostichus* in SSRU A. This requires further investigation over the intersessional period to help with reviewing this fishery.

4.154 There is no information on sightings or landings available to estimate the level of IUU fishing in Subarea 48.6.

4.155 A total of 205 *D. eleginoides* and seven *D. mawsoni* (total 212 fish) have been tagged and released, mostly in SSRU A, and three fish (all *D. eleginoides*) have been recaptured.

4.156 The Scientific Committee noted disproportionately fewer *D. mawsoni* tagged relative to *D. eleginoides*. It noted that *D. mawsoni* may be larger fish and difficult to tag as previously discussed (paragraph 4.146).

4.157 The Scientific Committee noted that Conservation Measure 41-01 specifies the tagging rate for *Dissostichus* spp. generally. It was agreed that in regions where both species occur, the tagging rate should be in proportion to the species and sizes of *Dissostichus* spp. present in the catches (paragraphs 11.7 to 11.11). However, the Scientific Committee recognised that there may be other ramifications associated with this requirement, and requested that WG-FSA examine this issue.

4.158 To ensure adequate numbers of fish of each species are tagged, the Scientific Committee noted that in regions where both species occur, it may be necessary to increase the rate that fish are tagged from the present rate of one fish per tonne to three fish per tonne as is being recommended in other regions (paragraph 4.192).

4.159 The Scientific Committee noted that determining the optimal number of tagged fish and recaptures required before an assessment can be conducted is complex; however, it was noted that in SSRU 882E a stock assessment was completed this year after 1 324 fish had been tagged with 55 tag returns (Annex 5, Tables 7 and 8).

4.160 The Scientific Committee recognised that in addition to the deployment and recovery of sufficient tagged fish, other information such as biological data may be required before an assessment can be completed.

4.161 Dr Naganobu suggested that toothfish densities in Subarea 48.6 may be lower than those in Subareas 88.1 and 88.2, so any comparison of tagging efforts among the areas may need further investigation. He advised against increasing the tagging rate in Subarea 48.6 at this time.

4.162 Dr Constable noted that the surface area of SSRU A in Subarea 48.6 is similar to the area of Subarea 88.1 as a whole. Therefore, it would be useful if WG-FSA could consider the need to subdivide SSRU A in Subarea 48.6 into smaller SSRUs in order to facilitate assessments similar to that for the fishery in SSRU 882E.

4.163 Four Members (Japan, Republic of Korea, New Zealand and Norway) and a total of five vessels notified their intention to fish for *Dissostichus* spp. in Subarea 48.6 in 2006/07.

Management advice for Subarea 48.6

4.164 The Scientific Committee recommended that all the requirements of the fishery, including fishery-based research (Conservation Measure 41-01), by-catch limits (Conservation Measure 33-03) and associated measures, be carried forward to the 2006/07 season.

Dissostichus spp. (Subarea 58.4)

4.165 The Scientific Committee noted that there were four divisions within Subarea 58.4 that were fished for *Dissostichus* spp. during 2005/06.

Dissostichus spp. (Division 58.4.1)

4.166 Five Members (Chile, Republic of Korea, New Zealand, Spain and Uruguay) and six vessels fished in the exploratory fishery in Division 58.4.1 in 2005/06. The precautionary catch limit for *Dissostichus* spp. was 600 tonnes and the reported catch was 425 tonnes. The closure of SSRUs C (15 February 2006) and G (27 January 2006) was triggered by the catch of *Dissostichus* spp. and the Scientific Committee noted that the over-run of the catch limit in SSRU C (by 50 tonnes) was partly attributed to an amendment to the reported catch which was submitted to the Secretariat after the closure of the fishery (CCAMLR-XXV/BG/3). Information on this fishery is summarised in Annex 5, Appendix H.

4.167 The fishery targets *D. mawsoni* and has operated in SSRUs C, E and G. Information on IUU activities indicated that approximately 689 tonnes of *Dissostichus* spp. was taken in 2005/06. The Scientific Committee noted that most of the catch reported in 2005/06 was taken in SSRUs C and G and that it was possible that these SSRUs were also the focus of IUU fishing. If this were the case, then the total extraction of *Dissostichus* spp. from these SSRUs in 2005/06 was higher than the precautionary catch limit and may not be sustainable.

4.168 A total of 908 *D. mawsoni* and 23 *D. eleginoides* (total 931 fish) have been tagged and released; there are no reports of recaptures. Most of the fish tagged and released were from SSRUs C (427 fish), E (180 fish) and G (324 fish).

4.169 Six Members (Australia, Republic of Korea, Namibia, New Zealand, Spain and Uruguay) and a total of nine vessels notified their intention to fish for *Dissostichus* spp. in Division 58.4.1 in 2006/07.

Dissostichus spp. (Division 58.4.2)

4.170 Three Members (Chile, Republic of Korea and Spain) and four vessels fished in the exploratory fishery in Division 58.4.2. The precautionary catch limit for *Dissostichus* spp. was 780 tonnes and the reported catch was 164 tonnes. Information on this fishery is summarised in Annex 5, Appendix I.

4.171 The fishery targets *D. mawsoni* and has operated in SSRUs A, C and E in recent seasons. Information on IUU activities indicated that approximately 221 tonnes of *Dissostichus* spp. was taken in 2005/06.

4.172 A total of 463 *D. mawsoni* and 15 *D. eleginoides* (total 478 fish) have been tagged and released; there are no reports of recaptures. Most of the fish tagged and released were from SSRUs A (237 fish) and E (190 fish). The fishery appears to have caught small and large fish in the early years but the smaller length classes have not been caught in more recent years.

4.173 The Scientific Committee noted that the catch of macrourids reported in 2004/05, when fishing was concentrated in SSRU A, was relatively higher (22% of the catch of *Dissostichus* spp.) than in other seasons (2–10% of the catch of *Dissostichus* spp.) when fishing was concentrated in SSRU E.

4.174 Six Members (Australia, Republic of Korea, Namibia, New Zealand, Spain and Uruguay) and a total of nine vessels notified their intention to fish for *Dissostichus* spp. in

Division 58.4.2 in 2006/07. The Scientific Committee noted that if all these vessels fished, this would represent a doubling of fishing effort by Members in this division. There was also a rapid increase in IUU fishing in this division (Annex 5, paragraphs 5.94 to 5.105).

Dissostichus spp. (Division 58.4.3a)

4.175 Two vessels (Spain) fished in the exploratory fishery in Division 58.4.3a. The precautionary catch limit for *Dissostichus* spp. was 250 tonnes and the reported catch was 89 tonnes. Information on this fishery is summarised in Annex 5, Appendix J.

4.176 The fishery targets *D. eleginoides* and the Scientific Committee noted that the catch-weighted length frequencies for this species were similar to those reported for *D. eleginoides* taken by longline in Division 58.5.2 (see Annex 5, Appendix N). Information on IUU activities indicated that approximately 98 tonnes of *Dissostichus* spp. were taken in 2004/05; there was no information on IUU fishing in 2005/06.

4.177 A total of 303 *D. eleginoides* have been tagged and released and six fish have been recaptured.

4.178 Three Members (Japan, Republic of Korea and Spain) and a total of four vessels notified their intention to fish for *Dissostichus* spp. in Division 58.4.3a in 2006/07.

Dissostichus spp. (Division 58.4.3b)

4.179 Three Members (Chile, Spain and Uruguay) and four vessels fished in the exploratory fishery in Division 58.4.3b. The precautionary catch limit for *Dissostichus* spp. was 300 tonnes and the reported catch was 361 tonnes. The fishery targets *D. mawsoni* and fishing took place outside the prescribed season, in accordance with Conservation Measure 41-07. The closure of the fishery (13 March 2006) was triggered by the catch of *Dissostichus* spp. and the Scientific Committee noted that the over-run of the catch limit (61 tonnes) was partly attributed to an amendment to the reported catch which was submitted to the Secretariat after the closure of the fishery (CCAMLR-XXV/BG/3). Information on this fishery is summarised in Annex 5, Appendix K.

4.180 Information on IUU activities indicated that approximately 1 015 tonnes of *Dissostichus* spp. was taken in 2004/05, and 1 808 tonnes in 2005/06. The Scientific Committee expressed concern that the total extraction of *Dissostichus* spp. in the 2004/05 and 2005/06 seasons exceeded the precautionary catch limit by a factor of 4.4 and 7.2 respectively. The Scientific Committee agreed that such extractions were unlikely to be sustainable.

4.181 A total of 392 *D. mawsoni* and 14 *D. eleginoides* (total 406 fish) have been tagged and released and seven fish have been recaptured.

4.182 The Scientific Committee noted that tagging rates by vessels in this area have apparently been much lower than tagging rates by the same vessels in other areas (Table 5).

The Scientific Committee requested information from the vessels and observers operating in Subarea 58.4 on the reasons for this lower tagging rate which may be due to operational constraints or the poor condition of toothfish caught.

4.183 Six Members (Australia, Japan, Republic of Korea, Namibia, Spain and Uruguay) and a total of eight vessels notified their intention to fish for *Dissostichus* spp. in Division 58.4.3b in 2006/07. The Scientific Committee noted that if all these vessels fished, this would represent a doubling of the number of vessels which fished in 2005/06.

Overview of *D. mawsoni* fisheries in Subarea 58.4

4.184 The Scientific Committee noted the increasing levels of fishing activity occurring in the range of *D. mawsoni* in the Indian Ocean sector (notably in Divisions 58.4.1, 58.4.2 and 58.4.3b), particularly the attention being given to the region between 60°E and 110°E along the margins of the continental shelf of Antarctica and BANZARE Bank. The estimated total removals from these divisions in 2005/06 was 3 668 tonnes (this total comprised 74% IUU). Given the proximity of these fisheries to one another, the Scientific Committee agreed that the separation of these fisheries may prove to be inappropriate once there is an understanding of stock structure in the region. In light of this, the combined scale of these removals is greater than the catch limit for Subarea 88.1, which is based on assessments of stock status and long-term annual yield. However, the Scientific Committee noted that although the sizes of the two subareas are similar, the fishable grounds in Subarea 58.4 are limited to the margins of the continental shelf of Antarctica and BANZARE Bank, unlike Subarea 88.1 where fishable grounds are much larger.

4.185 On the basis of the fishery reports for these divisions, the Scientific Committee also noted:

(i) by-catch rates, particularly for *Macrourus* spp., seem unusually low, especially when compared to rates experienced in comparable areas in Subareas 88.1 and 88.2 and to the common occurrence of these fish in an earlier trawl survey of BANZARE Bank (SC-CAMLR-XVIII, Annex 5, paragraph 3.79; van Wijk et al., 2000);

(ii) the total number of tagged fish released in these divisions is 1 815 but it is unclear how many of these fish have survived because the Scientific Committee was advised that observers in the fishery have reported a great difficulty in tagging these large fish and that many of them do not recover from the process of tag and release, remaining on the surface after release and becoming vulnerable to predators, such as being attacked by giant petrels;

(iii) the tagging rate in Division 58.4.3b, which is the region for which most catch is taken, has not reached the required level of one fish per tonne in the last two seasons.

4.186 The Scientific Committee recalled that an Australian survey in 1999 had not detected any young *Dissostichus* spp. in Division 58.4.3b. Commercial data (see Fishery Report) confirm that the *D. mawsoni* found in this area are on average about 140 cm long with a minimum at about 100 cm. The absence of smaller fish and the relatively small area of

BANZARE Bank and low CPUE compared to Subareas 88.1 and 88.2 suggest a small stock size, while the dynamics, including stock structure and productivity, are completely unknown. On the basis of information available and the outcomes of the Ross Sea assessment, which is for a much larger area, extractions of *Dissostichus* spp. at the level of 2 000 tonnes a year are unlikely to be sustainable.

4.187 The Scientific Committee had similar concerns about the productivity of the populations of *D. mawsoni* in Divisions 58.4.1 and 58.4.2, although there appear to be some young fish in Division 58.4.2.

4.188 Given the comparatively high level of total removals across these divisions, the low level of reporting on removals (the available data are only for 26% of the total estimated catch), and the potential unreliability of the tagging program, the Scientific Committee considered that there was an urgent need to review how to acquire information on the status of the stocks in the region, including stock structure, such as through otolith-based studies, and how to assess productivity and yield, such as through more structured experimental fishing. This will not be possible until the meeting of WG-FSA in 2007.

4.189 The Scientific Committee agreed that the tagging program should be accelerated (Annex 5, paragraph 5.46). Some vessels fishing in these three divisions have achieved tagging rates of three fish per tonne and greater. Tagging rates in Division 58.4.3b have been low, none reaching the required level of one fish per tonne over the last two years. The Scientific Committee recommended that tagging rates in Divisions 58.4.1 and 58.4.2 should be raised to three fish per tonne. Furthermore, it agreed that all fish recorded as being tagged and released should be healthy and not have been subjected to seabird predation. The Scientific Committee urged Members to correspond with each other in order to implement appropriate methods for achieving the required level of tagging in all divisions.

Management advice for *D. mawsoni* in Subarea 58.4

4.190 The Scientific Committee recommended urgent consideration of how to acquire appropriate data for assessments of stock status and yield of *D. mawsoni* in the Indian Ocean sector because of (i) the lack of progress towards assessments in these divisions, and (ii) a rapidly escalating catch in the region.

4.191 The Scientific Committee requested submissions by Members on stock structure, biological parameters (e.g. growth, length–weight relationship, maturity), recruitment and methods for assessment of these stocks.

4.192 The Scientific Committee agreed that the tagging program should be accelerated (Annex 5, paragraph 5.46). Some vessels fishing in these three divisions have achieved tagging rates of three fish per tonne and greater. Tagging rates in Division 58.4.3b have been low, none reaching the required level of one fish per tonne over the last two years. The Scientific Committee recommended that tagging rates in Divisions 58.4.1 and 58.4.2 should be raised to three fish per tonne. Furthermore, it agreed that all fish recorded as being tagged and released should be healthy and not have been subjected to seabird predation. The

Scientific Committee urged Members to correspond with each other in order to implement appropriate methods for achieving the required level of tagging in all divisions (paragraph 4.189).

Dissostichus spp. (Subareas 88.1 and 88.2)

4.193 Six Members (Argentina, New Zealand, Norway, Russia, UK and Uruguay) and 13 vessels fished in the exploratory fishery in Subarea 88.1. The precautionary catch limit for *Dissostichus* spp. was 2 964 tonnes and the total catch was 2 952 tonnes. The fishery was closed on 6 February 2006 (CCAMLR-XXV/BG/3), and the following SSRUs were closed during the course of fishing:

- SSRUs B, C, G closed 3 January, triggered by the catch of *Dissostichus* spp. (total catch 343 tonnes; 99% of the catch limit);
- SSRUs H, I, K closed 19 January, triggered by the catch of *Dissostichus* spp. (total catch 1 976 tonnes; 104% of the catch limit);
- SSRU J closed 5 February, triggered by the catch of *Dissostichus* spp. (total catch 548 tonnes; 99% of the catch limit).

The IUU catch for the 2005/06 season was estimated to be zero tonnes.

4.194 Nine Members (Argentina, Republic of Korea, New Zealand, Norway, Russia, South Africa, Spain, UK and Uruguay) and a total of 21 vessels notified their intention to fish for *Dissostichus* spp. in Subarea 88.1 in 2006/07.

4.195 Five Members (Argentina, New Zealand, Norway, Russia and the UK) and seven vessels fished in the exploratory fishery in Subarea 88.2. The precautionary catch limit for *Dissostichus* spp. was 487 tonnes and the total catch was 465 tonnes. The fishery was closed on 15 February 2006 (CCAMLR-XXV/BG/3). The IUU catch for the 2005/06 season was estimated to be 15 tonnes. Information on this fishery and management advice is summarised below.

4.196 Seven Members (Argentina, New Zealand, Norway, Russia, Spain, UK and Uruguay) and a total of 16 vessels notified their intention to fish for *Dissostichus* spp. in Subarea 88.2 in 2006/07.

4.197 The Fishery Report for *Dissostichus* spp. in Subareas 88.1 and 88.2 is in Annex 5, Appendix F.

4.198 In 2005 the Scientific Committee recommended that Subareas 88.1 and 88.2 be split into two areas for stock assessment purposes: (i) the Ross Sea (Subarea 88.1 and SSRUs 882A, B), and (ii) SSRU 882E.

4.199 The catch limits for Subarea 88.1 and 88.2 SSRUs in the Ross Sea were changed as part of a three-year experiment (SC-CAMLR-XXIV, paragraphs 4.163 to 4.166). To assist administration of the SSRUs, the catch limits for SSRUs 881B, C and G were amalgamated

into a 'north' region and those for SSRUs 881H, I and K were amalgamated into a 'slope' region. Within Subarea 88.2, SSRU 882E was treated as a separate SSRU with its own catch limit, whilst SSRUs 882C, D, F and G were amalgamated with a single catch limit.

4.200 Under Conservation Measure 41-01 each longline vessel fishing in exploratory fisheries for *Dissostichus* spp. is required to tag and release *Dissostichus* spp. at a rate of one toothfish per tonne of green weight caught throughout the season.

4.201 In 2005/06, all but five vessels achieved a tagging rate of more than one toothfish per tonne of toothfish landed (Table 5). The vessels that failed to achieve the required tagging rate were the *Antartic II* (Argentina), *Volna* (Russia) and *Yantar* (Russia) in both Subareas 88.1 and 88.2; the *Viking Sur* (Uruguay) in Subarea 88.1; and the *Frøyanes* (Norway) in Subarea 88.2.

4.202 Since 2000/01, more than 11 000 *Dissostichus* spp. have been tagged in Subareas 88.1 and 88.2 (WG-FSA-06/34), and 250 tagged fish recaptured. Since 2000/01 a total of 5 678 *D. mawsoni* have been tagged by New Zealand vessels in the Ross Sea (Subarea 88.1 and SSRUs 882A–B) and 94 of these were recaptured by New Zealand vessels. The New Zealand vessel data were used as inputs for the base-case model, as complete data (i.e. some release data for 2004) for other vessels were unavailable for the assessment (WG-FSA-06/34).

4.203 The CASAL model, using catch-at-age, CPUE, tag–recapture data, and *D. mawsoni* biological parameters was used to estimate the current and initial population size, and to calculate the long-term annual yield that would satisfy the CCAMLR decision rules.

Management advice for *Dissostichus* spp.
in Subareas 88.1 and 88.2

4.204 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 for the Ross Sea (Subarea 88.1 and SSRUs 882A–B) was 3 072 tonnes. At this yield there is a less than 10% chance of spawning biomass dropping to less than 20% of the initial biomass. A yield of 3 072 tonnes is therefore recommended.

4.205 For SSRU 882E, assuming a future fishing selectivity equal to the maturity ogive, the constant catch for which there was a 10% chance of spawning biomass dropping to less than 20% of the initial biomass was 353 tonnes. A yield of 353 tonnes is therefore recommended.

4.206 For SSRUs 882C, D, F and G the Scientific Committee could provide no new advice, but noted that the catches in these areas had provided some useful biological data for toothfish. Therefore, the Scientific Committee recommended the current catch limits in these SSRUs be continued for the 2006/07 season.

4.207 The Scientific Committee recommended that the allocation method used to set the 2005/06 catch limits for SSRUs in Subarea 88.1 be continued for the 2006/07 season.

4.208 The Scientific Committee agreed that the current designations of SSRUs in Subareas 88.1 and 88.2 are almost certainly not optimal, but a detailed revision of these would require, at least, a consolidated movement model for fish in these subareas, which is not yet available. Such a revision should take account not only of the principal target species, but also of by-catch species and ecosystem considerations.

4.209 The Scientific Committee recommended that tagging be continued as part of the Research and Data Collection Plan (Conservation Measure 41-01) and urged all Members to continue to tag fish at the required rate.

4.210 The Scientific Committee also considered that the introduction of more structured research plans for exploratory fisheries may lead to a more effective and efficient collection of research data. It therefore recommended that development of such plans should be considered during the intersessional period.

4.211 The Scientific Committee recommended that there should continue to be provision for a 10-tonne research exemption in all SSRUs in Subareas 88.1 and 88.2 having a zero catch limit so as to provide additional opportunities for research and tagging in areas where, often, data are scarce. However, paragraphs 12 and 13 of Conservation Measures 41-09 and 41-10, should be revisited in order to:

- clarify that a 10-tonne research exemption will be granted only for a single vessel in a single SSRU, not one vessel per Member. This will limit the total catch in a closed SSRU to 10 tonnes. On receipt of a notification under Conservation Measure 24-01, Annex A, from a Member that it intends to undertake research under the 10-tonne research exemption in a particular SSRU, the Secretariat will notify all Members of this fact and will not allow additional notifications for that SSRU in that season;

- clarify that paragraphs 12 and 13 of Conservation Measures 41-09 and 41-10 override the normal interpretation of Conservation Measure 24-01 in respect of multiple notifications by Members in a single SSRU;

- clarify that there is an allowance for the retention of 10 tonnes green weight of *Dissostichus* spp.;

- clarify that by-catch and *Dissostichus* spp. that are tagged and returned do not count against the 10-tonne limit. The retained catch of toothfish should count against the overall catch limit for the larger area within which the SSRU lies;

- increase the required tagging rate under the 10-tonne research exemptions to a minimum of three fish per tonne and a target rate of 10 fish per tonne (paragraph 4.151). This will also require a change to Conservation Measure 41-01, Annex C, paragraph 2(i).

Review of potential destructive fishing practices

Interim prohibition on the use of gillnets in the Convention Area

4.212 The Scientific Committee was asked to comment on a proposal to prohibit deep-sea gillnet fishing in the Convention Area (WG-FSA-06/46). Gillnets considered in the document are those described by FAO which include trammel nets. The Scientific Committee noted information exists that fishing vessels with gillnets have been observed in the Convention Area. The Scientific Committee agreed that gillnets are non-selective fishing devices and if not utilised correctly could take mobile species indiscriminately. In addition, gillnets may have adverse impacts if dragged along the bottom and have the potential to 'ghost' fish over long time periods when lost or discarded. The Scientific Committee agreed that it would be reasonable to have an interim prohibition of deep-sea gillnetting in the Convention Area until the Scientific Committee has investigated and reported on the potential impacts of this gear in the Convention Area and the information has been reviewed by the Commission.

4.213 The Scientific Committee also noted that the suggested interim prohibition would apply only to commercial vessels and not for research purposes. At present some Members utilise gillnets in inshore areas to sample fish populations. These programs have been conducted using approved methods for a number of years. If Members wished to initiate new research programs using gillnets, the Scientific Committee should be notified in order that the proposals be reviewed and approved before being undertaken. The Scientific Committee noted that action with respect to regulating the use of gillnets in the Convention Area should not jeopardise existing research programs in coastal waters, which occur in waters less than 150 m deep.

Bottom trawl fishing and destructive fishing practices within the CAMLR Convention Area

4.214 The Scientific Committee was also asked to comment on a proposal to address the negative impacts of bottom trawl fishing on oceanic ecosystems, and in particular vulnerable marine ecosystems, in the Convention Area (CCAMLR-XXV/BG/33). The proposal was that:

(i) in high-seas areas where there is an RFMO with competence to regulate bottom fisheries, that RFMO would take action to:

  (a) immediately freeze the footprint of bottom-trawl fishing (e.g. no expansion into new areas or in existing areas), unless the RFMO determines that such expansion would not cause significant adverse harm to vulnerable marine ecosystems;

  (b) end all bottom trawling by 2009, unless the RFMO determines that its continuation would not cause significant adverse harm.

4.215 The Scientific Committee noted that it supports attempts to remove destructive fishing practices in the Convention Area. It noted that at present bottom trawl fishing is prohibited around the Antarctic Continent and there are no plans to initiate new bottom trawl fishing.

4.216 However, some Members noted that in the case of the present proposal, the issue would best be examined by the Commission which may wish to provide further guidance to the Scientific Committee to be considered at its next meeting.

Crab resources

4.217 No target fishery for crabs was carried out in the last four seasons and no proposal for their harvest has been received by CCAMLR for the 2006/07 season.

Advice to the Commission

4.218 The Scientific Committee recommended that the existing Conservation Measures 52-01 and 52-02 on crabs should remain in force.

Squid resources

Martialia hyadesi (Subarea 48.3)

4.219 No target fishery for squid (*Martialia hyadesi*) was carried out in the last four seasons and no new request has been submitted to CCAMLR to continue exploratory fishing in the 2006/07 season.

Advice to the Commission

4.220 The Scientific Committee recommended that the existing Conservation Measure 61-01 on *M. hyadesi* should remain in force.

Fish and invertebrate by-catch

4.221 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.

4.222 Consideration of fish by-catch in krill fisheries is not included in this section. See section 2.

Assessment of the status of by-catch species and groups

4.223 No new assessment had been conducted which would enable the recommended catch limits to be revised in 2006. As a result, the Scientific Committee recommended that precautionary measures should be adopted so as to set an upper limit on by-catch, thus reducing the possibility of localised depletion.

4.224 The Scientific Committee recalled that the assessment of rajids and macrourids remains a priority. The acquisition of biological data on rajids caught during longline fishing is continuing in Subareas 88.1 and 88.2, and tagging programs are also being undertaken in these subareas, as well as in Division 58.5.2 and Subarea 48.3. The Scientific Committee encouraged these efforts, and looked forward to receiving the results of intersessional work aimed at providing an initial assessment of rajid stocks.

Estimation of by-catch levels and rates

4.225 Estimates of total removals of by-catch in the longline and trawl fisheries are shown in Tables 10 and 11 respectively of the WG-FSA report (Annex 5). Rajids and macrourids constitute the majority of by-catch in longline fisheries, followed by the morid *Antimora rostrata*, which predominates in the category 'Other Species'. *Channichthys rhinoceratus* and *Pseudochannichthys georgianus* were predominant in by-catch in icefish fisheries in Division 58.5.2 and Subarea 48.3 respectively, but were found in much smaller proportions than is observed in by-catch of longline fisheries. Icefish is itself caught as a by-catch in the krill fishery in Subarea 48.3.

4.226 Estimates of fish by-catch were equivalent to those obtained in previous years using fine-scale data (C2 forms). By-catch of macrourids on longlines in Subarea 88.1 have, however, decreased considerably, probably partly because of a decrease in the requirement to conduct longline research hauls, and also as a result of the implementation of the move-on rule when by-catch levels are high.

Reporting of by-catch data

4.227 Estimates of longline by-catch of fish from observer data were compared with those from fine-scale data (C2). While there is consistency between the two types of data for macrourids, this is not the case for rajids, for which data reporting seems unsatisfactory except in the areas in which they are retained and processed. It was also noted that estimates of catch rates still include little information on drop-offs (whether deliberate or accidental) of rays from hooks on the line. The Scientific Committee emphasised that observers should complete all fields of data reporting forms correctly and asked WG-FSA to review the performance of the 2006/07 season.

4.228 The Scientific Committee agreed that L5 observer forms have become too complex and recommended that observers' tasks should be simplified. In particular, the requirement to record the total weight of each by-catch taxon for every haul should be relaxed. The mean weight of by-catch species should be obtained from observations made during the biological sampling period and not the tally period.

4.229 The Scientific Committee recommended that the instructions to observers with respect to sampling longlines for by-catch be simplified as follows:

Tally period –

- 25% of hooks should be observed for tally counts each day
- the tally period may be broken up into several periods each day
- tally period includes counts of target fish species, fish and invertebrate by-catch, and interactions of birds and mammals with the fishing gear.

Biological data –

- Biological sampling periods and tally periods should be consecutive (the mean weight of by-catch is worked out during the biological sampling period).

Rajids –

- Skate and ray observations should be conducted at least once every 48 hours and, if possible, should cover approximately 10% of the hooks hauled.

4.230 The Scientific Committee recommended that observers be thoroughly briefed by technical coordinators regarding the guidelines for recording by-catch data.

Mitigation measures

4.231 The Scientific Committee endorsed WG-FSA's recommendations that the by-catch move-on rule (Conservation Measure 33-03, paragraph 5) should not be modified, as this measure seems to have been effective, at least in Subarea 88.1, in reducing by-catch and the number of times individual SSRUs would have had to be closed following by-catch limits being reached.

4.232 In view of the development of new longline fishing techniques, the Scientific Committee encouraged Members experimenting with such methods to monitor closely the impact of fishing operations on all species (target species, fish and invertebrate by-catch and marine mammals and birds).

Management advice

4.233 The Scientific Committee recommended that the by-catch move-on rule (Conservation Measure 33-03, paragraph 5) remain unmodified for this year, but recommended that it be reviewed at WG-FSA-07. It requested that the Secretariat provide data for the analysis of by-catch (as shown in Annex 5, Tables 10 to 12) for the start of that meeting.

4.234 Management advice regarding the recommendations for scientific observation is included in section 2.

INCIDENTAL MORTALITY

5.1 The Scientific Committee reviewed the report of ad hoc WG-IMAF (Annex 5, section 7 and Appendix D). It endorsed the report and its conclusions, and the plan of intersessional work (SC-CAMLR-XXV/BG/28) subject to the comments set out below.

5.2 The Scientific Committee invited Members to review the membership of ad hoc WG-IMAF and to facilitate the attendance of their representatives at its meetings, especially South American members. Further, where possible and appropriate, the attendance of technical coordinators would be beneficial to WG-IMAF, WG-FSA and the general coordination of the observer program (Annex 5, Appendix D, paragraph 5).

Incidental mortality of seabirds during regulated fishing
in the Convention Area in 2005/06

5.3 The Scientific Committee noted that:

(i) the total number of observed seabird mortalities in all longline fisheries in the Convention Area, with the exception of the French EEZ in Subarea 58.6 and Division 58.5.1, was one (a white-chinned petrel in Division 58.4.3b). The total extrapolated longline mortality was two birds (Annex 5, Appendix D, Table 3). This compared to 97 birds estimated killed in longline fisheries in the Convention Area, with the exception of the French EEZ, in 2004/05 (Annex 5, Appendix D, paragraph 11);

(ii) the total reported seabird mortality from observers for Subarea 58.6 and Division 58.5.1 was 57 and 592 birds respectively (Annex 5, Appendix D, Table 4). The extrapolated total seabird mortalities for Subarea 58.6 and Division 58.5.1 were 235 and 2 352 respectively (Annex 5, Appendix D, Table 5). This compared to estimates of 242 and 4 387 respectively in 2004/05 (SC-CAMLR-XXIV, paragraph 5.8);

(iii) when seabird mortalities from the Subarea 58.6 and Division 58.5.1 EEZs within the Convention Area are included, the total extrapolated seabird mortalities during longline fishing operations was estimated to be 2 589 (Annex 5, Appendix D, paragraph 6);

(iv) for the first time no albatrosses were observed captured in longline fisheries in the Convention Area (Annex 5, Appendix D, paragraph 6 and Table 8);

(v) in the Subarea 48.3 icefish trawl fishery 33 seabirds, including both albatrosses and petrels, were observed killed and another 89 released alive and uninjured (Annex 5, Appendix D, Table 12). The rate of mortality in this subarea in 2006 was 0.07 birds per trawl compared to 0.14, 0.37 and 0.20 in 2005, 2004 and 2003 respectively (Annex 5, Appendix D, paragraph 23 and Table 14);

(vi) there were no seabird mortalities observed in the Division 58.5.2 trawl fishery, the Area 48 krill fishery or any of the pot fisheries (Annex 5, Appendix D, paragraphs 26, 29 and 32).

5.4 The Scientific Committee noted that 97% of reported seabird captures in the Convention Area, with the exception of the French EEZ in Subarea 58.6 and Division 58.5.1, were during longline hauling (Annex 5, Appendix D, paragraph 12). For the French EEZ in Subarea 58.6 and Division 58.5.1, 28% of seabirds captured were caught alive (30% in 2004/05), indicating that they were taken on the haul (Annex 5, Appendix D, paragraph 16). This emphasises a need to increase the focus on haul mitigation measures to reduce the remaining seabird by-catch in longline fisheries in the Convention Area (Annex 5, Appendix D, paragraph 16).

5.5 The Scientific Committee noted the ongoing efforts to use and develop effective mitigation measures in the French EEZ fisheries and that France continues to reduce its total seabird by-catch by about one half each year (Annex 5, Appendix D, paragraphs 15 and 19). However, the level of seabird captures during longline fishing in the French EEZ remains far above that recorded elsewhere in the Convention Area. Seasonal differences in the fishing patterns between areas may account for the differences in catch rates between the French EEZ and other areas, with no longline fishing conducted in equivalent high-risk areas during the summer period (Annex 5, Appendix D, paragraph 19).

5.6 With respect to the French EEZ in Subarea 58.6 and Division 58.5.1 the Scientific Committee recommended that:

(i) consideration be given to increasing the proportion of hooks observed (e.g. to 40–50%) (Annex 5, Appendix D, paragraph 17);

(ii) a thorough analysis of data be undertaken for the 2003/04 to 2005/06 seasons (Annex 5, Appendix D, paragraph 17);

(iii) provision of additional information on the nature of captures, the factors affecting captures, and details of mitigation devices used (Annex 5, Appendix D, paragraph 18);

(iv) all relevant raw by-catch data be submitted, as is done for other Convention Area subareas and divisions, to allow reporting on the total seabird by-catch for the entire Convention Area (Annex 5, Appendix D, paragraph 20).

5.7 Prof. Beddington asked what additional measures France intended to apply to address the continuing by-catch of seabirds in this fishery. Prof. Duhamel indicated that France was considering a revision to the closed season with the intention of further reducing the overlap between the white-chinned petrel breeding season and the fishery. Further, all the vessels in the French EEZ are now autoliners using 50 g/m IWLs and implementing the full range of Conservation Measure 25-02 requirements. Dr Holt enquired as to whether the fishing season could be deferred until after 1 May as occurs in other areas. Prof. Duhamel noted that, due to severe weather conditions during the austral winter, France considered that a delayed season was not feasible for safety reasons.

5.8 Prof. Duhamel noted that an increase in the proportion of hooks observed would be logistically difficult to achieve given the present workload of observers and that only a single observer is deployed on vessels in this fishery due to limited space on board the vessels. Mr Smith, ad hoc WG-IMAF Co-convener, noted that higher observation rates were achieved in other Convention Area fisheries through the deployment of two observers and that the

recommendation was to allow the levels of error associated with estimates of incidental mortality to be better determined, as current levels of coverage may be insufficient to allow this to occur in a statistically robust manner.

5.9 The Scientific Committee looked forward to a detailed submission of information from France in 2007 to address its recommendations in paragraphs 5.6(ii) to (iv) and requested that France consider further its ability to work toward the recommendation in paragraph 5.6(i).

5.10 The Scientific Committee noted that the continuing decreases in incidental mortality in the Convention Area were positive and in particular noted the significance of having no albatross mortality observed in the Convention Area longline fisheries in 2005/06.

5.11 The Scientific Committee acknowledged the continued decline of seabird and marine mammal by-catch in the Convention Area, but noted that several areas of concern remain: in the French EEZ of Subarea 58.6 and Division 58.5.1 during longline haul operations, and during icefish trawl operations in Subarea 48.3 (Annex 5, paragraph 7.9). The ongoing success in minimising and mitigating by-catch of seabirds in longline fisheries in the Convention Area has resulted from an ongoing and adaptive approach to application of mitigation measures. The success and uptake of this approach has been contingent on the sustained very high level (100%) of observer coverage in the Convention Area (Annex 5, Appendix D, paragraph 63).

Incidental mortality of marine mammals during regulated fishing
in the Convention Area in 2005/06

5.12 The Scientific Committee noted that:

(i) there were no reports of incidental mortality of marine mammals in longline gear; this differs from 2004/05, when pinnipeds (5 animals) and cetaceans (2 animals) were reported caught (Annex 5, Appendix D, paragraph 33);

(ii) two marine mammals were reported entangled and released alive in longline fisheries; one Antarctic fur seal (*Arctocephalus gazella*) in Division 58.5.2 and one southern elephant seal (*Mirounga leonina*) in Subareas 88.1/88.2 (Annex 5, Appendix D, paragraph 33);

(iii) one Antarctic fur seal was reported caught and killed in the krill trawl fishery in Subarea 48.1 (compared to 95 Antarctic fur seals observed caught during krill fishing operations in the same area (Area 48) in 2004/05) (Annex 5, Appendix D, paragraph 34);

(iv) one leopard seal (*Hydrurga leptonyx*) was caught and killed in the Division 58.5.2 toothfish trawl fishery (compared to one Antarctic fur seal in 2004/05) (Annex 5, Appendix D, paragraph 36);

(v) there were no reports of incidental mortality of marine mammals in pot fisheries (Annex 5, Appendix D, paragraph 37).

5.13 Methods reported deployed to avoid marine mammal capture were net barriers and a seal exclusion device. The Scientific Committee encouraged the continued reporting of use and experiences with mitigation measures as it is useful to make annual comparisons along with the capture rates of associated gear, with a view to identifying potentially effective methods over time (Annex 5, Appendix D, paragraph 35).

5.14 The Scientific Committee noted the positive result this year with the reduction in marine mammal mortalities; however, whilst this is good news, the need for continued vigilance and monitoring of incidental mortality in fisheries was emphasised, recollecting that three years ago seal by-catch in trawl fisheries was a new and difficult issue. The Scientific Committee further noted the need for improved reporting of the use of mitigation measures in all trawl fisheries so that the successful measures used could be documented and made available more widely.

Information relating to the implementation of
Conservation Measures 25-01, 25-02 and 25-03

5.15 The Scientific Committee noted that implementation of Conservation Measures 25-01, 25-02 and 25-03 is summarised as follows:

(i) With respect to Conservation Measure 25-01, observer reports indicated 100% implementation of this measure (Annex 5, Appendix D, paragraph 39).

(ii) With respect to Conservation Measure 25-02 –

(a) line weighting (Spanish system) – 100% reported implementation in all subareas and divisions (Annex 5, Appendix D, paragraph 40 and Table 10);

(b) line weighting (autoline system) – all vessels in high-latitude areas fishing in daylight met the requirement to achieve a consistent minimum line sink rate as described in Conservation Measure 24-02. Only one vessel using a variation on the autoline method used clip-on weights to achieve their sink rate requirements. All other autoline vessels were now using IWLs. The vessel using a trot-line system met the sink-rate requirements in Subarea 48.6 (Annex 5, Appendix D, paragraph 40);

(c) night setting and offal discharge – 100% implementation of night setting, and also for offal discharge restrictions in all areas where this was required (Subareas 48.3, 48.4, 58.6, 58.7, 88.1 and 88.2) (Annex 5, Appendix D, paragraph 41 and Table 10);

(d) discard of hooks – hooks were present in discards on 6 of 36 longline cruises; on three of these this was reported as a rare event. However, the observer's report for the *Globalpesca I* in Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b, the *Protegat* in Subarea 48.3, and the *Punta Ballena* in Subareas 88.1/88.2, indicated that this was a daily occurrence (Annex 5, Appendix D, paragraph 42);

(e) streamer lines – the number of cruises fully implementing streamer line specifications has increased from 74 to 80% this year (Annex 5, Appendix D, Table 9), although this is not as high as the 92% (34 of 37 cruises) in 2003. Four vessels failed on one streamer line specification and two vessels failed on two specifications. There was 100% implementation of attachment height (Annex 5, Appendix D, paragraphs 43 and 44 and Table 9);

(f) haul-scaring devices – in Subarea 48.3, four vessels did not use haul-scaring devices on all hauls. In Division 58.5.2, two trips were reported with 100% and 94% implementation of this requirement respectively. In Subarea 58.6 outside the French EEZ and Subarea 58.7 there was 100% implementation (one vessel fished) (Annex 5, Appendix D, paragraph 46 and Table 9).

(iii) With respect to Conservation Measure 25-03 –

(a) one of 9 trawl vessels in the Convention Area (11%) did not implement the prohibition on the discharge of offal during the shooting or hauling of trawl gear in Subarea 48.3 (Annex 5, Appendix D, paragraph 56). This level of implementation is higher than 2005, when 2 of 8 (25%) vessels discharged offal;

(b) three vessels were reported as having used net sonde cables. It was unclear whether these were actually net sonde cables or paravanes as had been the case in previous years, and the Scientific Committee requested additional information from scientific observers (Annex 5, Appendix D, paragraph 48);

(c) observer reports suggested that the reduced level of seabird mortality recorded during shooting operations was due to improved application of mitigation measures, including net cleaning, and a combination of weight added to the net and net binding. However, due to the lack of a specific field in the observers logbook to record the use of the method, the Scientific Committee requested additional information from scientific observers (Annex 5, Appendix D, paragraphs 51 and 58).

5.16 The Scientific Committee expressed concern about the level of discard of hooks in offal, in particular on those vessels where this was reported as a daily occurrence. Dr Holt noted that hooks continued to be found in nests of giant petrels in areas far from fishing grounds (paragraph 6.10). Dr Agnew noted that a long time series of marine debris data had been collected and reported by the UK. The data indicated a decline in incidence of hooks in seabirds at breeding colonies in recent years (SC-CAMLR-XXV/BG/9), attributed to the decrease in offal discharge in the general southeast Atlantic due to implementation of conservation measures. Further, Dr Agnew noted that standard forms are available from the Secretariat for reporting the incidence of hooks in seabirds at breeding colonies. The Scientific Committee recommended that Members collect data on the standard forms and report the data to CCAMLR (paragraph 6.9; see also www.ccamlr.org/pu/e/sc/deb/forms-inst.htm).

5.17 With respect to the icefish fishery in Subarea 48.3, the Scientific Committee recommended that an advisory note be added to Conservation Measure 42-01 to assist in the uptake of net binding as follows (Annex 5, Appendix D, paragraph 60):

> Add the following sentence to 'mitigation' paragraph 7:
>
> Vessels are encouraged to use net binding as a means to reduce seabird interactions. See SC-CAMLR-XXV, Annex 5, Appendix D, paragraph 59 for guidelines for net binding.

5.18 The Scientific Committee, noting the success to date of net binding in the icefish fishery in Subarea 48.3, recommended the use of net binding in other pelagic trawl fisheries in the Convention Area be tested as appropriate to assess its utility and provided guidelines to assist in a uniform uptake of this mitigation measure (Annex 5, Appendix D, paragraphs 59 and 61).

Incidental mortalities of seabirds during fishing outside the Convention Area

5.19 The Scientific Committee noted that new data on the incidental mortality of seabirds outside the Convention Area had been presented by New Zealand and South Africa. The data from South Africa included black-browed albatrosses likely to be predominantly Convention Area seabirds breeding at South Georgia. The data provided suggest that the levels of by-catch of Convention Area seabirds outside the Convention Area are much greater in magnitude than those reported within the Convention Area and are cause for serious concern (Annex 5, Appendix D, paragraphs 64, 67 and 68).

5.20 A substantial proportion of the mortality reported outside the Convention Area occurs when seabirds collide with trawl warp cables (Annex 5, Appendix D, paragraphs 68 to 70). This mortality is cryptic and experience outside the Convention Area suggests that it requires targeted observation to be detected (Annex 5, Appendix D, paragraph 71).

5.21 The Scientific Committee recommended expanded data collection to determine the extent of the interaction by dedicated seabird observers (Annex 5, Appendix D, paragraphs 62, 71 and 73) to assess the extent of seabird interactions with trawl warp cables in Convention Area fisheries to document if seabird interactions with trawl warp cables are occurring in the Convention Area fisheries (Annex 5, Appendix D, paragraph 75).

Incidental mortality of seabirds during unregulated longline fishing in the Convention Area

5.22 The Scientific Committee noted that the overall estimated total for the whole Convention Area in 2005/06 indicates a potential seabird by-catch in the unregulated fishery of 4 583 (95% CI range of 3 756 to 12 237) seabirds (SC-CAMLR-XXV/BG/27; Annex 5, Appendix D, paragraph 81 and Table 17).

5.23 In comparison with estimates for previous years, calculated in identical fashion, the overall catch for 2005/06 is similar to the overall catch estimated for 2003/04 (SC-CAMLR-XXV/BG/27). These are the lowest reported values since estimates started in 1996. This presumably reflects a commensurate reduction in toothfish removals and/or changes in the areas from where IUU fishing occurs (Annex 5, Appendix D, paragraph 82).

5.24 The Scientific Committee reiterated its conclusions of recent years that even these levels of incidental mortality of seabirds arising from IUU fishing were of substantial concern and likely unsustainable for some of the populations concerned (Annex 5, Appendix D, paragraph 86). Unlike this year in the regulated longline fisheries where no albatross were reported killed, the estimates from IUU fishing include a substantial number of albatrosses, many of which are still critically threatened. The Commission was encouraged to continue to take action in respect of incidental mortality of seabirds caused by IUU fishing (Annex 5, Appendix D, paragraph 87).

5.25 Prof. Moreno noted the gear conversion to deep-water gillnets by some IUU fishing vessels and that this may have an impact on the estimation of IUU catch and therefore the estimation of incidental seabird mortality in the Convention Area. Mr Smith, ad hoc WG-IMAF Co-convener, noted that consideration of this issue had been incorporated into the WG-IMAF intersessional work plan. Dr Constable noted that if the use of deep-water gillnets in the Convention Area were to be prohibited, then undertaking such work may not be a priority. The Scientific Committee agreed that with respect to this item, the work plan should be reviewed after the Commission had considered this matter.

Research into and experience with mitigation measures

5.26 The Scientific Committee noted:

(i) the success to date within the Convention Area in reducing seabird by-catch, but that the mitigation measures used continue to require refinement to potentially allow for fishing at any time of day without seasonal closure of fishing grounds (Annex 5, Appendix D, paragraph 89);

(ii) as CCAMLR mitigation measures and practices have been held up as a role model outside the Convention Area, and successfully exported to some of those fisheries, research into mitigation measure refinement remains a priority to support the export of best-practice mitigation (Annex 5, Appendix D, paragraph 89);

(iii) research endorsed at CCAMLR-XXIV (SC-CAMLR-XXIV, paragraph 5.16) to further develop improvements to the line-weighting regimes and use of streamer lines for both Spanish system and autoline vessels (Annex 5, Appendix D, paragraphs 88 to 102);

(iv) expectation that a suite of best-practice seabird by-catch mitigation for Spanish system longline vessels (Annex 5, Appendix D, paragraph 90) and autoline vessels (Annex 5, Appendix D, paragraph 102) can be developed in the near future.

5.27 With respect to future improvements to Conservation Measures 24-02 and 25-02, the Scientific Committee recommended:

(i) testing the efficacy of the new Spanish longline system line-weighting regime as a seabird deterrent and for operational characteristics (Annex 5, Appendix D, paragraph 89);

(ii) further research on the utility and cost of mechanised streamer line systems (Annex 5, Appendix D, paragraph 97);

(iii) testing the effectiveness of paired streamer lines in Southern Ocean conditions with typical seabird assemblages (Annex 5, Appendix D, paragraph 102);

(iv) observer logbook and cruise report modifications to improve data collections for longline haul mitigation, longline sink rates and estimation of access windows (vessel speed, sink rate and aerial extent of streamer lines).

5.28 Prof. Beddington clarified that CCAMLR's export of best-practice mitigation is actually of its model of by-catch assessment, mitigation development and conservation measure implementation. The specific mitigation measures used very successfully in CCAMLR fisheries have been designed for demersal longline gear and that the export of identical measures to pelagic longline fisheries would not be sensible without suitable modifications for the different gear and fishery operations.

5.29 Prof. Beddington queried as to why additional mitigation research was of priority when seabird by-catch in the Convention Area fisheries was at such low levels. Ms Rivera, ad hoc WG-IMAF Co-convener, noted that the current best-practice mitigation included night-setting and seasonal closures in most subareas and divisions. Past direction from the Scientific Committee and Commission (SC-CAMLR-XX, paragraph 4.63; CCAMLR-XX, paragraph 6.26; SC-CAMLR-XXIV, paragraph 5.16) has been to pursue the development of measures that might allow fishing during the day and without seasonal closures. Ms Rivera further noted that without additional modifications and improvements to the current mitigation measures, fishing during these times would likely not be possible without an associated significant increase in seabird by-catch.

5.30 With respect to the *Shinsei Maru No. 3* bottom-line system, the Scientific Committee noted that the threats to Convention Area seabirds during line-setting operations would be minimal and potentially lower than with the traditional Spanish system and requested that continued reporting of this methodology occur to provide information on its performance in relation to seabird by-catch (Annex 5, Appendix D, paragraphs 92 to 94).

Observer data collection

5.31 The Scientific Committee reviewed data collection needs relative to several areas of seabird and marine mammal interaction and mitigation and recommended additions or changes to logbooks and cruise reports including:

(i) improved reporting on:

(a) the use of net sonde cables (Annex 5, Appendix D, paragraph 48);

(b) the implementation of net binding (Annex 5, Appendix D, paragraphs 51 and 58);

(c) the adoption of mitigation measures in the icefish trawl fishery (Annex 5, Appendix D, paragraph 57);

(d) haul mitigation devices used in the Convention Area (Annex 5, Appendix D, paragraphs 107 and 120);

(e) data required for estimating the longline seabird access window (Annex 5, Appendix D, paragraphs 104, 118 and 119);

(ii) the implementation of a trawl warp-strike data protocol (Annex 5, Appendix D, paragraphs 62, 71, 122 and 123).

5.32 The Scientific Committee recommended that coverage of the krill fishery be increased to allow for adequate and representative sampling across all trawl fisheries for monitoring of by-catch and efficacy of mitigation measures especially with respect to the implementation of the trawl warp-strike data protocol (paragraph 5.32(ii)) (Annex 5, Appendix D, paragraphs 31 and 60).

5.33 The Scientific Committee recognised that a careful balance is needed when tasking observer duties; accordingly, priorities must be identified and established. In making the recommendations in paragraph 5.31, the Scientific Committee noted the general review of the implementation of the observer program (paragraphs 2.7 to 2.21).

Risk assessment of fisheries by statistical area

5.34 The Scientific Committee encouraged the further development by ad hoc WG-IMAF of a paper describing the methodology and approaches of CCAMLR's risk assessment of fisheries to seabird by-catch. Such a paper is likely to be useful to groups outside CCAMLR seeking to undertake similar processes, particularly those with fishery management responsibilities where Convention Area seabirds are taken outside the Convention Area (Annex 5, Appendix D, paragraphs 135 to 137).

5.35 The Scientific Committee noted that a key utility of the risk assessment is that it covers all of the Convention Area and is not restricted only to new and exploratory fisheries.

Incidental mortality of seabirds in relation to new and exploratory fisheries

5.36 The Scientific Committee noted that:

(i) Of the 39 applications for exploratory longline fisheries for 2005/06, 22 were undertaken (Annex 5, Appendix D, paragraph 138). A single seabird mortality was observed in Division 58.4.3b (Annex 5, Appendix D, paragraph 139).

(ii) The assessment of the 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-XXV/BG/26 with no changes to levels of risk this year (Annex 5, Appendix D, paragraphs 131 and 134).

(iii) The 41 proposals by 12 Members for exploratory fisheries in seven subareas/divisions of the Convention Area in 2006/07 were addressed in relation to the advice in Annex 5, Appendix D, Figure 2 and Table 18 and SC-CAMLR-XXV/BG/26. The results, summarised in Annex 5, Appendix D, Table 19, involve two categories: those that provide sufficient information and are assessed as conforming with advice relating to incidental mortality of seabirds (Annex 5, Appendix D, paragraph 143(i)), and those that contain insufficient information to be certain that they conform with advice relating to incidental mortality of seabirds (Annex 5, Appendix D, paragraph 143(ii)). The potential inconsistencies in the 13 proposals in this category were resolved at the meeting; all are now in conformity with advice relating to the incidental mortality of seabirds.

(iv) Issues relating to: exemptions from setting longlines at night; exemptions in respect of closed seasons; maintaining maximum levels for the incidental mortality of seabirds as in the 41-series conservation measures, with reversion to the provisions of Conservation Measure 25-02 when these are reached; and including reference to the definition of birds caught in all relevant conservation measures; have been advised previously (SC-CAMLR-XXIV, paragraph 5.33(iv)) and advice remains unchanged.

5.37 The Scientific Committee welcomed improvements in notifications this year and requested that Members take greater care in future submissions to ensure the intent to comply with relevant seabird by-catch measures was clear (Annex 5, Appendix D, paragraph 145).

5.38 The Scientific Committee welcomed proposed improvements to the pro forma and checklist prepared to assist Members in fulfilling notification requirements (CCAMLR-XXV/29). The Scientific Committee recommended that the one-page summary of notifications should also include a checklist to address Members' intentions comply with the four assessed elements: Conservation Measure 25-02; Conservation Measure 24-02 and if an exemption is sought from setting longlines at night, or fish outside specified fishing seasons; specified seabird by-catch levels; and scientific observer requirements (Annex 5, Appendix D, paragraph 147).

5.39 The Scientific Committee reiterated its recommendation that any vessel operating under the provisions of Conservation Measure 24-02, 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 (Annex 5, Appendix D, paragraph 148).

International and national initiatives relating to incidental mortality of seabirds in relation to longline fishing

5.40 The Scientific Committee noted reports on current international initiatives under the auspices of:

(i) ACAP – items of particular relevance to CCAMLR (Annex 5, Appendix D, paragraph 150);

(ii) FAO (NPOA-Seabirds) – noting the completion of plans by Brazil and Chile, a developing plan by Uruguay, and awaiting finalisation of South Africa's plan (Annex 5, Appendix D, paragraphs 153 to 155);

(iii) RFMOs – responses received to CCAMLR Resolution 22/XXIII from IOTC; progress with IATTC, IOTC, SEAFO and WCPFC (Annex 5, Appendix D, paragraphs 163 to 173);

(iv) NGOs – an update on BirdLife International's Albatross Task Force (Annex 5, Appendix D, paragraph 159) and its NPOA-Seabirds initiative (Annex 5, Appendix D, paragraph 156);

(v) a mitigation workshop held in Hobart, Australia, to assist in refining an experimental program for identifying and developing effective seabird mitigation measures for pelagic longline fisheries (Annex 5, Appendix D, paragraph 158).

5.41 The Scientific Committee noted the considerable progress made by some RFMOs and opportunities to work cooperatively with CCAMLR. However, it was recognised that for pelagic longline gear types in particular, there is at present no best-practice mitigation strategy that has been rigorously tested and is available for widespread uptake by the major RFMOs operating within the ranges of seabirds that breed and forage in the CCAMLR Convention Area (Annex 5, Appendix D, paragraph 174). The development of effective pelagic longline mitigation measures and their uptake outside the Convention Area should remain a high priority for CCAMLR, particularly for those fisheries where Convention Area seabirds are caught (Annex 5, Appendix D, paragraphs 158 and 175).

5.42 The Scientific Committee recommended that Members which are also members of WCPFC participate at its December 2006 meeting regarding the adoption of appropriate seabird mitigation measures within the WCPFC area (Annex 5, Appendix D, paragraphs 171 and 175).

5.43 Given the by-catch impacts of adjacent RFMO fisheries to birds that breed and forage in the Convention Area and consistent with CCAMLR's Resolution 22/XXIII, the Scientific Committee recommended that Members should be proactive in engaging with RFMOs and in promoting information exchange and strengthening their input into RFMO meetings by

including seabird experts on member state delegations. It was also agreed that a critical role of Members was to become involved in the development and implementation of seabird resolutions and other measures to reduce by-catch of albatrosses and petrels within RFMO jurisdictions (Annex 5, Appendix D, paragraph 151).

5.44 The Scientific Committee recommended that CCAMLR and its Members support a BirdLife International initiative at COFI-27 to advance best-practice guidelines for NPOA-Seabirds (Annex 5, Appendix D, paragraph 156).

5.45 The Scientific Committee recommended that the Commission be represented at the January 2007 tuna RFMOs meeting in Kobe, Japan, and that a paper be developed by the Secretariat describing the scientific and other processes CCAMLR has followed in developing and implementing effective seabird by-catch mitigation measures (Annex 5, Appendix D, paragraph 176).

Streamlining the work of the Scientific Committee

5.46 The Scientific Committee endorsed the recommendation to retain the linkage between ad hoc WG-IMAF and WG-FSA (Annex 5, Appendix D, paragraphs 183 and 184). It noted the shared areas of interest between WG-IMAF and WG-EMM and encouraged ongoing dialogue between the two groups (Annex 5, Appendix D, paragraph 187).

5.47 The Scientific Committee noted the support of WG-IMAF for the proposals for the restructure of the Scientific Committee's working groups (Annex 5, paragraphs 14.1 to 14.9 and Appendix D, paragraphs 185 and 186).

5.48 The Scientific Committee endorsed the WG-IMAF review of its terms of reference during the intersessional period with a view to proposing revisions in 2007 (Annex 5, Appendix D, paragraph 192) and the development of a medium-term research plan (Annex 5, Appendix D, paragraphs 193 to 195).

Other business

5.49 The Scientific Committee noted that Australia had requested consideration of a proposal to extend the fishing season in Division 58.5.2 by seven months for longline vessels. This request was made on the basis that the vessel limit for seabird by-catch coupled with the remaining mitigation measures specified in relevant conservation measures would be sufficient to achieve the level of mitigation required. The Scientific Committee endorsed the advice which ad hoc WG-IMAF provided on the proposal (Annex 5, paragraphs 7.66 to 7.70).

5.50 Dr Constable presented a revised proposal from Australia to extend the fishing season in Division 58.5.2 by two weeks for longline vessels, with the season start date to be mid-April rather than 1 May. All elements of Conservation Measure 25-02 including night setting, the use of paired streamer lines, the use of IWLs, the use of two observers and the existing seabird by-catch limit for season extension in that area would be applied to this additional season extension. Further, the vessel would operate in such a manner as to allow lines to be set and hauled sequentially to allow for accurate monitoring of the seabird by-catch limit.

5.51 Mr Smith, ad hoc WG-IMAF Co-convener, noted that in general this proposal did not conflict with the advice provided by WG-IMAF on this matter and was in line with the preference for a step-wise roll-back in seasonal closures. Further, he noted that the season was being extended in the austral autumn rather than in the austral spring as recommended by WG-IMAF, but the controls proposed and the modest season extension should mitigate the higher risk in the austral autumn.

5.52 The Scientific Committee endorsed the revised proposal from Australia and noted that it looked forward to detailed information on its implementation.

5.53 The Scientific Committee noted that the quality of advice it could provide was enhanced when detailed technical information, when needed, was submitted in papers in advance of the meeting and further that where supporting technical documents were not tabled, insufficient information may mean that the Scientific Committee needs to defer the provision of advice until the following year.

5.54 With respect to the Japanese proposal seeking to conduct longline sink rate tests within Subarea in 48.6 (CCAMLR-XXV/32), the Scientific Committee noted that the proposal did not pose any additional risk to seabirds, provided the standard sink rate, as detailed in Conservation Measure 24-02, is achieved (Annex 5, Appendix D, paragraph 212).

Advice to the Commission

5.55 This section attempts to distinguish between general advice (which the Commission may wish to note and/or endorse) and specific advice which includes requests to the Commission for action.

General advice

5.56 The Commission was requested to note:

(i) the continuing low levels of incidental mortality of seabirds in regulated longline fisheries in most parts of the Convention Area in 2006 and that for the first time, no albatrosses were reported taken in regulated longline fisheries (paragraph 5.3);

(ii) that effort is required on mitigating incidental mortality of seabirds during the haul of longlines (paragraph 5.4);

(iii) that levels of incidental mortality of seabirds in the French EEZs reduced from last year and that efforts continued to improve mitigation effectiveness (paragraphs 5.3 and 5.5 to 5.9);

(iv) the reduced levels of seabird and marine mammal incidental mortality in trawl fisheries in the Convention Area in 2006, notably of seabirds in the icefish fishery in Subarea 48.3 and of fur seals in krill fisheries in Area 48 (paragraphs 5.3 and 5.12);

(v) the need for improved reporting of the use of mitigation measures in all trawl fisheries (paragraph 5.14);

(vi) the assessment of implementation of relevant conservation measures, including improved performance for all elements (paragraph 5.15);

(vii) the concern that daily discarding of hooks in offal, as reported on some vessels, may have adverse impacts on bird populations (paragraph 5.16);

(viii) that cryptic mortality of birds in trawl fisheries outside the Convention Area is likely to be adversely impacting birds breeding within the Convention Area (paragraphs 5.19 and 5.20);

(ix) that despite the success to date in reducing Convention Area seabird by-catch, further research to develop best-practice mitigation, including improvements to line-weighting regimes and use of streamer lines for longline vessels, is required to potentially allow for fishing at any time of day without seasonal closure (paragraph 5.26);

(x) that the *Shinsei Maru No. 3* bottom-line system posed a minimal threat to seabirds and requests for further reporting on this system (paragraph 5.30);

(xi) that the Japanese proposal to conduct line sink rate testing within Subarea 48.6 (CCAMLR-XXV/32) did not pose any additional risk to seabirds provided the standard sink rate, as detailed in Conservation Measure 24-02, is achieved (paragraph 5.54).

5.57 The Commission was requested to endorse:

(i) the attendance where possible and appropriate of technical coordinators at working group meetings (paragraph 5.2);

(ii) the recommendations for consideration of increasing the proportion of hooks observed, thorough analysis of 2003/04 to 2005/06 data and provision of additional information on the nature of seabird captures in the French EEZ (paragraph 5.6);

(iii) the continued reporting of use and experiences with trawl by-catch mitigation devices for marine mammals (paragraph 5.13);

(iv) the improved data collection on marine debris relating to impacts on seabirds (paragraph 5.16);

(v) the advice to test the utility of this mitigation measure in other pelagic trawl fisheries, noting the success of net binding in reducing bird by-catch to date in Subarea 48.3 (paragraph 5.18);

(vi) the research to further improve Conservation Measures 24-02 and 25-02 (paragraph 5.27);

(vii) the improved reporting from observers on seabird and marine mammal interaction and mitigation, and the implementation of a bird trawl warp-strike data collection protocol (paragraph 5.31);

(viii) the further development of a paper describing the CCAMLR risk assessment of fisheries to bird by-catch (paragraph 5.34);

(ix) the recommendation that the checklist developed by the Secretariat to assist Members in their applications for new and exploratory fisheries be further improved (paragraph 5.38);

(x) the advice that the current linkage between WG-IMAF and WG-FSA be retained (paragraph 5.46);

(xi) the advice on the review of terms of reference and development of a medium-term research plan for WG-IMAF (paragraph 5.49);

(xii) the advice on the Australian proposal for a season extension in Division 58.5.2 for longline vessels (paragraphs 5.50 to 5.53).

Specific advice

5.58 The Commission was requested to consider taking action in respect of:

(i) suggested revisions to Conservation Measure 42-01 (paragraph 5.17);

(ii) continued action in respect of seabird mortality caused by IUU fishing (paragraph 5.24);

(iii) increasing observer coverage of the krill fishery (paragraph 5.32);

(iv) a request to Members to proactively engage with RFMOs, strengthen their input into RFMO meetings by including seabird experts on delegations and to become involved in the development and implementation of seabird resolutions and other measures to reduce by-catch of albatrosses and petrels within RFMO jurisdictions (paragraph 5.43);

(v) a recommendation that CCAMLR and its Members support a BirdLife International initiative at COFI-27 to advance best-practice guidelines for NPOA-Seabirds (paragraph 5.44);

(vi) a recommendation that the Commission be represented at the January 2007 tuna RFMOs meeting in Kobe, Japan, and that a paper be developed by the Secretariat describing the scientific and other processes CCAMLR has followed in developing and implementing effective seabird by-catch mitigation measures (paragraph 5.45).

ADDITIONAL MONITORING AND MANAGEMENT ISSUES

Marine debris

6.1 The Secretariat provided a review of surveys of marine debris and its impact on marine mammals and seabirds conducted by Members in the Convention Area (SC-CAMLR-XXV/BG/9). In March 2006, the Secretariat contacted all Members requesting current data on marine debris surveys to be submitted for inclusion in the CCAMLR database. Data were received from the UK (data reported from Bird Island, South Georgia, and Signy Island, South Orkney Islands) and Uruguay (data reported from King George Island, South Shetland Islands).

6.2 The CCAMLR marine debris database contains data from 12 sites, predominantly within Area 48. Of these 12 sites, four contain data for at least three years that have been collected according to CCAMLR standard methods. Marine debris data submitted to CCAMLR are as follows:

(i) beached marine debris: Chile (Cape Shirreff, Livingston Island, South Shetland Islands, 1993 to 1997), UK (Bird Island, South Georgia, 1989 to present; Signy Island, South Orkney Islands, 1991 to present), Uruguay (King George Island, South Shetland Islands, 2001 to present) and South Africa (Marion Island, 2004);

(ii) debris associated with seabird colonies: UK (Bird Island, 1993 to present);

(iii) marine mammal entanglement: UK (Bird Island, 1991 to present; Signy Island, 1997 to present);

(iv) hydrocarbon soiling of seabirds: UK (Bird Island, 1993 to present).

6.3 A summary of the trends in these data (SC-CAMLR-XXV/BG/9) indicated that:

(i) marine debris, principally packaging items and fishing gear, reached a peak in the period from 1994 to 1996 at Bird Island and Signy Island and has declined thereafter;

(ii) the level of marine debris found in seabird colonies at Bird Island increased between 1998 and 2003 since when there has been a substantial decline, particularly in the relative proportion of fishing gear, such as snoods and hooks;

(iii) Antarctic fur seal entanglement at Bird Island reached a peak in 1993 and has shown a general decline since that time, with the lowest levels recorded in 2004/05. Plastic packaging bands, synthetic string/longline fragments and fishing net are the most frequent entangling materials;

(iv) the number of seabirds contaminated with hydrocarbons remains low.

Reports of surveys of marine debris on beaches

6.4 Standardised surveys of marine debris were reported from Signy Island, South Orkney Islands, in 2005/06 (SC-CAMLR-XXV/BG/14), and Bird Island, South Georgia, in 2004/05 (SC-CAMLR-XXV/BG/12). In contrast to last year, when the there was an increase in the number of items recovered, there was a decrease in the number of items of debris at both Signy Island (29%) and Bird Island (43%).

6.5 Prof. O. Pin (Uruguay) informed the Scientific Committee that Uruguay remained committed to the continued collection and submission of data on marine debris associated with fishing operations.

6.6 Prof. Moreno informed the Scientific Committee that, owing to the retirement of Prof. D. Torres (Chile) during the intersessional period, it had not been possible to present any data or analysis at this time. Nevertheless, Chile remains committed to the continued collection and reporting of marine debris.

6.7 As in previous years, Dr Naganobu reported that no fishing gear had been lost from Japanese krill trawlers and that there had been no debris sighted at sea during the 2005/06 season.

Entanglement of marine mammals in marine debris

6.8 Standardised reporting of the entanglement of Antarctic fur seals in marine debris was reported from Signy Island, South Orkney Islands (SC-CAMLR-XXV/BG/15), where one entangled animal was recorded from Bird Island, South Georgia (SC-CAMLR-XXV/BG/13), where two entangled seals were recorded during winter, a reduction of 60% compared to the previous year, whereas the eight seals recorded in summer were a 100% increase compared to the number recorded during the previous summer; the overall number recorded between 1 April 2005 and 31 March 2006 (10) is the second lowest number of entanglements recorded since 1991.

Marine debris associated with seabird colonies

6.9 Marine debris associated with seabirds at Bird Island, South Georgia, from 1 April 2005 to 31 March 2006, was reported in SC-CAMLR-XXV/BG/11. There were 44 items of fishing gear (mostly longlining gear) found in seabird colonies, an increase from the previous year but still lower than the values in the period from 2000 to 2003.

6.10 Dr Holt noted that hooks continued to be found in nests of giant petrels in areas far from fishing grounds (paragraph 5.16).

Seabirds and marine mammals soiled with hydrocarbons

6.11 There were three incubating wandering albatrosses (*Diomedea exulans*) at Bird Island, South Georgia, reported contaminated with oil between 1 April 2005 and 31 March 2006, all of these were reported on the same day (30 December 2005) (SC-CAMLR-XXV/BG/11). The Scientific Committee noted that five of the six cases of oil contamination of wandering albatrosses from the same location in the previous year also occurred during a two-week period in March 2005 (SC-CAMLR-XXIV, paragraph 6.12).

Management advice

6.12 The Scientific Committee noted the reduction in the levels of marine debris in some parts of the Convention Area and encouraged all Members to submit data on marine debris to the Secretariat.

MANAGEMENT UNDER UNCERTAINTY

7.1 No new information relevant to this agenda item was provided by WG-EMM.

7.2 WG-FSA provided information dealing with catch and effort data for *Dissostichus* spp. in waters adjacent to the Convention Area, as well as information concerning IUU fishing. In addition, the Scientific Committee discussed a Russian proposal to classify the krill fishery using the continuous fishing system as a new and exploratory fishery, and technical aspects of CCAMLR-XXV/39 on improving the performance of CCAMLR with respect to its ecosystem-based approach to management.

7.3 Catch and effort data for *Dissostichus* spp. outside the Convention Area originated mostly from Areas 41 and 87 (Annex 5, Table 3). In order to assess the stock of *D. eleginoides* on the Scotia Ridge (Area 41) more adequately, WG-FSA requested that Members provide information on the sustainability of the resource, in particular because the western sector of Subarea 48.3, which is adjacent to the Scotia Ridge, was excluded from the area currently in the assessment.

7.4 Dr Barrera-Oro provided additional information on toothfish in Area 41. The fishery conducted by Argentina is a mixed fishery using both longlines and trawls in depths greater than 800 m. The catch limit for toothfish was 2 500 tonnes, of which 45% was allocated to by-catch.

7.5 The Scientific Committee noted the extensive work undertaken by WG-FSA (Annex 5, paragraphs 8.1 to 8.15) and JAG (CCAMLR-XXV, Annex 6) with respect to better estimating the level of IUU catches. The Scientific Committee noted WG-FSA's management advice (Annex 5, paragraphs 8.14 and 8.15).

7.6 The Scientific Committee endorsed WG-FSA's recommendation for further development of the new methodology proposed by JAG with the following actions (paragraphs 11.2 to 11.4):

(i) SCIC should consider whether the weightings of individual categories were appropriate, whether the number of levels in each category was correct and whether there were other useful categories that might be used without overly complicating the analysis.

(ii) SCIC should determine the vulnerability of different areas to IUU fishing, for instance using the template provided by SCIC-06/9.

(iii) WG-FSA will develop distributions of likely catch rates of IUU fishing vessels by area using data from licensed vessels. The attention of SCIC is drawn to the fact that data are currently most limiting in the areas which have higher levels of IUU fishing.

7.7 In future, determination of credible ranges of IUU estimates should be followed by investigation of the consequences of this uncertainty for the assessments.

7.8 Drs Shust and V. Sushin (Russia) drew the attention of the Scientific Committee to discussions on the continuous fishing system used for catching krill under Agenda Item 4 (paragraphs 4.12 to 4.17) and noted that in their view the new method should be classified as a new and exploratory fishery. This would result in the development and implementation of the fishery plans, including a research plan as adopted by the Scientific Committee, becoming obligatory for all vessels using this method in any season. They emphasised that classifying this fishery as a new and exploratory fishery will in no way create obstacles for its development. On the contrary, within the framework of a new or exploratory fishery it may be possible to resolve more rapidly the abovementioned scientific, methodological and organisational difficulties related to the implementation of the new krill fishing method.

7.9 New Zealand provided a proposal on further improving CCAMLR's ability to manage Southern Ocean fisheries by expanding the current Fishery Plan concept endorsed by the Commission into a forward-looking management plan ('Fisheries Management Plan') (CCAMLR-XXV/39).

7.10 Fisheries Management Plans would provide a mechanism to set the objectives for a fishery and define strategies to achieve those objectives. This would provide a stronger link between objectives and management and better integrate science, policy and compliance.

7.11 The Scientific Committee was only able to comment on some of the technical details of the proposal.

7.12 Drs Shust and Naganobu cautioned that the proposal outlined by New Zealand has the potential to further increase bureaucracy but might not necessarily improve fisheries and ecosystem management in the Southern Ocean.

7.13 Prof. Moreno stated that similar plans have been developed in the remit of FAO for application in countries bordering the Pacific Ocean. These plans offer a useful approach in individual countries, such as Chile, where they have been successfully implemented but may be more difficult to implement in RFMOs such as CCAMLR.

7.14 Dr Constable supported the approach taken by New Zealand in principal but noted that many of the points relate to how the Commission may choose to set objectives or manage the fisheries. He drew the attention of the Scientific Committee to the fact that some of the ideas

outlined by New Zealand had been initially discussed by WG-DAC in 1987/88. He also drew the attention of the Scientific Committee to the development of management strategy evaluations (Annex 5, paragraphs 12.5 to 12.7), noting that the Scientific Committee can assist both in the evaluation of management strategies as well as refining operational objectives for fisheries based on the most up-to-date information.

RESEARCH EXEMPTION

8.1 Scientific research surveys notified to the Secretariat under Conservation Measure 24-01 are regularly updated on the CCAMLR website. Future surveys in the Convention Area identified at the time of the meeting of the Scientific Committee for 2006/07 were:

- general research survey in Divisions 58.4.1, 58.4.2 and 58.4.3 by Japan from December 2006 to March 2007;
- bottom trawl survey in Subarea 48.1 by Germany in November–December 2006;
- multidisciplinary survey in Subarea 48.3 by the UK in September 2007;
- bottom trawl survey of Division 58.5.2 by Australia from April to June 2007;
- research survey using trawls, lines and traps in the Convention Area by Denmark in January 2007.

COOPERATION WITH OTHER ORGANISATIONS

9.1 The Scientific Committee was chaired during this section by Dr Shin, Vice-Chair of the Scientific Committee.

Cooperation with the Antarctic Treaty System

CEP

9.2 The Chair of the Scientific Committee, Dr Fanta, was an observer at the IXth meeting of CEP, from 12 to 16 June 2006, in Edinburgh, UK. The CEP meeting was chaired by Dr A. Press (Australia). Dr Fanta's report to the Scientific Committee (CCAMLR-XXV/BG/40) was presented by Dr N. Gilbert (CEP Observer) and covered the following key elements of CEP's discussions:

(i) CEP had agreed to develop a five-year work plan to assist with managing its expanding agenda. CCAMLR's work on developing a five-year work plan for WG-EMM was seen by CEP as a model example.

(ii) CEP had received a presentation from Dr D. Carlson, Director of the IPY Programme Office, on the International Polar Year. CEP had encouraged Parties to provide logistic and financial support for scientific research operations and outreach within the framework of the IPY.

(iii) CEP submitted nine new or revised management plans to the ATCM for subsequent approval. Two of those management plans included a marine component: ASPA No. 165 – Edmonson Point, Wood Bay, Ross Sea (Italy), and ASMA No. 1, Admiralty Bay, King George Island (Brazil, Ecuador, Poland, Peru and USA). These management plans had been considered by SC-CAMLR and approved by the Commission.

(iv) CEP spent considerable time discussing the issue of MPAs, in particular CCAMLR's proposed work to undertake a bioregionalisation of the Southern Ocean, with the aim of providing a scientific basis for identifying representative areas for protection. CEP members highlighted the need to base any further MPA work on a sustainable and scientific approach. CEP expressed its willingness to engage with CCAMLR on the issue of bioregionalisation and MPAs. The Committee further agreed that, during the intersessional period up to CEP-X, the new Chair of CEP, Dr Gilbert, should represent CEP on the Steering Committee for the CCAMLR Bioregionalisation Workshop.

(v) New Zealand had presented a report of a workshop on 'Non-native species in Antarctica' which was held in New Zealand in April 2006. The key issues outlined in the workshop report included, but were not limited to, concern over the transfer of species both into and within the Antarctic, and the need for practical preventive measures. It was considered that the introduction of non-native species to the region requires close consideration, particularly as a warming climate is expected to increase the ability of new introduced species to survive in the Antarctic. CEP placed the issue as a standing item on its agenda, and requested New Zealand to also submit the report to SC-CAMLR for consideration (SC-CAMLR-XXV/BG/21). CEP emphasised the need to maintain a dialogue with CCAMLR with respect to introduced marine species and the potential for fishing vessels to contribute to introducing new species to the Southern Ocean.

(vi) CEP also endorsed new Guidelines for Ballast Water Exchange in the Antarctic Treaty Area, aimed at reducing the risk of introducing non-native marine species into Antarctica through ballast water. The guidelines are intended to provide the means for early implementation of IMO's Convention for Control and Management of Ships Ballast Water and Sediments (2004). ATCM-XXIX adopted the guidelines by means of Resolution 3 (2006).

(vii) SCAR tabled a proposal to list southern giant petrels (*Macronectes giganteus*) as a Specially Protected Species under the provisions of Annex II to the Protocol. CEP agreed to postpone a decision on designation of the species pending a proposed review of its population status by IUCN. If this reappraisal changed the global status from Vulnerable to Near Threatened (using the IUCN 'Red List' criteria) then listing as a Specially Protected Species would not be justified under the procedures agreed by the CEP (Annex 8 of the Final Report of

CEP-VIII). However, CEP agreed to give further consideration to the option of designating this, and other species, on the basis of their regional status. SCAR was also urged to prepare proposals for listing other species that fell into the appropriate IUCN status categories (notably macaroni penguins (*Eudyptes chrysolophus*)), following CEP guidelines. SCAR was also requested to review the status of Ross seals (*Ommatophoca rossii*), which, like fur seals, have been listed as Specially Protected Species since 1964.

(viii) SCAR had also tabled a proposal to delist Antarctic fur seals as Specially Protected Species. SCAR noted that Antarctic fur seals are a conservation success-story and that populations in the Antarctic Treaty Area are expected to continue to increase. CEP agreed to recommend that the ATCM remove the two fur seal species from the list of Specially Protected Species under Annex II. In so doing, CEP emphasised its understanding that the species would continue to receive the comprehensive general protection afforded to all Antarctic seal species under the Protocol. CEP also requested SCAR to take regular advice from CCAMLR on the level of incidental seal mortality, potential impacts of krill harvest on seal populations as well as on the development and effectiveness of seal mitigation measures in the krill fishery.

(ix) SCAR had reported to CEP on the outcomes of its workshop on 'Marine Acoustics and the Southern Ocean' as well as on its work on a 'Broadband Calibration of Marine Seismic Sources – A Case Study'. SCAR reported that it had used the COMNAP survey on marine acoustic systems employed by national Antarctic program vessels, and, following discussions with the IWC Secretariat and others, had updated risk assessments undertaken two years earlier. SCAR noted that the recommended mitigation procedures were being used by most permitting authorities, however, further data was needed to ensure these procedures were as relevant and effective as possible. In particular, further research was needed to establish the natural levels of background noise as well as that emanating from human activities. The Committee agreed to keep this subject on the agenda and discuss it again at CEP-X along with the report from the recent IWC Workshop on Marine Acoustics.

(x) On the issue of cooperation with other organisations, CEP recognised the importance of its relationship with SC-CAMLR in ensuring the protection of the Antarctic environment and dependent and associated ecosystems. CEP agreed that, as of CEP-X, the CEP report of the CEP Observer to SC-CAMLR be presented as a working paper to ensure more detailed consideration by CEP. CEP also agreed that the report should include a list of contacts of those responsible for the working groups of SC-CAMLR, as well as clear references to those sites where electronic versions of the final reports of the meetings of SC-CAMLR can be found. CEP also supported the proposal that SC-CAMLR present future CEP meetings with syntheses of relevant information (including baseline information, results and expected tendencies) such as CEMP work, seabird and seal by-catch data, and marine debris monitoring activities. CEP also welcomed the CCAMLR Observer's offer to provide an overview of SC-CAMLR's work at CEP-X. This would focus on CCAMLR's advances in implementing its ecosystem approach to management, ecosystem monitoring and strategic model development.

(xi) Dr Gilbert was elected as CEP Chair for two years, and Dr T. Brito (Brazil) was elected to the position of Vice-Chair.

9.3 Dr Constable noted CEP's request for information on several issues and questioned whether this would be possible to deliver. He also suggested that at some future point, a joint meeting of CEP and SC-CAMLR may be a useful means of refining the relationship and deciding on the most appropriate means of working together.

9.4 Dr Gilbert noted that his report to CEP-X on SC-CAMLR-XXV, as well as the proposed presentation by the SC-CAMLR observer to CEP-X, would likely provide CEP with the information it had requested. However, Dr Gilbert warmly welcomed the suggestion by Dr Constable for a joint meeting and felt this was something CEP would be keen to support.

SCAR

9.5 Dr G. Hosie (SCAR Observer to CCAMLR) and Dr C. Summerhayes (SCAR Executive Director) presented the reports (CCAMLR-XXV/BG/22 and BG/23) tabled by SCAR:

(i) SCAR's biennial SCAR Delegates Meeting SCAR-XXIX was held in Hobart, Australia, in July 2006 in conjunction with COMNAP-XVIII. An invitation had been extended to the Chair of the Scientific Committee of CCAMLR to attend the SCAR-XXIX meeting as an observer. Unfortunately, Dr Fanta could not attend. SCAR will extend another invitation to CCAMLR to attend the SCAR-XXX meeting which is scheduled for 2008 in St Petersburg, Russia.

(ii) The 2nd SCAR Open Science Conference was conducted with SCAR-XXIX. It was a multi-disciplinary conference and attracted nearly 900 delegates from 32 countries. Many of the 45 science themes of the conference addressed CCAMLR-related issues.

(iii) The EBA Program is one of SCAR's new scientific research programs. It is seeking to address issues on biodiversity and the responses to climate change. This will be of interest to CCAMLR, and SCAR welcomes CCAMLR involvement in this program. EBA projects CAML, SCAR-MarBIN and CPRAG provide the opportunities for direct collaboration between SCAR and CCAMLR in scientific research.

(iv) CAML (www.caml.aq) is one of the major SCAR-sponsored projects for the IPY. CAML is aiming to investigate the distribution and abundance of Antarctica's marine biodiversity, and how it is affected by climate change. It seeks to provide a robust benchmark against which the effects of future change can be measured.

(v) CAML is well advanced in its planning for a circum-Antarctic survey in 2007/08. Nearly 30 nations have expressed interest in participating in CAML and potentially 16 ships could be involved in the survey. The CAML Scientific Steering Committee (SSC) subsequently invited Dr V. Siegel

(Convener, CCAMLR-IPY Steering Group) to attend the CAML SSC meeting in Bremerhaven, Germany, in June 2006, as an invited expert. He has worked with SCAR to incorporate proposed CCAMLR sampling protocols into CAML protocols. The next meeting of the CAML SSC will be in Poland in June 2007. It is hoped that Dr Siegel will be able to attend that meeting.

(vi) SCAR-MarBIN (www.scarmarbin.be) compiles and manages existing and new information on Antarctic marine biodiversity. SCAR-MarBIN's web portal provides a single easy access point to marine biodiversity information relevant to scientific research, conservation and sustainable management purposes. SCAR-MarBIN has collated records from 24 databases to date. CAML data will also be linked through SCAR-MarBIN.

(vii) SCAR-MarBIN will be a useful resource for CCAMLR, particularly for monitoring studies, and the purposes of bioregionalisation. SCAR-MarBIN would welcome CCAMLR's contribution of metadata records to further enhance SCAR-MarBIN. In order to improve the exchange of data and strengthen relations between SCAR and CCAMLR, the Data Manager will be invited to the SCAR-MarBIN Steering Committee. The next meeting of SCAR-MarBIN will be in Poland in June 2007.

(viii) SCAR has created a new Action Group on Continuous Plankton Recorder research (CPRAG, http://aadc-maps.aad.gov.au/aadc/cpr/index.cfm) to support the Southern Ocean Continuous Plankton Recorder Survey. Part of its terms of reference is to map the biodiversity and distribution of plankton and krill life stages, to use the sensitivity of plankton as early-warning indicators of environmental change in the Southern Ocean, and to serve as a reference on the status of the Southern Ocean for other monitoring programs. The database is available to assist CCAMLR with its ecosystem monitoring program and for bioregionalisation studies. CPRAG is interested in having a member from CCAMLR on the action group.

(ix) SCAR welcomed the invitation from the Chair of Scientific Committee for SCAR to participate in the land-based predator workshop in 2008. SCAR has considered sending two representatives, one with detailed knowledge of the data and another with detailed ecological knowledge.

(x) SCAR's proposal at ATCM-XXIX to delist the sub-Antarctic fur seal (*A. tropicalis*) and the Antarctic fur seal from the Antarctic Specially Protected Species list was accepted. The status and trends of Ross seal population numbers are now being examined for the purpose of submitting a similar recommendation to the ATCM. SCAR is also considering the listing of the southern giant petrel as a Specially Protected Species. The species is declining in Antarctic waters. Listing of this species would be on the basis of regional rather than global threats.

(xi) SCAR is discussing the possibility of merging the birds and seals groups into a new expert group dealing with top predators. There is similarity in the way each group works, and their combination may facilitate the exchange of

information. It is expected that the new group will bring new expertise in numerical analyses and modelling and will liaise with CCAMLR and WG-EMM.

(xii) SCAR convened its third international workshop on marine acoustic studies at the University of Cadiz, Spain, in January 2006. The workshop revised the original risk assessments for particular acoustic equipment currently used in the Southern Ocean, including acoustic releases, bathymetric echo sounders, sub-bottom profilers and echo-sounder arrays used for mapping krill. Mitigation procedures were discussed and a number of recommendations set for future activities and acoustic research in Antarctica. The workshop stressed that detailed research on natural background noise in the Southern Ocean is required before the effects of anthropogenic sounds can be assessed. A noise map for the Southern Ocean should be constructed from ships' tracks and marine geophysics data to define spatial and temporal components of anthropogenic noise.

(xiii) SCAR reaffirmed its commitment to work with CCAMLR in the future development of MPAs by providing appropriate experts and access to data. An observer participated in the September 2006 Experts Workshop on bioregionalisation held in Hobart, Australia. New methods used in the workshop may also prove very useful for a number of SCAR projects such as EBA and CAML, in addition to helping define MPAs. SCAR is keen to participate and collaborate in future bioregionalisation workshops and analyses.

(xiv) SCAR and SCOR co-sponsor an Oceanography Expert Group. One of its tasks is the development of a Southern Ocean Observing System (SOOS). The Expert Group and SOOS will provide information on climate change useful for CCAMLR. Dr Nicol provides a link between this group and CCAMLR. The next SOOS meeting is scheduled for later in 2007 to advance the planning of SOOS. CCAMLR was asked to join in the discussions. SCAR and SCOR are also co-sponsors of the developing ICED program. There are opportunities for ICED, CAML and CCAMLR to collaborate.

(xv) SCAR plans to hold the 3rd Open Science Conference with the SCAR-XXX meeting in St Petersburg, Russia, in July 2008, which will coincide with SCAR's 50th Anniversary celebration. SCAR will again invite the Chair of the Scientific Committee of CCAMLR to be an observer at SCAR-XXX. The 10th SCAR Biology Symposium is scheduled for 2009 in Sapporo, Japan. Prof. M. Fukuchi (Japan) is coordinating that symposium. Both the 3rd Open Science Conference and the 10th SCAR Biology Symposium are expected to have a strong IPY focus. SCAR welcomes CCAMLR's involvement in both meetings.

(xvi) SCAR is committed to maintaining a strong working relationship with CCAMLR. Further, it is seeking to develop collaborative research projects with CCAMLR, especially on the effects of environmental change on Antarctic marine ecosystems.

9.6 Dr Constable noted that many of the scientific research programs of SCAR are directed at terrestrial species but that theoretical biological questions for marine species related to climate change would be of interest to CCAMLR including how marine species ranges may alter and/or how Antarctic marine species may respond to climate change.

9.7 Dr Hosie agreed that this is at the forefront of SCAR's research and is a key issue in EBA and that CAML is a key component of EBA.

Reports of observers from international organisations

ASOC

9.8 Dr R. Werner drew attention to the four papers tabled by ASOC related to krill, marine protected areas and marine pollution (CCAMLR-XXV/BG/26, BG/27, BG/30 and BG/31).

9.9 ASOC shared the concern in regard to the urgency to undertake the allocation of krill catch limits among SSMUs taking into account the needs of predators. It has been noted at this Committee that notifications for krill fishing are increasing year after year, indicating an increase in the interest in the krill fishery.

9.10 ASOC felt that CCAMLR now has a great opportunity to consider this issue before krill catches are too high, ensuring that the Convention objectives are met. This task should be prioritised in the short-term work plan of the Scientific Committee and its working groups. Also, enough information needs to be collected from the fishery, especially through a scientific observation program that is applied consistently to all vessels fishing for krill using both traditional and new methods.

9.11 ASOC welcomed CCAMLR work towards bioregionalisation of the Southern Ocean and looked forward to further progress towards the full implementation of ecosystem-based management in the Convention Area, including the establishment of a system of marine protected areas.

9.12 Finally, ASOC shared the concerns over the unsustainable level of IUU fishing in Subarea 58.4, particularly on BANZARE Bank.

Reports of CCAMLR representatives at meetings
of other international organisations

IWC

9.13 Dr Kock reported from the IWC Scientific Committee that 853 minke whales and 10 fin whales were taken in whaling under special scientific permit in the Southern Ocean. SC-CAMLR's planned survey during the IPY, in which the SC-IWC was interested in participating, is unlikely to take place. SC-CAMLR and SC-IWC have formed a steering group to organise a joint workshop in 2008 to review metadata and information required for

ecosystem models. Further information, including the shared budget, will be found in a paper outlined by members of the steering group. This paper will be submitted to the SC-IWC and will form the basis for the organisation of the workshop.

9.14 New information was provided on the abundance of minke whales in (whaling) area III. Another IWC paper described the use of chemical tracer profiles to assess the feeding ecology of Antarctic type C killer whales which are the killer whales mostly interacting with the longline fishery. Japanese scientists were still unable to reconcile the differences between the minke whales abundance estimates from the second circum-Antarctic cruise (786 000, CV = 9.4%) and the third circum-Antarctic cruise (338 000, CV = 7.3%). The comprehensive assessment of the seven populations of Southern Ocean humpback whales has come to near completion with a workshop held in Hobart, Australia, in April 2006.

9.15 Prof. Beddington enquired about the composition of the SC-IWC steering committee for the joint CCAMLR-IWC symposium.

9.16 Drs Kock and Constable explained that Prof. D. Butterworth (South Africa) was a member as were they. Chairing of the SC-IWC steering committee was to be shared between Drs D. DeMaster (USA) and N. Gales (Australia).

Second Advisory Committee Meeting of ACAP

9.17 Prof. Moreno, on behalf of the Brazilian observer, reported on the Second Meeting of the Advisory Committee of ACAP (SC-CAMLR-XXV/BG/31).

9.18 This meeting was held in Brasilia, Brazil, on 5 and 6 June 2006. Relevant works from the ACAP working groups was presented:

(i) The Status and Trends Working Group reported that information on population trends of 40% of the ACAP list of species shows that some populations are increasing (27%), others are stable (30%) and some are decreasing (43%).

(ii) The Taxonomy Working Group reported on work related to the three contentious species, Gibson's and Antipodean albatrosses, shy and white-capped albatrosses, and Buller's and Pacific albatrosses.

(iii) The incidental mortality group reported that analyses of remote-tracking data of albatrosses and petrels indicate that high density of albatross distribution overlap within the jurisdiction of five RFMOs (CCAMLR, CCSBT, ICCAT, IOTC and WCPFC).

The next meeting of the Advisory Committee to ACAP will be held at Valdivia, Chile, in June 2007.

ICES

9.19 Dr Reid reported on the 2006 ICES Annual Science Conference that took place in Maastricht, Netherlands, from 19 to 23 September 2006. There were 18 theme sessions of which many contained science areas of relevance to CCAMLR. In particular there were sessions entitled:

- Integrated Assessment in Support of Regional Seas Ecosystem Advice – beyond Quality Status Reporting – which reported on the development of ecosystem models and their use in the provision of management advice.

- ICES in a Changing World – which considered issues that related to how management advice should take account of environmental change, both variability and long-term change.

9.20 The 2007 ICES Annual Science Conference will be held in Helsinki, Finland, from 18 to 22 September. Details are available from the ICES website.

CWP

9.21 The Data Manager participated in the CWP intersessional meeting in February 2006. The meeting reviewed progress on a range of fishery matters, including the application of the North Atlantic Format (NAF) for at-sea electronic logbook transmissions and reporting, the development of the UN-LOCODE for coding fishing ports in fishery statistics, and the development of data quality indicators (SC-CAMLR-XXV/BG/4).

9.22 The Scientific Committee noted that while a globally agreed electronic format for reporting catch and effort data may simplify data processing, licensed vessels fishing in the Convention Area already report data using agreed CCAMLR formats. In recent years a number of vessels have trialled a new five-day catch and effort reporting procedure which uses a NAF-like 'email text format' developed by the Secretariat (see www.ccamlr.org/pu/e/sc/fish/forms.htm). The email text format is yet to be evaluated by the Scientific Committee and Commission. However, the Scientific Committee noted that this format allows users to reduce the size of emails by submitting data in the body of email messages instead of using attached files. The reduced size of emails may lead to a reduction in the cost of data submission by vessels at sea.

9.23 The Scientific Committee also noted that the Secretariat uses the full names of ports in its CDS database, and the development of the FAO UN-LOCODE system appears to have limited application to the CCAMLR database. However, the implementation of globally agreed codes for fishing ports may facilitate future searches for information and the exchange of information between CCAMLR and other RFBs.

9.24 The Scientific Committee noted that FAO and CWP are developing data-quality criteria for fishery data, and that this development could have implications for the way CCAMLR may consider data-quality issues in the future.

Future cooperation

9.25 The Scientific Committee noted a number of international meetings of relevance to its work and nominated the following observers and representatives:

- 22nd Session of CWP on Fisheries Statistics, 26 February to 2 March 2007, Rome, Italy – Data Manager;
- ICES WGFAST, 30 April to 2 May 2007, Dublin, Ireland – UK;
- CEP-X, 30 April to 4 May 2007, New Delhi, India – Chair, Scientific Committee;
- 59th Annual Meeting of the SC-IWC, 7 to 18 May 2007, Anchorage, Alaska, USA – Dr Kock;
- 5th International Fisheries Observer Conference, 15 to 18 May 2007, Victoria, British Columbia, Canada – Science/Compliance Officer and Scientific Observer Data Analyst;
- Krill Workshop in Fourth International Zooplankton Production Symposium, 28 May to 1 June 2007, Hiroshima, Japan – Dr Kawaguchi;
- Third Meeting of the ACAP Advisory Committee (AC3), early June, Valdivia, Chile (dates to be confirmed) – Chile;
- SCAR-MarBIN Workshop, 7 and 8 June 2007, Białowieża, Poland – Data Manager;
- CCSBT:
  CCSBT-ERSWG 7th meeting, June 2007, Japan (dates and venue to be confirmed) – Japan;
  12th Scientific Committee and Stock Assessment Group Meeting, 10 to 14 September 2007, Hobart, Australia – Australia;
- ICES Annual Science Conference, 18 to 22 September 2007, Helsinki, Finland – UK.

BUDGET FOR 2007 AND FORECAST BUDGET FOR 2008

10.1 The agreed budget of the Scientific Committee for 2007 and the forecast budget for 2008 are summarised in Table 6. These budgets include the following items:

(a) Preparation and support for the annual meeting of WG-FSA, report editing, translation and publication as an annex to the report of SC-CAMLR.

(b) Support for the annual meeting of the newly formed WG-SAM (see section 13). Costs include the Data Manager's participation and two days of secretarial support assuming that the meeting will be held immediately prior to the meeting

of WG-EMM at the same, or a nearby, location. Costs also include the new requirement for report editing, translation and publication as an annex to the report of SC-CAMLR.

(c) Preparation and support for the annual meeting of WG-EMM, report editing, translation and publication as an annex to the report of SC-CAMLR, and participation costs (airfares, subsistence and freight) for four Secretariat staff.

(d) Participation costs (airfares and subsistence) for invited experts at the meetings of WG-SAM (one expert) and SG-ASAM (up to three experts, no airfares required). The terms of references for these experts are defined in Annex 5, paragraphs 13.9, 13.10 and 13.21.

(e) Editing, translation and publication of the report of SG-ASAM as an annex to the report of SC-CAMLR.

(f) Preparation and support for the 2007 Bioregionalisation Workshop, report editing, translation and publication as an annex to the report of SC-CAMLR, and participation costs (airfares, subsistence and freight) for Secretariat staff (see also paragraph 10.2).

(g) Participation costs (airfares and subsistence) for the Science/Compliance Officer and the Scientific Observer Data Analyst at the Fifth International Fisheries Observer Conference.

(h) CCAMLR-IWC Workshop preparations, including initial work by experts in 2007, and participation of 11 invited experts at the workshop (airfares and subsistence) and the development of review material (see SC-CAMLR-XXV/6). Costs identified in the Scientific Committee's budget represent 50% of the total estimate (see paragraph 10.3). Costs also include 50% of the total cost of report editing, translation and publication as an annex to the report of SC-CAMLR. The current estimate excludes the costs of preparation and support by Secretariat staff.

(i) Participation costs (airfare and subsistence) for the Data Manager at the meeting of SG-ASAM.

(j) Participation costs (airfare and subsistence) for the Data Manager at the planning meeting for the CCAMLR-IPY projects. It is anticipated that this meeting will be held in association with the meeting of SG-ASAM.

(k) Participation costs (airfares and subsistence) for an invited expert at a three-day workshop on land-based predators to be held in conjunction with WG-EMM (see (c) above).

10.2 The Scientific Committee noted that a number of experts may be invited to the 2007 Bioregionalisation Workshop, and that the associated costs could be funded from the recently established MPA Special Fund. The workshop steering committee would finalise these arrangements intersessionally, and develop the terms of references for the invited experts.

10.3 The Scientific Committee recommended that the cost of the CCAMLR-IWC Workshop should be shared equally between CCAMLR and the IWC. The costs identified in the Scientific Committee's budget (Table 6) represent 50% of the total cost of the initial work by experts in 2007, and the participation of invited experts at the workshop and the development of review material. Costs also include 50% of the total cost of report editing, translation and publication as an annex to the report of SC-CAMLR. The Scientific Committee noted that the reporting requirement may be modified following further consultation with the IWC. It also noted that the costs in 2008 exclude preparation and support by Secretariat staff and assumes that the meeting will be held at the CCAMLR Headquarters (SC-CAMLR-XXIV, paragraph 13.52). The total cost of the workshop will be revised in 2007 following advice from the IWC and further consideration by the Scientific Committee.

10.4 If there was a need to reduce CCAMLR's contribution to the budget of the CCAMLR-IWC Workshop, the Scientific Committee agreed that the workshop steering committee could approach Members for individual contributions of resources to the workshop to help it achieve its objectives.

10.5 The Scientific Committee agreed that the one-day joint workshop by WG-EMM and WG-FSA (developing methods of incorporating ecosystem models into finfish fishery assessments) in 2007 did not require any additional funding.

10.6 The Scientific Committee noted that the Special Science Fund currently holds deferred amounts for the independent external review of the GYM and part of the review of the *Scientific Observers Manual*. The Scientific Committee agreed to carry these funds forward.

10.7 The Scientific Committee endorsed the following expenditures under the Commission's budget for 2007:

- level funding of A$12 000 for language support for *CCAMLR Science*;
- participation cost for the Chair of the Scientific Committee at the 2007 meeting of CEP;
- participation cost for the Data Manager at the 2007 meeting of CWP.

10.8 The Scientific Committee recommended that the Commission also fund the following items:

- Electronic dissemination of *CCAMLR Science* via the CCAMLR website. The annual cost was estimated at A$800 with a one-off expense of A$3500 to load back-issues of the journal.
- The start-up costs for the Secretariat-based coordination of the tagging program in exploratory fisheries. These costs will cover the initial cost of purchasing sufficient tags and tagging equipment for all vessels notified in exploratory fisheries in 2007/08 and in future seasons. Tags and tagging equipment will be sold to Members on a cost-recovery basis. The start-up costs have been estimated at approximately A$100 000 and will be required in 2007 (paragraphs 4.39 to 4.41).

- Subject to the Commission's approval, the cost of establishing computer protocols which would allow VMS data to be used to validate the positions reported in fishery and observer data. It was expected that some protocols would need to be developed by the VMS provider, and the cost had yet to be determined by the Secretariat.

10.9 The Scientific Committee supported the Secretariat's proposal to establish a wireless network for meetings at the Headquarters (CCAMLR-XXV/13).

10.10 The Scientific Committee considered the Secretariat's proposal for the replacement of the Science/Compliance Officer on the retirement of the incumbent, Dr E. Sabourenkov (CCAMLR-XXV/9). The Scientific Committee agreed that the reorganisation of its work and future requirements would necessitate a full-time Science Officer in addition to the work performed by the Data Manager.

10.11 The Scientific Committee recognised Dr Sabourenkov's outstanding work in supporting the Scientific Committee, SCIC and the Commission. His capacity to address such a diverse and complex range of issues was made possible by his great institutional expertise and knowledge of CCAMLR matters.

10.12 Some Members recommended to the Commission that Dr Sabourenkov's term of employment be extended to 2009. Other Members believed that it is not within the competence of the Scientific Committee to discuss the terms of employment of individuals.

10.13 The Scientific Committee indicated that there would be merit if the new Science Officer was appointed at a time so as to allow some overlap with Dr Sabourenkov in order that he might share his expertise and knowledge prior to retirement.

ADVICE TO SCIC AND SCAF

11.1 The Chair presented the Scientific Committee's advice to SCIC and SCAF during the meeting. The advice to SCAF is summarised in Section 10. The advice to SCIC is summarised below, and the primary advice is provided elsewhere in this report.

IUU Fishing

11.2 The Scientific Committee agreed that the new methodology proposed by JAG be further developed (Annex 5, paragraphs 8.14 and 8.15), and recommended that SCIC:

(i) consider whether the weightings of individual categories were appropriate, whether the number of levels in each category was correct and whether there were other useful categories that might be used without overly complicating the analysis;

(ii) determine the vulnerability of different areas to IUU fishing, for instance using the template provided by SCIC-06/9.

11.3 In addition, the Scientific Committee agreed that WG-FSA would develop distributions of likely catch rates of IUU vessels fishing by area using data from licensed vessels.

11.4 The Scientific Committee advised SCIC that data are currently most limiting in the areas which have highest levels of IUU fishing. These matters were discussed under Agenda Item 7.

New and exploratory fisheries

11.5 The Scientific Committee, WG-FSA and ad hoc WG-IMAF considered the scientific aspects of the notifications for exploratory fisheries in 2006/07 (summarised in Annex 5, Table 5). This matter was considered under Agenda Item 4.

11.6 The Scientific Committee noted that WG-FSA had not attempted to determine whether the notifications for exploratory fisheries satisfied the requirements of the notification procedure (Conservation Measure 21-02) (Annex 5, paragraph 5.3). The Scientific Committee agreed that this was a task for SCIC.

Tagging program

11.7 The Scientific Committee reviewed the tagging requirements in exploratory fisheries, and endorsed the amendment to Conservation Measure 41-01, Annex C, to clarify the roles and responsibilities of the vessel and observers in relation to the tagging program (Annex 5, paragraph 3.53). The Scientific Committee also agreed that the tagging requirements for *Dissostichus* spp. must be applied in proportion to the species and sizes of *Dissostichus* spp. present in the catches.

11.8 The Scientific Committee also agreed that the tagging rate for *Dissostichus* spp. in exploratory fisheries be increased to (Annex 5, paragraphs 3.56 and 5.49):

- a minimum of three fish per tonne and a target of 10 fish per tonne in those SSRUs in Subareas 88.1 and 88.2 which are closed but carry a 10-tonne research exemption for a single vessel in a single season;
- a minimum of three fish per tonne in exploratory fisheries in Divisions 58.4.1 and 58.4.2.

11.9 The Scientific Committee noted that there are significant differences in the tagging rates achieved by different Members in some exploratory fisheries, and not in others. In 2005/06, all but five vessels achieved a tagging rate of more than one toothfish per tonne of toothfish landed (Annex 5, paragraph 5.60).

11.10 The Scientific Committee noted that the use of tagging data in the assessment of exploratory fisheries would need to take account of the uncertainty in the fishing patterns and fishing selectivities of IUU fishing. The use of gillnets in IUU fishing would introduce further uncertainty in the assessments.

11.11 The Scientific Committee endorsed WG-FSA's proposal that the Secretariat coordinate the tagging programs in new and exploratory fisheries starting from the 2007/08 season. All tags used by Members in exploratory fisheries should be purchased from the Secretariat for use in the 2007/08 season onwards (Annex 5, paragraph 3.57). These matters were further discussed in paragraphs 4.39 to 4.41.

Use of VMS data for validation of positions in fishery and observer data

11.12 The Scientific Committee recommended that the Commission authorise the Secretariat to routinely use VMS data to validate positions reported in observer data including tagging and fine-scale data (paragraphs 4.23 to 4.25 and Annex 5, paragraph 3.6; see also paragraph 10.8).

Scientific observers on krill vessels

11.13 The Scientific Committee reiterated the need to collect standard scientific observations on krill fishing vessels (SC-CAMLR-XXIV, paragraphs 11.6 to 11.8). The requirements for scientific observers had also been reviewed by WG-EMM (Annex 4, paragraph 3.43) and WG-FSA (Annex 5, paragraphs 7.8 and 11.2). Systematic scientific observer coverage of the krill fishery is required across all fishing methods so as to allow the Scientific Committee to develop advice on the fishery, including evaluation of by-catch and the efficacy of mitigation measures.

11.14 The Scientific Committee noted that most Members will be deploying scientific observers on their vessels in 2006/07 (paragraph 4.5 and Table 4). The Scientific Committee urged all Members to implement scientific observations, in accordance with the CCAMLR Scheme of International Scientific Observation, on vessels fishing for krill in the Convention Area. The priorities for scientific observers were to collect data to:

- compare fishing methods
- determine the level of by-catch of larval finfish
- better understand the occurrence of warp strike by seabirds.

11.15 This matter was further discussed under Agenda Item 4, and referred to SCIC for further consideration.

General conservation measure on environmental protection during fishing

11.16 The Scientific Committee briefly discussed the proposed implementation of a general conservation measure on environmental protection during fishing (CCAMLR-XXV/10).

11.17 The Scientific Committee supported this proposal and agreed generally that the implementation of this measure will consolidate the Commission's advice while preserving the various environmental protection provisions currently in force. The Scientific Committee recommended that the Commission introduce this new measure and associated changes.

Advice on sharks

11.18 The Scientific Committee recalled that JAG had requested that WG-FSA review information available on shark stocks in the Convention Area (CCAMLR-XXV, Annex 6, paragraphs 5.12 to 5.15).

11.19 WG-FSA reported that five shark species are known to occur around South Georgia, Crozet Islands and Kerguelen Islands. The identification of a sixth species from observer reports at South Georgia has yet to be confirmed. No sharks have been reported from Division 58.4.3 (Annex 5, paragraph 9.19). Data were insufficient to allow the Working Group to assess the potential for the commercial harvest of sharks in the Convention Area.

Use of gillnets

11.20 The Scientific Committee agreed that gillnets are non-selective fishing devices, and if not utilised correctly, could take mobile species indiscriminately. In addition, gillnets may have adverse impacts if dragged along the bottom and have the potential to 'ghost' fish over long time periods when lost or discarded (Annex 5, paragraph 5.71). The Scientific Committee recommended that the Commission establish an interim prohibition of deep-sea gillnetting in the Convention Area until the Scientific Committee has investigated and reported on the potential impacts of this gear in the Convention Area and the information has been reviewed by the Commission.

11.21 The Scientific Committee also recommended that the interim prohibition would apply only to commercial vessels and not for research purposes. At present, some Members utilise gillnets/trammel nets in inshore areas to sample fish populations. These programs have been conducted using approved methods for a number of years. If Members wished to initiate new research programs using these fishing gears, the Scientific Committee should be notified in order that the proposals be reviewed and approved before being undertaken. Action with respect to regulating the use of gillnets in the Convention Area should not jeopardise existing research programs in coastal waters.

Use of bottom trawls

11.22 The Scientific Committee held preliminary discussions regarding the proposal to limit the expansion of bottom trawling in high-seas areas (CCAMLR-XXV/BG/33) (paragraphs 4.214 to 4.216). The Scientific Committee noted the key points of this proposal, and developments outside the Convention Area, and referred the matter to the Commission for further consideration.

SECRETARIAT SUPPORTED ACTIVITIES

Data Management

12.1 The Scientific Committee noted the Data Manager's report which outlined the work undertaken by the Data Management Team in 2005/06, and measures taken to maintain the integrity of CCAMLR data. This work had included the development of databases and analytical routines, preparation of Volume 18 of the *Statistical Bulletin*, monitoring of CCAMLR fisheries and updating the Fishery Plans (SC-CAMLR-XXV/BG/3; Table 7).

12.2 The Data Management Team also monitored 144 catch limits for species in SSRUs, SSRU groups, management areas, divisions, subareas and areas in 2005/06. The majority of these limits were monitored at five-day intervals between December 2005 and August 2006. The CCAMLR model for forecasting fishery closures was used routinely once the reported catch of a species exceeded 50% of its catch limit. This resulted in the closure of 15 fishing areas (CCAMLR-XXV/BG/3).

12.3 The Scientific Committee noted this work and thanked the Data Management Team for its contribution to the work of the Scientific Committee and its working groups in 2005/06.

Rules for Access and Use of CCAMLR Data

12.4 The Scientific Committee considered Australia's proposal to amend the Rules for Access and Use of CCAMLR Data (CCAMLR-XXV/42). The purpose of the proposed amendments was to more readily identify the originator and purpose of data requests, ensure that commercially sensitive data were not released inappropriately and ensure that data owners were adequately consulted before their data are released.

12.5 The Scientific Committee noted that Australia's concerns may be addressed under the current rules, without the need to revise the rules. In particular it was noted that:

(i) data requests are submitted through a Member's representative to the Scientific Committee or Commission, and that representative is responsible for reviewing the request, forwarding the request to the Secretariat and informing the data requester of CCAMLR's rules;

(ii) each request is assessed by the Secretariat and, if need be, the Secretariat will consult with the representative to ascertain further details about the request, including its relevance to the work of CCAMLR and the type of data required.

12.6 The Scientific Committee also noted that paragraph 6 of the rules provides originators/owners of data with the right to: (i) be consulted (including assignation of authorship) on the preparation, if necessary including publication, of documents describing analyses and interpretation of their data; (ii) approve the level of detail revealed in documents using their data; (iii) stipulate terms and/or levels of data security if necessary.

12.7 The Scientific Committee also noted that the timeliness of data dispatch, when the data request meets the condition in paragraph 2(a) of the rules, is an important aspect of the rules

and allows scientists to undertake essential work in time for the meetings of working groups. The Scientific Committee agreed that the proposed 14-day period for approval (CCAMLR-XXV/42) added a significant delay to the dispatch of data under paragraph 2(a) of the rules, and an additional administrative layer for the Secretariat.

12.8 On the basis of these points, the Scientific Committee recommended that the Commission retain the Rules for Access and Use of CCAMLR Data, as adopted at CCAMLR-XXII (CCAMLR-XXII, paragraphs 12.1 to 12.6).

12.9 At the time of report adoption, Dr Constable noted that the Commission may need to consider whether the rules adequately describe the process that will give effect to the data owner's rights in paragraph 6 of the rules, and whether the process provides sufficient reporting of the use of data, thereby satisfactorily closing the process.

Policy of the publication of aggregated fine-scale data

12.10 The Scientific Committee considered a draft policy governing the presentation and publication of aggregated fine-scale data in the *Statistical Bulletin* (CCAMLR-XXV/31). The draft had been prepared by the Secretariat in accordance with the Commission's request (CCAMLR-XXIV, paragraph 4.62), and had been distributed to Members in April 2006 (COMM CIRC 06/36 and SC CIRC 06/9).

12.11 The draft policy allows all fine-scale catch and effort data to be aggregated and published in the *Statistical Bulletin* as follows:

(i) where fishing occurs frequently (three or more vessels per aggregated record), the data would be aggregated and published by fine-scale rectangle (0.5° latitude by 1.0° longitude);

(ii) where fishing is sparse (fewer than three vessels per aggregated record), the data would be aggregated and published by large rectangle (2.5° latitude by 5.0° longitude);

(iii) where the number of vessels is not reported (e.g. some historical data), the data would be aggregated and published by fine-scale rectangle.

12.12 This draft policy would require some small changes to the presentation of the catch distribution maps in the *Statistical Bulletin*, and some maps would include distributional information by fine-scale rectangle and large rectangle.

12.13 The Scientific Committee thanked the Secretariat for drafting a policy which was in the spirit of the Commission's work, provided transparency in published information, and provided a method for summarising data at appropriate scales when limited numbers of vessels are involved in taking the catch.

12.14 Dr Constable noted that these maps are useful for deliberations of the working groups, Scientific Committee and Commission. However, the appropriateness of publishing these maps in the proposed form in the public domain is a matter for the Commission.

12.15 Dr Naganobu suggested that fine-scale data for *Dissostichus* spp. should be aggregated and published by large rectangle, while fine-scale data for ***E. superba*** should be aggregated and published by fine-scale rectangle. The Scientific Committee noted that this matter is for the Commission to determine.

12.16 The Scientific Committee recalled the Commission's decision that the policy should be uniformly applied to all fisheries in the Convention Area (CCAMLR-XXIV, paragraph 4.62).

12.17 The Scientific Committee advised the Commission that the draft policy was suitable for the purpose of the work of the Scientific Committee and its working groups. It recommended that the catch distribution maps for each area should be plotted at the same scale, where feasible.

Publications

12.18 The Scientific Committee noted that the following documents had been published in 2006 in support of its work:

(i) Report of the Twenty-fourth Meeting of the Scientific Committee
(ii) *CCAMLR Science*, Volume 13
(iii) *CCAMLR Scientific Abstracts 2005*, available on the CCAMLR website
(iv) *Statistical Bulletin*, Volume 18
(v) Revisions to the *Scientific Observers Manual*.

12.19 The Scientific Committee agreed that language support for *CCAMLR Science* would be required in 2007, and sought level funding from the Commission's budget (see paragraph 10.7).

12.20 The Scientific Committee also agreed to the electronic dissemination of *CCAMLR Science* via the CCAMLR website, and sought funding from the Commission's budget in 2007 to implement web-based publication including back-issues of the journal (see paragraph 10.8). The Scientific Committee agreed that the web-based publication should reside in the public domain section of the CCAMLR website (under the 'Publications' menu) and recommended that a searchable index of *CCAMLR Science* papers be included.

12.21 The Scientific Committee agreed that the following paragraph should be inserted after the second introductory paragraph in the preface of the *CCAMLR Scientific Abstracts*: 'Publication of an abstract does not imply in any way that the paper was reviewed by the Scientific Committee or its working groups, or was used in the work of CCAMLR'.

INTERSESSIONAL WORK

Reorganisation of the work of the Scientific Committee
and its working groups

13.1 Dr Holt reported on the work of the Steering Committee on the Review of the Structure of the Working Groups of the Scientific Committee. In 2005/06 the Committee had worked by correspondence and had met in association with the meetings of WG-FSA-SAM and WG-EMM.

13.2 The Committee had:

(i) reviewed information and proposals on the reorganisation of the work of the Scientific Committee;

(ii) agreed that both short- and long-term needs of the Scientific Committee must be accommodated in any plausible reorganisation scheme;

(iii) agreed that it would be preferable for the reorganisation of the working groups to evolve from the existing framework used by the Scientific Committee and its working groups;

(iv) recognised that some aspects of the reorganisation may be introduced in the short term to address the present needs of the Scientific Committee, however the process is likely to require considerable time to be fully implemented;

(v) recognised that any reorganisation should not increase the total meeting time from the present five weeks (two weeks for WG-FSA including ad hoc WG-IMAF, two weeks for WG-EMM, and one week for WG-SAM) and that no increase in resources be required from the Secretariat.

13.3 The Steering Committee agreed that implementation of its requirements will impact on the way that the Scientific Committee currently does business. For example, it is anticipated that the Scientific Committee will be required to provide advice to the Commission with respect to matters such as MPAs, predator–prey–fishery models, stock assessment models, icefish and krill acoustic measurements, conservation status of seabirds and destructive fishing practices. In addition, it was recognised that some items presently on the working groups' agendas may be considered at multi-year intervals instead of annually, or not at all.

13.4 The Steering Committee recognised that the present working group structure could, with appropriate modification, address present and future needs. In particular, the role of WG-FSA-SAM could be expanded to serve as a technical group to address issues relevant to all three existing working groups (WG-FSA, WG-EMM and ad hoc WG-IMAF). Under this scenario, WG-FSA-SAM would be used by all three groups to address technical assessment and modelling issues, including fish stock assessment issues (of interest to WG-FSA), krill, seal and seabird stock assessment issues (of interest to WG-EMM), and estimation of the status of seabirds (of interest to WG-IMAF).

13.5 In order to address issues of interest to all working groups, the Steering Committee proposed that the Scientific Committee establish WG-FSA-SAM as a full working group (provisionally known as the Working Group on Statistics, Assessments and Modelling

(WG-SAM)), and develop a long-term science plan so its tasks may be prioritised. This would allow long-term planning by WG-SAM so that the appropriate experts could be present at the appropriate meetings. In addition, WG-SAM would need to be fluid in its composition, duration of meeting time and issues addressed. For example, the group might meet for two weeks to consider both fish and krill–predator–prey issues or for one week, for example, to consider only fish stock assessment issues. Conversely, WG-EMM may need to meet for one or two weeks depending on its workload for that year. Further, the duration of the meetings of WG-FSA may vary as its work becomes more established and some assessments are conducted at multi-year intervals instead of annually using standard models.

13.6 The Steering Committee proposed that the Scientific Committee establish a steering group to develop, and keep under review, a long-term science plan which would guide the work of its working groups, including WG-SAM. Membership of the steering group may be open to all Scientific Committee representatives, and would include the Chair of the Scientific Committee and the conveners of the working groups.

13.7 The Scientific Committee noted that WG-EMM had agreed that the proposed restructuring of WG-FSA-SAM outlined above had the potential of providing flexibility for appropriate experts present to address specific questions of interest to WG-EMM. Conversely, this new structure may reduce the total time some Members might spend participating in meetings. WG-EMM also agreed that it was necessary to ensure that the restructuring did not create the situation in which biologists and quantitative modellers are separated, as it is important to have input from both areas of expertise to develop appropriate management advice (Annex 4, paragraphs 7.6 and 7.7).

13.8 The Scientific Committee also noted that the proposal to restructure the work of WG-FSA-SAM had been considered by the subgroup itself (WG-FSA-06/6, paragraphs 8.2 to 8.4). The subgroup agreed that it could serve as a common umbrella under which the development of assessment methodologies of various types may be examined. This would provide a forum where the required expertise could be assembled for shorter and concentrated periods of time. This format would also enhance the subgroup's ability to assemble a critical mass of expertise needed to address its assigned tasks.

13.9 Further, the Scientific Committee noted that WG-FSA had endorsed the proposal for the reorganisation of the work of the Scientific Committee and restructuring of WG-FSA-SAM (Annex 5, paragraph 14.8). In doing so, the Working Group agreed that:

(i) a technical working group would allow the Scientific Committee to address a range of methodological issues using a common pool of experts. This would provide consistency in the approaches developed by the working groups;

(ii) the Scientific Committee would need to establish a long-term science plan which incorporated flexibility to address other important issues as these arose. It was recognised that the proposed restructure would require considerable time to be implemented, and that further changes may be required;

(iii) the introduction of multi-year assessments and reviews would allow WG-FSA to devote more time to other important matters such as biological and ecosystem processes. This multi-year approach may also be implemented by the other

working groups, thereby allowing those groups to consider in detail other matters of importance to their work (e.g. technical developments in the krill fishery; impact of fishing outside the Convention Area on Antarctic species).

13.10 The Scientific Committee also noted that ad hoc WG-IMAF had endorsed the proposed restructure (Annex 5, paragraph 7.60). In addition, WG-IMAF had reviewed its own structure and terms of reference, and identified some core intersessional tasks to further streamline its work (Annex 5, paragraphs 7.63 to 7.65). WG-IMAF had also confirmed that the existing linkage with WG-FSA remained appropriate, and facilitated the development of integrated advice on the management of fisheries.

13.11 Noting responses from WG-EMM (Annex 4, paragraphs 7.1 to 7.7), WG-FSA including WG-FSA-SAM (Annex 5, paragraphs 14.1 to 14.9; WG-FSA-06/6, paragraphs 8.2 to 8.4) and ad hoc WG-IMAF (Annex 5, Appendix D, paragraphs 181 and 182) to this proposal, the Scientific Committee thanked Dr Holt and the Steering Committee for developing this proposed reorganisation of the work of the Scientific Committee and its working groups.

13.12 The Scientific Committee endorsed the proposal and agreed to establish WG-SAM effective from the end of CCAMLR-XXV. It was agreed that 2007 would be a transition year when WG-SAM would focus on the tasks assigned by WG-FSA as well as the further development of the methodology for subdividing the catch limit of krill among SSMUs in Area 48. The Scientific Committee agreed that Drs Jones and Constable co-convene WG-SAM.

13.13 The Scientific Committee also agreed to establish a long-term science plan which would set the priorities of WG-SAM and the other working groups and subgroups. The Scientific Committee requested that working group conveners submit a joint paper to SC-CAMLR each year, outlining the priorities for their work. The Scientific Committee would review this paper and revise its priorities for future work.

13.14 Noting Dr Hanchet's wish to step down from his role as Convener of WG-FSA following the 2007 meeting, the Scientific Committee agreed to the following arrangements for the conveners of WG-SAM and WG-FSA after the 2007 meetings:

- Dr Jones would convene WG-FSA
- Dr Constable would convene WG-SAM.

13.15 The Scientific Committee thanked Dr Hanchet for continuing to convene WG-FSA until the end of the 2007 meeting of that working group, and thanked Dr Jones for co-convening WG-SAM in its first year, and then assuming the role of Convener of WG-FSA. The Scientific Committee also thanked Dr Constable for accepting to co-convene WG-SAM from the end of the 2007 meeting of that working group.

13.16 The Scientific Committee requested additional funds for editing, translating and publishing the report of WG-SAM as an annex to the report of SC-CAMLR (see paragraph 10.1).

Intersessional activities during 2006/07

13.17 The Scientific Committee accepted with great pleasure New Zealand's invitation to host the 2007 meeting of WG-SAM (one week) and the meeting of WG-EMM (two weeks) from 9 to 27 July 2007 in Christchurch.

13.18 The Scientific Committee reviewed and endorsed the intersessional work plans of WG-EMM, WG-FSA and ad hoc WG-IMAF, and the work plan for WG-SAM which had been agreed by WG-FSA.

13.19 The Scientific Committee agreed to the following meetings in the 2006/07 intersessional period:

- meeting of SG-ASAM and planning meeting for the CCAMLR-IPY projects in April 2007, in association with the 2007 meeting of ICES WGFAST in Dublin, Ireland, 23 to 27 April (Convener, dates and venue to be announced in December 2006);

- meeting of WG-SAM in Christchurch, New Zealand, from 9 to 13 July 2007 (Co-conveners Drs Jones and Constable);

- one-day joint workshop by WG-EMM and WG-FSA (developing methods of incorporating ecosystem models in finfish fishery assessments) in Christchurch, New Zealand, in July 2007 (Co-conveners Drs Hanchet and Reid, date to be announced);

- meeting of WG-EMM in Christchurch, New Zealand, from 16 to 27 July 2007 (Convener Dr Reid);

- Bioregionalisation Workshop in Brussels, Belgium, from 13 to 17 August 2007 (Co-conveners Drs Penhale and Grant);

- meeting of WG-FSA, including ad hoc WG-IMAF, in Hobart, Australia, from 8 to 19 October 2007 (Convener WG-FSA Dr Hanchet; Co-conveners WG-IMAF Ms Rivera and Mr Smith).

Third meeting of SG-ASAM

13.20 The Scientific Committee agreed to hold a third meeting of SG-ASAM in association with the 2007 meeting of ICES WGFAST (Dublin, Ireland, 30 April to 2 May). The Scientific Committee agreed to extend SG-ASAM's terms of reference (Annex 5, paragraphs 13.16 to 13.19) to include the development of acoustic sampling protocols for the CCAMLR-IPY projects (paragraph 13.39).

13.21 The Scientific Committee also agreed to hold the planning meeting for the CCAMLR-IPY projects in association with the meeting of SG-ASAM.

13.22 The Scientific Committee requested that the convener of WG-FSA, in consultation with the Scientific Committee's Chair and representatives, select a convener for the third meeting and determine a suitable venue and time for the meeting. It was hoped that these details could be announced by a CCAMLR circular in December 2006.

13.23 The Scientific Committee also agreed to the Data Manager's participation at future meetings of SG-ASAM (Annex 5, paragraph 13.22), and at the CCAMLR-IPY planning meeting associated with the 2007 meeting of SG-ASAM (paragraph 10.1).

CCAMLR-IPY projects

13.24 In 2005 the Commission noted the Scientific Committee's progress in developing CCAMLR's contribution to the IPY in 2008 (SC-CAMLR-XXIV, paragraphs 13.33 to 13.43). It noted that the Scientific Committee had developed a core project to conduct a synoptic survey of krill, pelagic fish and plankton biomass and biodiversity in the South Atlantic (CCAMLR-IPY-2008 Survey). This had been evaluated by the Joint IPY Committee and established as the 'lead project' under the IPY topic 'Natural Resources, Antarctic'. Accordingly, an umbrella project had been developed with a wider circum-Antarctic perspective than the original CCAMLR-IPY proposal above. The title of the umbrella proposal is 'Integrated circumpolar studies of Antarctic marine ecosystems to the conservation of living resources' and the short-form title of the proposed activity is listed as 'Antarctic Marine Ecosystem Studies (AMES)'.

13.25 The Commission had urged all Members to participate in the CCAMLR core project (CCAMLR-IPY-2008 Survey) or under the wider AMES umbrella. It noted that firm commitments for ship-time and other research activities were needed to be provided by the time of the 2006 meeting of WG-EMM.

13.26 Despite the strong request of the Commission, at the time of WG-EMM-06 no firm commitments could be made by Members to participate in the CCAMLR-IPY-2008 Survey.

13.27 WG-EMM and the CCAMLR-IPY steering group expressed their concerns about the lack of commitment for the necessary ship-time to conduct the CCAMLR-IPY-2008 Survey. The Working Group noted that the current situation could embarrass CCAMLR and its Members if the survey was to be cancelled, as this project had become a core research activity of the CCAMLR-IPY initiative. It was noted that all the necessary scientific requirements had been fulfilled to obtain the full endorsement of the IPY community and to finalise the necessary planning for the 2008 field season.

13.28 The Convener of the CCAMLR-IPY steering group and the Chair of the Scientific Committee were tasked to write an urgent CCAMLR circular (COMM CIRC 06/92 and SC CIRC 06/35) to inform Members of this serious situation and the potential consequences for the entire CCAMLR-IPY initiative. Commission representatives were asked to assist, where possible, in their national decision-making process required to secure the necessary budget and logistics support the CCAMLR-IPY-2008 Survey.

13.29 By the time of SC-CAMLR-XXV, only one firm commitment had been received. Peru, an Acceding State, had confirmed that in would participate in the CCAMLR-IPY-2008 Survey. The Scientific Committee thanked Peru for this commitment, and noted with great

regret that several Members who had expressed their strong interest at the beginning of the planning phase had withdrawn their tentative commitments due to domestic decisions on the necessary budget or access to the required ship-time.

13.30 The Scientific Committee agreed that the limited available resources of participating research vessels precluded the conduct of the CCAMLR-IPY-2008 Survey, as initially agreed by CCAMLR and endorsed by the IPY Joint Committee. As a consequence, it would not be possible for CCAMLR to obtain a revised estimate of krill biomass in Area 48 in 2008.

13.31 The Scientific Committee agreed that it would not be prudent to postpone the decision on the participation of CCAMLR in IPY any longer, because the steering group would run out of time to finalise the planning of the survey before the start of the field season in January 2008. Furthermore, it was felt necessary to inform those projects associated with the planned CCAMLR-IPY-2008 Survey, such as IWC and SCAR-GEB, about the unsuccessful development, so that they may modify their projects accordingly.

13.32 The Scientific Committee decided, in order to minimise the negative effects on the international reputation of CCAMLR as a leading research organisation in the Antarctic, to carry on with its contribution to IPY with a modified acoustic research project on krill and other key species and to make best use of the available research resources during IPY.

13.33 Some Members (including India, Italy, New Zealand and Norway) and an Acceding State (Peru) indicated that they were still optimistic that they will be able to carry out CCAMLR-related krill research in different parts of the Convention Area during IPY 2008. The SCAR-CAML program may also collect ancillary acoustic and net-haul data and make these data available to CCAMLR.

13.34 Therefore, the Scientific Committee requested members of the CCAMLR-IPY steering group to determine, as a matter of urgency, if research vessels engaged in other IPY projects would be available to measure krill acoustic biomass and conduct net sampling and CTD casts. If such ships were available, the convener of the steering group should investigate if CCAMLR scientists may participate in the research effort to collect data relative to CCAMLR's objectives. If such opportunities exist, then the convener should communicate this to the steering group and to CCAMLR Members.

13.35 The Scientific Committee noted Dr Siegel's wish to resign from his post as Convener of the CCAMLR-IPY steering group. Dr Siegel expressed the opinion that the Convener, as well as the members of the steering group, should be recruited from Members who will actively participate with their vessels in the CCAMLR-IPY field activities. The Scientific Committee thanked Dr Siegel for his relentless efforts to establish the CCAMLR-IPY projects.

13.36 The Scientific Committee endorsed the nominations of Drs S. Iversen (Norway) and E. Fanta (Brazil) as the new Co-conveners of the steering group, and endorsed the revised membership of the group which now consisted of Drs V. Alder (Argentina), M. Azzali (Italy), M. Gutiérrez (Peru), S. Hanchet (New Zealand), G. Hosie (SCAR-CAML) and N. Sanjeevan (India), with support from the Data Manager.

13.37 The Scientific Committee agreed that the membership of this group would be open to all participating Members.

13.38 The Scientific Committee recommended that the Commission urge all Members to contribute to the CCAMLR-IPY projects and advise the CCAMLR-IPY steering group as soon as possible of any new development regarding the availability of ship-time.

13.39 The Scientific Committee tasked SG-ASAM in 2007 with developing the acoustic sampling protocols for the IPY, and agreed that the steering group hold a planning meeting in association with SG-ASAM (paragraphs 13.19 and 13.21).

Joint CCAMLR-IWC Workshop

13.40 The Scientific Committee endorsed the recommendations of the Steering Committee for the CCAMLR-IWC Workshop (SC-CAMLR-XXV/6). Details of the workshop would be developed in 2007 and finalised at SC-CAMLR-XXVI (see also paragraph 10.1).

13.41 The terms of reference for the workshop (SC-CAMLR-XXIV, paragraph 13.47) are to:

1. Consider the types of information needed for models on the Antarctic marine ecosystem that could be developed for providing management advice.

2. Consider how the information could be used in modelling the Antarctic marine ecosystem, the quality of the information, and key gaps needing to be resolved before such information might be used in the development of those models.

3. Consider metadata, rather than reviewing individual datasets and undertaking analyses to summarise the data, where the metadata would comprise information on the estimates of abundance, population trends and parameters, their data sources and methods used to estimate them.

The workshop is scheduled in April 2008 in Hobart, Australia.

Invitation of observers to the next meeting

13.42 The Scientific Committee agreed that all observers invited to the 2006 meeting would be invited to participate in SC-CAMLR-XXVI.

Invitation of experts to the meetings of working groups

13.43 The Scientific Committee agreed that up to three experts may be invited to the meeting of SG-ASAM, and endorsed the terms of reference for these experts (Annex 5, paragraph 13.21; see also paragraph 10.1(d)).

13.44 The Scientific Committee agreed that one invited expert would be invited to the meeting of WG-SAM, and endorsed the terms of reference and selection process for that expert (Annex 5, paragraphs 13.9 and 13.10; see also paragraph 10.1(d)).

13.45 The Scientific Committee noted that a number of experts may be invited to the 2007 Bioregionalisation Workshop, and that the workshop steering committee would finalise these arrangements intersessionally, and develop the terms of reference for the invited experts.

Next meeting

13.46 The next meetings of the Scientific Committee and the Commission are scheduled at the CCAMLR Headquarters in Hobart, Australia, from 22 October to 2 November 2007.

ELECTION OF THE CHAIR AND VICE-CHAIR OF THE SCIENTIFIC COMMITTEE

14.1 Vice-Chairs, Mr L. Pshenichnov (Ukraine) and Dr Shin, advised that the Scientific Committee representatives had met during SC-CAMLR-XXV and had unanimously re-elected Dr Fanta to the Chair of the Scientific Committee for a second term (2007 and 2008). The Scientific Committee welcomed Dr Fanta's return to the Chair. Dr Fanta thanked the Scientific Committee for its vote of confidence.

14.2 Dr Shin's term as Vice-Chair ended with this meeting and the Scientific Committee sought nominations for a new Vice-Chair. Dr Shin nominated Dr Sullivan and this nomination was seconded by Mr Pshenichnov. Dr Sullivan was unanimously elected to the position for a term of two regular meetings (2007 and 2008). A very warm welcome was extended to the incoming Vice-Chair.

14.3 The Scientific Committee thanked Dr Shin for his significant contribution to its work.

OTHER BUSINESS

US AMLR Research and Monitoring Program

15.1 Dr Holt informed the Scientific Committee of challenges facing the US AMLR Research Program. Continuation of the program is contingent on availability of a research vessel and future budget decisions. The US Government is currently operating under a continuing resolution that caps funding at FY06 levels. The USA is evaluating all options for continuing land- and ship-based research that would enable it to continue its predator–prey ecosystem-based research program. Dr Holt noted that the USA had submitted to CCAMLR the extensive time series of predator–prey data from the Antarctic Peninsula region (including Subarea 48.1) from research over the past 18 years, and is looking at all options to continue this in the future.

15.2 The US AMLR Program has developed long-term collaborations with Chile, Germany, the Republic of Korea and others, and Dr Holt advised that the closure of the program may adversely impact on these Members' research efforts.

15.3 The Scientific Committee expressed grave concern at the diminishing effort in CCAMLR-orientated research (paragraphs 13.24 to 13.34).

15.4 The Scientific Committee thanked the USA for establishing the US AMLR Research and Monitoring Program which was specifically developed and designed to assist CCAMLR in meeting its objectives in the Antarctic Peninsula region. This program has been integral to the development of population models for krill in the southwest Atlantic and in assisting with the planning and undertaking of the CCAMLR-2000 Survey, which led to a revision of the precautionary catch limits for krill in the region.

15.5 The US AMLR Program has provided fundamental data and expertise that underpinned the subdivision of this area into SSMUs. This program now provides a comprehensive time series for predator populations, krill and fish across all SSMUs in Subarea 48.1 for a long period with low fishing by comparison to the precautionary catch limits.

15.6 The Scientific Committee agreed that the likely termination of this field program, at a time when the krill fishery is expanding, is potentially a major problem because it will deprive CCAMLR of an opportunity to monitor the effects of fishing on krill and its predators in SSMUs. This question has been of paramount importance to CCAMLR, as indicated in its many reports and publications. The decision to initiate the US AMLR Program in Subarea 48.1 has placed CCAMLR in a unique position in being able to effectively implement an ecosystem-based management procedure.

15.7 The Scientific Committee could now face great difficulty in finding ways to maintain CCAMLR's progress for this region at a time that is most critical when, as the Scientific Committee also noted elsewhere in this report (paragraph 4.4 and Table 4), the krill fishery is rapidly expanding.

15.8 The Scientific Committee agreed that it is essential to maintain the US AMLR Program because:

(i) the program has annual observations over the long term in an ecosystem that can vary greatly from one year to another, and this time series overcomes the difficulties of many programs that cannot distinguish between interannual variation and long-term change;

(ii) the program provides a time series that can be used as a benchmark for determining in future whether the ecosystem is undergoing long-term change;

(iii) with continued annual monitoring, the attributes of this time series provide a unique capability for contributing to a feedback management procedure to achieve sustainable krill harvesting in SSMUs as well as at the larger scale in Area 48.

15.9 The Scientific Committee agreed that, if a decision was indeed taken to terminate the field program, at the very least, it was desirable to enable the US AMLR field operations to continue until such time as the management procedure for the krill fishery in Area 48 has been fully developed and a thorough understanding of the field requirements for the future management of the fishery is achieved.

Vanuatu-flagged vessels in the krill fishery

15.10 During the meeting, the Scientific Committee was informed that Vanuatu was considering deploying five 'super-trawlers' in the krill fishery in 2006/07 (CCAMLR-XXV/BG/46).

15.11 The Scientific Committee recalled that the Vanuatu-flagged vessel *Atlantic Navigator* had operated in the krill fishery in Area 48 in 2003/04 and 2004/05, and had been the first vessel to use the new continuous fishing system (SC-CAMLR-XXIV, paragraph 4.8 and Tables 2 and 3). However, there was no information on what type of operations these vessels would carry out.

15.12 The Scientific Committee also noted that the FV *Feolent*, mentioned in the limited information provided by Vanuatu, had fished for krill under the Ukrainian flag in 2004/05 (Annex 4, paragraph 3.1; WG-EMM-05/5).

15.13 The Scientific Committee noted that the information provided by Vanuatu was insufficient to determine whether this additional fishing effort and resulting catches could trigger the limit of 620 000 tonnes of krill agreed in Conservation Measure 51-01. However, it was noted that notifications for 2006/07 contained notifications with expected catch levels of 100 000 tonnes per vessel (Table 4).

15.14 The Scientific Committee recommended that the Commission seek assurance from Vanuatu, prior to fishing, that its vessels will comply with all conservation measures in force.

15.15 The Scientific Committee drew the Commission's attention to the potential increases in krill catches that had been notified to the meeting. If all these notifications proceed as planned, the krill fishery could escalate from its current low level to a level approaching the trigger level in Conservation Measure 51-01 in a single year. The possibility of such a rapid increase in the krill catch further emphasised the necessity of obtaining sufficient information from the current fishery to ensure future management needs. This would be particularly problematic if the fishery was concentrated in certain regions or subareas.

15.16 The Scientific Committee reiterated the importance of obtaining fishery and observer data from all vessels operating in the krill fishery.

Change to the Rules of Procedure

15.17 The Scientific Committee adopted the change in its Rules of Procedure which was proposed in SC-CAMLR-XXV/5. This change is consistent with that of the Commission agreed last year (CCAMLR-XXIV, paragraph 20.6), and is in accordance with the Scientific Committee's decision regarding extending invitations to observers to attend meetings of its working groups (SC-CAMLR-XXIV, paragraphs 13.45 to 13.57).

15.18 The Scientific Committee agreed to insert a new rule between current Rules 19 and 20. The new rule states that:

'Each observer invited in accordance with Rule 19 above shall notify the Executive Secretary as early as possible before any meeting of the name of its representative and before or at the beginning of the meeting the names of its experts and advisers'.

15.19 The Scientific Committee noted that this new rule will also apply to meetings of any subsidiary body of the Committee.

ADOPTION OF THE REPORT

16.1 The report of the Twenty-fifth meeting of the Scientific Committee was adopted.

CLOSE OF THE MEETING

17.1 In closing the meeting, Dr Fanta thanked the Secretariat staff for their dedicated support, the interpreters for facilitating the plenary discussions, the conveners of working groups, subgroups and other groups for developing the intersessional work of the Scientific Committee, and all participants for their efforts. These collective contributions had resulted in a productive and amicable meeting.

17.2 Dr Holt, on behalf on the Scientific Committee, thanked Dr Fanta for her leadership and kind patience. The Scientific Committee also congratulated Dr Fanta on her re-election to the Chair for a second term, and looked forward to the next meeting.

17.3 The meeting was closed.

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Table 1: Monthly catch (tonnes) of krill reported by Flag States fishing in Subareas 48.1, 48.2 and 48.3 in 2003/04 and 2004/05. Periods in which observer coverage occurred are shaded. Source: monthly catch and effort reports. GBR – UK; JPN – Japan, KOR – Republic of Korea; POL – Poland; RUS – Russia; UKR – Ukraine; USA – United States of America; VUT – Vanuatu.

Season	Area/ subarea	Month	Flag State							
			GBR	JPN	KOR	POL	RUS	UKR	USA	VUT
2003/04	48*	February		664						
		March		1490						
		April		6077						
		May		7209						
		June		7731						
		July		4574						
		August		5514						
		September		339						
	48.1	January								19
		February				738				174
		March			1608	410			11	4370
		May							641	22
		June							57	423
		October								90
		December								55
	48.2	January								258
		February								1
		March			1827	1689		3064	516	1107
		April			5400	1699		4723		5134
		May			2279	1408			1286	2933
		October								1472
	48.3	January	16							
		February			1728					
		April							2759	
		May			1740	129		1392		
		June			6228	1772		2975	1327	4094
		July			2777	1123	680		1780	4508
		August			935		95			6097
		September								499
2004/05	48*	March		3048						
		April		5377						
		May		3228						
		June		3150						
		July		4289						
		August		3586						
		September		187						
	48.1	February			142	196				
		March				240				
		May						387		
	48.2	January								700
		February			559	36				9250
		March			6112	1251		4290		7137
		April			8594	1068		4639		8451
		May			6448	786		1254	2160	5601
	48.3	May			354	57		1877		
		June			2024	701		5078		5897
		July			2687			2565		7062
		August						1052		4291

* Subarea not specified

Table 2: Catch (tonnes) of target species for the 2005/06 season (December 2005 to November 2006). Catches reported to date (5 October 2006) in the catch and effort reporting system, unless indicated otherwise.

	Species	Member country	Subarea or division														Total
			48.1	48.2	48.3	48.4	48.6	58.4.1	58.4.2	58.4.3a	58.4.3b	58.5.1	58.5.2	58.6	58.7	88.1	88.2	
Toothfish	*Dissostichus eleginoides*	Australia											1 825					1 825
		Chile			440													440
		EC – France[1]										3 045		641				3 686
		EC – Spain			373				0	88	0							461
		EC – UK			1 561	6												1 567
		Japan					74											74
		Korea, Republic of			225													225
		New Zealand			382	12										1		395
		Russia														0		0
		South Africa			304									7	41			352
		Uruguay			249													249
	Dissostichus mawsoni	Argentina														147	65	213
		Australia											0					0
		Chile						44	26		2							73
		EC – Spain						221	11	1	311							543
		EC – UK														315	94	409
		Japan					63											63
		Korea, Republic of						157	126									283
		New Zealand				0										1 342	57	1 399
		Norway														98	215	314
		Russia														673	33	706
		Uruguay						2			47					375		425
	Total (toothfish)		0	0	3 534	18	137	425	164	89	361	3 045	1 825	648	41	2 952	465	13 704
Icefish	*Champsocephalus gunnari*	Australia											659[2]					659
		Chile			1 189													1 189
		EC – UK			336													336
		Korea, Republic of			646													646
	Total (icefish)		0	0	2 171	0	0	0	0	0	0	0	659	0	0	0	0	2 830
Krill	*Euphausia superba*	EC – Malta	952	129														1 081
		EC – Poland	4 544		788													5 332
		EC – UK			0													0
		Japan	19 756		12 955													32 711
		Korea, Republic of	41 702	466														42 168
		Norway	7 612		1 158													8 770
		Ukraine	12 710	2 312														15 022
	Total (krill)		87 277	2 907	14 901	0	0	0	0	0	0	0	0	0	0	0	0	105 084

[1] 31 August 2006

[2] Reported by Australia at the time of adoption of the report.

Table 3: Catch (tonnes) of target species for the 2004/05 season (December 2004 to November 2005). Official record of catch provided by Members in STATLANT data.

	Species	Member Country	Subarea or division															Total
			48.1	48.2	48.3	48.4	48.6	58.4.1	58.4.2	58.4.3a	58.4.3b	58.5.1	58.5.2	58.6	58.7	88.1	88.2	88.3	
Toothfish	*Dissostichus eleginoides*	Australia								1			2 744						2 745
		Chile			738														738
		EC – France										5 065		558					5 623
		EC – Spain			372			0		90	1								463
		EC – UK			1 627	27													1 654
		Japan					49												49
		Korea, Republic of							1	9									10
		New Zealand						0	0							1	0	0	2
		Russia														5			5
		South Africa			303									79	142				524
		Uruguay														0			0
	Dissostichus mawsoni	Argentina														253			253
		Australia								0			0						0
		Chile						146	25		41								211
		EC – Spain						145	8	10	242								405
		EC – UK														260			260
		Korea, Republic of					2	167	54		13								237
		New Zealand						21	38							1 499	268	2	1 828
		Norway														207	4		210
		Russia														527	139		666
		Uruguay														367			367
	Total (toothfish)		0	0	3 039	27	51	480	127	110	297	5 065	2 744	637	142	3 120	411	2	16 250
Icefish	*Champsocephalus gunnari*	Australia											1 851						1 851
		Chile			1 513														1 513
		EC – UK			20														20
		Korea, Republic of			179														179
		Ukraine	0	1	0														1
	Total (icefish)		0	1	1 712	0	0	0	0	0	0	0	1 851	0	0	0	0	0	3 563
Krill	*Euphausia superba*	EC – Poland	436	3 140	759														4 335
		EC – UK			0														0
		Japan	6 090	5 187	11 516														22 793
		Korea, Republic of	142	21 713	5 065														26 920
		Ukraine	413	11 354	10 673														22 440
		USA	15	2 144															2 159
		Vanuatu		31 139	17 249														48 389
	Total (krill)		7 095	74 678	45 262	0	0	0	0	0	0	0	0	0	0	0	0	0	127 035

Table 4: Summary of notifications for the krill fishery in Area 48 in the 2006/07 season.

Member	Date of notification	Number of vessels	Expected level of catch (tonnes of krill)	Months during which fishing will proceed	Subareas where fishing will take place	Products to be derived from catch		Observers
						Type	% of catch	
Chile	24 October 2006	1	<4 000		48.1, 48.2	(research)		Yes
Japan	18 May 2006	1	30 000	January–September 2007	48.1, 48.2, 48.3	Raw (crude)	30	Yes
						Boiled	10	
						Peeled	20	
						Meal	40	
Korea, Republic of	11 July 2006	3	45 000	March–August 2007	48.1, 48.2, 48.3	Frozen whole round	69	No
						Meal	31	
Norway	12 June 2006	1	100 000	December 2006–November 2007	48.1, 48.2, 48.3, 48.4	Krill meal	95	Yes
						Oil	1	
						Other	4	
	24 October 2006	1	100 000	Late 2007 season	48.1, 48.2, 48.3, 48.4	*		
Poland	31 May 2006	1	14 400	January–November 2007	48.1, 48.2, 48.3	Fresh	51.4	Yes
						Boiled	7	
						Meat	20.8	
						Meal	20.8	
Russia	24 October 2006	2	25 000	May–November 2007	48.1, 48.2, 48.3, 48.4	Raw	60	Yes
						Meal	20	
						Meat	10	
						Technical Produce	10	
Ukraine	26 June 2006	3	50 000	February–November 2007	48.1, 48.2, 48.3	Canned meat	17.4	Yes
						Boiled frozen	24	
						Krill paste	16	
						Krill meal	42	
						Fresh frozen	0.6	
USA	24 October 2006	*	*	*	48			
Total		9	368 400		48.1, 48.2, 48.3, 48.4			

* To be announced

Table 5: Number of *Dissostichus* spp. tagged and released and the tagging rate (fish per tonne of green weight caught) reported by vessels operating in the exploratory fisheries for *Dissostichus* spp. in 2005/06. The majority of fish tagged and released were *D. mawsoni*, and the number of *D. eleginoides* tagged and released is indicated in brackets. Source: Fishery Reports.

Subarea or division	Flag State	Vessel name	*Dissostichus* spp. tagged and released			Reported catch of *Dissostichus* spp. (tonnes)
			Number of fish		Tagging rate	
48.6	Japan	*Shinsei Maru No. 3*	146	(144)	1.07	137
	Total		146	(144)		137
58.4.1	Chile	*Globalpesca I*	12		1.61	7
		Globalpesca II	23		0.62	37
	Korea, Republic of	*Insung No. 2*	182		1.16	157
	New Zealand	*San Aspiring*	1		*	0
	Spain	*Tronio*	249		1.13	221
	Uruguay	*Paloma V*	2	(1)	0.81	3
	Total		469	(1)		425
58.4.2	Chile	*Globalpesca I*	24	(1)	0.91	26
	Korea, Republic of	*Insung No. 2*	101		0.80	127
	Spain	*Galaecia*	11		1.03	11
	Total		136	(1)		164
58.4.3a	Spain	*Galaecia*	104		1.17	89
	Total		104			89
58.4.3b	Chile	*Globalpesca I*	0		0	2
	Spain	*Galaecia*	97	(2)	0.66	147
		Tronio	38		0.23	164
	Uruguay	*Paloma V*	40	(2)	0.85	47
	Total		175	(4)		361
88.1	Argentina	*Antartic II*	122		0.83	147
	New Zealand	*Avro Chieftain*	266		1.05	254
		Janas	283	(1)	1.05	271
		San Aotea II	512	(2)	1.30	393
		San Aspiring	437		1.03	426
	Norway	*Frøyanes*	121		1.23	98
	Russia	*Volna*	250		0.76	329
		Yantar	246		0.71	344
	UK	*Argos Georgia*	50		1.14	44
		Argos Helena	275	(4)	1.02	271
	Uruguay	*Paloma V*	142	(16)	1.33	107
		Punta Ballena	211		1.04	202
		Viking Sur	62		0.94	66
	Total		2977	(23)		2952
88.2	Argentina	*Antartic II*	16		0.24	65
	New Zealand	*Janas*	64		1.13	57
	Norway	*Frøyanes*	196	(2)	0.91	215
	Russia	*Volna*	0		0	4
		Yantar	0		0	29
	UK	*Argos Georgia*	76		1.86	41
		Argos Helena	92	(1)	1.72	54
	Total		444	(3)		465

* One fish tagged, no weight reported

Table 6: Scientific Committee budget for 2007 and forecast budget for 2008. * The notes refer to the items described in paragraph 10.1.

2006 Budget A$	Item	2007 Budget A$	2008 Forecast A$	Notes*
	Working Group on Fish Stock Assessment (WG-FSA)			
5 400	Computing facilities	5 500	5 700	
29 100	Preparation and secretarial support	30 000	31 000	
80 200	Report completion and translation	80 400	83 600	
114 700		115 900	120 300	a
	Working Group on Stock Assessment Methods (WG-SAM)			
3 700	Preparation and Secretariat support	3 800	3 900	
	Report completion and translation	20 000	20 000	
3 700		23 800	23 900	b
	Working Group on Ecosystem Monitoring and Management (WG-EMM)			
24 800	Preparation and Secretariat support	25 500	26 300	
37 400	Report completion and translation	38 500	40 000	
62 200		64 000	66 300	c
	Other expenses for Scientific Committee program			
52 700	WG-EMM meeting (airfares, subsistence, freight)	42 600	56 000	c
12 000	External experts invited to meetings	12 500	13 000	d
7 500	SG-ASAM report (translation and publication)	7 500	7 800	e
4 000	Bioregionalisation workshop	26 000	0	f
	International Fishery Observer Conference	12 500	0	g
	CCAMLR-IWC Workshop – organisation	10 000	88 500	h
	CCAMLR-IWC Workshop – report		20 000	h
	SG-ASAM meeting	6 000	0	i
	International Polar Year	2 000	0	j
	Land-based predator workshop		6 000	k
1 200	**Contingency**	1 200	1 200	
A$ 258 000		A$ 311 500	A$ 403 000	

Table 7: Summary of major database and analytical tasks conducted by the Data Management Team in 2005/06.

Regular administration and maintenance of the database-management system to ensure that the databases are operating efficiently and that the data security measures are functioning to the specifications required to maintain data integrity and confidentiality.
Processing and validation of CEMP data and updating of CEMP indices (WG-EMM-06/4).
Processing and validation of fishery and scientific observer data, including data from the fishery in the South African EEZ around Prince Edward and Marion Islands (Subareas 58.6 and 58.7 and Area 51) and data from the French EEZs in Division 58.5.1 (Kerguelen Islands) and Subarea 58.6 (Crozet Island).
Revision of data forms used for reporting scientific observer data, fine-scale data and catch and effort reports (see www.ccamlr.org/pu/e/sc/fish/forms.htm and www.ccamlr.org/pu/e/sc/obs/logbooks.htm).
Development of a manual on the procedures for the extraction and mathematical manipulation of data used by WG-FSA.
Initial validation of assessments involving CASAL, immediately prior to WG-FSA, using the input parameter files and associated papers submitted to WG-FSA.
Work to extend the time series of catch-weighted length frequencies for *D. eleginoides* in Subarea 48.3 (WG-FSA-06/4).
Estimation of γ and the precautionary catch limit for krill in Division 58.4.2 (SC-CAMLR-XXV/8).

ANNEX 1

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SC-CAMLR-XXV/2	Provisional Annotated Agenda for the Twenty-fifth Meeting of the Scientific Committee for the Conservation of Antarctic Marine Living Resources
SC-CAMLR-XXV/3	Report of the meeting of the Working Group on Ecosystem Monitoring and Management (Namibia, 17 to 28 July 2006)
SC-CAMLR-XXV/4	Report of the Working Group on Fish Stock Assessment (Hobart, Australia, 9 to 20 October 2006)
SC-CAMLR-XXV/5	Proposed changes to Scientific Committee Rules of Procedure Secretariat
SC-CAMLR-XXV/6	CCAMLR-IWC Workshop on Antarctic Ecosystem Model Inputs (SC-CAMLR Steering Committee for the CCAMLR-IWC Workshop)
SC-CAMLR-XXV/7	Summary report Experts Workshop on Bioregionalisation of the Southern Ocean (Hobart, Australia, 4 to 8 September 2006) (Australia, Japan, New Zealand, United Kingdom, United States)
SC-CAMLR-XXV/8	Estimation of gamma (γ) for krill in Division 58.4.2 Secretariat

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SC-CAMLR-XXV/BG/1 Rev. 2	Catches in the Convention Area in the 2004/05 and 2005/06 seasons Secretariat
SC-CAMLR-XXV/BG/2	Report of the Second Meeting of the Subgroup on Acoustic Survey and Analysis Methods (Hobart, Australia, 23 and 24 March 2006)
SC-CAMLR-XXV/BG/3	Data Management report on activities during 2005/06 Secretariat

SC-CAMLR-XXV/BG/4	Report on the intersessional meeting of the Coordinating Working Party on Fisheries Statistics (CWP) Secretariat
SC-CAMLR-XXV/BG/5 Rev. 1	Convener's progress report on intersessional activities of the Subgroup for the Implementation of the CCAMLR 2008 IPY Survey V. Siegel (Convener, Steering Group 'CCAMLR 2008 IPY Survey')
SC-CAMLR-XXV/BG/6	Observer's Report from the 58th Meeting of the Scientific Committee of the International Whaling Commission (St Kitts, 26 May to 6 June 2006) CCAMLR Observer (K.-H. Kock, Germany)
SC-CAMLR-XXV/BG/7	Report of the Convener of WG-EMM-06 to SC-CAMLR-XXV
SC-CAMLR-XXV/BG/8	Synopses of papers submitted to WG-EMM-06 Secretariat
SC-CAMLR-XXV/BG/9	Review of CCAMLR activities on monitoring marine debris in the Convention Area Secretariat
SC-CAMLR-XXV/BG/10	Summary of scientific observation programs undertaken during the 2005/06 season Secretariat
SC-CAMLR-XXV/BG/11	Fishing equipment, marine debris and hydrocarbon soiling associated with seabirds at Bird Island, South Georgia, 2005/06 Delegation of the United Kingdom
SC-CAMLR-XXV/BG/12	Beach debris survey – Main Bay, Bird Island, South Georgia 2004/05 Delegation of the United Kingdom
SC-CAMLR-XXV/BG/13	Entanglement of Antarctic fur seals (*Arctocephalus gazella*) by man made debris at Bird Island, South Georgia during the 2005 winter and 2005/06 breeding season Delegation of the United Kingdom
SC-CAMLR-XXV/BG/14	Beach debris survey, Signy Island, South Orkney Islands 2005/06 Delegation of the United Kingdom

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SC-CAMLR-XXV/BG/16	Proposal for recording fine-scale data from vessels using the continuous fishing system in the krill fishery Secretariat
SC-CAMLR-XXV/BG/17	Évaluation de la biomasse et campagne de marquage Délégation française
SC-CAMLR-XXV/BG/18	To the question for bioregionalisation of the Antarctic waters with ecosystem approach Delegation of Russia
SC-CAMLR-XXV/BG/19	Potential for the achievement of marine protected area objectives using CCAMLR conservation measures Delegation of the United Kingdom
SC-CAMLR-XXV/BG/20	Educational observer on board fishing vessels in Brazil Delegation of Brazil
SC-CAMLR-XXV/BG/21	Non-native Species in the Antarctic: Report of a Workshop Delegation of New Zealand
SC-CAMLR-XXV/BG/22	Calendar of meetings of relevance to the Scientific Committee in 2006/07 Secretariat
SC-CAMLR-XXV/BG/23	Directions followed by the French fishing companies involved in the toothfish fishery of the French EEZ, in order to minimise the incidental mortality of birds Delegation of France (available in English and French)
SC-CAMLR-XXV/BG/24	Update from the Bioregionalisation Workshop Steering Committee on progress towards the 2007 Workshop on Bioregionalisation Submitted by the Steering Committee for the CCAMLR Bioregionalisation Workshop
SC-CAMLR-XXV/BG/25	Vacant
SC-CAMLR-XXV/BG/26	IMAF risk assessment of fisheries by Statistical Area Ad Hoc Working Group on Incidental Mortality Associated with Fishing (WG-IMAF)

SC-CAMLR-XXV/BG/27	Incidental mortality of seabirds during unregulated longline fishing in the Convention Area Ad Hoc Working Group on Incidental Mortality Associated with Fishing (WG-IMAF)
SC-CAMLR-XXV/BG/28	Intersessional work plan for Ad Hoc WG-IMAF for 2006/07 Ad Hoc Working Group on Incidental Mortality Associated with Fishing (WG-IMAF)
SC-CAMLR-XXV/BG/29	Ad Hoc WG-IMAF Convener's summary for the Scientific Committee 2006
SC-CAMLR-XXV/BG/30	Report of the Convener of WG-FSA to SC-CAMLR-XXV, October 2006
SC-CAMLR-XXV/BG/31	Observer report on Second Meeting of Advisory Committee of the Agreement on the Conservation of Albatrosses and Petrels – ACAP (Brasilia, Brazil, 5 to 8 June 2006) CCAMLR Observer (Brazil)

Other documents

WG-FSA-06/20	*Saga Sea* krill harvesting and production T. Williksen (Norway)
WG-FSA-06/23	On possible impact of new continuous krill fishing technology on juvenile fish and larvae S.M. Kasatkina
WG-FSA-06/57	Analysis of krill catch data from continuous and conventional trawls by the *Saga Sea* and *Atlantic Navigator* D.J. Agnew, A. Payne, J. Hooper and J. Roe (United Kingdom)
WG-EMM-06/7	By-catch of small fish in a sub-Antarctic krill fishery K.A. Ross, L. Jones, M. Belchier and P. Rothery (United Kingdom)

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CCAMLR-XXV/1	Provisional Agenda for the Twenty-fifth Meeting of the Commission for the Conservation of Antarctic Marine Living Resources

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CCAMLR-XXV/4 Rev. 1	Review of the 2006 budget, draft 2007 budget and forecast budget for 2008 Executive Secretary
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CCAMLR-XXV/6	CCAMLR's contribution to FIRMS (Fishery Resource Monitoring System) Secretariat
CCAMLR-XXV/7	Report of the Meeting of the Joint Assessment Group (Walvis Bay, Namibia, 17 to 19 July 2006)
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CCAMLR-XXV/10	General environmental protection during fishing Secretariat
CCAMLR-XXV/11	CCAMLR-25 Year Celebratory Statement Secretariat
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CCAMLR-XXV/12	Executive Secretary's Authority Secretariat
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CCAMLR-XXV/14	Late payments of Member contributions Secretariat
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CCAMLR-XXV/16	Summary of notifications for new and exploratory fisheries in 2006/07 Secretariat
CCAMLR-XXV/16 CCAMLR-XXV/22 CORRIGENDUM	Withdrawal of exploratory fishery notification for New Zealand vessel, *Janas*, in Division 58.4.1 during the 2006/07 season Secretariat
CCAMLR-XXV/17	Notifications of Argentina's intention to conduct exploratory longline fisheries for *Dissostichus* spp. in 2006/07 Delegation of Argentina
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CCAMLR-XXV/31	Draft policy on the publication of aggregated fine-scale catch and effort data Secretariat
CCAMLR-XXV/32	Proposal for revising Conservation Measure 41-04 (2005) – Limits on the Exploratory Fishery for *Dissostichus* spp. in Statistical Subarea 48.6 in the 2005/06 Season Delegation of Japan
CCAMLR-XXV/33	CCAMLR and the CCSBT Secretariat
CCAMLR-XXV/34	CDS Fund Panel proposal Secretariat

CCAMLR-XXV/35	An upsurge in directed fishing for or by-catch of sharks in the Convention Area – draft conservation measure for the conservation of sharks catches associated with fisheries managed by CCAMLR Delegation of France
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CCAMLR-XXV/37	Evaluation of compliance with conservation measures: identification of key compliance elements Secretariat
CCAMLR-XXV/38	Implementation of Conservation Measures 10-06 and 10-07: Provisional Lists of IUU vessels, 2006 Secretariat
CCAMLR-XXV/39	Fishery management plans: a tool to strengthen CCAMLR's fisheries management regime Delegation of New Zealand
CCAMLR-XXV/40	A proposal that CCAMLR adopt and implement a cooperation enhancement program Delegation of Australia
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CCAMLR-XXV/44	A draft conservation measure on combatting illegal, unreported and unregulated fishing in the Convention Area by the vessels of non-Contracting parties Delegation of Australia
CCAMLR-XXV/45	A proposal to adopt a conservation measure seeking an interim prohibition on deep sea gillnet fishing in the Convention Area Delegation of Australia

CCAMLR-XXV/46	Report of the Standing Committee on Administration and Finance (SCAF)
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CCAMLR-XXV/BG/3 CORRIGENDUM	Implementation of fishery conservation measures in 2005/06 Secretariat
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CCAMLR-XXV/BG/5	Withdrawn
CCAMLR-XXV/BG/6	Report of the Conference on Marine Biodiversity, Fisheries Management and Marine Protected Areas (MPAs) (European Parliament, Brussels, 10 November 2005) CCAMLR Observer (European Community)
CCAMLR-XXV/BG/7	Report of First International Meeting on Establishment of a South Pacific Regional Fisheries Management Organisation (Wellington, New Zealand, 14 to 17 February 2006) Executive Secretary
CCAMLR-XXV/BG/8	Report of the CCAMLR Observer to ATCM-XXIX (Edinburgh, Scotland, 12 to 23 June 2006) Executive Secretary
CCAMLR-XXV/BG/9 Rev. 1	Implementation of the System of Inspection and other CCAMLR enforcement provisions in 2005/06 Secretariat

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CCAMLR-XXV/BG/16	Conserving pattern and process in the Southern Ocean: designing a marine protected area for the Prince Edward Islands Delegation of South Africa
CCAMLR-XXV/BG/17	Scientific observation on krill fishing vessels: proposal to amend Conservation Measures 51-01, 51-02 and 51-03 Delegation of Ukraine (available in English and Russian)
CCAMLR-XXV/BG/18	Area-based conservation and management measures utilised under CCAMLR Submitted by IUCN
CCAMLR-XXV/BG/19	Report on the Third Meeting of the FIRMS Steering Committee Secretariat
CCAMLR-XXV/BG/20	Point de situation faisant suite au travail intersessionnel sur l'E-CDS Délégation française
CCAMLR-XXV/BG/21	Assessment of IUU fishing in the French waters bordering Kerguelen and Crozet Islands for season 2005/06 (1 July 2005 to 30 June 2006) General information concerning CCAMLR Area 58 Delegation of France (available in English and French)

CCAMLR-XXV/BG/22	Report on the activities of the Scientific Committee on Antarctic Research (SCAR) 2005/06 SCAR Observer to CCAMLR (G. Hosie, Australia)
CCAMLR-XXV/BG/23	SCAR Report on Marine Acoustics and the Southern Ocean Submitted by SCAR
CCAMLR-XXV/BG/24	Report of the CCAMLR Observer to the Seventh meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea (UNICPOLOS) (12 to 16 June 2006, United Nations Headquarters, New York, United States) CCAMLR Observer (Australia)
CCAMLR-XXV/BG/25	Report on the transfer of a crew member from the vessel *Globalpesca I* during exploratory fishing in the area of CCAMLR Delegation of Chile (available in English and Spanish)
CCAMLR-XXV/BG/26	Ecosystem management of Antarctic krill in the south Atlantic – uncertainties and priorities Submitted by ASOC
CCAMLR-XXV/BG/27	Improving monitoring and control of the krill fishery Submitted by ASOC
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CCAMLR-XXV/BG/30	Achieving a network of marine protected areas in the CCAMLR Area Submitted by ASOC
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CCAMLR-XXV/BG/32	Heard Island and McDonald Islands Exclusive Economic Zone – 2005/06 IUU catch estimate for Patagonian toothfish Delegation of Australia

CCAMLR-XXV/BG/33	Bottom trawl fishing and destructive fishing practices within the CCAMLR Convention Area Delegation of the USA
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CCAMLR-XXV/BG/38	IUU catch in the Convention Area by the *Taruman* during 2004/05 season Delegation of Australia
CCAMLR-XXV/BG/39	Meeting of the Joint Assessment Group (17 to 19 July 2006) Comments of DG FISH Delegation of the European Community
CCAMLR-XXV/BG/40	Report on the 9th Meeting of the Committee for Environmental Protection (CEP IX) (Edinburgh, Scotland, 12 to 16 June 2006) Chair of the CCAMLR Scientific Committee
CCAMLR-XXV/BG/41	FAO Observer's Report FAO Observer (R. Shotton)
CCAMLR-XXV/BG/42	Report of the CCAMLR Observer to Sharing the Fish – Allocation Issues in Fisheries Management 2006 Conference (Fremantle, Australia, 26 February to 2 March 2006) CCAMLR Observer (Australia)
CCAMLR-XXV/BG/43	CCAMLR Observer's Report from the 13th Annual Meeting of CCSBT CCAMLR Observer (Japan)

CCAMLR-XXV/BG/44	Report on port inspections of vessels on IUU list Delegation of South Africa
CCAMLR-XXV/BG/45	Observer's Report on the 3rd Annual Meeting of the South East Atlantic Fisheries Organisation (SEAFO) CCAMLR Observer (Namibia)
CCAMLR-XXV/BG/46	Recent correspondence received from Vanuatu Secretariat
CCAMLR-XXV/BG/47	Report of Scientific Committee Chair to the Commission
CCAMLR-XXV/BG/48 Rev. 1	New and revised conservation measures recommended by SCIC for adoption by the Commission
CCAMLR-XXV/BG/49 Rev. 1	Proposals for new and revised measures submitted by SCIC to the Commission for further consideration
CCAMLR-XXV/BG/50	Summary advice of SCIC to the Commission
CCAMLR-XXV/BG/51	Information on five Vanuatu-flagged vessels Secretariat
CCAMLR-XXV/BG/52	Correspondence received from the Government of the Republic of Vanuatu Secretariat
CCAMLR-XXV/BG/52 ADDENDUM	Correspondence received from the Government of the Republic of Vanuatu Secretariat
CCAMLR-XXV/BG/53	Rapport concernant les activités du Comité des pêcheries de l'Organisation de coopération et de développement économiques (OCDE) Délégation française

ANNEX 3

AGENDA FOR THE TWENTY-FIFTH MEETING OF THE SCIENTIFIC COMMITTEE

AGENDA FOR THE TWENTY-FIFTH MEETING OF THE SCIENTIFIC COMMITTEE

1. Opening of the meeting
   - (i) Adoption of the agenda
   - (ii) Report of the Chair
   - (iii) Preparation of advice to SCAF and SCIC

2. CCAMLR Scheme of International Scientific Observation
   - (i) Scientific observations conducted in 2005/06
   - (ii) Review of the Scientific Observation Program
   - (iii) Advice to the Commission

3. Ecosystem monitoring and management
   - (i) Advice from WG-EMM
   - (ii) Management of protected areas
   - (iii) Interactions between WG-EMM and WG-FSA(iv) Advice to the Commission

4. Harvested species

   - (i) Krill resources
     - (a) Status and trends
     - (b) Advice from WG-EMM
     - (c) Advice to the Commission

   - (ii) Fish resources
     - (a) Status and trends
     - (b) Target species
     - (c) Advice from WG-FSA
     - (d) Advice to the Commission

   - (iii) New and exploratory fisheries
     - (a) New and exploratory fisheries in the 2005/06 season
     - (b) Notifications for new and exploratory fisheries in the 2006/07 season
     - (c) Revision of boundaries
     - (d) Advice to the Commission

   - (iv) Crab resources
     - (a) Status and trends
     - (b) Advice from WG-FSA
     - (c) Advice to the Commission

   - (v) Squid resources
     - (a) Status and trends
     - (b) Advice from WG-FSA
     - (c) Advice to the Commission

(vi) Fish and invertebrate by-catch
  (a) Status and trends
  (b) Advice from WG-FSA
  (c) Advice to the Commission

5. Incidental mortality
  (i) Incidental mortality of seabirds and marine mammals arising from fisheries
  (ii) Advice to the Commission

6. Additional monitoring and management issues
  (i) Marine debris
  (ii) Marine mammal and bird populations
  (iii) Advice to the Commission

7. Management under conditions of uncertainty about stock size and sustainable yield

8. Scientific research exemption

9. Cooperation with other organisations
  (i) Cooperation with the Antarctic Treaty System
  (ii) Reports of observers from other international organisations
  (iii) Reports of representatives at meetings of other international organisations
  (iv) Future cooperation

10. Budget for 2007 and forecast budget for 2008

11. Advice to SCIC and SCAF

12. Secretariat supported activities
  (i) Data management
  (ii) Publications

13. Scientific Committee activities
  (i) Reorganisation of the work of the Scientific Committee and its working groups
  (ii) Intersessional activities during 2006/07
  (iii) Third meeting of SG-ASAM
  (iv) JAG
  (v) CCAMLR-IPY projects
  (vi) Joint CCAMLR-IWC workshop
  (vii) Invitation of observers to the next meeting
  (viii) Invitation of experts to the meetings of working groups
  (ix) Next meeting

14. Election of the Chair and Vice-Chair of the Scientific Committee

15. Other business

16. Adoption of the Report of the Twenty-fifth Meeting of the Scientific Committee

17. Close of the meeting.

ANNEX 4

REPORT OF THE WORKING GROUP ON ECOSYSTEM MONITORING AND MANAGEMENT

(Walvis Bay, Namibia, 17 to 28 July 2006)

CONTENTS

REPORT OF THE WORKING GROUP ON ECOSYSTEM MONITORING AND MANAGEMENT

(Walvis Bay, Namibia, 17 to 28 July 2006)

INTRODUCTION

Opening of the meeting

1.1 The twelfth meeting of WG-EMM was held at the Pelican Bay Hotel, Walvis Bay, Namibia, from 17 to 28 July 2006. The meeting was convened by Dr K. Reid (UK).

1.2 The meeting was opened by the Hon. Minister of Fisheries and Marine Resources, Dr A. Iyambo, who welcomed participants and outlined the fisheries management and environmental challenges which Namibia shares with CCAMLR. These challenges include the development and implementation of ecosystem-based management, consideration of natural and anthropogenic changes, the conservation of living resources and the sustainability of fishery resources. Namibia became a Member of CCAMLR in 2001.

1.3 Dr Reid thanked the Hon. Minister and his team at the Ministry of Fisheries and Marine Resources for their warm hospitality and for hosting the meeting.

1.4 Dr Reid extended his welcome to the participants, and outlined the program of work for the meeting. This work included:

- the Second Workshop on Management Procedures to Evaluate Options for Subdividing the Krill Catch Limit among Small-scale Management Units (SSMU) during the first week of the meeting (Section 2 and Appendix D);
- discussion of the core business of the Working Group during the second week of the meeting.

1.5 The Working Group observed the passing of Dr Geoff Kirkwood, colleague and long-serving participant of CCAMLR. It recognised that its work had greatly benefited from Dr Kirkwood's intellect and scientific contributions, and he would be greatly missed.

Adoption of the agenda and organisation of the meeting

1.6 The provisional agenda was discussed and the Working Group agreed to include consideration of the reorganisation of the work of the Scientific Committee under 'Other Business' (Item 7). The adopted agenda is in Appendix A.

1.7 The meeting participants are listed in Appendix B. The documents submitted to the meeting are listed in Appendix C.

1.8 The report was prepared by Drs D. Agnew (UK), A. Constable (Australia), R. Holt (USA), Mr J. Hinke (USA), Drs S. Kawaguchi (Australia), S. Nicol (Australia), M. Pinkerton (New Zealand), D. Ramm (Data Manager), K. Reid (Convener), C. Reiss (USA), V. Siegel (Germany), W. Trivelpiece (USA), G. Watters (USA) and P. Wilson (New Zealand).

SECOND WORKSHOP ON MANAGEMENT PROCEDURES

2.1 The Second Workshop on Management Procedures to Evaluate Options for Subdividing the Krill Catch Limit among Small-scale Management Units, referred to hereafter as the Second Workshop on Management Procedures, was held at the Pelican Bay Hotel, Walvis Bay, Namibia, from 14 to 21 July 2006. The report of the workshop appears in Appendix D of this report.

2.2 The Working Group agreed that there had been a considerable amount of work done since WG-EMM-05 to develop models (KPFM2, EPOC and SMOM), and to build parameter sets (WG-EMM-06/30 Rev. 1) on which the provision of advice could be based. The Working Group noted that the workshop had focused on the output of KPFM2, and also explored structural uncertainty about allocation options using both KPFM2 and SMOM.

2.3 In simulation trials conducted using KPFM2 it is apparent that, should the fishery occur entirely in Subarea 48.1 and catch an amount of Antarctic krill (*Euphausia superba*) equivalent to 9% of B_0, then there will be considerable negative impacts on the ecosystem in that region and, under the assumptions of flux, there would also be negative consequences for the downstream SSMUs in Subareas 48.2 and 48.3 (paragraph 5.23).

2.4 Simulation trials using both KPFM2 and SMOM indicate that Fishing Option 1 would have relatively greater negative impacts on the ecosystem compared to the other fishing options (paragraph 5.43).

2.5 The Working Group agreed that even when KPFM2 and SMOM were used to integrate uncertainties, differences in the consequences of the different fishing options were still evident. The Working Group also agreed that further evaluation of Fishing Options 2 to 4 (paragraph 5.43) will require additional work on the development and interpretation of performance measures.

2.6 The Working Group also agreed that all simulations indicated that the performance of Fishing Options 2 to 4 would be improved when monitoring data are used to update the allocation of catches among SSMUs, i.e. in a manner analogous to Fishing Option 5 (paragraph 5.43).

2.7 The Working Group noted that EPOC was used as a tool to explore the potential variability in the productivity of krill between SSMUs and across Area 48 based on an empirical model of primary production using ice, sea-surface temperature and chlorophyll data from satellites (WG-EMM-06/38 Rev. 1). The Working Group agreed that the fits to existing data for the Antarctic Peninsula are promising and noted the workshop discussion on how these results could inform decisions on the metapopulation structure of krill (Appendix D, paragraphs 6.1 and 6.2) and encouraged future work to tune the EPOC models to data and to provide important parameters for existing models.

2.8 The Working Group encouraged future work to further develop the adaptive management framework in SMOM.

2.9 The Working Group recognised the considerable work in the development of KPFM2 to date and encouraged the authors to continue that development particularly in relation to evaluation of feedback management procedures and conditioning to data.

2.10 The Working Group encouraged the development of an agreed set of aggregate performance measures which are comprehensive, reliable, and cover the range of information outlined in paragraph 2.12 of Appendix D.

2.11 The Working Group recognised that it will be important for future modelling frameworks to capture some of the dynamics of the fishery. For example, how fishing masters make decisions about where they fish and when. Factors such as the abundance, condition, location and colour of krill, ice conditions and fishing experience are important considerations in targeted fishing and might affect model outputs.

STATUS AND TRENDS IN THE KRILL FISHERY

Fishing activity

Season 2004/05

3.1 Dr Ramm advised that the total catch of krill reported from the fishery in Area 48 in the 2004/05 season was 127 035 tonnes (WG-EMM-06/5). Vanuatu reported the largest catch of krill with a total of 48 389 tonnes. The Republic of Korea, Japan and Ukraine also reported large catches (26 920, 22 793 and 22 440 tonnes respectively). Poland and the USA reported catches of 4 335 and 2 159 tonnes respectively.

3.2 The Working Group noted that the Vanuatu-flagged vessel had used a conventional trawl and an unconventional continuous pumping system for catching krill, and ceased operating at the end of the season.

3.3 The Working Group noted that, with the exception of the Republic of Korea, all Contracting Parties fishing for krill in the 2004/05 season had submitted fine-scale data. Korea had advised that the fine-scale data for 2004/05 were on board the fishing vessels, and that these data would be submitted as soon as the vessels returned to port.

3.4 The Working Group expressed its appreciation to Japan for resubmitting the entire time series of catch and effort data from the Japanese fleet on a haul-by-haul basis. As a result of this submission, a substantial amount of the fine-scale data from the krill fishery is now available from the CCAMLR database on a haul-by-haul basis (WG-EMM-06/5, Table 7).

3.5 The Working Group requested that the Secretariat liaise with Members to ascertain whether or not haul-by-haul catch and effort data were available for seasons where aggregated data had been submitted in past seasons.

3.6 The Working Group noted the new format used to map the geographic distribution of catches of krill based on fine-scale data (WG-EMM-06/5, Figure 1). Dr Ramm reported that this format had been developed following a request by the Scientific Committee for the Secretariat to draft a policy governing the presentation and publication of aggregated fine-scale data (CCAMLR-XXIV, paragraph 4.62). This policy would be discussed by the Scientific Committee at its next meeting.

3.7 The Working Group agreed that the maps provided useful information on the krill fishery, and reaffirmed that the use of such maps is subject to the 'Rules for Access and Use of CCAMLR Data' and further consideration of the draft policy on the presentation and publication of aggregated fine-scale data.

Current season (2005/06)

3.8 Dr Ramm reported that so far this season (2005/06) seven vessels had harvested krill and had reported a catch of 64 415 tonnes, caught mostly in Subarea 48.1 (61 508 tonnes) between March and May (WG-EMM-06/5). The Republic of Korea had reported the largest catch (27 875 tonnes), followed by Japan (18 503 tonnes), Ukraine (15 022 tonnes), Poland (1 635 tonnes), Malta (1 081 tonnes) and Norway (298 tonnes).

3.9 The Working Group noted that the vessel *Dalmor III* had begun its fishing campaign under the Maltese flag, and was subsequently re-flagged to Poland.

3.10 Based on the catch of krill reported so far this season to the end of May, and the equivalent catch reported to the end of May last season, the preliminary estimate of total catch for the 2005/06 season was approximately 97 090 tonnes. The Working Group noted that this estimate is based on catches taken over a five-month period.

3.11 The Working Group noted that the Norwegian-flagged vessel *Saga Sea* was fishing with a conventional trawl and an unconventional continuous pumping system. The vessel began fishing in Subarea 48.1 in June 2006, and had reported a catch of 298 tonnes to the Secretariat by 29 June (WG-EMM-06/5). The vessel was collecting fine-scale catch and effort data in accordance with a new trial procedure which had been developed in consultation with Norwegian and UK scientists and the Secretariat (see also paragraph 3.27).

Notifications for 2006/07

3.12 The Working Group reviewed the notifications of Members' intentions to fish for krill in the forthcoming season (WG-EMM-06/6 Rev.1). Five Members had notified their intention to fish in 2006/07 using nine vessels in Subareas 48.1, 48.2, 48.3 and 48.4. The expected total catch of krill notified by Members was 239 000 tonnes.

3.13 The Working Group noted that the expected catches notified by Members varied widely (WG-EMM-06/6 Rev. 1), ranging from 14 400 to 100 000 tonnes per vessel. In particular, the Working Group noted that the highest expected catch was notified by Norway and that some of this catch may be taken using the new pumping system (see also paragraphs 3.25 to 3.33 and 3.51 to 3.58).

3.14 The Working Group noted that Members had advised of their maximum expected catch. In previous seasons, the expected catch notified overestimated the actual catch taken (e.g. in 2004/05, the expected catch notified was 226 000 tonnes and the reported catch was 127 035 tonnes (see SC-CAMLR-XXIII, Annex 4, paragraph 3.4; WG-EMM-06/5)).

Deployment of scientific observers

3.15 The Secretariat had received two notifications for the placement of CCAMLR scientific observers on krill fishing vessels in Area 48 in 2005/06 (one national scientific observer on the Ukrainian-flagged vessel *Konstruktor Koshkin* and one international scientific observer (UK) on the Norwegian-flagged vessel *Saga Sea*).

3.16Eight scientific observer datasets were submitted for the 2004/05 season. These data were collected by CCAMLR scientific observers on board the vessels *Niitaka Maru* (Japan), *InSung Ho* (Republic of Korea), *Foros* (Ukraine), *Feolent* (Ukraine), *Top Ocean* (USA) and *Atlantic Navigator* (Vanuatu).

3.17 At present, the CCAMLR database holds scientific observer data from 28 trips/deployments between 1999/2000 and 2004/05 in Subareas 48.1, 48.2 and 48.3 (WG-EMM-06/5, Appendix 1).

3.18 The Working Group noted that the report from the Uruguayan scientific observer deployed on the *Atlantic Navigator* in 2005 had not been submitted to the Secretariat. However, it recalled that a descriptive analysis of the data collected by the observer had been submitted as WG-EMM-05/12 at last year's meeting (SC-CAMLR-XXIV, Annex 4, paragraph 3.29).

By-catch of fish and invertebrates

3.19 The Working Group noted that CCAMLR scientific observers had observed by-catch in 9.6% (4 511 tows) of the total number of tows conducted in the krill fishery in Area 48 between 1999/2000 and 2004/05 (WG-EMM-06/5). By-catch observations were made in Subarea 48.1 in the 2000/01 and 2004/05 seasons, Subarea 48.2 in 2004/05 and Subarea 48.3 in 2001/02, 2003/04 and 2004/05. These data indicated that the by-catch of fish in the krill fishery represented approximately 0.01% of the total catch of krill by weight, but the Working Group noted discussion in paragraphs 3.34 to 3.36.

By-catch of birds and mammals

3.20 The Working Group noted that the data submitted to CCAMLR for the 2004/05 season indicated that one Cape petrel (*Daption capense*) had been killed after becoming entangled in the mesh of a seal excluder panel, and one southern fulmar (*Fulmarus glacialoides*) had been released uninjured after becoming caught on a cable splice. A total of 21 fatalities of Antarctic fur seal (*Arctocephalus gazella*) was observed and 72 fur seals were caught and released alive.

3.21 Dr Ramm also reported that a total of 229 fur seals had been observed to have been killed accidentally in the krill fishery in Area 48 up to 2003/04. Another two seals (species unknown) were reported killed in 2003/04. There were no observations or reports of incidental catches in the krill fishery between 1999/2000 and 2002/03 (WG-EMM-06/5).

3.22 The Working Group noted that the number of seal fatalities in 2003/04 and 2004/05 which had been reported to the meeting last year (SC-CAMLR-XXIV, Annex 4, paragraphs 3.14 and 3.16) had been revised by the Secretariat following data correction and validation.

3.23 The Working Group also noted that the information on incidental catches in the krill fishery is transmitted annually to ad hoc WG-IMAF by the Secretariat.

Ecosystem implications

3.24 The Working Group noted the time series of preliminary estimates of the FPI which had been updated by the Secretariat (WG-EMM-06/5). The limitations of this index were briefly discussed, and the Working Group agreed that further work was required to develop indices of fishery–predator overlap which may provide inputs to ecosystem models (paragraphs 6.12 and 6.13).

Description of the fishery

3.25 WG-EMM-06/18 outlined the trawling methods, and sampling and data recording protocols developed for the *Saga Sea*. The protocols had been developed at the request of the Scientific Committee which had agreed that the fishery using the new pumping system would not be considered as a 'new and exploratory fishery' if adequate information on this operation was collected and submitted to CCAMLR (SC-CAMLR-XXIV, paragraph 4.8).

3.26 The Working Group noted that the *Saga Sea* was using a conventional trawl and an unconventional pumping system. The unconventional continuous trawl allowed the vessel to take and process krill without having to recover the trawl; continuous trawling can extend over periods of days.

3.27 WG-EMM-06/18 described a trial reporting procedure to record the date, time, position, characteristics of trawl, depth of fishing and estimated catch at two-hourly intervals during continuous trawling. This procedure had been requested by the Scientific Committee in 2005 (SC-CAMLR-XXIV, paragraph 4.8), and full details would be submitted to the Scientific Committee at its next meeting for consideration.

3.28 WG-EMM-06/18 also described biological sampling protocols, including krill demography, fish by-catch, within-swarm study of krill and the use of video to record predator behaviour. These protocols were developed in response to concerns of the impact of the new pumping system on other elements of the ecosystem (SC-CAMLR-XXIV, paragraph 4.9). One CCAMLR international scientific observer and a national observer are currently deployed on the *Saga Sea*.

3.29 WG-EMM-06/27 raised concerns about the continuous krill fishing technology, and its potential impact on various components of the marine ecosystem, such as an increased catch of small-sized krill and by-catch of fish larvae, compared with conventional midwater trawls. Other effects, such as noise affecting the behaviour of predators, and the impact of bubble screens and clouds on pelagic organisms, were also examined. The authors noted the importance of scientific observations to understand the nature of the new fishing method and its ecosystem impact.

3.30 Dr T. Knutsen (Norway) informed the Working Group of his recent correspondence with the Aker Seafoods Company about its new continuous pumping system. The company's representative had stated clearly that no air bubbles were introduced into the codend of the trawl nor into the surrounding water. The pump system is basically a Mammut pump (or airlift system) that transfers air from one (air supply) hose to the other (codend water extraction) hose at depth. The air released in the second hose rises to the surface expanding on its way, and initiates a suction of seawater on the codend side of the trawl that allows water and krill to be brought to the storage tank on board the vessel. Hence, it should be reasonably clear that at least one of the points raised by the Working Group has already been addressed. Dr Agnew confirmed that the UK observer on the *Saga Sea* had also indicated that a single air hose was used, and that there was no air released within the net.

3.31 Dr L. Pshenichnov (Ukraine) commented that, in his opinion, the new continuous pumping system constituted a new and exploratory fishery and as such should be covered by a separate conservation measure.

3.32 Drs V. Bizikov, S. Kasatkina and V. Sushin (Russia) suggested that in connection with the concerns mentioned by the Scientific Committee (SC-CAMLR-XXIV, paragraphs 4.8 and 4.9), continuation of this fishing technology implemented on board the *Saga Sea* should be conducted in accordance with the rules and requirements of CCAMLR for exploratory fisheries until the relevant description of the new fishery technology is presented to, and analysed by, the Scientific Committee. Further, they believe that categorising this as an exploratory fishery would not restrict its development while ensuring adequate scientific monitoring and control.

3.33 Drs Agnew, Constable and Knutsen stated that, in their opinion, the role of WG-EMM was to specify the information that the Scientific Committee would need to understand the issues raised in SC-CAMLR-XXIV, paragraph 4.8, and not to make recommendations on the matter in paragraphs 3.31 and 3.32. They noted that decisions about the category of fishing is the responsibility of the Commission.

Scientific observation

3.34 WG-EMM-06/7 described the by-catch of small fish and squid in the krill fishery at South Georgia. The analysis was based on data from four trawlers which operated in 2004.

3.35 Most hauls observed (67%) contained by-catch of small fish. The species assemblage varied according to location, bottom topography and time of day, but was not related to fishing depth or krill density. Juvenile myctophids were thought to be vulnerable to krill trawling at night due to diel vertical migration. In contrast, *Champsocephalus gunnari* and

Lepidonotothen larseni occurred continuously within the depth range of krill trawling. The authors estimated that 1.5 million *L. larseni* were taken by the krill fishery in 2004, and it was thought that the species' population could withstand this high juvenile mortality. The by-catch of *C. gunnari* was low in 2004 compared with previously observed seasons.

3.36 The Working Group noted that the occurrence of fish larvae by-catch observed in the krill fishery was higher than the previous general understanding of by-catch in the fishery. The Working Group agreed that such results underscore the importance and need to increase observer coverage in the krill fishery.

3.37 At the time of report adoption, a number of participants noted that it would be usual practice to refer the paper described in paragraph 3.34 to WG-FSA to determine whether there are implications for its advice on fish stocks. They suggested that WG-EMM-06/7 be tabled for consideration by WG-FSA.

3.38 The Working Group noted the report by a national observer on an Ukrainian-flagged krill trawler in 2005/06 (WG-EMM-06/34). The observer reported almost no sea-ice, and that krill were almost absent from the traditional fishing ground in Subarea 48.2 (west and north of Coronation Island) from 22 February to 13 March 2006. The estimated CPUE for krill was 11.4 tonnes/hour or 135 tonnes/fishing day. Most of the krill caught ranged between total lengths of 39 and 48 mm. In contrast, in Subarea 48.1, fishing was profitable in the Elephant Island area, Livingston Island area, and Bransfield Strait where CPUE ranged from 17.4–20.5 tonnes/hour from March to May. Krill lengths ranged from 33 to 61 mm, with 47–55 mm krill dominating catches at Elephant Island, Livingston Island and north of the Palmer Archipelago. Small krill (two modes of 35–39 and 39–47 mm) were only observed in Bransfield Strait.

3.39 The Working Group welcomed the Ukrainian observer report (WG-EMM-06/34) and agreed that this report provided useful information on the characteristics of fishing ground and krill condition. This information may help understand the dynamics of the fishery.

3.40 Dr Reiss reported on the size distribution of krill taken during a scientific survey undertaken by the USA in the Elephant Island area and in Bransfield Strait in 2006. Krill length ranged from 30 to 60 mm, with large individuals (>50 mm) occurring mostly in the Elephant Island area, and small krill (<40 mm) found in Bransfield Strait.

3.41 Dr Siegel noted that the absence of small- to medium-sized krill in the Elephant Island area is due to continued poor recruitment since 2003.

3.42 WG-EMM-06/24 examined how current data collection through the fishery operation could contribute to a greater understanding of krill biology. The authors proposed a further way forward to collect krill information, including revisiting historical data accumulated by the fishery operators, and the possible use of the IPY as a driving force in coordinating scientific acoustic surveys, krill sampling, and on-board experiments with commercial krill fishery operations.

Data requirements from the fishery

3.43 The Working Group noted that with the advent of new fishing technology (paragraphs 3.25 to 3.33) it is essential to obtain systematic information from the krill fishery that is comparable across fishing methods.

Information required from krill vessels in general

3.44 The Working Group noted that the following information should be collected and available from all krill fishing methods: catch and effort information capable of characterising CPUE; information on the total mortality of krill (krill caught as well as krill killed but not landed); information on the biological characteristics of krill; and information on the incidental mortality of other ecosystem components. The Working Group recognised that some of these data have been made available from some of the existing or past fisheries.

3.45 The Working Group needs to have an adequate assessment of the by-catch associated with each method of fishing. Currently there are a number of assessments from the trawl fishery but there has not been a broad-scale assessment of the seasonal and areal extent of fish or invertebrate by-catch. There also needs to be a systematic assessment of the by-catch of seals and seabirds.

3.46 Systematic assessment of the effects of fisheries requires systematic collection of data and in the CCAMLR context this information is collected by CCAMLR scientific observers. An impediment to assessing the effects of the krill fishery is the lack of observer coverage on many krill fishing vessels.

3.47 All methods of fishing produce waste either as part of the catching process or as part of the factory processes. The Working Group has not been presented with detailed information on the disposal of waste associated with krill fisheries and encouraged the presentation of data that would allow some assessment of this issue.

3.48 Dr Kasatkina noted that special working groups on analysis of fishing technologies are currently operating within the framework of the Fishery Technology Committee (FTC) of ICES. In view of this, it would be useful to evaluate methodological approaches and methods developed by these groups. Experts from FTC may be invited to WG-EMM meetings for consultations. Such cooperation with FTC could be helpful for analysis, both of the continuous fishing method, and for other new fishing methods that could be implemented into the krill fishery in future.

3.49 The Working Group noted that little information from the fishery was currently being used in the formulation of catch limits. Noting that next year there will be a review of precautionary catch limits, the Working Group requested the submission of information arising from the fishery that will be used in next year's review.

3.50 The Working Group recognised that there was now a considerable volume of haul-by-haul data from the krill fishery and scientific observer data and reports. With the exception of the information on marine mammals and birds, which is analysed by ad hoc WG-IMAF, these

data are not routinely examined by any working group. The Working Group recommended that in future a subgroup should meet to conduct specified analyses during WG-EMM meetings.

Information required from continuous pumping vessels

3.51 The Working Group noted that WG-EMM-06/27 had suggested that the new pumping system for krill fishing may represent a number of potential threats to the Antarctic marine ecosystem.

3.52 At its 2005 meeting, SC-CAMLR agreed (SC-CAMLR-XXIV, paragraph 4.8) that this technology would not constitute a new or exploratory fishery if there is:

- an adequate description of the selectivity of the method for krill
- a characterisation of the haul (or catch rate)
- information on the location of krill catches.

3.53 The Scientific Committee had also expressed concern (SC-CAMLR-XXIV, paragraph 4.9) that there might be considerable potential for this type of fishing gear to impact other elements of the ecosystem, particularly:

- by-catch associated with the fishery, including seabirds and marine mammals
- larval finfish and immature krill catches
- zooplankton caught in the process of fishing operations.

3.54 Norway fully intends to provide this scientific information requested by the Scientific Committee but, because the *Saga Sea* did not commence fishing until 15 June in the 2005/06 season, there had been no opportunity to acquire, analyse and submit the requested data before the 2006 meeting of WG-EMM.

3.55 A data collection plan was elaborated between Norway, the Secretariat and the UK who are providing an international scientific observer (WG-EMM-06/18). Dr Knutsen reported that Norway was willing to examine other data collection options, such as incorporating a CTD on the net, to obtain additional scientific information.

3.56 The method of continuous krill fishing using modified gear and trawl system represents an unconventional fishing technique. The Working Group requested more details of the fishing technology used by *Saga Sea* to evaluate whether the current reporting system is adequate to provide information required for assessment of the impact of this type of fishing technique on the Antarctic marine ecosystem.

3.57 The Working Group therefore agreed to request details of the trawl and pumping system from the Norwegian company operating it, including further information on the use of air in the system and on the difference in size between krill caught in the conventional trawl compared with those caught by the continuous pumping system.

3.58 Table 1 of WG-EMM-06/27 might also be useful to indicate the sort of information that would assist the Working Group in assessing the ecosystem effects of this type of fishery operation.

3.59 The Working Group recalled that observer reports from the *Atlantic Navigator* were submitted last year (WG-EMM-05/12, and the UK observer report) and include a general description of the operation of the continuous pumping system. Combined data from both types of trawl were presented and, to assess selectivity, these data need to be separated.

3.60 The Working Group noted that information on the sizes of krill caught by conventional trawls and continuous pumping, catch rate and catch locations from the *Atlantic Navigator* and the *Saga Sea* have been submitted to the Secretariat. The Working Group recommended that these data should be catalogued.

3.61 The Working Group requested the Chair of the Scientific Committee to ask WG-FSA to examine the catalogued data at their 2006 meeting to assess the difference between the two types of krill fishing and to provide a commentary to the Scientific Committee. It was also noted that these data will be available through the usual data access rules for any Member to analyse, and this option was encouraged.

3.62 The data collection plan (WG-EMM-06/18) identified sampling procedures for the scientific observer specifically to examine the issues of concern to the Scientific Committee. It is intended that the data collected from the *Saga Sea* will be comparable to those of a conventional krill trawl fishery.

3.63 The data collection plan outlined in WG-EMM-06/18 indicated the level of sampling for each type of information and the suggested sample size. Although there was some concern that the stipulated sample size (100 krill per catch for conventional trawls and 150 krill three times a day for continuous trawls) was possibly too low to adequately describe the krill population being fished, there were no suggestions for alternative sampling strategies.

3.64 The Working Group viewed the sampling plan in WG-EMM-06/18 as an interim sampling plan from the continuous pumping system but noted that the plan would be modified as a result of experience over the next year. The results of the sampling program and suggested modifications to the plan should be presented to the Working Group next year.

Ad hoc Group on Fishery Dynamics

3.65 Through discussion at the Second Workshop on Management Procedures, the importance of understanding fishery dynamics and its modelling in future work was identified (paragraph 2.11).

3.66 The Working Group agreed that the primary question that modelling should address is to identify which krill–fishery interactions have important influences on the ecosystem and the fisheries.

3.67 The Working Group further recognised the following question:

> What are the spatial and temporal scales at which krill–fishery interactions operate compared with the scale of resolution used in ecosystem models?

It is therefore important to characterise the relationship between processes at different relevant scales.

3.68 Although some attempts have been made to conceptualise fishery behaviour in the past (e.g. WG-EMM-05/30), most of the fishery information is still anecdotal.

3.69 The Working Group recognised the need for systematic collection and analysis of fishery information, and to further understand the fishery, the need to answer the above questions.

3.70 The ad hoc group listed the sorts of information deemed necessary to adequately model fishing fleet behaviours:

- skippers' decisions to fish and halt fishing
- definitions and types of commercially profitable aggregations
- strategies used in relation to fishery products and fishing gear etc.
- acoustic data from fishing vessels and scientific surveys
- historical haul-by-haul data on CPUE, length-frequency data and fishing locations
- CCAMLR scientific observer data.

3.71 The ad hoc group recognised that most of this information is held by the fishery operators, and therefore voluntary contribution by the data holders was necessary. The Working Group agreed to form an intersessional correspondence group on fishery dynamics to further make progress in:

- identifying the sorts of information available;

- collecting this information through dialog with fishery operators (SC-CAMLR-XXIII, paragraphs 3.31 to 3.42);

- initiate modelling work.

3.72 Dr Kawaguchi agreed to lead the correspondence group.

3.73 Dr M. Naganobu (Japan) commented that Japan:

(i) was generally supportive of the idea of a correspondence group to collect fishery information to support modelling fishery dynamics, but the issue of commercial confidentiality must be retained and data submission must be on a voluntary basis;

(ii) has voluntarily submitted this information to the Working Group continuously, and has contributed to its analysis to understand fleet behaviours;

(iii) suggested that it would be ideal if the outcome of these analyses be fed back to the data originators for their benefit.

Regulatory issues

3.74 The Working Group reviewed the conservation measures in force in the krill fisheries (WG-EMM-06/5). It noted that the change to the monthly reporting of catch in Conservation Measure 23-03 recommended at WG-EMM-05 (SC-CAMLR-XXIV, Annex 4, paragraph 5.46)

had been reviewed by the Scientific Committee. The Scientific Committee proposed further changes which were adopted by the Commission. The revised Conservation Measure 23-03 (2005) required that monthly catch and effort reports be submitted at the spatial resolution of the catch limits, and that fine-scale data be submitted on a haul-by-haul basis.

3.75 The Working Group thanked Japan for resubmitting the entire set of catch and effort data on a haul-by-haul basis. The Working Group encouraged all Members participating, or who have participated, in the krill fisheries to resubmit historic fine-scale data on a haul-by-haul basis if these data are available (paragraph 3.5).

3.76 The Working Group agreed to use the biomass and CV estimates from the 2006 BROKE-West Survey in Division 58.4.2 (WG-EMM-06/16) to revise the precautionary catch limit for krill in that division; this is further discussed in paragraphs 5.34 and 5.35.

Key points for consideration by the Scientific Committee

3.77 The Working Group acknowledged that the continuous pumping system presented some unique challenges to recording effective fishing effort, catch and searching effort. Norway has agreed a recording system with the Secretariat, which could be modified on the advice of the Working Group (paragraph 3.55).

3.78 Norway should request further information from the fishing company on the details of the continuous pumping system that are of concern from an ecosystem perspective (paragraph 3.57).

3.79 The Working Group has not yet defined a single effective measure of CPUE in conventional or continuous pumping krill fishing operations; nor is such a measure of CPUE used in stock assessments or management decision rules. Until such time as these issues have been addressed, all krill fisheries should provide information appropriate to the current management system (paragraph 3.44).

3.80 The discussions at this meeting have demonstrated the need for systematic scientific observation of all krill fishing activities (paragraph 3.46).

3.81 The Working Group has made repeated requests for information on fishing methodologies, technology and fishing operations and has had little response from most fishing nations. In particular, operational data were needed on fishing selectivity and total mortality. The Working Group reiterated its request for detailed information from fishing nations so that their operations can be better understood and thus appropriately managed (paragraph 3.49).

3.82 The Working Group agreed to use the biomass and CV estimates from the 2006 BROKE-West Survey in Division 58.4.2 (WG-EMM-06/16) to revise the precautionary catch limit for krill in that division (paragraph 3.76); this is further discussed in paragraphs 5.34 and 5.35.

STATUS AND TRENDS IN THE KRILL-CENTRIC ECOSYSTEM

Status of predators, krill resource and environmental influences

Predators

4.1 WG-EMM-06/4 reviewed updates to the CEMP indices. The CEMP indices have been updated by eight members, representing 10 field sites and 13 CEMP parameters for 2005/06. A number of CEMP indices have not yet been provided by some Members, but some data submissions are expected in the near term. Data from Admiralty Bay, King George Island, have not yet been submitted, but the Working Group was assured that the 2005/06 data will be submitted.

4.2 To summarise CEMP indices, the development of an ordination approach was presented in WG-EMM-06/4. The ordination approach requires time series data with no missing values and preliminary ordination analyses of the CEMP indices used a three-year running average to interpolate missing values. The Working Group agreed that continued development of the ordination technique needs to be considered in terms of how to provide advice to the Scientific Committee on trends in the ecosystem. In particular, work is needed to identify how to include CEMP data directly in a feedback management procedure. It was also noted that the methods for appropriately dealing with missing years in a CEMP parameter series warrants further exploration (e.g. see de la Mare and Constable, 2000).

4.3 WG-EMM-06/31 reported preliminary findings arising from two New Zealand research voyages that visited the Balleny Islands in early 2006. The voyages collected a diverse array of data and specimens, including the first-ever samples from shallow marine environments and a comprehensive survey of penguin colonies. Data collected during these voyages will assist in the development of New Zealand's approach to encourage marine protection around the Balleny Islands.

4.4 At present, much of the data collected from the research voyages have yet to be analysed, but there appears to be an increase in chinstrap penguin populations since the last known census.

4.5 WG-EMM-06/P1 reported results of the 2005/06 field season of seabird research at the US AMLR site at Cape Shirreff. Chinstrap penguin populations continued to decline; however, reproductive success during the season was above the 10-year mean and chick fledging weights increased compared to the low mean weights of last season. Gentoo penguin populations remained stable and experienced the highest reproductive success in a decade. Diets of both penguin species were dominated by krill in the 41–55 mm size range, continuing a trend of increasing size and percentage of female krill in the penguins' diets. This pattern was similar to that observed during the period from 1997/98 to 2000/01.

4.6 WG-EMM-06/8 reported that gentoo penguins exhibited delayed dispersal of young coupled with extended parental provisioning, behaviours not observed in the closely related Adélie and chinstrap penguins. During a two-week post-fledging period, gentoo chicks made an average of five trips to sea. The duration of these trips increased significantly with chick age, with trips to sea becoming more similar to adult foraging trips in both timing and duration. These behaviours are hypothesised to provide the opportunity for chicks to gain

experience at sea prior to dispersal and may be of importance in explaining why gentoo penguin populations remain relatively stable while both Adélie and chinstrap penguin populations have declined in the Antarctic Peninsula region.

4.7 The Working Group noted that Antarctic fur seal pups may also benefit from a pre-weaning transition by learning to forage near natal colonies. The Working Group suggested future work on this issue could use time-depth recorders to assess the diving behaviour of juvenile gentoo penguins during their extended fledging period. It was noted that such studies are primarily limited by time and budget constraints.

4.8 WG-EMM-06/17 reported on the winter dispersal patterns of chinstrap penguins from two colonies in the South Shetland Islands that were tagged and followed during the 2000 and 2004 winters using the ARGOS satellite tracking system. Comparisons between sites and years revealed a high degree of variability in the winter distributions of chinstrap penguins between sites and years and within sites, across years. The paper provided new information on habitats utilised by chinstrap penguins during the non-breeding season and is of importance to models of predator–prey–fishery interactions in the region.

4.9 The Working Group noted that the hypotheses concerning new versus historical breeding ranges raised in WG-EMM-06/17 suggested that there may be environmental conditions under which new local populations can establish or which may result in inter-site movement of penguins may be more common. Identifying such environmental conditions, particularly in relation to changes in the extent of sea-ice, would be of interest to the Working Group. The Working Group also suggested that genetic analyses may help to differentiate ancestral stocks within local breeding populations. The different winter distributions of chinstrap penguins also corroborate the utility of seasonal parameterisations of the operational models being developed by members of WG-EMM.

4.10 WG-EMM-06/P4 examined the complexity of foraging dynamics for colonially nesting macaroni penguins. Results indicate that individual penguins do not range evenly over the habitats adjacent to their respective breeding colonies, that animals from one colony tend to forage in locations separate from those used by animals from nearby colonies (or at least overlap can be restricted).

4.11 The Working Group noted that the segregation of foraging areas for adjacent colonies of breeding macaroni penguins is consistent with other research in the Antarctic, and that recognition of such partitioned foraging areas is important for discerning local- versus regional-scale effects on predator populations.

4.12 WG-EMM-06/P5 discussed the spatial and temporal variability in the fish component of the diets of Antarctic fur seals from 10 sites in the South Atlantic Ocean sector of the Antarctic. Although fish is a secondary component of the diet of Antarctic fur seals in the Scotia Sea, the fish component of their diet varied between sites. The authors suggested that these differences reflect differences in marine habitat, variability in oceanographic conditions and the long-term effects of harvesting among the surveyed sites.

4.13 WG-EMM agreed that alternative prey types and the timing of diet switching is important for fur seal foraging and reproductive biology. In particular, it was noted that while fish prey may be more energy rich than krill, the availability and catchability of fish prey is

presumably lower than for krill. The Working Group commented that variability in the fish component of fur seal diets would be an important aspect of future modelling work with respect to predator sensitivity to krill availability and welcomed future papers on this topic.

4.14 WG-EMM-06/P6 examined how foraging and reproductive effort in breeding chinstrap penguins responded to interannual variation in the abundance of krill in the vicinity of Seal Island, South Shetland Islands, from 1990 to 1992. Krill density varied by a factor of 2.5 between these years and was positively correlated with annual measures of breeding performance (e.g. adult mass, population size, chick growth, breeding success and fledgling weight). In contrast, measures of penguin foraging effort (dive depth, dive duration, number of trips per day, trip duration, number of dives per trip and dive rate) did not differ between years. The authors concluded that chinstrap penguins reduce reproductive success rather than increase foraging effort in response to decreases in prey abundance in a manner consistent with predictions of life-history strategies for long-lived seabirds.

4.15 WG-EMM-06/21 examined the long-term responses of predator populations to environmental variability at two sites in the South Shetland Islands. The study compared trends in indices of population abundance, juvenile recruitment and summer breeding performance among Adélie, gentoo and chinstrap penguins breeding at these colonies. Recruitment rates of the pygoscelid penguins were related to an index of recruitment of Antarctic krill. The long-term declines in the abundance of Adélie and chinstrap penguins in the South Shetland Islands may be linked to variability in krill recruitment via declines in juvenile penguin survival rates.

4.16 The Working Group commented that the two periods of strong decline in Adélie penguin abundance reported at Admiralty Bay likely derive from multiple, inter-related causes that could include changing environmental conditions, changes in krill availability and predation by skuas.

4.17 With respect to modelling predator populations in the Antarctic, the Working Group also noted that such colony-level processes may depend on more than just food availability and that greater understanding of the factors influencing both intra- and interannual changes in survival of juvenile and adult predators may be an appropriate direction for future model development.

4.18 WG-EMM-06/P2 examined SST anomalies at South Georgia and found these to be cross-correlated with frequent El Niño–La Niña events between 1987 and 1998. Nonlinear mixed-effects models indicated that positive anomalies at South Georgia explained extreme reductions in Antarctic fur seal pup production over 20 years of study. Simulated environmental time series suggested that the observed nonlinearity in responses in pup production were observed only under persistent high SST levels. These anomalies were likely associated with low availability of prey, largely krill, which affected female Antarctic fur seals over time scales longer than the pup-rearing period.

4.19 WG-EMM-06/P3 examined the relationship between variability in sea-ice cycles with long-term trends in the populations of Adélie, gentoo and chinstrap penguins breeding in the South Orkney Islands. Cycles in sea-ice lead to reduced prey biomass, and simultaneous interannual population changes in the three penguin species. Adélie penguins appeared less buffered against changes in the environment, their numbers fluctuated greatly and their population decline was strong and linear. Chinstrap penguins, considered to be better adapted

to ice-free conditions, were affected by discrete events of locally increased ice cover, but showed less variable, nonlinear responses to sea-ice loss. Gentoo penguins were temporarily affected by negative anomalies in regional sea-ice, but persistent sea-ice reductions were likely to increase their available niche. Ultimately, variability in penguin populations reflected the local balance between species that were better adapted to ice conditions and changes in the food web driven by global climate forcing.

4.20 The Working Group commented that, given the contrasting responses of particular predator populations from the same area, choosing the representative species for measuring the effect of fishing versus climate on predator populations will be critical for providing management advice and feedback on krill fishery management procedures. In this regard, it may not be possible to restrict attention to only one 'representative' species.

4.21 The Working Group also noted that trends in the Adélie penguin populations presented in WG-EMM-06/21 mirrored these reported in WG-EMM-06/P3 for much of the historical record, but that these trends have diverged recently. Such a divergence may have occurred because of local differences in environmental conditions or predation pressure at breeding colonies.

4.22 The Working Group noted that analysis of long-term population data from both the South Shetland Islands (WG-EMM-06/21) and South Orkney Islands (WG-EMM-06/P3) revealed consistent declines in both Adélie and chinstrap penguin numbers over the last 20 to 30 years. This is contrary to the prevailing 'conventional wisdom' which suggests increasing chinstrap penguin populations and decreasing Adélie penguin populations associated with decreasing winter pack-ice in this region.

4.23 WG-EMM-06/39 presented data on the fur seal population breeding at Cape Shirreff, South Shetland Islands. First-year survival was found to be important for sustaining fur seal population growth. Pregnancy rates for females breeding at Cape Shirreff are comparable to South Georgia (1983–1992). However, adult female survival is approximately 5% greater at Cape Shirreff than at South Georgia and age-at-first reproduction is higher at Cape Shirreff.

4.24 The Working Group commented that the relatively higher degree of variation in the survival of juvenile fur seals could derive from a lack of foraging experience under increasingly variable environmental conditions, or from relatively higher predation risk from leopard seals. Similar constraints on predator populations during early life stages were identified for the penguin populations considered in WG-EMM-06/8 and 06/21.

4.25 The Working Group agreed that the information provided in the life-tables presented in WG-EMM-06/39 were fundamental for understanding fur seal population dynamics.

4.26 The Working Group further noted that there is sufficiently large interannual variation in the number of adult fur seals returning to breeding colonies that these colonies need to be monitored annually to satisfactorily estimate trends in local populations.

Krill

4.27 Evidence from the fishery suggested that there had been a shift in krill availability between the 2004/05 and 2005/06 seasons (WG-EMM-06/5). Most of the krill catch in the

2005/06 season to date had come from Subarea 48.1, whereas in 2004/05 most of the catch had come from Subarea 48.2. This scarcity of krill in Subarea 48.2 in the 2005/06 season was also reported by an observer on a Ukrainian-flagged vessel (WG-EMM-06/34).

4.28 Results from the US AMLR survey off Elephant Island suggested that in 2005/06 krill biomass in this region was also at the low point of a 5–6 year cycle which also corresponded to a period of low proportional recruitment and this was reflected in the size frequency reported by the fishery (WG-EMM-06/32 and 06/34). The krill population consisted of many large krill. In the 2005/06 season there was extensive warm surface water in the Elephant Island area which may be associated with the lack of krill.

4.29 It was suggested that a large sea-ice year would be required to produce a suitable recruitment pulse but, given the low levels of sea-ice recorded in recent years in the Antarctic Peninsula area, it was uncertain whether a large enough peak would occur in the near future.

4.30 The Working Group suggested that detailed analyses of trends in sea-ice and associated krill biomass and recruitment data be conducted for the entire time series of the data from the AMLR program to examine whether the trends reported earlier were still apparent.

4.31 Analysis of data from upward-looking acoustic sensors deployed on moorings at South Georgia indicated a regular annual cycle of krill biomass – high in summer and low in winter (WG-EMM-06/25). The interannual highs and lows in the time series corresponded reasonably well to high and low biomass estimates derived from ship-based surveys suggesting that these moorings may be able to provide long-term data that reflect the biomass over wider spatial scales.

4.32 The results from the moorings indicate that because of the sharp peaks in the biomass cycle, the exact timing of repeated acoustic surveys may be critical. Surveys that differ in their timing by only a few weeks might exhibit quite different estimates of biomass because they fall at different points of the cycle. Additionally, within this intra-annual framework, annual ship-based surveys may be able to detect differences between high and low krill years only if they differ by densities of 40 g m^{-2}.

4.33 The Working Group recognised the utility of such moorings for linking biological and physical information and for examining functional relationships between krill and krill predators.

4.34 It was noted that the patterns in krill biomass observed in the moorings corresponded well to cycles observed in the krill fishery and reported in WG-EMM-04/44. The fishery data indicated deeper fishing in winter and also a shift in the location of the fishery in the July–August period which corresponded to a small increase in krill biomass in the mooring data. Because the moorings are fixed at 200 m depth, the changes in biomass recorded may reflect the seasonal vertical migration cycles of krill as well as cycles of annual production.

4.35 Results from a large-scale survey in the Lazarev Sea conducted in December 2005 were presented in WG-EMM-06/10 and were compared to an autumn survey of the same area in 2004. Lower densities were estimated from the net survey for the 2005 survey than for the 2004 survey. The order of magnitude difference in density (3.15 krill per 1 000 m^{-3} in 2005 versus 31.12 krill per 1 000 m^{-3} in the previous year) could be a result of seasonal differences

or because of interannual changes in krill distribution and abundance. Acoustic data were collected on both of these voyages and could assist with the interpretation of the observed changes from the net surveys. These data would be presented to a future meeting of the Working Group.

4.36 Krill in the Lazarev Sea spawned much earlier in 2005 than anticipated, despite the presence of considerable residual sea-ice in December. Recruitment in 2005 was strong and there was evidence of considerable success from spawning in 2004.

4.37 Two papers reported on the results of a large-scale survey of Division 58.4.2. WG-EMM-06/15 reported an overview of the BROKE-West Survey which included oceanography, a krill biomass survey and ecological measurements at all trophic levels from viruses to cetaceans. The results of this survey will be used to examine whether this large division could be subdivided on the basis of ecological information as requested by the Scientific Committee (SC-CAMLR-XXI, paragraph 3.15). Evidence of the existence of such ecological boundaries is apparent in the preliminary results of the survey and from analyses presented in WG-EMM-06/37.

4.38 A preliminary analysis of the BROKE-West krill demographics indicated considerable similarities with those presented for the neighbouring Lazarev Sea in the same season (WG-EMM-06/10).

4.39 The survey results will also be used, in conjunction with the 1996 BROKE survey of Division 58.4.1, to examine environmental correlates with krill distribution around one-third of the Antarctic coastline which can be used in ecosystem models.

4.40 The results of the acoustic survey of krill in Division 58.4.2 were presented in WG-EMM-05/16. The survey consisted of eleven meridional acoustic transects, spaced at five-degree intervals, across the entire statistical division. Krill were widely distributed throughout the survey area, although there were some transects where little krill was detected. The northern extent of the transect lines was at 62°S and the southern extent was determined either when net samples indicated that *E. crystallorophias* was present, or when ice or the coastline was encountered.

4.41 The acoustic data were collected and analysed so as to be as comparable as possible to the methods used on the BROKE and the CCAMLR-2000 surveys. The target-strength model used was that of Greene et al. (1991) to maintain the comparability between these three surveys. The acoustic results will be reanalysed for the 2007 meeting of the Working Group using the SDWBA model.

4.42 Discrimination of acoustic targets was achieved by using the three-frequency algorithm as used for the CCAMLR-2000 Survey and by conducting 76 directed trawls to confirm the identity of acoustic targets.

4.43 The major differences in survey design between CCAMLR-2000 and BROKE-West were that the CCAMLR-2000 Survey used a stratified random design whereas the BROKE-West Survey used regularly spaced transect lines, and the BROKE-West Survey proceeded 24 hours per day, whereas CCAMLR-2000 surveyed only during the day. These differences were a result of the constraints imposed by using a single ship in the BROKE-West Survey and through the necessity of sharing a sampling design with the oceanographic survey. The

survey design, with its deviations from the CCAMLR-2000 design, had been presented to the 2005 meeting of the Working Group (WG-EMM-05/11) and the Working Group had approved the design (SC-CAMLR-XXIV, Annex 4, paragraph 4.90).

4.44 The biomass of krill in Division 58.4.2 (area: 1.57 million km^2) was estimated to be 15.89 million tonnes with a CV of 47.93%. The average density of krill detected acoustically was 10.15 g m^{-2} which falls between the value detected in Division 58.4.1 in the BROKE Survey (5.5 g m^{-2}, CV 19%) and that detected in Area 48 during the CCAMLR-2000 Survey (21.4 g m^{-2}, CV 11.4%).

4.45 The Working Group agreed that this was an excellent survey and that the results should be used to calculate a new precautionary limit for Division 58.4.2. Because the existing precautionary catch limit in Division 58.4.2 was established using a biomass estimate from the 1981 FIBEX Survey which used an outdated methodology and survey design, the new precautionary catch limit should be calculated only using the much more robust estimate from the BROKE-West Survey.

4.46 A conceptual model of the krill maturity cycle based on long-term experimental observations was presented in WG-EMM-06/23. The effects of light, food and temperature were examined and the key parameters appeared to be food and temperature. Additionally, the moulting physiology of krill means that once a krill has regressed in winter it cannot immediately respond to increased food concentrations by maturing but has to pass through several moult cycles before reproduction is possible. The details of this interaction between environmental variables and the physiology of the animal needs to be captured in ecological models that aim to examine variation in krill production.

Environment

4.47 WG-EMM-06/13 provided an update of the relationships between DPOI, oceanographic conditions (e.g. upper ocean temperature and salinity), and parameters related to krill recruitment and density. The Working Group agreed that long time series of data, and rigorous statistical methods, are needed to establish the significance of such relationships.

4.48 The Working Group agreed that it is important to identify plausible causal mechanisms which may be responsible for relationships between environmental/climatic drivers and biological parameters. Explicitly articulated assumptions and links between various components of the environment and ecosystem are needed to test to what extent each conceptual view of reality is consistent with the empirical evidence. A rigorous approach is needed to understand if/how environment–biological relationships can be used in developing operating models for various parts of the Southern Ocean ecosystem.

4.49 WG-EMM-06/31 summarised preliminary results from two New Zealand research voyages to the Balleny Islands, Ross Sea. These voyages are part of a continued New Zealand focus of intense scientific research in this region. The Working Group also recognised the work of other Member countries, including Japan, in the region.

Other prey species

4.50 There were no papers tabled and no discussion under this agenda item.

Report of the Subgroup on Methods

4.51 The Subgroup on Methods (convened by Dr M. Goebel (USA)) met to discuss four papers (WG-EMM-06/11, 06/16, 06/32, 06/36) and the report of SG-ASAM (SC-CAMLR-XXV/BG/5) which dealt with various aspects of acoustic assessments and methodology. An additional paper, WG-EMM-06/8, which presented results of a recent study of gentoo penguin fledging behaviour, was also considered by the group.

4.52 Results presented in WG-EMM-06/8 had implications for the modification of CEMP Standard Method A7 'Chick weight at fledging', specifically, to account for the fact that fledging and dispersal of gentoo penguins from the natal colony are not simultaneous. The subgroup recommended appropriate modifications of the A7 index be considered. Dr Trivelpiece offered to draft intersessionally some text to be appended to CEMP Standard Method A7 to reflect the difference in gentoo fledging behaviour compared to other pygoscelid penguins for consideration by WG-EMM-07.

4.53 In the absence of expertise on krill acoustics, the Working Group felt that no recommendations for changes in methodology based on the tabled papers should be provided. The biological aspects of the methodological approaches in the following papers were considered by the Working Group.

4.54 WG-EMM-06/11 presented an analysis of acoustic data collected in the Ross Sea by an exploratory fishery for toothfish along with a later directed study of mesopelagic backscatter by a research vessel. Multifrequency data with limited biological sampling from the research cruise were used to compare and interpret the single-frequency opportunistically collected data by the fishery. Net sampling on the research cruise focused on the continental slope region of the eastern Ross Sea and around the Balleny Islands. A general southerly decrease in acoustic density and diversity in mark types was found. This study adds to the knowledge of mesopelagic backscatter and the species composition of different mark types for the Ross Sea and argues the importance of increasing spatial and temporal coverage of acoustic data collection by using fishing vessels operating in the Ross Sea.

4.55 The Working Group agreed that such data were useful in elucidating the level of mesopelagic biomass and further studies should be encouraged.

4.56 WG-EMM-06/36 used acoustic assessments for two SSMUs in two different years to compare total krill biomass with the proportion of 'fishable biomass' defined as densities greater than 100 g m^{-2}. The relationship between total krill biomass and the proportion in densities great enough to make it economically available to the fishery remains unclear. However, the authors argued that the relationship varied significantly interannually and seasonally and the nature of the relationship required additional investigation. They suggest that using the standing stock of krill in an SSMU alone to allocate krill catch fails to consider densities of krill necessary to sustain the fishery.

4.57 The authors reiterated that a reanalysis of data from the CCAMLR-2000 Survey, as well as from other surveys (e.g. US AMLR), to identify the frequency and distribution of fishable biomass from overall biomass, could be useful to understand the local variability in krill available to the fishery in relation to the size of SSMUs.

4.58 WG-EMM-06/32 presented a reanalysis of the krill biomass estimates using guidelines developed from the first meeting of SG-ASAM. Specifically, krill biomass estimates from the long-term US AMLR survey in Subarea 48.1 were adjusted using a simplified SDWBA algorithm which took account of the range of krill size. Applying the modified method resulted in a reduction in the total krill biomass estimate and this result should be considered in allocations of the krill catch. Use of acoustic windows based on the range of krill size affects variability and CVs of the estimate and requires further study and development.

4.59 The Working Group noted three important issues which arose from discussion of WG-EMM-06/36: (i) the acoustic technology is moving forward rapidly; (ii) the current model approved by the Commission for the estimation of acoustic biomass provides a slightly lower biomass and higher CV in the restricted areas of the US AMLR survey area examined; and (iii) the time trends of biomass vary greatly from the historical time series based on the Greene algorithm previously used to describe biomass trends.

4.60 The Working Group suggested that in addition to the work that has been completed regarding the development of a physics-based acoustic model of krill, that two additional sources of uncertainty be examined. First, density contrast differences between krill and the water column could vary and may influence biomass estimates. Second, Demer and Conti (2005) suggested that krill examined during the CCAMLR-2000 Survey were fatter than krill examined when the original krill length–weight relationship had been devised (Hewitt and Demer, 1993), and so this source of uncertainty should also be examined in any acoustic estimate of krill.

4.61 The Working Group also considered SC-CAMLR-XXV/BG/2, the report of the second meeting of SG-ASAM which was held in 2006. The meeting focused primarily on icefish acoustics but offered advice on general issues relevant to acoustic surveys in CCAMLR waters. In the absence of krill acoustic experts at that meeting the recommendations for improvements were confined to studies of fish biomass, however, they are worth noting to this group. The recommendations for survey design included:

(i) the use of multiple frequencies
(ii) mark identification using directed trawls or other ground truthing methods
(iii) target strength determination by *in situ* measurements
(iv) calibration of acoustic gear used in the survey.

4.62 Recommendations from SG-ASAM included the need for standardisation in the presentation of methodology and results and that any future requirements agreed to should be discussed jointly for krill and fish. The report included nine recommendations to the Scientific Committee for assessments and protocols for icefish surveys (see SC-CAMLR-XXV/BG/2, p. 15).

4.63 The Working Group noted that there may be an issue of potential target overlap between krill and icefish that could result in mis-identifying icefish as krill, or vice versa.

4.64 The Working Group also considered WG-EMM-06/16 that provided a detailed description of the survey design and methodology used to estimate the krill density in Division 58.4.2. Dr Nicol suggested that this could form the framework for other researchers to apply acoustic techniques in their work.

Future surveys

4.65 At its 2005 meeting the Commission (CCAMLR-XXIV, paragraphs 4.76 to 4.80):

(i) recalled the Scientific Committee's progress in developing CCAMLR's contribution to IPY in 2008;

(ii) noted that the Scientific Committee had established a 'lead project' under the IPY topic 'Natural Resources, Antarctic' as the umbrella proposal 'Integrated circumpolar studies of Antarctic marine ecosystems to the conservation of living resources' with the short form title listed as 'Antarctic Marine Ecosystem Studies (AMES)';

(iii) urged all Members to participate in the CCAMLR core project, which is the large-scale survey in the Atlantic sector of the Southern Ocean (EoI 148), noting that firm commitments for ship-time and other research activities should be provided to the next round of consultations in association with the WG-EMM meeting in July 2006;

(iv) welcomed Peru's proposal to participate in the CCAMLR-IPY projects as an Acceding State.

4.66 Early in 2006 the Convener of the CCAMLR-IPY Steering Group (Dr Siegel) received the official endorsement of the CCAMLR umbrella project by the IPY Joint Committee. The CCAMLR AMES project is now listed as IPY Project 131 on the official IPY website (www.ipy.org).

4.67 The steering group was also informed that IWC and SCAR have established subgroups for future coordinated planning with CCAMLR on whale and marine bird censuses during the CCAMLR-IPY 2008 multiship survey.

4.68 The Working Group noted that it would also be beneficial to keep close contact with other IPY projects (e.g. CAML, ICCED), which might collect scientific data of value to the work of WG-EMM and the Scientific Committee.

4.69 The CCAMLR-IPY Steering Group met during the WG-EMM meeting and reviewed the current status of progress in the implementation of the CCAMLR-IPY program. Despite the request of the Commission, at the time of the WG-EMM meeting, no firm commitments could be made by Members to participate in the large-scale CCAMLR survey in 2008. However, it was recognised that a few Members are more advanced in the process of final commitment with respect to research vessel ship-time than others.

4.70 The Working Group and the steering group expressed its concern about the lack of commitment for the necessary ship-time to the CCAMLR-IPY survey. The Working Group

noted that the current situation could be embarrassing to CCAMLR and its Members if the survey must be cancelled as a core research activity of the entire CCAMLR-IPY project. It was noted that all the necessary scientific requirements had been fulfilled to obtain the full endorsement of the IPY community and to finalise the necessary planning for the 2008 field season. However, final decisions are still outstanding on the required ship-time to conduct the multiship survey.

4.71 The Working Group, therefore, supported the proposal of the steering group, that the convener of the steering group and the Chair of the Scientific Committee write an urgent CCAMLR circular letter and inform Commission Members about the serious situation and the potential consequences for the entire CCAMLR-IPY program. Commission representatives should be asked to assist, where possible, in the decision-making process at national levels for the necessary budget and logistics support to facilitate support where possible.

Key points for consideration by the Scientific Committee

4.72 The CEMP indices have been updated by eight members, representing 10 field sites and 13 CEMP parameters for 2005/06. A number of CEMP indices have not yet been provided by some Members, but some data submissions are expected in the near future (paragraph 4.1).

4.73 The Working Group noted that analysis of long-term population data from both the South Shetland and South Orkney Islands revealed consistent declines in both Adélie and chinstrap penguin numbers over the last 20 to 30 years. This is contrary to the prevailing 'conventional wisdom' which suggests increasing chinstrap penguin populations and decreasing Adélie penguin populations associated with decreasing winter pack-ice in this region (paragraph 4.22).

4.74 Evidence from the krill fishery suggested that there had been a shift in krill availability between the 2004/05 and 2005/06 seasons (WG-EMM-06/5). Most of the krill catch in the 2005/06 season to date had come from Subarea 48.1, whereas in 2004/05 most of the catch had come from Subarea 48.2. This scarcity of krill in Subarea 48.2 in the 2005/06 season was also reported by an observer on a Ukrainian-flagged vessel (paragraph 4.27).

4.75 Results of a large-scale survey of Division 58.4.2 (BROKE-West) which included oceanography, a krill biomass survey and ecological measurements at all trophic levels from viruses to cetaceans were presented. These will be used to examine whether this large division could be subdivided on the basis of ecological information as requested by the Scientific Committee (SC-CAMLR-XXI, paragraph 3.15). Evidence of the existence of such ecological boundaries is apparent in the preliminary results of the survey and from analyses completed to date (paragraph 4.37).

4.76 The biomass of krill in Division 58.4.2 was estimated to be 15.89 million tonnes with a CV of 47.93%. The average density of krill detected acoustically was 10.15 g m^{-2} which falls between the value detected in Division 58.4.1 in the BROKE survey (5.5 g m^{-2}, CV 19%) and that detected in Area 48 during the CCAMLR-2000 Survey (21.4 g m^{-2}, CV 11.4%) (paragraph 4.44).

4.77 The Working Group noted the urging last year by the Commission for Members to participate in the CCAMLR-IPY project (paragraph 4.65) but that, at the time of the WG-EMM meeting, no firm commitments could be made by Members to participate in the large-scale CCAMLR survey in 2008. It was recognised that a few Members are more advanced in the process of final commitment with respect to research vessel ship-time than others (paragraph 4.69).

4.78 The Working Group expressed its concern about the lack of commitment for the necessary ship-time to the CCAMLR-IPY survey. It was noted that the current situation could be embarrassing to CCAMLR and its Members if the survey must be cancelled as a core research activity of the entire CCAMLR-IPY project. It was noted that all the necessary scientific requirements had been fulfilled to obtain the full endorsement of the IPY community and to finalise the necessary planning for the 2008 field season. However, final decisions are still outstanding on the required ship-time to conduct the multiship survey (paragraph 4.70).

4.79 The Working Group, therefore, requested that the Convener of the steering group and the Chair of the Scientific Committee write an urgent CCAMLR circular letter and inform Commission Members about the serious situation and the potential consequences for the entire CCAMLR-IPY program. Commission representatives should be asked to assist, where possible, in the decision-making process at national levels for the necessary budget and logistics support to facilitate support where possible (paragraph 4.71).

STATUS OF MANAGEMENT ADVICE

Protected areas

5.1 The Advisory Subgroup on Protected Areas (convened by Dr Wilson) met during the WG-EMM meeting and discussed matters relating to Item 5.1 of the WG-EMM agenda. These discussions were considered by WG-EMM.

CEMP sites

5.2 The Working Group noted that CEMP site protection under Conservation Measure 91-01 (2004) is required to be reviewed every five years. It also noted that the management plans for the Cape Shirreff and Seal Islands CEMP sites had been modified and renumbered in 2004 (CCAMLR-XXIII, paragraphs 10.26 and 10.27). However, it was unclear from the record whether this constituted a formal review of the two relevant measures (Conservation Measures 91-02 and 91-03 respectively). This would suggest that Conservation Measures 91-02 and 91-03 could have been reviewed in 2005 or will come up for review in 2009. The Working Group referred the matter to the Subgroup on Protected Areas for clarity and requested that, should the measures have required review in 2005, then such a review should be undertaken urgently and, if possible, before the Scientific Committee's meeting in 2006. In addition, the Working Group was informed that all CEMP-related work on Seal Islands has ceased and that, after a formal notification on the matter has been received from the USA, Conservation Measure 91-03 (2004) 'Protection of the Seal Islands CEMP Site' is likely to become redundant.

5.3 It was also noted that revision of CEMP site maps will only be complete on receipt of the Admiralty Bay CEMP site map (King George Island). The USA advised that the required map has been completed in collaboration with Brazil and will be provided in the near future.

ATCM draft management plans for protected areas with marine components

5.4 The Working Group noted that there were no new draft management plans for Antarctic protected areas received for consideration from the ATCM by CCAMLR.

5.5 The Working Group noted the reports of two New Zealand research voyages to the Balleny Islands (Ross Sea) (WG-EMM-06/31), and investigations carried out by Ukraine in the vicinity of the Argentine Islands (Antarctic Peninsula) (WG-EMM-06/33). The Working Group noted that research in both regions may, in future, result in New Zealand and Ukraine submitting proposals to the ATCM to designate the Balleny Islands and Argentine Islands (respectively) as ASPAs.

5.6 The Working Group noted the two criteria stated in ATCM Decision 9 (2005) that draft management plans that contain marine areas which require a prior approval of CCAMLR are those:

(i) where there is actual harvesting or potential capability of harvesting of marine living resources which might be affected by site designation; or

(ii) for which there are provisions specified in a draft management plan which might prevent or restrict CCAMLR-related activities.

5.7 The Working Group noted that, by the time of its meeting, no feedback was received from Members following SC CIRC 06/7 regarding two questions posed by the Scientific Committee relating to the implementation of ATCM Decision 9 (2005) (SC-CAMLR-XXIV, paragraph 3.63), namely:

(i) The Scientific Committee asked WG-EMM and WG-FSA to develop guidelines to indicate what percentage of the range of a known harvestable resource could be covered by protected areas within a statistical unit before CCAMLR would need to determine if a protected area proposed by ATCM might impact on rational use.

(ii) The Scientific Committee asked each Member of CCAMLR to indicate which of the recent proposals from ATCM concerning protected areas with marine components should, in retrospect, have been required to be submitted to CCAMLR according to the criteria in ATCM Decision 9 (2005).

5.8 To avoid potential confusion in the future, the Working Group recommended that standard terminology be adopted within CCAMLR to distinguish between 'ATCM draft management plans with marine components' and 'marine protected areas (MPAs)' *per se*.

5.9 The Working Group recognised that work on both questions given in paragraph 5.7 would help to develop a procedure that could be provided to ATCM to determine whether a

draft ATCM plan for protected areas with marine components should be referred to CCAMLR for review. However, the Working Group noted that it has not, as yet, developed such procedures.

5.10 In response to question (i), the Working Group noted that the development of such guidelines had not commenced at the time of the meeting. In response to question (ii), the Working Group noted that no information had been obtained from individual Members of CCAMLR. The Working Group noted that all draft ATCM protected area proposals with marine components to date (SC CIRC 06/7, Appendix II) have been reviewed and approved by CCAMLR. However, it remains uncertain in retrospect how many of these actually needed to have been considered by CCAMLR.

5.11 The Working Group recommended that, at least in the near future, all ATCM protected area proposals with marine components should continue to be provided to CCAMLR for review unless they are clearly not required according to ATCM Decision 9.

5.12 The Working Group considered that it was not possible at this stage to specify a generic process for considering those ATCM proposals with marine components that are submitted to CCAMLR for consideration. The Working Group noted that the assessment process requires flexibility, and generic guidelines would be overly restrictive until such time as a sufficient number of proposals have been reviewed that meet the criteria in Decision 9.

Bioregionalisation

5.13 The Working Group noted that the Scientific Committee had provided two broad terms of reference to deal with how MPAs could contribute to furthering the work of CCAMLR (SC-CAMLR-XXIV, paragraphs 3.53 to 3.59) and how to consider proposals currently under development, or in a conceptual phase, for MPAs in the Convention Area (SC-CAMLR-XXIV, paragraphs 3.60 to 3.73). The latter also outlined detailed terms of reference for a steering committee to facilitate collaboration with CEP to organise a workshop to establish a bioregionalisation of the Convention Area and to consolidate advice on a system of protected areas (SC-CAMLR-XXIV, paragraphs 3.65, 3.66 and 3.66(4) particularly).

5.14 The Working Group noted that the Scientific Committee had endorsed the suggestion that CEP be invited to undertake the initial work to develop bioregionalisation of coastal provinces, as an extension of its terrestrial bioregionalisation work, while the Scientific Committee undertakes the initial work to delineate oceanic provinces (SC-CAMLR-XXIV, paragraph 3.67). This message was conveyed to CEP in June 2006. It was also noted that such a division of work between CCAMLR and CEP on bioregionalisation may not be so clear in the future as the CCAMLR scientific community also has expertise for coastal areas and the separation of coastal and oceanic provinces may only emerge after comprehensive analysis.

5.15 In respect to the workshop on bioregionalisation, it was noted that a high priority had been attached to this work by the Commission and that the Commission had indicated that the workshop should be brought forward from 2008 to 2007 (CCAMLR-XXIV, paragraph 4.18). It was also noted that the steering committee has not yet nominated its convener and, as such, has not yet commenced its work required to prepare for the workshop. The Working Group

noted that any further delays were likely to compromise the optimal and timely use of available expertise from within WG-EMM and that this would be likely to affect the timeline envisaged by the Commission.

5.16 The Working Group recommended that the steering committee should make full use of available expertise within WG-EMM and WG-FSA in its workshop preparations to ensure adequate identification of work to address various aspects, such as essential ecosystem components, environmental parameters and fisheries considerations, for incorporation into a comprehensive bioregionalisation of the Southern Ocean. In order to facilitate coordination of work on the proposed workshop, the Working Group recommended that conveners of all SC-CAMLR working groups also become members of the steering committee.

5.17 Dr Constable presented a statistical method for undertaking regionalisations of ocean areas (WG-EMM-06/37). The demonstration used sea-surface height, bathymetry and sea-ice climatologies, but the method can include any number of datasets at a variety of spatial scales. The method was applied to each CCAMLR statistical area. There was good qualitative agreement between the initial regionalisations and the broad characteristics of the region given in the literature. The Working Group agreed that it would be useful to continue the development of this method to assist CCAMLR in both its ecosystem modelling work and in undertaking a bioregionalisation of the Convention Area.

5.18 Dr Constable indicated that a small independent workshop will be held in early September 2006 in Hobart, Australia, to develop the regionalisation work further. The workshop is being hosted by the Antarctic Climate and Ecosystems Cooperative Research Centre and WWF, sponsored by Peregrine Adventures. All members of WG-EMM are welcome to attend the workshop and should contact Dr Constable if they are interested. It is intended that a report of the workshop will be provided to the Scientific Committee in October 2006. The report will be valuable with respect to the CCAMLR Bioregionalisation/ Protected Area workshop.

5.19 Dr Pinkerton thanked Dr Constable for his valuable contribution to bioregionalisation, pointing out that for Area 88, in general, the preliminary results shown in WG-EMM-06/37, Figure 4, were a good match of the system delineated by work presented in WG-EMM-06/14, and suggested it could also be used on a smaller scale around, for example, the Balleny Islands.

Harvesting units

5.20 A correspondence group comprising Drs Nicol and Naganobu had been tasked with examining the issue of determining ecological boundaries within large statistical areas with the aim of defining smaller harvesting units (SC-CAMLR-XXI, paragraph 3.15).

5.21 The group had agreed to focus on the east Antarctic region and was awaiting the analysis of the 2006 BROKE-West Survey of Division 58.4.2 which collected data that would be of use in the process of defining ecological boundaries. The combination of the datasets of BROKE-West and the 1996 BROKE survey of Division 58.4.1 would allow a comprehensive analysis of the ecosystems of the 30–150°E region. The group agreed to provide some analyses based on these and other datasets for the 2007 meeting of WG-EMM.

5.22 The process of defining harvesting units will also be assisted by the bioregionalisation process outlined in WG-EMM-06/37.

Small-scale management units

5.23 By reviewing the results from simulations conducted using KPFM2 (Appendix D), the Working Group agreed that, should the fishery occur entirely in Subarea 48.1 and catch an amount of krill equivalent to 9% of B_0, then there will be considerable negative impacts on the ecosystem in that region and, under the assumptions of flux, there would also be negative consequences for predators in Subareas 48.2 and 48.3 (paragraph 2.3).

5.24 The Working Group agreed that further simulation trials conducted using both KPFM2 and SMOM indicate that Fishing Option 1 (allocation of catches according to the historical distribution of catches, among SSMUs, by the krill fishery) would have relatively greater negative impacts on the ecosystem compared to the other fishing options.

5.25 The Working Group also agreed that all simulations indicated that the performance of Fishing Options 2, 3 and 4 (allocation of catches, respectively, according to the spatial distributions of predator demand, standing krill biomass, and the difference between standing krill biomass and predator demand) would be improved when monitoring data are used to update the allocation of catches among SSMUs, i.e. in a manner analogous to Fishing Option 5 (allocation of catches based on monitoring data).

5.26 The Working Group noted that larger areas, such as groups of SSMUs or statistical subareas, may be better suited to the modelling of krill dynamics. However, it was also agreed that the scale of SSMUs was appropriate for modelling both predator dynamics and the interactions between predators and the fishery.

Analytical models

5.27 Dr Agnew introduced the report of the 2006 meeting of WG-FSA-SAM (WG-FSA-06/6), noting that assessments for three stocks of toothfish (Subarea 48.3, Division 58.5.2 and the Ross Sea) had now been developed in the integrated assessment software CASAL. Whilst the structure of the individual models is somewhat different, they include provisions for spatial structure of the stock, multiple fishing fleets and multiple data sources, such as recruitment surveys, length frequency in the catch, CPUE and mark–recapture data. Methods for applying the CCAMLR decision rules within CASAL to determine catch limits have been developed by WG-FSA-SAM and WG-FSA, and the results of such methods agree with the results using the stochastic projection method of GYM.

5.28 The Working Group considered that there may be some merit in examining the potential of such models for krill. Currently the krill assessment uses a stochastic projection model (GYM) whereas CASAL is an estimation model. Integrated models could, for instance, include the CCAMLR krill synoptic survey data, other survey data, CPUE data, relative and absolute estimates of recruitment, recruitment variability, and length-frequency

data from the catch. The Working Group noted that CASAL was one of a suite of integrated assessment methods, and that the development of integrated models could proceed using various software platforms.

5.29 The Working Group acknowledged that construction of such integrated assessment models could present significant challenges, not least in representing the complex spatial structure of the stock and fishery. Models also need to be harmonised with the Working Group's development of integrated ecosystem models.

5.30 CASAL allows the construction of operating models for simulation studies of the performance of different integrated assessment models. Such simulation models would allow investigation of the sensitivity of integrated assessments to input data, for instance the relationship between recruitment variability and natural mortality, and the level of catches relative to the size of the stock. Such models could also be used to investigate the performance of management procedures against uncertainty in parameters.

5.31 WG-EMM encouraged participants to investigate the potential of integrated assessments for krill, and to present papers for consideration of both WG-FSA-SAM and WG-EMM.

Existing conservation measures

5.32 The Working Group reviewed conservation measures which apply to krill fisheries in 2005/06 (a list was provided in WG-EMM-06/5) with the objective of identifying whether updated or new scientific information should be considered in the potential application of conservation measures to krill fisheries during 2006/07. It was agreed that new information from a krill biomass survey conducted in Division 58.4.2 and reported in WG-EMM-06/16 bears directly on the future application of Conservation Measure 51-03 (Precautionary catch limitation on *E. superba* in Division 58.4.2).

5.33 WG-EMM-06/16 reported a standing stock of 15.89 million tonnes of krill in Division 58.4.2. The CV for the estimate was reported as 47.9%, which is larger than the CV for the CCAMLR-2000 Survey in Statistical Area 48.

5.34 The Working Group requested that the Data Manager use the information reported in WG-EMM-06/16 to estimate a precautionary catch limit for krill in Division 58.4.2 in a manner that is consistent with the most recent estimates made for Statistical Area 48 (resulting from the CCAMLR-2000 Survey) and Division 58.4.1 (resulting from the BROKE survey). This request was made because: (i) the Working Group agreed that consistency of computation is important, and (ii) the latest version of the GYM which was available at the meeting was not the same as that used to compute precautionary catch limits for Area 48 and Division 58.4.1.

5.35 Assuming that time and resources are available for the Data Manager, it was agreed that he should endeavour to complete the aforementioned calculations prior to the forthcoming meeting of the Scientific Committee, to which the results would be presented. It was acknowledged that this should provide the Scientific Committee with the information

needed to advise the Commission on updating the precautionary catch limit in Conservation Measure 51-03, a value equal to the γ estimated by the Data Manager multiplied by the B_0 estimate of 15.89 million tonnes.

5.36 The Working Group recalled that precautionary catch limits for krill are constrained by one of two possible harvest rates, an estimate of γ that is determined by performance relative to an escapement criterion, and an estimate of γ that is determined by performance relative to a depletion criterion. The precautionary catch limits for krill in Area 48 and Division 58.4.1 were constrained by the former estimate of γ, but it was noted that the CV reported in WG-EMM-06/16 may be sufficiently large to cause a revised estimate of the precautionary catch limit for krill in Division 58.4.2 to be constrained by the latter estimate.

Key points for consideration by the Scientific Committee

Protected areas

5.37 The Working Group noted that CEMP site protection under Conservation Measure 91-01 (2004) in respect of Conservation Measures 91-02 and 91-03 may need to be reviewed in 2006 (paragraph 5.2).

5.38 The Working Group recommended that, at least in the near future, all ATCM protected area proposals with marine components should continue to be provided to CCAMLR for review (paragraph 5.11).

5.39 To avoid potential confusion in the future, the Working Group also recommended that standard terminology be adopted within CCAMLR to distinguish between 'ATCM draft management plans with marine components' and 'marine protected areas (MPAs)' *per se* (paragraph 5.8).

5.40 The Working Group noted a number of important points relevant to the topic of bioregionalisation (paragraphs 5.13 to 5.19):

(i) despite the fact that the Commission has indicated a workshop on bioregionalisation and to consolidate advice on marine protected areas is of high priority (CCAMLR-XXIV, paragraph 4.18), a convener for this workshop has not been nominated and preparations for the workshop have not commenced (paragraphs 5.13 and 5.15);

(ii) the steering committee tasked with developing the workshop on bioregionalisation would benefit from full use of the available expertise within WG-EMM and WG-FSA with coordination being facilitated by the conveners of SC-CAMLR working groups participating in the steering committee (paragraph 5.16);

(iii) the development of statistical approaches to bioregionalisation like that presented in WG-EMM-06/37 should continue (paragraph 5.17);

(iv) an independent workshop on bioregionalisation will be hosted by the Antarctic Climate and Ecosystems Cooperative Research Centre and WWF, sponsored by Peregrine Adventures in Hobart, Australia, during September 2006, and this workshop will provide information that is useful to CCAMLR (paragraph 5.18).

Harvesting units

5.41 The Working Group was unable to advise the Scientific Committee on harvesting units at this time. Work on this topic will continue during the forthcoming intersessional period (paragraph 5.21).

Small-scale management units

5.42 Recalling the work and discussion outlined in paragraphs 2.1 to 2.11 and in the Report of the Second Workshop on Management Procedures (Appendix D), the Working Group noted that simulation results indicate that, should the fishery occur entirely in Subarea 48.1 and catch an amount of krill equivalent to 9% of B_0, then there will be considerable negative impacts on the ecosystem in that region and, under the assumptions of flux, there would also be negative consequences for predators in Subareas 48.2 and 48.3 (paragraph 5.23).

5.43 The Working Group recalled the six candidate methods for subdividing the krill catch, also called fishing options (SC-CAMLR-XXIV, Annex 4, Appendix D, paragraph 2.2). The agreed candidate methods were based on:

(i) the spatial distribution of catches by the krill fishery (Fishing Option 1);

(ii) the spatial distribution of predator demand (Fishing Option 2);

(iii) the spatial distribution of krill biomass (Fishing Option 3);

(iv) the spatial distribution of krill biomass minus predator demand (Fishing Option 4);

(v) spatially explicit indices of krill availability that may be monitored or estimated on a regular basis (Fishing Option 5);

(vi) pulse-fishing strategies in which catches are rotated within and between SSMUs (Fishing Option 6).

5.44 Despite substantial uncertainty in various aspects of the predator–prey–fishery system, further simulation trials indicate that Fishing Option 1 would have relatively greater negative impacts on the ecosystem compared to the other fishing options (paragraph 5.24).

5.45 Evaluation of Fishing Options 2 to 4 will require additional work on the development and interpretation of performance measures, but all simulations indicated that the performance of these options would be improved when monitoring data are used to update the allocation of catches among SSMUs, i.e. in a manner analogous to Fishing Option 5 (paragraph 5.25).

5.46 In considering the results of separate simulations intended to complement those indicated in the preceding three paragraphs (see also paragraph 2.7), the Working Group noted that larger areas, such as groups of SSMUs and statistical subareas may be better suited to the modelling of krill dynamics. The Working Group also noted that the scale of SSMUs was appropriate for the modelling of predator dynamics and interactions between predators and the fishery (paragraph 5.26).

5.47 The Working Group recognised that substantial and important progress had been made in developing models and performance measures for use in advising the Scientific Committee on spatially-explicit management strategies for krill in Statistical Area 48. Nevertheless, there is considerable scope for additional work, and the Working Group encouraged participants to continue work following the suggestions in paragraphs 2.8 to 2.11 and the future work identified in the Report of the Second Workshop on Management Procedures (Appendix D, section 6).

Analytical models

5.48 Noting the discussions outlined in paragraphs 5.27 to 5.31, the Working Group reiterated that there may be merit in examining the potential of integrated stock assessment models for krill, and encouraged participants to present papers on this topic for consideration by both WG-FSA-SAM and WG-EMM.

Existing conservation measures

5.49 The Working Group again noted that CEMP site protection under Conservation Measure 91-01 (2004) in respect of Conservation Measures 91-02 and 91-03 may need to be reviewed in 2006 (paragraph 5.2).

5.50 The Working Group reviewed conservation measures which apply to krill fisheries in 2005/06 (a list was provided in WG-EMM-06/5) with the objective of identifying whether updated or new scientific information should be considered in the potential application of conservation measures to krill fisheries during 2006/07. It was agreed that new information from a krill biomass survey conducted in Division 58.4.2 and reported in WG-EMM-06/16 bears directly on the future application of Conservation Measure 51-03 (Precautionary catch limitation on *E. superba* in Division 58.4.2) (paragraph 5.32).

5.51 The Working Group requested that the Data Manager use the information reported in WG-EMM-06/16 to estimate a precautionary catch limit for krill in Division 58.4.2 in a manner that is consistent with the most recent estimates made for Statistical Area 48 (resulting from the CCAMLR-2000 Survey) and Division 58.4.1 (resulting from the BROKE survey). This request was made because: (i) the Working Group agreed that consistency of computation is important, and (ii) the version of the GYM which was available to the Working Group was not the same as that used to compute precautionary catch limits for Statistical Area 48 and Division 58.4.1 (paragraph 5.34).

5.52 Assuming that time and resources are available for the Data Manager, it was agreed that he should endeavour to complete the aforementioned calculations prior to the

forthcoming meeting of the Scientific Committee, to which the results would be presented. It was acknowledged that this should provide the Scientific Committee with the information needed to advise the Commission on updating the precautionary catch limit in Conservation Measure 51-03 to be the γ estimated by the Data Manager multiplied by the B_0 estimate of 15.89 million tonnes (paragraph 5.35).

FUTURE WORK

Predator surveys

6.1 The Working Group noted that a number of its participants had been involved in intersessional discussions regarding predator surveys. These discussions were summarised for the group by Drs Goebel and Constable.

6.2 During the intersessional period, a 'Wildlife Awareness Manual for the Antarctic Peninsula, South Shetland and South Orkney Islands', was published by the UK to provide practical information on breeding colony locations for those operating aircraft in these areas (Harris, 2006). It was felt that this manual would be a useful basis for initiating discussion on the design and conduct of predator surveys. To facilitate this process it would, however, be useful for participants to gain a better understanding of the data presented in the manual and clarify whether other sources of data (e.g. Antarctic Site Inventory – see SC-CAMLR-XXIV, Annex 4, paragraph 6.4) might be available to assist in future planning and design of predator surveys.

6.3 Intersessional discussions indicated that future predator surveys should aim to fill important spatial gaps in existing count and census data. Identifying such gaps will be an important component of work to complete in planning for large-scale predator surveys.

6.4 Intersessional discussions also suggested that holding a workshop to discuss the abundance of predators and surveys needed to fill key information gaps in such estimates of abundance, should be deferred by the Working Group to 2008.

Ecosystem models, assessments and approaches to management

6.5 The Working Group considered a number of papers on ecosystem models along with their use in providing advice on options to subdivide precautionary catch limit for krill in Area 48 amongst SSMUs. These models included the spatial multispecies operating model (SMOM) of krill–predator interactions (WG-EMM-06/12, 06/28), the krill–predator–fishery model (KPFM2) (WG-EMM-06/20, 06/22, 06/30 Rev. 1) and the ecosystem, productivity, ocean, climate (EPOC) modelling framework (WG-EMM-06/38 Rev. 1). The details of these discussions and their application are in the report of the Second Workshop on Management Procedures (Appendix D).

6.6 Dr Constable suggested that the authors of these papers submit them for publication in *CCAMLR Science*. This is because the papers all contribute directly to the work of, and provision of advice by, the Scientific Committee and have arisen directly from discussions in and with the advice of the Working Group.

6.7 Dr Reid noted that the choice of journal is the choice of the authors and that there may be domestic reasons for choosing alternative journals.

6.8 WG-EMM-06/14 presented progress towards a trophic model of the ecosystem of the Ross Sea for investigating ecosystem effects of the Antarctic toothfish fishery. It reported on the further development of a carbon-budget trophic-model of the Ross Sea. The Ross Sea is a low primary production system, with production being localised in space and time. The middle-trophic level is dominated by the Antarctic silverfish (*Pleuragramma antarcticum*).

6.9 The Working Group noted that conclusions on the effects of toothfish fishing on the ecosystem cannot yet be made. It encouraged further work on this model to provide insights into the dynamics of the Ross Sea system and to identify the important trophic linkages through which fisheries may indirectly affect the food web of the region.

6.10 The Working Group thanked Dr Pinkerton for his paper as it represented significant progress in the development of trophic models for the region. Dr É. Plagányi (South Africa) noted that there were improvements in this paper on approaches to trophic models in the literature and that this modelling work can be used to help identify the key trophic linkages that may need to be represented in the simplified multispecies models to be used for evaluating management procedures.

6.11 Dr Pinkerton noted that this study has funding for a further three years. It has already identified that the primary area that could be affected by toothfish fishing would be in the western part of the Ross Sea with possible effects on demersal prey species and on toothfish predators such as Weddell seals and killer whales. Future work will aim to develop dynamic models of the food web.

6.12 Drs Holt and Wilson noted the overlap between predators and fisheries in the Ross Sea and indicated work being undertaken by scientists in the USA and New Zealand to develop a proposal for an index for Weddell seals to be considered for inclusion in CEMP in order to monitor for effects of the toothfish fishery in the Ross Sea. The Working Group welcomed these developments and looked forward to receiving proposals for such an index.

6.13 The Working Group noted the need for linkages between experts in WG-EMM and WG-FSA on this work. These linkages would need to involve experts with respect to ecosystem modelling and assessments as well as experts with respect to understanding the biology and ecology of the region and how to interpret changes in CEMP indices developed for the region.

6.14 WG-EMM-06/19 presented further work on modelling the krill–predator dynamics of the Antarctic ecosystem. Results indicated that krill is unable to fully utilise the primary production available. The precision of parameters is reported. The model is extended in this version to include other predators as a group variable, reflecting squid, fish and seabirds, in order to ensure the crabeater seal variable is not a surrogate for these predators as well as the seal group itself. This is work in progress with a number of areas identified for improvement in the future. The development of an improved set of abundance and trend estimates of various krill predators is seen as a priority for improving the reliability of current models, and it is suggested that this should be a key focus of the joint CCAMLR-IWC workshop on this topic.

6.15 The Working Group noted that a strength of the approach in WG-EMM-06/19 is the use of data to condition the models. This paper provides an illustration of how this is done.

6.16 WG-EMM-06/26 updated information presented to the Working Group at its 2005 meeting on the program on the Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean (ICCED). This program is an international initiative launched in May 2005 in response to the increasing need to develop integrated circumpolar analyses of Southern Ocean ecosystems. CCAMLR community scientists have been instrumental in developing this initiative, and a key aim of ICCED is to link with CCAMLR scientists to develop management procedures that include relevant aspects of the wider operation of ocean ecosystems.

6.17 An important aspect of developing ecosystem models and in developing management advice is to consider the movement of biota from one management unit to another. WG-EMM-06/35 discussed a number of issues that need to be addressed in modelling movement, particularly if modelling units are large compared to the ability of the biota to rapidly mix over the entire unit. It provides a solution to the usual movement transition matrices that ensures biomass is not moved in and out of model polygons faster than is biologically reasonable.

6.18 The Working Group noted the progress in developing operating models for use by SC-CAMLR to evaluate management procedures. It noted the current and future work programs of WG-FSA-SAM to develop operating models to evaluate toothfish and icefish management procedures. Some papers presented to WG-EMM this year have direct relevance to the work of WG-FSA-SAM.

Operating Models Subgroup

6.19 The Working Group noted that the Scientific Committee endorsed the recommendation of the Working Group last year to establish the Subgroup on Development of Operating Models (convened by Dr Constable) and to begin a newsgroup to facilitate this work (SC-CAMLR-XXIV, paragraph 3.37). It recommended that the name be shortened to the Operating Models Subgroup for ease of translation and correspondence.

6.20 The Working Group thanked and congratulated the Secretariat on establishing a very useful newsgroup, which is now available for Members to use. It noted the ease of access and the utility of the newsgroup to maintain a record of correspondence on issues being considered by the subgroup. The Working Group noted that the main discussion items in the newsgroup would currently be:

- newsgroup structure and coordination
- single-species models for krill
- multispecies and ecosystem models
- data and parameters for use in existing models
- developments in data and parameters
- organisation of the CCAMLR-IWC workshop.

6.21 The Working Group noted that the newsgroup might be useful to WG-FSA-SAM in developing:

- single-species models for icefish
- single-species models for toothfish.

6.22 The Working Group noted that it will take time for users to become familiar with this form of correspondence and for the newsgroup to be fully utilised. Nevertheless, it encouraged experts developing operating models for use in evaluating management procedures to begin to utilise the newsgroup as a means of generally exchanging ideas and approaches to facilitate the work of WG-EMM.

6.23 Dr Constable indicated that his intention as moderator of the newsgroup was to circulate updates to members of the newsgroup on the activities of the group each month. In order to facilitate rapid exchange of information, it would be useful if members of the newsgroup have in their electronic profile advice on whether they wish to be sent notices when other members post a message on the newsgroup.

6.24 The Working Group agreed that the general tasks for the subgroup would include, *inter alia*:

(i) further development of models presented to the Second Workshop on Management Procedures;

(ii) development of feedback management procedures, including identifying what data might be available from monitoring and how they could be used in such procedures;

(iii) how to adapt models from one area to others within CCAMLR and also how to adapt models and tools developed outside SC-CAMLR;

(iv) review and update parameters used in models;

(v) comparisons of model data and parameters derived using different estimation methods and whether model outcomes are robust to the different approaches;

(vi) development of models that are conditioned on available data.

6.25 The Working Group did not attempt to prioritise these tasks but encouraged members to participate as much as possible in this work.

6.26 The Working Group noted that the outcomes of the FAO Workshop on Modelling Ecosystem Interactions for Informing an Ecosystem Approach to Fisheries to be held in 2007 would be of interest to WG-EMM in its development of ecosystem models for CCAMLR (paragraph 7.16).

CCAMLR-IWC workshop

6.27 The Working Group noted that SC-CAMLR endorsed the recommendation of the Working Group last year to hold a joint workshop with the Scientific Committee of the IWC (SC-IWC) on the development of models of Antarctic krill predators, particularly to discuss the data inputs to those models (SC-CAMLR-XXIV, paragraphs 13.44 to 13.53). The terms of reference for the workshop adopted by the Scientific Committee are given in paragraph 13.47 of SC-CAMLR-XXIV.

6.28 The Scientific Committee established a steering committee to develop a work plan and initiate subgroups to begin preparations of materials for the workshop in 2008 over the intersessional period and provide next year a consolidated proposal for the workshop, including details of a work plan over 2007–2008, a venue and a budget. It also agreed that the new CCAMLR Headquarters would be an appropriate workshop venue pending consideration of timing, budget and the availability of the Secretariat (SC-CAMLR-XXIV, paragraph 13.52).

6.29 The Working Group noted that the CCAMLR Executive Secretary, Dr D. Miller, and Dr K.-H. Kock (IWC Observer) had undertaken their tasks to convey the invitation of SC-CAMLR to SC-IWC to participate in the workshop (SC-CAMLR-XXIV, paragraph 13.51).

6.30 Prof. D. Butterworth (SC-IWC Observer) provided the Working Group with the results of the deliberations of the SC-IWC (CCAMLR-XXV/BG/5; SC-CAMLR-XXV/BG/6). The SC-IWC had expressed a desire to be involved in the workshop and established a steering committee to oversee the process from their perspective. It identified a number of questions and issues to be addressed by the workshop as well as the input that it could make to the workshop. It also outlined a set of tasks and options to be considered by the steering group to facilitate this work. These are outlined in the SC-IWC Report 2006, Annex K, Appendix 6. In particular, the SC-IWC would hope that the workshop should at least provide:

(i) improvements in the development of multispecies spatial models that provide reliable advice regarding krill consumption by large whales in the Southern Ocean and in the southern hemisphere;

(ii) improvements in ability to compare the performance of alternate models in providing management advice that is robust to uncertainty;

(iii) improvements in the characterisation of the temporal and spatial distribution of krill in the Southern Ocean, as well as improvements in the understanding regarding the nature and extent to which sea ice is an important covariate;

(iv) improvements in the collation and integration of time series of data for information on: (a) oceanographic and other environmental data, (b) phytoplankton/other sources of primary production, (c) other zooplankton, (d) forage fish, and (e) other upper trophic level species.

6.31 In addition, where possible, the SC-IWC would expect analyses that use agreed criteria to test for the relative importance of competitive interactions in the Southern Ocean

ecosystem. If this is not possible, it would at least expect advances in the development of experiments that could be undertaken to test various aspects of the family of hypotheses considered.

6.32 As the convener of the SC-CAMLR steering committee for the workshop, Dr Constable convened a discussion by a small group to develop advice to the joint workshop steering group (i.e. the combined steering committees from SC-CAMLR and SC-IWC) on matters that may need to be considered in developing the work plan and approaches to the workshop from the SC-CAMLR perspective. Such advice is provided below on the objectives and scope of the workshop, the data requirements for the workshop, organisation of the workshop and steps that will need to be taken for reporting to SC-CAMLR.

6.33 With respect to the objectives and scope of the workshop, the Working Group suggested that the following points be considered by the steering group:

(i) The requirements of the two scientific committees are very similar. However, it noted that the expectations of the SC-IWC may be much greater than can be achieved. In particular, there may be insufficient time to consider models to as full an extent as suggested by the SC-IWC. The highest priority should be to ascertain the data available for modelling and the attendant uncertainties in those data so that they can be used appropriately in the current and foreseen modelling approaches. The steering group might wish to consider whether the workshop could be undertaken over a longer period than one week in order to provide time for discussions on models. If this occurred, the workshop agenda might be structured in such a way that experts need not attend for the whole meeting.

(ii) It will be important to identify the current suite of ecosystem/multispecies modelling approaches that might be used to inform management advice in order to determine the data to be considered by the workshop. For example, SC-CAMLR has considered relatively small-scale krill–predator models in the southwest Atlantic, while the SC-IWC has considered Antarctic-wide models of large-scale krill–predator dynamics. While a broad discussion on issues in modelling aspects of the Antarctic marine ecosystem might be useful, it was considered that the primary focus would best be on current and identifiable future modelling needs, including, *inter alia*:

(a) What are the spatial and temporal scales appropriate for each species in these models for the purposes of SC-CAMLR and SC-IWC?

(b) How do the dynamics of krill need to be modelled to examine the relative importance of predator consumption versus environmental forcing on those dynamics, and what data are needed to satisfactorily model the dynamics and to discriminate between these hypotheses?

(iii) In order to identify the important data requirements for these models, it would be useful to identify the associated key sources of uncertainty and how those uncertainties can best be dealt with, i.e. what data would be most useful for dealing with those uncertainties?

6.34 The Working Group identified a number of issues that need to be clarified with respect to the data to be considered by the workshop:

(i) Data need to be collated at the metadata level for use in modelling (time trends in abundance, population parameters and so on) rather than collating raw data.

(ii) The concept of 'metadata' as it relates to the workshop objectives needs to be clearly articulated. In that sense, it was noted that metadata (or summary data) are the actual numeric estimates for the quantities to be used in models. Such data need to be at the appropriate level of resolution and to include actual numeric estimates of uncertainty (e.g. variance, covariances or CI). They also need to be accompanied by a reasonably comprehensive description of the data sources and estimation methods used to generate the data. These descriptions should be sufficient for determining the degree of bias in the data and what the ranges of the associated uncertainties might be. The issue of process error (i.e. error other than that arising from survey sampling variance), where relevant, should be included in the description as well as estimates of this where possible. In addition, where there are alternative reasonable interpretations and/or analyses of the underlying data that can lead to substantially different absolute estimates or trends, these should be provided. Single best estimates should not be provided in isolation in situations where substantial uncertainty exists.

(iii) An important outcome would be to determine the comparability of different datasets to be used in the models, e.g. comparability between different surveys of pack-ice seals.

(iv) Data need to be scaled appropriately in order to avoid the potential mismatch between scales, i.e. how does one scale up CCAMLR ecosystem data to large-scale models of the SC-IWC and how does one scale down the IWC data to provide input to smaller-scale SC-CAMLR models?

(v) In the first instance, metadata should be obtained for key species and environmental parameters for the current and imminent modelling approaches at spatial and temporal scales appropriate to those models. It will also be important to identify the degree to which such metadata could be partitioned into smaller spatial and temporal scales in case such modelling became important in the future or became of interest in preparing for the workshop.

6.35 The Working Group identified the following points which will need to be considered by the steering group in organising the workshop:

(i) Achievable milestones will need to be identified in order to create realistic expectations on the potential outcomes of the workshop and to positively engage participants in the process. It was also considered that the workshop may be a part of a longer-term process for achieving all of the aims identified by SC-CAMLR and SC-IWC.

(ii) It is expected that each of the steering committees that comprise the steering group will have conveners reporting back to either SC-CAMLR or SC-IWC. It was noted that the steering group is not a decision-making body except in relation to organising the workshop.

(iii) The steering group will need to undertake its initial organisational work without budgets from the CCAMLR or IWC Secretariats. The steering group is encouraged to work primarily by correspondence and to use opportunities that might arise for some members of the steering group to meet and consider aspects of its work, such as at meetings of SC-CAMLR or SC-IWC.

(iv) An important issue in obtaining metadata for the workshop would be to address any concerns of the data holders including, *inter alia*:

(a) the need to treat data holders evenly and openly
(b) data-ownership be recognised
(c) due credit is given to data holders for their contribution to this work
(d) publication of outputs arising from the data is agreed
(e) evaluation of the utility of data in models is with respect only to quantifying the range of uncertainty surrounding the data, therefore identifying how to use the data appropriately.

(v) Given these issues, it was agreed that access to data will need to comply with the data access rules and protocols of both CCAMLR (*CCAMLR Basic Documents*, Part II, Rules for Access and Use of CCAMLR Data) and the IWC (International Whaling Commission 2004 Report of the Scientific Committee, Annex T: Report of the Data Availability Working Group. *J. Cetacean Research and Management*, 6 (Suppl.): 406–407). It was noted that Procedure B of the IWC is likely to be the appropriate procedure from the IWC perspective and that both sets of rules of access have many consistencies. It was agreed that the Secretariats of both organisations should establish the appropriate protocols for data access consistent with these approaches.

(vi) It was noted that some of the information needed for the workshop is not held in either the CCAMLR or IWC Secretariats. It will be useful if the steering group could correspond, with the assistance of the CCAMLR and IWC Secretariats, with data holders in the wider CCAMLR and IWC communities.

(vii) Rules of participation in the workshop will need to be developed by the Secretariats in order to satisfy the rules of procedure of both organisations. It was noted that such rules of participation should enable participation by representatives of Members of both organisations as well as participation of relevant experts. It would be useful if the steering group could determine an appropriate list of experts that might be usefully involved in the meeting in order to help SC-CAMLR and SC-IWC determine participation in the workshop.

(viii) It was agreed that, depending on budgetary constraints, commissioned reviews by experts prior to the workshop would be useful in collating and reviewing available metadata on relevant taxonomic groups. It would be expected that

such reviews be available to workshop participants at least three months prior to the workshop in order to provide the opportunity for participants to use these papers to develop submissions to the workshop.

(ix) It was agreed that the workshop would be usefully held early in 2008 prior to the meeting of SC-IWC. It was noted that SC-CAMLR had agreed that the CCAMLR Headquarters would be an appropriate venue. It was agreed that this would be a good venue for the workshop.

6.36 The Working Group congratulated the subgroup on progressing these issues and encouraged the steering group to establish a work program, workshop format and budget in time for advising SC-CAMLR of these details at its meeting in October 2006.

6.37 In view of the positive response of the SC-IWC to holding a joint CCAMLR-IWC workshop and its establishment of a steering committee to support the process, the Working Group recommended that the Chair of the Scientific Committee, with the support of the Executive Secretary, correspond with the IWC Secretariat and the Chair of the SC-IWC to initiate preparations for the workshop, including the following actions:

- formally establish the steering group for the workshop as a combination of the two steering committees;
- establish communication between the two convenors of the steering committees to jointly convene the work of the steering group;
- request that the steering group take note of the comments above;
- begin correspondence between the CCAMLR and IWC Secretariats on the issues described above.

Long-term work plan

6.38 The Working Group noted the following future work arising from the Second Workshop on Management Procedures:

(i) development on models provided to the workshop this year –

(a) EPOC (Appendix D, paragraphs 6.1 to 6.3)
(b) SMOM (Appendix D, paragraph 6.4)
(c) KPFM2 (Appendix D, paragraph 6.5);

(ii) development of performance measures (Appendix D, paragraph 6.6);

(iii) development of suitable models of fleet dynamics (Appendix D, paragraphs 6.7 and 6.8);

(iv) technical discussions on models (Appendix D, paragraph 6.9) on –

(a) improvements and refinements to models
(b) incorporation of future needs into models
(c) developing datasets to provide further parameter estimations
(d) evaluation of the performance of models in relation to agreed technical requirements;

(v) development of Fishing Options 5 and 6 (Appendix D, paragraph 6.10), including –

(a) defining Fishing Option 6
(b) determining how to acquire knowledge to assist the development of these options;

(vi) further development of spatially-explicit management frameworks and to advance methods for use by CCAMLR to evaluate such management frameworks for krill (Appendix D, paragraph 6.11), including, *inter alia* –

(a) development of operating models;

(b) development and evaluation of decision rules for adjusting fishing activities (e.g. catch limits) based on field data in the future;

(c) further development of operational objectives and performance measures and the means for providing integrated advice to the Commission on the relative merits of different strategies with respect to Article II.

6.39 The Working Group also noted that it would be useful to further develop models on the Ross Sea, including the development of dynamic models (paragraph 6.10).

6.40 The Working Group discussed and identified work to assist different elements of its agenda, notably:

(i) Krill and krill fishery –

(a) develop an index of CPUE for the krill fishery, noting the differences between vessels (paragraph 3.79);

(b) develop a fleet dynamics model (paragraphs 2.11 and 3.65 to 3.73);

(c) review precautionary catch limits for krill (SC-CAMLR-XXIV, Annex 4, paragraphs 6.39 and 6.48), including, *inter alia*:

- implement the recommendations of SG-ASAM with respect to estimating biomass from acoustic data;

- review method for determining the CV of the acoustic biomass estimate;

- review parameters, including growth and recruitment variability;

- examine whether integrated modelling approaches could be used to estimate recruitment variability and *M* from long-term datasets;

- evaluate the existing krill fishery management strategy;

(d) define harvesting units (paragraphs 5.20 and 5.22);

(e) review available time series of krill data compared to environment variables (paragraph 4.30).

(ii) CEMP –

(a) consider methods for summarising CEMP indices to signal the effects of fishing on the ecosystem and changes needed in krill fishing (feedback management) (including, *inter alia*, paragraph 4. 2):

- review use of ordination methods
- consider how to deal with missing values in time series of CEMP data
- review the use of the FPI for krill;

(b) develop a proposal to consider whether a parameter for Weddell seals could be part of CEMP to monitor effects of toothfish fishing in the Ross Sea (paragraph 6.12).

(iii) Krill predators –

(a) consider estimating age-specific mortality rates for predators, in particular characterising how predator mortality may change with different environmental factors (paragraph 4.17);

(b) consider metapopulation models for predators, in particular the circumstances under which movement between land-based colonies might arise or the colonisation of new areas (paragraph 4. 9);

(c) hold a workshop on estimating predator abundance in 2008 (paragraph 6.4).

6.41 The Working Group considered the large volume of work being proposed to assist its work in the future. It considered the priorities of this work in light of the priorities indicated by the Scientific Committee last year (SC-CAMLR-XXIV, paragraph 3.39):

(i) facilitate the continued evaluation of management procedures to allocate the precautionary catch limit in Area 48 among SSMUs;

(ii) consider revising estimates of B_0 and γ in all areas taking account of recent developments in estimating parameters used in assessments, thereby revising estimates of precautionary yield;

(iii) develop SSMU-specific estimates of predator abundance and demand in Area 48.

6.42 The Working Group noted that its timetable of work will need to be cognisant of the other work of the Scientific Committee which includes:

- IPY coordination workshop (2007)
- workshop on bioregionalisation (2007)
- CCAMLR-IWC workshop (April 2008).

6.43 The Working Group agreed that, although significant progress was made with respect to subdividing the krill catch limit amongst SSMUs, the work on this item remained to be completed and requires a mechanism for considering contributions on this item over the coming years until sufficient work has been completed to adequately address the item.

6.44 The Working Group agreed that a further workshop on the subdivision of krill catch limits next year would not be appropriate. However, this work remains a high priority to be completed. The Working Group noted there was a need for clarity on the operational objectives before substantial further progress can be made. In order to progress work and to help determine when such work might be considered complete, time needs to be set aside during the meeting next year to consider the following issues:

(i) technical improvement of models and parameter inputs (paragraph 6.38(iv))
(ii) operational objectives, performance measures and the means for providing integrated advice to the Commission on the relative merits of different krill fishing strategies with respect to Article II (paragraph 6.38(vi)c).

6.45 To that end, the Working Group requested its members to provide input on these issues to next year's meeting. Some of this work may benefit from input from WG-FSA-SAM, particularly in relation to technically improving models and estimating parameters. The Working Group requested that the Scientific Committee consider whether WG-FSA-SAM could consider contributions on this topic at its next meeting.

6.46 The Working Group noted there has been insufficient time in recent meetings to review the state of knowledge on krill and krill-predator biology. It recommended that such work be brought forward in the work of WG-EMM. For example, the second week of the meeting could give emphasis to one or two topics.

6.47 Given these considerations, the Working Group recommended the following timetable of workshops, although this may be changed if work on these issues is progressed more quickly in the meantime or other items are considered to be of higher priority by the Scientific Committee:

(i) review of B_0 and precautionary catch limits (WG-EMM workshop 2007)
(ii) predator abundance and surveys (WG-EMM workshop 2008)
(iii) mechanism for progressing subdivision of krill catch limits amongst SSMUs (WG-EMM workshop 2009).

6.48 It was agreed that this timetable should not preclude the work being done in other groups or workshops of the Scientific Committee.

6.49 For 2007, the Working Group agreed that a workshop to review estimates of B_0 and precautionary catch limits for krill should be held in conjunction with the Working Group meeting, which could consider the following points:

(i) review of parameters used in the assessment, including growth and recruitment variability;

(ii) examine whether integrated modelling approaches could be used to estimate recruitment variability and *M* from long-term datasets;

(iii) consider the level of krill escapement to provide for predators in the decision rule;

(iv) consider alternative methods for estimating catch limits for krill according to the CCAMLR decision rules and how the different methods might be compared and evaluated for providing advice;

(v) consider sources of uncertainty that may not be able to be included specifically in the estimation of B_0 or the assessment process generally.

6.50 The Working Group requested SG-ASAM and WG-FSA-SAM to provide input to the workshop on what is the most appropriate method for estimating B_0 from survey data, considering design-based versus model-based estimation methods. It also requested SG-ASAM to review the method for estimating CV for the biomass estimate provided by Demer and Conti (2005) and consider whether this is sufficient to determine the uncertainty in B_0 more generally.

6.51 The Convener of WG-EMM asked Dr Nicol to convene the workshop to review B_0 and the precautionary catch limits for krill, and the Working Group agreed with his nomination.

6.52 The Working Group agreed not to invite an outside expert to this workshop but participants were encouraged, as appropriate, both to independently consult with outside experts and to bring new delegates to the workshop.

6.53 In discussing its long-term program of work, the Working Group agreed that it would be timely to review the agenda and how a more flexible approach to each year's meeting might be needed. It was noted that the work program needs to be realistic in order to retain the confidence of the Scientific Committee and Commission. The Working Group agreed that it would be useful if Dr Reid could correspond with the Working Group to develop a work plan for the coming years and an approach to managing the agenda each year. It was considered that this plan should be submitted to the Scientific Committee to provide input to the discussion on re-organising the work of the Scientific Committee. In addition, the Working Group requested that the Scientific Committee provide advice on what it considers to be the priority work programs for WG-EMM over the coming years.

6.54 In terms of meeting organisation, the Working Group noted that it would be useful to absorb the workshop report into the Working Group report. It was agreed that the Working Group should not have to receive and adopt the recommendations and future work of the workshop; agreement by the workshop was sufficient to have obtained agreement from the Working Group.

6.55 Dr Constable noted that this could mean that the work of the Working Group be separated into two parts so that report adoption for the respective parts could be achieved at the end of each part. Such a process would provide flexibility in the order of work in the first and second weeks. The order could be determined by how overlap in experts between WG-FSA-SAM and WG-EMM would best be achieved.

6.56 The Working Group agreed that it is desirable to achieve efficiencies in the organisation of its work in order to maximise the time available for expert consultations.

Key points for consideration by the Scientific Committee

6.57 The Working Group would like the Scientific Committee to consider, as appropriate, the following points arising from discussions of future work:

(i) the progress made on assessing abundance of predators and that the workshop on this topic should be deferred until 2008 to consider estimates of abundance of predators and how gaps may be filled through future surveys or other work (paragraphs 6.1 to 6.4);

(ii) the progress made in developing models of the Antarctic marine ecosystem (paragraphs 6.5 to 6.18);

(iii) the need for linkages between WG-FSA and WG-EMM with respect to (a) modelling and assessment methods, (b) biology and ecology of relevant species, (c) ecosystem effects of fisheries, in fish-based ecosystems such as the Ross Sea (paragraphs 6.13 and 6.18);

(iv) the recommended change to the name of the Subgroup on the Development of Operating Models to Operating Models Subgroup (paragraph 6.19);

(v) the development of the newsgroup to support the Operating Models Subgroup (paragraphs 6.20 to 6.23), including thanking the Secretariat for facilitating the establishment of the newsgroup;

(vi) the general tasks identified by the Operating Models Subgroup (paragraph 6.24);

(vii) the progress made in establishing a steering group for the CCAMLR-IWC workshop on the development of models of Antarctic krill predators, particularly to discuss the data inputs to those models (paragraph 6.27);

(viii) the general points for future work of WG-EMM (paragraphs 6.38 to 6.40);

(ix) the general discussion surrounding its future work program (paragraphs 6.41 to 6.43);

(x) the request for Members to provide input to next year's meeting of WG-EMM on operational objectives, performance measures and the means for providing integrated advice to the Commission on the relative merits of different krill fishing strategies with respect to Article II (paragraphs 6.44 and 6.45);

(xi) the request for Members to provide input to next year's meetings of WG-EMM and WG-FSA-SAM on technical improvement of models and parameter inputs (paragraphs 6.44 and 6.45);

(xii) the need to consider how to bring forward in the work of WG-EMM, reviews of the biology of key species (paragraph 6.46);

(xiii) the recommendation that the following timetable of workshops be undertaken in conjunction with meetings of WG-EMM, although this may be changed if work on these issues is progressed more quickly in the meantime or other items are considered to be of higher priority by the Scientific Committee (paragraph 6.47) –

(a) review of B_0 and precautionary catch limits (WG-EMM workshop 2007)
(b) predator abundance and surveys (WG-EMM workshop 2008)
(c) mechanism for progressing subdivision of krill catch limits amongst SSMUs (WG-EMM workshop 2009);

(xiv) this timetable should not preclude the work being done in other groups or workshops of the Scientific Committee (paragraph 6.48);

(xv) the workshop in 2007 to review estimates of B_0 and precautionary catch limits for krill should be held in conjunction with the Working Group meeting, and could consider the following points (paragraph 6.49) –

(a) review of parameters used in the assessment, including growth and recruitment variability;

(b) examine whether integrated modelling approaches could be used to estimate recruitment variability and M from long-term datasets;

(c) consider the level of krill escapement to provide for predators in the decision rule;

(d) consider alternative methods for estimating catch limits for krill according to the CCAMLR decision rules and how the different methods might be compared and evaluated for providing advice;

(e) consider sources of uncertainty that may not be able to be included specifically in the estimation of B_0 or in the assessment process generally;

(xvi) the request for WG-FSA-SAM to provide input to the WG-EMM workshop on what is the most appropriate method for estimating B_0 from survey data, considering design-based versus model-based estimation methods (paragraph 6.50);

(xvii) the request for SG-ASAM to also provide input to the WG-EMM workshop on what is the most appropriate method for estimating B_0 from survey data and to include a review of the method for estimating CV for the biomass estimate (paragraph 6.50);

(xviii) the recommended convener for the workshop in 2007 is Dr Nicol (paragraph 6.51);

(xix) the Convener of WG-EMM will correspond with the Working Group to develop a work plan for the coming years and an approach to managing the agenda each year, taking note of the discussion in paragraphs 6.53 to 6.56 and to submit this plan to the Scientific Committee to provide input to the discussion on reorganising the work of the Committee.

OTHER BUSINESS

Meeting of the Steering Committee on the Review of the Structure of the Working Groups of the Scientific Committee

7.1 On 16 July 2006, several members of the SC-CAMLR Steering Committee on the Review of the Structure of the Working Groups of the Scientific Committee met in Walvis Bay, Namibia. The meeting was held on the Sunday before the start of the WG-EMM meeting and included Drs Constable (author of SC-CAMLR-XXIV/BG/30: model reviewed by the Scientific Committee), S. Hanchet (New Zealand) (WG-FSA Convener), Holt (Steering Committee Convener) and C. Jones (USA) (WG-FSA-SAM Convener), Ramm (CCAMLR Secretariat Data Manager), Reid (WG-EMM Convener) and Ms G. Tanner (CCAMLR Secretariat Communications Officer). Absent were Drs K.-H. Kock (Germany) and Naganobu, Ms K. Rivera and Mr N. Smith (Co-conveners of ad hoc WG-IMAF) and Dr E. Fanta (Scientific Committee Chair).

7.2 The steering committee reviewed past correspondence among its members and reiterated that both short- and long-term needs of the Scientific Committee must be accommodated in any plausible reorganisation scheme. The committee also agreed that it would be preferable if the reorganisation of the working groups resembled evolution rather than revolution. In particular, many aspects of the working groups' activities are presently being appropriately addressed so 'it should not be fixed if it is not broken'. The reorganisation process is likely to require considerable time but present needs are being met. It also recognised that any reorganisation should not result in an increase in the total meeting time from the present five weeks (presently two weeks for WG-FSA, two weeks for WG-EMM, and one week for WG-FSA-SAM) and that no increase in resources be required from the Secretariat.

7.3 However, future requirements will need modifications of the present way the Scientific Committee does business. For example, it is anticipated that the Scientific Committee will be required to provide advice to the Commission with respect to marine protected areas, predator–prey–fishery models, stock assessment models, icefish and krill acoustic

measurements, conservation status of seabirds and destructive fishing practices to name a few. In addition, it was recognised that some items presently on the working groups' agendas may be done at multi-year intervals instead of annually, or not at all.

7.4 The committee recognised that the present Scientific Committee working group structure could, with appropriate modification, address present and future needs. It felt that WG-FSA-SAM could be expanded to serve as a technical group to address issues relevant to all three existing working groups (WG-FSA, WG-EMM, ad hoc WG-IMAF). One possible version would be that WG-FSA-SAM be used by all three groups to address technical assessment and modelling issues. These would include fish stock assessment issues (of interest to WG-FSA), krill, seal and seabird stock assessment issues (of interest to WG-EMM), and estimation of the status of seabirds (of interest to WG-IMAF).

7.5 As WG-FSA-SAM would be addressing issues of interest to all working groups, the Scientific Committee would need to provide guidance on priority of tasks to be undertaken. Therefore, WG-FSA-SAM should become a working group of the Scientific Committee. The Scientific Committee would need to conduct a long-term review of its work plan using the model developed by WG-EMM's five-year plan. This would allow long-term planning by WG-FSA-SAM so that the appropriate experts could be present at the appropriate meetings. It would be very fluid in its composition, duration of meeting time and issues addressed. It might meet two weeks if considering both fish and krill–predator–prey issues or one week, for example, when considering only fish stock assessment issues. Conversely, WG-EMM may need to meet for one or two weeks depending on its workload for that year. As the work of WG-FSA becomes more static where assessments are conducted at multi-year intervals instead of annually using standard models, it might need one or two weeks to meet depending on its work load.

7.6 The Working Group agreed that the proposed restructuring of WG-FSA-SAM has the potential of providing flexibility to have the appropriate experts present to address specific questions of interest to WG-EMM. Conversely, this new structure may reduce the total time some members might spend participating in meetings.

7.7 The Working Group agreed that it was necessary to ensure that the restructuring did not create the situation in which biologists and quantitative modellers are separated by groups as it is important to have input from both areas of expertise to develop appropriate management advice.

ICCED

7.8 ICCED is a multidisciplinary international initiative to develop a coordinated circumpolar approach to understand climate interactions in the Southern Ocean, the implications for ecosystem dynamics, the impacts on biogeochemical cycles, and the development of management procedures (WG-EMM-06/26). Several CCAMLR scientists have been instrumental in developing this initiative and a key aim of ICCED is to link with CCAMLR scientists to develop management procedures that include relevant aspects of the wider operation of ocean ecosystems.

7.9 The Working Group recognised the close connection many CCAMLR scientists had with various aspects of ICCED and encouraged continued cooperation between the two groups. The Working Group looked forward to seeing results of activities relative to CCAMLR's work completed by the ICCED initiative.

Ross Sea ecosystem

7.10 Data on diet, foraging behaviour and habitat use for killer whales, Weddell seals, penguins, petrels and skuas found in the Ross Sea shelf ecosystem are summarised to increase appreciation among fishery managers of the close spatial and temporal ecological overlaps among predators and the Antarctic toothfish fishery and Antarctic minke whale harvest (WG-EMM-06/29). Most top predators in the Ross Sea feed at relatively great depths while three species feed in the entire water column and others forage near the surface to mid-depths.

7.11 The Working Group recognised that, as the Ross Sea fishery has expanded over the last few years, there was an increasing need to investigate effects on top predators and toothfish prey species which overlap spatially and temporally with the toothfish fishery.

7.12 The need to address ecosystem effects in the Ross Sea, and even the entire East Antarctic region, in the future work of WG-EMM was also noted. It was noted that the Ross Sea ecosystem in particular was a fish-centric ecosystem as opposed to the west Atlantic krill-centric ecosystem. The Working Group encouraged researchers working in these areas to participate in future WG-EMM meetings and to submit appropriate information, data and research results during future years.

7.13 It was agreed that WG-EMM needed to provide increased emphasis on ecosystem aspects of the Ross Sea and East Antarctic regions, however, it was also noted that many of the Working Group's agenda items addressed Antarctic-wide issues and that these should not in the future be partitioned into regional initiatives.

Workshop on krill-based ecosystem dynamics

7.14 The Working Group was informed by correspondence to Dr Reid that the Lenfest Ocean Program, a non-profit private organisation that supports scientific research, is considering sponsoring a scientific/technical workshop on krill-based ecosystem dynamics in the southwest Atlantic to be held in April–June 2007. The workshop would further develop a broad-based technical understanding of: (i) the dynamics of the krill-based ecosystem in the southwest Atlantic, (ii) how climate change and fishing might impact those dynamics, and (iii) what might need to be done to enhance measures taken by CCAMLR to conserve species dependent on krill for food.

7.15 The Working Group noted the utility of the proposed workshop and it would be very interested in seeing the outcomes of the workshop. Interested members should contact the Lenfest Ocean Program directly (www.lenfestoceans.org).

FAO Workshop on Modelling Ecosystem Interactions
for Informing an Ecosystem Approach to Fisheries

7.16 The Working Group was informed that FAO will be conducting a Workshop on Modelling Ecosystem Interactions for Informing an Ecosystem Approach to Fisheries during the second or third quarter of 2007. Participation will be by FAO invitation only. However, as CCAMLR scientists have considerable expertise relative to ecosystem modelling, it is likely that individuals with high level of experience in this topic will be welcomed to participate. The CCAMLR Secretariat was invited to submit the names of a small number of experts who would be able to contribute. Interested individuals should contact the CCAMLR Secretariat.

ADOPTION OF THE REPORT AND CLOSE OF THE MEETING

8.1 The report of the twelfth meeting of WG-EMM was adopted.

8.2 At the close of the meeting, Dr Pinkerton advised the Working Group that New Zealand had confirmed that it would host the meeting of WG-EMM in 2007. The venue and time of the meeting would be announced as soon as these were finalised.

8.3 In closing the meeting, Dr Reid thanked all participants for their goodwill and collaboration, and for their detailed contributions to the meeting. He also thanked Dr Miller and the Secretariat staff for their support.

8.4 Dr Reid also thanked the Namibian Delegation for their contributions and warm hospitality. He encouraged further participation at future meetings of CCAMLR working groups.

8.5 Dr Holt, on behalf of the Working Group, thanked Dr Reid for his leadership. This was Dr Reid's first year as Convener of WG-EMM and he had met the challenges of this position with enthusiasm, and had led the meeting to a successful conclusion.

8.6 The meeting was closed.

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APPENDIX A

AGENDA

Working Group on Ecosystem Monitoring and Management
(Walvis Bay, Namibia, 17 to 28 July 2006)

1. Introduction
   - 1.1 Opening of the meeting
   - 1.2 Adoption of the agenda and organisation of the meeting

2. Second Workshop on Management Procedures to evaluate options for subdividing the krill catch limit among SSMUs

3. Status and trends in the krill fishery
   - 3.1 Fishing activity
   - 3.2 Description of the fishery
   - 3.3 Scientific observation
   - 3.4 Regulatory issues
   - 3.5 Key points for consideration by the Scientific Committee

4. Status and trends in the krill-centric ecosystem
   - 4.1 Status of predators, krill resource and environmental influences
   - 4.2 Other prey species
   - 4.3 Methods
   - 4.4 Future surveys
   - 4.5 Key points for consideration by the Scientific Committee

5. Status of management advice
   - 5.1 Protected areas
   - 5.2 Harvesting units
   - 5.3 Small-scale management units
   - 5.4 Analytical models
   - 5.5 Existing conservation measures
   - 5.6 Key points for consideration by the Scientific Committee

6. Future work
   - 6.1 Predator surveys
   - 6.2 Ecosystem models, assessments and approaches to management
   - 6.3 Long-term work plan
   - 6.4 Key points for consideration by the Scientific Committee

7. Other business
   - 7.1 Reorganisation of the work of the Scientific Committee

8. Adoption of report and close of meeting.

APPENDIX B

LIST OF PARTICIPANTS

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(Walvis Bay, Namibia, 17 to 28 July 2006)

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APPENDIX C

LIST OF DOCUMENTS

Working Group on Ecosystem Monitoring and Management
(Walvis Bay, Namibia, 17 to 28 July 2006)

WG-EMM-06/1	Provisional Agenda and Provisional Annotated Agenda for the 2006 Meeting of the Working Group on Ecosystem Monitoring and Management (WG-EMM)
WG-EMM-06/2	List of participants
WG-EMM-06/3	List of documents
WG-EMM-06/4	CEMP indices: 2006 update Secretariat
WG-EMM-06/5	Krill fishery report: 2006 update Secretariat
WG-EMM-06/6 Rev. 1	Summary of notifications for krill fisheries in 2006/07 Secretariat
WG-EMM-06/7	By-catch of small fish in a sub-Antarctic krill fishery K.A. Ross, L. Jones, M. Belchier and P. Rothery (United Kingdom)
WG-EMM-06/8	Development of foraging behaviour and evidence of extended parental care in the gentoo penguin (*Pygoscelis papua*) M. Polito and W.Z. Trivelpiece (USA)
WG-EMM-06/9	Impact of predation by Cape fur seals *Arctocephalus pusillus* on Cape gannets *Morus capensis* at Malgas Island, Western Cape, South Africa A.B. Makhado, R.J.M. Crawford and L.G. Underhill (South Africa) (*African Journal of Marine Science*, submitted)
WG-EMM-06/10	Demography of Antarctic krill in the Lazarev Sea (Subarea 48.6) in the 2005/06 season V. Siegel (Germany)
WG-EMM-06/11	Descriptive analysis of mesopelagic backscatter from acoustic data collected in the Ross Sea R.L. O'Driscoll (New Zealand)

WG-EMM-06/12	A spatial multi-species operating model (SMOM) of krill–predator interactions in small-scale management units in the Scotia Sea É. Plagányi and D. Butterworth (South Africa)
WG-EMM-06/13	Time series of Drake Passage Oscillation Index (DPOI) from 1952 to 2006, Antarctica M. Naganobu and K. Kutsuwada (Japan)
WG-EMM-06/14	Progress towards a trophic model of the ecosystem of the Ross Sea, Antarctica, for investigating effects of the Antarctic toothfish fishery M. Pinkerton, S. Hanchet and J. Bradford-Grieve (New Zealand)
WG-EMM-06/15	An overview of a large ecosystem survey of the southwest Indian Ocean sector of the Southern Ocean (CCAMLR Division 58.4.2) S. Nicol, S. Kawaguchi, T. Jarvis, G. Williams, N. Bindoff, D. Thiele (Australia), J. Schwarz (Germany), A. Davidson, S. Wright, J. Gedamke and P. Thompson (Australia) (IWC SC Meeting Document Number SC/58/E27)
WG-EMM-06/16	Biomass of Antarctic krill (*Euphausia superba*) off east Antarctica (30–80°E) in January–March 2006 T. Jarvis, E. van Wijk, N. Kelly, S. Kawaguchi and S. Nicol (Australia)
WG-EMM-06/17	Winter distribution of chinstrap penguins from two breeding sites in the South Shetland Islands of Antarctica W.Z. Trivelpiece, S. Buckelew, C. Reiss and S.G. Trivelpiece (USA)
WG-EMM-06/18	Technical note on the sampling procedures of the Saga Sea J. Hooper (United Kingdom), T. Knutsen (Norway), D. Agnew (United Kingdom) and S.A. Iversen (Norway)
WG-EMM-06/19	Further progress on modelling the krill–predator dynamics of the Antarctic ecosystem M. Mori (Japan) and D.S. Butterworth (South Africa) (IWC SC Meeting Document Number SC/58/E14)
WG-EMM-06/20	A comparison of model predictions from KPFM1 and KPFM2 J. Hinke, G. Watters (USA), S. Hill and K. Reid (United Kingdom)
WG-EMM-06/21	Comparison of long-term trends in abundance, recruitment and reproductive success of five populations of *Pygoscelis* penguins in the South Shetland Islands, Antarctica J.T. Hinke (USA), K. Salwicka (Poland), S.G. Trivelpiece, G.M. Watters and W.Z. Trivelpiece (USA)

WG-EMM-06/22	KPFM2, be careful what you ask for – you just might get it G.M. Watters, J.T. Hinke (USA), K. Reid and S. Hill (United Kingdom)
WG-EMM-06/23	The krill maturity cycle: a conceptual description of the seasonal cycle in Antarctic krill S. Kawaguchi, T. Yoshida, L. Finley, P. Cramp and S. Nicol (Australia)
WG-EMM-06/24	Learning about Antarctic krill from the fishery S. Kawaguchi and S. Nicol (Australia)
WG-EMM-06/25	Intra-annual variability in the abundance of Antarctic krill (*Euphausia superba*) at South Georgia, 2002–2005: within-year variation provides a new framework for interpreting previous 'annual' krill density estimates R.A. Saunders, J.L. Watkins, K. Reid, E.J. Murphy, P. Enderlein, D.G. Bone and A.S. Brierley (United Kingdom) *(CCAMLR Science*, submitted)
WG-EMM-06/26	Integrated analyses of circumpolar climate interactions and ecosystem dynamics in the Southern Ocean (ICED) E.J. Murphy (United Kingdom), E. Hofmann (USA) and R. Cavanagh (United Kindom)
WG-EMM-06/27	On possible influence of continuous krill fishing technology with the use of 'air-bubbling suspension system' on ecosystem elements S.M. Kasatkina and V.A. Sushin (Russia)
WG-EMM-06/28	An illustrative management procedure for exploring dynamic feedback in krill catch limit allocations among small-scale management units É. Plagányi and D. Butterworth (South Africa)
WG-EMM-06/29	Managing ecosystem uncertainty: critical habitat and dietary overlap of top-predators in the Ross Sea D. Ainley, V. Toniolo, G. Ballard (USA), K. Barton (New Zealand), J. Eastman (USA), B. Karl (New Zealand), S. Focardi (Italy), G. Kooyman (USA), P. Lyver (New Zealand), S. Olmastroni (Italy), B.S. Stewart, J.W. Testa (USA) and P. Wilson (New Zealand)
WG-EMM-06/30 Rev. 1	A compilation of parameters for a krill–fishery–predator model of the Scotia Sea and Antarctic Peninsula S. Hill, K. Reid, S. Thorpe (United Kingdom), J. Hinke and G. Watters (USA) *(CCAMLR Science*, submitted)

WG-EMM-06/31	Preliminary report from New Zealand research voyages to the Balleny Islands in the Ross Sea region, Antarctica, January to March 2006 B.R. Sharp (New Zealand)
WG-EMM-06/32	A review and update of krill biomass trends in the South Shetland Islands, Antarctica, using the simplified stochastic wave born approximation C.S. Reiss and A.M. Cossio (USA)
WG-EMM-06/33	Last investigations of Ukraine in Antarctica connected with assumed marine protected area Delegation of Ukraine
WG-EMM-06/34	The state of krill (*E. supberba*) fisheries in Subareas 48.2 and 48.1 in February–May 2006 V.A. Bibik (Ukraine)
WG-EMM-06/35	A nonparametric algorithm to model movement between polygon subdomains in a spatially explicit ecosystem model T. Lenser and A. Constable (Australia)
WG-EMM-06/36	Estimates of krill biomass with commercial significance in small-scale management units applying geostatistics techniques S.M. Kasatkina and P.S. Gasyukov (Russia)
WG-EMM-06/37	Regionalisation of the Southern Ocean: a statistical framework B. Raymond and A. Constable (Australia)
WG-EMM-06/38 Rev. 1	Using the EPOC modelling framework to assess management procedures for Antarctic krill in Statistical Area 48: evaluating spatial differences in productivity of Antarctic krill A.J. Constable (Australia)
WG-EMM-06/39	A life table for female Antarctic fur seals breeding at Cape Shirreff, Livingston Island M.E. Goebel, B.I. McDonald, J.D. Lipsky (USA), V.I. Vallejos, R.A. Vargas, O. Blank (Chile), D.P. Costa (USA) and N.J. Gales (Australia)
WG-EMM-06/40	Report of the Workshop on Management Procedures (Walvis Bay, Namibia, 17 to 21 July 2006)

Other Documents

WG-EMM-06/P1	Seabird research at Cape Shirreff, Livingston Island, Antarctica, 2005/06 E.S.W. Leung, R.A. Orben and W.Z. Trivelpiece (USA) (*AMLR 2005/2006 Field Season Report*)

WG-EMM-06/P2	The effects of global climate variability in pup production of Antarctic fur seals J. Forcada, P.N. Trathan, K. Reid and E.J. Murphy (United Kingdom) (*Ecology*, 86 (9): 2408–2417)
WG-EMM-06/P3	Contrasting population changes in sympatric penguin species in association with climate warming J. Forcada, P.N. Trathan, K. Reid, E.J. Murphy and J.P. Croxall (United Kingdom) (*Global Change Biology*, 12: 1–13)
WG-EMM-06/P4	Foraging dynamics of macaroni penguins (*Eudyptes chrysolophus*) at South Georgia during brood-guard P.N. Trathan, C. Green, J. Tanton, H. Peat, J. Poncet and A. Morton (United Kingdom) (*Marine Ecology Progress Series*, in press)
WG-EMM-06/P5	Spatial and temporal variability in the fish diet of Antarctic fur seal *Arctocephalus gazella* in the atlantic sector of the southern ocean K. Reid, D. Davis, I.J. Staniland (United Kingdom) (*Canadian Journal of Zoology*, in press)
WG-EMM-06/P6	Effects of variability in prey abundance on reproduction and foraging in chinstrap penguins (*Pygoscelis antarctica*) D.A. Croll, D.A. Demer, R.P. Hewitt, J.K. Jansen, M.E. Goebel and B.R. Tershy (USA) (*Journal of Zoology*, in press)
WG-EMM-06/P7	See WG-EMM-06/39
CCAMLR-XXV/BG/5	Collaboration with CCAMLR on a workshop regarding Antarctic krill predators Secretariat
SC-CAMLR-XXV/BG/2	Report of the Second Meeting of the Subgroup on Acoustic Survey and Analysis Methods (Hobart, Australia, 23 and 24 March 2006)
SC-CAMLR-XXV/BG/5	Convener's progress report on intersessional activities of the Subgroup for the Implementation of the CCAMLR 2008 IPY Project V. Siegel (Convener, Steering Group 'CCAMLR 2008 IPY Survey')
SC-CAMLR-XXV/BG/6	Observer's Report from the 58th Meeting of the Scientific Committee of the International Whaling Commission (St Kitts, 26 May to 6 June 2006) CCAMLR Observer (K.-H. Kock, Germany)

APPENDIX D

REPORT OF THE SECOND WORKSHOP ON MANAGEMENT PROCEDURES

(Walvis Bay, Namibia, 17 to 21 July 2006)

CONTENTS

REPORT OF THE SECOND WORKSHOP ON MANAGEMENT PROCEDURES

(Walvis Bay, Namibia, 17 to 21 July 2006)

INTRODUCTION

1.1 The Second Workshop on Management Procedures to Evaluate Options for Subdividing the Krill Catch Limit among Small-Scale Management Units (SSMUs) was held at the Pelican Bay Hotel, Walvis Bay, Namibia. The workshop was conducted during the first week of WG-EMM-06 (17 to 21 July 2006) and was co-convened by Ms T. Akkers (South Africa) and Dr C. Reiss (USA).

1.2 The preliminary agenda was discussed and adopted without change (Attachment 1), and the meeting participants are listed in Attachment 2.

1.3 The report was prepared by Dr S. Hill (UK), Mr J. Hinke (USA), Drs C. Jones (USA), S. Nicol (Australia), M. Pinkerton (New Zealand), D. Ramm (Data Manager) and K. Reid (Convener, WG-EMM).

1.4 The first workshop was held in 2005 (SC-CAMLR-XXIV, Annex 4, Appendix D), and aimed to evaluate management procedures for the krill fishery by examining six candidate methods for subdividing the krill catch. The agreed candidate methods to be evaluated were based on:

(i) the spatial distribution of catches by the krill fishery;

(ii) the spatial distribution of predator demand;

(iii) the spatial distribution of krill biomass;

(iv) the spatial distribution of krill biomass minus predator demand;

(v) spatially explicit indices of krill availability that may be monitored or estimated on a regular basis;

(vi) pulse-fishing strategies in which catches are rotated within and between SSMUs.

1.5 At its meeting in 2005, WG-EMM welcomed the developments achieved during the first workshop, and agreed to a second workshop to continue the evaluation of procedures to allocate the precautionary krill catch limit in Area 48 among SSMUs.

1.6 The terms of reference for the second workshop were to (SC-CAMLR-XXIV, Annex 4, paragraph 6.44):

(i) Review the development of operating models since the 2005 Workshop on Management Procedures.

(ii) Explore the performance of the operating models submitted to the workshop by determining whether they meet necessary benchmarks and conducting appropriate sensitivity analyses.

(iii) Evaluate the candidate options for allocating the precautionary krill catch limit among the SSMUs in Statistical Area 48.

(iv) Summarise the results of those evaluations in the form of advice to the WG-EMM.

1.7 Papers tabled for consideration at the workshop were WG-EMM-06/12, 06/20, 06/22, 06/23, 06/28, 06/30 Rev. 1, 06/35, 06/38 Rev. 1 and 06/39.

STATE OF MODELLING

Requested model incorporations

2.1 WG-EMM-05 specified that models relevant to the evaluation of options for subdividing the precautionary limit of krill catch in Area 48 amongst SSMUs should include (SC-CAMLR-XXIV, Annex 4, paragraph 6.18):

(i) shorter time steps and/or seasonality
(ii) alternative movement (of krill between regions) hypotheses
(iii) a threshold krill density below which a fishery will not operate.

2.2 WG-EMM-05 requested that candidate operating models should include performance measures that allow results to be compared between models (SC-CAMLR-XXIV, Annex 4, paragraphs 2.3 and 6.45). The performance factors should include measures pertaining to: (i) predators, (ii) krill and (iii) fishery.

2.3 Three models relevant to the evaluation of options for subdividing the precautionary limit of krill catch in Area 48 amongst SSMUs were presented to the workshop. These models, and the relevant documents, were EPOC (Ecosystem, Productivity, Ocean, Climate) (WG-EMM-06/38 Rev. 1), SMOM (Spatial Multispecies Operating Model) (WG-EMM-06/12 and 06/28) and KPFM2 (Krill–Predator–Fishery Model) (WG-EMM-06/20 and 06/22).

2.4 The workshop recognised that it was important that models show how uncertainty in parameters, environmental effects and different model structures/assumptions change the predicted dynamics of the system. EPOC, SMOM and KPFM2 handle uncertainty in a similar way to produce a probability 'envelope' of future states that is considered likely to bound the true state.

Status of EPOC

2.5 The EPOC modelling framework was first presented in WG-EMM-05/33. WG-EMM-06/38 Rev. 1 described a model of krill productivity in Area 48 within the EPOC model framework. Krill productivity was parameterised using data including empirical data on krill growth and reproduction, insolation, and satellite data on ocean dynamics, sea-ice concentration, sea-surface temperature and surface chlorophyll concentration. EPOC was demonstrated to have the potential to investigate the productivity of krill under various scenarios of environmental variability/climate change.

Status of SMOM

2.6 WG-EMM-06/12 described SMOM, which is based on the dynamics of krill and two generic predators (penguins and fur seals). Coded in AD-ModelBuilder, SMOM aims to be a minimally realistic, quantitative representation of current reality and future dynamics.

2.7 WG-EMM-06/28 described an example of how a Management Strategy Evaluation (MSE) approach could be used to manage the allocation of krill catch in Area 48 amongst SSMUs. In this example, the available observations of the state of the system are first identified. Next, SMOM is used as an operating model to predict the state of the resource in the future from the observations under a given management strategy. The likely future states are evaluated using a set of performance statistics. The performance statistics are used to compare candidate management strategies that adjust catches according to control/management rules. The MSE approach suggested here illustrates the potential utility of feedback within a formalised adaptive management method.

Status of KPFM

2.8 KPFM was first presented in WG-EMM-05/13. This model is now referred to as KPFM1. KPFM2 was developed from KPFM1 to address the requirements given during WG-EMM-05 and summarised above (paragraphs 2.1 and 2.2). KPFM2 was recognised by the workshop as having addressed the issues raised in WG-EMM-05.

2.9 In addition, KPFM2 can take into account some further issues identified as potentially important during the WG-EMM-05 Workshop on Management Procedures (SC-CAMLR-XXIV, Annex 4, Appendix D, paragraph 3.36), namely:

(i) predators that can forage outside their natal SSMUs
(ii) various plausible relationships between predator survival and foraging success
(iii) differential access to krill between different predators and fishery.

As well as those performance measures suggested by WG-EMM-05, some novel aggregate performance measures were also included in KPFM2.

2.10 KPFM2 follows from, but is substantially different to, KPFM1. However, WG-EMM-06/20 presented a comparison of KPFM1 and KPFM2 and the workshop was reassured that the models gave very similar results when they were applied to the same scenario.

2.11 WG-EMM-06/30 Rev. 1 presented a preliminary compilation of parameters that were applicable to models used to investigate interactions between krill, predators, environment and fishery in Area 48 (spatially resolved at the scale of the SSMUs and temporally resolved for a six-month time step). The workshop recognised the importance of developing a common parameter set applicable to multiple different models. It is also recognised as important that parameter values have an 'audit trail' so that values are traceable to their source.

2.12 Considerable discussion during the workshop addressed how aggregate performance measures should be used to present complex results to the Scientific Committee. Further

work will be required to agree on a set of aggregate performance measures that are comprehensible and reliable, and cover the range of information deemed necessary. In particular, aggregate performance measures should, *inter alia*:

(i) take into account and appropriately combine all model outputs considered valuable;

(ii) take into account correlations between various measures;

(iii) provide sufficient information to enable performance to be assessed relative to Article II;

(iv) aim to be value-free (e.g. 'high versus low' rather than 'good versus bad' or 'acceptable versus not acceptable').

REVIEW OF PARAMETER PLAUSIBILITY AND SENSITIVITY

3.1 The workshop agreed that an appropriate way to use the three available models would be to use KPFM2 as the primary model to examine the implications of various catch allocation schemes, and to use EPOC and SMOM to provide additional insights and to examine sensitivities to specific sources of uncertainty.

Requested model incorporations

Alternate parameterisation of transport and advection

3.2 The workshop reiterated that a key source of uncertainty is the role of advection (flux) in krill dynamics. The bounds on this uncertainty are: no flux, with local populations maintained by local recruitment; and flux with krill advected as passive drifters on ocean currents. In KPFM2, krill movement between areas is specified in a seasonally resolved matrix of instantaneous transport rates. No flux is represented by setting all cells to zero. Matrices parameterised using output from the circulation model developed by OCCAM are used to represent flux. SMOM can use random krill movements between areas. EPOC has the potential to simulate a range of flux scenarios.

3.3 WG-EMM-06/35 described an algorithm for modelling biomass flow between areas that reduces the underestimation of biomass retention within areas. Many movement algorithms assume instant mixing throughout an area once biomass has entered the area. While this may be satisfactory for modelling the behaviour within that area, it might not be satisfactory for modelling the subsequent departure of the biomass into other areas. This paper provides a solution to this problem and may be of assistance in developing operating models for evaluating krill management procedures. This algorithm has not been used to estimate potential krill flux, but the paper shows that the assumptions of mixing within models need to be considered before accepting that they will adequately reflect the desired movement patterns of the model species, such as krill.

3.4 The workshop agreed that the transport matrices presented in WG-EMM-06/30 Rev. 1 could be used to explore uncertainty about flux.

3.5 The influence of flux on predator populations will depend on the ability of predators to move between areas. Possible bounds on this uncertainty are no movement of predators between SSMUs and a homogenous distribution of predators during the winter (with no movement in summer). It was proposed that this may be a way of parameterising KPFM2 in order to explore this uncertainty. However, the homogenous distribution of all predators is not biologically sensible and produces implausible dynamics in KPFM2. The winter predator distributions presented in WG-EMM-06/30 Rev. 1 were considered more plausible.

Short time steps and/or seasonality

3.6 The time step in KPFM2 can be set to any period. The model runs presented to the workshop, and the parameters presented in WG-EMM-06/30 Rev. 1, were based on a seasonal time step of six months, which captures differences between SSMUs in the seasonal overlap between fishing activities and predator breeding. The time step in EPOC can be any period from one day upwards. SMOM is currently parameterised as an annual model.

Krill density to halt fishing

3.7 KPFM2 allows the analyst to specify the threshold SSMU-scale krill density that causes voluntary cessation of fishing operations. The workshop was unable to identify appropriate values for this threshold, but noted that it might be linked to predator foraging performance.

3.8 The average krill density in an SSMU may well be lower than the threshold density required for profitable operations by the fishing fleet. The average SSMU-scale density will not therefore reflect the density reacted to by the fleet on smaller-scale fishing grounds. Such considerations also apply to krill predators which also use only a portion of the SSMU for foraging. The SSMUs and the modelling process, however, were designed taking account of the distribution of historical catches and predator foraging locations.

Plausibility, sensitivity and uncertainty in other parameters

3.9 Another key source of uncertainty is the form of the relationship between prey availability and predator population responses and how this accommodates processes such as prey switching, predator saturation and dependence on highly aggregated resources. KPFM2 and SMOM can accommodate a range of responses from hyperstable, through linear to hyperdepletion (Figure 1). Uncertainty can be included in EPOC at desired points in the ecological functions of the taxa.

3.10 Other sources of uncertainty include:

(i) The role of mesopelagic fish in the system –

WG-EMM-06/30 Rev. 1 suggested that myctophids may be the most important krill consumers, but this is based on limited evidence (see also subparagraph (iii)).

(ii) The relative competitive abilities of predators and the fishery –

KPFM2 can be used to explore this issue.

(iii) The size and age ranges of krill targeted by different predators and the fishery –

KPFM2 does not represent size-selective targeting, but the competition settings might be used to explore this issue. However, it was noted that EPOC can include age structure in its representation of populations.

(iv) Starting conditions –

KPFM2 runs can be initialised with predator and prey populations at equilibrium. This can be used as a reference point against which to compare the effects of different fishing options. However, it is important to consider scenarios where predator populations might be increasing or decreasing.

(v) Trends in krill recruitment or its variability –

There is published evidence for such trends (Siegel and Quetin, 2003). Decreasing recruitment might make it difficult for the Commission to appropriately manage fisheries to achieve the objectives of Article II. EPOC can model krill recruitment from environmental variables.

(vi) Fleet dynamics –

The current models do not include explicit representations of fleet behaviour, however the aims of the workshop can be partly achieved by considering the distribution of catches at the SSMU scale.

(vii) The mechanisms through which krill availability affects predator dynamics –

In KPFM2 and SMOM this is modelled primarily as an effect on predator recruitment. However, both models can be used to explore the effects of krill availability on predator survival.

3.11 WG-EMM-06/30 Rev. 1 presented a compilation of parameter values for use in ecosystem models. Empirically derived predator parameters should be presented as means and ranges to represent uncertainty in these values. Fur seal mortality parameters were updated using data from WG-EMM-06/P7. This also affected fur seal recruitment parameters.

3.12 The workshop noted that the aggregation of diverse species into 'generic' predators might potentially mask important species-specific responses. It is therefore important that the range of 'generic' predators represents the range of life histories in the predator community.

3.13 The workshop noted that parameters and functions in the models should capture important aspects of the dynamics of krill and its predators but that the parameters do not necessarily need to represent specific biological processes to achieve this.

3.14 WG-EMM-06/22 presented further development of aggregate performance measures, including the use of aggregate trade-off plots to evaluate the candidate fishing options and other model output. Examples of these trade-off figures are presented in Figures 2(a) (using the arithmetic mean) and 2(b) (using the geometric mean). In these plots, the columns represent different fishing options and the rows represent SSMUs. The upper value in each cell represents the aggregate 'Fishery Performance' score, and the lower value represents the aggregate 'Ecosystem Performance' score (on a scale of 0 to 1 with 1 representing highest performance). Individual cells are shaded according to the magnitude of the difference between the two performance values and represent the aggregate trade-off.

3.15 The workshop agreed that aggregate trade-off plots are important in providing a basis for discussion, but should be interpreted with caution. The workshop considered that the value of the performance score may need to be interpreted relative to the range over which most important differences occur.

MODEL OUTPUTS AND PERFORMANCE MEASURES

4.1 The workshop agreed that the two major sources of uncertainty to be addressed in the workshop, and the appropriate parameter sets to bound these uncertainties in KPFM2, were:

(i) the role of flux in krill dynamics: bounded by the seasonal movement matrices based on OCCAM output and no movement;

(ii) the degree of stability in the relationship between krill availability and predator population responses: bounded by *rphi* values of 0.37 and 1 (see Figure 1).

4.2 The workshop noted the broad agreement in trajectories between SMOM and KPFM2 in simulation trials when the parameterisation of the two models was consistent. On this basis, as well as on biological plausibility of the results, it was agreed that there was confidence in these modelling approaches for evaluating the different fishing options.

4.3 The workshop examined results from a large number of KPFM2 scenarios. The workshop first considered the simulated trajectories of abundance for predator groups from trials using random recruitment and allocation of Fishing Options 1 to 4 with 60-year simulations and 50 Monte Carlo trials per simulation.

4.4 It was agreed that use of aggregate outputs of population trajectories should be examined, though it was recognised that: (i) aggregating can potentially smooth projections across all species, and relative effects on species may be different; (ii) the values of the aggregate measures will be influenced by the individual measures that are included; and (iii) the values of the aggregate scores may not be scaled correctly to appropriately reflect the

magnitude of the effects of the fishing options. The workshop recognised the importance of examining all output components before making decisions. The workshop examined a variety of performance measures plotted against each other, and agreed that this was a useful way to examine trade-offs between different ecosystem and fishery characteristics.

4.5 The workshop examined several types of aggregate trade-off plots to evaluate the candidate fishing options. While plots such as these are ultimately desirable to summarise outcomes and trade-offs, it was recognised that at present they require further development. However, they provided a very useful mechanism towards generating discussions (see paragraphs 3.12 to 3.14).

4.6 The workshop agreed that KPFM2 could first be used to explore a fishing scenario which originally concerned the Commission. This scenario is the continued development of the krill fishery towards taking the full catch limit with the potential to concentrate all its fishing effort in only a small area. This scenario was the reason for establishing the process of subdividing the Area 48 krill catch limit amongst SSMUs.

4.7 To examine this concern, a primary simulation scenario was performed where fishing was conducted only in Subarea 48.1 under a constant quota determined as 0.09 (γ) of an estimate of biomass just prior to the fishing period. Other trials were also undertaken, these included having fishing mostly in Subarea 48.1 (87.5%) with some fishing in Subareas 48.2 and 48.3 (12.5%) and carrying out scenarios using different values of γ (0.03, 0.06, 0.09). Each scenario included 50 Monte Carlo trials across 60 years (with fishing starting at year 21 and stopping at year 41 and the sources of uncertainty outlined in paragraph 4.1).

4.8 On the basis of an examination of individual trajectories and performance indicators from these trials, the workshop agreed that under a flux model, increasing fishing in Subarea 48.1 can have an impact on other areas. The magnitude of these effects is dependent on the level of the quota. The workshop noted that if models are run with no movement, localised effects could be more substantial. Results for the primary scenario are presented in Figure 3.

4.9 The workshop agreed that these results corroborate the concerns of the Commission about the effects of localised fishing and are consistent with the notion that this fishery should be managed on a spatial basis.

4.10 SMOM was modified during the workshop to be comparable with KPFM2. SMOM was set up with similar parameters to KPFM2 in terms of: (i) periods of fishing and recovery in the simulation; (ii) allocated fishing catch; (iii) predator depletion and recovery performance measures; and (iv) the parameter set originally detailed in WG-EMM-06/30 Rev. 1 and modified during the workshop.

4.11 Differences between the versions of SMOM and KPFM2 used in the workshop, and the simulations performed, included: (i) penguins and seals are the only predators in SMOM – fish and whales are not included explicitly, though their consumption is included in the model indirectly; (ii) uncertainty in the adult survival rates for predators is included in SMOM; (iii) movement of krill in SMOM is not comparable with movement in KPFM2, so the comparison can only usefully be completed under the 'no movement' scenario; and (iv) the present version of SMOM does not consider differential access to krill between predators and the fishery.

4.12 The workshop next considered the performance measure trade-offs associated with Fishing Options 1 to 4. As an example of this, Figure 4(a) shows predator trajectories (seals, penguins, whales and fish) in two selected SSMUs under Fishing Options 1 and 4 (overlaid). A comparison of Fishing Options 1 and 4 in this figure demonstrated that the former was skewed towards relatively higher fishery performance and the latter slightly skewed towards relatively higher ecosystem performance. Figure 4(b) shows predator trajectories (penguins and seals) from the SMOM model and demonstrates similar trajectories to those from KPFM2, supporting the suggestion that Fishing Option 1 results in lower ecosystem performance.

4.13 Results from the modified SMOM agree well (qualitatively) with simulation results from KPFM2 in those scenarios that could be tested (e.g. Figures 4(a) and 4(b)). The modified SMOM also demonstrated that it can compare performance measures across different management schemes in a similar way to KPFM2. This shows that multiple approaches are useful in exploring how ecosystem dynamics can be modelled for management purposes.

4.14 The workshop next considered the trade-offs under Fishing Option 5. Figure 5(a) shows output from KPFM2 illustrating an example of changes in catch and predator trajectories when catch is adjusted in response to periodic reassessments of resource status. An illustrative feedback catch control rule using SMOM also highlighted the contrast in predator trajectories when assuming that initial catch allocations are fixed over time rather than being adjusted in response to changes in trends observed from monitoring data (Figure 5(b)). Additional KPFM2 and SMOM results showed the extent to which the efficacy of a feedback mechanism relied on the number and types of future monitoring data available. The workshop agreed that this demonstrates how monitoring standing stock and consequent adjustments in fishing allocation can improve performance measures.

4.15 An example was given of how SMOM can be used to develop a management scheme for Area 48 which includes feedback through management control rules. Two management responses to negative changes in monitoring indicators in an SSMU were discussed: (i) transfer of catch from an affected SSMU to a pelagic SSMU with no land-based predators; and (ii) a reduction of catch in the affected SSMU resulting in a lower overall catch.

4.16 The workshop considered how to make judgments regarding optimal trade-offs, and agreed that this was more appropriate to the role of the Commission. However, it was recommended that advice should be developed based on trade-offs relative to Article II of the CAMLR Convention.

4.17 When the workshop specifically considered the trajectories of fish using KPFM2, it was noted that there appear to be more dynamic responses in the model results than might be expected in reality. The parameterisation of this generic predator group may need to be revised.

4.18 The workshop discussed other aspects of the results of Fishing Option 1 and agreed that the performance of this option is highly dependent on the particular subset of the historical catch data used to initialise this option.

4.19 The workshop next examined fishery-based performance measures, which included an analysis of catch versus CV of catch (Figure 6). It was noted that the variance in catch is similar for all allocation options in most SSMUs.

4.20 In addition, the workshop examined the trade-off between the mean realised catch versus the distribution of catch relative to the historical catch. This demonstrated considerable differences between fishing options, including that distribution of catch in Fishing Option 1 most closely represents the historical distribution of catch (Figure 7).

4.21 Due to time constraints some members felt that while Fishing Option 1 had been vetted, other fishing options had not been similarly examined.

ADVICE TO WG-EMM

5.1 The workshop agreed that there had been a considerable amount of work done since WG-EMM-05 to develop models on which the provision of advice could be based (paragraphs 2.5 to 2.10).

5.2 In simulation trials conducted in KPFM2 it was apparent that, should the fishery occur entirely in Subarea 48.1 and catch an amount of krill equivalent to 9% of B_0, then there will be considerable negative impacts on the ecosystem in that region and, under the assumptions of flux, there would also be negative consequences for the downstream SSMUs in Subareas 48.2 and 48.3 (paragraphs 4.6 and 4.7).

5.3 In simulation trials both KPFM2 and SMOM indicated that Fishing Option 1 would have relatively greater negative impacts on the ecosystem compared to the other fishing options (paragraphs 4.12 and 4.13).

5.4 The workshop agreed that even when KPFM2 and SMOM were used to integrate uncertainties there were apparent differences in the consequences of the different fishing options, but the workshop agreed that further evaluation of Fishing Options 2 to 4 will require additional work on the development and interpretation of performance measures (paragraphs 4.13 and 4.16).

5.5 The workshop also agreed that all simulations indicated that the performance of Fishing Options 2 to 4 would be improved when monitoring data are used to update the allocation of catches among SSMUs, i.e. in a manner analogous to Fishing Option 5 (paragraphs 4.14 to 4.17).

FUTURE WORK

EPOC

6.1 The workshop reviewed EPOC and the way that model was used to explore the potential variability, between SSMUs and across Area 48, of the productivity of krill based on a model of krill food using ice, sea-surface temperature and chlorophyll data from satellites (WG-EMM-06/38 Rev. 1). Model results showed that: (i) local productivity (biomass, length

and recruitment) can vary widely between SSMUs at a given time, (ii) variation in recruitment over the time series can be up to 1.2 in some SSMUs, (iii) SSMU-scale processes may be too small for modelling krill dynamics, and (iv) regional movement models may not be needed to model areas within regions. The fits to existing data for the Antarctic Peninsula are promising.

6.2 The workshop noted that larger areas, such as SSMU groups and subareas, may be better suited to the modelling of krill dynamics. The workshop also noted that the scale of SSMUs was appropriate for the modelling of predator dynamics, and the interactions between predators and the fishery.

6.3 The workshop encouraged future work to tune the EPOC models to data and to provide important parameters for existing models (see also paragraph 2.5).

SMOM

6.4 The workshop encouraged future work to further develop the adaptive management framework in SMOM (see also paragraph 2.7). It was noted that some of this development would require considerable work.

KPFM2

6.5 The workshop recognised the considerable work in the development of KPFM2 to date and encouraged the authors to continue that development, particularly in relation to evaluation of feedback management procedures and conditioning to data.

Aggregate performance measures

6.6 The workshop encouraged the development of an agreed set of aggregate performance measures which are comprehensive and reliable, and cover the range of information outlined in paragraph 2.12.

Understanding fleet dynamics

6.7 The workshop recognised that it will be important for future modelling frameworks to capture some of the dynamics of the fishery. For example, how skippers make decisions about where they fish and when. Factors such as the abundance of krill, sea-ice conditions and the condition, location and colour of krill, as well as fishing experience, are important considerations in targeted fishing.

6.8 The workshop encouraged WG-EMM to consider this issue further.

Technical forum

6.9 The workshop encouraged intersessional discussions to provide guidance to model developers on issues such as:

- improvements and refinements to models
- incorporation of future needs into models
- developing datasets to provide further parameter estimations
- evaluation of the performance of models in relation to agreed technical requirements.

Spatially explicit management procedures

6.10 The workshop agreed that Fishing Options 5 (feedback management) and 6 (pulse fishing) need to be explored further. In that respect, the workshop recommended that consideration be given to defining what is meant by Fishing Option 6. In considering and evaluating both options, the workshop recommended that WG-EMM consider how knowledge, such as through field research including monitoring programs, might be acquired to assist in designing these options and for effectively implementing them in the longer term.

6.11 The workshop encouraged further development of spatially explicit management frameworks and to advance methods for use by CCAMLR to evaluate such management frameworks for krill, including, *inter alia*:

(i) development of operating models;

(ii) development and evaluation of decision rules for adjusting fishing activities (e.g. catch limits) based on field data in the future;

(iii) further development of performance measures and the means for providing integrated advice to the Commission on the relative merits of different strategies with respect to Article II.

ADOPTION OF REPORT AND CLOSE OF WORKSHOP

7.1 The report of the workshop was adopted.

7.2 In closing the workshop, the Co-conveners of the workshop, Ms Akkers and Dr Reiss, thanked Drs É. Plagányi (South Africa), A. Constable (Australia), G. Watters (USA), Hill, Mr Hinke and Dr Reid for further developing the three models which had been used by the workshop, and for undertaking numerous trials during the workshop. The Co-conveners also thanked the participants for their contributions which led to the success of the workshop. The workshop had been difficult and covered a substantial amount of work. The Co-conveners also thanked the Secretariat staff for their support.

7.3 Dr Constable, on behalf of the workshop, thanked the Co-conveners for their thorough preparations which had kept the workshop on track. Their guidance and leadership had allowed the workshop to articulate important issues and to achieve its aims.

7.4 The workshop was closed.

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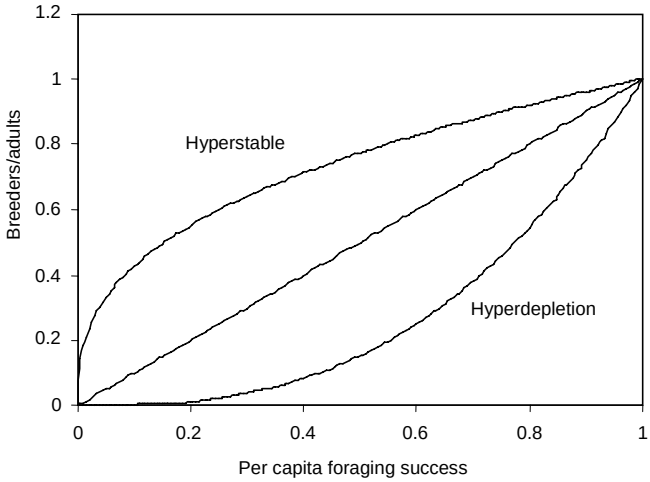

Figure 1: Potential forms of the relationship between prey availability (expressed as per capita foraging success) and the dynamic response of a predator population (the proportion of adults that breed). The central line shows a proportional response (shape parameter used in KPFM2, *rphi* = 1), while the upper (*rphi* = 0.37) and lower curves (*rphi* = 2.70) show the hyperstable and hyperdepletion situations respectively.

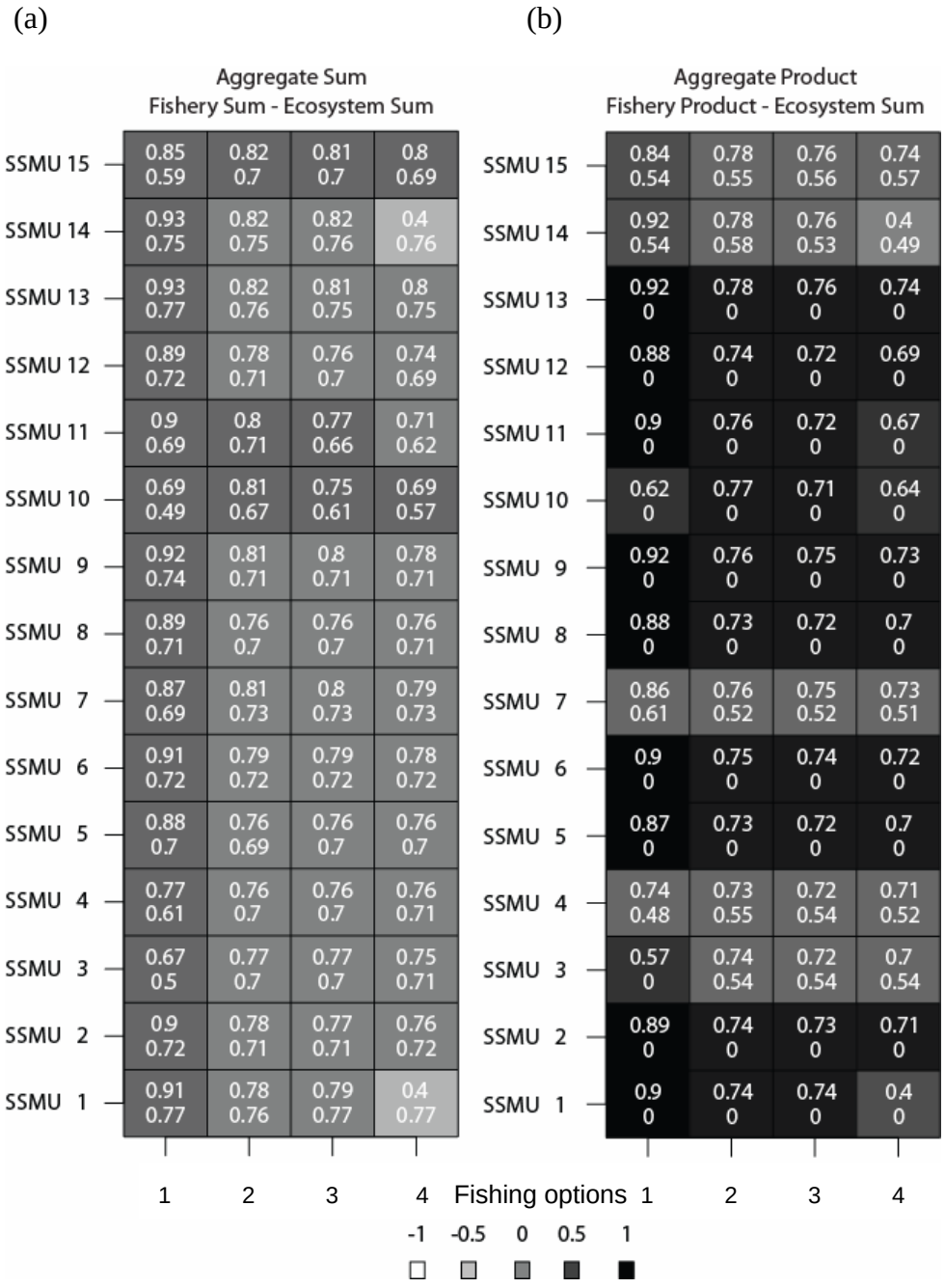

Figure 2: Examples of summarised results from KPFM2. Tables (a) and (b) present aggregate measures of fishery performance (top number in each cell) and ecosystem performance (lower number in each cell), for each SSMU (rows) resulting from each of four fishing options (columns). The shade of each cell indicates the relative value of the fishery and ecosystem aggregates. Dark shades indicate that fishery performance exceeds ecosystem performance while light shades indicate that ecosystem performance exceeds fishery performance. Intermediate shades are closer to a balanced trade-off where fishery and ecosystem performance are similar. The aggregate values in (a) are arithmetic means of component performance measures while those in (b) are geometric means. While arithmetic means show the average performance across components, geometric means indicate the simultaneous performance. Geometric means are sensitive to zeros. An ecosystem aggregate value of zero suggests that at least one ecosystem component is not meeting a performance criterion. The SSMUs are as follows: Antarctic Peninsula pelagic area (1), west (2); Drake Passage west (3), east (4); Bransfield Strait west (5), east (6); Elephant Island (7), east (8); South Orkney Islands pelagic area (9), west (10), northeast (11), southeast (12); and South Georgia pelagic area (13), west (14), east (15).

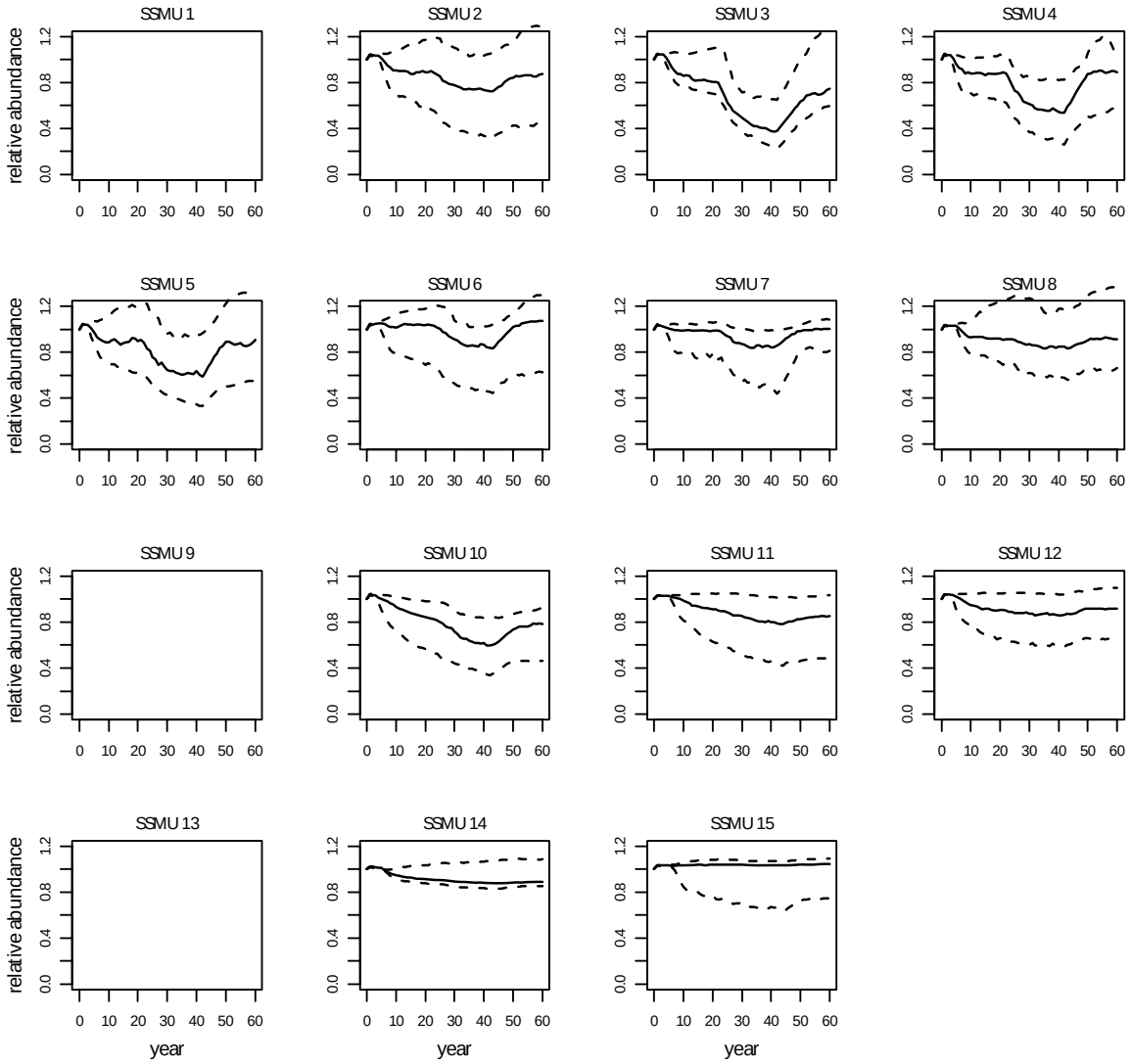

Figure 3: Penguin abundance trajectories demonstrating the effect of fishing occurring only in the SSMUs in Subarea 48.1 (SSMUs 1–8). The solid black lines are medians and the dashed black lines bound the 90% probability envelopes. These simulations were conducted with γ equal to 0.09. Penguins do not breed in SSMUs 1, 9 and 13. See Figure 2 for the list of SSMUs.

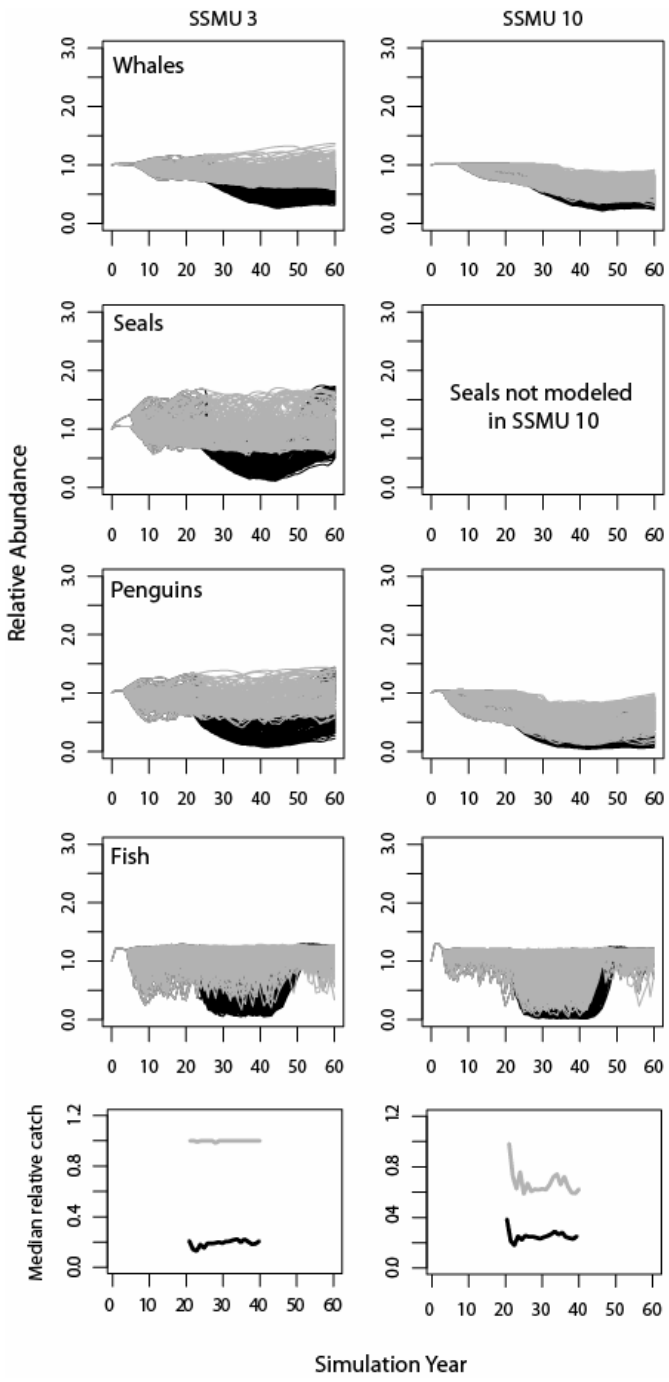

Figure 4(a): Predator abundance trajectories (seals, penguins, whales and fish) and median relative catch from KPFM2 under Fishing Options 1 (black) and 4 (grey) in SSMU 3 (Drake Passage west) and in SSMU 10 (South Orkney west).

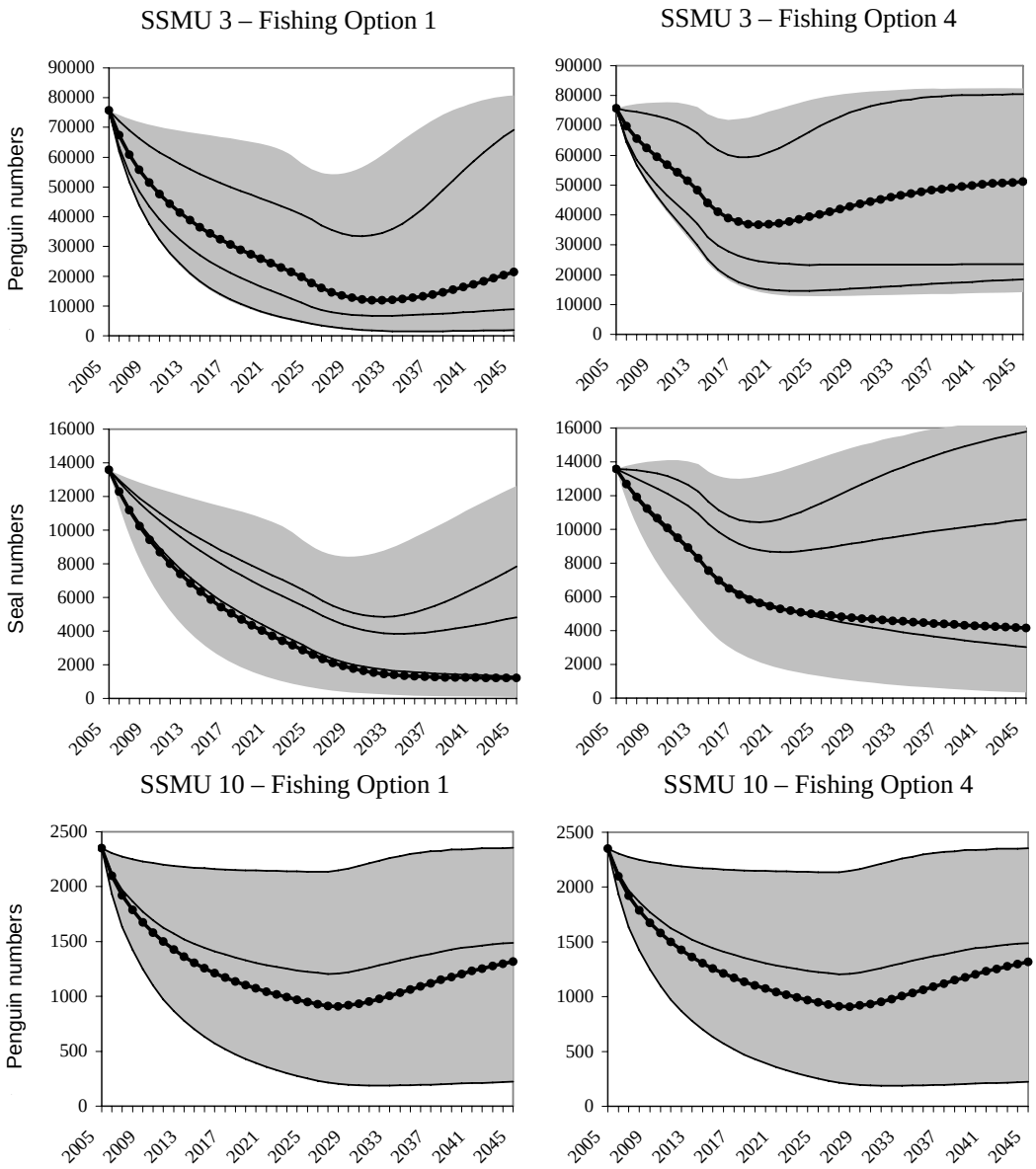

Figure 4(b): Population trajectories generated by SMOM of penguin and seal abundance (in terms of numbers) in SSMU 3 (Drake Passage west) and SSMU 10 (South Orkney west) compared under Fishing Options 1 and 4, from 120 model representations and when using a model version that assumes no krill movement between SSMUs. Three individual trajectories are shown, with the median represented as a dark dotted line and the shaded areas showing the 90% probability envelopes. Note that trajectories assume fishing occurs for the first 20 years, but is set to zero thereafter to assess resource recovery.

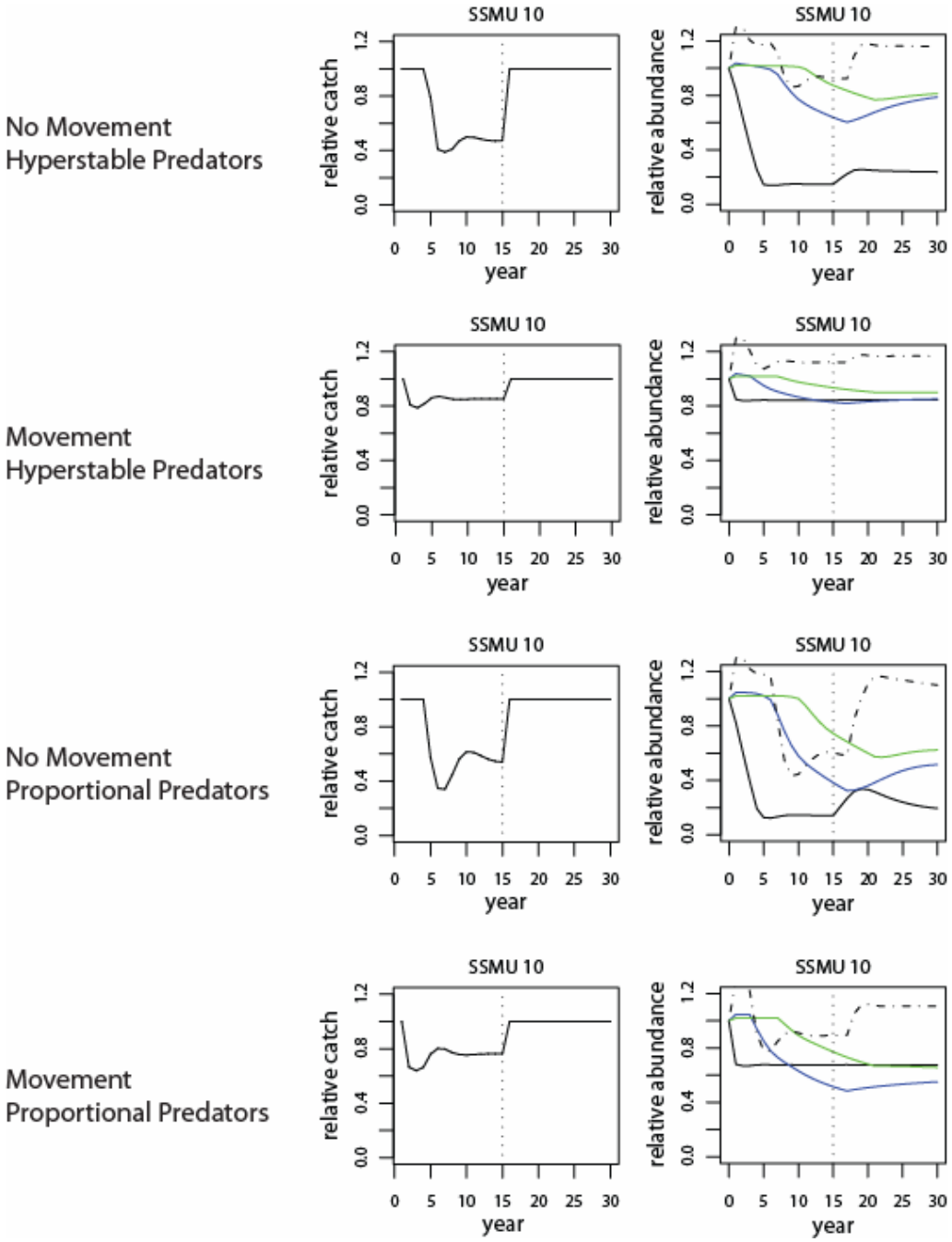

Figure 5(a): KPFM2 example output of an MSE leading to reallocation of fishery catch under four combinations of model uncertainty. In each example, a single reassessment of the difference between krill standing stock and predator demand is conducted in year 15 that results in a reduced reallocation of catch to the fishery in SSMU 10 (South Orkney west). The panels illustrate two main effects of the reallocation. The fishery is able to catch the full allocation after the reassessment because the allocation has been reduced, and predators recover in response to reduced catches (but the degree of this response is uncertain).

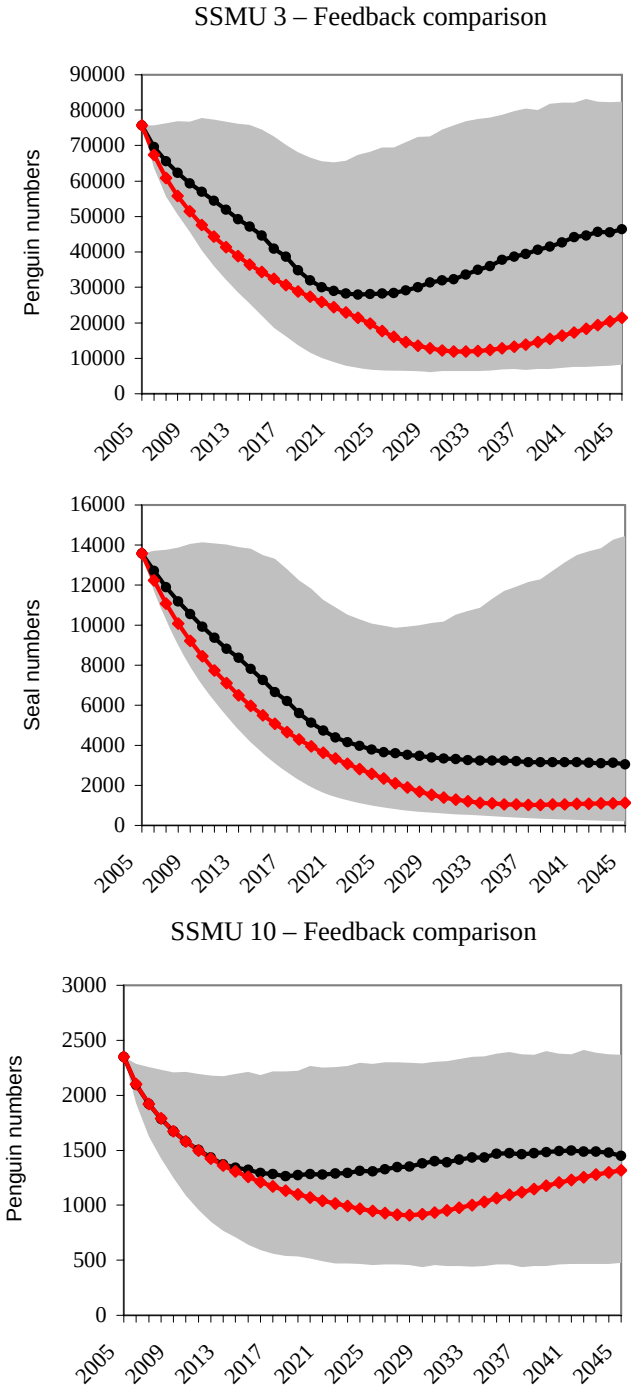

Figure 5(b): SMOM example output of an MSE. Plots show predicted change in abundance for penguins and seals in SSMU 3 (Drake Passage west) and SSMU 10 (South Orkney west, no seals) compared under two scenarios: no feedback in catch allocations (i.e. catches constant as per Fishing Option 1) (diamond symbols); and using a feedback control rule (circle symbols) based on a moderate amount of monitoring information available for all SSMUs. Trajectories represent the median and the shaded areas show the 90% probability envelopes for the feedback scenario – note that the lower 5%ile of the corresponding probability envelop for the no-feedback scenario is not shown but is necessarily lower.

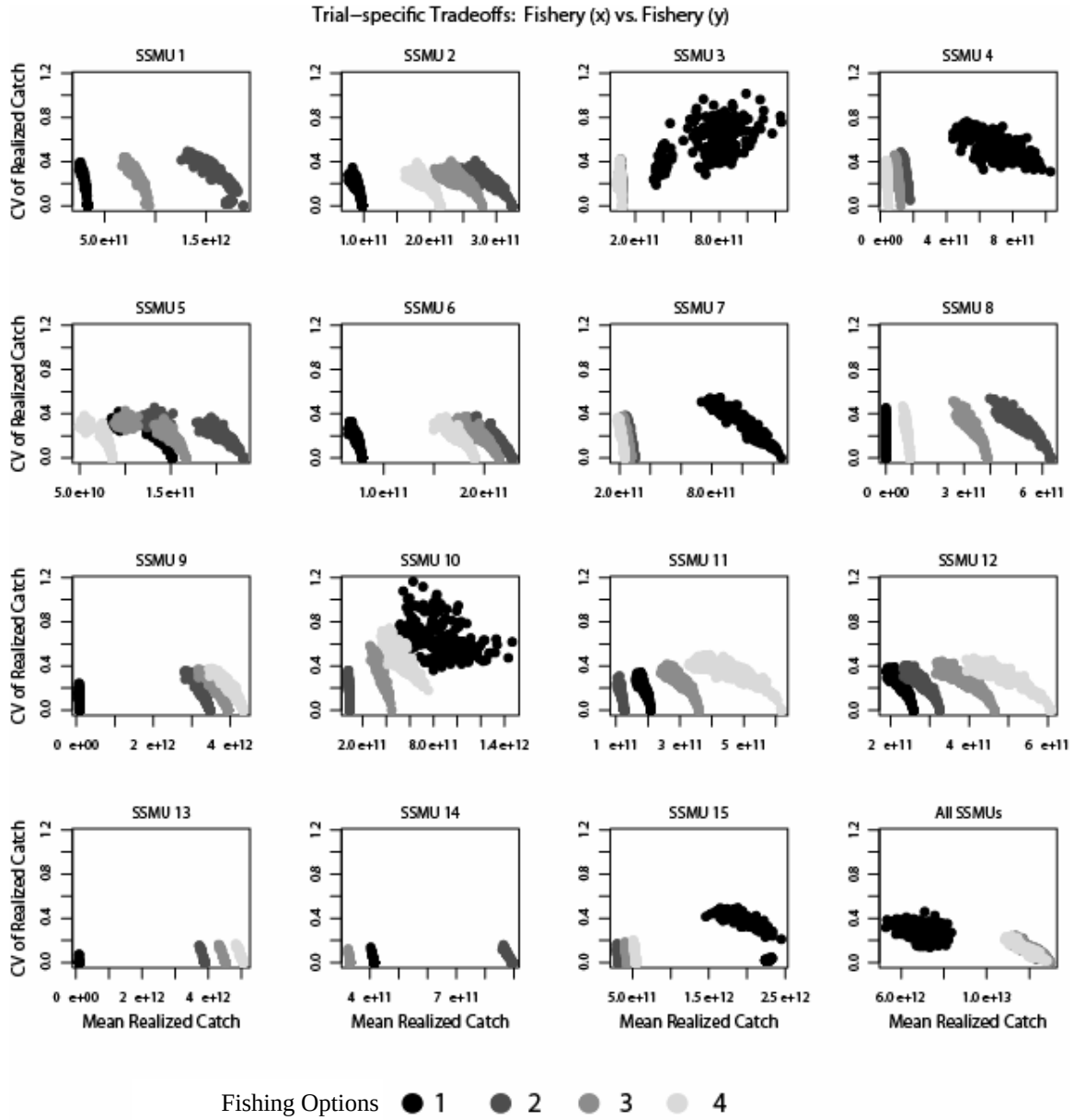

Figure 6: KPFM2 predictions of the trade-offs between mean realised catch and the CV of the catch under the four fishing options. Each cloud of points incorporates four sources of model uncertainty for each fishing option. Fishing Options 1 to 4 are identified by a shaded dot.

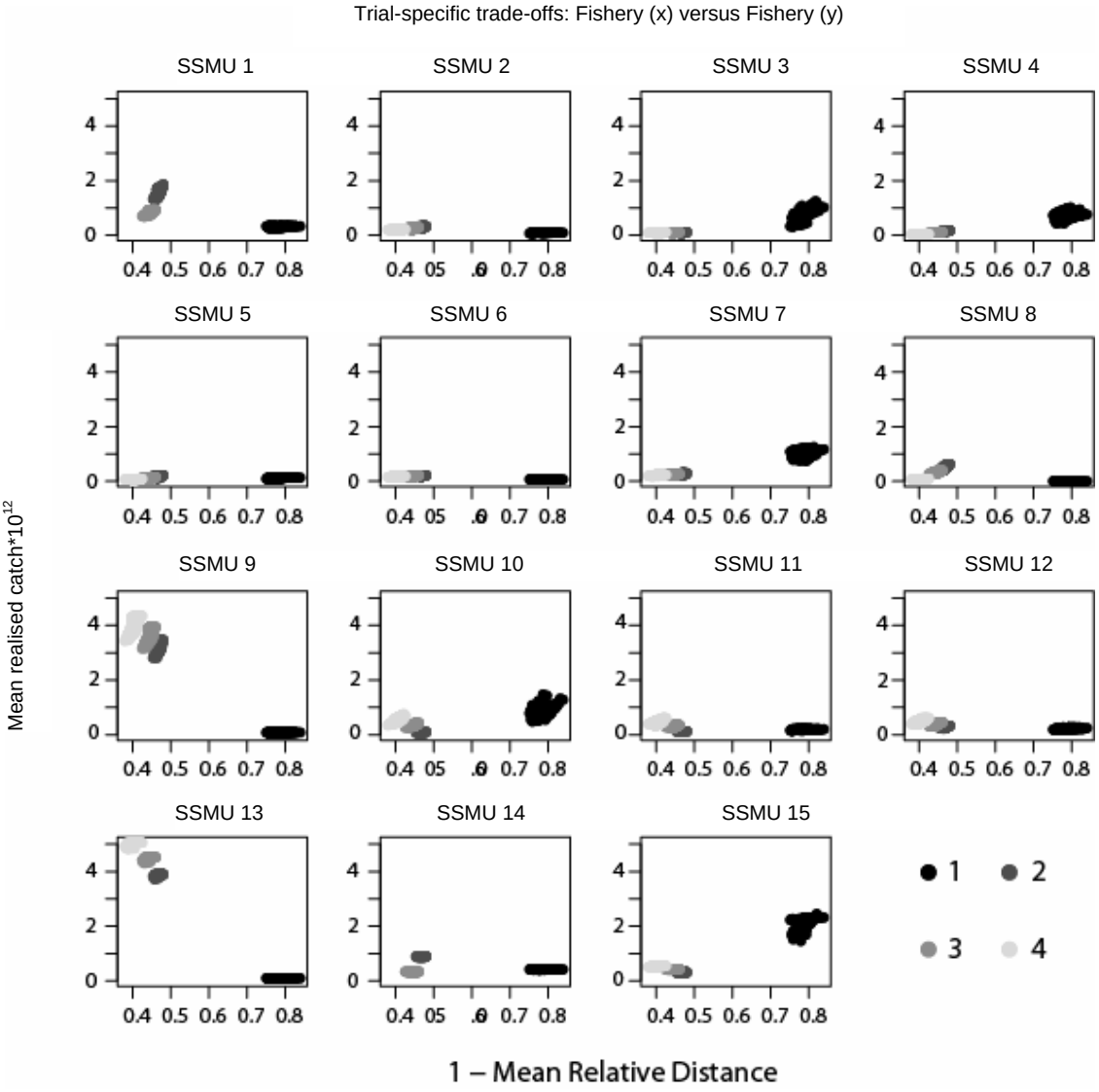

Figure 7: Fishery performance trade-offs between the distributions of catch relative to the historical distributions of catch versus the mean realised catch. Note the scale of each panel is the same, allowing for direct comparison of realised catches in each area. Fishing Options 1 to 4 are identified by a shaded dot and represent model simulations that incorporated the two main sources of uncertainty.

ATTACHMENT 1

AGENDA

Second Workshop on Management Procedures
(Walvis Bay, Namibia, 17 to 21 July 2006)

1. Introduction
   - 1.1 Adoption of agenda
   - 1.2 Co-convener presentation review of 2005 workshop findings: How did we get here?
   - 1.3 Papers tabled for consideration during the workshop

2. State of modelling
   - 2.1 Requested model incorporations
   - 2.2 Status of EPOC
   - 2.3 Status of SMOM
   - 2.4 Status of KPFM

3. Review of parameter plausibility and sensitivity
   - 3.1 Alternate parameterisation of transport and advection
   - 3.2 Short time steps and/or seasonality
   - 3.3 Krill density to halt fishing
   - 3.4 Review plausibility, sensitivity and uncertainty in other parameters

4. Model outputs and performance measures

5. Provisional advice to WG-EMM

6. Future work

7. Adoption of report and close of workshop.

ATTACHMENT 2

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ANNEX 5

REPORT OF THE WORKING GROUP ON FISH STOCK ASSESSMENT

(Hobart, Australia, 9 to 20 October 2006)

CONTENTS

[1] Appendices F to R have been published only in electronic format. For these reports, please refer to www.ccamlr.org/pu/E/e_pubs/fr/drt.htm.

REPORT OF THE WORKING GROUP ON FISH STOCK ASSESSMENT

(Hobart, Australia, 9 to 20 October 2006)

OPENING OF THE MEETING

1.1 The meeting of WG-FSA was held in Hobart, Australia, from 9 to 20 October 2006. The Convener, Dr S. Hanchet (New Zealand), opened the meeting and welcomed participants.

1.2 The Working Group paused in memory of Dr Geoff Kirkwood (UK), colleague and long-serving participant of CCAMLR. The Working Group acknowledged Dr Kirkwood's major contributions to the development of assessment methods, the evaluation of fish stocks and the management of fisheries.

ORGANISATION OF THE MEETING AND ADOPTION OF THE AGENDA

Organisation of the meeting

Meeting documents

2.1 Dr Hanchet advised that there were a number of meeting papers which had been submitted after the deadline and without prior notification (see Part II, paragraph 9, Guidelines for the Submission of Papers to Meetings of SC-CAMLR Working Groups); these papers were not considered during the meeting.

2.2 The Working Group reconsidered last year's decision that all meeting documents should be distributed as locked pdf files (SC-CAMLR-XXIV, paragraph 12.15). Locked documents prevented rapporteurs and subgroup coordinators from extracting electronically essential information and text from meeting papers. It was agreed that meeting documents should be made available on the CCAMLR website and on the meeting server as unlocked pdf files.

Agenda

2.3 The agenda of the meeting was discussed and adopted with the addition of subitem 3.3.7 on depredation (Appendix A). The Working Group noted the Commission's request to review the effectiveness of the new move-on rule for by-catch (Conservation Measure 33-03, paragraph 5) in reducing by-catch in Subareas 88.1 and 88.2 in 2005/06 (CCAMLR-XXIV, paragraph 11.39).

Report restructure

2.4 The Working Group noted that the Scientific Committee (SC-CAMLR-XXIV, paragraphs 13.18 to 13.25) and the Commission (CCAMLR-XXIV, paragraphs 4.70 to 4.75) had acknowledged the significant improvements arising from the recent restructure of the

report, but had agreed that the size of the 2005 report was untenable. That report (including the appendices) had resulted in a budget overrun in translating and publishing costs and had severely stretched the Secretariat resources.

2.5 WG-FSA agreed to reduce the size of its 2006 report through extensive editing and cross-referencing to other reports, avoiding duplication of text, and following the guidelines in the rapporteurs notes.

2.6 The possibility of non-translation of some or all appendices, and of not updating/translating Fishery Reports where the assessments and resulting yield estimates are similar to last year, was also considered (see paragraphs 13.23 to 13.25).

2.7 The report was prepared by the participants, and includes the Agenda (Appendix A), List of Participants (Appendix B), List of Documents considered at the meeting (Appendix C), Report of ad hoc WG-IMAF (Appendix D) and Fishery Reports (Appendices F to R).

REVIEW OF AVAILABLE INFORMATION

Data requirements specified in 2005

Development of the CCAMLR database

3.1 The Data Manager, Dr D. Ramm, provided an update on recent developments in managing CCAMLR's data. During the intersessional period, the Secretariat had further developed procedures and data forms at the request of the Scientific Committee and its working groups. This work included:

(i) revising data forms used for reporting scientific observer data, fine-scale data and catch and effort reports (CCAMLR-XXIV, paragraph 4.50; SC-CAMLR-XXIV, paragraphs 4.192 to 4.200). The revisions were outlined in WG-FSA-06/4 and the data forms are available on the CCAMLR website: www.ccamlr.org/pu/e/sc/fish/forms.htm; www.ccamlr.org/pu/e/sc/obs/logbooks.htm;

(ii) developing a manual on the procedures for the extraction and mathematical manipulation of data used by WG-FSA (SC-CAMLR-XXIV, paragraph 4.17 and Annex 5, paragraph 3.7). The manual was available on the meeting server;

(iii) developing an electronic reference library of relevant meeting documents (SC-CAMLR-XXIV, paragraph 12.19). At the time of the meeting, the reference library contained all documents from the meetings of WG-FSA since 1995. Documents from meetings of other working groups will be added as Secretariat resources become available. The library was available on the meeting server, and documents were available generally to meeting participants under the Rules for Access and Use of CCAMLR Data;

(iv) conducting an initial validation of assessments involving CASAL, immediately prior to WG-FSA, using the input parameter files and associated papers submitted to WG-FSA (WG-FSA-06/6, paragraphs 6.1 and 6.2). These

assessments were for *Dissostichus* spp. in Subareas 48.3, 88.1 and 88.2 and Division 58.5.2. The work involved the validation of the input parameter files submitted, and the validation that the assessment results as quoted in the accompanying papers can be reproduced using those input files. The validation steps and results were reported in a document which was available on the meeting server;

(v) extending the time series of catch-weighted length frequencies for *D. eleginoides* in Subarea 48.3 (SC-CAMLR-XXIV, Annex 5, Appendix G, paragraph 6 and Table 13.1, Task 50) by reviewing the procedure used and revising the available catch and length data (see WG-FSA-SAM-06/4 and WG-FSA-06/4). As a result, catch-weighted length frequencies for *D. eleginoides* in Subarea 48.3 were now available for the seasons 1984/85 to 1988/89 and from 1990/91 to the present (22 seasons including 2005/06).

Data processing

3.2 The Secretariat had processed fishery and observer data from the 2005/06 season which had been submitted prior to the meeting, and these data were available for analyses at the meeting. However, data from fishing conducted in September 2006 were not yet available and some data were overdue. Those data, and data from the remainder of the season, would be submitted later in the year.

3.3 In addition, the Secretariat had processed available fine-scale and observer data from the fishery in the South African EEZ around Prince Edward and Marion Islands (Subareas 58.6 and 58.7 and Area 51) in 2005/06, and data from the French EEZs in Division 58.5.1 (Kerguelen Islands) and Subarea 58.6 (Crozet Island) in 2005/06 (to August 2006).

3.4 The Secretariat began preliminary validation of data from 2005/06 prior to the meeting, and this procedure will be extended and completed in the forthcoming intersessional period.

3.5 The Working Group noted that Mr A. Dunn (New Zealand), in association with the Secretariat, had undertaken validation of tagging data held in the observer database with position data from the fine-scale data from Subareas 88.1 and 88.2 in preparation for the analysis reported in WG-FSA-06/34. A number of discrepancies and errors in reporting east/west positional data about longitude 180° had been detected, i.e. positions reported in fine-scale data were in the opposite hemisphere to corresponding positions reported by the scientific observers. Some errors were clear to identify and correct, while others required an arbitrary decision on the accuracy of the different datasets. The corrections applied had resulted in changes in the interpretation of the observer data (including tag returns, and age- and length-frequency data), and their implication in stock assessment.

3.6 The Working Group requested that the Scientific Committee and Commission consider the feasibility of using VMS data to validate positional data reported in fine-scale and observer data. Flag States and scientific observers were also urged to check the reported positions in the data, especially near longitudes 0° (Subarea 48.6) and 180° (Subarea 88.1).

Fishery plans

3.7 The Secretariat has maintained the database which holds the information on Fishery Plans and updated data from 2005/06 to the time series prior to the meeting.

Fisheries information

Catch, effort, length and age data reported to CCAMLR

3.8 Under the conservation measures in force in 2005/06, fishing took place in 13 fisheries targeting icefish (*Champsocephalus gunnari*), toothfish (*D. eleginoides* and/or *D. mawsoni*) and krill (*Euphausia superba*):

- fishery for *C. gunnari* in Subarea 48.3
- fishery for *C. gunnari* in Division 58.5.2
- fishery for *D. eleginoides* in Subarea 48.3
- fishery for *D. eleginoides* in Subarea 48.4
- fishery for *D. eleginoides* in Division 58.5.2
- exploratory fishery for *Dissostichus* spp. in Subarea 48.6
- exploratory fishery for *Dissostichus* spp. in Division 58.4.1
- exploratory fishery for *Dissostichus* spp. in Division 58.4.2
- exploratory fishery for *Dissostichus* spp. in Division 58.4.3a
- 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 *E. superba* in Area 48.

3.9 In addition, four other managed longline fisheries targeting toothfish were conducted in the Convention Area in 2005/06:

- fishery for *D. eleginoides* in the French EEZ in Division 58.5.1
- fishery for *D. eleginoides* in the French EEZ in Subarea 58.6
- fishery for *D. eleginoides* in the South African EEZ in Subarea 58.6
- fishery for *D. eleginoides* in the South African EEZ in Subarea 58.7.

3.10 Catches of target species by region and gear reported from fisheries conducted in the CAMLR Convention Area in the 2005/06 fishing season are summarised in Table 1.

3.11 The Working Group noted the Secretariat's work in monitoring fisheries in 2005/06 (CCAMLR-XXV/BG/3).

3.12 The Secretariat updated the catch-weighted length frequencies for *C. gunnari* taken in fisheries in Subarea 48.3 and Division 58.5.2, *D. eleginoides* taken in fisheries in Subareas 48.3 and 58.7 and Division 58.5.2, and *D. mawsoni* taken in fisheries in Subareas 88.1 and 88.2 (WG-FSA-06/4).

3.13 The Secretariat updated the catch histories for target species and by-catch species with catch limits in the Convention Area (WG-FSA-06/4). Catch histories for *Dissostichus* spp. included estimates of IUU catches (see below).

3.14 The Working Group noted the developments in longline fishing methods used in exploratory fisheries for *Dissostichus* spp. by Japan in Subarea 48.6, and Russia in the Ross Sea (WG-FSA-06/15 and 06/5 respectively). These developments were also considered by ad hoc WG-IMAF (paragraphs 7.37 to 7.41, see also paragraph 6.52).

3.15 The developments resulted in similar gear configurations consisting of a single main line with vertical branch lines (12–22 m in length) with weights and hooks. This configuration allowed the rapid deployment of the longlines, with hooks sinking rapidly to the extent of the branch lines. Hooks in the Japanese system were spaced at various intervals along the branch lines, while the hooks in the Russian system were bunched together on the branch lines.

3.16 The height of hooks above the sea floor was adjustable in the Japanese system, and it was reported that this height above the sea floor could be set to reduce by-catch. The Russian system was also reported to reduce by-catch and it was thought that *Dissostichus* spp. caught by the bunched hooks deterred by-catch species from approaching the baits.

3.17 The Working Group welcomed developments in gear configuration and mitigation methods, and urged Members to conduct statistical evaluation of new methods, using rigorous experimental design, to assess the performance of new gear, its selectivity and impact on ecosystem components (paragraph 6.52). The Working Group also encouraged Members where possible to collaborate to obtain comparative data from vessels fishing side-by-side.

Estimates of catch and effort from IUU fishing

3.18 WG-FSA reviewed estimates of IUU catches in the Convention Area for 2005/06 prepared by the Secretariat and based on information submitted by 1 October 2006 (Table 2 and WG-FSA-06/11 Rev. 2). 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 Working Group endorsed these estimates for use in stock assessment.

3.19 WG-FSA also considered the developments in the estimation of IUU catches which had been made following the 2006 meeting of JAG. This included estimating the probability of IUU events based on the reliability of the sightings, vessel identifications, information sources and vessel activities, and the vulnerability of the area fished (SCIC-06/9). These matters were discussed under Item 8.

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

3.20 Catches of *Dissostichus* spp. in the Convention Area which were reported to the Secretariat in STATLANT data and the catch and effort reporting system, and catches outside

the Convention Area reported in the CDS in 2004/05 and 2005/06 are summarised in Table 3. The catch of *Dissostichus* spp. outside the Convention Area in 2004/05 and 2005/06 was reported mostly from Areas 41 and 87.

3.21 Based on the historic fishing and trading patterns of vessels participating in the CDS, the Secretariat advised that catches reported outside the Convention Area in 2004/05 and 2005/06 indicated legitimate fishing activities and that there was no evidence to suggest that any misreporting had occurred.

3.22 The Working Group requested that Members provide information on the sustainability of the *Dissostichus* resource on the Scotia Ridge in order to develop advice on the possible impact of fishing in Area 41 on the *Dissostichus* resource in the western section of Subarea 48.3. It was noted that the western section of Subarea 48.3 was excluded from the region currently considered in the assessment of *D. eleginoides* in that subarea (Management Areas A, B, C).

3.23 The Working Group noted the scientific observations conducted on board a Ukrainian-flagged longliner fishing for *D. eleginoides* in Area 41 (WG-FSA-06/13). Observations included biological data on the target species and by-catch species, and information on the fishing gear. The Working Group thanked the author for providing detailed biological information.

Scientific observer information

3.24 Scientific observers appointed under the CCAMLR Scheme of International Scientific Observation were deployed on all vessels targeting finfish in the Convention Area, and some vessels targeting krill. Scientific observers have participated in 54 cruises so far in 2005/06: 49 cruises on vessels targeting *Dissostichus* spp. or *C. gunnari* (37 cruises on longliners; 9 cruises on trawlers and 3 cruises on pot vessels); and 5 cruises on vessels fishing for *E. superba* (WG-FSA-06/36 Rev. 2 to 06/39 Rev. 1). Scientific observations were discussed under Items 7 and 11.

Inputs for stock assessment

Catch-at-length/age from fisheries

3.25 Scaled length-frequency data for all fisheries were presented in WG-FSA-06/4 and 06/29. Mr Dunn reported the results described in WG-FSA-06/29 and the process of data validation which uncovered previously undetected location errors in observer data mostly due to observers failing to include a negative sign for longitudes west of 180°.

3.26 Although fewer length-frequency data were collected in 2005/06 than in previous years, due to the change in sampling methodology, the data for 2005/06 were more representative of the fishery as a whole.

Research surveys

3.27 The USA conducted a bottom trawl survey in the region of the northern Antarctic Peninsula part of Subarea 48.1, including the previous fishing grounds for the icefish *Chaenodraco wilsoni* exploited between 1978 and 1987 (WG-FSA-06/14). The report from the survey incorporated a species inventory of the region, information on the biomass of the most abundant demersal species, their distribution, size and maturity composition and their dietary patterns. In the area, two ichthyofaunal elements overlap: the low-Antarctic and the high-Antarctic fauna. In contrast to the South Shetland Islands further north, high-Antarctic elements of the fish fauna become more dominant, in particular among icefish. The species with the highest biomass was *Gobionotothen gibberifrons*. However, biomass of all finfish species in that region is currently not at a level which would allow a reopening of the fishery.

3.28 A trawl survey in Division 58.5.2 of *D. eleginoides* and *C. gunnari* was described in WG-FSA-06/42 Rev. 1, and a review of the use of data from the time series of trawl surveys was presented in WG-FSA-06/44 Rev. 1. It was noted that the decision to exclude some shots from analysis of earlier surveys because they were 'unrepresentative' could be revisited by down-weighting them using their estimated variance rather than totally excluding them, and that this could be examined intersessionally. The Working Group considered whether a core series of surveys could be specified giving a reasonable time series of representative abundance estimates for juvenile fish. It was noted that survey group 1, consisting of the 2001, 2002, 2004, 2005 and 2006 surveys, was considered to be the best possible 'core' series available. Some surveys should be excluded because they did not adequately cover the total potential habitat of juvenile fish, in particular, some of the strata covering deeper (>500 m) water, were not sampled in these years.

3.29 The results of the UK groundfish survey for Subarea 48.3 carried out in January 2006 were given in WG-FSA-06/51. This survey, which included both demersal trawls and a limited acoustic survey, targeted *C. gunnari*. The Working Group was interested in the degree to which icefish and krill could be distinguished in acoustic surveys. Dr M. Belchier (UK) noted that acoustic marks for icefish can be determined by their 'stick' shape seen in acoustic plots, while krill tend to form more dense clusters near the surface in these plots. This was validated by targeted net tows. The Working Group noted that the results showed a strong cohort of 2-year-old fish and an unusually high number of older (50 cm) icefish.

CPUE analyses

3.30 Updated standardisation analyses of CPUE data for Subarea 88.1 and SSRUs 882A–B were given in WG-FSA-06/47. The Working Group noted that these analyses indicated an increase of close to 50% in recent seasons relative to the start of the fishery. There was some concern that the method, which includes vessels as fixed effects in the generalised linear mixed model (GLMM), could give underestimates of the coefficient of variation for each fishing season's estimate of CPUE. Mr Dunn noted that even if this were the case, the incorporation of process error for the CPUE series in the CASAL assessment will adequately quantify the uncertainty in the CPUE series and thus the relative amount of statistical weight this data should be given in the estimation procedures in CASAL.

3.31 The Working Group considered the validity of including the standardised CPUE series in the CASAL assessment given the conclusions of WG-FSA-06/47 that the series cannot be considered as a realistic index of abundance, but has been influenced largely by changes in fisher behaviour and learning. It was agreed that, where possible, all available data should be included in assessments.

3.32 A comprehensive description of the development of the Subarea 48.3 fishery with respect to its influence on standardised CPUE indices is detailed in WG-FSA-06/53.

3.33 From the information presented, the conclusion can reasonably be made that there were two distinct periods of relatively stable fishing behaviour (pre-1993 and post-1997), with a period of fairly rapid change in the fleet and its behaviour in the intervening period, particularly with regard to the transition from summer to winter and from day to night setting. The observed discontinuity in the standardised CPUE series between the 1993 and 1997 years and the relatively stable series post-1997 cannot be fully explained simply with a hypothesis of unrecorded IUU. It is most likely to be the result of a combination of factors, including changes in fleet composition, area, time and depth of operations and the introduction of new management requirements including observers (WG-FSA-06/53).

3.34 The Working Group considered the usefulness of the CPUE series for years prior to 1998 given that many vessels in this period only fished for one or two seasons. It was agreed that splitting the series into a pre- and post-1998 series was a reasonable approach for the current assessment. However, the Working Group recommended that the selection of vessels to be used in the analysis should be reviewed in the future.

Tagging studies

3.35 WG-FSA-06/32 presented results from the skate tagging program for the Ross Sea. Over 9 000 skates have been tagged and released over a period of seven years, and 47 (0.5%) have been recaptured. The paper reported that there was no recorded movement between SSRUs, and the maximum distance travelled was less than 70 km. The distance travelled by tagged skates did not increase with increased period at liberty. The paper concluded that some skates survive being caught on longlines, and tagged and released, for up to four years, and that they appeared to make only small-scale movements along depth contours.

3.36 WG-FSA-06/34 reported on the toothfish tagging program in the Ross Sea. A total of 10 775 *D. mawsoni* have been released and 225 recaptured, and 818 *D. eleginoides* released and 25 recaptured. In 2006, New Zealand vessels had increased the size of toothfish being tagged so that, for the first time, the size distribution of the tagged fish in the Ross Sea was very close to the size composition of the catch.

3.37 WG-FSA-06/56 reported on tagging in Subarea 48.4. Tagging has been carried out since 2004/05 season, and in 2005/06 a total of 134 *D. eleginoides* and 10 *D. mawsoni* were tagged and released during fishing operations. This represented a tagging rate of seven fish per tonne of catch. The paper noted that the UK proposes to continue the mark–recapture experiment in Subarea 48.4 over the 2006/07 and 2007/08 fishing seasons, and recalled that the objective of the experiment will be to assess toothfish population structure and size once a suitable number of tags had been released and recovered.

3.38 WG-FSA-06/64 reported toothfish tag–release and recapture data used in a CASAL assessment model for Division 58.5.2. Dr Constable noted that Australia was maintaining a mark–recapture program for *D. eleginoides* and skates in Division 58.5.2, and that it was concentrating on distributing tags across a wider spatial area than had been done in the past. He also noted that it was tagging at a rate greater than one tag per tonne of toothfish caught.

3.39 WG-FSA-06/53 reported that the South Georgia tagging program continued this year. Since 2000, 13 162 toothfish have been tagged and 364 toothfish were recovered in 2006. Dr D. Agnew (UK) also reported that the tagging program has been extended to rays, with 389 fish tagged in 2006.

3.40 In 2005/06, 4 451 toothfish were tagged in exploratory fisheries (Tables 7 and 8) and 113 tagged fish were recaptured. Toothfish were tagged at an average rate greater than the required one per tonne, although some Flag States in some SSRUs failed to achieve the required level (see Fishery Reports: Appendices F to R). In established fisheries, 4 660 toothfish were tagged in Subarea 48.3, 144 in Subarea 48.4, 1 825 in Division 58.5.2, 1 240 in Subarea 58.6 and approximately 500 during a survey in Division 58.5.1.

3.41 The Working Group noted that C2 and observer data could now be linked on the vessel haul number, which considerably assisted the interpretation of tagging data. However, there was some confusion over submission of the data. The Working Group recalled that tagging in exploratory fisheries was a responsibility of the Flag State, but recognised the value in having scientific observers undertake tagging and record tagging data in the observer database.

3.42 The Working Group suggested, as a solution, that:

(i) observers continue to collect and record tag data in their logbook forms, and periodically provide the vessel with the data on request;

(ii) vessels report tag data to the Secretariat along with their monthly fine-scale data;

(iii) the Secretariat treat the tag data in the observer database as their primary source of data, using the vessel-reported data only when the observer data are unavailable or unreported.

3.43 The following amendments to Conservation Measure 41-01, Annex C, are required:

1. The responsibility for ensuring the progress of tagging, tag recovery and correct reporting shall lie with the Flag State. The CCAMLR scientific observer, in cooperation with the fishing vessel, shall normally be expected ~~required~~ to undertake the tagging program.

3. All relevant tag data and any data recording tag recaptures shall be reported electronically in the CCAMLR format[1] to the Executive Secretary (i) by the vessel every month along with its monthly C2 reports, and (ii) by the observer as part of the data reporting requirements for observer data ~~within three months of the vessel departing the exploratory fisheries~~.

3.44 Since each Flag State is operating its own tagging program, there are currently a large number of different types of tags in the fishery. It has sometimes proven difficult to

understand whether a non-matching tag–return record arises from a previously unknown run of deployed tags, or is a typographical error. The Working Group agreed that a solution to this issue would be to ask observers and/or the vessel to take a photographic record of all returned tags in exploratory fisheries and attach this to the database. An alternative solution is to require that all returned tags are forwarded to a central depositary at the Secretariat.

3.45 The Working Group recommended that for a trial period of one year, observers/vessels take time-stamped photographs of all returned tags and forward them to the relevant tagging program coordinator and the Secretariat.

3.46 It was further noted that New Zealand has been acting as the tagging program coordinator for the Ross Sea, but that now the exploratory fisheries tagging programs have been extended to a number of new areas outside the Ross Sea. To ensure efficient coordination of all these programs, the Working Group asked the Secretariat to investigate the feasibility of it becoming the tagging program coordinator for all exploratory fisheries. This would entail maintaining a supply of tags and tagging equipment in the Secretariat, keeping an accurate record of all tags supplied and recalling all unused tags, and holding all returned tags physically at the Secretariat. Flag States would request tags, or a tagging kit, from the Secretariat prior to embarking on an exploratory fishery.

3.47 It will not be possible for this change to be implemented in time for the start of the 2006/07 exploratory fishery fishing season, however it should be fully implemented in time for the start of the 2007/08 fishing season. The cost of setting up the tagging scheme will be recovered through Members purchasing the tags, and or tagging kits, from the Secretariat. The Working Group requested the Scientific Committee to identify with SCAF what funds from the 2007 budget would be available for the initial purchase of tags by the Secretariat. The Secretariat is requested to notify Members once tags and kits are available for purchase.

3.48 Dr K. Shust (Russia) expressed concern at the low recapture rate of tags in Subareas 88.1 and 88.2. He suggested that using mark–recapture data as a major input for the CASAL model of the assessments in Subareas 88.1 and 88.2 could result in substantial uncertainty about the catch limit if the assumptions about tagging parameters were not met (WG-FSA-06/60, Table 6). Uncertainty might arise from:

(i) a high mortality level of tagged fish;

(ii) annual and seasonal variations in ice- and fishing-fleet distribution within the Ross Sea that influence heavily the possibility of fish tagging and recapturing;

(iii) the current subdivision of the Ross Sea into SSRUs, some of which are closed to the fishery and, consequently, tagging.

3.49 In Dr Shust's opinion, the following issues should be investigated:

(i) The tagging-induced mortality rate (10%) estimated for *D. eleginoides* in Subarea 48.3 (Agnew et al., 2006) should not necessarily be applied to another species (*D. mawsoni*) and other subareas (88.1 and 88.2). This rate should be quantified through a special tagging study on *D. mawsoni* in the Ross sea.

(ii) Uncertainty dependent on the variability of fishing fleet distribution, position of the tagging releases and recaptures should be evaluated both for particular years and the observation period in general.

(iii) Tagging of toothfish should be carried out also in those SSRUs that are currently closed for the fishery.

3.50 Regarding paragraph 3.48(i), the Working Group agreed that more tag-induced mortality experiments, particularly on large fish, should be undertaken.

3.51 Regarding paragraph 3.48(iii), the Working Group noted that research in SSRUs in Subareas 88.1 and 88.2 that were otherwise closed to fishing (Conservation Measures 41-09 and 41-10) had provided valuable data and allowed the opportunity to undertake additional tagging studies. It agreed that these areas should continue to carry an allowance for 10 tonnes of research catch limited to a single fishing vessel per season.

3.52 In 2005/06, vessels undertaking tagging within closed SSRUs in Subareas 88.1 and 88.2 under the 10-tonne research provision had achieved tagging rates of four to six fish per tonne. In order to advance CCAMLR's tagging program, the Working Group recommended that the tagging rate for single vessels operating 10-tonne research catches in closed SSRUs in Subareas 88.1 and 88.2 should be raised to a minimum of three tags per tonne, with a target level of up to 10 fish per tonne of retained catch. The Working Group emphasised that only fish in good condition should be tagged, that fish should be tagged in proportion to their presence in the catch, and that tagged fish do not count against a catch limit.

Management advice

3.53 The Working Group recommended that Conservation Measure 41-01, Annex C, be amended to clarify the roles and responsibilities of the vessel and observers (paragraph 3.43).

3.54 In exploratory fisheries, for a single trial year (2006/07), observers should take a photographic record of all tags recovered and forward these photographs to the Secretariat.

3.55 The Secretariat should take responsibility for coordinating the tagging programs in new and exploratory fisheries starting from the 2007/08 season. All tags used by Members in exploratory fisheries should be purchased from the Secretariat for use in the 2007/08 season onwards. The Scientific Committee and SCAF should identify funds required by the Secretariat, which will be recovered through the sale of tags and tagging kits to Members undertaking exploratory fisheries.

3.56 The requirement for tagging in those SSRUs in Subareas 88.1 and 88.2 which are closed but carry a 10-tonne research exemption for a single vessel in a single season, should be increased from one tag per tonne to a minimum of three tags per tonne and a target of 10 tags per tonne.

Biological parameters

3.57 A review of biological parameters for two species of Ross Sea skates was provided in WG-FSA-06/31. The Working Group noted that estimates of most parameters were still uncertain and encouraged further work.

3.58 The estimation of maturity for *D. eleginoides* in Subarea 48.3 was given in WG-FSA-06/53. Mr Dunn asked whether the depletion level in SSB in the CASAL model was sensitive to changes in the maturity ogive; he also asked whether (i) a sex-specific maturity ogive for Subarea 48.3 *D. eleginoides* should be used, and (ii) is such a strong apparent disparity between male and female maturity expected. The Working Group noted that the initial assessment results suggested that estimated levels of depletion were reasonably insensitive. There was not sufficient time for construction and analysis of a two-sex model at this meeting, but this should be done in future work.

3.59 Dr S. Candy (Australia) noted that when interpreting maturity-at-age from maturity-at-length, via a given growth curve and distribution and level of estimation uncertainty, the estimation error level and distribution needed to be taken into account. He was willing to supply the code that could effect this corrected calculation of maturity-at-age.

3.60 Estimates of natural and fishing mortality from tag–recapture data were reported in WG-FSA-06/54. The Working Group noted that this method could only estimate natural mortality over the exploited age range. It also noted that reliable estimates of M were probably not important for younger unexploited fish in CASAL, but were important for older fish, given the problems when estimating natural mortality and selectivity with dome-shaped selectivity patterns.

3.61 Dr Constable asked whether the estimated lower value of natural mortality in WG-FSA-06/54 was feasible, given the apparent lack of older fish in the population. It was noted that a value of natural mortality that is higher than is currently assumed on the younger fish, but at the level estimated in the paper on the selected age range, could result in the same population structure in the older fish as is seen assuming the current single-valued natural mortality-at-age.

3.62 The Working Group agreed that the analysis of mark–recapture data from all tagging programs might be useful in singular analyses, outside the integrated stock assessment framework, such as estimating natural mortality or movement patterns.

Stock structure and management areas

3.63 The prevalence of a copepod ectoparasite on *D. mawsoni* in the Ross Sea was examined to evaluate its use as a stock marker (WG-FSA-06/28). The small-scale regional differences identified by this method suggested it had limited use for stock discrimination.

3.64 Two papers examined stock structure using otolith microchemistry (WG-FSA-06/P1 and 06/P2). The Working Group considered that some small-scale regional differences identified in WG-FSA-06/P1 were unlikely to reflect stock structure. Dr A. Constable (Australia) remarked that Australia was looking into otolith analysis, with respect to stock

structure, in the Indian Ocean, in relation to identifying potential spawning migrations from Division 58.5.2 to other areas, and encouraged the idea of using such analyses to these ends.

3.65 The Working Group encouraged further work on stock structure, but noted that the results in these three papers made no change to the stock assessments being carried out at this meeting.

Depredation

3.66 In recalling the advice of the Scientific Committee (SC-CAMLR-XXIV, paragraph 3.77) to develop a system to quantify the interactions between marine mammals and the longline fishery, the Working Group considered several papers on depredation submitted to the meeting.

3.67 The Working Group noted the apparent ad hoc nature of the depredation estimate for the toothfish resource in the South African EEZ in Subareas 58.6 and 58.7 given in WG-FSA-06/58 (based on WG-FSA-SAM-05/15). Dr Agnew reported that in Subarea 48.3 depredation has been estimated using CPUE analyses and indicated much lower estimates of depredation than in Subareas 58.6 and 58.7. He also reported that including depredation in the initial assessment models for toothfish in Subarea 48.3 made little change in the calculated long-term yield.

3.68 The Working Group noted that interpreting depredation as pure removals from the population, at lower levels, would have little effect, but when included in CPUE calculations, it may become influential. It also noted that depredation is likely to be a learning process, and that static assumptions, with respect to catch removals, will not apply. The Working Group noted that the selectivity of the depredation needs to be quantified.

3.69 The Working Group noted that incorporation of depredation estimates in evaluating yields could be very difficult, given the likelihood that levels of future depredation may change over time. It noted that the approach used for IUU catches was perhaps applicable. It further noted that measures to counteract depredation used by legal and IUU vessels, would likely be different, given the lack of the need of IUU vessels to adhere to strictures regarding the discouraging of depredation.

3.70 Estimates of depredation for Crozet and Kerguelen Islands based on CPUE were given in WG-FSA-06/63. It was noted that remains of toothfish left on the line was insufficient as a marker of depredation in some cases, as it would appear that removal of the whole fish could be effected. The Working Group noted the variation of depredation between vessels. It suggested that vessel noise production and the length of the line could be factors.

3.71 An instance of depredation of *D. mawsoni* by giant squid in the Ross Sea was reported in WG-FSA-06/P3. It was noted that scarring, due to giant squid, was found on toothfish and that this was a reasonably common event. Mr J. Fenaughty (New Zealand) noted that killer and sperm whales were occasionally seen in the Ross Sea, but that he could only recall a single instance when cetacean depredation had occurred.

3.72 The Working Group was unable to make any strong assertions on levels of removals due to depredation, based on currently employed methods. With respect to observers,

although not a strict requirement, studies are being made where depredation occurs. The Working Group recommended that protocols be developed within the Scheme of International Scientific Observation so that levels of depredation in the *Dissostichus* spp. fisheries in the CAMLR Convention Area can be estimated.

3.73 The Working Group noted that a general research program for WG-FSA-SAM was needed to approach the issue in a stock assessment sense. It also noted that a depredation conference occurred recently, and that the proceedings from this could form a useful background for WG-FSA-SAM discussions.

PREPARATION FOR ASSESSMENTS AND ASSESSMENT TIMETABLE

Report of SG-ASAM

4.1 The second meeting of SG-ASAM which was held in Hobart, Australia, in March 2006 (Annex 6) was convened by Dr R. O'Driscoll (New Zealand). The meeting's terms of reference were limited to issues with respect to the conduct of acoustic surveys and the identification of *C. gunnari* (SC-CAMLR-XXIV, paragraphs 13.28 and 13.29).

4.2 The Working Group considered the findings of the second meeting of SG-ASAM. These findings were also considered by WG-FSA-SAM (WG-FSA-06/6, paragraphs 3.5 to 3.7).

4.3 SG-ASAM's recommendations regarding the development of acoustic methods for *C. gunnari*, acoustic survey design and documentation, and archiving of data were endorsed by the Working Group.

4.4 The Working Group encouraged SG-ASAM to develop a comprehensive echogram library (Annex 6, paragraph 62) for use in characterising acoustic marks and identifying species. This should include detailed information on the morphology of the marks.

4.5 SG-ASAM's proposal to hold a third meeting in 2007 (Annex 6, paragraphs 65 to 69) was supported by the Working Group, and it recommended that the terms of reference for that meeting be extended to take account of future work identified by WG-FSA (see Item 13). However, the Working Group also noted that the survey design and methodology for the proposed CCAMLR-IPY synoptic survey of krill in 2008 may also become a priority for SG-ASAM in 2007.

4.6 The Working Group thanked Dr O'Driscoll, the invited experts and other participants of SG-ASAM for their contribution to the further development of acoustic methodology.

Report from WG-FSA-SAM

4.7 The third meeting of WG-FSA-SAM was held immediately prior to WG-EMM-06, from 10 to 14 July 2006, at the Pelican Bay Hotel, Walvis Bay, Namibia. WG-FSA-SAM was tasked to examine three priority areas of work: (i) estimation of parameters; (ii) continued

development and evaluation of methods; and (iii) review of stock assessment methods for WG-FSA-06. The meeting was convened by Dr C. Jones (USA). The full report of WG-FSA-SAM is provided in WG-FSA-06/6.

4.8 The Working Group noted that no formal terms of reference had been adopted for WG-FSA-SAM during previous WG-FSA meetings, and that proposed terms of reference had been drafted by consensus during the 2006 meeting of WG-FSA-SAM. These proposed terms are listed in WG-FSA-06/6, and were endorsed by WG-FSA.

4.9 WG-FSA-SAM held discussions primarily relevant to advancements in assessment methods for *Dissostichus* spp. and reviews of preliminary stock assessments.

4.10 With respect to model inputs and estimation of parameters, the Working Group noted that WG-FSA-SAM had considered topics relevant to recruitment indices derived from trawl surveys, survey design, biomass and numbers-at-age/length, CPUE indices, tag–recapture experiments, commercial catch-at-length, catch-at-age, age and growth, natural mortality, stock-recruit relationship (steepness) and recruitment variability, selectivity, movement and length–weight relationships (WG-FSA-06/6, paragraphs 2.1 to 2.48).

4.11 The Working Group considered advice and recommendations for revision of parameter estimates for the WG-FSA-06 assessments as set out by WG-FSA-SAM. The Working Group agreed a natural mortality (M) value of 0.13, a steepness (h) value of 0.75, and a recruitment variability (σ_R) value of 0.60 be used for *Dissostichus* spp. when no other data are available.

4.12 The Working Group noted that the principal integrated assessment methods considered by WG-FSA-SAM were the ASPM and CASAL (WG-FSA-06/6, paragraphs 2.49 to 2.85), as well as general issues that are common to both integrated approaches.

4.13 The Working Group agreed with WG-FSA-SAM's recommendation that integrated assessments should use common default values for parameters for a given species where specific data were unavailable to inform a choice for a specific assessment. However, some members felt that a common approach to determining the relative data weightings may not be appropriate across all integrated assessments.

4.14 The Working Group noted that WG-FSA-SAM had reviewed preliminary integrated assessments for *Dissostichus* spp. for the Ross Sea (Subarea 88.1) and Division 58.5.2. The Working Group thanked Members who had made provisional assessments available and had made progress advancing integrated methods during the intersessional period.

4.15 No major new developments of the ASPM approach were presented to WG-FSA-SAM. The Working Group agreed that a method for including tagging data in the ASPM approach remains a priority.

4.16 The Working Group endorsed the recommendations of WG-FSA-SAM that integrated assessments be developed for toothfish in Subareas 48.3, 58.6/58.7, 88.1 and 88.2 and Division 58.5.2, and noted the specific recommendations for each assessment (WG-FSA-06/6, paragraphs 6.1 to 6.16).

4.17 The Working Group encouraged Members to continue exploring alternative assessment methods for *Dissostichus* spp., *C. gunnari*, and other harvested species in these and other parts of the Convention Area, and presenting these alternative methods for evaluation during future meetings of WG-FSA-SAM.

4.18 The Working Group agreed that MSEs, which provide a mechanism for measuring efficacy of methods toward achieving management objectives, should be considered a high priority during future meetings of WG-FSA-SAM.

4.19 The Working Group agreed that it may not be necessary to conduct full assessments of *Dissostichus* spp. each year. If a stock should require a new assessment, methodologies would have the opportunity to be developed during meetings of WG-FSA-SAM prior to their implementation. Should information suggest that there were significant errors in model assumptions, there should be the possibility of revising an assessment in an intermediate year. The Working Group recommended that in preparation for considering this proposal, simulations should be conducted during the intersessional period to explore the consequences of such an assessment timetable on the management of the target species and the fishery.

Summary of the report from the invited expert to WG-FSA-SAM-06

4.20 Dr M. Maunder (IATTC) attended the WG-FSA-SAM meeting as an invited outside assessment modelling expert. His report was submitted to WG-FSA (WG-FSA-06/8). Dr Maunder was requested to provide advice in the following areas:

> Review and evaluate use of alternative approaches for the assessment of toothfish in the Convention Area, including:
>
> (i) CASAL
> (ii) mark–recapture approaches
> (iii) other models or quantitative methodologies.

4.21 Dr Maunder gave favourable remarks to the general process adopted by WG-FSA-SAM. WG-FSA-06/8 adequately addressed all terms of reference. The Working Group reviewed and endorsed the majority of recommendations provided by Dr Maunder.

4.22 The Working Group agreed that Dr Maunder's invitation and participation in WG-FSA-SAM was worthwhile and valuable toward the work of WG-FSA.

Review of preliminary stock assessment papers

4.23 Preliminary stock assessments were presented to the Working Group for the following toothfish and icefish fisheries:

- South Georgia (Subarea 48.3) – *D. eleginoides*
- Heard Island and McDonald Islands (Division 58.5.2) – *D. eleginoides* and *C. gunnari*
- Prince Edward Island (Subareas 58.6 and 58.7) – *D. eleginoides*
- Ross Sea (Subareas 88.1 and 88.2) – *Dissostichus* spp.

4.24 Presentations of preliminary assessments were given to the Working Group, which provided detail beyond what was included in the WG-FSA papers, including an exploration of model inputs, diagnostics and sensitivities and decision-making processes for the preliminary assessments that were tabled.

Preliminary assessments of *Dissostichus* spp.

4.25 Two preliminary assessment approaches for *D. eleginoides* in Subarea 48.3 were examined by the Working Group. A preliminary CASAL integrated assessment (WG-FSA-06/53) considered both length-based and age-based models, and 10 different scenarios incorporating suggestions made by WG-FSA-SAM. The Working Group noted that in most scenarios there was no substantial effect on precautionary catch limits.

4.26 The Working Group noted that there was a trend in residuals when fitting tagging data using the CASAL integrated approach in Subarea 48.3, and recommended that reasons and consequences of this be explored. The Working Group acknowledged that there was a range of possible explanations for this pattern, including unaccounted trends in tag mortality, natural mortality, and selectivity with age/size. These problems are likely to be very complex. The Working Group recommended that optimal numbers of tag releases and recaptures to accommodate the model, as well as sensitivity to extending time in water before expecting recapture, be examined for tagging assessments in general.

4.27 Dr P. Martinez (Argentina) reported on progress made in updating the ASPM for *D. eleginoides* in Subarea 48.3 (WG-FSA-06/59) fitting standardised CPUE, total annual catches, and catch-proportions-at-length and presented some preliminary results. As in the previous version of the model (WG-FSA-SAM-05/5 and WG-FSA-05/73), interannual recruitment variability is included in the model by fitting the steepness parameter h and the annual recruitment vector ε_y through the stock-recruitment function.

4.28 The Working Group suggested that this model could be greatly improved if a method for incorporating mark–recapture data was established, as was recommended during WG-FSA-05. The Working Group also noted that issues raised relating to the model structure, data weighting and recruitment detailed in the WG-FSA-SAM report (WG-FSA-06/6) remain to be addressed. The Working Group also suggested that these aspects of the ASPM approach should be pursued during the intersessional period, and results and technical discussion taken up during WG-FSA-SAM.

4.29 Preliminary assessments for *D. eleginoides* in Division 58.5.2 were presented using the GYM and CASAL modelling approaches (WG-FSA-06/45 Rev. 1 and 06/64 respectively). The GYM approach was similar to that used in previous years, updated with information from the 2005/06 trawl survey as presented in WG-FSA-06/42 Rev. 1. A CASAL integrated assessment was presented for Division 58.5.2 which was based on the preliminary model presented at WG-FSA-SAM. The Working Group noted that it gave similar results to the GYM assessment under the same conditions.

4.30 The Working Group discussed the available survey information for Division 58.5.2 (WG-FSA-06/44 Rev. 1), and agreed that the 1992 and 2000 surveys were of little value to the assessment. They agreed that all other trawl surveys for *D. eleginoides* would be appropriate for incorporation into the assessment for Division 58.5.2.

4.31 Use of mark–recapture information as a means of providing biomass estimates of *D. eleginoides* for Division 58.5.2 was discussed by the Working Group. Dr Constable presented a summary of tag releases and recaptures by area. The Working Group agreed that there were problems with the mark–recapture data accurately estimating biomass levels in this division, owing to the fact that most releases took place in a relatively small area, and there was little mixing. Hence, biomass levels reflected only localised abundance and were likely underestimated across the whole area using these data.

4.32 A presentation on the assessment of the Prince Edward Island (South African EEZ in Subareas 58.6 and 58.7) *D. eleginoides* fishery using the ASPM was given by Dr M. Haddon (Australia) on behalf of South African colleagues who were not present. The preliminary assessment (WG-FSA-06/58) incorporated recommendations as set out by WG-FSA-SAM. The Working Group noted that the model demonstrated reasonable fits to the data. However, there was some concern expressed that the model may not represent the true dynamics, given the large drop in CPUE and the large spikes in recruitment. The Working Group recommended that it would be valuable in future assessments to examine potential area and depth interactions, as well as selectivity by year.

4.33 The estimates of catch limits for Subareas 58.6 and 58.7 provided in WG-FSA-06/58 did not appear to be calculated using established CCAMLR decision rules. The Working Group did not explore this further, as the authors were not present to address this issue. The Working Group requested that South Africa provide the source code and data for the assessment that can then be validated by the Secretariat prior to the next WG-FSA meeting.

4.34 The Working Group thanked the authors for incorporating the recommendations of WG-FSA-SAM in this assessment. The Working Group added that it would be beneficial to have stock assessment scientists from South Africa at future meetings of WG-FSA to allow for further discussion and refinement of Prince Edward Island assessments.

4.35 Preliminary assessments for *Dissostichus* spp. in Subareas 88.1 and 88.2 were presented in WG-FSA-06/48, 06/50 and 06/60.

4.36 WG-FSA-06/60 presented a CASAL integrated assessment of the Ross Sea fishery (Subarea 88.1 and SSRUs 882A and B) that updated the 2005 assessment using new parameter estimates along with revised catch, CPUE, catch-at-age and tag–recapture data. A suite of sensitivity scenarios requested by WG-FSA-SAM was included in the preliminary assessment.

4.37 The Working Group noted that in this assessment the model fits-to-age distribution becomes poor in later years for the shelf area fishery. The Working Group was unclear as to why this was happening, since fits-to-age distribution were far better within the slope and northern fisheries. The Working Group recommended that the influence of individual datasets on the assessment be examined to better determine which components effect model fitting and identify potential flaws in the data. For this reason, it recommended that the model using only the New Zealand vessels be used for providing management advice.

4.38 WG-FSA-06/50 reported the development of an alternative preliminary assessment of the Ross Sea *Dissostichus* spp. fishery by means of a Triple Instantaneous Separable VPA (TSVPA). This assessment method has been used by ICES and is applied to the Ross Sea fishery using, primarily, catch-at-age data and the time series of standardised CPUE. The

results of the paper suggest a pre-exploitation spawning biomass of 910 608 tonnes, a current biomass (2005) of 1 520 660 tonnes and a possible yield according to the CCAMLR decision rules of 55 000 tonnes.

4.39 The Working Group noted that the model estimates of spawning stock biomass were very large, and input data used for the analysis should be verified for possible errors. The Working Group also noted that spawning stock biomass was estimated in the model to increase as the fishery developed, and suggested this may be the result of the effect of increasing CPUE due to the fishing industry developing and improving fishing methods in this fishery. It was requested that these issues be explored in the intersessional period.

4.40 The Working Group thanked the authors for presenting this alternative assessment method, and recommended that technical aspects of this new methodology be presented and reviewed by WG-FSA-SAM for potential future use in assessing the Ross Sea toothfish fishery. They also recommended that the use of tag data incorporated into this approach be explored.

4.41 Dr Shust noted that work should also be undertaken to review whether the tagging data are sufficient for estimating stock abundance in this fishery.

4.42 A preliminary assessment of SSRU 882E was presented in WG-FSA-06/48. This consisted of an update of the 2005 assessment with revised catch, CPUE, catch-at-age and tag–recapture data from New Zealand and all vessels. The Working Group agreed that the reference case described in the paper was an appropriate scenario to proceed with for the assessment.

Preliminary assessments for *C. gunnari*

4.43 A preliminary assessment for the estimation of precautionary yield of icefish in the vicinity of Heard Island (Division 58.5.2) for the 2006/07 CCAMLR season was presented in WG-FSA-06/43 Rev. 1. This paper provided a preliminary assessment of yield based on new survey results (WG-FSA-06/42 Rev. 1) using standard short-term projection assessment methods previously employed for icefish in this division.

4.44 The Working Group noted that the small cohort predicted during last year's assessment was identified in the 2006 survey described in WG-FSA-06/43 Rev. 1. The lack of strong year classes recruiting to the population has resulted in a large decrease in estimated biomass of *C. gunnari*. The Working Group noted that this dynamic is typical of this stock and agreed that the reference case described in the paper was an appropriate scenario to proceed with for the assessment.

4.45 No preliminary assessments were provided to the Working Group for *C. gunnari* in Subarea 48.3. However, the Working Group reviewed the results of a trawl survey in Subarea 48.3 (WG-FSA-06/51), and agreed that information from this survey should be used for an assessment of this stock for the 2006/07 and 2007/08 fishing seasons.

Assessments to be carried out and assessment timetable

4.46 Assessment issues addressed during the course of WG-FSA were identified by the Scientific Committee during the previous year's CCAMLR meeting, the WG-FSA-SAM meeting, papers available to WG-FSA, and assessment subgroup discussions during WG-FSA.

4.47 With regard to the assessment of *D. eleginoides* in Subarea 48.3, the Working Group noted that papers using two approaches (CASAL and ASPM) had been discussed. The Working Group noted the decision reached last year by the Scientific Committee (SC-CAMLR-XXIV, paragraphs 4.55 to 4.57), and the requests by WG-FSA (SC-CAMLR-XXIV, Annex 5, paragraph 12.13) and WG-FSA-SAM (WG-FSA-06/6, paragraph 2.75) that tag data be included in the ASPM. Because tag data cannot currently be incorporated into the ASPM, the Working Group agreed that only the integrated assessment using CASAL be used to provide management advice for the 2006/07 fishing season for *D. eleginoides* in Subarea 48.3.

4.48 Two assessment papers for *Dissostichus* spp. in the Ross Sea (Subarea 88.1 and SSRUs 882A and B) were discussed (CASAL and TSVPA). The Working Group recommended that the TSVPA model should be reviewed and evaluated by WG-FSA-SAM. The Working Group agreed that the integrated assessment using CASAL be used to provide management advice for the 2006/07 fishing season for *Dissostichus* spp. in the Ross Sea.

4.49 With regard to the assessment of *D. eleginoides* in Division 58.5.2, the Working Group noted that two potential approaches (GYM and CASAL) were available. Although the Working Group concluded that both approaches provide similar results under the same conditions, it considered that the CASAL approach offered an advantage over the GYM, since the integrated approach allows for the inclusion of more available data in the assessment process. The Working Group agreed that only the integrated assessment using CASAL be used to provide management advice for the 2006/07 fishing season for *D. eleginoides* in Division 58.5.2.

4.50 The Working Group agreed that an assessment of *C. gunnari* in Subarea 48.3 be undertaken for the 2006/07 and 2007/08 fishing seasons using the short-term projection approach as has been employed in previous assessments of this stock.

4.51 All assessment work was undertaken by primary authors of preliminary assessments, and reviewed independently. Tasks of independent reviewers are listed in WG-FSA-06/6, paragraph 6.3. The outcomes of the assessments were reported in the Fishery Reports.

4.52 Fishery Reports that have been revised or developed as a result of analyses and deliberations during the course of WG-FSA-06 are:

(i) Subarea 48.3 – *D. eleginoides* and *C. gunnari*
(ii) Division 58.5.1 – *D. eleginoides*
(iii) Division 58.5.2 – *D. eleginoides* and *C. gunnari*
(iv) Subareas 58.6 and 58.7 – *D. eleginoides* (South African EEZ)
(v) Subarea 58.6 – *D. eleginoides* (French EEZ)
(vi) Subarea 88.1 and SSRU 882E – *Dissostichus* spp.

4.53 The Working Group assigned a number of scenarios and sensitivity analyses to be undertaken for stock assessments prior to determining the case that will be taken forward for estimating precautionary catch limits. These are described within the individual Fishery Reports.

ASSESSMENTS AND MANAGEMENT ADVICE

New and exploratory fisheries in 2005/06 and notifications for 2006/07

5.1 In 2005 the Commission agreed to seven exploratory longline fisheries for *Dissostichus* spp. in the 2005/06 season (Conservation Measures 41-04, 41-05, 41-06, 41-07, 41-09, 41-10 and 41-11), and no new fisheries had been notified for 2005/06. Activities in the exploratory fisheries are outlined below and summarised in Table 4.

5.2 Notifications for exploratory fisheries in 2006/07 are summarised in Table 5. Twelve Members submitted paid notifications for exploratory longline fisheries for *Dissostichus* spp. in Subareas 48.6, 88.1 and 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b. There were no notifications for new fisheries, and no notifications were received for fisheries in closed areas.

5.3 The Working Group agreed that it would not attempt to determine whether the notifications for exploratory fisheries satisfied the requirements of the notification procedure (Conservation Measure 21-02); this, it believed, should be done by SCIC.

5.4 Unstandardised CPUE data for *Dissostichus* spp. caught in exploratory longline fisheries between 1996/97 and 2005/06 are summarised in Table 6.

5.5 Under Conservation Measure 41-01, 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 caught throughout the season. In 2005/06, 4 451 *Dissostichus* spp. were reported to have been tagged and released in exploratory fisheries (Table 7) and 113 tags were recovered (Table 8).

Progress towards assessments of new and exploratory fisheries

5.6 The Working Group noted for the second year that substantial progress had been made in assessing stocks of D*issostichus* spp. in Subareas 88.1 and 88.2 (see Appendix F and paragraphs 5.54 to 5.62) to develop management advice.

5.7 For the other subareas and divisions in which exploratory fisheries are conducted, the Working Group was unable to develop management advice based on assessments of yield and was therefore unable to provide any new advice on catch limits for these fisheries. The reported catches in these fisheries are summarised in Table 9.

5.8 Given the large number of notifications for 2006/07, the Working Group reiterated the urgent need to develop a means for estimating abundance and providing assessments of stock status in exploratory fisheries other than in Subareas 88.1 and 88.2.

General management advice for new and exploratory fisheries

5.9 The Working Group reiterated the necessity for Members fishing in exploratory fisheries for *Dissostichus* spp. to conduct the fishery-based research outlined in Conservation Measure 41-01, and submit data to the Secretariat in a timely manner.

5.10 In addition, the Working Group reiterated the importance for Members to conduct tagging and to submit data as part of the Research and Data Collection Plan (Conservation Measure 41-01). Members should also be urged to emphasise to their vessels the need to look out for tagged fish and submit accurate tag–recapture data to the Secretariat in a timely manner (see also paragraphs 3.5 and 3.6).

5.11 The Working Group did not attempt to determine whether the notifications for exploratory fisheries satisfied the requirements of Conservation Measure 21-02.

5.12 With the exception of Subareas 88.1 and 88.2, 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.

5.13 For the other areas and divisions in which exploratory fisheries are conducted, the Working Group reiterated the urgent need to develop a means for estimating abundance and providing assessments of stock status for all exploratory fisheries. In this context, it noted that with the continuing tagging programs in a number of areas, in the medium to long term it may be possible to obtain mark–recapture estimates of abundance provided that sufficient tags are deployed each year.

5.14 The Working Group drew the attention of the Scientific Committee to the fact that there are significant differences in the tagging rates achieved by different Members in some areas, and not in others. It is important to understand whether this is due to operational constraints which might suggest differences in mark–recapture model parameters, or to other reasons.

5.15 There are similar differences in by-catch rates between Members, and between different areas which need to be understood (paragraphs 5.41 to 5.46).

Dissostichus spp. Subarea 48.6

5.16 One vessel (Japan) fished in the exploratory fishery in Subarea 48.6 in 2005/06. The precautionary catch limit for *Dissostichus* spp. was 900 tonnes and the total catch was 137 tonnes. Information on this fishery is summarised in Appendix G.

5.17 The fishery has operated predominantly in SSRU A and the main species caught is *D. eleginoides* over the course of the fishery, although 46% of the catch in 2005/06 was *D. mawsoni.* The Working Group noted that there is uncertainty in the spatial distribution of the two species of *Dissostichus* in SSRU A. This requires further investigation over the intersessional period to help with reviewing this fishery.

5.18 There is no information on sightings or landings available to estimate the level of IUU fishing in Subarea 48.6.

5.19 A total of 205 *D. eleginoides* and seven *D. mawsoni* (total 212 fish) have been tagged and released, mostly in SSRU A, and three fish (all *D. eleginoides*) have been recaptured.

5.20 Four Members (Japan, Republic of Korea, New Zealand and Norway) and a total of five vessels notified their intention to fish for *Dissostichus* spp. in Subarea 48.6 in 2006/07.

Management advice for Subarea 48.6

5.21 The Working Group recommended that all the requirements of the fishery, including fishery-based research (Conservation Measure 41-01), by-catch limits (Conservation Measure 33-03) and associated measures, be carried forward to the 2006/07 season.

Dissostichus spp. Subarea 58.4

Dissostichus spp. Division 58.4.1

5.22 Five Members (Chile, Republic of Korea, New Zealand, Spain and Uruguay) and six vessels fished in the exploratory fishery in Division 58.4.1 in 2005/06. The precautionary catch limit for *Dissostichus* spp. was 600 tonnes and the reported catch was 425 tonnes. The closure of SSRUs C (15 February 2006) and G (27 January 2006) was triggered by the catch of *Dissostichus* spp. and the Working Group noted that the over-run of the catch limit in SSRU C (by 50 tonnes) was partly attributed to an amendment to the reported catch which was submitted to the Secretariat after the closure of the fishery (CCAMLR-XXV/BG/3). Information on this fishery is summarised in Appendix H.

5.23 The fishery targets *D. mawsoni* and has operated in SSRUs C, E and G. Information on IUU activities indicated that approximately 689 tonnes of *Dissostichus* spp. was taken in 2005/06. The Working Group noted that most of the catch reported in 2005/06 was taken in SSRUs C and G and that it was possible that these SSRUs were also the focus of IUU fishing. If this were the case, then the total extraction of *Dissostichus* spp. from these SSRUs in 2005/06 was higher than the precautionary catch limit, and may not be sustainable.

5.24 A total of 908 *D. mawsoni* and 23 *D. eleginoides* (total 931 fish) have been tagged and released; there are no reports of recaptures. Most of the fish tagged and released were from SSRUs C (427 fish), E (180 fish) and G (324 fish).

5.25 Six Members (Australia, Republic of Korea, Namibia, New Zealand, Spain and Uruguay) and a total of nine[1] vessels notified their intention to fish for *Dissostichus* spp. in Division 58.4.1 in 2006/07.

[1] Revised number of vessels following advice from New Zealand that one vessel has been withdrawn (COMM CIRC 06/114).

Dissostichus spp. Division 58.4.2

5.26 Three Members (Chile, Republic of Korea and Spain) and four vessels fished in the exploratory fishery in Division 58.4.2. The precautionary catch limit for *Dissostichus* spp. was 780 tonnes and the reported catch was 164 tonnes. Information on this fishery is summarised in Appendix I.

5.27 The fishery targets *D. mawsoni* and has operated in SSRUs A, C and E in recent seasons. Information on IUU activities indicated that approximately 221 tonnes of *Dissostichus* spp. was taken in 2005/06.

5.28 A total of 463 *D. mawsoni* and 15 *D. eleginoides* (total 478 fish) have been tagged and released; there are no reports of recaptures. Most of the fish tagged and released were from SSRUs A (237 fish) and E (190 fish). The fishery appears to have caught small and large fish in the early years but the smaller length mode has not been caught in more recent years.

5.29 The Working Group noted that the catch of macrourids reported in 2004/05, when fishing was concentrated in SSRU A, was relatively higher (22% of the catch of *Dissostichus* spp.) than in other seasons (2–10% of the catch of *Dissostichus* spp.) when fishing was concentrated in SSRU E.

5.30 Six Members (Australia, Republic of Korea, Namibia, New Zealand, Spain and Uruguay) and a total of nine vessels notified their intention to fish for *Dissostichus* spp. in Division 58.4.2 in 2006/07. The Working Group drew the attention of the Scientific Committee to the likely doubling of fishing effort by Members in this division. There was also a rapid increase in IUU fishing in this division (paragraphs 5.94 to 5.105).

Dissostichus spp. Division 58.4.3a

5.31 Two vessels (Spain) fished in the exploratory fishery in Division 58.4.3a. The precautionary catch limit for *Dissostichus* spp. was 250 tonnes and the reported catch was 89 tonnes. Information on this fishery is summarised in Appendix J.

5.32 The fishery targets *D. eleginoides* and the Working Group noted that the catch-weighted length frequencies for this species were similar to those reported for *D. eleginoides* taken by longline in Division 58.5.2 (see Appendix N). Information on IUU activities indicated that approximately 98 tonnes of *Dissostichus* spp. were taken in 2004/05; there was no information on IUU fishing in 2005/06.

5.33 A total of 303 *D. eleginoides* have been tagged and released and six fish have been recaptured.

5.34 Three Members (Japan, Republic of Korea and Spain) and a total of four vessels notified their intention to fish for *Dissostichus* spp. in Division 58.4.3a in 2006/07.

Dissostichus spp. Division 58.4.3b

5.35 Three Members (Chile, Spain and Uruguay) and four vessels fished in the exploratory fishery in Division 58.4.3b. The precautionary catch limit for *Dissostichus* spp. was 300 tonnes and the reported catch was 361 tonnes. The fishery targets *D. mawsoni* and fishing took place outside the prescribed season, in accordance with Conservation Measure 41-07. The closure of the fishery (13 March 2006) was triggered by the catch of *Dissostichus* spp. and the Working Group noted that the over-run of the catch limit (61 tonnes) was partly attributed to an amendment to the reported catch which was submitted to the Secretariat after the closure of the fishery (CCAMLR-XXV/BG/3). Information on this fishery is summarised in Appendix K.

5.36 Information on IUU activities indicated that approximately 1 015 tonnes of *Dissostichus* spp. was taken in 2004/05, and 1 808 tonnes in 2005/06. The Working Group expressed concern that the total extraction of *Dissostichus* spp. in the 2004/05 and 2005/06 seasons exceeded the precautionary catch limit by a factor of 4.4 and 7.2 respectively. The Working Group agreed that such extractions were unlikely to be sustainable.

5.37 A total of 392 *D. mawsoni* and 14 *D. eleginoides* (total 406 fish) have been tagged and released and seven fish have been recaptured.

5.38 The Working Group noted that tagging rates by vessels in this area have apparently been much lower than tagging rates by the same vessels in other areas. The Working Group requested information from the vessels and observers operating in Subarea 58.4 on the reasons for this lower tagging rate which may be due to operational constraints or the poor condition of toothfish caught.

5.39 The Working Group recalled that a trawl survey conducted by Australia in 1999 (SC-CAMLR-XVIII, Annex 5, paragraph 3.79) had not found evidence for juvenile *Dissostichus* spp. in this division, and noted that the catch-weighted length frequencies from the fishery support the survey findings.

5.40 Six Members (Australia, Japan, Republic of Korea, Namibia, Spain and Uruguay) and a total of eight vessels notified their intention to fish for *Dissostichus* spp. in Division 58.4.3b in 2006/07. The Working Group noted that if all these vessels fished, this would represent a doubling of the number of vessels which fished in 2005/06.

Overview of *D. mawsoni* fisheries in Subarea 58.4

5.41 The Working Group noted the increasing levels of fishing activity occurring in the range of *D. mawsoni* in the Indian Ocean sector (notably in Divisions 58.4.1, 58.4.2 and 58.4.3b), particularly the attention being given to the region between 60°E and 110°E along the margins of the continental shelf of Antarctica and BANZARE Bank. The estimated total removal from these divisions in 2005/06 was 3 668 tonnes (this total comprised 74% IUU). Given the proximity of these fisheries to one another, the Working Group agreed that the separation of these fisheries may prove to be inappropriate once there is an understanding of stock structure in the region. In light of this, the combined scale of these removals is greater than the catch limit for Subarea 88.1, which is based on assessments of stock status and long-term annual yield.

5.42 On the basis of the Fishery Reports for these divisions, the Working Group also noted that:

(i) by-catch rates, particularly for *Macrourus* spp., seem unusually low, especially when compared to rates experienced in comparable areas in Subareas 88.1 and 88.2 and to the common occurrence of these fish in an earlier trawl survey of BANZARE Bank (SC-CAMLR-XVIII, Annex 5, paragraph 3.79; van Wijk et al., 2000);

(ii) the total number of tagged fish released in these divisions is 1 815, but it is unclear how many of these fish have survived because the Working Group was advised that observers in the fishery have reported a great difficulty in tagging these large fish and that many of them do not recover from the process of tag and release, remaining on the surface after release and becoming vulnerable to predators, such as being attacked by giant petrels;

(iii) the tagging rate in Division 58.4.3b, which is the region for which most catch is taken, has not reached the required level of one fish per tonne in the last two seasons.

5.43 The Working Group recalled that a 1999 Australian survey had not detected any young *Dissostichus* spp. in Division 58.4.3b. Commercial data (see Fishery Report) confirm that the *D. mawsoni* found in this area are on average about 140 cm long with a minimum at about 100 cm. The absence of smaller fish and the relatively small area of BANZARE Bank and low CPUE compared to Subareas 88.1 and 88.2 suggest a small stock size, whilst the dynamics, including stock structure and productivity, are completely unknown. On the basis of information available and the outcomes of the Ross Sea assessment, which is for a much larger area, extractions of *Dissostichus* spp. at the level of 2 000 tonnes a year are unlikely to be sustainable.

5.44 The Working Group had similar concerns about the productivity of the populations of *D. mawsoni* in Divisions 58.4.1 and 58.4.2, although there appear to be some young fish in Division 58.4.2.

5.45 Given the comparatively high level of total removals across these divisions, that the low level of reporting on removals (the available data are only for 26% of the total estimated catch), and the potential unreliability of the tagging program, the Working Group considered that there was an urgent need to review how to acquire information on the status of the stocks in the region, including stock structure, such as through otolith-based studies, and how to assess productivity and yield, such as through more structured experimental fishing. This will not be possible until the meeting of WG-FSA in 2007.

5.46 The Working Group agreed that the tagging program should be accelerated. Some vessels fishing in these three divisions have achieved tagging rates of three fish per tonne and greater. Tagging rates in Division 58.4.3b have been low, none reaching one per tonne over the last two years. The Working Group recommended that tagging rates in Divisions 58.4.1 and 58.4.2 should be raised to three fish per tonne.

Management advice for *D. mawsoni* in Subarea 58.4

5.47 The Working Group recommended urgent consideration of how to acquire appropriate data for assessments of stock status and yield of *D. mawsoni* in the Indian Ocean sector because of (i) the lack of progress towards assessments in these divisions, and (ii) a rapidly escalating catch in the region.

5.48 The Working Group requested submissions by Members on stock structure, biological parameters (e.g. growth, length–weight relationship, maturity), recruitment and methods for assessment of these stocks.

5.49 The Working Group recommended that tagging rates in Divisions 58.4.1 and 58.4.2 should be raised to three fish per tonne.

Dissostichus spp. Subareas 88.1 and 88.2

5.50 Six Members (Argentina, New Zealand, Norway, Russia, UK and Uruguay) and 13 vessels fished in the exploratory fishery in Subarea 88.1. The precautionary catch limit for *Dissostichus* spp. was 2 964 tonnes and the total catch was 2 952 tonnes. The fishery was closed on 6 February 2006 (CCAMLR-XXV/BG/3), and the following SSRUs were closed during the course of fishing:

- SSRUs B, C G closed 3 January, triggered by the catch of *Dissostichus* spp. (total catch 343 tonnes; 99% of the catch limit);
- SSRUs H, I K closed 19 January, triggered by the catch of *Dissostichus* spp. (total catch 1 976 tonnes; 104% of the catch limit);
- SSRU J closed 5 February, triggered by the catch of *Dissostichus* spp. (total catch 548 tonnes; 99% of the catch limit).

The IUU catch for the 2005/06 season was estimated to be zero tonnes. Information on this fishery and management advice is summarised below (paragraphs 5.54 to 5.70).

5.51 Nine Members (Argentina, Republic of Korea, New Zealand, Norway, Russia, South Africa, Spain, UK and Uruguay) and a total of 21 vessels notified their intention to fish for *Dissostichus* spp. in Subarea 88.1 in 2006/07.

5.52 Five Members (Argentina, New Zealand, Norway, Russia and the UK) and seven vessels fished in the exploratory fishery in Subarea 88.2. The precautionary catch limit for *Dissostichus* spp. was 487 tonnes and the total catch was 465 tonnes. The fishery was closed on 15 February 2006 (CCAMLR-XXV/BG/3). The IUU catch for the 2005/06 season was estimated to be 15 tonnes. Information on this fishery and management advice is summarised below (paragraphs 5.54 to 5.70).

5.53 Seven Members (Argentina, New Zealand, Norway, Russia, Spain, UK and Uruguay) and a total of 16 vessels notified their intention to fish for *Dissostichus* spp. in Subarea 88.2 in 2006/07.

5.54 The Fishery Report for *Dissostichus* spp. in Subareas 88.1 and 88.2 is in Appendix F.

5.55 In 2005 the Working Group recommended that Subareas 88.1 and 88.2 be split into two areas for stock assessment purposes: (i) the Ross Sea (Subarea 88.1 and SSRUs 882A, B), and (ii) SSRU 882E.

5.56 The catch limits for Subarea 88.1 and 88.2 SSRUs in the Ross Sea were changed as part of a three-year experiment (SC-CAMLR-XXIV, paragraphs 4.163 to 4.166). To assist administration of the SSRUs, the catch limits for SSRUs 881B, C and G were amalgamated into a 'north' region and those for SSRUs 881H, I and K were amalgamated into a 'slope' region. Within Subarea 88.2, SSRU 882E was treated as a separate SSRU with its own catch limit, whilst SSRUs 882C, D, F and G were amalgamated with a single catch limit.

5.57 The length frequency of *D. mawsoni* ranged from 50 to 180 cm. In all years, there has been a broad mode of adult fish at about 120–170 cm. In 2005/06, there was also a strong mode at about 60 cm in Subarea 88.2, with the smaller fish predominantly from the edge of the continental shelf in SSRUs 882F and G.

5.58 The standardised CPUE analysis of *D. mawsoni* on the three main fishing grounds in the Ross Sea (Subarea 88.1 and SSRUs 882A–B) showed no significant trend from 1998/99 to 2002/03, a decline in 2003/04, and a sharp increase in 2004/05 and 2005/06 (WG-FSA-06/47). Overall, the indices have increased about 50% since the beginning of the time series. 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. These factors were not present in 2004/05 or 2005/06. The Working Group considered that favourable ice conditions, fisher learning and experience, and improvements in gear were the most likely explanations for the increase in CPUE indices.

5.59 Under Conservation Measure 41-01 each longline vessel fishing in exploratory fisheries for *Dissostichus* spp. is required to tag and release *Dissostichus* spp. at a rate of one toothfish per tonne of green weight caught throughout the season.

5.60 In 2005/06, all but five vessels achieved a tagging rate of more than one toothfish per tonne of toothfish landed. The vessels that failed to achieve the required tagging rate were the *Antartic II* (Argentina), *Volna* (Russia) and *Yantar* (Russia) in Subareas 88.1 and 88.2; the *Viking Sur* (Uruguay) in Subarea 88.1; and the *Frøyanes* (Norway) in Subarea 88.2.

5.61 Since 2000/01, more than 11 000 *Dissostichus* spp. have been tagged in Subareas 88.1 and 88.2 (WG-FSA-06/34), and 250 tagged fish recaptured. Since 2000/01, a total of 5 678 *D. mawsoni* have been tagged by New Zealand vessels in the Ross Sea (Subarea 88.1 and SSRUs 882A–B) and 94 of these were recaptured by New Zealand vessels. The New Zealand vessel data were used as inputs for the base-case model, as complete data (i.e. some release data for 2004) for other vessels were unavailable for the assessment (WG-FSA-06/34).

5.62 The CASAL model, using catch-at-age, CPUE, tag–recapture data, and *D. mawsoni* biological parameters was used to estimate the current and initial population size, and to calculate the long-term annual yield that would satisfy the CCAMLR decision rules.

Management advice for *Dissostichus* spp. in Subareas 88.1 and 88.2

5.63 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 for the Ross Sea (Subarea 88.1 and SSRUs 882A–B) was 3 072 tonnes. At this yield there is a less than 10% chance of spawning biomass dropping to less than 20% of the initial biomass. A yield of 3 072 tonnes is therefore recommended.

5.64 For SSRU 882E, assuming a future fishing selectivity equal to the maturity ogive, the constant catch for which there was a 10% chance of spawning biomass dropping to less than 20% of the initial biomass was 353 tonnes. At this yield, the median escapement of 50% of the pre-exploitation spawning biomass level at the end of the 35-year projection period was 61%. A yield of 353 tonnes is therefore recommended.

5.65 For SSRUs 882C, D, F and G the Working Group could provide no new advice, but noted that the catches in these areas had provided some useful biological data for toothfish. Therefore, the Working Group recommended the current catch limits in these SSRUs be continued for the 2006/07 season.

5.66 The Working Group recommended that the allocation method used to set the 2005/06 catch limits for SSRUs in Subarea 88.1 be continued for the 2006/07 season.

5.67 The Working Group agreed that the current designations of SSRUs in Subareas 88.1 and 88.2 are almost certainly not optimal, but a detailed revision of these would require, at least, a consolidated movement model for fish in these subareas, which is not yet available. Such a revision should take account not only of the principal target species, but also of by-catch species and ecosystem considerations.

5.68 The Working Group recommended that tagging be continued as part of the Research and Data Collection Plan (Conservation Measure 41-01) and urged all Members to continue to tag fish at the required rate.

5.69 The Working Group also considered that the introduction of more structured research plans for exploratory fisheries may lead to a more effective and efficient collection of research data. It therefore recommended that development of such plans should be considered during the intersessional period.

5.70 The Working Group recommended that there should continue to be provision for a 10-tonne research exemption in all SSRUs in Subareas 88.1 and 88.2 having a zero catch limit so as to provide additional opportunities for research and tagging in areas where, often, data are scarce. However, paragraphs 12 and 13 of Conservation Measures 41-09 and 41-10, should be revisited in order to:

- clarify that a 10-tonne research exemption will be granted only for a single vessel in a single SSRU, not one vessel per Member. This will limit the total catch in a closed SSRU to 10 tonnes. On receipt of a notification under Conservation Measure 24-01, Annex A, from a Member that it intends to undertake research under the 10-tonne research exemption in a particular SSRU, the Secretariat will notify all Members of this fact and will not allow additional notifications for that SSRU in that season;

- clarify that paragraphs 12 and 13 of Conservation Measures 41-09 and 41-10 override the normal interpretation of Conservation Measure 24-01 in respect of multiple notifications by Members in a single SSRU;

- clarify that there is an allowance for the retention of 10 tonnes green weight of *Dissostichus* spp.;

- clarify that by-catch and *Dissostichus* spp. that are tagged and returned do not count against the 10-tonne limit. The retained catch of toothfish should count against the overall catch limit for the larger area within which the SSRU lies;

- increase the required tagging rate under the 10-tonne research exemptions to a minimum of three fish per tonne and a target rate of 10 fish per tonne (paragraph 3.48). This will also require a change to Conservation Measure 41-01, Annex C, paragraph 2(i).

Interim prohibition on the use of gillnets in the Convention Area

5.71 The Working Group was asked to provide comments on a proposal to prohibit deep-sea gillnet fishing in the Convention Area (WG-FSA-06/46). Gillnets considered in the document are those described by FAO which include trammel nets. The Working Group noted information exists that fishing vessels with gillnets have been observed in the Convention Area. The Working Group agreed that gillnets are non-selective fishing devices and if not utilised correctly could take mobile species indiscriminately. In addition, gillnets may have adverse impacts if dragged along the bottom and have the potential to 'ghost' fish over long time periods when lost or discarded. The Working Group agreed that it would be reasonable to have an interim prohibition of deep-sea gillnetting in the Convention Area until the Scientific Committee has investigated and reported on the potential impacts of this gear in the Convention Area and the information has been reviewed by the Commission.

5.72 The Working Group also noted that the suggested interim prohibition would apply only to commercial vessels and not for research purposes. At present some Members utilise gillnets in inshore areas to sample fish populations. These programs have been conducted using approved methods for a number of years. If Members wished to initiate new research programs using gillnets, the Scientific Committee should be notified in order that the proposals be reviewed and approved before being undertaken. The Working Group noted that action with respect to regulating the use of gillnets in the Convention Area should not jeopardise existing research programs in coastal waters.

Dissostichus eleginoides South Georgia (Subarea 48.3)

5.73 The Fishery Report for *D. eleginoides* in Subarea 48.3 is contained in Appendix L.

5.74 In 2005, Subarea 48.3 was subdivided into areas, one containing the South Georgia–Shag Rocks (SGSR) stock and other areas, to the north and west, that do not include the

SGSR stock. Within the SGSR area, three management areas (A, B and C) were defined (Conservation Measure 41-02/A). Catch limits for the areas to the north and west were set at zero for 2005/06.

5.75 The catch limits for *D. eleginoides* in the 2005/06 season for areas A, B and C were 0, 1 067 and 2 489 tonnes respectively, with an overall catch for SGSR of 3 556 tonnes. The total declared catch was 3 534 tonnes. There was no recorded IUU catch for the 2005/06 season. Catches in areas A, B and C were 10, 983 and 2 541 tonnes respectively.

5.76 The standardised GLMM CPUE analyses were updated. Standardised CPUE (for the whole SGSR fishery) showed a slight increase between 2005 and 2006. The CPUE data display high levels of variability up to 1995, and lower variability from 1996 to the present, the apparent discontinuity arising during a period of major and rapid change in the structure of the fleet and management of the fishery. Major changes occurring between 1993 and 1996 include changes in the spatial distribution of fishing, a change in the nationalities fishing, the introduction of 100% observer coverage and a shift to night setting and a winter fishery.

5.77 The Working Group agreed that the three periods of the fishery (1985–1992, 1993–1996, 1997–2006) had very different characteristics, and that interpreting the CPUE as a single series was not possible. Accordingly, the two-fleet CASAL model developed last year was used for the basic assessment model this year.

5.78 During 2005/06, a further 4 660 tagged *Dissostichus* spp. have been released in SGSR, bringing the total number of tagged fish released to around 13 000. In 2006, 364 recaptures of tagged fish were reported.

5.79 The Working Group agreed on a single CASAL assessment model, which was structurally similar to that presented at WG-FSA-05. A simple update of that assessment (which included both low $M = 0.13$ and low $L_\infty = 152.8$ cm) resulted in a reduced estimate of B_0, principally due to the influence of the 2006 tag returns. Revisions were made to some input parameters, following the advice of WG-FSA-SAM-06, including new parameter values for steepness, recruitment variability and maturity-at-age. Table 8 in Appendix L outlines the data and parameters used in the assessment model, as well as the structure of the model.

5.80 Likelihood profiles were calculated for the reference case. Recent CPUE, the length-frequency data, and the tag data are consistent in their information on a minimum level of B_0 (around 70 000 tonnes). It is clear that the tag data are the primary data source with respect to information on likely upper limits of B_0 (and, consequently, absolute levels of abundance) and give a consistent estimate of current, and, hence, historic abundance. It is also clear from the likelihood profiles that, as the number of releases and recaptures increases, so does the amount of information held in the tagging data on absolute levels of abundance.

5.81 Sensitivity to IUU was analysed in WG-FSA-06/53. Hypothesising an additional 10 000 tonnes of IUU in 2005 led to a 10% reduction in current biomass and made only a 1% difference to the calculated long-term yield.

5.82 Stock status and the long-term yield were calculated using the MCMC samples for the assessment model, as was done last year, with the appropriate long-term yield being 3 554 tonnes. The critical decision rule was the requirement that spawning biomass at the end

of a 35-year projection period should be 50% of the initial spawning biomass. This rule was implemented following the new recommended procedure outlined in the Fishery Reports for the assessments for toothfish in Subarea 48.3, the Ross Sea and Division 58.5.2.

5.83 As outlined in the Fishery Report (Appendix L), there were some trends in the fits to the mark–recapture data which may be due to complex interactions between the various assumptions about natural mortality-at-age, tagging parameters, growth and selectivity. Investigation of the driving factors behind these trends should be undertaken intersessionally. It was acknowledged that the results of this investigation may have implications for all current assessments.

Management advice

5.84 The Working Group recommended that the catch limit for toothfish in Subarea 48.3 (SGSR stock) should be 3 554 tonnes for the 2006/07 fishing season.

5.85 The catch limits for management areas A, B and C should be adjusted in a pro-rata manner to 0, 1 066 and 2 488 tonnes respectively. By-catch limits for skates/rays and macrourids should be similarly revised to 177 and 177 tonnes respectively.

Dissostichus eleginoides Kerguelen Islands (Division 58.5.1)

5.86 The Fishery Report for *D. eleginoides* in Division 58.5.1 is contained in Appendix M.

5.87 The catch of *D. eleginoides* reported for this division to 31 August 2006 was 3 045 tonnes. Only longlining is currently permitted in the fishery. The estimated IUU catch for the 2005/06 season was zero inside the French EEZ. Some IUU fishing may occur outside the EEZ as reported in WG-FSA-06/11 Rev. 2.

5.88 GLMM analyses show a general decreasing trend in the standardised CPUE up until 2003 followed by a period up to the current year for which the CPUE estimates are relatively constant. The trend in decreasing standardised average weight with fishing season continued for the 2005/06 season and probably indicates that the older age classes are less numerous in the exploited stock.

5.89 The survey being conducted on the FV *Austral* at Kerguelen from 30 August to mid-October 2006 has so far completed 205 trawls and 500 toothfish have been tagged. The Working Group looked forward to considering the results of the survey and encouraged further tagging.

5.90 By-catch removals are important for this fishery and the majority of the catch is processed but no stock assessment is available for evaluation of the impact on affected populations.

Management advice

5.91 The Working Group encouraged the estimation of biological parameters for Kerguelen. The Working Group also noted that a preliminary stock assessment could be carried out if CPUE, catch-weighted length frequencies and biological parameters were available.

5.92 The Working Group recommended that, where possible, all unprocessed rajids should be cut from the line while still in the water, except on the request of the observer. Avoidance of fishing in zones of specific high rates of abundance in by-catch should also be considered.

5.93 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, remain in force.

Dissostichus eleginoides Heard Island (Division 58.5.2)

5.94 The Fishery Report for *D. eleginoides* in Division 58.5.2 is contained in Appendix N.

5.95 The catch limit of *D. eleginoides* in Division 58.5.2 west of 79°20'E for the 2005/06 season was 2 584 tonnes (Conservation Measure 41-08) for the period from 1 December 2005 to 30 November 2006. The catch of *D. eleginoides* reported for this division as of 5 October 2006 was 1 825 tonnes. Of this, 1 097 tonnes (60%) was taken by trawl and the remainder by longline. The estimated IUU catch for the 2005/06 season, 112 tonnes, was the lowest since IUU fishing began in 1995/96.

5.96 The length-at-age vector from 2005 was revised using a two-segment linear model as discussed in 2005. The new vector better estimates the size of young fish. Young fish (<6 years old) are fast-growing. Fish older than 6 years are slower growing than previously estimated. Natural mortality was assumed to be 0.13 $year^{-1}$ as for the other toothfish assessments.

5.97 Additional length-at-age samples for fish of age >20 years can be obtained from the longline fishery. WG-FSA encouraged the collection of these data in order to improve the ability of the growth model to accurately predict mean length-at-age for these older fish.

5.98 The Working Group adopted a new assessment based on the CASAL model applied in Subareas 48.3 and 88.1 and SSRU 882E. This assessment has a number of differences to those assessments including:

- the use of survey data as observations of young fish;
- tagging data are unable to be used in the assessment because of the underestimation of biomass that would arise from the current localised concentration of tag releases and recaptures;

- recruitment is modelled without assuming a stock-recruitment relationship, and variability in recruitment is estimated from the vector of year-class strengths estimated in the model.

5.99 The Working Group also noted that the assessment of yield can be sensitive to the number of age classes in the population and agreed that the assessment be based on a population with the plus class at 35 years rather than 50 years because of the absence of evidence that the fish grow appreciably after 35 years.

5.100 The CASAL assessment used abundance-at-length estimated from the surveys, catch-at-length from the fisheries and standardised CPUE time series to estimate current and initial population size and year-class strengths since 1981. These results were then used in projections to estimate the long-term annual yield that satisfies the CCAMLR decision rules for toothfish.

5.101 Sensitivity trials were undertaken to determine how best to use the core series of surveys (2001, 2002, 2004, 2005, 2006) in conjunction with other surveys for which there were sufficient differences in survey design and data to indicate that the results from these surveys were unlikely to accurately reflect abundances of juvenile fish as in the core series. The scenario adopted for providing advice on yield was to assume that the core series provided a greater accuracy of abundance of juvenile fish ($q = 1$) and to allow the bias in the other surveys (1990, 1993, 1999, 2003) to be estimated via the catchability coefficient, q. Results showed that the 1990, 1993 and 2003 surveys were likely to have underestimated the abundance of fish while the 1999 survey was likely to be an overestimate.

5.102 Long-term annual yield was estimated to be 2 427 tonnes giving 50% escapement with a probability of depletion of 0.06.

5.103 The Working Group noted the successful progress in developing an integrated assessment of *D. eleginoides* in CASAL. It agreed that further work could be undertaken to refine this assessment including examining:

(i) the relative weighting of different datasets;

(ii) whether or how the 2003 survey should remain being used in the assessment;

(iii) the appropriate population structure, including the number of age classes to be used in the model and whether the model could be developed as a two-sex model;

(iv) whether improvement in the model structure can be made to allow the inclusion of tagging data in the assessment;

(v) the relationships between the estimated parameters, including the potential interaction between the catchabilities, q, of the different datasets, particularly the surveys, and the other parameters.

5.104 The Working Group also recommended that:

(i) given the lack of defined modes in the length-density data, it would be useful to use age–length keys, if possible, as an alternative method for estimating densities of cohorts;

(ii) studies on optimal sampling schemes for establishing age–length keys should be encouraged.

5.105 The Working Group encouraged the evaluation of the assessment and harvest strategy in Division 58.5.2 along with the further development and evaluation of management strategies for toothfish fisheries considered in general by the Working Group (section 12). It noted the estimated status of spawning stock at the beginning of the time series (B_0) is greater than the pre-exploitation median spawning biomass (i.e. status is greater than 1 in Appendix L, Figure 11), the latter of which is estimated from a lognormal distribution of recruitments based on mean recruitment, R_0, and the recruitment variability determined from the estimated time series of year-class strengths. This highlights how the quantities in decision rules may be different from the objectives. The Working Group encouraged evaluation of these alternative reference points in the decision rules (using estimates of B_0 or the pre-exploitation median spawning biomass as used here) to determine their robustness for meeting the underlying objectives of the Commission.

Management advice

5.106 The Working Group recommended that the catch limit for toothfish in Division 58.5.2 west of 79°20'E should be 2 427 tonnes for the 2006/07 fishing season.

Dissostichus eleginoides Crozet Islands (Subarea 58.6)

5.107 The Fishery Report for *D. eleginoides* in Subarea 58.6 (French EEZ) is contained in Appendix O.

5.108 The catch of *D. eleginoides* reported for this subarea to 31 August 2006 was 641 tonnes. Only longlining is currently permitted in the fishery. The estimated IUU catch for the 2005/06 season was zero inside the French EEZ. Some IUU fishing may occur outside the EEZ as reported in WG-FSA-06/11 Rev. 2.

5.109 Depredation on toothfish catches by killer whales is becoming a major problem for this longline fishery.

5.110 GLM analyses show a general decreasing trend in standardised CPUE to 2002/03 with a subsequent slight increase in 2003/04 and 2004/05 and a substantial increase for the 2005/06 season. The trend of decreasing standardised average weight from 1998/99 to 2004/05 showed a slight upturn in 2005/06.

5.111 During the season, 1 240 toothfish were tagged by observers on board commercial vessels. The Working Group encouraged France to continue with its tagging program.

5.112 By-catch removals are important for the longline fishery and the majority of the catch is processed but no stock assessment is available for evaluation of the impact on affected populations.

Management advice

5.113 The Working Group encouraged the estimation of biological parameters for *D. eleginoides* at Crozet Island. It also noted that a preliminary stock assessment could be carried out if CPUE, catch-weighted length frequencies and biological parameters were available.

5.114 Estimated total removals have declined steadily over the last eight seasons and are at substantially lower levels than those taken before then. Standardised CPUE fell substantially from 1999/2000 to 2002/03 but has since increased. In the absence of a stock assessment, the Working Group agreed that it was unable to recommend appropriate levels of catch for this fishery.

5.115 The Working Group recommended that, where possible, all unprocessed rajids should be cut from the line while still in the water, except on the request of the observer. Avoidance of zones of specific high by-catch abundance should also be considered.

5.116 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 32-13 remain in force.

Dissostichus eleginoides Prince Edward and Marion Islands
(Subareas 58.6 and 58.7)

5.117 The Fishery Report for *D. eleginoides* in Subareas 58.6 and 58.7 inside the South African EEZ is contained in Appendix P.

5.118 The catch limit of *D. eleginoides* in the South African EEZ for the 2005/06 season was 450 tonnes for the period from 1 December 2005 to 30 November 2006. The catch reported for Subareas 58.6 and 58.7 as of 5 October 2006 was 46.6 tonnes, all of which was taken by longlines. The IUU catch for the 2005/06 season was assumed to be equal to the IUU catch in 2004/05 at 156 tonnes.

5.119 Cetacean depredation of longline catches is reported to be significant, implying that total removals are greater than just the estimated fishery catches. It was noted that the pot fishery which avoided depredation was discontinued.

5.120 The CPUE series was updated for the meeting and the biological parameters altered to match those used in Subarea 48.3.

5.121 An augmented ASPM that used catches, standardised CPUE, and catch-at-length data was used to estimate a long-term annual yield. The results from the model were only slightly

sensitive to whether or not cetacean depredation was included in the calculations and whether or not year-specific weights were used with the CPUE indices. The model estimated the spawning biomass of the resource to be between 36 and 44% of its average pre-exploitation level, although significant uncertainties remain in the assessment.

Management advice for *D. eleginoides* at Prince Edward and Marion Islands (Subareas 58.6 and 58.7) inside the EEZ

5.122 In 2005, the Scientific Committee noted that the advice on the appropriate levels of future catch provided in WG-FSA-05/58 (see also WG-FSA-06/58) was not based on the CCAMLR decision rules. Therefore it was unable to provide management advice for the fishery in the South African EEZ at the Prince Edward Islands. The Scientific Committee recommended that CCAMLR decision rules also be used in estimating yields for this fishery and that the concerns of WG-FSA over the sensitivity of the ASPM to weightings used for different data sources and the estimation of recruitment levels for forward projections be noted.

5.123 The Scientific Committee also noted the recommendations by ad hoc WG-IMAF with respect to mitigation of seabird mortalities (SC-CAMLR-XXIII, Annex 5, paragraphs 5.289 and 5.290).

Management advice for *D. eleginoides* at Prince Edward Islands (Subareas 58.6 and 58.7 and Division 58.4.4) outside the EEZ

5.124 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 Scientific Committee therefore recommended that the prohibition of directed fishing for *D. eleginoides*, described in Conservation Measures 32-10, 32-11 and 32-12, remain in force.

Champsocephalus gunnari South Georgia (Subarea 48.3)

5.125 The Fishery Report for *C. gunnari* for South Georgia (Subarea 48.3) is contained in Appendix Q.

5.126 In the 2005/06 fishing season the catch limit set for *C. gunnari* in Subarea 48.3 was 2 244 tonnes. During the 2005/06 season the fishery caught 2 171 tonnes. The fishery opened on 15 November 2005 and was closed on advice of the Secretariat on 30 September 2006.

5.127 In January 2006, the UK undertook a random stratified bottom trawl survey of the South Georgia and Shag Rocks shelves (WG-FSA-06/51). The raw swept-area biomass estimates from surveys suggest that icefish stock size was between 20 000 and 50 000 tonnes throughout the 1990s (with the exception of the very large stock seen in 1990), and has steadily increased since 2000 to about 117 000 tonnes in 2006 (WG-FSA-06/51).

5.128 The catch-weighted length frequencies obtained from the commercial fishery and trawl surveys (WG-FSA-06/4 and 06/51 respectively) indicated that the population was dominated by a strong cohort of fast growing 2+ fish that were considerably larger (23.6 cm TL compared with 19.8 cm TL) than expected.

5.129 The Working Group agreed that a short-term assessment should be implemented in the GYM, using the one-sided bootstrap lower 95% confidence bound of total biomass from the 2006 survey.

5.130 Most input parameters for the assessment remained unchanged from 2005 except for an update of the length–weight parameters derived from the latest survey data and a change of selectivity function. A linear selectivity vector was used for *C. gunnari*, starting at and being fully selected by 2 years. This is a greater selectivity on 2-year olds than is usually chosen (normally a selectivity of 0.5 on 2-year-old fish is assumed). Full selectivity was assumed this year because the fish were larger than usual for 2-year olds (see paragraph 5.128).

5.131 Some concern was expressed that the fishery had been catching 2-year-old fish, which are not generally assumed to be mature. Mesh size regulations and a move-on rule for large catches of fish smaller than 24 cm applies in this fishery, and should protect most 2-year-old fish (which normally have a modal length of about 20 cm). In 2005/06 the fish were larger than usual, which resulted in them being selected by the fishery. Concern was expressed that the fishery might also catch significant numbers of 2-year-old fish in the 2006/07 fishing season, if they were again unusually large. There is no information on the abundance or size of these recruits. On the other hand, if next year's recruits are normal sized the fishery will, as usual, only partially select them.

5.132 The issue of future fishing on cohorts that have not been assessed, and for which there is no other estimate of recruitment, was raised in 2005 and remains a point of uncertainty in setting catch levels for icefish stocks (SC-CAMLR-XXIV, Annex 5, Appendix L, paragraph 30). The Working Group recommended that more work be directed at understanding this issue.

Management advice

5.133 The Working Group recommended that the catch limit for *C. gunnari* should be set at 4 337 tonnes in 2006/07 and 2 885 tonnes in 2007/08 based on the outcome of the short-term assessment.

5.134 All other components of Conservation Measure 42-01 should remain with an appropriate pro rata catch limit for catch taken in the period 1 March to 31 May (1 084 tonnes).

Champsocephalus gunnari Heard Island (Division 58.5.2)

5.135 The Fishery Report for *C. gunnari* in Division 58.5.2 is contained in Appendix R.

5.136 The catch limit of *C. gunnari* in Division 58.5.2 for the 2005/06 season was 1 210 tonnes for the period from 1 December 2005 to 30 November 2006. The catch reported for this division as of 5 October 2006 was 263 tonnes.

5.137 Catch-weighted length frequencies in the 2005/06 season were dominated by a single year class of 4+ fish. This cohort was observed to dominate the population in the survey undertaken in May–June 2006.

5.138 The short-term assessment was implemented in the GYM, using the one-sided bootstrap lower 95% confidence bound of total biomass from the 2006 survey. All other parameters were the same as in previous years.

Management advice

5.139 The Working Group recommended that the catch limit for *C. gunnari* in 2006/07 be no more than 42 tonnes.

5.140 The Working Group recommended that the Scientific Committee consider the following in providing advice to the Commission on Conservation Measure 42-02:

(i) Prior patterns in population dynamics of *C. gunnari* in Division 58.5.2 are such that the dominant 4+ age class is unlikely to be available to the fishery in 2006/07. Therefore the Working Group supported a scenario where projected yields were estimated only for classes <4+. As these year classes are low in abundance, the estimated yield is low, at 42 tonnes in the coming season, and 44 tonnes in the 2007/08 season. Yield in the second year is slightly increased due to the recruitment to the fishery in 2007/08 of the small 1+ age class evident in the 2006 survey. In considering this scenario, the Working Group noted that a low yield estimate was not unexpected, as:

  (a) the catch limit for 2005/06 was set in 2005 with the expectation that the dominant 4+ cohort would be unavailable to the fishery in 2006/07;

  (b) the absence of any indication of a strong 1+ or 2+ year class in the 2006 survey indicates that yields are likely to be low in future until a cohort as large as the 1+ cohort detected in the 2003 survey becomes evident.

(ii) A catch limit as low as 42 tonnes may be difficult to be targeted commercially without over-catch. There is also a small risk that the trawl fishery for *D. eleginoides* in Division 58.5.2 might take *C. gunnari* as by-catch. However, the Working Group noted that the by-catch of *C. gunnari* in the trawl fishery targeting *D. eleginoides* in Division 58.5.2 has never been large (<0.1 tonnes in 2005/06; WG-FSA-06/37 Rev. 1, Table 5).

5.141 The Working Group recommended that other measures in the conservation measure be retained.

5.142 The Working Group recommended that further work on developing a management procedure for *C. gunnari* is a high priority (SC-CAMLR-XXIV, Annex 5, Appendix M, paragraph 26).

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)

5.143 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 exploitation if scientific surveys had demonstrated that the condition of fish stocks had improved to the extent which would allow commercial harvesting.

5.144 Little information has come to bear with respect to fish stocks in one of the two subareas: Argentina reported on a long-term study conducted on juvenile *Notothenia rossii*, on *G. gibberifrons* and *N. coriiceps* in Potter Cove (King George Island, Subarea 48.1) from 1983 to 2006 (WG-FSA-06/25). The abundance of *N. coriiceps* fluctuated with no apparent trend while *N. rossii* declined following fishing in Subarea 48.1 in 1979/80 until the late 1990s and has been steadily increasing in abundance since then. Abundance of *G. gibberifrons* has been declining steadily over the years. Their numbers have remained close to zero for several years.

5.145 The USA conducted a bottom trawl survey in the region of the northern Antarctic Peninsula part of Subarea 48.1 including the previous fishing grounds for icefish (*C. wilsoni*) exploited between 1978 and 1987 (WG-FSA-06/14) (paragraph 3.27). The Working Group concluded that biomass of all finfish species in that region is currently not at a level which would allow a reopening of the fishery.

Management advice

5.146 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 respectively, remain in force.

South Sandwich Islands (Subarea 48.4)

5.147 During the 2004/05 season, one UK-flagged vessel started a tagging program on *D. eleginoides* in Subarea 48.4. Preliminary results from the survey were presented in WG-FSA-05/57. Two vessels from the UK and New Zealand fished in the area in 2005/06 and continued the tagging program. *Dissostichus eleginoides* formed 99% of the toothfish caught. A total of 134 *D. eleginoides* and 10 *D. mawsoni* were tagged over the northern shelf. The UK proposed to continue the mark–recapture experiment in Subarea 48.4 over the

2006/07 and 2007/08 fishing seasons in order to assist in the assessment of the toothfish population structure and size in accordance with Conservation Measure 41-03 (WG-FSA-06/56).

5.148 The Working Group welcomed this proposal and reiterated its comments from last year (SC-CAMLR-XXIV, Annex 5, paragraphs 5.143 to 5.145).

Management advice

5.149 The Working Group recommended that the mark–recapture program for *Dissostichus* spp. be continued for the next three to five years in Subarea 48.4 with a catch limit for *D. eleginoides* of 100 tonnes per season (Conservation Measure 41-03), noting the comments in SC-CAMLR-XXIV, Annex 5, paragraphs 5.143 to 5.145, and the need to ensure that the experiment is not affected by other fishing activities.

Stone crabs (*Paralomis* spp.) (Subarea 48.3)

5.150 Stone crabs were not exploited in the 2005/06 season. No proposal for the harvest of crabs has been received by CCAMLR for the 2006/07 season.

Management advice

5.151 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 remain in force.

Squid (*Martialia hyadesi*) (Subarea 48.3)

5.152 The exploratory fishery on *M. hyadesi* was subject to Conservation Measure 61-01. No new information on the species was available. No new request has been submitted to CCAMLR to continue exploratory fishing on this species in 2006/07.

Management advice

5.153 The Working Group recommended that the existing Conservation Measure 61-01 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 2004 (SC-CAMLR-XXIII, Annex 5, paragraph 6.38) included:

(i) assessment of the status of by-catch species and groups;

(ii) estimation of by-catch levels and rates;

(iii) by-catch reporting;

(iv) assessment of risk, both in terms of geographical areas and population demography;

(v) mitigation measures.

A work plan was agreed which addressed these issues as described below.

6.3 It was agreed that consideration of by-catch issues in the krill fishery for 2005/06 would not be considered by the Working Group but would be dealt with under section 10 – Considerations of ecosystem management.

Assessment of the status of by-catch species or groups

6.4 There were no new assessments of by-catch species or recommendations for revised catch limits in 2006.

6.5 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

Rajid spp. in the Ross Sea (Subareas 88.1 and 88.2)

6.6 WG-FSA-06/31 presented details of updated biological parameters for *Amblyraja georgiana* and *Bathyraja* cf. *eatonii*, the two main species of rajid taken as by-catch in the Ross Sea *Dissostichus* spp. fishery. Parameter estimates were provided for length–weight and length-at-maturity for both species, and of growth, longevity and natural mortality for *A. georgiana*. The authors noted that there was still considerable need to resolve the

uncertainty surrounding the taxonomy of skates before comparisons of biological parameters between regions could be undertaken reliably. The Working Group encouraged further work on estimating biological parameters of skates in the Convention Area.

6.7 WG-FSA-06/32 provided an update on the skate tagging program undertaken in the Ross Sea. Further details are given in paragraph 3.35. The Working Group thanked New Zealand for continuing with the skate tagging program in the Ross Sea. Australia and the UK informed the Working Group of their continuing skate tagging programs in Division 58.5.2 and Subarea 48.3 respectively. Further details are provided in paragraphs 3.37 to 3.39.

6.8 The UK and New Zealand informed the Working Group that they planned to initiate preliminary stock assessments of rajids during the intersessional period.

Macrourus spp.

6.9 No new information was made available at the meeting upon which any new assessments of *Macrourus* spp. could be based.

Estimation of by-catch levels and rates

6.10 Fine-scale data (haul-by-haul) estimates of total removals of by-catch species from longline and trawl fisheries from within the CAMLR Convention Area are shown in Tables 10 and 11 respectively.

6.11 By-catch rates for macrourids (as a percentage of *Dissostichus* spp. catch) for the 2005/06 fishing season ranged from 0.8 to 20.8% and were broadly similar to those obtained during the 2004/05 season.

6.12 Total catch of macrourids only exceeded the catch limit in Subarea 88.2 (Table 10) (see also paragraphs 6.42 to 6.50).

6.13 The Working Group noted that the by-catch rate of macrourids in Subarea 88.1 was considerably reduced during the 2005/06 season. Mr Fenaughty indicated that the relaxation of some of the requirements governing research sets (SC-CAMLR-XXIV, paragraph 4.173) had contributed greatly to the observed reduction. He considered that vessels were now no longer forced into areas of known high macrourid density by minimum line spacing, hook numbers, and by area restrictions caused by ice and other vessels. It was noted that none of the SSRUs in Subarea 88.1 had been closed due to exceeding the by-catch limit in 2005/06 as had been the situation in 2004/05. The Working Group agreed that the threat of the new move-on rule in Conservation Measure 33-03 had also helped (paragraphs 6.42 to 6.50).

6.14 Reported rajid by-catch (as a percentage of *Dissostichus* spp. catch) in longline fisheries within the Convention Area in 2005/06 was low except in those areas where almost all rajids are retained and processed (Division 58.5.1 and Subarea 58.6) as highlighted in SC-CAMLR-XXIV, Annex 5, Appendix N, paragraph 22. It was again noted that rajid by-catch rates were likely to be underestimated in other areas as they did not include those animals cut off or lost from longlines.

6.15 Estimates of by-catch rates of other species were generally lower than observed in 2004/05. The morid *Antimora rostrata* made up the majority of the catch of other species.

6.16 The Working Group noted that no fine-scale haul-by-haul by-catch data were available from Subareas 58.6 and 58.7 (South African EEZ).

6.17 Low levels of by-catch were recorded from all trawl fisheries operating within the Convention Area in 2005/06 (Table 11). By-catch rates were considerably lower than observed in the longline fisheries. The major by-catch species in trawl fisheries were *Channichthys rhinoceratus* in fisheries for *D. eleginoides* and *C. gunnari* in Division 58.5.2, *Pseudochaenichthys georgianus* in the fishery for *C. gunnari* in Subarea 48.3 and *C. gunnari* in the trawl fishery for krill in Subarea 48.3.

Reporting of by-catch

6.18 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

6.19 Observer by-catch data were extracted by the Secretariat for each fishery for the 2005/06 fishing season and summarised in WG-FSA-06/36 Rev. 2 (longline fisheries) and 06/37 Rev. 1 (trawl fisheries). These documents include tables of the species composition of the observed catch and biological data collected.

6.20 The Working Group recalled that during the 2005 meeting of WG-FSA, estimates of total removals of by-catch using observer data had proved to be very difficult to calculate (SC-CAMLR-XXIV, Annex 5, Appendix N, paragraph 39). Analysis of data from Subareas 88.1 and 88.2 demonstrated that the most common recurring problem was incomplete fields in observer data. Of particular concern had been the inability to 'scale-up' total removals as information on 'Estimated percentage of haul observed for by-catch' was often found to be incomplete. In addition, the recording of retained and discarded fish was inconsistent between vessels and trips in the observer data.

6.21 The Scientific Committee recommended that the catch composition form L5 be modified by adding fields for recording 'number of hooks observed for by-catch' and the total estimated number and weight of each species retained or discarded during longline hauling (i.e. observed numbers and weights, scaled in proportion to the number of hooks observed). These additional fields would assist in the validation and checking of by-catch records (SC-CAMLR-XXIV, paragraph 4.192).

6.22 In order to assess whether changes to the L5 catch composition form and associated observer reporting had led to greater consistency between fine-scale and observer data for by-catch, it was necessary for the Working Group to examine the 2005/06 L5 observer data in greater detail.

6.23 Table 12 provides an overview of by-catch rates for selected species extracted from the L5 observer data. The mean number of hooks observed for by-catch varied greatly between statistical areas ranging from 16.8% in Division 58.5.2 to 58.4% in Subarea 58.4. Estimates of total green-weight removals from observer data, obtained from a variety of sources (e.g. factory estimates, vessel logbooks, weighing all retained by-catch etc.) (column 'a') was compared with extrapolated estimates of total removals (column 'b') obtained by scaling the mass of by-catch observed on hooks during by-catch observation periods to the fraction of the total number of hooks observed.

6.24 For macrourids, rajids and 'other' by-catch, there was reasonable agreement between the values for total removals estimated by the different methods (Table 3). Consistency was greatest in those areas where few vessels had been operating thereby reducing the between-vessel/observer variability. Dr Agnew noted that it was likely that the variance around any scaled estimate of the mass of total removals (column 'b') was likely to encompass the value of total removals estimated by observers (column 'a') as there was considerable variability in percentage of hooks observed for by-catch within statistical areas throughout the season.

6.25 Dr Belchier noted that it had been impossible to accurately assess the variance around the mean number of hooks observed for by-catch from the information supplied in the L5 database for the whole fleet in each fishery. It was clear that there were still missing values, and incomplete fields within the database and inconsistency between vessels and trips in the observer data.

6.26 The Working Group noted that there was less agreement between the different observer estimates of rajid by-catch than for the other taxa (Table 12). The inability to accurately record rajid by-catch in those fisheries where it is a requirement to cut free caught rajids at the sea surface was highlighted by WG-FSA in 2005 (SC-CAMLR-XXIV, Annex 5, Appendix N, paragraph 42). As a result of these concerns the Working Group had reiterated the need for observers to fill out L11 forms correctly. The greater discrepancy observed between the two observer-derived estimates of rajid by-catch suggests that there are still issues to be resolved relating to the accurate recording of rajid by-catch (see also paragraphs 6.28 to 6.34).

6.27 There was broad agreement between macrourid by-catch rates derived from fine-scale catch-and-effort data and scaled observer data, particularly when the likely variance around the mean was considered (see paragraph 6.24). The lack of consistency between the recorded rates again highlighted the current difficulties associated with the accurate recording of rajid by-catch.

Rajid cut offs

6.28 Following concerns raised at WG-FSA-05 about the inconsistency in observer reporting of rajid by-catch, the Working Group recommended that additional information on skate by-catch (and in particular cut-offs) be collected by vessels on the fine-scale C2 form (SC-CAMLR-XXIV, Annex 5, Appendix N, paragraph 51). It was anticipated that this new information would provide a useful check given the inconsistent reporting of cut-offs through observer forms.

6.29 Fine-scale C2 information was available to the meeting for the first time. The Working Group agreed that this was a significant and welcome development and will greatly assist in assessing the levels of rajid by-catch.

6.30 A preliminary comparison of fine-scale vessel-derived C2 estimates of rajid by-catch was made with those derived from observer data, including information derived from both the L11 (rajid data) and L5 (by-catch) datasets.

6.31 Considerable inconsistencies were observed both within the observer-derived datasets and between observer and fine-scale (C2) data in all fisheries for which information was available. Specific causes of the observed inconsistencies were not identified by the Working Group. However, the Working Group agreed that the most likely underlying cause was inexperience with the new data reporting requirements. It was noted that this was the first year for which such data were available and it was likely to take time for the new reporting requirements for rajid by-catch, required of both vessels and observers, to bed-down.

6.32 The possible confusion surrounding the categorisation of the 'fate' of rajids (i.e. cut off line, retained, landed then discarded etc.) was highlighted as an area of concern. Inconsistencies between the categorisation of the fate of caught rajids in the C2 and observer data were considered to be likely reasons for the observed differences in the databases.

6.33 The Secretariat confirmed that the new four-category scale for assessing rajid release condition had been adopted by observers (SC-CAMLR-XXIV, Annex 5, Appendix N, paragraph 87).

6.34 It was suggested that survivorship experiments could be conducted by returning caught rajids to the sea floor in large cages to assess survivorship. It was agreed that the possibility of moving towards biennial assessments would free up time to undertake further intersessional work on rajids and other by-catch issues.

Improvements to by-catch data collection

6.35 The observations described in the paragraphs above have highlighted the ongoing difficulties encountered by observers in accurately collecting data on levels of by-catch in the longline fishery. The Working Group agreed that the requirements for observers to collect data have become considerable and data-entry forms have become complex. Confusion surrounding the recording of by-catch may have contributed to the observed inconsistencies in the by-catch data. Of particular concern was the additional number of fields that are now required in form L5.

6.36 The Working Group recommended that the requirement to obtain a total weight for each by-catch taxa for each set should be relaxed. It was noted that this information was already available from the C2 vessel data.

6.37 It was also recommended that collection of by-catch data be simplified. The period assigned for observation of hooks for bird by-catch should also be assigned as the tally/counting period for fish and invertebrate by-catch. It was agreed that it remained useful to record a tally of the target species during this period. This period should be used only to record counts of by-catch and not to collect additional biological information.

6.38 Mean weight of by-catch species should be obtained from observations made during the biological sampling period and not the tally period. It was noted that it was most appropriate for mean weights obtained from biological observations immediately prior to or after the tally period to be used to scale up catch weights from tally counts of by-catch. It was also noted that it was unlikely that accurate information on release condition of rajids could be obtained during the tally period (particularly in bad weather) and recommended that at least one observation period every 48 hours would still be required as recommended in the past (SC-CAMLR-XXIV, paragraph 4.204).

6.39 A summary of the recommended simplification of the instructions to observers with respect to sampling longlines for by-catch are as follows:

Tally period –

- 25% of hooks should be observed for tally counts each day
- the tally period may be broken up into several periods each day
- tally period includes counts of fish, fish by-catch, birds and mammal interactions.

Biological data –

- Biological sampling periods should be done adjacent to the tally periods.

Rajids –

- Skate and ray observations should be conducted at least once every 48 hours and, if possible, should cover approximately 10% of the hooks hauled.

6.40 Incomplete recording of by-catch by observers may be due to uncertainty surrounding 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.

Management advice

6.41 Management advice resulting from discussions concerning the reporting of by-catch are considered under section 11.

Mitigation measures

By-catch move-on rule

6.42 In Subarea 88.1 in 2004/05 the by-catch limits for macrourids were exceeded in SSRUs I and K, and closures of SSRUs G, I, J and K were triggered by the by-catch limits for *Macrourus* spp. These closures were, in some cases, the result of high by-catch levels being made by only a few fishing vessels. In an attempt to avoid this situation in future, the Commission adopted a new by-catch move-on rule for the 2005/06 fishing season:

Conservation Measure 33-03, paragraph 5:

> If the catch of *Macrourus* spp. taken by a single vessel in any two 10-day periods in a single SSRU exceeds 16% of the catch of *Dissostichus* spp. by that vessel in that SSRU in those periods, the vessel shall cease fishing in that SSRU for the remainder of the season.

6.43 The Commission has requested that the Scientific Committee provide it with an analysis of the effectiveness of this rule in reducing by-catch in Subareas 88.1 and 88.2 in the 2005/06 fishing season (CCAMLR-XXIV, paragraph 11.39).

6.44 None of the SSRUs in Subarea 88.1 were closed on by-catch or exceeded their by-catch limit in 2005/06. However, in Subarea 88.2 the by-catch limit was exceeded in SSRUs C, D, E, F and G, and the closure of SSRUs C, D, F and G was triggered by the macrourid by-catch limit. The macrourid by-catch for Subarea 88.1 as a whole was 88% of the macrourid catch limit in 2004/05 and 54% of the macrourid catch limit in 2005/06. The macrourid by-catch exceeded the catch limit for Subarea 88.2 as a whole. Thus the new move-on rule appears to have helped to reduce by-catch levels and the number of closures in Subarea 88.1 but not in Subarea 88.2, probably because of the different configuration of SSRUs in Subarea 88.2 allowing fewer options for moving between SSRUs, and the requirement that more research be done in this area.

6.45 The move-on rule allows for the by-catch of macrourids to be greater than 16% of the catch of *Dissostichus* spp. for two 10-day periods before the vessel has to move. The first time that catch goes above 16% therefore acts as a warning sign. The Working Group analysed the number of times that individual vessels caught more than 16% of macrourids in a 10-day period, for each SSRU of exploratory fisheries in 2004/05 and 2005/06.

6.46 Over all exploratory fisheries (Subareas 48.6, 88.1, 88.2, Divisions 58.4.1, 58.4.2, 58.4.3a) the 'warning' first 10-day period was triggered 25 times in 2004/05 and 23 times in 2005/06. If this particular by-catch rule had been applicable in 2004/05, individual vessels would have experienced SSRU closures on 14 occasions. In 2005/06 the actual closure of an SSRU to an individual vessel occurred only seven times.

6.47 Considering Subarea 88.1 alone, the warning first 10-day period was triggered 19 and 13 times in 2004/05 and 2005/06 respectively. A closure would have been, or was, triggered 12 and 3 times in 2004/05 and 2005/06 respectively.

6.48 This represents a reduction in the proportion of 'warning' periods that would have, or did, trigger a closure of an SSRU to a vessel and demonstrates that vessels were actively seeking to avoid triggering a closure.

6.49 The Working Group concluded that the new by-catch move-on rule was proving to have some effectiveness both in reducing by-catch and the number of times SSRUs were closed because of by-catch.

6.50 Some vessels had experienced the problem of arriving in an SSRU towards the end of a 10-day period and had experienced high by-catch levels on grounds where fishing had not, as yet, taken place during a season and knowledge of the species mix was yet to be obtained. This curtailed their ability to adequately research low by-catch areas within the SSRU. It was

for this reason that a 'warning' period was built into the design of the move-on rule, so that vessels were not immediately excluded from an area after one 'hit' of by-catch. The precautionary response of most vessels has been to avoid arriving in a new SSRU at the end of a 10-day period but circumstances such as area closures and ice coverage do not always enable this flexibility. If this difficulty persists, some revision of the by-catch rule might be appropriate, such as only including 10-day periods as qualifying 'warning' periods if a vessel had fished in the SSRU for more than two days in that period.

Management advice

6.51 The Working Group recommended that the rule remain unmodified for a further year, and be the subject of review at WG-FSA-07. It requested that the Secretariat provide the data for the analysis of by-catch (Tables 10 to 12) for the start of the meeting.

New fishing methods

6.52 WG-FSA-06/5 and 06/15 described modified bottom longline fishing gears that have been deployed by Russian and Japanese vessels respectively fishing for *Dissostichus* spp. in the Convention Area. By-catch rates of macrourids were reportedly much less than obtained by conventional 'Spanish' type longlines. However, the Working Group noted the need for experimental trials to determine the significance of the reduction in by-catch rates. Further discussion of the methodologies is provided in paragraph 3.14.

6.53 The Working Group noted that in addition to the new gear described in paragraph 6.52, several trials of seabird mitigation measures have been suggested in paragraphs 7.37 to 7.41.

6.54 The Working Group agreed that during the development of new gear, including mitigation measures, it is important that the impact of fishing on all species be monitored (target species, fish and invertebrate by-catch as well as marine mammals and birds) (Appendix D, paragraphs 113 and 186).

INCIDENTAL MORTALITY OF MAMMALS AND SEABIRDS ASSOCIATED WITH FISHING
(see also Appendix D)

Advice to the Scientific Committee

General
(see also Appendix D, paragraphs 1 to 5)

7.1 The plan of intersessional work for 2006/07 (SC-CAMLR-XXV/BG/28) summarises requests to Members and others for information of relevance to the work of the Working Group (Appendix D, paragraphs 1 to 4). 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 especially technical coordinators and South American Members (Appendix D, paragraph 5).

Incidental mortality of seabirds and marine mammals in fisheries in the Convention Area (see also Appendix D, paragraphs 6 to 62)

Seabirds in longline fisheries

7.2 The total number of observed seabird mortalities in longline fisheries was one, a white-chinned petrel in Division 58.4.3b. The total extrapolated longline mortality for 2005/06 was two birds (Table 3). This compared to 97 birds estimated killed in 2004/05 (Appendix D, paragraph 11). When seabird mortalities reported from EEZs within the Convention Area are included, the total extrapolated seabird mortalities during longline fishing operations in 2005/06 were estimated to be 2 589. This estimate includes 235 birds in Subarea 58.6 and 2 352 birds in Division 58.5.1. For the first time no albatrosses were observed captured in longline fisheries in the Convention Area (Appendix D, Table 8; WG-FSA-06/36 Rev. 2, Table 3).

7.3 The total number of seabirds observed caught and released uninjured was 32 (Appendix D, Table 1). The Working Group noted that the incidence of birds being caught injured and uninjured (i.e. birds that are caught on the haul) accounted for 97% of seabird captures in 2005/06 (Appendix D, Table 1). As last year, this proportion of seabirds caught on the haul suggests that an increased focus on haul mitigation measures is required (SC-CAMLR-XXIV, Annex 5, paragraph 7.3; Appendix D, paragraph 12).

French EEZs in Subarea 58.6 and Division 58.5.1

7.4 In 2005/06, data were available from 20 cruises in Subarea 58.6 and 27 cruises in Division 58.5.1. The proportion of hooks observed was 25 and 24% respectively (Appendix D, paragraph 13). In 2005/06 the total reported seabird mortality from observers for Subarea 58.6 and Division 58.5.1 was 57 and 592 birds respectively (Appendix D, Table 4). The corresponding incidental mortality rates were 0.0362 and 0.092 birds/thousand hooks. The extrapolated total seabird mortalities for Subarea 58.6 and Division 58.5.1 were 235 and 2 352 respectively (Appendix D, Table 5). All vessels in the French EEZs were autoliners using 50 g/m IWLs in 2005/06, compared with one such vessel in the previous season. Two-thirds of the birds were caught by two vessels in Subarea 58.6, and in Division 58.5.1, 72% of captures were by three vessels. This may indicate that there are individual vessel effects that need to be examined to effectively reduce further seabird captures in these areas (Appendix D, paragraph 14).

7.5 Similar to last year, the Working Group noted that 28% of seabirds captured were caught alive (30% in 2004/05), indicating that they were taken on the haul (Appendix D, Table 4). This emphasises a need to focus on haul mitigation measures to reduce the remaining seabird by-catch in longline fisheries in the Convention Area (Appendix D, paragraph 16).

7.6 The Working Group noted that France continues to reduce its total seabird by-catch by about one half each year (77 and 57% of the previous seasons' rates respectively in Subarea 58.6 and Division 58.5.1) (Appendix D, paragraphs 15 and 19). However, the level of seabird captures during longline fishing in the French EEZ remains far above that recorded elsewhere in the Convention Area. Seasonal differences in the fishing patterns between areas may account for the differences in catch rates between the French EEZ and other areas, with no longline fishing conducted in equivalent high-risk areas during the higher-risk summer period.

7.7 The Working Group acknowledged that some of its recommendations regarding future research and monitoring of the French seabird captures were addressed in 2005 and noted that the following remain for 2006 (Appendix D, paragraph 17). The Working Group recommended that:

(i) consideration be given to increasing the proportion of hooks observed (e.g. to 40–50%) (Appendix D, paragraph 17);

(ii) a thorough analysis of data be undertaken for the 2003/04 to 2005/06 seasons (Appendix D, paragraph 17);

(iii) provision of additional information on the nature of captures, the factors affecting captures, and details of mitigation devices used (Appendix D, paragraph 18);

(iv) all relevant raw by-catch data be submitted, as is done for other Convention Area subareas and divisions, to allow reporting on the total seabird by-catch for the entire Convention Area (Appendix D, paragraph 20).

Seabirds in trawl fisheries

7.8 The percentage of trawl effort observed in 2005 for the Subarea 48.3 icefish fishery, Division 58.5.2 toothfish/icefish fishery, and the Area 48 krill fishery was 78% (100% of vessels), 100% (100% of vessels), and 15% (43% of vessels) respectively (Appendix D, paragraphs 22, 25 and 27). The Working Group reiterated its 2005 recommendation that coverage of the krill fishery be increased to allow for adequate and representative sampling across all trawl fisheries for monitoring of by-catch and efficacy of mitigation measures (Appendix D, paragraphs 31, 60 and 121).

7.9 The Working Group noted a continuing general downward trend in seabird mortalities reported in the icefish fishery in Subarea 48.3 (Appendix D, paragraph 23). In 2005, 33 seabirds, including albatross and petrel species, were observed killed in the Subarea 48.3 icefish trawl fishery, and another 89 released alive and uninjured (Appendix D, Table 12). The mortalities included 11 black-browed albatrosses, 20 white-chinned petrels, 1 grey-headed albatross and 1 unknown petrel species and were reported from four vessels. This compares to 11 bird mortalities (and 14 released alive) in 2005 and 87 bird mortalities (and 132 entanglements) in 2004. The rate of mortality in this subarea in 2006 was 0.07 birds per trawl compared to 0.14, 0.37 and 0.20 in 2005, 2004 and 2003 respectively (Appendix D, paragraph 24 and Table 14). There were no seabird mortalities observed in the Division 58.5.2 trawl fishery (Appendix D, Table 12).

7.10 The Working Group noted that no seabird mortality was recorded on the *Saga Sea* while fishing with continuous trawls in Subarea 48.1. Similarly, no mortalities were recorded on the *Atlantic Navigator* using either continuous trawl or traditional pelagic trawl methods in Subarea 48.1 (Appendix D, paragraph 28).

Seabirds in pot fisheries

7.11 No incidental seabird mortalities were recorded during three cruises targeting *D. eleginoides* in Divisions 58.5.1 and 58.5.2 and Subarea 48.3 (Appendix D, paragraph 32).

Marine mammals in longline, trawl and pot fisheries

7.12 There were no reports of incidental mortality of marine mammals in longline gear (WG-FSA-06/36 Rev. 2). This differs from 2004/05, when both pinnipeds (5 animals) and cetaceans (2 animals) were reported caught (Appendix D, paragraph 33). Two marine mammals were reported entangled and released alive in longline fisheries (one Antarctic fur seal in Division 58.5.2 and one southern elephant seal in Subarea 88.1/88.2; WG-FSA-06/38, Table 2) (Appendix D, paragraph 33).

7.13 In 2005/06, one Antarctic fur seal was reported caught and killed in the krill trawl fishery in Subarea 48.1 (Appendix D, Table 12). The Working Group noted that this level of mortality is greatly reduced from 2004/05, when 96 Antarctic fur seals were observed caught during krill fishing operations in the same area (Area 48). The Working Group noted that no marine mammal mortality was reported on the *Saga Sea* while fishing continuous trawls in Subarea 48.1 in 2005/06 (Appendix D, paragraph 34). Methods reported deployed to avoid marine mammal capture were net barriers and a seal-exclusion device (WG-FSA-06/37 Rev. 1). The Working Group encouraged the continued reporting of use and experiences with mitigation measures as it is useful to make annual comparisons along with the capture rates of associated gear, with a view to identifying potentially effective methods over time (Appendix D, paragraph 35).

7.14 One leopard seal was caught and killed in the Division 58.5.2 toothfish trawl fishery (compared to one Antarctic fur seal in 2004/05) (Appendix D, paragraph 36 and Table 12).

7.15 There were no reports of incidental mortality of marine mammals in pot fisheries (Appendix D, paragraph 37; WG-FSA-06/39 Rev. 1).

Information relating to the implementation of Conservation Measures 25-01, 25-02 and 25-03

7.16 This year the level of reported performance was improved with 100% implementation for nearly all measures, with streamer line design and use and the discard of hooks in offal being the exceptions. With respect to Conservation Measure 25-02, this is summarised as follows:

(i) line weighting (Spanish system) – 100% reported compliance in all subareas and divisions (Appendix D, paragraph 40 and Table 10);

(ii) line weighting (autoline system) – all vessels fishing in Subareas 88.1 and 88.2 and Division 58.4.2 south of 60°S in daylight met the requirement to achieve a consistent minimum line sink rate as described in Conservation Measure 24-02. As in previous years this line-weighting requirement has been fully achieved by all vessels. For 2005/06, the Working Group noted that only one vessel (*Protegat* in Subarea 48.3), using a variation on the autoline method, used clip-on weights to achieve the sink rate requirements. All other autoline vessels were now using IWLs. The Working Group noted that the *Shinsei Maru No. 3*, using a trot-line system, met the sink rate requirements in Subarea 48.6 (Appendix D, paragraph 40);

(iii) night setting and offal discharge – 100% compliance with night setting, and also for offal discharge in all areas where this was required (Subareas 48.3, 48.4, 58.6, 58.7, 88.1 and 88.2) (Appendix D, paragraph 41 and Table 10);

(iv) discard of hooks – hooks were present in discards on 6 of 36 longline cruises; on three of these this was reported as a rare event. However, the observer reports for the *Globalpesca I* in Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b, the *Protegat* in Subarea 48.3, and the *Punta Ballena* in Subareas 88.1/88.2 indicated that this was a daily occurrence (Appendix D, paragraph 42; WG-FSA-06/38, Table 1);

(v) streamer lines – the number of cruises complying with streamer line specifications has increased from 74 to 80% this year (Appendix D, Table 9), although this is not as high as the 92% (34 of 37 cruises) in 2003. However most of the non-compliant vessels had only minor deviations from the requirement. The cruises where streamer lines did not comply failed on streamer lengths (5 cruises), total streamer line length (3 cruises, but only one of these deviated by more than 3 m from the required length) and branched streamer spacing (1 cruise). Four vessels failed on one different streamer line specification (*Globalpesca II*, *Insung No. 2* and *Galaecia* in Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b; *Frøyanes* in Subareas 88.1/88.2) and two vessels failed on two specifications (*Koryo Maru No. 11* in Subareas 58.6/58.7; *Viking Sur* in Subareas 88.1/88.2). There was 100% compliance with attachment height (Appendix D, paragraphs 43 and 44 and Table 9);

(vi) haul-scaring devices – in Subarea 48.3, four vessels (*Protegat* (78%), *Jacqueline* (46 %), *Argos Georgia* (90%) and *Viking Bay* (98%)) did not use haul-scaring devices on all hauls. In Division 58.5.2, two trips by the *Janas* were reported with 100 and 94% compliance with this requirement respectively. In Subareas 58.6 outside the French EEZ and 58.7 there was 100% compliance (one vessel fished) (Appendix D, paragraph 46 and Table 9).

7.17 The Working Group noted a reported increase in the discharge of gear debris, which occurred on three vessels, one in Subarea 48.3, and two in Divisions 58.4.1, 58.4.2, 58.4.3a

and 58.4.3b. There was 100% compliance with inorganic garbage discharge requirements for longline vessels, though one trawl vessel discharged inorganic discharge in Subarea 48.3. No vessels discharged oil (Appendix D, paragraph 47; WG-FSA-06/38, Table 1).

7.18 The Working Group reiterated its concern that care was needed to ensure accurate reporting of data by observers because inaccurate reporting may have consequences for reviewing the performance of vessels in fisheries (Appendix D, paragraph 49).

7.19 Conservation Measure 25-01 prohibits the use of plastic packaging bands to secure bait boxes. The use of other plastic packaging bands is restricted to those vessels with on-board incineration facilities and all bands must be cut and disposed of using this facility. Information from observer reports indicated 100% implementation of this measure, compared to non-compliance indicated by observer reports on 1 of 10 vessels in 2005 (Appendix D, paragraph 39; WG-FSA-06/38, Table 1).

7.20 With respect to Conservation Measure 25-03, 1 of 9 trawl vessels in the Convention Area (11%) did not comply with the prohibition of discharge of offal during the shooting or hauling of trawl gear in Subarea 48.3 (Appendix D, paragraph 56; WG-FSA-06/38, Table 5). This level of compliance is higher than in 2005, when 2 of 8 (22%) vessels discharged offal.

7.21 Three vessels were reported as having used net sonde cables (*Cabo de Hornos* and *Betanzos* in Subarea 48.3; *Konstruktor Koshkin* in Subarea 48.1). It was unclear whether these were net sonde cables or paravanes, as had been the case in previous years, and the Working Group requested additional information from scientific observers (Appendix D, paragraph 48).

7.22 The Working Group noted observer reports suggesting that the reduced level of seabird mortality recorded during shooting operations was due to improved mitigation measures, including net cleaning, and a combination of weight added to the net and net binding. Detailed reporting on net binding was only recorded in two cruise reports from Subarea 48.3. This may have been partly due to the lack of a specific field in the scientific observer logbook to record the use of the method. The Working Group developed recommended changes to the logbook to collect these data in future (Appendix D, paragraphs 51 and 58).

7.23 The consistency of reporting on the adoption of mitigation measures in the icefish trawl fishery varied considerably. The Working Group recommended changes to the observer logbook to improve the collection of these data (Appendix D, paragraph 57).

7.24 The Working Group strongly recommended the use of net binding in the *C. gunnari* fishery in Subarea 48.3, and other pelagic trawl fisheries in the Convention Area, as appropriate, and provided guidelines to assist in a uniform uptake of this mitigation measure (Appendix D, paragraph 59).

7.25 The Working Group recommended that an advisory note be added to Conservation Measure 42-01 to assist in the uptake of this mitigation measure as follows (Appendix D, paragraph 60):

Add the following sentence to 'mitigation' paragraph 7:

Vessels are encouraged to use net binding as a means to reduce seabird interactions. See SC-CAMLR-XXV, Annex 5, Appendix D, paragraph 59 for guidelines for net binding.

7.26 Noting the success to date of net binding in the icefish fishery (Appendix D, paragraphs 54 and 58), the Working Group will review future data, such as that obtained from the recommended increased observer coverage in the krill fisheries (Appendix D, paragraph 31), to assess the utility of this mitigation measure in other pelagic trawl fisheries (Appendix D, paragraph 61).

7.27 The Working Group acknowledged the continued decline of seabird and marine mammal by-catch in the Convention Area, but several areas of concern remain regarding seabirds caught: in the French EEZ of Subarea 58.6 and Division 58.5.1, during longline haul operations in Subareas 48.3, 58.6 and 58.7, and during icefish trawl operations in Subarea 48.3. The Working Group's recommendations address each of these areas and generally involve continued vigilance with improved monitoring and reporting. The ongoing success in minimising and mitigating by-catch of seabirds in longline fisheries in the Convention Area has resulted from an ongoing and adaptive approach to application of mitigation measures. The success and uptake of this approach has been contingent on the sustained very high level (100%) of observer coverage in the Convention Area (Appendix D, paragraph 63).

Incidental mortality of seabirds outside the Convention Area
(see also Appendix D, paragraphs 64 to 75)

Longline

7.28 As requested in 2005 (SC-CAMLR-XXIV/BG/28), New Zealand provided new data on mortality of seabirds outside the Convention Area relevant to fisheries and/or seabirds within the Convention Area. Cruises on New Zealand domestic vessels were observed in 2003/04 and 2004/05, and species from the Convention Area were among those captured (Appendix D, paragraphs 64 and 65).

7.29 The Working Group noted that despite its request, no other Members reported on longline seabird by-catch from outside the Convention Area. The Working Group encouraged reporting of new information in 2006.

Trawl

7.30 New Zealand and South Africa provided new data on mortality of seabirds outside the Convention Area relevant to fisheries and/or seabirds within the Convention Area (Appendix D, paragraphs 67 and 68). The data provided suggest that the levels of mortality of Convention Area seabirds outside the Convention Area are much greater in magnitude than

those reported within the Convention Area and are a cause for serious concern. The South African data included black-browed albatrosses likely to be predominantly Convention Area seabirds breeding at South Georgia.

7.31 The cryptic nature of seabird warp-strike mortality and the need for specifically tasked seabird observers to record and quantify this type of mortality has been noted in recent years (Appendix D, paragraph 71). The Working Group re-emphasised the need for effective mitigation of seabird by-catch in trawl fisheries (Appendix D, paragraph 70), recommended expanded data collection by dedicated seabird observers to determine the extent of the interaction (Appendix D, paragraphs 62, 71 and 73) and noted that restricting offal discharge during trawl operations would significantly reduce the observed by-catch in this fishery.

Development of a trawl warp cable data collection protocol for inside the Convention Area

7.32 The Working Group developed forms and a protocol to collect seabird trawl warp-strike data and recommended that they are used in all trawl fisheries in the Convention Area. The objective is to assess the extent of seabird interactions with trawl warp cables in Convention Area fisheries and is to be undertaken in three stages (Appendix D, paragraph 74). The first stage recommended for 2006/07, requiring sampling across a high proportion of vessels in trawl fisheries, is to document if seabird interactions with trawl warp cables are occurring in the Convention Area fisheries (Appendix D, paragraph 75).

Incidental mortality of seabirds during unregulated longline fishing in the Convention Area (see also Appendix D, paragraphs 76 to 87)

7.33 The overall estimated total for the whole Convention Area in 2005/06 indicates a potential seabird by-catch in the unregulated fishery of 4 583 (95% CI range of 3 756 to 12 237) seabirds (SC-CAMLR-XXV/BG/27). The values for this and previous years are summarised in respect of different parts of the Convention Area in Appendix D, Table 17 (Appendix D, paragraph 81).

7.34 In comparison with estimates for previous years, calculated in identical fashion, the overall catch for 2005/06 is similar to the overall catch estimated for 2003/04 (SC-CAMLR-XXIV/BG/27). These are the lowest reported values since estimates started in 1996. This presumably reflects a commensurate reduction in toothfish removals and/or changes in the areas from where IUU fishing occurs (Appendix D, paragraph 82).

7.35 The Working Group noted that grey petrels have comprised between 5 and 11% of the catch in the regulated fishery in Division 58.5.1 over the last three years and undertook to examine methods of estimating the by-catch of this species by IUU vessels as an intersessional task with a view to assessing the level of take of grey petrels in future years (Appendix D, paragraph 84).

7.36 Nevertheless, the Working Group reiterated its conclusions of recent years that even these levels of incidental mortality of seabirds arising from IUU fishing were of substantial concern and likely unsustainable for some of the populations concerned (Appendix D, paragraph 86). The Commission was encouraged to continue to take action in respect of incidental mortality of seabirds caused by IUU fishing (Appendix D, paragraph 87).

Research into and experience with mitigation measures
(see also Appendix D, paragraphs 88 to 115)

Longline

7.37 Noting the success to date within the Convention Area in reducing seabird by-catch, the Working Group recalled that the mitigation measures used continue to require refinement to potentially allow for fishing at any time of day without seasonal closure of fishing grounds (SC-CAMLR-XIX, paragraphs 4.40 and 4.41). Further, as CCAMLR mitigation measures and practices have been held up as a role model outside the Convention Area and successfully exported to some of those fisheries, research into mitigation measure refinement remains a priority to support the export of best-practice mitigation (Appendix D, paragraph 89).

7.38 The Working Group noted research under way to further develop improvements to the line-weighting regimes and use of streamer lines for both Spanish system and autoline vessels (Appendix D, paragraphs 89 to 102). Ultimately, the Working Group expects that a suite of best-practice seabird by-catch mitigation for Spanish system longline vessels (Appendix D, paragraph 90) and autoline vessels (Appendix D, paragraph 102) can be developed.

7.39 With respect to future improvements to Conservation Measures 24-02 and 25-02, the Working Group recommended:

(i) test the efficacy of the new Spanish longline system line-weighting regime as a seabird deterrent and for operational characteristics (Appendix D, paragraph 89);

(ii) further research on utility and cost of mechanised streamer line systems (Appendix D, paragraph 97);

(iii) testing the effectiveness of paired streamer lines in Southern Ocean conditions with common seabird assemblages (Appendix D, paragraph 102);

(iv) observer logbook and cruise report modifications to improve data collections for longline haul mitigation, longline sink rates and estimation of access windows (vessel speed, sink rate and aerial extent of streamer lines).

7.40 With respect to the *Shinsei Maru No. 3* bottom-line system, the Working Group determined that the threats to Convention Area seabirds during line-setting operations would be minimal and potentially lower than with the traditional Spanish system and that continued reporting of this methodology would provide valuable information on its performance in relation to seabird by-catch (Appendix D, paragraphs 92 to 94; paragraphs 6.52 to 6.54).

7.41 Given the continued high percentage of seabirds caught during longline haul operations in the Convention Area in 2005/06 (97% of seabird interactions) (Appendix D,

paragraph 12 and Table 1), the Working Group noted two effective mitigation devices – the 'moon pool' and the Brickle curtain (Appendix D, paragraphs 113 and 114). The Working Group encouraged technical coordinators to instruct observers to collect information on haul mitigation devices used in the Convention Area (Appendix D, paragraphs 107 and 109).

Observer data collection
(see also Appendix D, paragraphs 117 to 124)

7.42 The Working Group reviewed data collection needs relative to several areas of seabird and marine mammal interaction and mitigation and recommended additions or changes to logbooks and cruise reports including:

(i) improved reporting on the use of net sonde cables (Appendix D, paragraph 48);

(ii) net binding (Appendix D, paragraphs 51 and 58);

(iii) the adoption of mitigation measures in the icefish trawl fishery (Appendix D, paragraph 57);

(iv) a warp-strike protocol (Appendix D, paragraphs 62, 71, 122 and 123);

(v) information on haul mitigation devices used in the Convention Area (Appendix D, paragraph 107);

(vi) improved reporting for estimating longline access windows (the distance astern at which longlines sink beyond the reach of seabirds; pertinent data are vessel speed, longline sink rate and aerial extent of streamer line) (Appendix D, paragraphs 105, 118 and 119).

Research into the status and distribution of seabirds
(see also Appendix D, paragraphs 125 to 130)

7.43 The Working Group welcomed a report on albatross and petrel populations from ACAP. The Working Group reiterated that such information is best compiled and reviewed by ACAP and noted that the summary documents provided this year had been invaluable (Appendix D, paragraph 125).

7.44 A report from ACAP outlined a proposal for the development of Species Conservation Assessments for all the ACAP-listed species. It was proposed that these Species Assessments would be web-based and housed on the ACAP website, and thereby readily available for consideration by CCAMLR Members. Consideration of this proposal will be progressed at the ACAP Meeting of Parties to be held in New Zealand in November 2006. The Working Group is encouraged by the proposal for Species Conservation Assessments and agreed they would be useful for the work of ad hoc WG-IMAF (Appendix D, paragraph 126).

7.45 New distribution data on southern and northern giant petrels foraging from Macquarie Island were incorporated into the assessments of risk for the CCAMLR subareas (Appendix D, paragraph 130; SC-CAMLR-XXV/BG/26).

Incidental mortality of seabirds in relation to new and exploratory fisheries
(see also Appendix D, paragraphs 131 to 148)

7.46 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 (SC-CAMLR-XXV/BG/26). There were no changes to levels of risk this year (Appendix D, paragraphs 131 to 134).

7.47 The Working Group noted a tabled description of the ad hoc WG-IMAF risk assessment and considered that it would be useful to develop this paper further, with a view to making the methodology and approaches more accessible to groups outside CCAMLR seeking to undertake similar processes, particularly those with fishery management responsibilities where Convention Area seabirds are taken outside the Convention Area. The paper would be developed intersessionally by the Working Group (Appendix D, paragraphs 135 to 137).

7.48 Of the 39 applications for exploratory longline fisheries for 2005/06, 22 were undertaken (Appendix D, paragraph 138). No incidental mortality of seabirds was observed in fisheries in Subareas 48.6, 88.1 and 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b. One seabird mortality was observed in Division 58.4.3b (Appendix D, paragraph 139).

7.49 The 41 proposals by 12 Members for exploratory fisheries in seven subareas/divisions of the Convention Area in 2006/07 were addressed in relation to the advice in Appendix D, Figure 2 and Table 18, and SC-CAMLR-XXV/BG/26. The results, summarised in Appendix D, Table 19, involve two categories: those that provide sufficient information and are assessed as conforming with advice relating to incidental mortality of seabirds (Appendix D, paragraph 143(i)), and those that contain insufficient information to be certain that they conform with advice relating to incidental mortality of seabirds (Appendix D, paragraph 143(ii)). Applications by Argentina (CCAMLR-XXV/17), Republic of Korea (CCAMLR-XXV/20) and Uruguay (CCAMLR-XXV/28) fall into the latter category. The Working Group noted that as for last year (SC-CAMLR-XXIV, paragraph 5.33) these inconsistencies should be able to be resolved during the Scientific Committee meeting (Appendix D, paragraphs 140 to 144).

7.50 The Working Group welcomed improvements in notifications this year and requested that Members take greater care in future submissions to ensure the intent to comply with relevant seabird by-catch measures was clear (Appendix D, paragraph 145).

7.51 The Working Group welcomed CCAMLR-XXV/29 which proposed further improvements to the pro forma and checklist prepared to assist Members in fulfilling notification requirements, and noted that the proposed approach should improve the information available to the Working Group in future. The Working Group recommended that the one-page summary of notifications should also include a four-part checklist to

address Members' intentions to comply with the four assessed elements: Conservation Measure 25-02; Conservation Measure 24-02 if an exemption is sought from setting longlines at night, or fish outside specified fishing seasons; specified seabird by-catch levels; and scientific observer requirements (Appendix D, paragraph 147).

7.52 The Working Group reiterated its recommendation that any vessel operating under the provisions of Conservation Measure 24-02, 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 (Appendix D, paragraph 148).

International and national initiatives relating to incidental mortality of seabirds in relation to longline fishing (see also Appendix D, paragraphs 149 to 177)

7.53 Information was reported on current international initiatives under the auspices of:

(i) ACAP – items of particular relevance to CCAMLR (Appendix D, paragraph 150);

(ii) FAO (NPOA-Seabirds) – noting the completion of plans by Brazil and Chile, a developing plan by Uruguay, and awaiting finalisation of South Africa's plan (Appendix D, paragraphs 153 to 155);

(iii) RFMOs – response received to CCAMLR Resolution 22/XXIII from IOTC; progress with IATTC, IOTC, SEAFO and WCPFC (Appendix D, paragraphs 163 to 173);

(iv) NGOs – an update on BirdLife International's Albatross Task Force (Appendix D, paragraph 59) and its NPOA-Seabirds initiative (Appendix D, paragraph 156);

(v) a mitigation workshop held in Hobart, Australia, to assist in refining an experimental program for identifying and developing effective seabird mitigation measures for pelagic longline fisheries (Appendix D, paragraph 158).

7.54 The Working Group noted the considerable progress made at WCPFC, SEAFO, IOTC, IATTC and ICCAT, and opportunities to work cooperatively with CCAMLR. However, it was recognised that for pelagic longline gear types in particular, there is at present no best-practice mitigation strategy that has been rigorously tested and is available for widespread uptake by the major RFMOs operating within the ranges of seabirds that breed and forage in the CCAMLR Convention Area (Appendix D, paragraph 174). The development of proven pelagic longline mitigation measures and their uptake outside the Convention Area should remain a high priority for CCAMLR (Appendix D, paragraphs 158 and 175) and the Working Group recommended that Members that are also members of WCPFC participate in the WCPFC's deliberations in December 2006 regarding the adoption of appropriate seabird mitigation measures for adoption within the WCPFC (Appendix D, paragraphs 171 and 175).

7.55 Given the by-catch impacts of adjacent RFMO fisheries to birds that breed and forage in the Convention Area, the Working Group recommended that ACAP Parties and CCAMLR

Members should be proactive in engaging with RFMOs and in promoting information exchange and strengthening their input into RFMO meetings by including seabird experts on Member State delegations. It was also agreed that a critical role of Parties and Members was to become involved in the development and implementation of seabird resolutions and other measures to reduce by-catch of albatrosses and petrels within RFMO jurisdictions. (Appendix D, paragraph 151).

7.56 The Working Group recommended that CCAMLR and its Members support a BirdLife International initiative at COFI-27 to advance best-practice guidelines for NPOA-Seabirds (Appendix D, paragraph 156).

7.57 The Working Group recommended to the Scientific Committee that the Commission be represented at the January 2007 tuna RFMOs meeting in Kobe, Japan, and that the Secretariat develop a paper describing the scientific and other processes CCAMLR has followed in developing and implementing effective seabird by-catch mitigation measures. That paper would, *inter alia*, emphasise the requirement for extensive and sustained scientific observer coverage in addition to applied and adaptive mitigation research in any effort to reduce seabird mortality associated with fishing operations (Appendix D, paragraph 176).

Streamlining the work of the Scientific Committee
(see also Appendix D, paragraphs 181 to 197)

7.58 Ad hoc WG-IMAF noted that streamlining its agenda for this year's meeting was a useful step forward, made additional recommendations for future agenda improvements (Appendix D, paragraph 181) and noted that regular review of its agenda and a move to completing some tasks on a biennial and triennial basis would allow further streamlining of the agenda in future (Appendix D, paragraph 182).

7.59 Noting that the current interactions with WG-FSA allowed the transfer of useful knowledge on fishing technologies and practices, ongoing dialogue on matters of mutual interest and a useful element of peer review during meetings, ad hoc WG-IMAF recommended that it could conduct its work most effectively if it retained its linkage with WG-FSA (Appendix D, paragraphs 183 and 184). It noted the shared areas of interest between WG-IMAF and WG-EMM and encouraged ongoing dialogue between the two groups (Appendix D, paragraph 187). The Working Group agreed that having one stream of advice to the Scientific Committee was preferable over the potential for the presentation of conflicting advice if this interaction did not occur, and noted that this interaction contributed to streamlining the work of the Scientific Committee.

7.60 Ad hoc WG-IMAF noted the proposals for the restructure of the Scientific Committee's working groups (paragraphs 14.1 to 14.9) and further noted its support for the proposals (Appendix D, paragraph 185), along with the need for ongoing dialogue between working groups with respect to future change and the content of the research plans of other working groups (Appendix D, paragraph 187).

7.61 The Working Group noted the very positive results over the last few years with respect to minimising seabird and marine mammal by-catch throughout the Convention Area. It recommended that despite the continuing reductions in by-catch in the Convention Area, there

was a need to remain vigilant with monitoring of by-catch and the implementation of conservation measures and to continue to strive to minimise seabird and marine mammal by-catch in all Convention Area fisheries (Appendix D, paragraphs 188 to 190).

7.62 The Working Group noted the opportunity to focus on the by-catch of Convention Area seabirds and marine mammals outside the Convention Area given CCAMLR's responsibility for these Antarctic marine living resources (Convention Article I). To date, CCAMLR measures and practices have been held up as a role model outside the Convention Area and the mitigation measures adopted within the Convention Area have been, or are in the process of being, adopted by neighbouring RFMOs (Appendix D, paragraph 191).

7.63 Ad hoc WG-IMAF reviewed its original terms of reference (SC-CAMLR-XII, paragraph 10.19). The Working Group discussed proposed revisions to the terms of reference and made additional suggestions for consideration during the intersessional period with a view to WG-IMAF recommending revised terms of reference in 2007 (Appendix D, paragraph 192).

7.64 The Working Group recommended the development of a medium-term research plan for ad hoc WG-IMAF as an intersessional task for the group and noted that in future it may be possible to conduct short workshops in association with the annual WG-IMAF meeting to address critical items in the plan. The use of invited experts at such workshops was highlighted by the Working Group as likely being crucial to their success (Appendix D, paragraphs 193 to 195).

7.65 The Working Group discussed the time required to undertake the core work of ad hoc WG-IMAF and noted that at present it required the allotted five days to conduct its work program; however, the Working Group indicated its intention to further review the required duration of the meeting in 2007 (Appendix D, paragraphs 196 and 197).

Other business
(see also Appendix D, paragraphs 198 to 212)

Australian proposal on extending fishing season in Division 58.5.2 for longline vessels

7.66 Australia requested consideration of a proposal to extend the fishing season in Division 58.5.2 by seven months for longline vessels. This request was made on the basis that the vessel limit for seabird by-catch coupled with the remaining mitigation measures specified in relevant conservation measures would be sufficient to achieve the level of mitigation required. The Working Group noted that:

(i) current mitigation measures in the absence of season limits are unlikely to adequately mitigate capture of white-chinned petrels during the summer season in higher-risk areas;

(ii) where season extensions are under consideration they should be undertaken in a stepwise manner to allow review of results and appropriate responses;

(iii) two observers are needed so that seabird mortality limits can be monitored accurately;

(iv) a season extension into the austral spring was preferable as white-chinned petrels are less susceptible to by-catch at this time (Appendix D, paragraphs 202 to 204).

7.67 The Working Group noted that a three-seabird limit had previously been introduced as a precautionary measure to extend the fishing season for one month in Division 58.5.2 (Conservation Measure 41-08, paragraph 3). However, this did not automatically mean that this was the appropriate mechanism for mitigating incidental seabird mortality in this fishery over an additional seven-month season extension (Appendix D, paragraph 205).

7.68 The Working Group noted that the vessel may catch in excess of three seabirds in a single set during the breeding season and as longline vessels typically undertake several sets before beginning to haul lines, the potential for a substantial increase in seabird incidental mortality in Division 58.5.2 exists as a result of this proposal (Appendix D, paragraphs 206 to 208).

7.69 The Working Group noted that its preference would be for a closely monitored and stepwise roll-back in the season in Division 58.5.2 rather than a one-step move to fishing throughout the year (Appendix D, paragraph 210).

7.70 The Working Group noted that it would be preferable if a paper was submitted to facilitate consideration of the risks that the additional fishing might entail to seabirds, and how these might be mitigated, including:

- an assessment of the likely outcome in terms of bird mortality, including supporting information for that assessment detailing the likely seabird by-catch rates and totals;

- what additional measures (if any) and their likely efficacy, could be deployed to mitigate the additional risk of mortality to seabirds (Appendix D, paragraph 211).

Line sink rate testing proposal for Subarea 48.6

7.71 With respect to the Japanese proposal seeking dispensation from leaving the Convention Area to conduct longline sink rate tests when fishing at the end of one season and into the subsequent season in Subarea in 48.6 (CCAMLR-XXV/32), the Working Group noted that the proposal did not pose any additional risk to seabirds provided the standard sink rate, as detailed in Conservation Measure 24-02, is achieved (Appendix D, paragraph 212).

General

7.72 The Working Group noted that the quality of advice it could provide was enhanced when detailed technical documents were submitted in support of proposed changes on

conservation measures in advance of the meeting. Further, where supporting technical documents were not tabled, insufficient information may mean that the Working Group needs to defer the provision of advice until the following year.

EVALUATION OF THREATS ARISING FROM IUU ACTIVITIES

Current estimate of IUU catches

8.1 The Working Group examined the calculations of IUU catches made by the Secretariat for the 2005/06 season (WG-FSA-06/11 Rev. 2). As in previous years, and subject to further development of a new methodology proposed by JAG (CCAMLR-XXV, Annex 6; SCIC-06/9), the estimation of IUU catches was made using the standard methodology. It is based on information supplied to the Secretariat by Members on the number of IUU vessels active in an area, estimates of the duration of a fishing trip likely to be undertaken by an IUU vessel in that area, the number of fishing trips represented by the sighting, and the likely IUU catch rate in that area.

8.2 The Working Group agreed to use the data presented in Tables 2 and 13 in its assessments. In accordance with the agreement at WG-FSA-05 (SC-CAMLR-XXIV, Annex 5, paragraph 8.3), the Working Group only considered estimates of IUU fishing using data up to September 2006, and did not present extrapolations of these data to the end of the fishing season. It noted that estimates of IUU fishing in 2004/05, presented at WG-FSA-05 up to 30 September 2005, had been updated using information submitted between 30 September and 30 November 2005. This affected only Division 58.4.3b, adding 100 tonnes of IUU catch. The initial estimate of 336 tonnes of unattributed undocumented landings was reduced by 70 tonnes after reconsideration of the timing of one incident.

8.3 At the time of the meeting Australia released the details of the FV *Taruman* logbook, seized on 6 September 2005. The logbook indicated that 145 tonnes had been taken, remarkably similar to the Secretariat's original estimate of 144 tonnes (SC-CAMLR-XXIV, Annex 5, Table 3.2), but that this was mostly caught outside the Convention Area. Therefore, the estimation of IUU catches for the 2005/06 season was amended to include 28 tonnes of *D. eleginoides* taken by the vessels from Subarea 88.1 (Table 3).

Development of a new methodology for estimation of IUU catches

8.4 JAG had suggested two changes to the CCAMLR IUU assessment methodology: the inclusion of a factor expressing the confidence that various types of sightings represent actual IUU activity; and the introduction of distributions rather than point estimates of some of the parameters used in the assessment, for instance the number of days per cruise and catch per day (CCAMLR-XXV, Annex 6, paragraphs 4.1 to 4.11). The Working Group noted that there is currently no better way of estimating a third component of the methodology, that of understanding the relationship of confirmed sightings to unsighted IUU activity, than that proposed by Agnew and Kirkwood (2005) and Ball (2005). However, it was noted that the methodology could provide robust estimates of unsighted activities on a certain but not yet defined level of surveillance activity in the area concerned.

8.5 Progress has been made on both former issues. SCIC-06/9 presented an initial application of the proposed confidence ranking of sightings data, including some suggested changes to the category definitions. Applying the resultant weightings to the estimated IUU catch resulted in reductions in estimated IUU catch of between 4 and 33% for the tested areas and years. The Working Group noted that such reductions would be appropriate only to statistically estimated values. It recommended that SCIC consider whether the weightings of individual categories was appropriate, whether the number of levels in each category was correct and whether there were other useful categories that might be used without overly complicating the analysis.

8.6 The Working Group recalled its repeated requests (SC-CAMLR-XXIV, Annex 5, paragraph 8.10) and that of JAG (CCAMLR-XXV, paragraph 4.13) that SCIC determine the vulnerability of different areas to IUU fishing, basing this assessment on the level, type and quality of surveillance in the fishery, attractiveness/accessibility of fishing opportunities and the presence of deterrents. The Working Group suggested that SCIC-06/9 could provide SCIC with the template needed to complete this task.

8.7 The Working Group briefly investigated the data (catch per day and days per trip) available to move to a statistical description of uncertainty in the form of a distribution of likely catch rates of IUU vessels. It concluded that the most appropriate method for deriving distributions of such data for use in IUU estimation was to bootstrap existing data on CPUE within days fishing per trip. Unfortunately, the areas of most importance to the Commission now (Divisions 58.4.1, 58.4.2, 58.4.3) are those for which good data are least abundant. Some extrapolation can be made between subareas/divisions, but this is limited to the comparability of the different areas in terms of latitude, climate, toothfish density and other factors. There are some circumstances under which IUU CPUE could be expected to be lower than licensed CPUE (when IUU vessels are wary of being apprehended) or higher than licensed CPUE (when they are able to ignore restrictive conservation measures such as a requirement for night setting).

8.8 The Working Group agreed that the objective of undertaking this work on uncertainty was to try and describe credible ranges of possible IUU catch that captured the real level of such catches. Rather than asking WG-FSA-SAM to determine the level of uncertainty in IUU estimates that would lead to significant impacts on the assessment, it would be more appropriate to present the ranges determined from IUU estimation to the assessment groups and ask them to determine whether these ranges would have a significant impact on the assessments.

8.9 Such an approach was adopted by WG-FSA-06/53 and 06/45 Rev. 1 which had investigated the effect of uncertainty in IUU catches in Subarea 48.3 and Division 58.5.2 respectively. These investigations showed that the addition or subtraction of uncertain amounts of IUU in the mid- and late 1990s had a relatively small impact on estimated biomass and calculations of sustainable yield.

Review of historical trends in IUU activity

8.10 The Working Group noted that the level of IUU fishing around sub-Antarctic islands continues to decline. However, it expressed great concern at the increase in IUU activity in

Division 58.4.3b (which has increased by 62% since 2004/05) and adjacent to the continent in Divisions 58.4.1 (689 tonnes in 2005/06, 0 tonnes in 2004/05) and 58.4.2 (221 tonnes in 2005/06, 86 tonnes in 2004/05).

8.11 The Working Group is developing a program of work which should lead to assessments of all new and exploratory fisheries. Fishing and tagging effort has been restricted to only a few SSRUs in Divisions 58.4.1 and 58.4.2, and future analyses are likely to concentrate on these areas where fishing and tagging data are available. Consequently any analysis of these data must also have access to information on IUU fishing at the same spatial resolution.

8.12 The Working Group asked SCIC to provide advice on precisely where, in Divisions 58.4.1 and 58.4.2, IUU fishing is occurring.

8.13 Given the situation with IUU fishing in these three areas, the Working Group considered that there was an urgent need to review its research program in the area. This will not be possible until its meeting in 2007. Nevertheless, the Working Group agreed that the tagging program should be accelerated.

Management advice

8.14 The Working Group recommended further development of the new methodology proposed by JAG with the following actions:

(i) SCIC should consider whether the weightings of individual categories were appropriate, whether the number of levels in each category was correct and whether there were other useful categories that might be used without overly complicating the analysis.

(ii) The Working Group requested SCIC to determine the vulnerability of different areas to IUU fishing, for instance using the template provided by SCIC-06/9.

(iii) The Working Group will develop distributions of likely catch rates of IUU vessels by area using data from licensed vessels. The attention of the Scientific Committee and SCIC is drawn to the fact that data are currently most limiting in the areas which have highest levels of IUU fishing.

8.15 In future, determination of credible ranges for IUU estimates should be followed by investigation of the consequences of this uncertainty for the assessments.

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

Summary of biological information contained in WG-FSA papers

9.1 In addition to information which was pertinent to the assessment of stocks and dealt with in Fishery Reports and paragraphs 3.57 to 3.73, 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 the biological understanding of these species. Summaries of those working documents containing biological information will be available in the *CCAMLR Scientific Abstracts* and so are not repeated here. The papers address the following subject areas:

- maturity stages observed in *D. mawsoni* in the Ross Sea (WG-FSA-06/9);
- species composition of fish found in the stomachs of *D. mawsoni* in the Ross Sea, with *M. whitsoni* as the dominant prey fish species (WG-FSA-06/10);
- diet of *D. mawsoni* in the Ross Sea (WG-FSA-06/17, 06/27);
- the ectoparasite load of *D. mawsoni* in the Ross Sea (WG-FSA-06/28);
- biology of *D. eleginoides* from outside CCAMLR waters in FAO Area 41 (WG-FSA-06/13);
- the mercury content of *D. eleginoides* in the Pacific, Indian and Atlantic Ocean basins (WG-FSA-06/24);
- the standing stock, spatial distribution and biological features of the demersal fish fauna off the tip of the Antarctic Peninsula (WG-FSA-06/14);
- the status of nearshore *N. rossii*, *G. gibberifrons* and *N. coriiceps* from the South Shetland Islands (WG-FSA-06/25);
- spawning condition and feeding of icefish from the 2006 groundfish survey around South Georgia (WG-FSA-06/51);
- biological parameters of Ross Sea skates (WG-FSA-06/31);
- movement of Ross Sea skates from a tagging program (WG-FSA-06/32).

Matters arising from biology and ecology papers

9.2 (i) The mercury content of *D. eleginoides* in three different ocean basins of the Southern Ocean. Mercury content in the Pacific and Indian Ocean basins was high and in the range commonly found in shark, swordfish or king mackerel. In contrast, *D. eleginoides* found in the Atlantic Ocean basin had a low content (WG-FSA-06/24). In response, the Working Group cautioned that sample sizes were small and from too small an area for broad generalisations to ocean-wide patterns in mercury in *D. eleginoides* tissue to be made. The hypothesis of the Antarctic Convergence as a barrier to mercury is worthy of further study, however it is not substantiated by the experimental design used in the study described in WG-FSA-06/24. Unpublished data from toothfish from the Australian fishery in Division 58.5.2 suggest that levels of mercury in *D. eleginoides* ~60 cm in length range from 0.10–0.33 ppm, which is considerably lower than those derived from the study in question, for fish from the lower end of lengths measured.

(ii) The status of nearshore *N. rossii*, *G. gibberifrons* and *N. coriiceps* derived from a long-term monitoring program (1983–2006) at Potter Cove (South Shetland Islands). *Notothenia rossii* and *G. gibberifrons* declined in the 1980s and first half of the 1990s. Since then, *N. rossii* increased in numbers while *G. gibberifrons* remained close to zero. *Notothenia coriiceps* remained stable over the whole period of investigation (WG-FSA-06/25).

(iii) Reviewed biological parameters of Ross Sea skates – the taxonomy of several skate species in the Southern Ocean, such as *A. georgiana* and *B. eatonii*, needs clarification. Considerable differences in biological parameters, such as length–weight relationships and length-at-maturity, exist in individuals of one species from vastly different areas, such as the Ross Sea and South Georgia (WG-FSA-06/31).

9.3 In order to place more emphasis on knowledge gaps and to allow a more focused discussion in the future, the Working Group proposed three topics for discussion during the meeting of WG-FSA in 2007. It noted that this should not preclude the submission of other biological papers. These are:

- reproduction in toothfish
- stock structure in toothfish
- taxonomy in Antarctic skates.

Species profiles

9.4 Species profiles for *Dissostichus* spp. and *C. gunnari* were developed by Dr I. Everson (UK) in the early 2000s, and at last year's WG-FSA meeting three species profiles were identified for preparation:

- *D. mawsoni* (Dr Hanchet)
- *D. eleginoides* (Drs M. Collins (UK) and Belchier)
- *C. gunnari* (Drs K.-H. Kock (Germany) and Belchier).

9.5 Work on the species profile of *D. mawsoni* has been completed and the Working Group thanked Dr Hanchet for its preparation during the intersessional period. The work on *D. eleginoides* and *C. gunnari* is likely to be completed in early 2007 and should be available for review from mid-2007. The Working Group encouraged profiles on macrourids and rajids.

9.6 The Working Group decided to restrict species profiles to a compilation and analysis of biological parameters to the species in question. All information required for stock assessment is contained in the Fishery Report of the particular species and does not need repetition in the species profiles. Species profiles should then be published in *CCAMLR Science* and further disseminated to the public domain through 'Fishbase' and other means to ascertain a distribution as wide as possible. The species profiles will be updated continuously by the Working Group once new information is available. Focusing discussions on biological parameters in the Working Group will help to provide updates from one annual meeting to the

next. The Working Group noted that care should be taken to ensure authors of working group papers and unpublished reports are appropriately acknowledged following the usual rules of data access.

CCAMLR Otolith Network

9.7 No new information had been obtained by the CON during the intersessional period on issues of inter-laboratory variability in age estimates of *D. eleginoides*. Dr Belchier suggested that a reference set of otoliths should be circulated between interested laboratories to assess the precision of age estimates between those laboratories that routinely age toothfish but to also include those that may do so in the future.

9.8 A workshop on the ageing of *C. gunnari* was held at AtlantNIRO in Kaliningrad, Russia, from 19 to 23 June 2006 (WG-FSA-06/7). The workshop concluded that a further intercalibration exercise (otolith exchange) was required on fresh otoliths before the precision of the method for reading whole otolith could be fully assessed. Following the workshop, fresh otoliths from the UK survey around South Georgia in January 2006 (WG-FSA-06/51) were sent to AtlantNIRO in Russia and Instituto Español de Oceanografía in Spain for further analysis. These otoliths will form the basis for a future otolith exchange between all laboratories participating in the otolith exchange.

Report of the Second Workshop on Estimating Age of Mackerel Icefish, *Champsocephalus gunnari*

9.9 The Second Workshop on Estimating Age of Mackerel Icefish, *Champsocephalus gunnari*, was hosted by AtlantNIRO, Kaliningrad, Russia, from 19 to 23 June 2006. The workshop focused on South Georgia, including Shag Rocks, given that otolith material was only available from that region. The aims of the workshop were agreed at WG-FSA-05 and are detailed in paragraph 4.33 of SC-CAMLR-XXIV. The glossary of common terms used to describe the structures and features within *C. gunnari* otoliths and the quality control issues closely follow the definitions used for *D. eleginoides* otoliths with minor modification and simplification (SC-CAMLR-XX, Annex 5, Appendix H; *FAO Fisheries Report*, No. 685, 2001). The workshop report is provided as WG-FSA-06/7.

9.10 The time constraints during the workshop only allowed the use of whole otoliths to determine age. However, the workshop outlined that further plausible methods exist for age validation in the species which have been either used already (see Annexes 3 and 4 of WG-FSA-06/7) or need more detailed exploration in the future:

- length-frequency analysis
- progression of strong year classes
- progression of discrete length modes sampled for age structure
- marginal increment analysis
- daily increment analysis
- numerical integration of daily growth increment widths.

The biological characteristics of *C. gunnari* make the use of tagging and rearing studies to estimate and validate ageing in the species unlikely.

9.11 A 1 July birthdate, as used before, was confirmed as the most appropriate for the majority of the South Georgia *C. gunnari* population. In order to determine precision in age estimates between readers, a routine intercalibration exercise was undertaken. There was considerable discussion as to whether otoliths should be read 'blind', i.e. with no prior knowledge of individual fish lengths and other biological information. *A priori* knowledge of length provides useful information that would assist the reader to assign 'plausible' ages to fish. The participants of the workshop eventually agreed that for the purposes of the assessment of the precision exercise and in order to be consistent with the age determination workshop for *D. eleginoides* (SC-CAMLR-XX, Annex 5, Appendix H), otoliths would be read 'blind'.

9.12 In summary, the results of the intra-reader analysis (WG-FSA-06/7, paragraphs 4.2.5 to 4.2.8) demonstrated the expected differences between the precision of age readings made by experienced and inexperienced readers of icefish otoliths. The most experienced reader had 85% agreement between consecutive readings while there was only 30% total agreement between successive readings of the least experienced reader. There was good agreement between readers in locating the position of the first and second annuli. Good agreement between readings of the youngest year classes was observed but increased discrepancy with increasing age was evident.

9.13 The workshop agreed that given the age of collection of the available otoliths and the decreasing readability of *C. gunnari* otoliths with increasing storage time, a further intercalibration exercise (otolith exchange) was required on fresh otoliths before the precision of the method for reading whole otoliths could be fully assessed. For the time being, Dr Belchier agreed to circulate new otoliths obtained from the most recent South Georgia surveys to participating laboratories. The otoliths used in the intercalibration exercise would be retained as a reference set to maintain precision over time and to assist with the training of new and inexperienced otolith readers. Further analyses (as described in WG-FSA-06/7, paragraph 4.2.4) would be initiated on completion of age readings by all institutes.

9.14 The workshop agreed that Dr Z. Frolkina (AtlantNIRO, Kaliningrad, Russia) would work closely with Dr Belchier in order to develop a comprehensive protocol for the reading of whole otoliths that would include images of otoliths to assist with identification of annual structures. It was suggested that prior to the otolith exchange, a sub-sample of new otoliths from the recent UK survey around South Georgia in January–February 2006 should be sent to AtlantNIRO where otoliths would be read and annotated photographs taken showing the location of annual structures. Otoliths would then be sent to the other laboratories taking part in the exchange where the procedure would be repeated. Images and age information should be exchanged between participating institutes and areas of disagreement discussed and resolved prior to a full otolith exchange program. The five institutes represented at the workshop expressed a desire to be involved in the otolith exchange program and other institutes would be able to participate as appropriate.

9.15 For the collection of otoliths for growth studies, the workshop recommended that, where possible, at least 10 otoliths should be collected per 1 cm length bin for each sex. In light of the apparent growth and/or spawning differences observed between Shag Rocks and South Georgia, it is recommended that this sampling protocol be applied separately to each region. It was recognised that for the larger size classes this may prove difficult, therefore as

many otoliths should be collected as possible. For sampling from the commercial fishery, the standard CCAMLR protocol should be continued (see *CCAMLR Scientific Observers Manual*).

9.16 The integration of all available information on *C. gunnari* growth, including larval and juvenile growth, information on spawning time and location and the possible use of information available year-round from higher predator studies, was strongly recommended to assist with the provision of plausible growth models for this species.

9.17 The Working Group was grateful to AtlantNIRO for hosting the workshop and thanked the Russian hosts for their neverending support in the course of the workshop.

The presence of exploitable stocks of sharks in the Convention Area

9.18 JAG noted reports on the use of gillnets by non-Contracting Parties in Subarea 58.6 and Division 58.4.3 (CCAMLR-XXV, Annex 6, paragraphs 5.12 to 5.15). Gillnet fishing vessels have been reported to catch sharks in addition to toothfish. There is no information on the shark species targeted nor their catch rates. JAG suggested that WG-FSA might consider, in the light of information available in the scientific literature, whether exploitable stocks of sharks do occur in the Convention Area.

9.19 Five shark species (*Lamna nasus*, *Somniosus antarcticus*, *Etmopterus cf. granulosus*, *Centroscymnus coelolepis* and *Squalus acanthias*) are known to occur in the northern part of the Convention Area around South Georgia, Crozet Islands (Subarea 58.6) and around Kerguelen Islands (Division 58.5.1). The identification of a sixth species (*Halaelurus canescens*) from observer reports at South Georgia has yet to be confirmed. Only the first three species listed above appear to be abundant enough to have the potential to attract commercial interest (Duhamel et al., 2005). No sharks have yet been reported from Division 58.4.3.

9.20 Given the limited information available on sharks in the Convention Area, the Working Group felt unable to further assess their potential for commercial exploitation.

CONSIDERATION OF ECOSYSTEM MANAGEMENT

Continuous krill trawling

10.1 The Working Group discussed the recording of larval and juvenile fish by-catch in the krill fishery (WG-FSA-06/24, 06/57) that utilises the krill pumping technology (WG-FSA-06/20). It was pointed out that at present there are no data available addressing the impact of continuous trawl systems on larval/juvenile fish and krill. It was recognised that larval/juvenile fish by-catch is likely to be heavily influenced by the time of year, time of day, area and depth of fishing, all of which complicates any comparative analysis. Although some data on larval fish by-catch have been acquired in the past (e.g. Iwami et al., 1996), these are not sufficient for either fully characterising the catch or estimating its level across the fleet.

10.2 Although the krill fishery is currently at a low level compared with its catch limits, concerns about its likely rise have led to efforts in WG-EMM to increase research efforts towards the understanding of the ecosystem effects of such rise, and to develop management procedures to cope with it. This increase in effort has not yet been extended to understanding the effect of an increased krill fishery on fish population dynamics, particularly of exploited fish species, such as *C. gunnari*.

10.3 The Working Group recommended that the Scientific Committee require Members to increase the level of scientific observer coverage across the krill fleet, and to develop objectives for such monitoring to include both the target species and by-catch. To facilitate the correct recording of larval fish by-catch, the Working Group requested the Secretariat to contact all CCAMLR technical coordinators to compile a standard methodology for sampling fish by-catch and an identification guide for larval/juvenile fish likely to be found in krill trawls.

Ecological interactions

Benthos by-catch

10.4 In the course of the US survey at the northern part of the Antarctic Peninsula (WG-FSA-06/14), by-catch from each haul was sorted into 44 feasible taxonomic groups, weighed and counted in continuation of work conducted in the South Shetland Islands since 2001 (WG-FSA-01/33 Rev. 1, 03/38). With the exception of some of the deeper hauls, stations along the Antarctic Peninsula shelf, and those directly north of Joinville–D'Urville Islands, show considerable quantities of benthos biomass, indicating long and well established communities. In contrast, stations further north and offshore of Joinville Island were sparsely populated.

10.5 The broad pattern in the density of benthic communities is likely to lie within the influence of changes in oceanographic regimes in that area. Stations far north are likely to be more influenced by Weddell Sea water and the number of icebergs carried with them which, when stranding, may lead to a considerable impact on the benthos. Regions in Bransfield Strait support impressive sponge communities. In particular, the massive hexactinellid (glass) sponges are indicative of a stable environment. The dominance of sponges on many stations is such that it obscured the contribution of other taxa to these communities. Vast and diverse communities of tunicates were encountered on shelf stations along the northern Antarctic Peninsula.

By-catch of juvenile fish in the krill fishery

10.6 The last review on the by-catch issue of post-larval and juvenile fish in the krill fishery was provided in 1996 (WG-FSA-96/19). Since then, only limited information has been provided to CCAMLR.

10.7 New information on the fish by-catch was obtained on board the four fishing vessels in the 2004 season (WG-EMM-06/7). Most hauls (67%) contained small fish, and the assemblage varied independently with locality, time of day and water depth but not fishing depth or krill density. Fish by-catch included *C. gunnari*, *Lepidonotothen larseni*, muraenolepidids and the myctophids *Krefftichthys anderssoni* and *Gymnoscopelus nicholsi* occurred in the greatest number of hauls with mean catches of 7–26 x 10^{-5} individuals m^{-3}.

10.8 Given the potentially substantial by-catch of juvenile fish, the Working Group recommended that data from the krill fishery should be collected more extensively in the future to allow a better assessment on the impact of the krill fishery on fish species.

Marine mammal–longline fisheries interactions

10.9 CCAMLR has not yet developed and introduced a system to quantify the interactions between marine mammals and longline fisheries. Reports summarising cetacean interactions (primarily killer whales and sperm whales) were provided in Purves et al. (2004) and Kock et al. (2005). New information became available from the Crozet and Kerguelen fishing grounds from 2003 to 2005 (WG-FSA-06/63) (paragraphs 3.66 to 3.73). The by-catch of Antarctic fur seals had been an issue for a number of years. By-catch in 2005/06 was only one seal.

Development of ecosystem models

10.10 The Working Group noted the further development of a carbon-budget trophic model for investigating the ecosystem effects of the *D. mawsoni* fishery in the Ross Sea (WG-EMM-06/14) reported by WG-EMM (Annex 4, paragraphs 6.8 to 6.11). WG-EMM noted that conclusions on the effects of fishing for *D. mawsoni* on the ecosystem cannot yet be made. However, it encouraged further work on this model to provide insights into the dynamics of the Ross Sea system and to identify the important trophic linkages through which fisheries may indirectly affect the food web of the region.

10.11 Dr Constable reported that an ecosystem model was currently being developed to examine the ecosystem effects of the *C. gunnari* and *D. eleginoides* fisheries within Division 58.5.2. Dr Belchier noted that a substantial amount of work had been carried out in the past on the trophodynamic role of *C. gunnari* in Subarea 48.3. Substantial input data were now available to inform the development of ecosystem effects of fishing models for this subarea.

10.12 The Working Group agreed that it would be useful to bring together the different groups working on effects of finfish fishing models to discuss common approaches and ways to further develop these models. In particular, such work should focus on methods and approaches of using single-species assessment models to inform the ecosystem models and vice versa.

10.13 The Working Group recommended that a one-day workshop should be held to discuss approaches to developing models to examine the effects of finfish fisheries on the ecosystem. It noted that the workshop should focus on *C. gunnari* as a typical prey species and

D. eleginoides and *D. mawsoni* as typical predator species. The Working Group recommended the workshop take place in July 2007 between the proposed WG-FSA-SAM and WG-EMM meetings. This timing would allow the opportunity for participants from both meetings to come together and would encourage useful collaboration and interaction.

SCHEME OF INTERNATIONAL SCIENTIFIC OBSERVATION

11.1 In accordance with CCAMLR's Scheme of International Scientific Observation, scientific observers were deployed on all vessels in all finfish fisheries in the Convention Area.

11.2 Information collected by scientific observers was summarised in WG-FSA-06/36 Rev. 2, 06/37 Rev. 1, 06/38 and 06/39 Rev. 1.

11.3 Thirty-seven longline cruises were conducted during the 2005/06 season, with scientific observers (international and national) on board all vessels. Ten cruises were undertaken in Subarea 48.3 by 10 vessels, two cruises were undertaken in Subarea 48.4 by two vessels, two cruises were undertaken by one vessel in Subarea 48.6, six cruises were undertaken by five vessels in Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b, two cruises were conducted by one vessel in Division 58.5.2, two cruises were conducted by one vessel in Subareas 58.6 and 58.7 and 13 cruises were undertaken in Subareas 88.1 and 88.2 by 13 vessels.

11.4 During the 2005/06 fishing season, six vessels conducted nine trawl cruises targeting finfish. All trawlers fishing for finfish carried scientific observers. In total, three national and five internationally designated scientific observers participated in these operations. In addition, five scientific observation programs were conducted by one national and four internationally designated scientific observers on board krill vessels operating in the Convention Area (43% of vessels).

11.5 Three pot cruises were conducted during the 2005/06 season, all targeting *D. eleginoides*. Two cruises were undertaken in Division 58.5.2 by the Australian-flagged vessel *South Princess*, with national scientific observers on board, and one cruise was undertaken in Subarea 48.3 by the Uruguayan vessel *Punta Ballena* with an international scientific observer on board.

11.6 The quality of submitted observer logbook data was high. The Working Group commended all observers who worked in the CAMLR Convention Area in 2005/06 for their hard work, and the Secretariat for the careful collection and compilation of the data.

11.7 The Working Group considered that the Scheme of International Scientific Observation could be used to help determine levels of reporting and detection of tag–recapture events on board fishing vessels. It recommended that work be carried out by Members in the intersessional period to determine whether methods could be developed in which the scheme could be used for this purpose.

11.8 The Working Group suggested changes to the logbook to facilitate the monitoring of depredation in the *Dissostichus* spp. fisheries in the CAMLR Convention Area. These changes include provision within the logbook for observers to record the number and type of marine mammals observed during tally counts and whether the mammals were observed interacting with the fishing operation.

11.9 The Working Group noted that the workload of observers is continuing to increase and that it would be useful to review all the tasks that the observers are required to do. It noted that if the observers were required to perform too many tasks, then the quality of the data produced might decrease.

11.10 The Working Group was informed that France has developed a photographic database to assist observers with the identification of seabirds and fish in the Convention Area. This database will be available for download from the observer section of the CCAMLR website early next year.

11.11 Additional issues related to the Scheme of International Scientific Observation are contained in various areas in this report. These include:

(i) depredation (paragraphs 3.66 to 3.72);

(ii) by-catch (paragraphs 6.35 to 6.40);

(iii) incidental mortality in fisheries (paragraphs 7.8 and 7.42 and Appendix D, paragraphs 117 to 124);

(iv) krill trawling (paragraph 10.3);

(v) tagging (paragraph 3.41).

Advice to the Scientific Committee

11.12 Advice provided to the Scientific Committee by the Working Group on the areas outlined above was as follows:

(i) The Working Group recommended that protocols be developed within the Scheme of International Scientific Observation so that levels of depredation in the *Dissostichus* spp. fisheries in the CAMLR Convention Area can be estimated (paragraph 3.72):

(a) This includes provision within the logbook for observers to record the number and type of marine mammals observed during tally counts and whether the mammals were observed interacting with the fishing operation (paragraph 11.8).

(ii) The instructions to observers with respect to sampling longlines for by-catch be simplified as follows (paragraph 6.39):

(a) Tally period –

- 25% of hooks should be observed for tally counts each day
- the tally period may be broken up into several periods each day
- tally period to include counts of fish, fish by-catch, birds and mammal interactions.

(b) Biological data

- Biological sampling periods should be done adjacent to the tally periods.

(c) Rajids

- Skate and ray observations should be conducted at least once every 48 hours and, if possible, should cover approximately 10% of the hooks hauled.

(iii) Observers should 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 (paragraph 6.40).

(iv) The Working Group reiterated its 2005 recommendation that coverage of the krill fishery be increased to allow for adequate and representative sampling across all trawl fisheries for monitoring of by-catch and efficacy of mitigation measures (paragraph 7.8).

(v) The Working Group reviewed data collection needs relative to several areas of seabird and marine mammal interaction and mitigation and recommended additions or changes to logbooks and cruise reports as detailed in paragraph 7.42.

(vi) The Working Group recommended that the Scientific Committee require Members to increase the level of scientific observer coverage across the krill fishing fleet, and to develop objectives for such monitoring to include both the target species and by-catch. To facilitate the correct recording of larval fish by-catch, the Working Group requested the Secretariat to contact all CCAMLR technical coordinators to compile a standard methodology for sampling fish by-catch and an identification guide for larval/juvenile fish likely to be found in krill trawls (paragraph 10.3).

(vii) The Working Group recommended that observers continue to collect and record tag data on their logbook forms, and periodically provide the vessel with the data on request (paragraph 3.42).

(viii) The Working Group recommended that work be carried out by Members in the intersessional period to determine whether methods could be developed in which the scheme could be used to determine levels of reporting and detection of tag–recapture events on board fishing vessels (paragraph 11.7).

FUTURE ASSESSMENTS

12.1 The Working Group considered future assessment work in light of the discussion and outcomes of this year's meeting. Items for future work agreed by the Working Group are listed below. These include general items which will contribute to the development of WG-FSA's work and items identified to develop specific assessments.

12.2 In identifying future work, the Working Group considered matters of importance to develop the assessment process, data inputs and 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.

12.3 The Working Group confirmed its earlier advice (SC-CAMLR-XXIV, Annex 5, paragraphs 12.2 and 12.3) that all new assessment methods must be reviewed by WG-FSA-SAM prior to consideration by the Working Group.

General research toward advancing assessments

12.4 The Working Group agreed that the following items would contribute to the general development of assessment methods:

- development of a pro forma for the presentation of stock assessments in the Fishery Reports;
- development of approaches to describing the current status of a stock in relation to where it would be had there been no fishing. This description may be used to identify trends in the productivity of populations, and for providing advice to the Scientific Committee on the status of stocks. Such a method may also be generalised to examine the relative impacts of different fisheries on a stock (WG-FSA-06/6, paragraph 7.2);
- further development of operating models to generate future simulation data for testing candidate management procedures and developing future advice on catch limits;
- development of additional sensitivity runs in all assessment approaches that examine structural assumptions of growth, natural mortality and fishing selectivities;
- development of other methods for estimating natural mortality;
- examination of data-weighting methods used in the current assessments;

- submission to the Secretariat of parameter files and a complete model code or documentation of assessment models presented to WG-FSA-SAM;

- development of a long-term management procedure for *C. gunnari.*

Development of management strategy evaluations

12.5 The Working Group agreed that evaluation of the toothfish assessment procedures is a high priority. Frameworks for management strategy evaluation have been considered both inside and outside CCAMLR (e.g. ICES 1999 special issue; SC-CAMLR-XXI, Annex 5, paragraphs 9.6 and 9.7; WG-FSA-02/80). The Working Group encouraged Members to evaluate management strategies for toothfish (harvest control rules, data acquisition and assessments) and to submit their analyses to WG-FSA-SAM.

12.6 The Working Group encouraged the evaluation of the assessment and harvest strategy along with the further development and evaluation of management strategies for toothfish fisheries considered in general by the Working Group (paragraph 5.105). It noted that in the assessment for Division 58.5.2, the estimated status of spawning stock at the beginning of the time series (B_0) is greater than the pre-exploitation median spawning biomass (i.e. status is greater than 1), the latter of which is estimated from a lognormal distribution of recruitments based on mean recruitment, R_0, and the recruitment variability determined from the estimated time series of year-class strengths. This highlights how the quantities in the decision rules may be different from the objectives. The Working Group encouraged evaluation of these alternative reference points in the decision rules (using estimates of B_0 or the pre-exploitation median spawning biomass as used here) to determine their robustness for meeting the underlying objectives of the Commission.

12.7 The Working Group noted that further work may be possible in refining operational objectives for managing fisheries in the Convention Area. It encouraged submissions based on the accumulated knowledge of the Antarctic marine ecosystem since the early discussions on these issues. It also noted that discussions on developing operational objectives and performance measures by the Commission's Working Group on Developing Approaches to Conservation (1986–1988) and the development of the decision rules for krill (prey species) and toothfish (top predators) by WG-Krill and WG-FSA respectively, would be useful background to this work.

Subarea 48.3 – *D. eleginoides*

12.8 The Working Group agreed that the following items would contribute to the further development of the assessment of *D. eleginoides* in Subarea 48.3:

- further development of assessment models using catch-at-age;

- reliable estimation of year-class strength;

- exploration of the feasibility of using a two-sex model;

- investigation of a pseudo-spatial fishery model, separating South Georgia and Shag Rocks;

- further investigation and refinement of data to obtain a core subset of catch and effort data with which to generate the standardised CPUE indices.

Division 58.5.2 – *D. eleginoides*

12.9 The Working Group noted the successful progress in developing an integrated assessment of *D. eleginoides* in CASAL. It agreed that further work could be undertaken to refine this assessment, including examining:

(i) the relative weighting of different datasets;

(ii) whether or how the 2003 survey should remain being used in the assessment;

(iii) the appropriate population structure, including the number of age classes to be used in the model and whether the model could be developed as a two-sex model;

(iv) the relationships between the estimated parameters, including the potential interaction between the catchabilities, q, of the different datasets, particularly the surveys, and the other parameters.

12.10 The Working Group also recommended that:

(i) given the lack of defined modes in the length-density data, it would be useful to use age–length keys, if possible, as an alternative method for estimating densities of cohorts;

(ii) studies on optimal sampling schemes for establishing age–length keys should be encouraged.

Subareas 88.1 and 88.2 – *D. mawsoni*

12.11 The Working Group agreed that the following items would contribute to the further development of the assessment of *D. mawsoni* in Subareas 88.1 and 88.2:

- further investigation and appropriateness of inclusion of the tag and recapture data from all countries fishing in Subareas 88.1 and 88.2;

- consideration of movement and stock structure;

- evaluation of the robustness of the CASAL assessment to recruitment and equilibrium assumptions;

- evaluation of the relative importance of tagging data to the assessments;

- evaluation of the relative importance of catch-at-age and CPUE data to the assessments;
- presentation and review of TSVPA to WG-FSA-SAM. Evaluation of technical aspects and data inputs of the TSVPA model. This includes effects of increasing CPUE (with development of the fishery) and effects on estimates of spawning stock biomass.

Other exploratory fisheries – *Dissostichus* spp.

12.12 The Working Group agreed that the following items would contribute to the development of the assessments in other exploratory fisheries for *Dissostichus* spp. (paragraphs 5.41 to 5.49):

- examination of the effect of tagging efforts in SSRUs, and the development of schemes of tagging that may lead to assessments of SSRUs;
- estimation of biological parameters and potential productivity of stocks in Subareas 58.4 (all divisions) and 48.6;
- development of work which will lead to a greater understanding of the stock structure of *D. mawsoni*, particularly in the Indian Ocean sector;
- exploration of methods other than tagging that may lead to information on stock status and population dynamics;
- identify minimum data requirements that may lead to assessments.

Subarea 48.3 – *C. gunnari*

12.13 The Working Group agreed that the following items would contribute to the further development of the assessment of *C. gunnari* in Subarea 48.3:

- investigation of the consequences and solutions to setting catch limits which might result in high harvesting rates on small, unassessed, recruiting year classes;
- further development of the acoustic protocol for assessing biomass;
- continued assessment of accuracy and precision of otolith-based age estimates.

Division 58.5.2 – *C. gunnari*

12.14 The Working Group agreed that the following item would contribute to the further development of the assessment of *C. gunnari* in Division 58.5.2:

- review of biological parameters and cohort progression based on survey and catch data.

FUTURE WORK

Intersessional work

13.1 Future work identified by the Working Group is summarised in Table 14 and SC-CAMLR-XXV/BG/28, 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 list the tasks identified at the meeting or associated with established meeting procedures, 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 in 2005/06. 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 this meeting, as well as the meeting of WG-FSA-SAM. The Working Group thanked all subgroup coordinators for their efforts, and in particular Dr Jones for convening WG-FSA-SAM and providing significant guidance to the development of assessment models.

13.3 WG-FSA encouraged the subgroups to continue their work in the forthcoming intersessional period, focusing where possible on a small number of key issues identified at the meeting. In addition, the subgroups provide a conduit for information on a wide range of related research. The Working Group reminded participants that membership to the subgroups was open to all participants.

13.4 The Working Group agreed to the following intersessional work plan for the subgroups (coordinators are listed in brackets):

- WG-FSA-SAM (Dr Jones) will review and further develop assessment methods and preliminary assessments (see below).

- Subgroup on By-catch (Dr Belchier) will review and further develop the assessment of the status of by-catch species and groups, estimation of by-catch levels and rates, assessment of risk both in terms of geographical areas and population demography, estimation of by-catch limits and mitigation measures.

- Subgroup on Tagging (Mr Dunn, Drs Agnew and D. Welsford (Australia) and the Secretariat) will review and further develop the tagging programs and the treatment of tagging data, the structure of the tagging database and the tagging protocol, and the development of a characterisation of tagging programs in the Convention Area, including skates and rays and tagging in EEZs. The subgroup was also tasked with guiding the implementation of the proposed Secretariat-based coordination of tagging efforts in exploratory fisheries.

- Subgroup on the Observer Program (Drs E. Balguerías (Spain) and I. Ball (Australia)) will review and further develop the observer protocols, the *Scientific Observers Manual* and priorities for scientific observers in various fisheries.

- Subgroup on Biology and Ecology (Drs Collins and Kock) will review the literature, identify gaps in knowledge and update and coordinate the development of species profiles and the further development of CON.

- Subgroup on Ecosystem Interactions (Dr Kock) will review the literature and develop a work plan for the subgroup and one for the intersessional workshop (paragraphs 13.12 to 13.14).

- Subgroup on IUU Fishing (Dr Agnew, Mr Dunn and the Secretariat) will review and further develop approaches for improved estimation of IUU fishing and total removals and develop the time series of catches estimated from IUU fishing.

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

13.6 In addition, the Working Group assigned other tasks to the Secretariat and/or Members.

13.7 The responsibilities for coordinating the intersessional activities of ad hoc WG-IMAF are set out in SC-CAMLR-XXV/BG/28.

Meeting of WG-FSA-SAM

13.8 The Working Group agreed to hold a one-week meeting of WG-FSA-SAM in 2007, in association with the meeting of WG-EMM. The general work plan for WG-FSA-SAM was outlined in Section 12, and the Working Group recognised that this plan may be expanded subject to the proposed reorganisation of the work of the Scientific Committee and the proposed re-structure of WG-FSA-SAM (paragraphs 14.1 to 14.9).

13.9 The Working Group agreed that an external expert be invited to the 2007 WG-FSA-SAM meeting. The terms of reference for the participation of the invited expert were as follows:

(i) review and evaluate use of alternative approaches for the assessment of toothfish in CCAMLR waters, including:

  (a) CASAL
  (b) mark–recapture approaches
  (c) other models or quantitative methodologies;

(ii) provide input to approaches for evaluating management strategies.

13.10 The Working Group reviewed the procedure for selecting an invited expert. It was agreed that the Convener of WG-FSA-SAM would identify a suitable candidate in consultation with the Convener of WG-FSA, the Chair of the Scientific Committee and participants of WG-FSA-SAM.

13.11 The Working Group noted that the Scientific Committee will need to consider a budget for the invited expert in 2007.

Workshop on developing methods of incorporating ecosystem models in finfish fishery assessments

13.12 The Working Group agreed to hold a one-day workshop on developing methods of incorporating ecosystem models in finfish fishery assessments in association with the meetings of WG-FSA-SAM and WG-EMM in 2007 (paragraphs 10.12 and 10.13).

13.13 It was envisaged that the workshop would attract participants from WG-FSA, WG-FSA-SAM and WG-EMM. Therefore, the Working Group deferred the development of the workshop objectives and the appointment of a convener to the Scientific Committee.

13.14 The Working Group agreed that invited experts would not be required at this workshop.

Meeting of SG-ASAM

13.15 The Working Group noted progress made by SG-ASAM in issues with respect to acoustic methods for *C. gunnari* (paragraphs 4.1 to 4.6).

13.16 The Working Group recommended that the Scientific Committee should again consider the following terms of reference for SG-ASAM, which were proposed by WG-FSA in 2005 (SC-CAMLR-XXIV, Annex 5, paragraph 13.9):

(i) to develop, review and update as necessary, protocols on:

  (a) the design of acoustic surveys to estimate the abundance index 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 stations, and *in situ* target strength measurements;

(ii) to evaluate results of acoustic surveys carried out in the CAMLR Convention Area in previous years;

(iii) to estimate target strength and its statistical characteristics for key species in the CAMLR Convention Area;

(iv) to use data from acoustic surveys to investigate ecological interactions and produce information for ecosystem monitoring and management.

13.17 The Working Group noted that the focus of SG-ASAM regarding the work of WG-FSA should remain with resolving difficulties identified with the estimation of icefish abundance. However, it also recognised that estimates of the abundance and distribution of pelagic species are needed (namely, *Pleuragramma* spp., myctophid spp.), when developing ecosystem models (SC-CAMLR-XXIII, Annex 4, paragraph 6; SC-CAMLR-XXIV, Annex 4, Appendix D).

13.18 The Working Group recommended that an immediate issue for WG-FSA to be further addressed by SG-ASAM is the acoustic protocol for assessing *C. gunnari* in Subarea 48.3, including:

(i) classification of volume backscattering strength attributed to *C. gunnari* versus other taxa with special attention to multiple-frequency acoustic methods;

(ii) further improvements in target strength estimates for *C. gunnari* using a variety of methods including physics-based and empirical models, *in situ* measurements and *ex situ* measurements;

(iii) combination of trawl and acoustic indices for stock assessment;

(iv) uncertainty assessments for *C. gunnari* biomass and abundance indices from combining trawl and acoustic surveys;

(v) protocols for archiving data.

13.19 The Working Group recommended that the issues relevant to the application of acoustic methods for pelagic finfish estimates should be addressed to SG-ASAM, including:

(i) frequency-specific definition of myctophid spp. target strength;

(ii) classification of volume backscattering strength of myctophid spp. versus other taxa with special attention to multiple-frequency acoustics methods.

13.20 The Working Group noted that ICES WGFAST is meeting in Dublin, Ireland, from 23 to 27 April 2007 (with associated subgroup meetings on 21–22 and 28–29 April). The Working Group recommended that the Scientific Committee investigate the possibility of holding the third meeting of SG-ASAM in conjunction with the ICES WGFAST meeting. Representatives of several Members will already be attending ICES WGFAST.

13.21 The Working Group recommended that the Scientific Committee consider inviting experts to the meeting, and that the terms of reference for these experts be the same as those used in 2006 (SC-CAMLR-XXIV, paragraph 13.31).

13.22 The Working Group recommended that the CCAMLR Data Manager should attend future meetings of SG-ASAM, and that the Secretariat cost associated with attending meetings away from Hobart should be included in the Scientific Committee's budget.

Fishery Reports

13.23 The Working Group reviewed its procedure for developing and updating the Fishery Reports. As part of future preparation for meetings of WG-FSA, the Secretariat was tasked with updating the tables, figures and text of the reports, to the extent possible, prior to each meeting.

13.24 The Working Group agreed that Fishery Reports adopted at its meeting and forwarded to the Scientific Committee for consideration, would not include the section on management advice. Instead, management advice for each fishery would be included in the main body of the Working Group's report. However, the Working Group agreed that the section on management advice should be copied to the Fishery Reports prior to the reports being published on the CCAMLR website.

13.25 The Working Group requested that WG-FSA-SAM consider:

(i) what the minimum requirements should be within an individual Fishery Report for reporting an integrated assessment using CASAL;

(ii) to what extent a common language could be used in this regard to assist translation.

OTHER BUSINESS

Reorganisation of the Scientific Committee working groups

14.1 Dr Holt reported on the work of the Steering Committee on the Review of the Structure of the Working Groups of the Scientific Committee. In 2005/06 the Committee had worked by correspondence and had met in association with the meetings of WG-FSA-SAM and WG-EMM.

14.2 The Committee had:

(i) reviewed information and proposals on the reorganisation of the work of the Scientific Committee;

(ii) agreed that both short- and long-term needs of the Scientific Committee must be accommodated in any plausible reorganisation scheme;

(iii) agreed that it would be preferable for the reorganisation of the working groups to evolve from the existing framework used by the Scientific Committee and its working groups;

(iv) recognised that some aspects of the reorganisation may be introduced in the short term to address the present needs of the Scientific Committee, however the process is likely to require considerable time to be fully implemented;

(v) recognised that any reorganisation should not increase the total meeting time from the present five weeks (two weeks for WG-FSA including ad hoc WG-IMAF, two weeks for WG-EMM, and one week for WG-FSA-SAM) and that no increase in resources be required from the Secretariat.

14.3 The Steering Committee agreed that implementation of future requirements will need modifications of the present way the Scientific Committee does business. For example, it is anticipated that the Scientific Committee will be required to provide advice to the Commission with respect to matters such as marine protected areas, predator–prey–fishery models, stock assessment models, icefish and krill acoustic measurements, conservation status of seabirds and destructive fishing practices. In addition, it was recognised that some items presently on the working groups' agendas may be considered at multi-year intervals instead of annually, or not at all.

14.4 The Steering Committee recognised that the present working group structure could, with appropriate modification, address present and future needs. In particular, the role of WG-FSA-SAM could be expanded to serve as a technical group to address issues relevant to all three existing working groups (WG-FSA, WG-EMM, ad hoc WG-IMAF). Under this scenario, WG-FSA-SAM would be used by all three groups to address technical assessment and modelling issues, including fish stock assessment issues (of interest to WG-FSA), krill, seal and seabird stock assessment issues (of interest to WG-EMM), and estimation of the status of seabirds (of interest to WG-IMAF).

14.5 In order to address issues of interest to all working groups, the Steering Committee proposed that the Scientific Committee establish WG-FSA-SAM as a working group ('WG-SAM'), and develop a long-term science plan so that tasks may be prioritised. This would allow long-term planning by WG-SAM so that the appropriate experts could be present at the appropriate meetings. In addition, WG-SAM would need to be fluid in its composition, duration of meeting time and issues addressed. For example, the group might meet during two weeks to consider both fish and krill–predator–prey issues or one week, for example, to consider only fish stock assessment issues. Conversely, WG-EMM may need to meet for one or two weeks depending on its workload for that year. Further, the duration of the meetings of WG-FSA may vary as its work becomes more established and some assessments are conducted at multi-year intervals instead of annually using standard models.

14.6 The Steering Committee proposed that the Scientific Committee establish a steering group to develop, and keep under review, a long-term science plan which would guide the work of its working groups, including WG-SAM. Membership of the steering group may be open to all Scientific Committee representatives, and would include the Chair of the Scientific Committee and the conveners of the working groups.

14.7 The proposal for reorganising the work of the Scientific Committee, and in particular the work of WG-FSA-SAM, was considered by WG-FSA-SAM (WG-FSA-06/6, paragraphs 8.2 to 8.4). The subgroup agreed that it could serve as a common umbrella under which the development of assessment methodologies of various types may be examined. This would provide a forum where the required expertise could be assembled for short concentrated periods of time. This format would also enhance the subgroup's ability to assemble a critical mass of expertise needed to address its assigned tasks.

14.8 WG-FSA endorsed this proposal for the reorganisation of the work of the Scientific Committee and restructuring of WG-FSA-SAM. In doing so, the Working Group agreed that:

(i) a technical working group would allow the Scientific Committee to address a range of methodological issues using a common pool of experts. This would provide consistency in the approaches developed by the working groups;

(ii) the Scientific Committee would need to establish a long-term science plan which incorporated flexibility to address other important issues as these arose. It was recognised that the proposed restructure would require considerable time to be implemented, and that further changes may be required;

(iii) the introduction of multi-year assessments and reviews would allow WG-FSA to devote more time to other important matters such as biological and ecosystem processes. This multi-year approach may also be implemented by the other working groups, thereby allowing those groups to consider in detail other matters of importance to their work (e.g. technical developments in the krill fishery; impact of fishing outside the Convention Area on Antarctic species).

14.9 The Working Group noted that ad hoc WG-IMAF had also endorsed the proposed restructure (paragraph 7.60). In addition, WG-IMAF had reviewed its own structure and terms of reference, and identified some core intersessional tasks to further streamline its work (paragraphs 7.63 to 7.65). WG-IMAF had also confirmed that the existing linkage with WG-FSA remained appropriate, and facilitated the development of integrated advice on the management of fisheries.

CCAMLR's contribution to FIRMS

14.10 The Working Group recalled that the Commission agreed to participate in the partnership of leading regional organisations which are contributing to the development of FIRMS (CCAMLR-XXIV, paragraphs 15.24 to 15.27). The partnership agreement was signed in February 2006.

14.11 The main component of CCAMLR's and other partners' contribution to FIRMS is the development of 'fact sheets' which present fishery and resource information of interest to FIRMS in a format which is common to all partners. The fact sheets are web-based and may contain keywords and related information which can be searched using tools developed in XML (Extensible Markup Language). Four types of fact sheets are being developed to provide general information on: FIRMS partners (institution fact sheet), fishery resources (resource fact sheet), fisheries (fishery fact sheet) and selected species (species fact sheet).

14.12 In due course, each FIRMS partner will develop fact sheets on the resources, fisheries and key species within their jurisdictional responsibility. Each partner will retain ownership of its fact sheets and will be responsible for developing and updating their contents.

14.13 The Secretariat has proposed the following guidelines for developing CCAMLR fact sheets:

(i) fact sheets will be developed in accordance with the Rules for Access and Use of CCAMLR Data;

(ii) fact sheets will be based, where possible, on information published by CCAMLR;

(iii) to the extent possible, fact sheets will serve a dual purpose: (a) contribute to FIRMS; and (b) provide a public library of general information on the CCAMLR website.

14.14 The Secretariat presented an example fact sheet on the toothfish fishery in Subarea 88.1. Based on the example presented, the Working Group agreed that the fact sheets would make a useful contribution to the general information available on the CCAMLR website.

14.15 The Working Group agreed that the fact sheets developed for FIRMS must be developed in accordance with CCAMLR's data access rules. The Working Group reiterated that any data requested by FIRMS, or for the purpose of other global assessments, must only be released with the prior approval of the data owners (paragraphs 2b and 9 of the Rules for Access and Use of CCAMLR Data).

14.16 The Working Group also noted that the Species Profiles (paragraphs 9.4 to 9.6) would provide helpful contributions to the development of resource fact sheets.

Continuous krill trawling

14.17 In the 2006 fishing season, the Norwegian-flagged vessel *Saga Sea* started fishing operations for krill in the Convention Area. The vessel used the continuous trawling technology, which has been previously developed by the *Atlantic Navigator*. At its 2005 meeting, the Scientific Committee agreed that this new technology would not be considered a 'new and exploratory fishery' 'if there is an adequate description of the selectivity of the method for krill, a characterisation of the haul (or catch rate) and information on the location of krill catches. In particular, because haul duration can extend for several days, there existed the potential for single hauls to occur in several different SSMUs'. Finally, 'there might be considerable potential for this type of fishing gear to impact other elements of the ecosystem either through by-catch, particularly of larval fish, or through incidental mortality of either immature krill, or other small pelagic species' (SC-CAMLR-XXIV, paragraphs 4.8 and 4.9).

14.18 The Scientific Committee had called for papers describing the continuous trawling method and analysing its impacts, and for WG-EMM to advise it on the issue. Unfortunately, at the time that WG-EMM met, the *Saga Sea* had not been fishing for long enough in the 2005/06 season for there to be sufficient data to analyse. WG-EMM therefore asked WG-FSA to 'examine the catalogued data at their 2006 meeting to assess the difference between the two types of krill fishing and to provide a commentary to the Scientific Committee' (Annex 4, paragraph 3.61).

14.19 This topic does not normally fall within the remit of WG-FSA. WG-FSA undertook this work in the spirit of providing a service for the Scientific Committee, acknowledging the limits of its expertise and knowledge of krill fishing.

14.20 Accordingly, WG-FSA convened a subgroup to consider this issue. The report of the subgroup is appended as Appendix E. The Working Group also forwarded papers submitted on this topic for direct consideration by the Scientific Committee (WG-FSA-06/20, 06/23, 06/57 and WG-EMM-06/7).

14.21 The Working Group reached no conclusion on whether the available data constituted 'an adequate description of the selectivity of the method for krill, a characterisation of the haul (or catch rate) and information on the location of krill catches' or whether 'there might be considerable potential for this type of fishing gear to impact other elements of the ecosystem'.

14.22 The Working Group submitted the report of its subgroup for consideration by the Scientific Committee.

Other

14.23 Dr E. Marschoff (Argentina) pointed out that in WG-FSA-06/51 and 06/22 *inter alia*, references are made to alleged authorities which the Argentine Republic does not recognise. Reference is also made to inspections carried out on a unilateral basis by the UK in the Convention Area. This infringes the multilateral system of the Commission, which is the only legal mechanism applicable within the waters surrounding South Georgia. He recalled that the Malvinas Islands, South Georgia and South Sandwich Islands and the surrounding waters are an integral part of the Argentine national territory. These islands being illegally occupied by the UK, are subject to a sovereignty dispute between the two countries which is recognised by several international organisations. Therefore, Dr Marschoff rejects references to those alleged authorities and inspections carried out unilaterally by the UK, as well as incorrect references to the territory and status of the Malvinas Islands, South Georgia and South Sandwich Islands and the surrounding waters made in documents at this Working Group.

ADOPTION OF THE REPORT

15.1 The report of the meeting and associated background documents SC-CAMLR-XXV/BG/26, BG/27 and BG/28 were adopted.

CLOSE OF MEETING

16.1 In closing the meeting, the Dr Hanchet thanked the subgroup coordinators, rapporteurs and all other participants for their contributions and participation in the meeting, as well as the intersessional activities. This work had resulted in the revision of the integrated assessments

for toothfish in Subareas 48.3, 88.1 and 88.2, and the development of a new integrated assessment for toothfish in Division 58.5.2. The investigation of exploratory fisheries for toothfish in Subareas 48.6 and 58.4 was also initiated.

16.2 Drs Agnew and Constable, on behalf of the Working Group, thanked Mr Dunn for sharing his expertise in CASAL, and for providing remote-access computers during the meeting. The Working Group thanked Dr Hanchet for guiding its work. The assessments were becoming increasingly complex and Dr Hanchet's leadership had ensured the success of the meeting. The Working Group thanked the Secretariat for its assistance.

16.3 The meeting was closed.

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Table 1: Total reported catches (tonnes) of target species in fisheries in the Convention Area in the 2005/06 season. Source: catch and effort reports submitted by 5 October 2006 unless otherwise indicated.

Target species	Region	Fishery	Fishing season		Conservation measure	Catch (tonnes) of target species		Reported catch (% limit)
			Start	End		Reported	Limit	
Champsocephalus gunnari	48.3	Trawl	15-Nov-05	30-Sep-06[1]	42-01 (2005)	2 171	2 244	97
	58.5.2	Trawl	01-Dec-05	30-Nov-06	42-02 (2005)	263	1 210	22
Dissostichus eleginoides	48.3	Longline and pot	01-May-06	31-Aug-06[1]	41-02 (2005)	3 534	3 556	99
	48.4	Longline	01-Apr-06	30-Sep-06	41-03 (2005)	18	100	18
	58.5.1	Longline in French EEZ[3]	ns	ns	ns	3 045	ns	-
	58.5.2	Longline and trawl	01-Dec-05	30-Nov-06	41-08 (2005)	1 825	2 584	71
	58.6	Longline in French EEZ[3]	ns	ns	ns	641	ns	-
	58.6	Longline in South African EEZ	ns	ns	ns	7	ns	-
	58.7	Longline in South African EEZ	ns	ns	ns	41	ns	-
Dissostichus spp.	48.6	Exploratory longline	01-Dec-05	30-Nov-06	41-04 (2005)	137	910	15
	58.4.1	Exploratory longline	01-Dec-05	30-Nov-06	41-11 (2005)	425	600	71
	58.4.2	Exploratory longline	01-Dec-05	30-Nov-06	41-05 (2005)	164	780	21
	58.4.3a	Exploratory longline	01-May-06	31-Aug-06	41-06 (2005)	89	250	35
	58.4.3b	Exploratory longline	01-May-06	13-Mar-06[1,4]	41-07 (2005)	361	300	120
	88.1	Exploratory longline	01-Dec-05	06-Feb-06[1]	41-09 (2005)	2 952	2 964	100
	88.2	Exploratory longline	01-Dec-05	15-Feb-06[1]	41-10 (2005)	465	487	96
Euphausia superba	48	Trawl	01-Dec-05	30-Nov-06	51-01 (2002)	105 084	4 000 000	3
	58.4.1	Trawl	01-Dec-05	30-Nov-06	51-02 (2002)	0	440 000	0
	58.4.2	Trawl	01-Dec-05	30-Nov-06	51-03 (2002)	0	450 000	0
Lithodidae	48.3	Pot	01-Dec-05	30-Nov-06	52-01 (2005)	2[2]	1 600	0
Martialia hyadesi	48.3	Exploratory jig	01-Dec-05	30-Nov-06	61-01 (2005)	0	2 500	0

[1] Fishery closed on advice from the Secretariat
[2] By-catch in fishery for *D. eleginoides*
[3] Data reported by France for fishing to August 2006
[4] Exemption to prescribed season in accordance with conservation measures
ns Not specified by CCAMLR

Table 2: Estimated effort, catch rates and total catches from IUU fishing for *Dissostichus* spp. in the Convention Area in the 2005/06 season. Detailed calculations are in WG-FSA-06/11 Rev. 2 (see also SC-CAMLR-XXIII, Annex 5, Table 3.3).

Subarea/ division	Estimated start of IUU fishing	No. of vessels sighted	No. of IUU fishing vessels otherwise reported	Total no. vessels reported	Additional no. vessels extrapolated to 30 Nov 2006	Estimated no. of IUU fishing vessels	Estimated number of days fished (not extrapo-lated)	Estimated number of days fished (extrapolated)	Mean catch rate (tonnes/day)	Estimated IUU catch to 1 Sep 2006 (not extrapo-lated)
		1	2	3	4	5	6	7	8	9
48.3	1991			0	0		0		2.1	0
58.4.1	2005	4		4	1.2	5.2	246	320	2.8	689
58.4.2	2002	2		2	0.6	2.6	123	160	1.8	221
58.4.3a	2003			0		0	0	0	0.8	0
58.4.3b	2003	14		14	4.2	18.2	861	1 119	2.1	1 808
58.4.4a	1996			0		0	0	0	2.0	0
58.5.1	1996	1		1	0.3	1.3	57	74	3.7	211
58.5.2	1997	1		1	0.3	1.3	59	77	1.9	112
58.6	1996	1		1	0.3	1.3	40	52	0.6	24
58.7	1996			0		0	0	0	0.5	0
88.1	2002			0		0	0	0	4.8	0
88.2 (attributed to SSRU E)	2006	1		1	0.3	1.3	5	5	2.9	15
Total		24								3 080
Undocumented landings which cannot be attributed to individual sightings or subareas										266

Notes on columns 1 to 9:

1. From reports of vessel sightings submitted by Members.
2. From information reported via other sightings, port inspections or fishing vessels/traders. No such reports were used in 2006.
4. Calculated pro rata for 1 September to 30 November 2006.
6. Estimates of the duration of fishing trips for IUU vessels have been agreed and used by WG-FSA for a number of years.
8. Mean catch rates per day taken from catch and effort reports, where available. CDS data used otherwise.

Other notes:

Three sightings of gillnetters have not been included in this assessment.

Names of vessels sighted:

58.4.1 *West Ocean* (2), *East Ocean*, *North Ocean*
58.4.2 *Condor*, *Typhoon I*
58.4.3b *Odin* (2), *South Ocean*, *Condor*, *Sargo*, *Ross*, *Hammer*, *East Ocean*, *Perseverance* (2), *Tropic*, *Gale* (2), *Gold Dragon*
58.5.1 *Black Moon*
58.5.2 *North Ocean*
58.6 *Typhoon I*
88.2 *Volna* – 5 days fishing only allocated

Table 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 2004/05 and 2005/06 seasons.

2004/05 season

Inside	Subarea/division	Reported catch	IUU catch	Total CCAMLR	*Catch limit*
	48.3	3 039	23	3 062	*3 050*
	48.4	27		27	*28*
	48.6	51		51	*910*
	58.4.1	480		480	*600*
	58.4.2	127	86	213	*780*
	58.4.3 (a and b)	406	1 114	1 520	*550*
	58.4.4	0	220	220	*0**
	58.5.1	5 065	268	5 333	*0**
	58.5.2	2 744	265	3 009	*2 787*
	58.6	637	12	649	*0**
	58.7	142	60	202	*0**
	88.1	3 120	28	3 143	*3 250*
	88.2	411		411	*375*
	88.3	2			*0***
	Total inside	16 250	2 076	18 321	
Outside	Area	CDS catch EEZ	CDS catch high seas	Total outside CCAMLR	
	41	3 736	3 327	7 063	
	47		78	78	
	51	8	33	41	
	81	54		54	
	87	5 226	385	5 611	
	Total outside	9 024	3 823	12 847	
Global total				31 168	

2005/06 season (to 5 October 2006)

Inside	Subarea/division	Reported catch	IUU catch	Total CCAMLR	*Catch limit*
	48.3	3 534		3 534	*3 556*
	48.4	18		18	*100*
	48.6	137		137	*910*
	58.4.1	426	689	1 115	*600*
	58.4.2	164	221	385	*780*
	58.4.3 (a and b)	449	1 808	2 257	*550*
	58.5.1	3 045	211	3 256	*0**
	58.5.2	1 825	112	1 937	*2 584*
	58.6	648	24	672	*0**
	58.7	41		41	*0**
	88.1	2 952		2 952	*2 964*
	88.2	465	15	480	*487*
	Total inside	13 704	3 080	16 784	

(continued)

Table 3 (continued)

Outside	Area	CDS catch EEZ	CDS catch high seas	Total outside CCAMLR
	41	2 131	1 750	3 881
	47		231	231
	51	3		3
	81		407	407
	87	3 309	217	3 526
	Total outside	5 443	2 605	8 048
	Global total			25 967

* Outside EEZ ** closed to fishing, research permitted in accordance with Conservation Measure 24-01

Reported Catch: 2004/05 from STATLANT data
2005/06 catch and effort reports to 5 October 2006, except data for France reported to August 2006

IUU Catch: From WG-FSA-06/11 Rev. 2

CDS Catch: Data submitted to the CDS by 5 October 2006. 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.

Table 4: Participation in exploratory fisheries for *Dissostichus* spp. in 2005/06. Source: WG-FSA-06/4.

Subarea/division	Participating Member	Number vessels fishing	*Dissostichus* spp. catch (tonnes)	
			Limit	Reported
Exploratory fisheries in Area 48 (Atlantic Ocean sector)				
48.6	Japan	1		
	New Zealand	-		
Total		1	910	137
Exploratory fisheries in Area 58 (Indian Ocean sector)				
58.4.1	Australia	-		
	Chile	2		
	Korea, Republic of	1		
	New Zealand	1		
	Spain	1		
	Uruguay	1		
Total		6	600	425
58.4.2	Australia	-		
	Chile	2		
	Korea, Republic of	1		
	New Zealand	-		
	Spain	1		
Total		4	780	164
58.4.3a	Australia	-		
	Chile	-		
	Korea, Republic of	-		
	Spain	2		
Total		2	250	89
58.4.3b	Australia	-		
	Chile	1		
	Korea, Republic of	-		
	Spain	2		
	Uruguay	1		
Total		4	300	361
Exploratory fisheries in Area 88 (Southwest Pacific sector)				
88.1	Argentina	1		
	Korea, Republic of	-		
	New Zealand	4		
	Norway	1		
	Russia	2		
	South Africa	-		
	Spain	-		
	UK	2		
	Uruguay	3		
Total		13	2964	2952

(continued)

Table 4 (continued)

Subarea/division	Participating Member	Number vessels fishing	*Dissostichus* spp. catch (tonnes)	
			Limit	Reported
88.2	Argentina	1		
	Korea, Republic of	-		
	New Zealand	1		
	Norway	1		
	Russia	2		
	Spain	-		
	UK	2		
	Uruguay	-		
Total		7	487	465

Table 5: Number of vessels notified in exploratory longline fisheries for *Dissostichus* spp. in the 2006/07 season (a), and corresponding number of participating Members, number of vessels and catch limits agreed in conservation measures in force in the 2005/06 season (b). Source: CCAMLR-XXV/16.

Member notifications	Number of vessels notified per subarea/division						
	48.6	58.4.1	58.4.2	58.4.3a	58.4.3b	88.1	88.2
(a) Exploratory longline fisheries for *Dissostichus* spp. in the 2006/07 season							
Argentina						2	2
Australia		1	1		1		
Japan	2			1	1		
Korea, Republic of	1	2	3	2	3	3	
Namibia		1	1		1		
New Zealand	1	4	2			4	4
Norway	1					1	1
Russia						2	2
South Africa						1	
Spain		1	1	1	1	1	1
UK						2	2
Uruguay		1	1		1	5	4
Number of Members	4	6	6	3	6	9	7
Number of vessels	5	9[1]	9	4	8	21	16
(b) Conservation measures in force in the 2005/06 season							
Number of Members	2	6	5	4	5	9	8
Number of vessels	1[2]	11	8	1[2]	1[2]	21	17
Target species catch limit (tonnes)	910	600	780	250	300	2 964	487

[1] Revised number of vessels following advice from New Zealand that one vessel has been withdrawn (COMM CIRC 06/114).

[2] Maximum number per country at any one time.

Table 6: Unstandardised CPUE (kg/hook) of *Dissostichus* spp. in exploratory longline fisheries reported between 1996/97 and 2005/06. Source: fine-scale data from commercial and fishery-based research hauls. SSRUs as defined in Conservation Measure 41-01.

Subarea/ division	SSRU	Season									
		1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
48.6	486A								0.04	0.07	0.16
	486E									0.08	
58.4.2	5842A									0.08	0.08
	5842C							0.10		0.07	0.17
	5842D							0.19	0.06		
	5842E							0.21	0.11	0.14	0.22
58.4.3a	5843A									0.05	0.05
58.4.3b	5843B								0.09	0.16	0.16
88.1	881A	0.01				0.02		0.16			0.08
	881B	0.05	0.03			0.16	0.25	0.27	0.11	0.55	0.07
	881C					0.44	0.87	0.58	0.31	0.53	1.07
	881E		0.07	0.06		0.03		0.05	0.08	0.28	
	881F		0.00					0.03			
	881G		0.06	0.02		0.13	0.12	0.16	0.12	0.15	0.63
	881H		0.17	0.26	0.38	0.41	0.72	0.47	0.21	0.73	0.59
	881I		0.37	0.23	0.28	0.28	0.43	0.20	0.16	0.44	0.39
	881J			0.09	0.18	0.04			0.04	0.22	0.36
	881K		0.32	0.15	0.39		0.45		0.01	0.32	0.50
	881L					0.12			0.10	0.13	0.15
88.2	882									0.38	
	882A						0.82		0.11	0.44	0.54
	882B								0.06		
	882D										0.43
	882E							0.35	0.42	0.70	0.34
	882F										0.26
	882G										0.03

Table 7: Number of *Dissostichus* spp. tagged and released in exploratory longline fisheries. Source: scientific observer data submitted to CCAMLR.

Subarea/ division	Season						
	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	Total
48.6	0	0	0	4	62	146	212
58.4.1	0	0	0	0	462	469	931
58.4.2	0	0	0	0	342	136	478
58.4.3a	0	0	0	0	199	104	303
58.4.3b	0	0	0	0	231	175	406
88.1	326	756	1 068	1 752	3 221	2 977	10 100
88.2	0	12	94	433	341	444	1 324

Table 8: Number of tagged *Dissostichus* spp. recaptured in exploratory longline fisheries. Source: scientific observer data submitted to CCAMLR.

Subarea/ division	Season						
	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	Total
48.6	0	0	0	0	0	3	3
58.4.1	0	0	0	0	0	0	0
58.4.2	0	0	0	0	0	0	0
58.4.3a	0	0	0	0	0	6	6
58.4.3b	0	0	0	0	1	6	7
88.1	1	4	13	40	77	70	205
88.2	0	0	0	10	17	28	55

Table 9: Reported catch of *Dissostichus* spp. in exploratory fisheries in Subareas 48.6, 88.1 and 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b. Source: STATLANT data to 2004/05 and catch and effort reports in 2005/06.

Season	Reported catch (tonnes) of *Dissostichus* spp. in exploratory fisheries							
	48.6	58.4.1	58.4.2	58.4.3a	58.4.3b	88.1	88.2	All exploratory fisheries
1996/97						<1	<1	<1
1997/98						42	<1	42
1998/99						297		297
1999/00						751	<1	751
2000/01			<1			660	<1	660
2001/02						1 325	41	1 366
2002/03			117			1 831	106	2 055
2003/04	7		20		7	2 197	375	2 605
2004/05	51	480	127	110	297	3 120	411	4 594
2005/06	137	425	164	89	361	2 952	465	4 592
Total	194	905	427	198	664	13 173	1 398	16 960

Table 10: Catches for macrourids, rajids and other species taken as by-catch from longline fisheries in 2005/06, and reported in fine-scale data. Catches are given in tonnes and as a percentage of the catch of *Dissostichus* spp. (TOT). (Rajids cut from the longlines and released are not included in these estimates.) * – no by-catch data available from Subarea 58.6 South African EEZ. na – not applicable.

Subarea/ division	Target catch (tonnes)	Macrourids			Rajids			Other		
		Catch (tonnes)	% TOT	Catch limit	Catch (tonnes)	% TOT	Catch limit	Catch (tonnes)	% TOT	Catch limit
48.3	3 522	136	3.9	177	7	0.2	177	44	1.2	
48.4	19	5	26	na	1	6.6	na	1	7.3	na
48.6	137	8	5.8	50	0	0		2	1.5	20
58.5.2	656	26	4	360	17	2.5	120	20	3	50
58.5.1 French EEZ	3 045	339	12.7	na	435	16.3	na	42	1.4	na
58.6 French EEZ	641	132	11.7	na	163	14.4	na	28	4.3	na
58.6 South African EEZ*	41			na			na			na
58.7 South African EEZ	27	4	13.7	na	0	0	na	0	0.9	na
58.4.1	421	15	3.6	96	0	0	50	1	0.1	20
58.4.2	158	4	2.8	124	0	0	50	1	0.6	20
58.4.3a	89	1	0.8	26	7	8	50	8	9.3	20
58.4.3b	365	8	2.2	159	1	0.3	50	1	0.3	20
88.1	2 951	258	8.8	474	5	0.2	148	18	0.8	160
88.2	442	92	20.8	78	0	0	100	12	2.8	100

Table 11: Catches (tonnes) of target species and by-catch from trawl fisheries in 2005/06, and reported in fine-scale data. (ANI – *Champsocephalus gunnari*; GRV – *Macrourus* spp.; KRI – *Euphausia superba*; LIC – *Channichthys rhinoceratus*; NOR – *Notothenia rossii*; NOS – *Notothenia squamifrons*; SGI – *Pseudochaenichthys georgianus*; SRX – *Rajid* spp.; SSI – *Chaenocephalus aceratus*; TOP – *Dissostichus eleginoides*; TOT – *Dissostichus* spp.).

Subarea/ division	Target species	Total (tonnes)	ANI	GRV	KRI	LIC	NOR	NOS	SGI	SRX	SSI	TOT	Other
48.3	ANI	1 825	1 817		<1		1		6		<1		<1
58.5.2	ANI	279	260	<1		17		<1		<1		1	<1
48.1	KRI	47 521	9		47 512		<1		<1		<1		<1
48.2	KRI	2 801			2 802								
58.5.2	TOP	1 102	3	<1		<1		2		<1			<1

Table 12: Comparison of observer-reported catches obtained from scientific observer data (L5). Column ‘a’ shows totals derived from a range of sources (factory log etc.); column ‘b’ are scaled totals from line observations. GRV – *Macrourus* spp.; SRX – *Rajid* spp.; ANT – *Antimora rostrata*.

Subarea/ division	Mean % hooks observed	GRV		SRX		ANT	
		a	b	a	b	a	b
48.3	36.4	135	145	77	58	35	30
48.4	42.5	5	4.5	2.8	4.3	0.07	0.07
48.6	50.1	2.7	2.8			0.6	0.6
58.5.2	16.7	20.2	12.7	16	46.6	0.3	0.2
88.1	51.4	290	303.7	4	6.1	12.1	13
58.4	65.8	23.3	5.8	0.7	2.5	1.3	0.5

Table 13: Revised estimated effort, mean catch rates and total catches by subarea/division in the unregulated fishery for *Dissostichus* spp. in the 2004/05 season.

Subarea/ division	Estimated start of unregulated fishery	No. of vessels sighted	No. of unregulated vessels otherwise reported	Total no. vessels reported	Estimated no. of vessels fishing illegally 2005	Estimated no. of days per fishing trip	No. trips per year	Estimated effort days fished, no extrapolation	Mean catch rate per day (tonnes) (2)	Estimated IUU catch to 1 Dec 2005
		1	2	3	5	6	7	8	10	11
48.3	1991	1		1	1	15	1.0	15	1.6	23
58.4.2	2002		2	2	2	41	1.5	123	0.7	86
58.4.3a	2003	2		2	2	41	1.5	123	0.8	98
58.4.3b	2003	7	4	11	11	41	1.5	677	1.5	1 015
58.4.4a	1996	2		2	2	40	2.5	200	1.1	220
58.5.1	1996		1	1	1	30	1.9	57	4.7	268
58.5.2	1997		1	1	1	30	2.0	59	4.5	265
58.6	1996	1		1	1	40	1.0	40	0.3	12
58.7	1996	2		2	2	40	1.5	120	0.5	60
88.1	2002	1		1	1	7.7	1.0	7	3.6	28
88.2										0
Total										2 076
Undocumented landings of toothfish which cannot be attributed to a sighting or an area										508

Notes on columns 1 to 11:

1. From reports of vessel sightings submitted by Members.
2. From information reported via other sightings, port inspections or fishing vessels/traders.
6. Estimates of the duration of fishing trips for IUU vessels have been agreed and used by WG-FSA for a number of years.
10. Mean catch rates per day taken from the catch and effort database where available. CDS data used otherwise.

Names of sighted vessels where known:

48.3 *Elqui*
58.4.2 *Sargo*/*Keta*
58.4.3a *Hammer* (2)
58.4.3b *Condor*, *Koko*, *Jian Yuan*, *Kang Yuan* (2), *Ross* (2), *North Ocean*
58.4.4a *Condor*, *Red Lion* (sighted in Division 58.4.4b but advised that it intended to fish in Division 58.4.4a)
58.5.1 *Condor*
58.5.2 *Condor*
58.6 *Sea Storm*
58.7 *Aldabra*
88.1 *Taruman* (145 tonnes unloaded, 28 tonnes reported caught in Subarea 88.1)

Plus five separate sightings of unknown vessels (four in Division 58.4.3b, one in Subarea 58.7)

Table 14: List of tasks identified by WG-FSA for the 2006/07 intersessional period. Tasks identified by ad hoc WG-IMAF are listed in SC-CAMLR-XXV/BG/28. The paragraph numbers (Ref.) refer to this report. E – established practice. Priority: high priority (1); general request (2).

	Task	Ref.	Priority	Action required	
				Members/Subgroups	Secretariat
	Organisation of the meeting				
1.	Submit papers to WG-FSA-07 in accordance with the guidelines.	E	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.	Submit data in a timely manner and using current CCAMLR formats.	E	1	Members to implement	Assist
4.	Process fishery, observer and survey data submitted to CCAMLR.	E	1		Implement
5.	Validate data and liaise with Members to resolve inconsistencies.	E	1	Members to assist	Implement
6.	To the extent possible, update the tables, figures and general text of data in the Fishery Reports.	13.23	1		Implement
7.	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
8.	Update estimates of catches reported in CDS data by season and area outside the Convention Area.	E	1		Implement
9.	Update information on scientific observations.	E	1		Implement
10.	Update Fishery Plans.	E	2		Implement
11.	Notify research surveys.	E	1	Members to implement	
12.	Conduct statistical evaluation of new methods to assess the performance of new gear, its selectivity and impact on ecosystem components.	3.17, 6.52	1	Members to implement	
13.	Provide information of the sustainability of the *Dissostichus* resource on the Scotia Ridge.	3.22	2	Members to implement	Archive
14.	Report tag data to the Secretariat along with monthly fine-scale data.	3.42	1	Members to implement	Archive

	Task	Ref.	Priority	Action required	
				Members/Subgroups	Secretariat
	Assessments and management advice				
15.	Review and provide additional information for Fishery Reports.	E	2	Members to implement	Update
16.	Conduct simulations to explore the consequences of a multi-year assessment on the management of the target species and the fishery.	4.19	1	Members to implement	
17.	Conduct general research toward advancing assessments.	12.4	2	Members to implement	
18.	Develop management strategy evaluations.	12.5–12.7	1	Members to implement	
	Fish and invertebrate by-catch				
19.	Cut all rajids from fishing lines while still in the water, except on the request of the observer during biological sampling periods.	E	1	Members to implement	
20.	Provide data for the analysis of by-catch (Tables 1 to 3) for the start of the 2007 meeting.	6.51		Members to implement	Update
	Evaluation of threats arising from IUU activities				
21.	Further develop estimation methods.	8.4–8.9, 8.14	1	SCIC to consider, Members to implement	Coordinate and implement
	Biology, ecology and demography of target and by-catch species				
22.	Publish the Species Profiles in *CCAMLR Science* and further disseminate to the public domain through 'Fishbase' and other means to ascertain a distribution as wide as possible.	9.6		Subgroup to coordinate	Assist
23.	Collect data from the krill fishery more extensively in the future to allow a better assessment of the impact of the krill fishery on fish species.	10.8		Members to implement	Assist
	Consideration of ecosystem management				
24.	One-day workshop should be held to discuss approaches to developing models to examine the effects of finfish fisheries on the ecosystem.	10.13	1	Members to contribute	Assist

	Task	Ref.	Priority	Action required	
				Members/Subgroups	Secretariat
	New and exploratory fisheries				
25.	Conduct the fishery-based research outlined in Conservation Measure 41-01, and submit the data to the Secretariat in a timely manner.	5.9		Members to implement	Archive
26.	Look out for tagged fish and submit accurate tag–recapture data to the Secretariat in a timely manner.	5.10		Members to implement	Archive
27.	Further develop the assessment of *D. mawsoni* in Subareas 88.1 and 88.2.	12.11		Members to implement	Assist
28.	Develop a means for estimating abundance and providing assessments of stock status in exploratory fisheries other than in Subareas 88.1 and 88.2.	5.8	1	Members to implement	Assist
29.	Develop the assessments in other exploratory fisheries for *Dissostichus* spp.	12.12		Members to implement	Assist
	Scheme of International Scientific Observation				
30.	Use only current versions of CCAMLR data forms.	E	1	Members to implement	Assist
31.	Update the *Scientific Observers Manual* and data forms.	E	1		Implement
32.	Change the logbook to facilitate the monitoring of depredation in the *Dissostichus* spp. fisheries in the CCAMLR Convention Area.	11.8			Implement
33.	Make available a photographic database to assist observers with the identification of seabirds and fish in the Convention Area.	11.10		France to submit	Implement
34.	During a trial period of one year, observers/vessels to take time-stamped photographs of all returned tags and forward them to the relevant tagging program coordinator and the Secretariat.	3.45	1	Members to implement	Archive
35.	Investigate the feasibility of it becoming the tagging program coordinator for all exploratory fisheries.	3.46–3.47	1	Tagging Subgroup to provide guidance	Implement
36.	Implement the instructions to observers with respect of sampling longlines for by-catch.	6.39		Members to implement	Assist

	Task	Ref.	Priority	Action required	
				Members/Subgroups	Secretariat
37.	Develop methods to help determine levels of reporting and detection of tag–recapture events on board fishing vessels.	11.7		Members to implement	Assist
38.	Review all tasks that observers are required to do.	11.9		Members to implement	Assist
	Future assessments				
39.	Further develop the assessment of *D. eleginoides* in Subarea 48.3.	12.8		Members to implement	Assist
40.	Further develop the assessment of *D. eleginoides* in Division 58.5.2.	12.9–12.10		Members to implement	Assist
41.	Further develop the assessment of *C. gunnari* in Subarea 48.3.	12.13		Members to implement	Assist
42.	Further develop the assessment of *C. gunnari* in Division 58.5.2.	12.14		Members to implement	Assist
43.	Develop a subgroup work plan for the intersessional period.	13.5		Subgroup coordinators to implement	Assist
44.	Hold a meeting of WG-FSA-SAM in 2007.	13.8–13.11		Convener to coordinate	Assist
45.	Hold a workshop on developing methods of incorporating ecosystem models in finfish fishery assessments.	13.12–13.14		Convener to coordinate	Assist

APPENDIX A

AGENDA

Working Group on Fish Stock Assessment
(Hobart, Australia, 9 to 20 October 2006)

1. Opening of the meeting

2. Organisation of the meeting and adoption of the agenda

    2.1 Organisation of the meeting
    2.2 Size of the WG-FSA report

3. Review of available information

    3.1 Data requirements specified in 2005
        3.1.1 Development of the CCAMLR database
        3.1.2 Data processing
        3.1.3 Fishery plans

    3.2 Fisheries information
        3.2.1 Catch and effort 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 Inputs for stock assessment
        3.3.1 Catch-at-length/age from fisheries
        3.3.2 Research surveys
        3.3.3 CPUE analyses
        3.3.4 Tagging studies
        3.3.5 Biological parameters
        3.3.6 Stock structure and management areas
        3.3.7 Depredation

4. Preparation for assessments and assessment timetable

    4.1 Report from the Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM)
    4.2 Report from the Subgroup on Assessment Methods (WG-FSA-SAM)
    4.3 Review of preliminary stock assessment papers
    4.4 Assessments to be carried out and assessment timetable

5. Assessments and management advice

5.1 New and exploratory fisheries in 2005/06 and notifications for 2006/07
- 5.1.1 New and exploratory fisheries in 2005/06
- 5.1.2 New and exploratory fisheries notified for 2006/07
- 5.1.3 Update Fishery Report for Subareas 88.1 and 88.2
- 5.1.4 Progress towards assessments of other exploratory fisheries

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 *Dissostichus eleginoides* Crozet Islands (French EEZ in Subarea 58.6)
- 5.2.5 *Dissostichus eleginoides* Prince Edward and Marion Islands (South African EEZ in Subareas 58.6 and 58.7)
- 5.2.6 *Champsocephalus gunnari* South Georgia (Subarea 48.3)
- 5.2.7 *Champsocephalus gunnari* Heard Island (Division 58.5.2)

5.3 Assessment and management advice for 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 Assessment of the status of by-catch species and groups
6.2 Estimation of by-catch levels and rates
6.3 By-catch reporting
6.4 Assessment of risk
6.5 Mitigation measures

7. Incidental mortality of mammals and seabirds associated with fishing (ad hoc WG-IMAF Report)

8. Evaluation of the threats arising from IUU activities

8.1 Development of approaches for estimating total removals of toothfish
8.2 Review of historical trends in IUU activity

9. Biology, ecology and demography of target and by-catch species

9.1 Review information available to the meeting
9.2 Species profiles
9.3 CCAMLR otolith network
9.4 Ageing workshop of *C. gunnari* in 2006

10. Considerations of ecosystem management

    10.1 Ecological interactions (e.g. multi-species, benthos etc.)
    10.2 Interactions with WG-EMM
    10.3 Development of ecosystem models

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 the scientific observer program
        11.2.1 *Scientific Observers Manual*
        11.2.2 Sampling strategies
        11.2.3 Priorities

12. Future assessments

13. Future work

    13.1 Organisation of intersessional activities in subgroups
    13.2 Intersessional meetings

14. Other business

    14.1 Reorganisation of Scientific Committee working groups
    14.2 CCAMLR's contribution to FIRMS

15. Adoption of the report

16. Close of the meeting.

APPENDIX B

LIST OF PARTICIPANTS

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(Hobart, Australia, 9 to 20 October 2006)

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APPENDIX C

LIST OF DOCUMENTS

Working Group on Fish Stock Assessment
(Hobart, Australia, 9 to 20 October 2006)

WG-FSA-06/1	Provisional Agenda and Provisional Annotated Agenda for the 2006 Meeting of the Working Group on Fish Stock Assessment (WG-FSA)
WG-FSA-06/2	List of participants
WG-FSA-06/3	List of documents
WG-FSA-06/4	CCAMLR fisheries: 2006 update Secretariat
WG-FSA-06/5	Use of a deep-water longline of the Spanish type and its modifications in the Russian research of Ross Sea toothfish during the season 2004/05–2005/06 N.V. Kokorin and I.G. Istomin (Russia)
WG-FSA-06/6	Report of the WG-FSA Subgroup on Assessment Methods (Walvis Bay, Namibia, 10 to 14 July 2006)
WG-FSA-06/7	Report of the Second Workshop on Estimating age of Mackerel Icefish, *Champsocephalus gunnari* (AtlantNIRO, Kaliningrad, Russia, 19 to 23 June 2006)
WG-FSA-06/8	Report from invited expert to WG-FSA-SAM-06
WG-FSA-06/9	On maturity level of gonads of Antarctic toothfish *Dissostichus mawsoni* from the southern Ross Sea (Subarea 88.1) in December 2005–February 2006 V.G. Prutko (Ukraine)
WG-FSA-06/10	Species composition of fish from Antarctic toothfish *Dissostichus mawsoni* stomachs of the Ross Sea A.V. Balushkin (Russia) and V.G. Prutko (Ukraine)
WG-FSA-06/11 Rev. 2	Estimation of IUU catches in the Convention Area in the 2005/06 fishing season Secretariat

WG-FSA-06/12	Comparison of census methods for black-browed albatrosses breeding at the Ildefonso Archipelago, Chile G. Robertson, K. Lawton (Australia), C.A. Moreno (Chile), R. Kirkwood (Australia) and J. Valencia (Chile)
WG-FSA-06/13	Brief report on scientific observation on the fishery vessel *Mellas* (FAO Statistical Area 41, January to July 2006) S. Usachev (Ukraine)
WG-FSA-06/14	Standing stock, spatial distribution and biological features of demersal finfish from the 2006 US AMLR bottom trawl survey of the northern Antarctic Peninsula and Joinville–D'Urville Islands (Subarea 48.1) C.D. Jones (USA) and K.-H. Kock (Germany)
WG-FSA-06/15	Report of new longline system in the exploratory fisheries for *Dissostichus* spp. in 2005/06 Delegation of Japan
WG-FSA-06/16	VACANT
WG-FSA-06/17	The results of investigations of the feeding of Antarctic toothfish *D. mawsoni* in the Ross Sea in 2005/06 A.F. Petrov (Russia)
WG-FSA-06/18	Notes on the Second Meeting of the WCPFC – Ecosystem and Bycatch Specialist Working Group, Manila, 10 August 2006 C. Small (BirdLife International)
WG-FSA-06/19	Distribution of albatrosses and petrels in the WCPFC Convention Area and overlap with WCPFC longline fishing effort C. Small (BirdLife International)
WG-FSA-06/20	*Saga Sea* krill harvesting and production T. Williksen (Norway)
WG-FSA-06/21	Recommended changes to Conservation Measure 25-02 pertaining to the Spanish system of longline fishing G. Robertson (Australia) and C. Moreno (Chile)
WG-FSA-06/22	Best practice seabird by-catch mitigation for Spanish-rig longline vessels with emphasis on line weighting regimes G. Robertson (Australia), C.A. Moreno (Chile), B. Wienecke (Australia), P. Gandini (Argentina), G. McPherson (Australia) and J.-P. Seco Pon (Argentina)
WG-FSA-06/23	On possible impact of new continuous krill fishing technology on juvenile fish and larvae S.M. Kasatkina

WG-FSA-06/24	Mercury concentrations in Patagonian toothfish, *Dissostichus eleginoides* Smitt 1898, among three distinct ocean basins K. Dawson Guynn and M.S. Peterson (USA)
WG-FSA-06/25	Information on the status of fjord *Notothenia rossii*, *Gobionotothen gibberifrons* and *Notothenia coriiceps* in the lower South Shetland Islands derived from a long-term monitoring program (1983–2006) at Potter Cover E.R. Barrera-Oro and E.R. Marschoff (Argentina) (*CCAMLR Science*, submitted)
WG-FSA-06/26	Species profile for Antarctic toothfish (*Dissostichus mawsoni*) S.M. Hanchet (New Zealand)
WG-FSA-06/27	Stomach contents of sub-adult Antarctic toothfish (*Dissostichus mawsoni*) from the western Ross Sea, Antarctica D.W. Stevens (New Zealand)
WG-FSA-06/28	Preliminary analyses of an ectoparasite *Eubrachiella antarctica* as a marker for stock discrimination of Antarctic toothfish in the Ross Sea P.J. Smith, A. McKenzie and L. Tubbs (New Zealand)
WG-FSA-06/29	A characterisation of the toothfish fishery in Subareas 88.1 and 88.2 from 1997/98 to 2005/06 S.M. Hanchet, M.L. Stevenson and A. Dunn (New Zealand)
WG-FSA-06/30	Towards a seabird mortality risk assessment: distribution of seabirds in the WCPFC Convention Area and potential overlap with fisheries S. Waugh (New Zealand)
WG-FSA-06/31	Review of biological parameters for Ross Sea skates M.P. Francis (New Zealand)
WG-FSA-06/32	Summary of Ross Sea skate tagging programme results S.L. Ballara, A. Dunn and M.P. Francis (New Zealand)
WG-FSA-06/33	Some thoughts on the CCAMLR risk assessment for seabird–fishery interactions S. Waugh (New Zealand)
WG-FSA-06/34	An updated descriptive analysis of the toothfish (*Dissostichus* spp.) tagging programme in Subareas 88.1 and 88.2 up to 2005/06 A. Dunn and S.M. Hanchet

WG-FSA-06/35	Estimating fishing gear selectivity for trawlers using length-frequency data from concurrent commercial trawl and longline fishing for Patagonian toothfish in Division 58.5.2 and the ratio of their hazard functions S.G. Candy (Australia)
WG-FSA-06/36 Rev. 2	A summary of observations on board longline vessels operating within the CCAMLR Convention Area during the 2005/06 season Secretariat
WG-FSA-06/37 Rev. 1	Summary of observations aboard trawlers operating in the Convention Area during the 2005/06 season Secretariat
WG-FSA-06/38	A summary of scientific observations related to Conservation Measures 25-01 (1996), 25-02 (2005), and 25-03 (2003) Secretariat
WG-FSA-06/39 Rev. 1	Summary of an observation aboard a pot vessel operating in the Convention Area during the 2005/06 season Secretariat
WG-FSA-06/40	Report of ACAP Working Group on Status and Trends Agreement on the Conservation of Albatrosses and Petrels – Status and Trends Working Group
WG-FSA-06/41	Interactions between seabirds and deep water hake trawl gear: an assessment of impacts in South African waters 2004/05 B.P. Watkins, S.L. Petersen and P.G. Ryan (South Africa)
WG-FSA-06/42 Rev. 1	Report on a random stratified trawl survey to estimate distribution and abundance of *Dissostichus eleginoides* and *Champsocephalus gunnari* conducted in the Heard Island region (Division 58.5.2), May–June 2006 G.B. Nowara, R. Williams and T. Lamb (Australia)
WG-FSA-06/43 Rev. 1	Preliminary assessment of mackerel icefish, *Champsocephalus gunnari*, in the vicinity of Heard Island and McDonald Islands (Division 58.5.2), based on a survey in May–June 2006 using the Generalised Yield Model D.C. Welsford (Australia)
WG-FSA-06/44 Rev. 1	Review of the use of survey data and length-at-age models in the assessment of *Dissostichus eleginoides* in the vicinity of Heard Island and McDonald Islands (Division 58.5.2) D.C. Welsford, A.J. Constable and G.B. Nowara (Australia) (*CCAMLR Science*, submitted)

WG-FSA-06/45 Rev. 1	Preliminary assessment of Patagonian toothfish, *Dissostichus eleginoides*, in the vicinity of Heard Island and McDonald Islands (Division 58.5.2), based on a survey in May–June 2006 using the Generalised Yield Model D.C. Welsford, A.J. Constable, T. Lamb and T. Robertson (Australia)
WG-FSA-06/46	A proposal to adopt a conservation measure seeking an interim prohibiting on deep sea gillnet fishing in the Convention Area Delegation of Australia
WG-FSA-06/47	Standardised CPUE analysis of the Antarctic toothfish (*Dissostichus mawsoni*) fishery in the Ross Sea for the years 1997/98 to 2005/06 A. Dunn and S.M. Hanchet (New Zealand)
WG-FSA-06/48	Assessment models for Antarctic toothfish (*Dissostichus mawsoni*) in SSRU 882E including data from the 2005/06 season A. Dunn and S.M. Hanchet (New Zealand)
WG-FSA-06/49	The use of CCAMLR Statistical Subareas 88.1 and 88.2 and Division 58.4.1 by Macquarie Island giant petrels R. Trebilco, R. Gales, B. Baker and A. Terauds (Australia)
WG-FSA-06/50	Antarctic toothfish stock assessment for the Ross Sea by means of the TSVPA separable cohort model D. Vasilyev and K. Shust (Russia)
WG-FSA-06/51	Report of the South Georgia groundfish survey (Subarea 48.3) in January 2006 M.A. Collins, C. Jones, J. Clark. S. Fielding, J. Slakowski, T. North, W. Reid and J. Watts (United Kingdom)
WG-FSA-06/52	Integrated weight longlines with paired streamer lines – best management practice for demersal longline fisheries: preliminary results K. Dietrich, E. Melvin and L. Conquest (USA)
WG-FSA-06/53	Assessment of toothfish in Subarea 48.3, 2006 D.J. Agnew, R. Hillary, M. Belchier, J. Clark and J. Pearce (United Kingdom)
WG-FSA-06/54	Estimates of natural and fishing mortality from toothfish mark–recapture and catch-at-age data at South Georgia R.M. Hillary and D.J. Agnew (United Kingdom) (*CCAMLR Science*, submitted)
WG-FSA-06/55 Rev. 1	WITHDRAWN

WG-FSA-06/56	Results of the tagging experiment for *D. eleginoides* in Subarea 48.4 A. Payne and D.J. Agnew (United Kingdom)
WG-FSA-06/57	Analysis of krill catch data from continuous and conventional trawls by the *Saga Sea* and *Atlantic Navigator* D.J. Agnew, A. Payne, J. Hooper and J. Roe (United Kingdom)
WG-FSA-06/58	2006 assessment of the toothfish (*Dissostichus eleginoides*) resource in the Prince Edward Islands vicinity A. Brandão and D.S. Butterworth (South Africa)
WG-FSA-06/59	A proposal methodology to assess the Patagonian toothfish stock abundance at CCAMLR Subarea 48.3 using ASPM O.C. Wöhler and P.A. Martínez (Argentina)
WG-FSA-06/60	Assessment models for Antarctic toothfish (*Dissostichus mawsoni*) in the Ross Sea including data from the 2005/06 season A. Dunn and S.M Hanchet (New Zealand)
WG-FSA-06/61	Seabird warp-strike form Ministry of Fisheries (New Zealand)
WG-FSA-06/62	Seabird warp-strike measurement protocol for observers in New Zealand trawl fisheries Ministry of Fisheries (New Zealand)
WG-FSA-06/63	Marine mammals and demersal longlines fishery interactions in Crozet and Kerguelen Exclusive Economic Zones: an assessment of the depredation level C. Roche, N. Gasco, G. Duhamel and C. Guinet (France) (*CCAMLR Science*, submitted)
WG-FSA-06/64	An integrated stock assessment for the Patagonian toothfish (*Dissostichus eleginoides*) in Division 58.5.2 using CASAL A. Constable, S. Candy, T. Lamb and I. Ball (Australia) (*CCAMLR Science*, submitted)

Other Documents

WG-FSA-06/P1	Ashford, J.R., C.M. Jones, E. Hofmann, I. Everson, C. Moreno, G. Duhamel and R. Williams. 2005. Can otolith elemental signatures record the capture site of Patagonian toothfish (*Dissostichus eleginoides*), a fully marine fish in the Southern Ocean? *Can. J. Fish. Aquat. Sci.*, 62: 2832–2840.
WG-FSA-06/P2	Ashford, J.R., A.I. Arkhipkin and C.M. Jones. 2006. Can the chemistry of otolith nuclei determine population structure of Patagonian toothfish *Dissostichus eleginoides*? *J. Fish Biol.*, 69: 708–721.

WG-FSA-06/P3	Petrov, A.F. 2006. A case of giant squid attack on Antarctic toothfish *Dissostichus mawsoni* Norman, 1937 (*Perciformes, Nototheniidae*) caught on bottom-set longline in the Ross Sea *Voprosy ichthiologii* (in press) (in Russian)
CCAMLR-XXV/16	Summary of notifications for new and exploratory fisheries in 2006/07 Secretariat
CCAMLR-XXV/17	Notifications of Argentina's intention to conduct exploratory longline fisheries for *Dissostichus* spp. in 2006/07 Delegation of Argentina
CCAMLR-XXV/18	Notifications of Australia's intention to conduct exploratory longline fisheries for *Dissostichus* spp. in 2006/07 Delegation of Australia
CCAMLR-XXV/19	Notifications of Japan's intention to conduct exploratory longline fisheries for *Dissostichus* spp. in 2006/07 Delegation of Japan
CCAMLR-XXV/20	Notifications of the Republic of Korea's intention to conduct exploratory longline fisheries for *Dissostichus* spp. in 2006/07 Delegation of the Republic of Korea
CCAMLR-XXV/21	Notifications of Namibia's intention to conduct exploratory longline fisheries for *Dissostichus* spp. in 2006/07 Delegation of Namibia
CCAMLR-XXV/22	Notifications of New Zealand's intention to conduct exploratory longline fisheries for *Dissostichus* spp. in 2006/07 Delegation of New Zealand
CCAMLR-XXV/23	Notifications of Norway's intention to conduct exploratory longline fisheries for *Dissostichus* spp. in 2006/07 Delegation of Norway
CCAMLR-XXV/24	Notifications of Russia's intention to conduct exploratory longline fisheries for *Dissostichus* spp. in 2006/07 Delegation of Russia
CCAMLR-XXV/25	Notification of South Africa's intention to conduct an exploratory longline fishery for *Dissostichus* spp. in 2006/07 Delegation of South Africa
CCAMLR-XXV/26	Notifications of Spain's intention to conduct exploratory longline fisheries for *Dissostichus* spp. in 2006/07 Delegation of Spain

CCAMLR-XXV/27	Notifications of the United Kingdom's intention to conduct exploratory longline fisheries for *Dissostichus* spp. in 2006/07 Delegation of the United Kingdom
CCAMLR-XXV/28	Notifications of Uruguay's intention to conduct exploratory longline fisheries for *Dissostichus* spp. in 2006/07 Delegation of Uruguay
CCAMLR-XXV/32	Proposal for revising Conservation Measure 41-04 (2005) – Limits on the Exploratory Fishery for *Dissostichus* spp. in Statistical Subarea 48.6 in the 2005/06 Season Delegation of Japan
CCAMLR-XXV/BG/3	Implementation of fishery conservation measures in 2005/06 Secretariat
CCAMLR-XXV/BG/4	Summary of current conservation measures and resolutions in force 2005/06 Secretariat
SC-CAMLR-XXV/BG/1 Rev. 2	Catches in the Convention Area in the 2004/05 and 2005/06 seasons Secretariat
SC-CAMLR-XXV/BG/2	Report of the Second Meeting of the Subgroup on Acoustic Survey and Analysis Methods (Hobart, Australia, 23 and 24 March 2006)
SC-CAMLR-XXV/BG/17	Évaluation de la biomasse et campagne de marquage Délégation française
SCIC-06/9	New methodology for estimating IUU catches Secretariat
WG-EMM-06/7	By-catch of small fish in a sub-Antarctic krill fishery K.A. Ross, L. Jones, M. Belchier and P. Rothery (United Kingdom)
WG-FSA-SAM-06/1	Provisional Agenda and Annotated Provisional Agenda for the 2006 Meeting of the WG-FSA Subgroup on Assessment Methods (WG-FSA-SAM)
WG-FSA-SAM-06/2	List of participants
WG-FSA-SAM-06/3	List of documents
WG-FSA-SAM-06/4	Extending the time series of catch-weighted length frequencies Secretariat

WG-FSA-SAM-06/5	Proposed trawl survey report format R.L. O'Driscoll (New Zealand) (Appendix 1: O'Driscoll, R.L. and N.W. Bagley. 2006. Trawl survey of hoki, hake and ling in the Southland and sub-Antarctic areas, November–December 2004 (TAN0414). *New Zealand Fisheries Assessment Report* 2006/2: 60 pp.)
WG-FSA-SAM-06/6	Using mark-recapture and catch-age data to estimate fishing and natural mortality for the Patagonian toothfish at South Georgia R.M. Hillary and D.J. Agnew (United Kingdom)
WG-FSA-SAM-06/7	A Von Bertalanffy growth model for Division 58.5.2 fitted to length-at-age data and a comparison of predicted with observed growth from mark–recapture data S.G. Candy, A.J. Constable, T. Lamb and R. Williams (Australia)
WG-FSA-SAM-06/8	Revised estimates of the biological parameters for Antarctic toothfish (*Dissostichus mawsoni*) in the Ross Sea A. Dunn, P.L. Horn and S.M. Hanchet (New Zealand)
WG-FSA-SAM-06/9	A descriptive analysis of the toothfish (*Dissostichus* spp.) tagging programme in the Ross Sea up to 2005/06 A. Dunn and S.M. Hanchet (New Zealand)
WG-FSA-SAM-06/10	Developments towards an investigation of potential bias from the analysis of tag–release and recapture data in Ross Sea Antarctic toothfish abundance estimates A. Dunn (New Zealand)
WG-FSA-SAM-06/11	Preliminary assessment models of Antarctic toothfish (*Dissostichus mawsoni*) in the Ross Sea including data from the 2005/06 season A. Dunn and S.M. Hanchet (New Zealand)
WG-FSA-SAM-06/12	An update on the development of a management procedure for the toothfish (*Dissostichus eleginoides*) resource in the Prince Edward Islands vicinity A. Brandão and D.S. Butterworth (South Africa)
WG-FSA-SAM-06/13	Review of some assumptions for modelling Patagonian toothfish dynamics at CCAMLR Subarea 48.3 A. Aubone, P.A. Martínez and O.C. Wöhler (Argentina)
WG-FSA-SAM-06/14	An investigation of integrated stock assessment methods for the Patagonian toothfish (*Dissostichus eleginoides*) in Division 58.5.2 using CASAL A. Constable, S. Candy and I. Ball (Australia)

WG-FSA-SAM-06/15	Review of the use of survey data and length-at-age models in the assessment of *Dissostichus eleginoides* in the vicinity of Heard Island and McDonald Islands (Division 58.5.2) D.C. Welsford, A.J. Constable and G.B. Nowara (Australia)
WG-FSA-SAM-06/16	Application of continuous time Markov chains to modelling animal movement: estimation of movement rates and retention times for Patagonian toothfish C. Wilcox, M. Bravington and D. Peel (Australia)

APPENDIX D

REPORT OF THE AD HOC WORKING GROUP ON INCIDENTAL MORTALITY ASSOCIATED WITH FISHING (AD HOC WG-IMAF)

CONTENTS

REPORT OF THE AD HOC WORKING GROUP ON INCIDENTAL MORTALITY ASSOCIATED WITH FISHING (AD HOC WG-IMAF)
(Hobart, Australia, 9 to 13 October 2006)

Intersessional work of ad hoc WG-IMAF

The Secretariat reported on the intersessional activities of ad hoc WG-IMAF according to the agreed plan of intersessional activities for 2005/06 (SC-CAMLR-XXIV/BG/28). The report contained records of all activities planned and is available on the IMAF page of the CCAMLR website.

2. The Working Group thanked the Science Officer for his work on the coordination of IMAF intersessional activities and the technical coordinators of national observer programs 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 2005/06 fishing season.

3. The Working Group concluded that most tasks planned for 2005/06 had been successfully implemented. During the intersessional period a number of documents with new data and information were received from Members and international organisations. In addition, much of the information requested intersessionally had been presented to the Working Group in papers submitted to the meeting. In particular, the Working Group noted new information on seabird mitigation activities undertaken by regional fisheries management organisations – IOTC, SEAFO, IATTC and WCPFC (see details in paragraphs 160 to 173). 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 2006/07, compiled by the Co-conveners and the Science Officer, be appended to its report (Table 20).

4. The Working Group especially welcomed to the meeting Mr I. Hay (Australia) and Mr C. Heinecken (South Africa) 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.

5. The Working Group greatly appreciated the participation of a national technical coordinator, Mr Heinecken. His perspective gained from training, briefing and debriefing many CCAMLR scientific observers over several years was invaluable as the Working Group addressed numerous observer-related and data collection issues. In addition to the continued participation of technical coordinators at future meetings, WG-IMAF would also benefit from the participation of South American Members.

Incidental mortality of seabirds and marine mammals
in fisheries in the Convention Area

6. The total extrapolated seabird mortalities during longline fishing for *Dissostichus* spp. outside EEZs in the Convention Area were estimated to be two from Division 58.4.3b. When seabird mortalities reported from EEZs within the Convention Area are included, the total extrapolated seabird mortalities during longline fishing operations in 2005/06 were estimated to be 2 589. This estimate includes 235 birds in Subarea 58.6 and 2 352 birds in Division 58.5.1. For the first time no albatrosses were observed captured in longline fisheries in the Convention Area.

7. Observers reported 33 seabird mortalities, including both albatrosses and petrels, during trawling for finfish in Subarea 48.3. No seabird mortalities were reported during trawling for krill or during pot fishing.

Seabirds in longline fisheries

8. Data were available from all 37 longline cruises conducted within the Convention Area during the 2005/06 season (WG-FSA-06/36 Rev. 2).

9. The Working Group noted that the proportions of hooks observed were similar to those observed for last year for Subarea 48.3 (29% (range 18–39) compared with 31% (range 20–62)); and slightly reduced for Subareas 88.1 and 88.2 (45% (range 20–74) compared with 51% (range 23–100)); Division 58.5.2 (33% (range 31–41) compared with 36% (range 31–41)); and Subareas 58.6 and 58.7 (35% (one vessel) compared with 65% (one vessel)). For other areas the observation rates and ranges increased from last year: Subarea 48.6, 50% compared with 31%; Subarea 58.4, 70% (range 47–100) compared with 56%.

10. As usual, the total observed seabird by-catch rate was calculated using the total number of hooks observed and the total seabird mortality observed (Table 1). The estimated total by-catch of seabirds by vessel was calculated using each vessel's observed catch rate multiplied by the total number of hooks set.

11. The total number of observed mortalities was one, a white-chinned petrel in Division 58.4.3b. The total extrapolated mortality for 2005/06 was two birds (Table 2). This compared to 97 birds estimated killed in 2004/05.

12. The total number of seabirds observed caught and released uninjured was 32 (Table 1). The Working Group noted that the incidence of birds being caught injured and uninjured (i.e. birds that are caught on the haul), accounted for 97% of seabird captures in 2005/06 (Table 1). As last year, this proportion of seabirds caught on the haul suggests that an increased focus on haul mitigation measures is required (SC-CAMLR-XXIV, Annex 5, paragraph 7.3).

French EEZs in Subarea 58.6 and Division 58.5.1

13. Data were available from 20 cruises in Subarea 58.6 and 27 cruises in Division 58.5.1. The proportion of hooks observed was 25 and 24% respectively (Table 4).

14. In 2005/06 the total reported seabird mortality from observers for Subarea 58.6 and Division 58.5.1 was 57 and 592 birds respectively (Table 4). The corresponding incidental mortality rates were 0.0362 and 0.092 birds/thousand hooks. The extrapolated total seabird mortalities for Subarea 58.6 and Division 58.5.1 were 235 and 2 352 respectively (Tables 5 and 6). All vessels in the French EEZs were autoliners using 50 g/m IWLs in 2005/06, compared with one such vessel in the previous season. Two-thirds of the birds were caught by two vessels in Subarea 58.6, and in Division 58.5.1, 72% of captures were by three vessels. This may indicate that there are individual vessel effects that need to be examined to effectively reduce further seabird captures in these areas.

15. Comparing the 2004/05 and 2005/06 seasons, observed incidental mortality rates decreased to 77 and 57% of the previous seasons' rates respectively in Subarea 58.6 and Division 58.5.1 (Table 7).

16. As for 2005, the Working Group noted that the reports of seabirds being caught injured and uninjured indicate that seabirds are being caught on the haul; this accounted for at least 28% of seabird captures in 2005/06 and 30% in 2004/05 (Table 4) (SC-CAMLR-XXIV, Annex 5, paragraph 7.10). This indicates that a much greater need to focus on haul mitigation measures is required to reduce the remaining seabird by-catch in longline fisheries in the Convention Area.

17. In 2005, the Working Group made recommendations regarding future research and monitoring of the French seabird captures (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraphs 39 to 43). Some of these recommendations were addressed in 2005 and the following remain for 2006. The Working Group recommended that:

- consideration be given to increasing the proportion of hooks observed (e.g. to 40–50%);

- a thorough analysis of data be undertaken for the 2003/04 to 2005/06 seasons, similar to that carried out by Delord et al. (2005). Such analyses should include consideration of the effects of time of year, area, moon phase, hour, sink rates, setting speed, bird abundance, streamer line configuration, fishing gear configuration, hook type, line colour, line-weighting regime, offal discharge, sea state and wind, observer and vessel, and special attention should be given to the circumstances associated with sets and hauls where a large number of birds are caught.

18. The Working Group requested that France supply additional information on the nature of captures (such as where in their body seabirds are hooked), the factors affecting captures (such as line hook-ups or other operational difficulties that may expose the line to bird attacks), and details of mitigation devices used, such as streamer line specifications (e.g. aerial extent, length and spacing of streamers, attachment height, number of streamers, towed device, use across sets and number of streamer lines deployed). This information, in combination with data describing where in their body seabirds are hooked, can indicate how to apply further mitigation or changes in fishing practice to reduce seabird by-catch.

19. The Working Group noted that France continues to reduce its total seabird by-catch by about one half each year. However, the total seabird captures during longline fishing in the French EEZs remains far above that recorded elsewhere in the Convention Area. Seasonal

differences in the fishing patterns between areas may account for the differences in catch rates between the French EEZs and other areas, with no longline fishing conducted outside the EEZs during the summer period, which is considered a high-risk time for seabird captures.

20. The Working Group recommended that all relevant raw data describing by-catch in the French EEZ fisheries (Subarea 58.6 and Division 58.5.1), as submitted from all subareas and divisions within the Convention Area, be submitted to CCAMLR to allow the Working Group to report on total seabird by-catch for the entire Convention Area.

Seabirds in trawl fisheries

21. A total of 33 bird mortalities were recorded in trawl fisheries in the Convention Area. These were all recorded in the icefish fishery in Subarea 48.3. In addition, 89 seabird entanglements with the seabirds released alive were recorded in the same fishery (Table 12).

Subarea 48.3 icefish

22. Data were available from all five trawl cruises conducted within Subarea 48.3 during the 2005/06 season (WG-FSA-06/37 Rev. 1, Table 1). The Working Group noted that there was 100% observer coverage of fishing vessels in this fishery with 78% of tows observed.

23. For 2005/06, 33 bird mortalities (11 black-browed albatross, 20 white-chinned petrels, 1 grey-headed albatross and 1 unknown petrel species) were reported in the Subarea 48.3 icefish fishery from four vessels; in addition 89 birds were released alive, uninjured (Table 12). This compares to 11 bird mortalities (and 14 released alive) in 2005 and 87 bird mortalities (and 132 entanglements) in 2004. The rate of mortality in this subarea in 2006 was 0.07 birds per trawl compared to 0.14, 0.37 and 0.20 in 2005, 2004 and 2003 respectively (Table 14).

24. The Working Group noted that there continued to be a general downward trend in the seabird mortality rate in this fishery (Table 14). However, it is difficult to compare between the level of mortality in 2005 and 2006 as the reduced level of mortality in 2005 was thought to be at least partially due to lower seabird abundance associated with reduced icefish catches (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraph 204). It was also noted that all recorded seabird mortalities, except one, occurred on the haul.

Division 58.5.2 toothfish/icefish

25. Data were available from all three trawl cruises conducted within Division 58.5.2 during the 2005/06 season (WG-FSA-06/37 Rev. 1, Table 1). The Working Group noted that there was 100% observer coverage of fishing vessels in this fishery with 100% of tows observed.

26. No seabird mortalities were recorded in the trawl fishery in Division 58.5.2. Observer reports from three cruises on board the *Southern Champion* indicated that no bird-scaring devices were deployed but the mitigation measures used were in full compliance with Conservation Measure 25-03.

Krill

27. Data were available from five trawl cruises conducted within Area 48 during the 2005/06 season (Table 1). The Working Group noted that there was not 100% observer coverage of fishing vessels in this fishery and only 15% of tows were observed.

28. The Working Group noted that no seabird mortality was recorded on the *Saga Sea* while fishing with continuous trawls in Subarea 48.1. Similarly, no mortalities were recorded on the *Atlantic Navigator* using either continuous trawl or traditional pelagic trawl methods in Subarea 48.1 (WG-FSA-06/57).

29. There were no recorded incidents of seabird mortality or entanglements in the krill fishery in Area 48, with two cruises in Subarea 48.1 and three cruises in Subarea 48.3, noting that one cruise is incomplete with the vessel still being at sea (WG-FSA-06/37 Rev. 1).

30. In 2005, the Working Group recommended increasing coverage in the krill fishery to 100% of vessels (SC-CAMLR-XXIV, Annex 5, paragraphs 7.55 and 7.56).

31. The Working Group reiterated its advice from 2005 and recommended that the observation of fishing effort in the krill fishery be increased from the current 15% of total effort on a few vessels to 30–50% of effort on 100% of vessels to allow for adequate and representative sampling across all trawl fisheries. This is especially important for the cryptic mortality known to be associated with trawl warp strike (paragraph 75) and for monitoring the ability to use net binding as a mitigation measure for seabirds during net deployment (paragraphs 54 and 59).

Seabirds in pot fisheries

32. During pot fishing in 2005/06, no seabird mortalities were recorded during three cruises targeting *D. eleginoides* in Divisions 58.5.1 and 58.5.2 and Subarea 48.3 (WG-FSA-06/39 Rev. 1).

Marine mammals in longline fisheries

33. There were no reports of incidental mortality of marine mammals in longline gear (WG-FSA-06/36 Rev. 2). This differs from 2004/05, when both pinnipeds (five animals) and cetaceans (two animals) were reported caught (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraphs 196 to 198). In addition, two marine mammals were reported entangled (one Antarctic fur seal in Division 58.5.2, one southern elephant seal in Subareas 88.1/88.2) (WG-FSA-06/38, Table 2).

Marine mammals in trawl fisheries

Krill

34. In 2005/06, and with 15% of total fishing effort observed, one Antarctic fur seal was reported caught and killed (Table 12). The Working Group noted that this level of mortality is greatly reduced from 2004/05, when 96 Antarctic fur seals were observed caught during krill fishing operations in the same area (Area 48) (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraph 217). The Working Group noted that no marine mammal mortality was reported on the *Saga Sea* while fishing continuous trawls in Subarea 48.1 in 2005/06.

35. Methods deployed to avoid marine mammal capture in 2005/06 were net barriers and a seal exclusion device (WG-FSA-06/37 Rev. 1). The Working Group considered it useful to compare mitigation measures used between years, and the capture rates of associated gear, with a view to identifying potentially effective methods over time.

Finfish

36. In Subarea 48.3, no marine mammal entanglements were recorded with 78% of trawls observed. One leopard seal was caught and killed in the Division 58.5.2 toothfish trawl fishery (compared to one Antarctic fur seal in 2004/05), with 100% observer coverage (Table 14). No mitigation methods were reported.

Marine mammals in pot fisheries

37. There were no reports of incidental mortality of marine mammals in pot fisheries (WG-FSA-06/39 Rev. 1).

Information relating to the implementation of Conservation Measures 25-01, 25-02 and 25-03

38. Information from observer reports relating to the implementation of Conservation Measures 25-01, 25-02 and 25-03 in 2005/06 were provided by the Secretariat in WG-FSA-06/38.

Conservation Measure 25-01 'Regulation of the use and disposal of plastic packaging bands on fishing vessels'

39. Conservation Measure 25-01 prohibits the use of plastic packaging bands to secure bait boxes. The use of other plastic packaging bands is restricted to those vessels with on-board incineration facilities and all bands must be cut and disposed of using this facility. Information from observer reports indicated 100% compliance with this measure, compared to non-compliance indicated by observer reports on one of 10 vessels in 2005 (WG-FSA-06/38, Table 1).

Conservation Measure 25-02 'Minimisation of the incidental mortality of seabirds in the course of longline fishing or longline fishing research in the Convention Area'

Line weighting

40. For Spanish system vessels there was 100% reported compliance with the line-weighting regime in all subareas and divisions, as for 2005 (WG-FSA-06/38, Table 4). For autoline vessels, all vessels fishing in Subareas 88.1 and 88.2 and Division 58.4.2 south of 60°S in daylight met the requirement to achieve a consistent minimum line sink rate as described in Conservation Measure 24-02. As in previous years, this line-weighting requirement has been fully achieved by all vessels. For 2005/06, the Working Group noted that only one vessel (*Protegat* in Subarea 48.3), using a variation on the autoline method, used clip-on weights to achieve the sink rate requirements. All other autoline vessels were now using IWLs. The Working Group noted that the *Shinsei Maru No. 3*, using a trot-line system, met the sink rate requirements in Subarea 48.6.

Night setting and offal discharge

41. There was 100% compliance with night setting, and also for offal discharge in all areas where this was required (Subareas 48.3, 48.4, 58.6, 58.7, 88.1 and 88.2) (WG-FSA-06/38, Table 4).

Discard of hooks

42. Observers reported hooks being present in discards on 6 of 36 longline cruises; on three of these this was reported as a rare event. However, the observer reports for the *Globalpesca I* in Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b, the *Protegat* in Subarea 48.3, and the *Punta Ballena* in Subareas 88.1/88.2, indicated that this was a daily occurrence (WG-FSA-06/38, Table 1).

Streamer lines

43. Compliance with streamer line design has increased from 74% (28 of 44 cruises) in 2004/05 to 80% (29 of 36 cruises) this year (WG-FSA-06/38, Table 3), although this is not as high as the 92% (34 of 37 cruises) in 2003. However most of the non-compliant vessels had only minor deviations from the requirement.

44. The cruises where streamer lines did not comply failed on streamer lengths (five cruises), total streamer line length (three cruises, but only one of these deviated by more than 3 m from the required length) and branched streamer spacing (1 cruise). Four vessels failed on one different streamer line specification (*Globalpesca II*, *Insung No. 2* and *Galaecia* in Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b; *Frøyanes* in Subareas 88.1/88.2) and two vessels did not comply on two specifications (*Koryo Maru No. 11* and *Viking Sur*). There was 100% compliance with attachment height.

Haul-scaring devices

45. Conservation Measure 25-02 (paragraph 8) requires that a device designed to discourage birds from accessing baits during the haul of longlines (haul-scaring devices) shall be employed in those areas defined by CCAMLR as average-to-high or high (level of risk 4 or 5) in terms of risk of seabird by-catch. These areas are currently Subareas 48.3, 58.6 and 58.7 and Divisions 58.5.1 and 58.5.2.

46. In Subarea 48.3, four vessels (*Protegat* (78%), *Jacqueline* (46%), *Argos Georgia* (90%) and *Viking Bay* (98%)) did not use haul-scaring devices on all hauls. In Division 58.5.2, two trips by the *Janas* were reported with 100 and 94% compliance with this requirement respectively. In Subarea 58.6 outside the French EEZ and Subarea 58.7 there was 100% compliance (one vessel fished).

Gear debris and garbage

47. The Working Group noted a reported increase in the discharge of gear debris, which occurred on three vessels, one in Subarea 48.3, and two in Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b. This included fishing gear, small sections of line, snoods and plastics. The Working Group noted that this may have additional negative effects on seabirds and marine mammals which could not be quantified at this time. There was 100% compliance with inorganic garbage discharge requirements for longline vessels, though one trawl vessel discharged inorganic discharge. No vessels discharged oil.

Net sonde cables

48. Three observer reports noted that vessel used net sonde cables (*Cabo de Hornos* and *Betanzos* in Subarea 48.3; *Konstruktor Koshkin* in Subarea 48.1). It was unclear whether these were net sonde cables or paravanes, as had been the case in previous years. The Working Group developed a description for incorporation into the scientific observer logbook to clarify the distinction between the two devices and submitted that material directly to the Scientific Observer Data Analyst (paragraph 121).

49. The Working Group reiterated its concern that care was needed to ensure accurate reporting of data by observers because inaccurate reporting may have consequences for reviewing the performance of vessels in fisheries.

Conservation Measure 25-03 'Minimisation of the incidental mortality of seabirds and marine mammals in the course of trawl fishing in the Convention Area'

50. A range of mitigation measures was used on board icefish vessels in Subarea 48.3 and compliance with Conservation Measure 25-03 was generally good. The *Argos Pereira* covered the upper parts of mesh ranging from 135–400 mm with a 'jacket' of 90 mm mesh net. The effectiveness of the panel was not discussed in the observer's report, but it was noted

that this was the only vessel to record no seabird mortalities or entanglements. However, the Working Group recalled that black-browed albatross mortality has been recorded in mesh sizes up to 800 mm (WG-FSA-03/79).

51. Observer reports suggested that the reduced level of seabird mortality recorded during shooting operations was due to improved mitigation measures, including net cleaning, and a combination of weight added to the net and net binding; the latter is described in WG-FSA-05/59 and SC-CAMLR-XXIV, Annex 5, Appendix O, paragraph 207. Detailed reporting on net binding was only recorded in two cruise reports from Subarea 48.3. This may have been partly due to the lack of a specific field in the observer logbook to record the use of the method. The Working Group developed recommended changes to the scientific observer logbook to collect these data in future (paragraphs 121 to 124).

Net binding

52. The Working Group noted that the *Insung Ho* used a synthetic netting material to tie slipknots around 150–400 mm sections of the mesh, as opposed to organic sisal string tied to the net as recommended in SC-CAMLR-XXIV, Annex 5, Appendix O, paragraph 207. The observer report also indicated that the slipknots frequently opened before the doors were paid away, causing the net to loft on the surface.

53. Net weighting was added to the net to reduce the surface time of the net during shots and hauls on two vessels. The *Cabo de Hornos* reported that 2 x 150 kg chains were stitched along the edges of the codend, and the *Argos Pereira* added two chains of 200 kg each.

54. On the *Cabo de Hornos*, in response to seven mortalities in a single shot in the 100–120 mm mesh, this section of the net was replaced with 150–200 mm mesh. While the effectiveness of this measure was not reported, it was noted that a total of only seven mortalities were recorded on this vessel (i.e. implying all coming from the smaller mesh). Observer reports indicated that two vessels used 'Brady Bafflers' and a third vessel deployed a pair of booms astern of the trawl ramp with net and rope hanging around 2 m seaward. Observers noted that both devices were of little use in preventing net entanglements with seabirds.

55. Similar to reports from last year (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraph 207) observer data from 2005/06 indicated that streamer lines appeared ineffective during the haul, as tension could not be maintained in the lines to keep them aloft as the vessel slowed, stopped or went in reverse during hauling.

56. The Working Group noted that the *Insung Ho* was non-compliant with the prohibition of offal discharge during shooting and hauling in Subarea 48.3 as prescribed in Conservation Measure 25-03 on 10 occasions (5.9%). Observer reports also indicated a failure to comply with deck lighting restrictions on board three vessels. The Working Group noted that no information on mitigation measures was recorded on the *Sil* (Table 10).

57. The consistency of reporting on the adoption of mitigation measures in the icefish trawl fishery varied considerably. The Working Group recommended changes to the observer logbook to improve the collection of these data (paragraphs 120 to 124).

58. Only a single seabird mortality was recorded during net shooting in the icefish fishery in Subarea 48.3. The Working Group recalled reports of the effective use of net binding to reduce seabird interactions with trawl nets in the *Champsocephalus gunnari* fishery in Subarea 48.3 (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraph 207; 2004/05 Cruise Reports). Preliminary trials conducted in 2004 and two subsequent seasons of operational experience indicate that binding the net is a highly effective and easily accomplished mitigation measure. There is increasing evidence from observer reports and anecdotal information from fishing companies and technical coordinators (Mr Heinecken and Dr D. Agnew, UK) that in combination with net cleaning and weighting, net binding may be largely responsible for reductions in seabird mortality during shooting operations.

59. The Working Group strongly recommended the use of net binding in the *C. gunnari* fishery in Subarea 48.3, and other pelagic trawl fisheries in the Convention Area, as appropriate. The following guidelines are provided to assist in a uniform uptake of this mitigation measure:

(i) When the net is on the deck, prior to shooting, the application of 3-ply sisal string (which typically has a breaking strength of around 110 kg), or a similar inorganic material, at intervals of approximately 5 m prevents the net from spreading and lofting at the surface. Net binding should be applied to mesh ranging from 120–800 mm. These mesh sizes have been shown to cause the majority of entanglements for white-chinned petrels and black-browed albatrosses, which are the most vulnerable species to this form of mortality in Subarea 48.3.

(ii) When applying the 'string', tie an end to the net to prevent the string from slipping down the net and ensure that it can be removed when the net is hauled.

(iii) Added weights to the codend should be used in conjunction with net binding to increase the sink rate of the net and increase the angle of the net's ascent during hauling, therefore reducing surface net time.

(iv) Net cleaning should be used in conjunction with added weight and net binding to reduce seabird captures during shooting operations.

60. The Working Group recommended that an advisory note be added to Conservation Measure 42-01 to assist in the uptake of this mitigation measure. Accordingly, the Working Group recommended that Conservation Measure 42-01 be revised as follows:

Add the following sentence to 'mitigation' paragraph 7:

Vessels are encouraged to use net binding as a means to reduce seabird interactions. See SC-CAMLR-XXV, Annex 5, Appendix D, paragraph 59 for guidelines for net binding.

61. The Working Group will review the use of net binding to assess the efficacy of this mitigation measure in all pelagic trawl fisheries.

62. The Working Group noted that no information is currently collected about seabird interactions with trawl warp cables. The Working Group strongly recommended that data be collected to assess and evaluate the nature and extent of such interactions. Data collection protocols, revisions to observer logbooks and cruise reports have been developed and will be incorporated by the Secretariat for 2006/07 fisheries (paragraphs 74, 122 and 123).

General

63. The Working Group reflected that the ongoing success in minimising and mitigating by-catch of seabirds in longline fisheries in the Convention Area has resulted from an ongoing and adaptive approach to application of mitigation measures. The success and uptake of this approach has been contingent on the sustained very high level (100%) of observer coverage in the Convention Area.

Incidental mortality of seabirds outside the Convention Area

Longline

New Zealand

64. Dr S. Waugh (New Zealand) noted that in New Zealand fisheries in 2003/04, observers reported the capture of the following seabird species that breed in the Convention Area: black-browed albatross (1), light-mantled albatross (1), grey petrel (3) and white-chinned petrel (4) caught in tuna longline fisheries, white-chinned petrel (31), Cape petrel (1) in autoline fisheries for ling. An additional 37 seabird captures of unidentified species were recorded by observers. Where estimation of total captures was possible, 514 seabirds were estimated in 2003/04 New Zealand longline fisheries.

65. For 2004/05 New Zealand fisheries, observers reported the capture of the following seabird species that breed in the Convention Area: grey petrel (2), white-chinned petrel (3) and southern giant petrel (2) caught in tuna longline fisheries, white-chinned petrel (10), grey petrel (1) and common diving petrel (1) caught in ling autoline fisheries, an additional 160 seabird captures of unidentified species were also reported. Where estimation of total captures was possible, 329 seabirds were estimated in the 2004/05 New Zealand longline fisheries.

Other areas

66. No other Members reported on longline seabird by-catch from outside the Convention Area.

Trawl

New Zealand

67. Dr Waugh reported that for observed trawl fisheries in New Zealand for 2003/04, estimated total captures of seabirds were 338 birds (34% CV) in hoki trawl fisheries and 845 birds (8% CV) in squid trawl fisheries. An additional 190 unidentified seabirds were recorded by observers. For 2004/05 there were 395 birds estimated caught (23% CV) in hoki trawl fisheries and 1 454 birds (7% CV) in squid trawl fisheries, with an additional 77 unidentified seabirds.

South Africa

68. Mr Heinecken reported on WG-FSA-06/41 which provided estimates of the incidental mortality of seabirds in South Africa's deep-water hake trawl fishery. Observations of seabird interactions with gear were made on 331 trawls during 20 trips on 14 vessels between mid-2004 and the end of 2005. Shy and black-browed albatross were killed most frequently and low numbers of white-chinned petrels, Cape gannets and sooty shearwaters were also killed. Mortalities were greater in winter, when more seabirds attended fishing vessels, primarily when offal was being discharged. The total extrapolated annual seabird mortality was approximately 18 000 (95% CI 8 000–31 000), of which 85% were killed on trawl warp cables and 15% entangled in nets. Of the birds killed, approximately 5 000 (95% CI 3 000–12 500) were black-browed albatrosses. Based on satellite-tracking data, these birds are likely to be predominantly Convention Area birds breeding in South Georgia.

69. The Working Group noted that the data collection protocols for warp cable strikes were similar to those used in the Falkland/Malvinas Islands (WG-FSA-04/79) and New Zealand (WG-FSA-05/41), with the exception that due to closely trimmed warp cable splices resulting in few birds being hauled on board, a new data field was added to estimate the number of birds that were observed to be dragged under water and not to surface. A proportion of these events were verified by post-hoc analysis of video recordings. The Working Group recognised that these estimates were based on a small observed sample and viewed the extrapolation with caution. However, the level of estimated seabird mortality remains a serious conservation concern.

70. As reported in previous studies of seabird mortality associated with warp cable strikes, the highest level of mortality was associated with periods of offal discharge (WG-FSA-04/79 and 05/41). Studies suggest that large-winged birds such as albatrosses and giant petrels (WG-FSA-04/79) are more susceptible to having their wings wrap around warp cables and being dragged underwater. It was noted that in July 2006, streamer lines became mandatory in the South Africa hake trawl fishery, as a means to deter seabirds from warp cable collisions. The Working Group encouraged the development of a more effective and operationally simple design of streamer lines that would be supported by the industry and deployed by the crew.

71. Mr Heinecken noted the cryptic nature of seabird warp-strike mortalities, not normally seen unless specific observations of bird contacts with warps are undertaken. The cryptic nature of this mortality and the need for specifically tasked seabird observers to record and

quantify this type of mortality has been noted in recent years (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraph 211; WG-FSA-04/79 and 05/41). The Working Group re-emphasised the need for effective mitigation of seabird by-catch in trawl fisheries, recommended expanded data collection by dedicated seabird observers to determine the extent of the interaction and noted that restricting offal discharge during trawl operations would significantly reduce the observed by-catch in this fishery.

Development of a trawl warp cable data collection protocol for inside the Convention Area

72. Dr Waugh reported on the development of data collection protocols (WG-FSA-06/62) to record seabird strikes and mortality on trawl warps in the New Zealand squid fishery and on intersessional work (WG-FSA-06/61) to develop a data collection protocol to investigate seabird and warp cable strikes in trawl fisheries in the Convention Area.

73. The levels of seabird mortality of Convention Area seabirds in trawl fisheries in New Zealand and South Africa are a conservation concern. Taken together with the seabird mortalities reported in the *C. gunnari* trawl fishery in Subarea 48.3 this year as well as past years (Table 14), the Working Group reiterated the need to monitor seabird strikes with trawl warp cables in the Convention Area (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraphs 210 to 212).

74. Thus, the Working Group developed forms and a protocol and recommended that they are used in all trawl fisheries in the Convention Area. The objective is to assess the extent of seabird interactions with trawl warp cables in Convention Area fisheries. This would be undertaken in three stages:

(i) document if seabird interactions with trawl warp cables are occurring in the Convention Area fisheries;

(ii) if detected, examine the nature and extent of seabird mortalities, including the vessel type, seabird species concerned and operational factors of the fishery that may contribute to the interactions;

(iii) examine mitigation options to reduce mortality of seabirds in these fisheries.

75. The Working Group recommended that the first stage occur in 2006/07, requiring sampling across a high proportion of vessels and fisheries (paragraphs 22, 25, 27 and 31).

Incidental mortality of seabirds during unregulated longline fishing in the Convention Area

76. As no information is available on rates of incidental mortality of seabirds 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.

77. 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.

78. As no information is available on rates of incidental mortality of seabirds 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 catch 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-XXV/BG/27 and in SC-CAMLR-XXII, Annex 5, paragraphs 6.112 to 6.117.

79. 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 2006 (SCIC-06/9), 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 incidental mortality rates (birds/thousand hooks) for the unregulated fishery are shown below. It should be noted that where incidental mortality 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-XXV/BG/26) has been used.

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
58.4.2, 58.4.3, 58.4.4	Summer	0.27	0.33	0.87
	Winter	0.006	0.006	0.042
88.1, 88.2	Summer	0.27	0.33	0.87
	Winter	Not applicable, access not possible in winter		

80. The estimates of potential unregulated seabird by-catch in the Convention Area in 2004/05 and comparison with estimates for previous years are provided in detail in SC-CAMLR-XXV/BG/27.

81. The estimated total for the whole Convention Area in 2005/06 indicates a potential incidental mortality of seabirds in the unregulated fishery of 4 583 (95% CI 3 756–12 237) seabirds. The values for this and previous years are summarised in respect of different parts of the Convention Area in Table 17.

82. In comparison with estimates for previous years, calculated in identical fashion, the value for 2005/06 is similar to the values estimated for 2003/04 (SC-CAMLR-XXIII/BG/23)

and 2004/05 (SC-CAMLR-XXIV/BG/27). These are the lowest reported values since estimates started in 1996. This presumably reflects a commensurate reduction in toothfish removals or changes in the areas from where IUU fishing occurs.

83. Based on the data since 1996 (SC-CAMLR-XXIV/BG/27), an estimated total of 185 716 (95% CI 151 187–543 319) seabirds have been killed by these vessels. Of these:

(i) 41 590 (95% CI 33 647–131 451) were albatrosses, including individuals of four species listed as globally threatened using the IUCN threat classification criteria (BirdLife International, 2004);

(ii) 7 359 (95% CI 6 011–20 597) were giant petrels, including one globally threatened species;

(iii) 116 478 (95% CI 94 973–333 776) were white-chinned petrels, a globally threatened species.

84. The Working Group also noted that grey petrels, a winter-breeding species that is another globally threatened species, have comprised between 5 and 11% of the catch in the regulated fishery in Division 58.5.1 over the last three years, and that some of the estimated 454 to 1 478 birds taken in the IUU fishery this year may have been of this species. The Working Group undertook to examine methods of estimating the by-catch of this species by IUU vessels within Division 58.5.1 as an intersessional task with a view to assessing the level of take of grey petrels in future years.

85. 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.

86. 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.

87. Many albatross and petrel species are facing potential extinction as a result of fishing operations. The Working Group again requested the Commission to continue to take action to prevent further incidental mortality of seabirds by unregulated vessels in the forthcoming fishing season.

Research into and experience with mitigation measures

Longline

88. Dr G. Robertson (Australia) presented WG-FSA-06/22 and reported results of an experiment on a chartered Spanish system longline vessel to examine a range of factors that affect the sink rate of longlines to improve seabird deterrent capabilities. This work was proposed in 2005 (WG-FSA-05/12; SC-CAMLR-XXIV, Annex 5, Appendix O, paragraphs 65 to 71) and endorsed by the Scientific Committee (SC-CAMLR-XXIV, paragraph 5.16) and the Commission (CCAMLR-XXIV, paragraph 5.1).

89. The research produced a range of recommendations, including a new line-weighting regime, aimed at improving sink rates to depths beyond where seabirds can access baited hooks. As outlined in WG-FSA-05/12, the next steps are to test the new line-weighting regime operationally in 2007 and its effectiveness as a seabird deterrent. The ongoing research will involve comparing the differences in sink rates between traditional Spanish system weights (bags of rocks) and elliptical steel weights. The objective of this trial is to determine the mass of steel weight that will sink gear at the same rate as the traditional weights (8.5 kg at 40 m) in Conservation Measure 25-02. The elliptical steel weights will be smaller and lighter, easier to handle and less likely to snag on the seabed (and hence result in less gear lost and less 'ghost' fishing).

90. Following final stages of research, the Working Group recommended that a suite of best-practice seabird by-catch mitigation measures for Spanish system longline vessels be developed.

91. The Working Group also noted the recommendation in WG-FSA-06/22 that Spanish system vessels could reduce line tension events that occur during setting and can often lead to seabird mortality events by reducing the number of hooks that become snagged on both the setting table and setting boxes. The use of a marine-grade stainless steel to manufacture a steel apron on the setting table and stainless steel sleeves in all hook boxes was considered to be an important step to ensuring the continued high level of performance of Spanish system vessels.

Shinsei Maru No. 3 bottom-line system

92. Based on the requested information received about the *Shinsei Maru No. 3* bottom-line system on the structure of the gear, the weight of line weights, estimated sink rates, and an accounting of any seabird interactions with the gear (WG-FSA-06/15; SC-CAMLR-XXIV, Annex 5, Appendix O, paragraph 81; WG-FSA-05/26), the Working Group determined that the threats to Convention Area seabirds during line-setting operations would be minimal and potentially lower than with the traditional Spanish system. The cruise report noted that no birds were hooked either in line setting or line hauling and a bird-scaring device was used during line hauling.

93. The Working Group noted with interest this gear design and weighting regime and agreed that continued reporting of this methodology would provide valuable information on its performance in relation to seabird by-catch.

94. The Working Group also noted with interest the comparatively high target species catch rates for the *Shinsei Maru No. 3* bottom-line system compared to the traditional Spanish system, although the source of the latter data was not provided in the paper (WG-FSA-06/15).

Integrated weight lines

95. The Working Group noted that previous trials on the sink rate of IWLs had investigated the sink rate of lines with 50 g/m of lead for a range of line diameters (9.0–11.5 mm). But it was noted that at the time of these trials that IWLs were only manufactured by a single company (Fiskevegn). Due to the success of IWLs in reducing seabird mortality and the widespread support for their operational characteristics, several other manufacturers are now producing IWLs.

96. The Working Group agreed that it was critical that IWLs produced by other manufacturers needed to strictly comply with the 50 g/m specification and to ensure that the operational characteristics of IWLs conformed with Conservation Measure 25-02. IWLs that are developed to being greater than 12 mm diameter would need to undergo independent sink rate tests to ensure that they meet the 0.2 m/sec sink rate, as required in Conservation Measure 24-02.

Streamer lines

97. The Working Group noted the recommendation in WG-FSA-06/22 that mechanised streamer line systems could greatly assist in their retrieval and agreed that further research was required into the utility and cost of such systems. Several key characteristics of streamer lines were identified as critical for such trials. These included the length of the mainline, the nature of the tension device (towed object), aerial extent, the material of the mainline and streamers and the attachment position and height.

Streamer lines and integrated weight line

98. Mr E. Melvin (USA) reported on WG-FSA-06/52, which described the results of research comparing the performance of 50 g/m IWLs to unweighted longlines (UWLs) both with and without paired streamer lines (PS) in the 2005 Bering Sea fishery for Pacific cod (*Gadus macrocephalus*). Performance measures included seabird mortality, abundance and behaviour, fish catch rates of target and non-target fish, an assessment of relative sink rates and 2 m access windows, as well as practical matters of relative handling and breaking strength.

99. All mitigation technologies dramatically decreased seabird by-catch rates, while having little to no effect on fish catch rates – target or by-catch species. Mitigation was more effective for surface foraging seabirds (91–100%) than for diving seabirds (79–97%). Shearwater seabird catch rates were significantly less for IWL-PS than for UWL-PS, reducing by-catch rates by 97% compared to no deterrent (UWLs). IWLs and UWL-PS performed

similarly reducing shearwater by-catch rates by 88 and 79% respectively. For surface foragers IWLs, UWL-PS and IWL-PS performed similarly reducing catch by 91, 98 and 100% respectively.

100. The substantial reductions in seabird mortality when using IWLs alone (91% for shearwaters and 88% for surface foragers) occurred despite the lack of a concomitant decrease in seabird attack rate or abundance. The Working Group concluded that attack rates alone are a poor indicator of seabird mortality and consequently a poor measure of success in seabird mitigation research programs. Seabird attack rates on longlines were significantly reduced within 60 m – the aerial extent of streamer lines – when PS were used. Functionally, IWLs reduced the 2 m access window by nearly half compared to UWLs. Sink rates and access windows varied between vessels. This variation was a function of deployment of gear relative to rotation of the propeller and vessel speed.

101. The paper recommended revisions to Conservation Measures 24-02 and 25-02 based on these results. Proposed revisions to Conservation Measure 24-02 included measuring sink rates to a depth of 2 m (in addition to or instead of 10 m or 15 m) and estimating the 2 m access window (seconds to 2 m x speed in m/s) for each set where sink rates are measured. Proposed revisions to Conservation Measure 25-02 included requiring two streamer lines instead of one during line setting and requiring 50 g/m (minimum weighting) IWLs for autoline vessels fishing in the Convention Area.

102. The need for revisions to conservation measures was discussed generally, noting that the number of seabirds taken in the Convention Area, not including the French EEZ, was near zero in 2005/06. However, the Working Group noted that while these findings indicated that the use of two streamer lines and 50 g/m IWLs constituted the best seabird mitigation practice for autoline longline fisheries in Alaska, that the effectiveness of two streamer lines compared to single lines need to be tested in Southern Ocean conditions in a fishery with similar seabird assemblages to those encountered within the Convention Area. This would ideally include a mix of *Thalassarche* and *Diomedea* albatrosses, *Procellaria* petrels and *Puffinus* shearwaters. The Working Group recommended that such tests are conducted.

Sink rates and access windows

103. The Working Group reviewed a data extract from 2005/06 sets with sink rate data for both Spanish gear and autoline vessels to examine sink rates achieved in Convention Area fisheries and to evaluate 2 m access windows relative to the aerial extent of streamer lines. All sink rate data were generated using the 10 m bottle line test – no TDRs were used to measure sink rates in the Convention Area. All autoline sets were made using IWLs, but the Working Group noted one exception. The *Protegat* fishing in Subarea 48.3 was categorised as an autoline vessel by the observer and had IWLs on board, but IWLs were not used and the gear that was set would best be described as Spanish gear (double-line system).

104. The Working Group noted that most sink rates (Figure 1) and streamer line aerial extent estimates (Table 11) greatly exceeded those documented through extensive TDR data collection activities for both IWLs and Spanish system gear. This observation led to questions regarding the methodology by which sink rates and streamer line aerial extent are measured by fishery observers. Estimates of the 2 m access window based on the available

sink rate data yielded a mean of 23 m for IWLs and 20 m for Spanish system gear. Mean streamer line aerial extent was 73 m for IWLs and 84 m for Spanish system gear. The Working Group recommended several observer logbook and cruise report modifications to address these points (paragraphs 118 and 119).

Longline bait

105. Dr T. Micol (France) reported results of a comparison made on board one French vessel on white-chinned petrel responses to treated mackerel baits (spicy) versus untreated baits. The petrels readily consumed all untreated baits. However, birds almost never swallowed treated baits immediately and they sometimes ignored them completely. While preliminary, these results suggest that treated baits could be effective in reducing seabird attacks on longline baits, and consequently reducing seabird capture on baited hooks. The Working Group looks forward to receiving a working paper detailing this research.

Longline hauling

106. Given that 32 birds were observed caught and uninjured during the haul, compared to a single mortality during line setting (WG-FSA-06/36 Rev. 2, Table 2), the Working Group reiterated that priority should be given to reducing the number of birds caught during line hauling (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraphs 11 and 84 to 86). Conservation Measure 25-02, paragraph 8, requires that a device designed to discourage birds from accessing baits during line hauling be used in high-risk areas for seabirds (Subareas 48.3, 58.6 and 58.7 and Divisions 58.5.1 and 58.5.2).

107. The Working Group noted that it was not possible to develop prescribed standards for the refinement of Conservation Measure 25-02 (SC-CAMLR-XXIV, Appendix O, paragraph 84), as the level of detail reported by observers on the design of devices currently used was insufficient to determine the most appropriate device to recommend. The Working Group recommended that the observer logbooks be updated to collect the required information in the 2006/07 season. Recommended changes were provided to the Secretariat (paragraph 120).

Longline hauling mitigation measures

108. A total of 312 birds were reported caught and released alive during line hauling operations in the 2005/06 season in Subareas 48.3, 48.4, 58.6 and 58.7 and Division 58.5.1 (WG-FSA-06/36 Rev. 2, Tables 2 and 6.1). In all the other areas where longline fishing operations occurred no birds were caught while hauling. No haul mitigation measures were reported for Subarea 58.6 and Division 58.5.1 where 280 of the 312 seabirds were caught during hauling.

109. For areas where haul mitigation measures were reported, the catch rates (birds/thousand hooks) for Subareas 48.3 and 48.4, and the South Africa EEZ areas (Subareas 58.6 and 58.7) were 0.003, 0.005 and 0.015 respectively.

110. A comparison of the catch rate by gear type indicates 0.001 birds/thousand hooks for autoline gear and 0.004 birds/thousand hooks for Spanish system gear.

111. Haul mitigation devices were reported in use at the hauling station for 78 to 100% sets (paragraph 22). Three haul mitigation designs were described in the observer reports:

(i) A single boom extending 3–5 m perpendicular from the side of the vessel, approximately 1–2 m aft of the hauling station. From the end of the boom, a single line was suspended with a buoy attached to the end of the line so that it just touched the water surface. With the rolling of the vessel, the buoy swung around in an erratic manner in front of the hauling station. The movement and size of the buoy distracted and scared any birds approaching the 'swing' area of the buoy.

(ii) A single boom extending 3–5 m perpendicular from the side of the vessel, approximately 1–2 m forward of the hauling station. From the boom, multiple sets of paired streamers were attached that reached down to the surface of the water.

(iii) A 'Brickle curtain', consisting of two booms, approximately 6 m in length, that extend out over the water ahead and aft of the hauling station. A rope was extended from the rail to the end of the first boom, across to the end of the second boom and back to the rail on the other side. Long bright orange streamers suspended from this rope at short (approximately) half a metre intervals that hung down into the water. Weights were attached to the ends of the streamers so that they extended below the surface of the water. The overall effect was a curtain of streamers that completely enclosed the line-hauling point. The device reportedly proved to be extremely effective in deterring birds from approaching close to the hauling point. However, a number of disadvantages to this system were noted. The close proximity of the streamers resulted in them getting tangled and hooked on exposed hooks on the line being retrieved. The resultant procedure of having to retrieve the system to unhook the line and then re-deploy it resulted in the crew becoming more and more reluctant to keep it in place. One vessel used three booms and the curtain of streamers extended down the starboard side of the vessel from a point forward of the hauling station to the stern.

112. A fourth system described where no birds were caught was a 'moon pool' where the line was hauled inside the vessel and not exposed on the surface outside the vessel.

113. The Working Group noted that the use of a moon pool poses the optimum mitigation efficacy against catching birds while hauling. From the results where seabirds were caught, the Brickle curtain was the most effective mitigation described. The single boom and suspended buoy was the least effective measure. It also noted that the greatest numbers of birds were caught during the southern summer season (September to April) in Subareas 58.6/58.7 (South African EEZ) where the single boom/buoy technique was used.

114. The Working Group noted that the Brickle curtain is a highly effective haul mitigation device for longline vessels. The Working Group encouraged technical coordinators to instruct observers to collect information on haul mitigation devices used in the Convention Area.

Trawl

115. WG-FSA-06/41 did not report data on mitigation trials; however, the authors reported that a pair of short streamer lines set over the warps in initial trials prevented seabirds from entering the danger zone where warps enter the water. Their use was recommended based on these initial trials and subsequently became a permit requirement starting in the second half of 2006. The authors also suggested that vessels should manage offal discharge to minimise seabird interactions.

General

116. The Working Group noted the need for seabird mitigation research to explore effects on target species and the by-catch of other taxa of new and additional mitigation measures.

Observer data collection

117. The Working Group reviewed data collection needs relative to several areas of seabird interactions and mitigation and proposed additions or changes to logbooks and cruise reports.

Longline

118. A review of sink rate data from the fishery for both Spanish gear and autoline gear (WG-FSA-06/38, Table 6) suggested that additional data would be useful to interpret anomalously high sink rates especially with Spanish longline gear. The Working Group suggested simple additions to the logbook to indicate the placement of bottle test attachment lines relative to added weights, how gear is set relative to the direction of the propeller, and if weight spacing during a bottle line test matches the spacing used typically during fishing.

119. As with sink rate data, aerial extent data on streamer lines varied greatly (Table 11), suggesting that instructions to fishery observers could be improved. Consequently, the cruise report illustration of aerial extent was revised to better match the illustration in Conservation Measure 25-02. Form modifications were developed to allow information to be collected on the distribution of streamers along the aerial extent of the streamer line. Details were provided describing how to better estimate the placement of streamer lines relative to the entry point of the hookline. In addition, specific instructions will be provided to technical coordinators on collecting these data where night-time setting is required.

120. Recognising that for the past two years most seabirds were caught during the haul and unspecified haul mitigation is being used in the Convention Area, data fields were added to the cruise report to improve reporting of haul mitigation being used in the Convention Area.

Trawl

121. To address the extent to which net binding is used during the shot, specific data fields were added to the logbook to indicate when net binding is used, if the most hazardous meshes are bound, and to report the spacing and nature of binding materials being used. In addition, data fields were added to allow observers to better determine if net sonde cables are being used. Changes include a specific illustration to help differentiate between paravanes and net sonde cables.

122. Several papers in recent years have documented the cryptic nature of seabird warp strikes, which can result in high levels of seabird mortality in trawl fisheries outside the Convention Area. The papers included protocols to measure these interactions and described methods to mitigate them (WG-FSA-03/91, 04/79, 04/46, 05/36, 05/41, 05/46, 05/P8, 06/41 and 06/61). The Working Group suggested that a warp-strike interaction protocol be developed for Convention Area trawl fisheries (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraphs 212 and 215). This protocol was developed intersessionally by the Working Group and was incorporated into scientific observer data collection instructions by the Secretariat during the meeting to allow data to be collected beginning in the 2006/07 fishery. The protocol includes collecting behavioural data on four classes of seabirds (albatrosses, giant petrels, white-chinned petrels and other petrels) and data on the abundance of total seabirds in a specified area near a warp, as well as selected operational data designed to explain the nature and extent of warp interactions.

123. The data collected by scientific observers using the protocol will be reviewed by the Working Group in 2007 to assess the threat posed by trawl warp strikes in the Convention Area and to determine if targeted mitigation methods need to be developed.

124. To improve the ability of the Working Group to assess seabird mortality reporting during trawl hauls, the current data collection protocol was augmented to include the extent to which the haul was monitored and to record seabirds found on warp cables.

Research into the status and distribution of seabirds

125. ACAP addresses all Procellariiform seabirds occurring in the Convention Area. ACAP was requested in 2005 to submit summary information detailing the population trends of albatrosses and petrels (SC-CAMLR-XXIV, Annex 5, paragraph 7.37), and this information was provided in WG-FSA-06/40. Summarised assessments of the population status and trends of the ACAP-listed species were provided to the meeting from which it is evident that for populations for which data are available:

(i) population size estimates of high–medium quality are available for 68% of all populations, 32% of populations having either low quality or no estimates of population size;

(ii) population trend information is only available for 40% of all populations of ACAP-listed species. For the populations for which trend data are available, 27% are increasing, 30% are stable and 43% are declining;

(iii) the availability of vital demographic parameters for these populations remains limited, with estimates of adult survival available for only 18% of populations, and immature recruitment/survival available for only 11% of populations;

(iv) overall, the level of information on population status and trends is limited for the *Procellaria* petrel group.

126. The report from ACAP (WG-FSA-06/40) outlined a proposal for the development of Species Conservation Assessments for all ACAP-listed species. These assessments would include a basic description of each species including such information as taxonomy, breeding locations, foraging distribution and overlap with fisheries. These data would include summaries of known threats at each breeding site, current population sizes and population trend data. It was proposed that these Species Assessments would be web-based and housed on the ACAP website, and thereby readily available for consideration by CCAMLR Members. Consideration of this proposal will be progressed at the ACAP Meeting of Parties to be held in New Zealand in November 2006. The Working Group was encouraged by the proposal for Species Conservation Assessments and agreed they would be useful for WG-IMAF's work.

127. Dr Waugh reported on the progress of the ACAP Breeding Sites Working Group. The group is actively collating site data, as well as developing assessments of land-based threats and best-practice island management guidelines.

128. WG-FSA-06/12 reported the results of a comparison in 2002 of census methods for black-browed albatrosses at the Ildefonso archipelago, a major breeding site for this species of albatross. Of the methods tested – ground-truthed air photography, boat-based photography, ground counts, point distance sampling and quadrat sampling – air photography was considered to be the most accurate method for this breeding site. Compared to air photography the other methods underestimated mortality by 9–55%. Air photography yielded a total of 47 000 breeding pairs of black-browed albatrosses at Ildefonso, representing the fourth largest population of this species of albatross in the world.

129. Dr Micol reported on preliminary results of a study that assessed the possible impact of longline fishing on the population dynamics of white-chinned petrels on the Crozet Islands. The breeding population on Crozet archipelago was found to be 35 000–51 000 pairs, an estimate extrapolated from surveys conducted on Possession Island. The comparison of the breeding population of white-chinned petrels on Possession Island between 1983 and 2004 indicated a decline of 41% in 20 years, at an annual rate of decrease of 2.6% per year. Modelling analysis showed that this decline was attributable both to environmental factors and to fisheries. More detailed results, including Kerguelen data, will be submitted to the next meeting of WG-IMAF.

130. The distribution of southern and northern giant petrels foraging from Macquarie Island was examined via satellite telemetry during the 2005/06 breeding season (WG-FSA-06/49). Four adults and two fledglings of each species were tracked and the time spent in CCAMLR areas was assessed for each species. Adult southern giant petrels, tracked during their incubation phase, spent 37% of their time at sea in Division 58.4.1, and 14% in Subarea 88.1. Adult northern giant petrels, tracked during chick rearing, spent less time in CCAMLR waters, only traversing waters in Division 58.4.1. Both southern and northern giant petrel fledglings traversed the Pacific Ocean, travelling east towards the South American

Continental Shelf. Southern giant petrel chicks took a more southerly route, traversing Subareas 88.1 and 88.2 along this course, while the more northerly route taken by the northern giant petrel fledglings did not take them through CCAMLR waters. This new distribution data was welcomed by the Working Group and was incorporated into the assessments of risk for CCAMLR subareas (SC-CAMLR-XXV/BG/26).

Incidental mortality of seabirds in relation to new and exploratory fisheries

Assessment of risk in CCAMLR subareas and divisions

131. 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 increases in seabird incidental mortality.

132. 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.

133. Comprehensive assessments of 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 (SC-CAMLR-XXV/BG/26).

134. This year additional information from a satellite-tracking study was provided on the at-sea distribution of southern and northern giant petrels that breed on Macquarie Island (WG-FSA-06/49). A CCAMLR observer report from a fishing cruise in Subarea 48.6 provided valuable distributional data on grey petrel, great shearwater, sub-Antarctic skua and southern fulmar from this infrequently visited area (Elcimo Pool, unpublished CCAMLR observer report, *Shinsei Maru No. 3*, 19 December 2005 to 3 April 2006). A record of Buller's albatross from this area was not considered at this stage because of concerns that this subarea was well outside the known distribution of this species. The revised assessments incorporating new information made available at the meeting (with changes/additions underlined) have been issued as SC-CAMLR-XXV/BG/26.

135. The Working Group noted a tabled description of the WG-IMAF risk assessment (WG-FSA-06/33) that represented progress towards full documentation of the process used for defining risk ratings within the Convention Area. This description identified several key data types used in the risk assessment (breeding distributions, and inferred and known foraging ranges of seabird species and their threat status). The process includes precautionary approaches in the face of data gaps, assignment of appropriate mitigation measures through specification of conservation measures, and the use of an expert group with a diversity of expertise in seabird population ecology and mitigation and operational aspects of fisheries.

136. The Working Group discussed whether seabird mortality information should be added to the assessments. It was considered that the current information described adequately the intrinsic risk to seabirds of fishing activities within a prescribed area. This rating would be

valid irrespective of fishing practice and changes in operation that might occur through time. Therefore the assessments provided a baseline against which relative risk and appropriate mitigation response by fisheries could be measured.

137. The Working Group considered that it would useful to develop this paper further, with a view to making the methodology and approaches more accessible to groups outside CCAMLR seeking to undertake similar processes, particularly those with fishery management responsibilities where Convention Area seabirds are taken outside the Convention Area. This would be developed intersessionally by the Working Group. Links to the ACAP Seabird Bycatch Working Group were identified as a key to coordination and dissemination of effective seabird by-catch management into other international regional fora.

New and exploratory longline fisheries operational in 2005/06

138. Of the 39 proposals last year for new and exploratory longline fisheries in seven subareas and divisions, only 22 were actually undertaken (SC-CAMLR-XXV/BG/1 Rev. 2).

139. One white-chinned petrel in Division 58.4.3b was the only reported incidental seabird mortality in new and exploratory fisheries in 2005/06 (paragraph 11). Clearly, the strict adherence to the specific requirements set out in Conservation Measures 24-02 and 25-02 with respect to line-weighting regimes, combined with fishing in areas of average-to-low and average risk, has proven successful in achieving zero or extremely low by-catch of seabirds.

New and exploratory longline fisheries proposed for 2006/07

140. The assessment of the risk to seabirds posed by new and exploratory longline fisheries in the Convention Area is incorporated into the revised assessment in SC-CAMLR-XXV/BG/26 (an update of SC-CAMLR-XXIV/BG/26) and summarised in Figure 2 and Table 18, and also includes an assessment of recommended levels of observer coverage.

141. Forty-one applications for exploratory longline fisheries, submitted by 12 countries, were received by CCAMLR in 2006. No applications for new longline fisheries were received. The areas for which these proposals were received were:

Subarea 48.6	Japan, Republic of Korea, New Zealand, Norway
Division 58.4.1	Australia, Republic of Korea, Namibia, New Zealand, Spain, Uruguay
Division 58.4.2	Australia, Republic of Korea, Namibia, New Zealand, Spain, Uruguay
Division 58.4.3a	Japan, Republic of Korea, Spain
Division 58.4.3b	Australia, Japan, Republic of Korea, Namibia, Spain, Uruguay
Subarea 88.1	Argentina, Republic of Korea, New Zealand, Norway, Russia, South Africa, Spain, UK, Uruguay
Subarea 88.2	Argentina, New Zealand, Norway, Russia, Spain, UK, Uruguay.

142. 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-XXV/BG/26. 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 2006, is set out in Table 19.

143. Applications fell into two categories:

(i) Those that provided sufficient information to indicate that the proposals fully comply with relevant seabird by-catch minimisation conservation measures (Conservation Measures 24-02 and 25-02, and the relevant measures in the 41-series) and do not conflict with the IMAF assessment. Applications submitted by Australia (CCAMLR-XXV/18), Japan (CCAMLR-XXV/19), Namibia (CCAMLR-XXV/21), New Zealand (CCAMLR-XXV/22), Norway (CCAMLR-XXV/23), Russia (CCAMLR-XXV/24), South Africa (CCAMLR-XXV/25), Spain (CCAMLR-XXV/26) and the UK (CCAMLR-XXV/27) were assessed as being fully compliant.

(ii) Those that contain insufficient information to be certain that the proposals fully comply with relevant seabird by-catch minimisation conservation measures, but which express sufficient sentiment to indicate that this is the intention. Applications by Argentina (CCAMLR-XXV/17), Republic of Korea (CCAMLR-XXV/20) and Uruguay (CCAMLR-XXV/28) fall into this category.

144. Applications in the second category usually state intent to comply with relevant conservation measures but then indicate elsewhere that their fishing plans do not comply. Typical examples include:

(i) fishing seasons simply stated as '2005/06', and not acknowledging that seasonal restrictions apply to some of the divisions and subareas;

(ii) stating an intent to fish outside fishing seasons without seeking a derogation by meeting the line sink rate requirements prescribed in Conservation Measure 24-02;

(iii) stating an intent to fish during the day without seeking a derogation from paragraph 4 of Conservation Measure 25-02 through implementation of the provisions of Conservation Measure 24-02;

(iv) stating an intent to have only one observer on board the vessel in areas where two are required.

145. The Working Group welcomed the improvements in notifications this year and in particular that only three (25%) of the notifications were now assessed in the insufficient information category compared with six (46%) in 2005. Members were requested to take greater care in future submissions to ensure the intent to comply with relevant seabird by-catch measures was clear.

146. Members who have submitted applications falling into the second category should be requested to confirm with the Secretariat that their proposals fully comply with relevant seabird by-catch minimisation conservation measures and do not conflict with the IMAF assessment for the subareas and divisions in which they wish to fish.

147. In 2005 the Working Group developed a checklist to assist Members when completing their notifications (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraph 193). The Secretariat used this information in developing a pro forma and checklist to assist Members in fulfilling notification requirements in 2006. The Working Group welcomed CCAMLR-XXV/29 which proposes further improvements to this approach and should improve the information available to the Working Group in future. The Working Group recommended that the one-page summary of notifications should also include a four-part checklist to address Members' intentions to:

(i) comply with the requirements of Conservation Measure 25-02 in order to minimise seabird by-catch;

(ii) comply fully with measures specified in Conservation Measure 24-02 if an exemption is sought from setting longlines at night, or fish outside specified fishing seasons (if applicable);

(iii) comply fully with measures specified in Conservation Measures 41-04, 41-05, 41-06, 41-07, 41-09, 41-10 and 41-11 (as applicable to the relevant subarea or division) if specified seabird by-catch levels are reached when fishing during daytime setting and/or fishing outside normal fishing seasons;

(iv) comply with scientific observer requirements specified in Conservation Measures 41-04, 41-05, 41-06, 41-07, 41-09, 41-10 and 41-11.

148. Setting of longlines within the Convention Area during daylight hours or outside normal fishing seasons 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 reiterated its recommendation 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 in previous years.

International and national initiatives relating to incidental mortality of seabirds in relation to longline fishing

ACAP

149. Mr W. Papworth provided an update on recent developments within ACAP. The second meeting of the Advisory Committee of ACAP was held in Brasilia, Brazil, from 5 to 8 June 2006. The meeting was preceded by workshops of the Breeding Sites Working Group and the Status and Trends Working Group. Six Parties were represented: Australia, Chile, France, New Zealand, South Africa and the UK. In addition, two Signatory States: Argentina and Brazil; one range State: the USA; and BirdLife International were represented. During proceedings, Argentina announced that its Government had ratified the Agreement; bringing the total number of ACAP Parties to 10. Brazil also notified the meeting that its ratification

process was well advanced and that it expected this would be completed by the second Meeting of the Parties in November this year. A full report of the meeting is available at www.acap.aq/.

150. Items of particular relevance to CCAMLR included:

(i) the review of data relevant to assessments of status and trends of albatross populations by the ACAP Status and Trends Working Group (WG-FSA-06/40);

(ii) development of a database by the Working Group on Breeding Sites for the collection and collation of data on breeding sites of ACAP species, including management activities and threats present at the sites. Analyses are proposed to contribute to the reporting format of the Status and Trends Working Group;

(iii) the establishment of a Seabird Bycatch Working Group (SBWG) to address issues related to fisheries interactions;

(iv) advice from ACAP's Taxonomic Working Group that available data do not warrant the recognition of Gibson's and Antipodean albatrosses or Buller's and Pacific albatrosses at the specific level, and to adopt a subspecific nomenclature for these taxa; and that data suggest shy and white-capped albatrosses are divergent and diagnosable and therefore warrant recognition at the specific level.

151. There was a substantial discussion on the incidental mortality of albatrosses and petrels in fisheries and how to further action that would improve the conservation status of seabirds that breed and forage in the Convention Area. The Working Group agreed that ACAP Parties and CCAMLR Members should be proactive in engaging with RFMOs and in promoting information exchange and strengthening their input into RFMO meetings by including seabird experts on Member State delegations. It was also agreed that a critical role of Parties and Members was to become involved in the development and implementation of seabird resolutions and other measures to reduce by-catch of albatrosses and petrels within RFMO jurisdictions. Further, Parties and Members should take steps beyond the current scope of IPOA-Seabirds and NPOA-Seabirds or similar plans should be developed for fisheries with a known seabird by-catch problem and assessments conducted for all other fisheries operating within their EEZs.

Relationship between CCAMLR and ACAP

152. ACAP's recently established SBWG was still seeking to agree to terms of reference and associated strategy. The Working Group agreed that it would be beneficial if WG-IMAF and SBWG maintained a close cooperative relationship, particularly with respect to technology transfer of best-practice mitigation measures. The work of both groups was seen as complementary. It was noted that many of the WG-IMAF members were also members of SBWG, and it would be useful to consider conducting frequent technical workshops around the WG-IMAF/WG-FSA meeting to ensure the best-practice measures developed by CCAMLR over the last 10 years can be readily transferred to other fisheries where Convention Area birds are currently being impacted by fisheries interactions.

FAO IPOA-Seabirds

153. The Secretariat reported on intersessional advice reporting further substantial progress in the development of the Chilean and Brazilian NPOA-Seabirds. Brazil had informed CCAMLR that in June 2006 it had finalised its NPOA-Seabirds and had begun implementing elements of the plan. The plan's main objective is to reduce seabird by-catch in Brazilian waters and to protect breeding colonies of Procellariiformes. Actions have already been developed to achieve the objective, including research on seabird by-catch and development of new technologies to avoid the by-catch. The Brazilian Government is promoting tests of seabird by-catch mitigation measures and awareness of the fishing sector with fishing practices compatible with seabird conservation.

154. Chile informed the Secretariat that the Chilean Subsecretary of Fisheries had begun the process of public consultations required to adopt the Chilean NPOA-Seabirds.

155. South Africa advised that, unfortunately, there had been not much progress achieved this year on the finalisation of the South African NPOA-Seabirds. The Working Group was also informed that Uruguay was in the early stages of developing a draft NPOA-Seabirds.

156. It was noted that there were now a number of NPOA-Seabirds developed and that the standard of these documents varied considerably. Dr B. Sullivan (UK) informed the meeting that guidelines for a model or best-practice NPOA had been developed by BirdLife International with the intent of strengthening the implementation of IPOA-Seabirds and securing support of national governments and RFMOs for this initiative at FAO. The Working Group supported this initiative and recommended its support by CCAMLR and CCAMLR Members at COFI-27.

Other international organisations and initiatives,
including non-governmental organisations

157. The Working Group was informed that the 4th International Fishers' Forum would be held in Costa Rica in November 2007. The Working Group hoped that the forthcoming meeting would continue the trend of previous meetings and provide outreach to fishers and encouragement to take practical steps to greatly reduce interactions with seabirds.

158. Mr Melvin provided information on a pelagic mitigation workshop that he will hold on 15 October 2006. The meeting had been set up to take advantage of the expertise present at the WG-IMAF meeting to assist in refining an experimental program for pelagic fisheries. The Working Group recalled previous advice to the Scientific Committee that many of the seabirds breeding in the Convention Area were being impacted by pelagic tuna fisheries that operate in the migratory ranges of these seabirds (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraph 63). Development of mitigation measures for pelagic longline fishers, although not of direct relevance to Convention Area demersal longline fisheries, was therefore still considered a high priority and encouraged the participation at the workshop of all WG-IMAF members.

159. Dr Sullivan updated the Working Group on the implementation of the BirdLife International Albatross Task Force, formerly known as Operation Ocean Task Force (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraph 154), which works at sea and in

onshore workshops to demonstrate the adoption of mitigation measures, and to collect baseline by-catch data, where required. The Task Force currently has three full-time mitigation instructors working in South Africa, two focusing on pelagic longline fisheries and one on the hake trawl fishery. There are also two employees working in pelagic fisheries in Brazil. There are also plans to have two people based in Chile by the end of 2006, and negotiations are under way to have a further four to six people working in South America and southern Africa in 2007/08.

RFMOs, tuna commissions and international governmental organisations and implementation of Resolution 22/XXIII

160. At the Twenty-third Annual Meeting of the Commission, CCAMLR adopted Resolution 22/XXIII seeking international actions to reduce the incidental mortality of seabirds arising from fishing. This resolution followed from great concern that, even though seabird by-catch had been substantially reduced within CCAMLR fisheries through implementation of conservation measures, populations of seabirds that breed and forage within CCAMLR waters continue to be threatened by IUU fishing and in trawl and longline fisheries in waters outside the Convention Area.

161. In particular, the resolution urges Members that are also members of other RFMOs to identify those mitigation measures that would be most effective at reducing or eliminating such mortality and to require such measures to be implemented in the relevant fisheries.

162. Appreciable progress had been made in terms of communication on seabird by-catch issues with RFMOs (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraphs 161 to 168) as reported below.

CCSBT

163. No data were reported to CCAMLR this year. However, Mr B. Baker (Australia) reported CCSBT's ERSWG had met in February this year, but the report from that meeting had not been accepted by the CCSBT Commission as yet. The CCSBT Commission meeting was running concurrently with WG-FSA and it was hoped the report from the meeting would be considered at this time, and hence released for consideration by CCAMLR at the soonest possible time.

IATTC

164. IATTC's Stock Assessment Working Group met in the USA from 15 to 19 May 2006 and recommended that IATTC coordinate with WCPFC, and other tuna RFMOs as appropriate, in its implementation of seabird resolutions and the development of scientific information and reports that support this implementation. This could include practical areas of cooperation on the mitigation of seabird by-catch. Further, it also recommended that IATTC should develop, in coordination with the other RFMOs, a strategy to mitigate by-catches in the different fisheries involved. The program should include standardisation of

data collection (whenever possible), discussion of research programs and activities to be undertaken in each, and a mechanism for the timely sharing of results. This item could be included in the agenda of the upcoming meeting in Kobe, Japan.

165. The IATTC's Bycatch Working Group met in the Republic of Korea on 24 June 2006. It noted the following:

(i) Information indicates that longline fisheries in the IATTC area may have both direct and indirect impacts on some seabird populations. The level of the impact is currently not known.

(ii) Remote-tracking data and at-sea observations highlight the importance of the IATTC area for foraging and breeding of waved and Laysan albatrosses, foraging of black-footed and black-browed albatrosses, and several other albatross species from New Zealand which migrate across the Pacific to forage in the Humboldt Current.

(iii) Observer data from US pelagic longline fisheries indicate by-catch of Laysan and black-footed albatrosses in the Northeast Pacific. No comparable data exist from industrial longline fleets in the central and southeast Pacific.

(iv) Plots of seabird distributions overlaid on pelagic longline effort revealed several areas of potential vulnerability to by-catch.

(v) Seabird by-catch mitigation measures have been developed which have effectively reduced seabird by-catch in longline fisheries, and more gear research is ongoing.

IOTC

166. IOTC's Working Party on Bycatch held its second meeting in the Seychelles on 1 August 2006. Prior to the meeting, IOTC had passed a seabird resolution (Resolution 06-04) in June which, *inter alia*, requires the use of tori lines below 30°S, but with an exemption for vessels targeting swordfish using the 'American longline system' (defined as monofilament line plus light sticks). Originally the resolution included prescribed by-catch limits as a performance indicator, but the deletion of this and the exemption of tori lines for swordfish was the result of lobbying by some industry representatives present at the meeting.

167. IOTC's Working Party on Bycatch discussed the resolution and its implications for the work of IOTC. There was general agreement that the derogation for swordfish in the resolution appeared to be scientifically unsupportable and should be removed. BirdLife International presented a paper to the meeting to support removal of the derogation. During the meeting a paper was developed that recommended the introduction of 20% observer coverage over a limited period of two years to assess the observer coverage rates necessary to characterise by-catch in IOTC fisheries in the longer term. However, agreement on the introduction of such a level of cover was not reached.

ICCAT

168. Dr Sullivan noted that ICCAT's Standing Committee on Research and Statistics (SCRS) accepted a UK proposal this year to conduct an assessment of the impact of incidental catch of seabirds resulting from vessels fishing in the ICCAT area. The assessment is called for in ICCAT's seabird resolutions (02-14). The UK's proposal received support from Brazil, the European Community, South Africa, Uruguay and the USA. ICCAT's Commission will address this SCRS recommendation at its annual meeting in Croatia in November 2006. The Working Group agreed that this news was encouraging and demonstrated increased progress with RFMOs actively addressing seabird by-catch.

SEAFO

169. WG-IMAF was informed that the recently concluded meeting of SEAFO had adopted a conservation measure (05/06) requiring the development within one year of effective mechanisms to collect data and report on seabird interactions to the SEAFO Commission. Further, the conservation measure called for all longline vessels operating south of 30°S to use bird-scaring lines, and for all vessels to set lines at night.

WCPFC

170. Dr Sullivan introduced WG-FSA-06/18 reporting on the Second Meeting of the WCPFC's Ecosystem and Bycatch Specialist Working Group, held in August 2006 in Manila, the Philippines. The meeting was presented with a range of discussion papers on ecological modelling and risk assessment for the WCPFC, distributional data from BirdLife International's *Procellariiform* Tracking Database (WG-FSA-06/19; see next paragraph), and mitigation measures available that could assist WCPFC Parties. The WCPFC working group drafted a resolution responding to an earlier WCPFC resolution 2005-01 that will be considered by the WCPFC Commission meeting in December 2006. The new resolution calls on Commission Members, *inter alia*, to require longline vessels to use at least two mitigation measures, one which must include side setting with a bird curtain, night setting or tori lines and one from a recommended suite of measures when operating south of 30°S and north of 23°N. The recommended mitigation measures include weighted branch lines, blue-dyed bait, line-shooters, bait casters, underwater-setting chutes and offal discharge management procedures.

171. The Working Group strongly encouraged Parties to ensure the participation of appropriately experienced mitigation practitioners to contribute to the December 2006 meeting of WCPFC. Their participation would ensure that the most appropriate mitigation measures are considered for adoption for application within WCPFC. Mitigation practitioners within the Working Group could assist in the provision of the appropriate advice.

172. WG-FSA-06/19 provided distributional data from BirdLife International's *Procellariiform* Tracking Database showing the overlap between a number of albatross and petrel species and the jurisdictional area of WCPFC. The *Procellariiform* Tracking Database includes distribution data for Pacific populations of 14 of the 16 albatross species that breed in the region. The WCPFC Convention Area overlaps with 41% of the global breeding

distribution of the 23 species of albatrosses and petrels for which there are data in the database, making it one of the most important RFMOs for albatrosses. Distribution in the WCPFC area is concentrated south of 30°S (mostly below 35°S) and north of 20°N. Some species spend a significant proportion (>40%) of their time in the high-seas areas. Key high-seas areas include the Tasman Sea and areas north of the Hawaiian Islands. The distribution of seabirds in high-seas areas emphasises the importance of WCPFC in bringing about a collaborative approach to reducing seabird by-catch.

173. WG-FSA-06/30 provided additional information on the distribution of albatrosses and petrels overlapping with the WCPFC Convention Area. This information complemented that in WG-FSA-06/19, and was preliminary to developing a risk assessment for the WCPFC fishery.

General

174. The Working Group was encouraged by the progress made by several RFMOs since the last meeting towards the mitigation of seabird by-catch in their fisheries. It noted with satisfaction the considerable progress made at WCPFC, SEAFO, IOTC and ICCAT, and their strong desire to work cooperatively with CCAMLR. However, it was recognised that for pelagic longline gear types in particular, there is at present no best-practice mitigation strategy that has been rigorously tested and available for widespread uptake by the major RFMOs operating to the north of the CAMLR Convention Area.

175. The Working Group expressed concern that some RFMOs may be considering adopting measures such as bait-casting machines, side-setting and deep-setting line shooters on the basis of information that lacked robust evaluation through controlled experiments on their effectiveness to mitigate seabird by-catch on a wide array of species. Development of proven pelagic mitigation measures and their uptake outside the Convention Area should remain a high priority for CCAMLR.

176. The Working Group also noted the high and persistent seabird by-catch outside the Convention Area of species found in the Convention Area. It recommended to the Scientific Committee that the Commission be represented at the January 2007 tuna RFMOs meeting in Kobe, Japan, and that the Secretariat develop a paper describing the scientific and other processes CCAMLR has followed in developing and implementing effective seabird by-catch mitigation measures. That paper would, *inter alia*, emphasise the requirement for extensive and sustained scientific observer coverage in addition to applied and adaptive mitigation research in any effort to reduce seabird mortality associated with fishing operations.

177. The Working Group noted that the successful uptake and transfer of operational and technical mitigation measures refined in the Convention Area, with the concomitant success in reducing seabird by-catch, to other areas and RFMOs is contingent, in part, upon sufficiently adequate levels of observer coverage in those RFMO fisheries such that the nature and extent of seabird by-catch, as well as the effectiveness of mitigation measures, can be accurately monitored.

Fishery reports

178. The Working Group reviewed the fishery reports developed by WG-FSA (Agenda Items 5.1 and 5.2) and the information relating to the by-catch of seabirds and marine mammals contained within the reports.

179. The Working Group updated the fishery reports based on the information contained in SC-CAMLR-XXIV, Annex 5, Appendix O, and the information contained in WG-FSA-06/36 Rev. 2, 06/37 Rev. 1, 06/38 and 06/39 Rev. 1.

180. The Working Group recommended that this process of updating fishery reports continue and noted that this process provided constructive interaction with WG-FSA and contributed to the streamlining of the work of Scientific Committee's working groups.

Streamlining the work of the Scientific Committee

Streamlining of agenda

181. Ad hoc WG-IMAF noted that streamlining its agenda for this year's meeting was a useful step forward. Based on the experiences at this meeting, the Working Group developed additional recommendations for future agenda improvements, including:

(i) update of the risk assessment only when new information is tabled;

(ii) the continued request for compilation of detailed information on various agenda items by ACAP;

(iii) a focus on the impacts of captures and by-catch of Convention Area seabirds and marine mammals outside the Convention Area;

(iv) improved data submission and data compilation prior to the start of the meeting.

182. The Working Group noted that regular review of its agenda and a move to completing some tasks on a biennial and triennial basis where appropriate would allow further streamlining of the agenda in future.

Interaction with WG-FSA

183. The Working Group noted that the current interactions with WG-FSA allowed the transfer of useful knowledge on fishing technologies and practices, ongoing dialogue on matters of mutual interest and a useful element of peer review during meetings.

184. The Working Group therefore agreed that it could conduct its work most effectively if it retained its linkage with WG-FSA.

185. Ad hoc WG-IMAF noted the proposed restructure of WG-FSA (SC-CAMLR-XXIV, Annex 5, paragraphs 14.1 to 14.9) and noted its support for the proposals, along with the need for ongoing dialogue with respect to future change and the content of the research plans of other working groups.

186. With respect to the development of new seabird and marine mammal mitigation devices, ad hoc WG-IMAF recognised that it was important to also consider the impact of such devices on other taxa (paragraph 116). The Working Group requested that where WG-FSA was aware of such interactions, the matter be raised so as to allow cooperative efforts to resolve them in a timely manner.

Interaction with WG-EMM

187. The Working Group noted the shared areas of interest between WG-IMAF and WG-EMM and encouraged ongoing dialogue between the two groups on matters of joint interest (e.g. marine mammal population status, interactions with fisheries).

Future focus of the work of ad hoc WG-IMAF

188. The Scientific Committee established ad hoc WG-IMALF in 1993. In 2001 it decided that its scope should be expanded to cover fishing other than by longlines and the group was renamed ad hoc WG-IMAF. The Working Group noted the very positive results in 2005/06 with respect to seabird and marine mammal by-catch throughout the Convention Area.

189. The Working Group agreed that despite the continuing reductions in by-catch in the Convention Area, there was a need to remain vigilant with our monitoring of by-catch and the implementation of conservation measures and to continue to strive to minimise seabird and marine mammal by-catch in all Convention Area fisheries.

190. Noting that time delays in responding to changing fishery dynamics and by-catch rates could have serious consequences for the conservation of seabirds and marine mammals, and that a biennial meeting of ad hoc WG-IMAF may mean three-year delays between the recognition of a problem and the development of a solution, the Working Group recommended that annual meetings continue.

191. The Working Group noted the opportunity to focus on the by-catch of Convention Area seabirds and marine mammals outside the Convention Area given CCAMLR's responsibility for these Antarctic marine living resources (Convention Article I) and the positive results being obtained within the Convention Area. To date CCAMLR measures and practices have been held up as a role model outside the Convention Area (paragraph 177) and the mitigation measures adopted within the Convention Area have been, or are in the process of being, adopted by neighbouring RFMOs.

192. As a result of the discussions detailed in paragraphs 188 to 191, ad hoc WG-IMAF reviewed its original terms of reference (SC-CAMLR-XII, paragraph 10.19). The Working

Group discussed proposed revisions to the terms of reference and made additional suggestions for consideration during the intersessional period with a view to ad hoc WG-IMAF recommending revised terms of reference in 2007.

Future research plan

193. The Working Group discussed the development of a medium-term research plan for ad hoc WG-IMAF. The Working Group noted that the current agenda required the meeting to be conducted without the benefit of detailed technical discussion of some items due to time constraints and the need to address all agenda items each year (noting that the move to undertaking some agenda items at multi-year intervals may alleviate this problem to some extent in the future).

194. The Working Group recommended the development of a medium-term research plan as an intersessional task for the group.

195. The Working Group noted that in future it may be possible to conduct short workshops in association with the annual ad hoc WG-IMAF meeting to address critical items in the medium-term research plan. The use of invited experts at such workshops was highlighted by the Working Group as likely being crucial to their success. A series of appropriate workshop subjects could be incorporated into the research plan during the intersessional period.

Duration of the meeting

196. Ad hoc WG-IMAF discussed the time required to conduct its core work and noted that at present it required the allotted five days to conduct its work program.

197. The Working Group noted that the revised terms of reference and results of intersessional work were unlikely to allow a reduction in required time in 2007; however, the Working Group indicated its intention to further review the required duration of the meeting in 2007.

Other business

Australian proposal on extending fishing season in Division 58.5.2 for longline vessels

198. Mr Baker and Mr Hay presented and sought advice from the Working Group on an Australian proposal to further extend the fishing season in Division 58.5.2 for longline vessels from the current 1 September to 30 September (Conservation Measure 41-08, paragraph 3) to 1 September to 30 April. If three seabirds are caught during the season extension by a vessel (between 1 September and 30 April), fishing would cease for that vessel.

199. Mr Baker and Mr Hay noted that Australian vessels have been fishing using longlines in the division since 2003 during the specified season, in compliance with the one-month season extension detailed in Conservation Measure 41-08, paragraph 3, since 2005 and to date have only caught one seabird in the fishery.

200. Further, they noted that the same company has been involved in the fishery throughout that period and has been involved in pioneering the development of IWLs.

201. The Working Group noted that in recent years it had only considered such proposals when a detailed technical document in support of the proposed change had been tabled in advance of the meeting (e.g. WG-FSA-04/73 from Australia proposing to undertake daytime setting subject to line-weighting requirements in Division 58.5.2).

202. The current advice for Division 58.5.2 from WG-IMAF (SC-CAMLR-XXV/BG/26) is that it is a Risk Level 4 area (average-to-high risk; prohibit longline fishing within the breeding season of the main albatross and petrel species (September to April) and ensure strict compliance with Conservation Measure 24-02).

203. Accordingly, the proposal appears to be contrary to the current advice of the Working Group. The proponents of the proposal noted that the implementation of a seabird by-catch limit during the extended season effectively means that a seasonal control is redundant (a duplication of measures).

204. The Working Group recalled its previous detailed deliberations on the extension of the fishing season in Subarea 48.3 in 2002 (SC-CAMLR-XXI, Annex 5, paragraphs 6.30 to 6.46) and 2003 (SC-CAMLR-XXII, Annex 5, paragraphs 6.46 to 6.54). A vessel took up the option of commencing fishing during the last two weeks of April 2003. The vessel commenced fishing on 15 April 2003, killed three seabirds on 20 April 2003 and then ceased fishing until the regular fishing season commenced on 1 May 2003 (SC-CAMLR-XXII, Annex 5, paragraph 6.50). With respect to the current proposal, of particular concern is that current mitigation measures are unlikely to adequately mitigate capture of white-chinned petrels during the summer season in higher-risk areas, that where season extensions are under consideration they should be undertaken in a stepwise manner to allow review of results and appropriate responses, that two observers are needed so that seabird mortality limits can be monitored accurately and that a season extension into the austral spring was preferable as white-chinned petrels are less susceptible to by-catch at this time (Nel et al., 2002).

205. The Working Group noted that a three-seabird limit had previously been introduced as a precautionary measure to extend the fishing season for one month in Division 58.5.2 (Conservation Measure 41-08, paragraph 3). However, this did not automatically mean that this was the appropriate mechanism for mitigating incidental seabird mortality in this fishery over an additional seven-month season extension.

206. The current closed season excludes fishing during the periods when local breeding seabirds (black-browed albatross, light-mantled albatross and southern giant petrel) are most active in this area. White-chinned petrels from Kerguelen are also inferred visitors to the area in the breeding season and the species recognised as being most difficult to mitigate against in longline fisheries. The removal in its entirety of a seasonal restriction in this area will allow fishing in the period assessed as having the greatest risk of seabird by-catch (the breeding season).

207. The Working Group noted that the vessel may catch in excess of three seabirds in a single set during the breeding season, as has been observed in other areas of similar risk where fishing has occurred during the white-chinned petrel breeding season. Further, as longline vessels typically undertake several sets before beginning to haul lines, and typically it is only during hauling that seabird mortalities are detected, the potential for a substantial increase in seabird incidental mortality in Division 58.5.2 exists as a result of this proposal.

208. Dr Micol reported observations from the Kerguelen longline fishery (Division 58.5.1) during the 2005 breeding season. From one night's fishing activity (three sets) a total of 41 white-chinned petrels were observed caught by a single vessel with 20 of those seabirds caught on a single set. This autoline vessel used IWLs (50 g/m), withheld offal during line setting, was fishing in full compliance with Conservation Measure 25-02 and also used additional streamer lines. The fishery in Division 58.5.1 is closed from mid-February to mid-March as an additional by-catch avoidance measure, to avoid periods of the year when white-chinned petrel captures have historically been at highest rates.

209. The Working Group noted that even with the use of measures additional to those under Conservation Measure 25-02, there is potential for a single multiple-capture event of more than three seabirds.

210. The Working Group noted that its preference would be for a closely monitored and stepwise roll-back in the season in Division 58.5.2 rather than a one-step move to fishing throughout the year. The Working Group had previously agreed to recommend extensions to the end of fishing seasons (i.e. September) rather than the early part of the season when birds are chick-rearing and risk of capture is higher due to their restricted foraging ranges and added nutritional requirements related to chick rearing.

211. The Working Group noted that the proposal did not contain information that allowed an assessment of the risks that the additional fishing might entail to seabirds, nor how these might be mitigated. It noted that the proposal would involve fishing in the breeding period for several species of seabirds vulnerable to mortality in longline fishing and thus posed much higher risk of seabird mortalities than current fishing outside the breeding season. The Working Group requested more timely and comprehensive information that would allow detailed and specific analysis of the risk of the proposal and how risks could be mitigated. Such information should include:

- an assessment of the likely outcome in terms of bird mortality, including supporting information for that assessment detailing the likely seabird catch rates and totals;

- what additional measures (if any) and their likely efficacy, could be deployed to mitigate the additional risk of mortality to seabirds.

Line sink rate testing proposal for Subarea 48.6

212. CCAMLR-XXV/32, submitted by Japan, requested dispensation from leaving the Convention Area to conduct longline sink rate tests when fishing at the end of one season and into the subsequent season in Subarea in 48.6. The Working Group reviewed the proposal, and noted that as the same vessel, gear and crew would be involved and that the vessel would

have undertaken regular line sink rate testing during the previous season, the proposal did not pose any additional risk to seabirds provided the standard sink rate, as detailed in Conservation Measure 24-02, is achieved.

Management advice

213. Management advice is provided in section 7 of the main text of WG-FSA's report.

References

BirdLife International. 2004. *Threatened Birds of the World 2004*. CD-ROM. BirdLife International: Cambridge, UK.

Delord, K., N. Gasco, H. Weimerskirch, C. Barbraud and T. Micol. 2005. Seabird mortality in the Patagonian toothfish longline fishery around Crozet and Kerguelen Islands, 2001–2003. *CCAMLR Science*, 12: 53–80.

Nel, D.C., P.G. Ryan and B.P. Watkins. 2002. Seabird mortality in the Patagonian toothfish longline fishery around the Prince Edwards Islands. *Ant Sci*., 14: 151–161.

Table 1: Observed incidental mortality of seabirds in the longline fisheries for *Dissostichus* spp. in Subareas 48.3, 48.4, 58.6, 58.7, 88.1, 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3 and 58.5.2 during the 2005/06 season, including related mitigation information. Sp – Spanish method; A – 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 observed (thousands)			No. of birds observed caught[1]						Observed seabird mortality (includes injured birds)[1] (birds/thousand hooks)			Streamer line in use %		Offal discharge during		
			N	D	Total	%N	Obs.	Set	% observed	Dead		Injured		Uninjured		N	D	Total	N	D	Set (%)	Haul	(%)
										N	D	N	D	N	D								
Subarea 48.3																							
Insung No. 22	1/5–18/6/06	Sp	97	0	97	100	242.1	994.7	24	0	0	0	0	0	0	0	0	0	100		(0)	O	(92)
Jacqueline	1/5–26/8/06	Sp	223	0	223	100	474.0	1760.5	26	0	0	0	0	4	0	0	0	0	100		(0)	O	(96)
Argos Helena	1/5–31/8/06	A	266	0	266	100	735.7	2187.0	33	0	0	0	0	0	0	0	0	0	100		(0)	O	(0)
Koryo Maru No. 11	2/5–22/7/06	Sp	156	0	156	100	338.1	1416.7	23	0	0	0	0	7	0	0	0	0	100		(0)	O	(96)
Polarpesca I	12/5–14/8/06	Sp	247	0	247	100	233.2	1278.9	18	0	0	0	0	1	0	0	0	0	99.6		(0)	O	(98)
Protegat	1/5–27/6/06	A	134	0	134	100	175.4	766.1	22	0	0	0	0	5	0	0	0	0	99		(0)	O	(0)
Punta Ballena	15/5–23/8/06	A	97	0	97	100	166.0	718.8	23	0	0	0	0	0	0	0	0	0	100		(0)	O	(0)
San Aspiring	1/5–27/8/06	A	236	0	236	100	770.5	1957.5	39	0	0	0	0	1	0	0	0	0	100		(0)	O	(0)
Viking Bay	1/5–16/8/06	Sp	216	0	216	100	349.1	1200.5	29	0	0	0	0	3	0	0	0	0	100		(0)	O	(100)
Argos Georgia	1/5–31/8/06	A	305	0	305	100	562.8	1835.7	30	0	0	0	0	0	0	0	0	0	100		(0)	O	(0)
Total						100	4046.9	14116.4	28.7							0	0	0					
Subarea 48.4																							
Argos Helena	7/4–15/4/06	A	30	0	30	100	54.3	113.4	47	0	0	0	0	0	0	0	0	0	100		(0)	O	(0)
San Aspiring	10/4–25/4/06	A	41	0	41	100	81.8	208.9	39	0	0	0	0	1	0	0	0	0	100		(0)	O	(0)
Total						100	136.1	322.3	42							0	0	0					
Subarea 48.6																							
Shinsei Maru No. 3	15/4–17/5/06	A	28	33	61	46	139.3	276.2	50	0	0	0	0	0	0	0	0	0	100	100	(0)	O	(0)
Shinsei Maru No. 3	5/1–29/3/06	A	59	125	184	32	346.2	702.1	49	0	0	0	0	0	0	0	0	0	100	100	(0)	O	(0)
Total						36	485.5	978.3	50							0	0	0					
Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b																							
Globalpesca I	22/12–21/2/06	Sp	2	86	88	2	318.5	541.5	58	0	0	0	0	0	0	0	0	0	100	100	(0)	O	(0)
Tronio	15/12–10/3/06	Sp	12	131	143	8	879.4	1848.4	47	0	0	0	0	0	0	0	0	0	100	100	(0)	O	(48)
Globalpesca II	21/12–22/1/06	Sp	0	44	44	0	261.4	422.2	61	0	0	0	0	0	0	0	0	0		100	(0)	O	(0)
Insung No. 2	4/1–4/3/06	Sp	8	104	112	7	683.2	882.5	77	0	0	0	0	0	0	0	0	0	100	100	(0)	O	(0)
Galaecia	2/12–22/2/06	Sp	11	93	104	11	776.7	1305.0	59	0	1	0	0	0	0	0	0.001	0.001	100	100	(0)	O	(81)
Galaecia	5/4–5/7/06	Sp	66	47	113	58	1830.4	1830.4	100	0	0	0	0	0	0	0	0	0	100	100	(0)	O	(0)
Total						16	4749.6	6830.0	70							0	<0.001	<0.001					
Division 58.5.2																							
Janas	25/7–13/9/06	A	92	74	166	55	226.1	744.4	30	0	0	0	0	0	0	0	0	0	100	100	(0)	O	(0)
Janas	7/5–27/6/06	A	64	63	127	50	322.3	923.4	34	0	0	0	0	0	0	0	0	0	100	100	(0)	O	(0)
Total						53	548.4	1667.8	33							0	0	0					
Area 51, Subareas 58.6, 58.7																							
Koryo Maru No. 11	19/2–30/3/06	Sp	68	0	68	100	242.4	676.1	35	0	0	0	0	10	0	0	0	0	100		(0)	O	(100)
Total						100	242.4	676.1	35							0	0	0					

(continued)

Table 1 (continued)

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks observed (thousands)			No. of birds observed caught[1]						Observed seabird mortality (includes injured birds)[1] (birds/thousand hooks)			Streamer line in use %		Offal discharge during	
			N	D	Total	%N	Obs.	Set	% observed	Dead		Injured		Uninjured		N	D	Total	N	D	Set (%)	Haul (%)
										N	D	N	D	N	D							
Subareas 88.1, 88.2																						
Avro Chieftain	2/12–13/1/06	A	0	38	38	0	115.2	232.8	49	0	0	0	0	0	0	0	0	0		100	(0)	(0)
Punta Ballena	2/1–5/2/06	A	0	81	81	0	109.5	538.9	20	0	0	0	0	0	0	0	0	0		100	(0)	(0)
San Aotea II	16/12–16/2/06	A	0	125	125	0	273.7	672.4	40	0	0	0	0	0	0	0	0	0		100	(0)	(0)
San Aspiring	2/12–15/2/06	A	0	93	93	0	295.2	637.8	46	0	0	0	0	0	0	0	0	0		100	(0)	(0)
Viking Sur	6/1–5/2/06	A	0	90	90	0	316.9	425.8	74	0	0	0	0	0	0	0	0	0		100	(0)	(0)
Antartic II	1/12–6/2/06	A	0	119	119	0	496.8	674.6	73	0	0	0	0	0	0	0	0	0		100	(0)*	(0)*
Argos Georgia	15/1–12/2/06	A	0	88	88	0	147.1	325.2	45	0	0	0	0	0	0	0	0	0		100	(0)	(0)
Argos Helena	11/12–10/2/06	A	4	156	160	3	316.0	729.9	43	0	0	0	0	0	0	0	0	0	100	100	(0)	(0)
Frøyanes	8/12–7/2/06	A	3	186	189	2	342.2	796.4	42	0	0	0	0	0	0	0	0	0	100	100	(0)	(0)
Janas	14/12–8/2/06	A	0	117	117	0	234.5	564.5	41	0	0	0	0	0	0	0	0	0		100	(0)	(0)
Volna	17/12–15/2/06	Sp	0	60	60	0	274.2	590.0	46	0	0	0	0	0	0	0	0	0		100	(0)	(0)
Yantar	17/12–15/2/06	Sp	0	66	66	0	116.6	527.8	22	0	0	0	0	0	0	0	0	0		100	(0)	(0)
Paloma V[2]	5/12–11/3/06	Sp	5	128	133	4	525.0	1256.4	41	0	0	0	0	0	0	0	0	0	100	100	(0)	(0)
Total						1	3562.9	7972.5	45							0	0	0				

[1] Bird ‘caught’ as defined by the Commission at CCAMLR-XXIII, paragraphs 10.30 and 10.31.

[2] *Paloma V* also conducted a small amount of fishing in Divisions 58.4.1 and 58.4.3b during this cruise.

Table 2: Extrapolated incidental mortality of seabirds, for those vessels upon which incidental mortalities of seabirds were observed in Division 58.4.3b during the 2005/06 season.

Vessel	Hooks observed (thousands)	Hooks set (thousands)	Percentage of hooks observed	% Night sets	Extrapolated number of incidental seabird mortalities		
					Night	Day	Total
Galaecia	776.7	1305.0	59	11	0	2	2

Table 3: Total extrapolated incidental mortality of seabirds and observed mortality rates (birds/thousand hooks) in longline fisheries in Subareas 48.3, 48.4, 48.6, 58.6, 58.7, 88.1 and 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b and 58.5.2 from 1997 to 2006 (- indicates no fishing occurred).

Subarea	Year									
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Subarea 48.3										
Extrapolated mortality	5755	640	210*	21	30	27	8	27	13	0
Observed mortality rate	0.23	0.032	0.013*	0.002	0.002	0.0015	0.0003	0.0015	0.0011	0
Subarea 48.4										
Extrapolated mortality	-	-	-	-	-	-	-	-	0	0
Observed mortality rate	-	-	-	-	-	-	-	-	0	0
Subarea 48.6										
Extrapolated mortality	-	-	-	-	-	-	-	0	0	0
Observed mortality rate	-	-	-	-	-	-	-	0	0	0
Subareas 58.6, 58.7										
Extrapolated mortality	834	528	156	516	199	0	7	39	76	0
Observed mortality rate	0.52	0.194	0.034	0.046	0.018	0	0.003	0.025	0.149	0
Subareas 88.1, 88.2										
Extrapolated mortality	-	0	0	0	0	0	0	1	0	0
Observed mortality rate	-	0	0	0	0	0	0	0.0001	0	0
Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b										
Extrapolated mortality	-	-	-	-	-	-	-	0	8	2
Observed mortality rate	-	-	-	-	-	-	-	0	<0.001	0.0002
Division 58.5.2										
Extrapolated mortality	-	-	-	-	-	-	0	0	0	0
Observed mortality rate	-	-	-	-	-	-	0	0	0	0
Total seabird mortality	6589	1168	366	537	229	27	15	67	97	2

* Excluding *Argos Helena* line-weighting experiment cruise.

Table 4: Observed incidental mortality of seabirds in the longline fisheries for *Dissostichus* spp. in Subarea 58.6 and Division 58.5.1 within the French EEZ during the 2005/06 season (September–August). A – autoliner; N – night-time setting; D – daytime setting (including nautical dawn and dusk).

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks observed (thousands)			Hooks baited (%)	No. of birds observed caught						Observed seabird mortality (includes injured birds) (birds/thousand hooks)			Streamer line in use %		Offal discharge during haul
			N	D	Total	%N	Obs.	Set	% observed		Dead		Injured		Uninjured							
											N	D	N	D	N	D	N	D	Total	N	D	
Subarea 58.6																						
Ship 3	17/9–3/10/05	A	34	0	34	100	96.7	390.6	24.7	NC	0	0	0	0	1		0	0	0	100	0	0
Ship 7	11/10–13/12/05	A	40	0	40	100	59.7	395.9	15.1	NC	1	0	0	0	0	0	0.0168	0	0.0168	100	0	0
Ship 1	30/10–2/11/05	A	50	0	50	100	74.7	297.5	25.1	NC	3	0	0	0	0	0	0.0401	0	0.0401	100	0	0
Ship 2	14/11–18/11/05	A	30	0	30	100	24.3	119.0	20.4	NC	0	0	0	0	0	0	0	0	0	100	0	0
Ship 11	14/11–25/11/05	A	14	0	14	100	43.0	180.0	23.9	NC	0	0	0	0	0	0	0	0	0	100	0	0
Ship 11	21/12–6/1/06	A	49	0	49	100	91.1	276.0	33.0	81	1	0	0	0	1	0	0.0110	0	0.0110	100	0	0
Ship 7	17/1–18/2/06	A	103	0	103	100	188.5	700.5	26.9	NC	4	0	0	0	22	0	0.0212	0	0.0212	100	0	0
Ship 11	28/1–7/2/06	A	37	0	37	100	53.5	197.0	27.2	NC	2	0	0	0	0	0	0.0374	0	0.0374	100	0	0
Ship 3	2/2–21/2/06	A	43	0	43	100	97.5	405.3	24.1	NC	13	0	0	0	6	0	0.1333	0	0.1333	100	0	0
Ship 1	4/2–25/2/06	A	52	0	52	100	111.2	447.8	24.8	NC	8	0	0	0	7	0	0.0719	0	0.0719	100	0	0
Ship 2	4/2–13/2/06	A	19	0	19	100	41.3	158.4	26.1	NC	0	0	0	0	1	0	0	0	0	100	0	0
Ship 6	5/2–23/2/06	A	45	0	45	100	96.0	393.8	24.4	NC	6	0	2	0	8	0	0.0833	0	0.0833	100	0	0
Ship 5	6/2–25/2/06	A	39	0	39	100	96.1	397.8	24.2	88	3	0	1	0	6	0	0.0416	0	0.0416	100	0	0
Ship 11	16/4–14/5/06	A	92	0	92	100	114.8	461.5	24.9	92	1	0	0	0	1	0	0.0087	0	0.0087	100	0	0
Ship 2	4/5–21/5/06	A	56	0	56	100	80.3	364.7	22.0	NC	0	0	0	0	1	0	0	0	0	100	0	0
Ship 1	22/5–19/6/06	A	76	0	76	100	122.5	527.3	23.2	86	11	0	1	0	0	0	0.0980	0	0.0980	100	0	0
Ship 5	9/6–25/6/06	A	53	0	53	100	96.7	392.4	24.6	NC	0	0	0	0	1	0	0	0	0	100	0	0
Ship 6	17/6–28/6/06	A	43	0	43	100	48.2	193.5	24.9	NC	0	0	0	0	0	0	0	0	0	100	0	0
Ship 3	25/6–28/6/06	A	11	0	11	100	19.0	87.2	21.8	NC	0	0	0	0	0	0	0	0	0	100	0	0
Ship 2	4/8–7/8/06	A	8	0	8	100	19.9	82.6	24.1	90	0	0	0	0	0	0	0	0	0	100	0	0
Total			894			100	1574.9	6468.6	24.3		53		4		55		0.0362		0.0362			

(continued)

Table 4 (continued)

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks observed (thousands)			Hooks baited (%)	No. of birds observed caught						Observed seabird mortality (includes injured birds) (birds/thousand hooks)			Streamer line in use %		Offal discharge during haul
			N	D	Total	%N	Obs.	Set	% observed		Dead		Injured		Uninjured							
											N	D	N	D	N	D	N	D	Total	N	D	
Division 58.5.1																						
Ship 11	1/9–8/11/05	A	184	0	184	100	277.4	1181.0	23.5	NC	9	0	0	0	2	0	0.0324	0	0.0324	100	0	0
Ship 5	2/9–8/11/05	A	194	0	194	100	414.7	1375.2	30.2	NC	5	0	0	0	7	0	0.0121	0	0.0121	100	0	0
Ship 6	6/9–29/11/05	A	226	0	226	100	500.6	2007.0	24.9	NC	25	0	0	0	1	0	0.0499	0	0.0499	100	0	0
Ship 1	9/9–30/10/05	A	151	0	151	100	317.5	1270.5	25.0	NC	35	0	0	0	7	0	0.1102	0	0.1102	100	0	0
Ship 7	15/9–3/10/05	A	170	0	170	100	392.1	1549.1	25.3	NC	66	0	0	0	18	0	0.1683	0	0.1683	100	0	0
Ship 2	17/9–8/11/05	A	143	0	143	100	325.1	1297.0	25.1	NC	7	0	0	0	12	0	0.0215	0	0.0215	100	0	0
Ship 3	7/10–6/12/05	A	121	0	121	100	392.1	1420.7	27.6	NC	126	0	0	0	7	0	0.3213	0	0.3213	100	0	0
Ship 2	7/12–31/1/06	A	155	0	155	100	320.4	1201.0	26.7	93	3	0	0	0	5	0	0.0094	0	0.0094	100	0	0
Ship 5	14/12–30/1/06	A	119	0	119	100	279.8	1141.2	24.5	86	10	0	1	0	27	0	0.0393	0	0.0393	100	0	0
Ship 1	31/12–29/1/06	A	72	0	72	100	167.5	710.3	23.6	NC	4	0	1	0	13	0	0.0299	0	0.0299	100	0	0
Ship 11	10/1–23/1/06	A	34	0	34	100	63.5	234.0	27.1	NC	0	0	0	0	0	0	0	0	0	100	0	0
Ship 3	12/1–30/1/06	A	39	0	39	100	110.7	444.2	24.9	NC	1	0	0	0	0	0	0.0090	0	0.0090	100	0	0
Ship 6	14/1–31/1/06	A	47	0	47	100	104.7	423.0	24.8	98	5	0	0	0	1	0	0.0478	0	0.0478	100	0	0
Ship 5	28/2–7/3/06	A	23	0	23	100	51.3	207.0	24.8	NC	13	0	0	0	4	0	0.2532	0	0.2532	100	0	0
Ship 1	1/3–15/3/06	A	38	0	38	100	90.9	387.0	23.5	NC	36	0	0	0	17	0	0.3961	0	0.3961	100	0	0
Ship 3	1/3–4/4/06	A	65	0	65	100	238.7	952.4	25.1	94	32	0	0	0	1	0	0.1341	0	0.1341	100	0	0
Ship 6	1/3–2/4/06	A	88	0	88	100	192.2	784.5	24.5	NC	14	0	0	0	0	0	0.0728	0	0.0728	100	0	0
Ship 7	1/3–28/3/06	A	63	0	63	100	167.7	729.2	23.0	NC	30	0	0	0	2	0	0.1789	0	0.1789	100	0	0
Ship 2	4/3–29/4/06	A	151	0	151	100	371.0	1526.3	24.3	87	3	0	0	0	5	0	0.0081	0	0.0081	100	0	0
Ship 11	8/3–13/4/06	A	90	0	90	100	125.3	507.6	24.7	91	42	0	0	0	5	0	0.3353	0	0.3353	100	0	0
Ship 5	14/4–4/6/06	A	136	0	136	100	325.0	1344.6	24.2	87	16	0	0	0	28	0	0.0492	0	0.0492	100	0	0
Ship 1	21/4–18/5/06	A	64	0	64	100	156.9	663.0	23.7	89	34	0	11	0	0	0	0.2868	0	0.2868	100	0	0
Ship 7	4/5–2/7/06	A	138	0	138	100	379.0	1490.3	25.4	93	30	0	5	0	27	0	0.0923	0	0.0923	100	0	0
Ship 3	11/5–20/6/06	A	78	0	78	100	264.2	1063.7	24.8	NC	14	0	0	0	4	0	0.0530	0	0.0530	100	0	0
Ship 6	14/5–12/6/06	A	72	0	72	100	159.8	648.0	24.7	NC	7	0	0	0	0	0	0.0438	0	0.0438	100	0	0
Ship 2	9/6–31/7/06	A	80	0	80	100	187.2	743.7	25.2	89	7	0	0	0	9	0	0.0374	0	0.0374	100	0	0
Ship 11	16/6–2/7/06	A	39	0	39	100	58.2	234.0	24.9	NC	0	0	0	0	1	0	0	0	0	100	0	0
Total			2780			100	6433.4	25535.2	25.0		574		18		203		0.0920		0.0920			

NC Not collected

Table 5: Estimated total seabird mortality in Subarea 58.6 and Division 58.5.1 within the French EEZ during the 2005/06 season.

Vessel	Hooks observed (thousands)	Hooks set (thousands)	Percentage of hooks observed	% Night sets	Estimated number of birds caught dead		
					Night	Day	Total
Subarea 58.6							
Ship 3	96.7	390.6	24.7	100	0	0	0
Ship 7	59.7	395.9	15.1	100	7	0	7
Ship 1	74.7	297.5	25.1	100	12	0	12
Ship 2	24.3	119.0	20.4	100	0	0	0
Ship 11	43.0	180.0	23.9	100	0	0	0
Ship 11	91.1	276.0	33.0	100	3	0	3
Ship 7	188.5	700.5	26.9	100	15	0	15
Ship 11	53.5	197.0	27.2	100	7	0	7
Ship 3	97.5	405.3	24.1	100	54	0	54
Ship 1	111.2	447.8	24.8	100	32	0	32
Ship 2	41.3	158.4	26.1	100	0	0	0
Ship 6	96.0	393.8	24.4	100	33	0	33
Ship 5	96.1	397.8	24.2	100	17	0	17
Ship 11	114.8	461.5	24.9	100	4	0	4
Ship 2	80.3	364.7	22.0	100	0	0	0
Ship 1	122.5	527.3	23.2	100	52	0	52
Ship 5	96.7	392.4	24.6	100	0	0	0
Ship 6	48.2	193.5	24.9	100	0	0	0
Ship 3	19.0	87.2	21.8	100	0	0	0
Ship 2	19.9	82.6	24.1	100	0	0	0
	1 574.9	6 468.6	24.3%		235		235
Division 58.5.1							
Ship 11	277.4	1 181.0	23.5	100	38	0	38
Ship 5	414.7	1 375.2	30.2	100	17	0	17
Ship 6	500.6	2 007.0	24.9	100	100	0	100
Ship 1	317.5	1 270.5	25.0	100	140	0	140
Ship 7	392.1	1 549.1	25.3	100	261	0	261
Ship 2	325.1	1 297.0	25.1	100	28	0	28
Ship 3	392.1	1 420.7	27.6	100	457	0	457
Ship 2	320.4	1 201.0	26.7	100	11	0	11
Ship 5	279.8	1 141.2	24.5	100	45	0	45
Ship 1	167.5	710.3	23.6	100	21	0	21
Ship 11	63.5	234.0	27.1	100	0	0	0
Ship 3	110.7	444.2	24.9	100	4	0	4
Ship 6	104.7	423.0	24.8	100	20	0	20
Ship 5	51.3	207.0	24.8	100	52	0	52
Ship 1	90.9	387.0	23.5	100	153	0	153
Ship 3	238.7	952.4	25.1	100	128	0	128
Ship 6	192.2	784.5	24.5	100	57	0	57
Ship 7	167.7	729.2	23.0	100	130	0	130
Ship 2	371.0	1 526.3	24.3	100	12	0	12
Ship 11	125.3	507.6	24.7	100	170	0	170
Ship 5	325.0	1 344.6	24.2	100	66	0	66
Ship 1	156.9	663.0	23.7	100	190	0	190
Ship 7	379.0	1 490.3	25.4	100	138	0	138
Ship 3	264.2	1 063.7	24.8	100	56	0	56
Ship 6	159.8	648.0	24.7	100	28	0	28
Ship 2	187.2	743.7	25.2	100	28	0	28
Ship 11	58.2	234.0	24.9	100	0	0	0
	6 433.4	25 535.2	25.2%		2 352		2 352

Table 6: Total estimated seabird by-catch and by-catch rate (birds/thousand hooks) in longline fisheries in Subarea 58.6 and Division 58.5.1 within the French EEZ in 2005/06.

Subarea/ division		Season 2005/06
Subarea 58.6		
	Estimated by-catch	235
	By-catch rate	0.0362
Division 58.5.1		
	Estimated by-catch	2 352
	By-catch rate	0.0920

Table 7: Total estimated seabird by-catch and by-catch rate (birds/thousand hooks) in longline fisheries in Subarea 58.6 and Division 58.5.1 within the French EEZ from 2000 to 2005.

Subarea/ division	Season					
	2000/01*	2001/02*	2002/03*	2003/04*	2004/05	2005/06
Subarea 58.6						
Estimated by-catch		1 243	720	343	242	235
By-catch rate		0.1672	0.1092	0.0875	0.0490	0.0362
Division 58.5.1						
Estimated by-catch	1 917	10 814	13 926	3 666	4 387	2 352
By-catch rate	0.0920	0.9359	0.5180	0.2054	0.1640	0.0920

* The number of observed hooks has not been collected and the values given are from the total number of hooks set.

Table 8: Species composition of birds killed in longline fisheries in Subarea 58.6 and Division 58.5.1 within the French EEZ during the 2005/06 season (September to August). N – night-time setting; D – daytime setting (including nautical dawn and dusk); PRO – white-chinned petrel; MAH – sub-Antarctic giant petrel; PCI – grey petrel; DAC – Cape petrel; PND – petrel non determined; EC – rockhopper penguin; () – % composition.

Vessel	Dates of fishing	No. of birds killed by group								Species composition (%)											
		Albatross		Petrels		Penguins		Total													
		N	D	N	D	N	D	N	D	WCP		PCI		DAC		MAH		PND		EC	
Subarea 58.6																					
Ship 3	17/9–3/10/05	0	0	0	0	0	0	0	0												
Ship 7	11/10–13/12/05	0	0	0	0	1	0	1	0											1	(100.0)
Ship 1	30/10–2/11/05	0	0	3	0	0	0	3	0	3	(100.0)										
Ship 2	14/11–18/11/05	0	0	0	0	0	0	0	0												
Ship 11	14/11–25/11/05	0	0	0	0	0	0	0	0												
Ship 11	21/12–6/1/06	0	0	1	0	0	0	1	0	1	(100.0)										
Ship 7	17/1–18/2/06	0	0	4	0	0	0	4	0	4	(100.0)										
Ship 11	28/1–7/2/06	0	0	2	0	0	0	2	0	2	(100.0)										
Ship 3	2/2–21/2/06	0	0	13	0	0	0	13	0	13	(100.0)										
Ship 1	4/2–25/2/06	0	0	8	0	0	0	8	0	8	(100.0)										
Ship 2	4/2–13/2/06	0	0	0	0	0	0	0	0												
Ship 6	5/2–23/2/06	0	0	8	0	0	0	8	0	6	(75.0)					2	(25.0)				
Ship 5	6/2–25/2/06	0	0	4	0	0	0	4	0	4	(100.0)										
Ship 11	16/4–14/5/06	0	0	1	0	0	0	1	0			1	(100.0)								
Ship 2	4/5–21/5/06	0	0	0	0	0	0	0	0												
Ship 1	22/5–19/6/06	0	0	12	0	0	0	12	0					11	(91.7)			1	(8.3)		
Ship 5	9/6–25/6/06	0	0	0	0	0	0	0	0												
Ship 6	17/6–28/6/06	0	0	0	0	0	0	0	0												
Ship 3	25/6–28/6/06	0	0	0	0	0	0	0	0												
Ship 2	4/8–7/8/06	0	0	0	0	0	0	0	0												
		0	0	56	0	1	0	57	0	41	(71.9)	1	(1.8)	11	(19.3)	2	(3.5)	1	(1.8)	1	(1.8)

(continued)

Table 8 (continued)

Vessel	Dates of fishing	No. of birds killed by group								Species composition (%)											
		Albatross		Petrels		Penguins		Total													
		N	D	N	D	N	D	N	D	WCP		PCI		DAC		MAH		PND		EC	
Division 58.5.1																					
Ship 11	1/9–8/11/05	0	0	9	0	0	0	9	0	7	(77.8)	2	(22.2)								
Ship 5	2/9–8/11/05	0	0	5	0	0	0	5	0	4	(80.0)	1	(20.0)								
Ship 6	6/9–29/11/05	0	0	25	0	0	0	25	0	21	(84.0)	4	(16.0)								
Ship 1	9/9–30/10/05	0	0	35	0	0	0	35	0	22	(62.9)	13	(37.1)								
Ship 7	15/9–3/10/05	0	0	66	0	0	0	66	0	66	(100.0)										
Ship 2	17/9–8/11/05	0	0	7	0	0	0	7	0	5	(71.4)	2	(28.6)								
Ship 3	7/10–6/12/05	0	0	126	0	0	0	126	0	125	(99.2)	1	(0.8)								
Ship 2	7/12–31/1/06	0	0	3	0	0	0	3	0	3	(100.0)										
Ship 5	14/12–30/1/06	0	0	11	0	0	0	11	0	10	(90.9)					1	(9.1)				
Ship 1	31/12–29/1/06	0	0	5	0	0	0	5	0	4	(80.0)					1	(20.0)				
Ship 11	10/1–23/1/06	0	0	0	0	0	0	0	0												
Ship 3	12/1–30/1/06	0	0	1	0	0	0	1	0	1	(100.0)										
Ship 6	14/1–31/1/06	0	0	5	0	0	0	5	0	5	(100.0)										
Ship 5	28/2–7/3/06	0	0	13	0	0	0	13	0	13	(100.0)										
Ship 1	1/3–15/3/06	0	0	36	0	0	0	36	0	36	(100.0)										
Ship 3	1/3–4/4/06	0	0	32	0	0	0	32	0	32	(100.0)										
Ship 6	1/3–2/4/06	0	0	14	0	0	0	14	0	14	(100.0)										
Ship 7	1/3–28/3/06	0	0	30	0	0	0	30	0	30	(100.0)										
Ship 2	4/3–29/4/06	0	0	3	0	0	0	3	0	3	(100.0)										
Ship 11	8/3–13/4/06	0	0	42	0	0	0	42	0	42	(100.0)										
Ship 5	14/4–4/6/06	0	0	16	0	0	0	16	0							16	(100.0)				
Ship 1	21/4–18/5/06	0	0	45	0	0	0	45	0					34	(75.6)			11	(24.4)		
Ship 7	4/5–2/7/06	0	0	35	0	0	0	35	0			30	(85.7)			5	(14.3)				
Ship 3	11/5–20/6/06	0	0	14	0	0	0	14	0	1	(7.1)	13	(92.9)								
Ship 6	14/5–12/6/06	0	0	7	0	0	0	7	0							7	(100.0)				
Ship 2	9/6–31/7/06	0	0	7	0	0	0	7	0			7	(100.0)								
Ship 11	16/6–2/7/06	0	0	0	0	0	0	0	0												
		0	0	592	0	0	0	592	0	444	(75.0)	73	(12.3)	34	(5.7)	30	(5.1)	11	(1.9)	0	(0.0)
Total (%)		0	0	648	0	1	0	649	0	485	(74.7)	74	(11.4)	45	(6.9)	32	(4.9)	12	(1.8)	1	(0.2)

Table 9: Compliance, as reported by observers, of streamer lines and haul scaring devices with the minimum specifications set out in Conservation Measure 25-02 (2005) during the 2005/06 season. Sp – Spanish method; A – autoliner; Y – yes; N – no; - – no information; MP – moon pool; * – conservation measure not applicable in this area.

Vessel name (Nationality)	Dates of fishing	Fishing method	Compliance with CCAMLR specifications	Compliance with details of streamer line specifications				Length of streamers (m)	Streamer line in use % setting		Haul scaring device used %
				Attachment, height above water (m)	Total length (m)	No. of streamers per line	Spacing of streamers per line (m)		Night	Day	
Subarea 48.3											
Insung No. 22	1/5–18/6/06	Sp	Y	Y (7.5)	Y (253)	10	Y (5)	Y (6.5)	100		100
Jacqueline	1/5–26/8/06	Sp	Y	Y (7.6)	Y (158)	9	Y (5)	Y (6.5)	100		46
Argos Helena	1/5–31/8/06	A	Y	Y (7.3)	Y (154)	13	Y (5)	Y (8)	100		MP
Koryo Maru No. 11	2/5–22/7/06	Sp	Y	Y (8)	Y (150)	10	Y (5)	Y (8)	100		100
Polarpesca I	12/5–14/8/06	Sp	Y	Y (8)	Y (150)	7	Y (5)	Y (7)	99.6		100
Protegat	1/5–27/6/06	A	Y	Y (8)	Y (150)	30	Y (5)	Y (6.5)	99		78
Punta Ballena	15/5–23/8/06	A	Y	Y (7)	Y (150)	7	Y (5)	Y (1–7)	100		100
San Aspiring	1/5–27/8/06	A	Y	Y (8)	Y (240)	22	Y (5)	Y (12)	100		100
Viking Bay	1/5–16/8/06	Sp	Y	Y (7)	Y (150)	9	Y (5)	Y (10)	100		98
Argos Georgia	1/5–31/8/06	A	Y	Y (7.6)	Y (155)	7	Y (5)	Y (7)	100		90
Subarea 48.4											
Argos Helena	7/4–15/4/06	A	Y	Y (7.3)	Y (154)	13	Y (5)	Y (1–8)	100		MP
San Aspiring	10/4–25/4/06	A	Y	Y (8)	Y (220)	22	Y (5)	Y (1–8)	100		100
Subarea 48.6											
Shinsei Maru No. 3	15/4–17/5/06	A	N	Y (7.5)	N (146)	6	Y (5)	Y (4.4–6.8)	100	100	100
Shinsei Maru No. 3	5/1–29/3/06	A	Y	Y (10)	Y (164)	6	Y (5)	Y (4.5–7.2)	100	100	100
Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b											
Globalpesca I	22/12–21/2/06	Sp	Y	Y (7)	Y (150)	7	Y (5)	Y (1–7)	100	100	0
Tronio	15/12–10/3/06	Sp	Y	Y (10)	Y (167)	12	Y (5)	Y (1–6.5)	100	100	100
Globalpesca II	21/12–22/1/06	Sp	N	Y (7)	Y (150)	6	Y (5)	N (1–6)		100	0
Insung No. 2	4/1–4/3/06	Sp	N	Y (7)	Y (150)	10	Y (5)	N (1–4.5)	100	100	100
Galaecia	2/12–22/2/06	Sp	N	Y (8)	Y (150)	8	Y (5)	N (1.5–5)	100	100	0
Galaecia	5/4–5/7/06	Sp	Y	Y (7)	Y (150)	9	Y (5)	Y (1–6.5)	100	100	0
Division 58.5.2											
Janas	25/7–13/9/06	A	Y	Y (7)	Y (175)	24	Y (5)	Y (1.3–7)	100	100	100
Janas	7/5–27/6/06	A	Y	Y (7)	Y (150)	15	Y (3)	Y (1–7)	100	100	94
Subareas 58.6, 58.7											
Koryo Maru No. 11	19/2–30/3/06	Sp	N	Y (7.7)	Y (161)	12	N (5.7)	N (1.6–4.2)	100		100

(continued)

Table 9 (continued)

Vessel name (Nationality)	Dates of fishing	Fishing method	Compliance with CCAMLR specifications	Compliance with details of streamer line specifications				Length of streamers (m)	Streamer line in use % setting		Haul scaring device used %
				Attachment, height above water (m)	Total length (m)	No. of streamers per line	Spacing of streamers per line (m)		Night	Day	
Subareas 88.1, 88.2											
Avro Chieftain	2/12–13/1/06	A	Y	Y (7.7)	Y (204)	24	Y (3)	Y (1–8.8)		100	MP
Punta Ballena	2/1–5/2/06	A	Y	Y (7)	Y (160)	7	Y (5)	Y (1–7)		100	0
San Aotea II	16/12–16/2/06	A	Y	Y (7)	Y (210)	13	Y (4.5)	Y (1–6.5)		100	0
San Aspiring	2/12–15/2/06	A	Y	Y (8)	Y (220)	20	Y (5)	Y (1–8)		100	0
Viking Sur	6/1–5/2/06	A	N	Y (7)	N (100)	10	Y (5)	N (1–6)		100	0
Antartic II	1/12–6/2/06	A	Y	-	-	-	-	-		100	0
Argos Georgia	15/1–12/2/06	A	Y	Y (7)	Y (155)	7	Y (5)	Y (1–7)		100	0
Argos Helena	11/12–10/2/06	A	Y	Y (8)	Y (150)	13	Y (4)	Y (1–9)	100	100	0
Frøyanes	8/12–7/2/06	A	N	Y (7.2)	N (147)	18	Y (4.5)	Y (1–6.5)	100	100	0
Janas	14/12–8/2/06	A	Y	Y (8)	Y (150)	19	Y (5)	Y (0.5–7.5)		100	0
Volna	17/12–15/2/06	Sp	Y	Y (7)	Y (150)	8	Y (5)	Y (1–6.5)		100	0
Yantar	17/12–15/2/06	Sp	Y	Y (7)	Y (150)	8	Y (5)	Y (1–6.5)		100	0
Paloma V[1]	5/12–11/3/06	Sp	Y	Y (7)	Y (150)	12	Y (5)	Y (1–6.5)		100	0

[1] *Paloma V* also conducted a small amount of fishing in Divisions 58.4.1 and 58.4.3b during this cruise.

Table 10: Summary of scientific observations relating to compliance with Conservation Measure 25-02 (2005), based on data from scientific observers from the 1996/97 to the 2005/06 seasons. Values in parentheses are the percentage of complete observer records. na – not applicable.

Subarea/season	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
2004/05	100 (100)	9.5	45	99	100 (100)	75	(100)	88	(100)	88	(100)	[7]		100	(100)	0.001	0
2005/06	100 (100)	10.0	40	100	100 (100)	100	(100)	100	(100)	100	(100)	[7]		100	(100)	0	0
Subarea 48.4																	
2005/06	Auto only	na	na	100	100 (100)	100	(100)	100	(100)	100	(100)	[7]		100	(100)	0	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
2004/05	100 (100)	6.5	19.5	29[6]	No discharge	100	(100)	100	(100)	100	(100)	[7]		0	(100)	0	0
2005/06	Auto only	na	na	36[6]	No discharge	50	(100)	100	(100)	50	(100)			100	(100)	0	0
Divisions 58.4.1,58.4.2, 58.4.3a, 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
2004/05	33[9] (100)	7.9	40	26[5]	No discharge	88	(100)	100	(100)	100	(100)	[7]		88	(100)	0	<0.001
2005/06	16[9] (100)	7.2	48	16[5]	No discharge	100	(100)	100	(100)	100	(100)			100	(100)	0	<0.001
Division 58.4.4																	
1999/00	0[9] (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
2004/05	Auto Only	na	na	50[8]	No discharge	100	(100)	100	(100)	100	(100)	[7]		100	(100)	0	0
2005/06	Auto Only	na	na	53[8]	No discharge	100	(100)	100	(100)	100	(100)	[7]		100	(100)	0	0

(continued)

Table 10 (continued)

Subarea/season	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 58.6 and 58.7																	
1996/97	0 (60)	6	35	52	69 (87)	10	(66)	100	(60)	10	(66)	90	(66)	60	(66)	0.52	0.39
1997/98	0 (100)	6	55	93	87 (94)	9	(92)	91	(92)	11	(75)	100	(75)	90	(83)	0.08	0.11
1998/99	0 (100)	8	50	84[2]	100 (89)	0	(100)	100	(90)	10	(100)	100	(90)	100	(90)	0.05	0
1999/00	0 (83)	6	88	72	100 (93)	8	(100)	91	(92)	0	(92)	100	(92)	91	(92)	0.03	0.01
2000/01	18 (100)	5.8	40	78	100 (100)	64	(100)	100	(100)	64	(100)	100	(100)	100	(100)	0.01	0.04
2001/02	66 (100)	6.6	40	99	100 (100)	100	(100)	100	(100)	100	(100)	100	(100)	100	(100)	0	0
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
2004/05	100 (100)	6.5	20	100	100 (100)	0	(100)	100	(100)	100	(100)	[7]		0	(100)	0.149	0
2005/06	100 (100)	9.1	40	100	100 (100)	0	(100)	100	(100)	100	(100)	100	(100)	0	(100)	0	0
Subarea 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 by 1 vessel	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
2004/05	33[9] (100)	9.0	45	1[4]	1% by 1 vessel	64	(100)	100	(100)	100	(100)	[7]		64	(100)	0	0
2005/06	100[9] (100)	9.2	35	1[4]	No discharge	85	(92)	100	(92)	85	(92)	[7]		100	(92)	0	0

[1] Includes daytime setting – and associated seabird by-catch – as part of line-weighting experiments on *Argos Helena* (WG-FSA-99/5).
[2] Includes some daytime setting in conjunction with use of an underwater-setting funnel on *Eldfisk* (WG-FSA-99/42).
[3] Conservation Measure 169/XVII allowed New Zealand vessels to undertake daytime setting south of 65°S in Subarea 88.1 to conduct a line-weighting experiment.
[4] Conservation Measures 210/XIX, 216/XX and 41-09 (2002, 2003, 2004) permit daytime setting south of 65°S in Subarea 88.1 if able to demonstrate a sink rate of 0.3 m/s.
[5] Conservation Measure 41-05 (2002, 2003, 2004) 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, 2004) 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 5 streamers per line was removed.
[8] Conservation Measure 41-08 (2004) permits daylight setting with the use of an integrated weighted line of at least 50 g/m.
[9] Conservation Measure 24-02 (2004) exempts vessels from line-weighting requirements if they comply with sink rates or have an integrated weighted line of 50 g/m.

Table 11: Aerial extent of streamer lines reported by observers during the 2005/06 season. Sp – Spanish method; A – autoliner.

Vessel name	Dates of fishing	Fishing method	Average setting speed (knots)	Aerial extent of streamer line
Subarea 48.3				
Insung No. 22	1/5–18/6/06	Sp	7.8	25
Jacqueline	1/5–26/8/06	Sp	9.4	50
Argos Helena	1/5–31/8/06	A	7.6	45
Koryo Maru No. 11	2/5–22/7/06	Sp	6.7	20
Polarpesca I	12/5–14/8/06	Sp	6.1	150
Protegat	1/5–27/6/06	A	6.0	40
Punta Ballena	15/5–23/8/06	A	6.3	30
San Aspiring	1/5–27/8/06	A	6.6	100
Viking Bay	1/5–16/8/06	Sp	8.0	60
Argos Georgia	1/5–31/8/06	A	7.1	40
Subarea 48.4				
Argos Helena	7/4–15/4/06	A	6.0	45
San Aspiring	10/4–25/4/06	A	6.0	100
Subarea 48.6				
Shinsei Maru No. 3	15/4–17/5/06	A	7.6	34
Shinsei Maru No. 3	5/1–29/3/06	Auto	7.6	60
Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b				
Globalpesca I	22/12–21/2/06	Sp	6.7	45
Tronio	15/12–10/3/06	Sp	8.9	65
Globalpesca II	21/12–22/1/06	Sp	8.2	110
Insung No. 2	4/1–4/3/06	Sp	8.1	145
Galaecia	2/12–22/2/06	Sp	8.2	45
Galaecia	5/4–5/7/06	Sp	7.9	125
Division 58.5.2				
Janas	25/7–13/9/06	A	5.7	51
Janas	7/5–27/6/06	A	5.9	30
Subareas 58.6, 58.7				
Koryo Maru No. 11	19/2–30/3/06	Sp	7.4	52
Subareas 88.1, 88.2				
Avro Chieftain	2/12–13/1/06	A	5.1	50
Punta Ballena	2/1–5/2/06	A	6.0	150
San Aotea II	16/12–16/2/06	A	6.1	59
San Aspiring	2/12–15/2/06	A	6.6	100
Viking Sur	6/1–5/2/06	A	6.9	40
Antartic II	1/12–6/2/06	A	6.8	
Argos Georgia	15/1–12/2/06	A	6.0	40
Argos Helena	11/12–10/2/06	A	7.7	50
Frøyanes	8/12–7/2/06	A	8.0	75
Janas	14/12–8/2/06	A	5.1	100
Volna	17/12–15/2/06	Sp	7.7	120
Yantar	17/12–15/2/06	Sp	7.2	50
Paloma V[1]	5/12–11/3/06	Sp	7.9	75

[1] *Paloma V* also conducted a small amount of fishing in Divisions 58.4.1 and 58.4.3b during this cruise.

Table 12: Observed incidences of seabird and marine mammal entanglements with trawl gear for the 2005/06 season. DIC – *Diomedea chrysostoma*; DIM – *Diomedea melanophrys*; DIX – *Diomedea exulans*; MAI – *Macronectes giganteus*; PDM – *Pterodroma macroptera*; PRO – *Procellaria aequinoctialis*; SEA – *Arctocephalus gazella*; SLP – *Hydrurga leptonyx*; * – data from cruise report.

Vessel	Dates of fishing	Area	Species	Total observed	
				Mortality (dead or injured)	Released alive (uninjured)
Betanzos	22/3–22/4/06	48.3	DIC		1
			DIM		12
			PRO	7	35
Cabo de Hornos	3/2–9/3/06	48.3	DIM	4	1
			PDM	1	1
			PRO	2	
Argos Pereira	25/12–19/1/06	48.3			
Sil	1/1–18/2/06	48.3	DIM	2	
			DIX		1
			MAI		1
*Insung Ho**	3/2–13/2/06	48.3	DIC	1	1
			DIM	5	18
			PRO	11	18
Southern Champion	11/3–31/3/06	58.5.2			
Southern Champion	29/4–23/6/06	58.5.2	SLP	1	
Southern Champion	22/7–16/9/06	58.5.2			
Niitaka Maru	26/6–5/7/06	48.3			
Niitaka Maru	10/7–28/7/06	48.3			
Saga Sea	17/6–11/8/06	48.1			
Konstruktor Koshkin	15/4–26/5/06	48.1	SEA	1	

Table 13: Seabird mortality totals and rates (BPT – birds/trawl) and species composition, recorded by observers in the CAMLR Convention Area trawl fishery during the 2005/06 season. ANI – *Champsocephalus gunnari;* DIC – grey-headed albatross; DIM – black-browed albatross; KRI – *Euphausia superba*; PRO – white-chinned petrel; PTZ – unknown petrel; TOP – *Dissostichus eleginoides*.

Area	Vessel (target species)	Cruise dates	Trawls		BPT	Dead				Total dead	Alive (combined)
			Set	Observed		DIC	DIM	PRO	PTZ		
48.1	*Saga Sea* (KRI)	17/6–11/8/06	550	550	0.00					0	0
	Konstruktor Koshkin (KRI)	15/4–26/5/06	577	289	0.00					0	0
	Total		1127	839	0.00					0	0
48.3	*Betanzos* (ANI)	22/3–22/4/06	70	63	0.11			7		7	48
	Cabo de Hornos (ANI)	3/2–9/3/06	138	101	0.07		4	2	1	7	2
	Argos Pereira (ANI)	25/12–19/1/06	71	35	0.00					0	0
	Sil (ANI)	1/1–18/2/06	137	137	0.01		2			2	2
	Insung Ho (ANI)	3/2–13/2/06	169	121	0.14	1	5	11		17	37
	Total		585	457	0.07	3%	33%	61%	3%	33	89
48.3	*Niitaka Maru* (KRI)	26/6–5/7/06	191	56	0.00					0	0
	Niitaka Maru (KRI)	10/7–28/7/06	204	125	0.00					0	0
	Total		395	181	0.00					0	0
58.5.2	*Southern Champion* (ANI/TOP)	11/3–31/3/06	143	143	0.00					0	0
	Southern Champion (ANI/TOP)	29/4–23/6/06	425	425	0.00					0	0
	Southern Champion (ANI/TOP)	22/7–16/9/06	518	518	0.00					0	0
	Total		1086	1086	0.00					0	0

Table 14: Seabird mortality totals and rates (BPT – birds/trawl) and species composition of by-catch, recorded by observers in the CAMLR Convention Area trawl fisheries over the last six seasons. DAC – Cape petrel; DIC – grey-headed albatross; DIM – black-browed albatross; MAI – southern giant petrel; MAH – northern giant petrel; PRO – white-chinned petrel; PTZ – unknown petrel; PWD – Antarctic prion.

Season	Area	Target species	Trips observed	Trawls		BPT	Dead								Total dead	Alive (combined)
				Set	Observed		DIC	DIM	PRO	MAH	PWD	PTZ	DAC	MAI		
2001	48.1	*E. superba*	2	485	427	0									0	0
	48.3	*C. gunnari*	6	381	350	0.26	5	46	41						92	40
	58.5.2	*D. eleginoides*	7	1441	1387	<0.10									0	0
		C. gunnari														
2002	48.3	*E. superba*	5	992	755	<0.10									0	0
	48.3	*C. gunnari*	5	460	431	0.16		18	49		1				68	52
	58.5.2	*D. eleginoides*	6	904	850	<0.10									0	1
		C. gunnari														
2003	48.3	*E. superba*	6	1928	1073										0	0
	48.3	*C. gunnari*	3	184	182	0.20	1	7	28						36	15
	58.5.2	*D. eleginoides*	8	1311	1309	<0.10		2	2				2		6	11
		C. gunnari				5										
2004	48	*E. superba*	1	334	258	<0.10									0	0
	48.3	*E. superba*	6	1145	829	<0.10									0	0
	48.3	*C. gunnari*	6	247	238	0.37	1	26	59					1	87	132
	58.5.2	*D. eleginoides*	5	1218	1215	<0.10									0	13
		C. gunnari														
2005	48.2	*E. superba*	2	391	285	<0.10							1		1	0
	48.3	*C. gunnari*	7	337	277	<0.14		9	1	1					11	14
	48.3	*E. superba*	5	1451	842	<0.10									0	0
	58.5.2	*D. eleginoides*	6	1303	1301	<0.11		5	3						8	0
		C. gunnari														
2006	48.1	*E. superba*	2	1127	839	0.00									0	0
	48.3	*C. gunnari*	5	585	457	0.07	1	11	20			1			33	89
	48.3	*E. superba*	2	395	181	0.00									0	0
	58.5.2	*D. eleginoides*	3	1086	1086	0.00									0	0
		C. gunnari														

Table 15: Seal mortality totals and rates (SPT – seals/trawl) and species composition, recorded by observers in the CAMLR Convention Area trawl fisheries during the 2005/06 season. ANI – *Champsocephalus gunnari;* KRI – *Euphausia superba*; SEA – Antarctic fur seal; SLP – leopard seal; TOP – *Dissostichus eleginoides*.

Area	Vessel (target species)	Cruise dates	Trawls		SPT	Dead		Total dead	Alive (combined)
			Set	Observed		SLP	SEA		
48.1	*Saga Sea* (KRI)	17/6–11/8/06	550	550	0.00			0	0
	Konstruktor Koshkin (KRI)	15/4–26/5/06	577	289	0.003		1	1	0
	Total		1127	839	0.001			1	0
48.3	*Betanzos* (ANI)	22/3–22/4/06	70	63	0.11			0	0
	Cabo de Hornos (ANI)	3/2–9/3/06	138	101	0.07			0	0
	Argos Pereira (ANI)	25/12–19/1/06	71	35	0.00			0	0
	Sil (ANI)	1/1–18/2/06	137	137	0.01			0	0
	InsungHo (ANI)	3/2–13/2/06	169	121	0.14			0	0
	Total		585	457	0.07			0	0
48.3	*Niitaka Maru* (KRI)	26/6–5/7/06	191	56	0.00			0	0
	Niitaka Maru (KRI)	10/7–28/7/06	204	125	0.00			0	0
	Total		395	181	0.00			0	0
58.5.2	*Southern Champion* (ANI/TOP)	11/3–31/3/06	143	143	0.00			0	0
	Southern Champion (ANI/TOP)	29/4–23/6/06	425	425	0.002	1		1	0
	Southern Champion (ANI/TOP)	22/7–16/9/06	518	518	0.00			0	0
	Total		1086	1086	0.001			1	0

Table 16: Seal mortality totals and rates (SPT – seals/trawl) and species composition of by-catch, recorded by observers in the CAMLR Convention Area trawl fisheries over the last six seasons. SEA – Antarctic fur seal; SES – southern elephant seal; SLP – leopard seal.

Season	Area	Target species	Trips observed	Trawls		SPT	Dead			Total dead	Alive (combined)
				Set	Observed		SLP	SEA	SES		
2001	48.1	*E. superba*	2	485	427	0.00				0	0
	48.3	*C. gunnari*	6	381	350	0.00				0	0
	58.5.2	*D. eleginoides* *C. gunnari*	7	1441	1387	0.001		1		1	2
2002	48.3	*E. superba*	5	992	755	0.00				0	0
	48.3	*C. gunnari*	5	460	431	0.00				0	0
	58.5.2	*D. eleginoides* *C. gunnari*	6	904	850	0.001		1		1	0
2003	48.3	*E. superba*	6	1928	1073	0.03		27		27	15
	48.3	*C. gunnari*	3	184	182	0.00				0	0
	58.5.2	*D. eleginoides* *C. gunnari*	8	1311	1309	0.003		2	2	4	2
2004	48	*E. superba*	1	334	258	0		0		0	0
	48.3	*E. superba*	6	1145	829	0.17		142		142	12
	48.3	*C. gunnari*	6	247	238	0				0	0
	58.5.2	*D. eleginoides* *C. gunnari*	5	1218	1215	0.002		3		3	0
2005	48.2	*E. superba*	2	391	285	0.06		16		16	8
	48.3	*C. gunnari*	7	337	277	0.00		0		0	2
	48.3	*E. superba*	5	1451	842	0.006		5		5	64
	58.5.2	*D. eleginoides* *C. gunnari*	6	1303	1301	0.00				0	1
2006	48.1	*E. superba*	2	1127	839	0.001		1		1	0
	48.3	*C. gunnari*	5	585	457	0.00				0	0
	48.3	*E. superba*	2	395	181	0.00				0	0
	58.5.2	*D. eleginoides* *C. gunnari*	3	1086	1086	0.00	1			1	0

Table 17: Estimated total potential seabird by-catch in unregulated longline fisheries in the Convention Area from 1996 to 2006.

Subarea/ division	Year	Extrapolated potential incidental mortality of seabirds		
		Lower	Median	Upper
48.3	2006	0	0	0
	1996–2005	1 835	3 486	56 766
58.4.2	2006	264	322	861
	1996–2005	707	863	2 305
58.4.3	2006	2 821	3 442	9 191
	1996–2005	1 747	2 131	5 691
58.4.4	2006	0	0	0
	1996–2005	3 886	4 741	12 659
58.5.1	2006	454	554	1 478
	1996–2005	48 327	58 965	157 442
58.5.2	2006	107	130	348
	1996–2005	32 657	39 845	106 391
58.6	2006	102	124	331
	1996–2005	44 927	54 817	146 366
58.7	2006	0	0	0
	1996–2005	12 856	15 686	41 884
88.1	2006	0	0	0
	1996–2005	489	598	1 578
88.2	2006	9	11	28
	1996–2005	0	0	0
Totals	2006	3 756	4 583	12 237
	1996–2005	147 431	181 133	531 082
Total		151 187	185 716	543 319

Table 18: Summary of IMAF assessment of risk to seabirds posed by new and exploratory longline fisheries in the Convention Area (see also Figure 1).

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 requirement[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. • 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 requirement is met at all times. • Daytime setting permitted subject to strict line sink rate requirements and seabird by-catch limits. • No offal dumping.	40% of hooks hauled[2] 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(s). • Strict line sink rate requirements at all times. • No daytime setting permitted. • No offal dumping.	45% of hooks hauled[2] 95% of hooks set
5 – high	• 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[2] 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] This is likely to require the presence of two observers.

Table 19: Summary of IMAF risk assessment in relation to proposed new and exploratory longline fisheries in 2006/07 (five-point risk scale as defined in SC-CAMLR-XXV/BG/26).

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.	Proposal from Korea (CCAMLR-XXV/20) does not contain sufficient information to be certain that it does not conflict with the IMAF assessment. Proposals from Japan (CCAMLR-XXV/19), New Zealand (CCAMLR-XXV/22) and Norway (CCAMLR-XXV/23) 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.	Proposal from Korea (CCAMLR-XXV/20) does not contain sufficient information to be certain that it does not conflict with the IMAF assessment. Proposals from Japan (CCAMLR-XXV/19), New Zealand (CCAMLR-XXV/22) and Norway (CCAMLR-XXV/23) 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 Korea (CCAMLR-XXV/20) and Uruguay (CCAMLR-XXV/28) do not contain sufficient information to be certain that they do not conflict with the IMAF assessment. Proposals from Australia (CCAMLR-XXV/18), Namibia (CCAMLR-XXV/21), New Zealand (CCAMLR-XXV/22) and Spain (CCAMLR-XXV/26) do not conflict with the IMAF assessment.
58.4.2	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 Korea (CCAMLR-XXV/20) and Uruguay (CCAMLR-XXV/28) do not contain sufficient information to be certain that they do not conflict with the IMAF assessment. Proposals from Australia (CCAMLR-XXV/18), Namibia (CCAMLR-XXV/21), New Zealand (CCAMLR-XXV/22) and Spain (CCAMLR-XXV/26) do not conflict with the IMAF assessment.

(continued)

Table 19 (continued)

Area	Risk scale	Mitigation requirements	Proposal assessment
58.4.3a	3 – average	• Strict compliance with standard seabird by-catch conservation measure. • Restrict longline fishing to May to August (outside the September through April albatross, giant petrel and white-chinned petrel breeding season) unless line sink rate requirements 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.	Proposal from Korea (CCAMLR-XXV/20) does not contain sufficient information to be certain that it does not conflict with the IMAF assessment. Proposals from Japan (CCAMLR-XXV/19) and Spain (CCAMLR-XXV/26) do not conflict with the IMAF 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 through April albatross, giant petrel and white-chinned petrel breeding season) unless line sink rate requirements 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 Korea (CCAMLR-XXV/20) and Uruguay (CCAMLR-XXV/28) do not contain sufficient information to be certain that they do not conflict with the IMAF assessment. Proposals from Australia (CCAMLR-XXV/18), Japan (CCAMLR-XXV/19), Namibia (CCAMLR-XXV/21) and Spain (CCAMLR-XXV/26) 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-XXV/17), Korea (CCAMLR-XXV/20) and Uruguay (CCAMLR-XXV/28) do not contain sufficient information to be certain that they do not conflict with the IMAF assessment. Proposals from New Zealand (CCAMLR-XXV/22), Norway (CCAMLR-XXV/23), Russia (CCAMLR-XXV/24), South Africa (CCAMLR-XXV/25), Spain (CCAMLR-XXV/26), and UK (CCAMLR-XXV/27) do not conflict with the IMAF assessment.

(continued)

Table 19 (continued)

Area	Risk scale	Mitigation requirements	Proposal assessment
88.1 south of 65°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 requirements and seabird by-catch limits. • No offal dumping at any time.	Proposals from Argentina (CCAMLR-XXV/17), Korea (CCAMLR-XXV/20) and Uruguay (CCAMLR-XXV/28) do not contain sufficient information to be certain that they do not conflict with the IMAF assessment. Proposals from New Zealand (CCAMLR-XXV/22), Norway (CCAMLR-XXV/23), Russia (CCAMLR-XXV/24), South Africa (CCAMLR-XXV/25), Spain (CCAMLR-XXV/26), and the UK (CCAMLR-XXV/27) do not conflict with the IMAF assessment.
88.2	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 requirements and seabird by-catch limits. • No offal dumping at any time.	Proposals from Argentina (CCAMLR-XXV/17) and Uruguay (CCAMLR-XXV/28) do not contain sufficient information to be certain that they do not conflict with the IMAF assessment. Proposals from New Zealand (CCAMLR-XXV/22), Norway (CCAMLR-XXV/23), Russia (CCAMLR-XXV/24), Spain (CCAMLR-XXV/26), and the UK (CCAMLR-XXV/27) do not conflict with the IMAF assessment.

Table 20: Intersessional work plan for ad hoc WG-IMAF for 2006/07.

The Secretariat will coordinate the intersessional work of the IMAF group. An interim review of work will be conducted in May 2007 and advised to ad hoc WG-IMAF in advance of WG-EMM/WG-SAM (July 2007). The outcome of the intersessional work will be reviewed in September 2007 and reported as a tabled paper to WG-IMAF in October 2007.

[1] In addition to work coordinated by the Science/Compliance 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 2006	Place all relevant sections of CCAMLR-XXV on IMAF page of CCAMLR website and notify IMAF group members, and technical coordinators and (via them) scientific observers.
1.2	Acknowledge work of technical coordinators and scientific observers.	Standing request		Dec 2006	Commend technical coordinators and all observers for their efforts in the 2005/06 fishing season.
1.3	Review new and exploratory fishery notifications.	Standing request	Mr Smith and Dr Waugh	At submission deadline	Transmit e-copies of notifications and adopted 2006 e-version of Table 19 to Dr Waugh and Mr Smith to prepare initial draft of IMAF table.
1.4	Prepare new and exploratory notification checklist relating to IMAF risk assessment.		Science Officer, Mr Smith	Mar 2007/ Aug 2007	Needs to be distributed to Mr Smith and Dr Waugh for review prior to circulation to Members in time for 2007 notifications of new and exploratory fisheries.
1.5	Prepare agenda for IMAF-07.		Science Officer, Co-Conveners	Feb 2007/ Aug 2007	Science Officer to forward e-version of last year's annotated agenda to Co-Conveners for revision prior to distribution to WG-IMAF for comments on revised structure, final version to be circulated later in year.
1.6	Prepare tables and figure formats for 2007 meeting.	Standing request	SODA*, Co-Conveners, IMAF members	May 2007, comments by mid-June 2007	SODA to forward e-version of all last year's tables and figures and agreed modifications to Co-Conveners for revision prior to distribution to WG-IMAF.

(continued)

Table 20 (continued)

	Task/Topic	Paragraphs of WG-FSA report	Members' Assistance[1]	Start/ Completion deadlines	Action
1.7	Membership of WG-IMAF.	Standing request	Members	Nov 2006/ as required	Request nomination of new members to IMAF, especially technical coordinators from those Members that deploy the greatest number of observers in the Convention Area, Members not currently involved and request all Members to send their representatives to the next IMAF meeting.
1.8	Submission of papers for IMAF-07.		Members, IMAF members, SODA	By 0900 24 Sep 2007	Submit papers specifically relevant to agenda items.
1.9	Allocation of submitted papers to agenda items and assignment of rapporteuring tasks.	Standing request	Co-Conveners	Before meeting	Prepare list, circulate to confirmed attendees and post on website.
2.	**Members' research and development activities:**				
2.1	Request Members provide updated information on national research programs on albatrosses, giant petrels and white-chinned petrels to ACAP in relation to status and trends of populations and foraging range and distribution, genetic profiles and the numbers and nature of by-catch specimens and samples.	Standing request	Members, IMAF members, technical coordinators, nominated scientists	Nov 2006/ Sep 2007	Explicit reminder to IMAF members in March 2007.
2.2	Risk assessment of seabird by-catch in the Convention Area.	Standing request	IMAF members	Nov 2006/ Sep 2007	Further work as appropriate to update SC-CAMLR-XXV/BG/26 for the Scientific Committee. Circulate any new tabled papers relating to seabird at-sea distributions to Co-Conveners and Dr Gales – and to other WG-IMAF members as requested.

(continued)

Table 20 (continued)

	Task/Topic	Paragraphs of WG-FSA report	Members' Assistance[1]	Start/ Completion deadlines	Action
2.3	Further develop draft manuscript describing CCAMLR's risk assessment process.		Drs Waugh and Gales, Mr Baker	Dec 2006/ Feb 2007	Review further developed draft manuscript (WG-FSA-06/33); circulate to IMAF intersessionally and receive comments by February 2007; intent for publication in peer-reviewed journal.
2.4	Request BirdLife International to provide summary data on distribution of Southern Ocean seabirds from its tracking database if accumulation of data warrants. Plan with BirdLife for the three-year review of tracking database.	Standing request	Science Officer, BirdLife International, Co-Conveners	Jul 2007	Request information. Circulate any new information to WG-IMAF. Co-conveners to liaise with BirdLife International with respect to three-year review.
2.5	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: • optimum configuration of line-weighting regimes and equipment; • experiences with IWL, especially the practicality of the gear in conjunction with a line-shooting device; • haul mitigation devices and experiences with their use; • tests of/experiences with streamer lines, especially with respect to paired vs single lines; • trawl haul mitigation and the use of net binding; • determination of appropriate 'access windows' for Convention Area seabirds and fisheries.	Standing request	Members, IMAF members, technical coordinators	Nov 2006/ Sep 2007	Request information, collate responses for IMAF-07, members to submit papers where possible.

(continued)

Table 20 (continued)

	Task/Topic	Paragraphs of WG-FSA report	Members' Assistance[1]	Start/ Completion deadlines	Action
2.6	Methods for preventing seal mortality or injury associated with krill trawl fishing.	Standing request	Members as appropriate, scientific observers, IMAF members	As soon as report available	Further testing of and continued reporting on effectiveness of various mitigation methods and devices; report to IMAF-07.
2.7	Continued experimental trials of mitigation measures in French EEZ.	Standing request	France, IMAF scientists	As soon as reports available	Report available results to IMAF-07, in particular details of multiple streamer lines and a repeat of the earlier modified DeLord analysis including all additional available data.
2.8	Information on modifications to standard longline gear.		IMAF	Sep 2007	Provide reports describing in detail hybrid longline methods, how they are deployed and retrieved, via a paper on these matters for IMAF-07.
2.9	Request data acquired from newly developed protocols for: seabird trawl warp strike observation, longline haul, and longline access window (sink rate, vessel speed, and aerial extent of streamer lines).	7.32 (App. D 74)	Drs Waugh and Sullivan and Mr Melvin, IMAF members	Aug 2007	Review data-to-date from new protocols developed at IMAF-06. Data extract in early August to allow paper to be drafted.
3.	**Information from outside the Convention Area:**				
3.1	Information on longline fishing effort in the Southern Ocean outside the Convention Area.	Standing request	Members, non-Contracting Parties, international organisations	Sep 2007	Request information intersessionally from those Members known to be licensing fishing vessels in areas adjacent to the CCAMLR Convention Area (e.g. Argentina, Brazil, Chile, UK, South Africa, Uruguay, New Zealand and Australia); review situation at IMAF-07. Request information from other Parties – Members and non-Contracting Parties (e.g. People's Republic of China, Japan, Republic of Korea)and review at IMAF-07.

(continued)

Table 20 (continued)

	Task/Topic	Paragraphs of WG-FSA report	Members' Assistance[1]	Start/ Completion deadlines	Action
3.2	Information on incidental mortality outside the Convention Area of seabirds breeding within the area.	Standing request	Members, IMAF members	Sep 2007	Repeat request to all IMAF members, especially to those relevant to item 3.1 above; review at IMAF-07.
3.3	Reports on use and effectiveness of mitigation measures outside the Convention Area.	Standing request	Members, non-Contracting Parties, international organisations	Sep 2007	Request information on use/implementation of mitigating measures, especially provisions in Conservation Measures 25-02, 24-02 and 25-03, as under item 3.1 above; review responses at IMAF-07.
4.	**Cooperation with international organisations:**				
4.1	Cooperation with ICCAT, IATTC, WCPFC, CCSBT, SEAFO and IOTC on specific issues regarding incidental mortality of seabirds.	Standing request	Co-Conveners, Science Officer	Nov 2006/ Sep 2007	Brief CCAMLR observers on desired feedback on IMAF matters (seabird by-catch levels and mitigating measures).
4.2	Collaboration and interaction with all tuna commissions (ICCAT, IATTC, IOTC, CCSBT, WCPFC, SEAFO) and regional fishery management organisations with responsibility for fisheries in areas where Convention Area seabirds are killed.		Relevant Members, CCAMLR observers	Nov 2006 and at specific meetings	Request information on: (i) annual data on distribution level of longline fishing effort; (ii) existing data on levels and rates of seabird by-catch; (iii) measures currently in use and whether voluntary or mandatory; (iv) nature and coverage of observer program; (v) scientific information supporting proposed or adopted mitigation measures. Support regulations for use of proposed or adopted mitigating measures at least as effective as Conservation Measure 25-02.

(continued)

Table 20 (continued)

	Task/Topic	Paragraphs of WG-FSA report	Members' Assistance[1]	Start/ Completion deadlines	Action
4.3	Tuna RFMO Meeting in Japan in Jan 2007.	7.57	Science Officer, Co-Conveners, Members	Dec 2006	Request members to support incidental mortality related initiatives at the meeting as referred to in CCAMLR Resolution 22/XXV.
4.4	Progress with NPOAs in respect of FAO IPOA-Seabirds.	Standing request	Relevant Members, IMAF members	By Sep 2007	Solicit reports to CCAMLR on progress for information and make review.
4.5	Support for ACAP attendance at AC/MOP meetings.	Standing request	Members as appropriate; Australia		Support the work of the Advisory Committee, implementation of its Action Plan, and coordinating activities between CCAMLR and ACAP. Report to IMAF-07.
4.6	IUCN Red List: Seabirds	Standing request	Secretariat	Aug 2007	Obtain from BirdLife International, circulate to IMAF members and table for SC-CAMLR-XXVI, any revisions to the conservation status of albatross, *Macronectes* and *Procellaria* species.
4.7	BirdLife International	Standing request	Science Officer, BirdLife International	Sep 2007	Request information from BirdLife International about its activities of relevance to IMAF, in particular its Seabird Program and 'Albatross Task Force'. BLI submission of updated report on RFMO evaluation to IMAF-07.
4.8	Southern Seabird Solutions	Standing request	New Zealand	Sept 2007	Report on progress to IMAF-07.
5.	**Data acquisition and analysis:**				
5.1	Acquisition from EEZs and elsewhere as appropriate, of seabird incidental mortality data for trawl fisheries.	Standing request	Members	Nov 2006/ Sep 2007	Request Members for appropriate data.

(continued)

Table 20 (continued)

	Task/Topic	Paragraphs of WG-FSA report	Members' Assistance[1]	Start/ Completion deadlines	Action
5.2	Acquisition of original data in CCAMLR format on seabird incidental mortality for French EEZs in Subarea 58.6 for 2000/01 and in Subarea 58.6 and Division 58.5.1 for 2006/07.	7.7 (App. D 17)	France	2001/02 data – as soon as possible, 2006/07 data – Sep 2007	Request France to submit reports and data logbooks prepared by national observers for the current and past fishing seasons, preferably using CCAMLR reporting formats.
5.3	Analysis of 2003/04 to 2005/06 vessel-specific by-catch information.	7.7 (App. D 17)	France	As soon as possible	Request analysis of the 2003/04 to 2005/06 by-catch data to identify factors contributing to high levels of by-catch via a paper for IMAF-07.
5.4	Status report on implementation of IMAF recommendations re: mitigation research programs, observer coverage and implementation of mitigation measures.	Standing request	France, IMAF	Sep 2007	Report to IMAF-07.
5.5	Provision of data by Brazil on by-catch of Convention Area seabirds in Brazilian waters.	Standing request	Brazil	As soon as possible	Report to IMAF-07.
5.6	Estimates of IUU take of seabirds.	Standing request	Secretariat	Before IMAF-07	Prepare 2007 estimates of IUU seabird by-catch.
5.7	Request updated information on distribution, status and trends of albatross and petrel populations from ACAP.	Standing request	Science Officer	Jul 2007	Request information. Submit paper to IMAF-07 by deadline.
6.	**Scientific observer issues:**				
6.1	Preliminary analysis of data from 2006/07 fisheries, including extrapolations for all fisheries (trawl and longline) where incidental mortalities (seabird and marine mammal) occur.	Standing request	SODA	IMAF meeting	Produce draft tables equivalent to Tables 1 to 19 of the FSA-06 report for IMAF-07 as soon as possible.

(continued)

Table 20 (continued)

	Task/Topic	Paragraphs of WG-FSA report	Members' Assistance[1]	Start/ Completion deadlines	Action
6.2	Changes to current seabird and marine mammal data collection included in the scientific observer cruise reports and logbooks for all fisheries.		SODA, IMAF, technical coordinators		IMAF follow through with Secretariat and with technical coordinators to assure that these changes are incorporated into observer forms and into training/briefing protocols used by technical coordinators.
6.3	Vessel operators reminded of exceeding minimum streamer line specifications and haul mitigation requirements in CM 25-02 and other seabird-related CMs.	Standing request	Members, technical coordinators	Nov 2006	Vessel operators advised to exceed standards to prevent compliance failures.
6.4	Review priorities and protocols for observers in the cruise logbooks, cruise reports and the *Scientific Observers Manual* and address identified issues especially to determine if data collections meet data requirements.	Standing request	IMAF	Sept 2007	Intersessional IMAF task group to be established to complete work. Report, as necessary, to IMAF-07.
7.	**Revision of seabird and marine mammal related conservation measures:**				
7.1	Research areas: (i) revaluate streamer line colours; (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; (v) comparison of steel elliptical weights versus traditional Spanish system weights;	Standing request App. D 89, 102)	IMAF	Sep 2007	Continued research to allow a more informed revision of conservation measures, with the intention of combining related conservation measures if possible.

(continued)

Table 20 (continued)

Task/Topic	Paragraphs of WG-FSA report	Members' Assistance[1]	Start/ Completion deadlines	Action
7.1 (continued)				
(vi) efficacy of 'new' Spanish line-weighting regime as a seabird deterrent;				
(vii) efficacy of paired streamer lines in Southern Ocean conditions;				
(viii) development of best management practice in Spanish system;				
(ix) development of best management practice in autoline gear.				

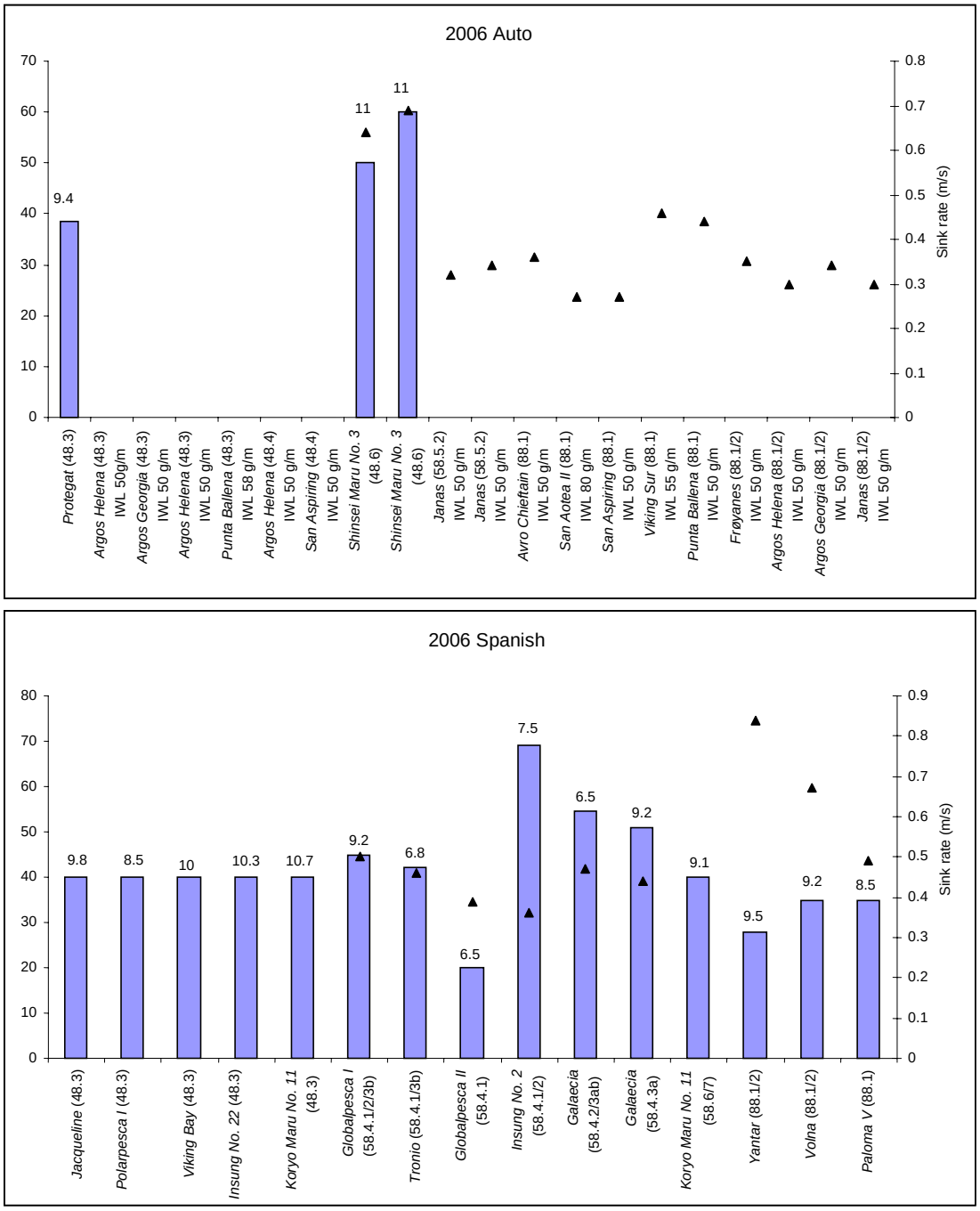

Figure 1: Longline weight spacing (y-axis in metres) and weights used (kilograms) by Spanish and autoline systems during the 2005/06 season. ▲: Sink rate (metres/second); IWL: Integrated Weighted Line (grams/metre).

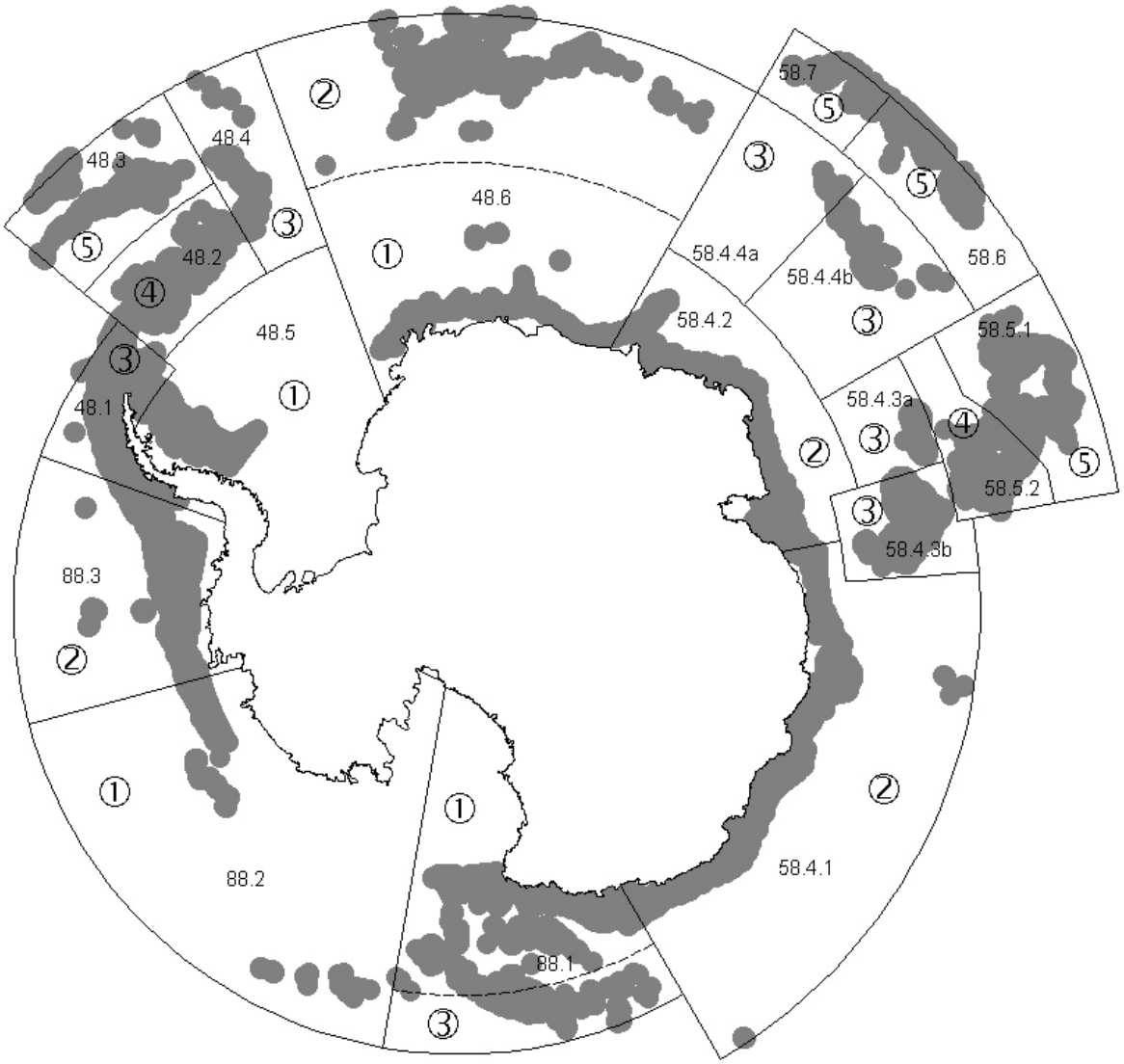

Figure 2: Assessment of the potential risk of interaction between seabirds, especially albatrosses, and longline fisheries within the Convention Area. 1: low, 2: average to low, 3: average, 4: average to high, 5: high. Shaded patches represent seabed areas between 500 and 1 800 m.

APPENDIX E

REPORT OF THE SUBGROUP ON CONSIDERATION OF CONTINUOUS TRAWLING FOR KRILL

REPORT OF THE SUBGROUP ON CONSIDERATION OF CONTINUOUS TRAWLING FOR KRILL

In the 2006 fishing season the Norwegian-flagged vessel *Saga Sea* started fishing operations for krill in the Convention Area. The vessel used the continuous trawling technology, which has been previously developed by the *Atlantic Navigator*. At its 2005 meeting, the Scientific Committee agreed that this new technology would not be considered a 'new and exploratory fishery' if there is an adequate description of the selectivity of the method for krill, a characterisation of the haul (or catch rate) and information on the location of krill catches. In particular, because haul duration can extend for several days, there existed the potential for single hauls to occur in several different SSMUs. Finally, there might be considerable potential for this type of fishing gear to impact other elements of the ecosystem either through by-catch, particularly of larval fish, or through incidental mortality of either immature krill, or other small pelagic species (SC-CAMLR-XXIV, paragraphs 4.8 and 4.9).

2. The Scientific Committee had called for papers describing the continuous trawling method and analysing its impacts, and for WG-EMM to advise it on the issue. Unfortunately, at the time that WG-EMM met, the *Saga Sea* had not been fishing for long enough in the 2005/06 season for there to be sufficient data to analyse. WG-EMM therefore asked WG-FSA to 'examine the catalogued data at their 2006 meeting to assess the difference between the two types of krill fishing and to provide a commentary to the Scientific Committee' (Annex 4, paragraph 3.68).

3. This topic does not normally fall within the remit of WG-FSA. Nevertheless a subgroup considered the issue as was requested by WG-EMM-06.

4. The subgroup noted that up to now only one observer report on the *Atlantic Navigator* for 2003/04 had been submitted to the Secretariat, by the UK observer. Pin et al. (2005) presented a document to WG-EMM-05 (WG-EMM-05/12) based on data from four Uruguayan observers on the *Atlantic Navigator* for the 2003/04 and 2004/05 seasons. Some of these data have been submitted to the Secretariat, but no official observer report has been submitted by Uruguay. The UK observer report and data on the *Saga Sea* fishing in 2005/06 were submitted to the Secretariat according to the required deadlines. These data were analysed and reported in WG-FSA-06/57 but the subgroup did not have sufficient time to review them directly. A description of the technology of continuous krill fishing was presented to WG-FSA by Norway in WG-FSA-06/20. Some confusion about the method (specifically the presence of bubbles in the net), which had arisen through apparent misunderstandings by scientific observers on the *Atlantic Navigator*, appeared now to be resolved.

5. The subgroup noted that the *Saga Sea* had 100% observer coverage in the 2005/06 fishing season, and encouraged Norway to ensure 100% scientific observer coverage on the *Saga Sea* in 2006/07.

Adequate description of the selectivity of the method for krill

6. There are two questions regarding selectivity that need to be resolved:

(i) Does the addition of the pumping system lead to changes in the selectivity of trawls in relation to krill?

(ii) Does the use of continuous trawling lead to different fishing patterns in fleets using continuous versus conventional methods that could result in different fleet selectivity?

7. Two papers had been submitted to WG-FSA. WG-FSA-06/23 examined existing reports and concluded that the pumping system had the potential to capture all animals in the codend of the net, regardless of size, and that there was higher potential for smaller krill to be caught than with conventional trawls. WG-FSA-06/57 examined data reported by the observer on the *Atlantic Navigator*, collected with identical nets operated in both continuous and conventional modes, and data reported by the observer on the *Saga Sea*, collected with nets operated in continuous mode only. Based on these data, WG-FSA-06/57 concluded that there was no evidence for the continuous trawling method selecting smaller-sized krill than the conventional method.

8. The data available on by-catch and size composition of krill trawls are currently inadequate to allow a comprehensive comparison of selectivity between continuous and conventional trawl systems. In particular, there were no comparable trawls from the *Saga Sea* (which in its 2005/06 fishing season used only continuous trawls). Research to estimate the selectivity of krill in any trawl and to estimate the non-landed mortality of krill would be useful in this analysis. Nevertheless, the available data suggest that the simple addition of a pump to a trawl is unlikely to change the selectivity of krill.

9. The subgroup recommended that the Scientific Committee call for further data collection to resolve this issue.

10. Regarding paragraph 6(ii), the analysis of selectivity by fleets requires comprehensive length-frequency data from fleets operating closely adjacent to each other, both spatially and temporally. In the absence of full observer coverage on the krill fleet, this question will remain difficult to resolve. A possible source of data is the observer coverage of all krill vessels fishing in Subarea 48.1 in the 2005/06 fishing season (including the *Saga Sea*), but these data have only just arrived at the Secretariat and were unavailable for analysis by the subgroup. The subgroup recognised that Norway has indicated that the *Saga Sea* will have a scientific observer in the 2006/07 fishing season, but the provision of sufficient data for a full analysis of the issue at WG-EMM-07 will require increased observer coverage of conventional krill fishing vessels.

11. The subgroup recommended that the Scientific Committee require scientific observer coverage on the entire krill fleet in the 2006/07 fishing season.

12. Dr S. Kasatkina (Russia) pointed out that the data provided from the *Saga Sea* do not include information on the selectivity of continuous trawl systems in relation to krill larval

and immature stages. There might be considerable potential for this type of fishing gear to impact krill larval and immature stages on known krill spawning grounds in Subareas 48.1 and 48.2.

Characterisation of the haul (or catch rate) and
information on the location of krill catches

13. WG-FSA-06/20, 06/57 and the Secretariat's analysis (SC-CAMLR-XXV/BG/16) reported on the current and future plans for characterisation of catch rates. This issue was complicated on the *Saga Sea* by the fact that in 2005/06 krill were pumped into holding tanks and from there into the factory, and there were occasions on which two trawls were deployed simultaneously.

14. Norway and the Secretariat devised a method of recording catch and effort details (position, time, depth, tonnes) on a two-hourly basis which would deal with these problems. However, while it was possible to record effort two-hourly (position, time, depth), because of the way the vessel processed its catch, total catch could only be measured over a 24-hour period and was then allocated equally to each effort two-hour period (WG-FSA-06/20, 06/57). This is probably adequate for determining daily catch, effort and catch rate but not adequate for accurately determining two-hourly catch rates. The subgroup recognised that from 2007 Norway plans to deploy a *Flow Scale* weight measurement device to weigh the krill catches continuously (WG-FSA-06/20) which may resolve the problem of correct attribution of catches to two-hourly intervals, but might not help in quantifying the catch and catch rates from each net when two nets are towed simultaneously.

15. Another problem arising with the continuous trawling system is accurate attribution of the location of catches. SC-CAMLR-XXV/BG/16 identified several instances where a continuous trawl lasting for several days had traversed the boundary of an SSMU one or more times. Characterisation of the haul or catch rate and information on the location of catches is possible, but not ideal, with the current recording systems. The methods used are able to attribute position and depth on a two-hourly basis, but are not adequate for correctly attributing catches to two-hourly fishing periods.

16. Whether the resolution of the haul, catch rate and location data are sufficient for the Scientific Committee's purposes will depend on the use to which the data are to be put. The subgroup regarded this to be a matter for consideration by the Scientific Committee.

Impact on other ecosystem components

17. WG-FSA-06/57 reported an analysis of juvenile fish by-catch in continuous trawling versus conventional trawling. There are very few data from conventional trawling, and none that are spatially and temporally comparable to those collected on the *Saga Sea*. Nevertheless, the paper concluded that catch rates from the *Saga Sea* appeared to be comparable with published data from conventional trawls fishing in the Atlantic sector.

18. The subgroup agreed that data are currently too limited to draw conclusions about this aspect.

19. More comprehensive data will be required from both continuous and conventional trawls to understand the issue, and the subgroup recommended that the Scientific Committee ensure increased levels of observer coverage in the krill fishery, preferably appointed in accordance with the Scheme of International Scientific Observation (main report, paragraphs 10.1 to 10.3).

20. Information on the interaction of seabirds and marine mammals with krill trawls is given in the main report, paragraphs 7.8 to 7.15.

21. Russian scientists expressed the opinion that none of the conditions specified by the Scientific Committee (SC-CAMLR-XXIV) concerning the continuous trawling have been adequately addressed during the 2005/06 season, namely: description of the selectivity of the new fishing method, a characterisation of the haul (or catch rate), information on krill catches and potential impact of the new fishing technique on the ecosystem.

Appendices F–R (Fishery Reports) are only available electronically at:
www.ccamlr.org/pu/e/e_pubs/fr/drt.htm

ANNEX 6

REPORT OF THE SECOND MEETING OF THE SUBGROUP ON ACOUSTIC SURVEY AND ANALYSIS METHODS

(Hobart, Australia, 23 and 24 March 2006)

CONTENTS

REPORT OF THE SECOND MEETING OF THE SUBGROUP ON ACOUSTIC SURVEY AND ANALYSIS METHODS
(Hobart, Australia, 23 and 24 March 2006)

INTRODUCTION

The second meeting of the Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM) was held on 23 and 24 March 2006. The meeting was convened by Dr R. O'Driscoll (New Zealand) and was held at the CCAMLR Headquarters in Hobart, Australia.

2. Dr D. Ramm (Data Manager) welcomed participants on behalf of the Secretariat and outlined local arrangements for the meeting.

3. Dr O'Driscoll reviewed the background to the meeting and the terms of reference recommended by the Scientific Committee (SC-CAMLR-XXIV, paragraphs 13.26 to 13.30). A provisional agenda was introduced and discussed. A subitem on future work was added to Item 6 and the agenda was adopted (Attachment A).

4. The list of participants is included as Attachment B and the list of documents submitted to the meeting is included as Attachment C.

5. This report was prepared by the participants. Two invited experts, Drs R. Korneliussen (Norway) and G. Macaulay (New Zealand), also provided brief, independent reports as was requested in their terms of reference (Attachment D).

REVIEW OF THE FINDINGS OF THE CAMBRIDGE WORKSHOP

6. Dr O'Driscoll summarised the major findings of the meeting of WG-FSA's Subgroup on Fisheries Acoustics (WG-FSA-SFA) that was held in Cambridge, UK, from 18 to 22 August 2003, to discuss acoustic estimates for icefish (*Champsocephalus gunnari*) (SG-ASAM-06/4).

7. WG-FSA-SFA made the following recommendations to WG-FSA (WG-FSA-03/14):

(i) Multiple-frequency acoustic methods be used to estimate the biomass of icefish in the pelagic zone of Subarea 48.3 and other parts of the CCAMLR Convention Area, incorporating the following:

(a) pelagic trawl sampling of acoustic marks;

(b) *in situ* determination of target strength;

(c) compilation of a trawl-validated echogram library (for target and non-target species);

(d) if possible synchronise bottom trawl and acoustic surveys (simultaneous surveys with two vessels or interchangeable bottom and pelagic trawls);

(e) calculate biomass and associated variance using acoustic data from each frequency.

(ii) Acoustic data are not used at the present time to adjust the biomass estimates from bottom trawl catches in the bottom 8 m.

(iii) A variety of methods (e.g. echoic chamber, physics-based and empirical models, *in situ* measurements of individuals and aggregations, and caged aggregations), be undertaken to reduce the uncertainty in estimates of target strength (TS) of icefish, and to improve scattering models.

(iv) Experimental work be undertaken to determine frequency-dependent target strength of other abundant species in the CCAMLR area.

(v) The efficiency of the dB difference method of taxa delineation be evaluated in relation to the range dependent signal to noise ratio.

(vi) Trawl selectivity and catchability be investigated as they impact on target strength determination, species delineation and observation volume.

(vii) Stratification of Subarea 48.3 be reviewed for trawl and acoustic surveys to reduce the variance associated with biomass estimates and length–age structure.

Dr O'Driscoll also reviewed acoustic work on icefish carried out since the WG-FSA-SFA meeting in Cambridge (SG-ASAM-06/4).

8. In January 2004, a short acoustic survey off South Georgia (WG-FSA-SAM-04/20) showed that icefish of all age classes spend time in midwater and reinforced the evidence that a bottom trawl survey can significantly underestimate biomass. This survey also showed that the dB differencing method may not be reliable at distinguishing icefish from krill. Some large catches of icefish were taken from 'krill-like marks' (i.e. on trawls through shoals that had MVBS values between 4 and 6 dB higher on the 120 kHz than on 38 kHz).

9. An extensive acoustic survey of the commercial fishing grounds to the northwest of South Georgia in January 2005 (WG-FSA-05/79) failed to locate significant aggregations of icefish in the water column. Commercial vessels that had fished in the area in December 2004 and January 2005 also did not catch commercial quantities of icefish. However, a number of targeted pelagic trawls were made which assisted in the identification of acoustic marks at South Georgia. These trawls suggested that (non-swimbladder) notothenid fish, such as *Patagonotothen guntheri*, may also appear stronger on 120 kHz than on 38 kHz. Other targeted trawls caught krill (*Euphausia superba*) and the myctophid *Protomyctophum choriodon*.

10. WG-FSA-SAM-04/9 applied a bootstrap method to refine estimates of *in situ* TS for icefish using the same data from the 2002 Russian survey that were considered by WG-FSA-SFA. A mean B_{20} of –83.61 dB with a standard deviation of 0.068 dB was estimated from full (untruncated) PDF distributions of TS and fish length. B_{20} is the intercept of the TS to fish length relationship with slope of 20 (i.e. $TS = 20 \log_{10}(\text{length}) + B_{20}$). There were considerable differences in the estimates of B_{20} obtained for small and large fish, suggesting

that a slope of 20 for the TS–length relationship may not be appropriate for icefish. Application of the new target strength estimates gave a higher biomass for the 2002 survey than that used in the stock assessment by WG-FSA in 2003 (WG-FSA-SAM-04/10).

11. SG-ASAM noted that estimates of B_{20} presented in WG-FSA-02/44, 03/14 and WG-FSA-SAM-04/9 were very similar. The main differences in the estimates obtained from the different TS analysis methods (least-squares and bootstrap, truncated and untruncated data) were between the estimates of standard deviation of B_{20}. The estimate of standard deviation affects survey uncertainty and therefore the lower 95% confidence interval on the biomass estimate.

12. Dr O'Driscoll pointed out that Dr D. Demer (USA) modelled the expected TS for icefish versus frequency and orientation angle at the WG-FSA-SFA meeting in Cambridge using the Kirchoff Ray Mode model and an icefish mass density estimate provided by Dr C. Jones (USA). The report stated that the 'model generally agrees with observed TS measurements if some assumptions are made about the fish orientation distribution. The results from this model also suggest that the dB difference boundary used is plausible for icefish discrimination' (WG-FSA-03/14, paragraph 6.15). SG-ASAM was unable to find further documentation of the TS modelling carried out by Dr Demer and so was not able to evaluate or discuss this.

13. SG-ASAM urged Members with data on icefish TS and modelling to document this so that it is available for consideration by future meetings of SG-ASAM.

NEW INFORMATION ON ICEFISH ACOUSTICS

14. Dr S. Fielding (UK) presented preliminary results from the South Georgia groundfish survey carried out from 4 January to 1 February 2006 on board the FPV *Dorada* (SG-ASAM-06/5). Sixty-five randomly stratified bottom trawls were undertaken around South Georgia for icefish stock assessment. Concurrent acoustic data were collected with the trawls using a two-frequency (120 and 38 kHz) calibrated Simrad™ EK500 echosounder. During the last two days of the cruise (restricted due to weather) acoustic transects were run at night across areas of high icefish density, identified from both the bottom trawl survey and from the presence of commercial fishing vessels reporting good catches. Targeted tows using an International Young Gadoids Pelagic Trawl (IYGPT) were undertaken during daytime working hours to 'ground truth' water column acoustic marks.

15. Six of the 65 bottom trawls caught greater than 90% by weight (not including benthos) of icefish. Echograms from these trawls indicated that, whilst strong marks persisted near the sea bottom, some icefish undertook excursions from the bottom into the water column during the day. Targeted IYGPT trawls confirmed that water column acoustic marks below 50 m depth were icefish, whilst overlying strong marks (at less than 50 m depth) were krill. Night-time transects across the regions of daytime icefish marks exhibited little visual similarity to daytime marks and it is uncertain whether this resulted from the movement of icefish to the surface or whether icefish remained at depth in a more dispersed form. Most icefish caught during the survey ranged in length between 20 and 30 cm.

16. Δ120–38 kHz S_v dB differences were calculated for all acoustic data during the trawls and indicated that pelagic marks, confirmed to be icefish from the IYGPT trawl, could have a Δ120–38 kHz S_v within the range of 2–12 dB, which is the range associated with krill detection. The Δ120–38 kHz S_v dB difference of icefish marks near the sea bottom were more variable and the difference was often less than 2 dB, i.e. values more typically associated with fish discrimination.

17. Acoustic data from the 2006 UK survey were made available to SG-ASAM to look at during the meeting.

18. Dr Korneliussen reported that the average relative frequency response of Atlantic mackerel (*Scomber scombrus*) was variable around 120 kHz and seemed to be dependent on fish size (see paragraph 34). SG-ASAM noted that if this was also the case for mackerel icefish, then this could explain the variability in the dB difference between different icefish marks.

19. Dr Macaulay questioned whether the survey bottom trawl would catch krill if these were associated with icefish close to the bottom. Dr Fielding was uncertain. The mesh size of the bottom trawl was probably too large to retain krill, but some might be expected to be stuck in the meshes.

20. Dr O'Driscoll noted that, although the catch rates of icefish from midwater marks were relatively low (only 50 kg in 1 hour tow), it was reassuring that the IYGPT trawl did not catch any krill during the tow on these marks. The same net made a large catch of krill (800 kg in 30 min) in a tow on surface layers above the icefish marks.

21. There is potential to look at TS data collected from icefish marks during the 2006 survey, although densities may have been too high to successfully detect individual targets. Sample power and angle data were also collected so target detection can be done independently of the EK500 algorithm.

22. Because of the large difference in acoustic marks between day and night, Dr O'Driscoll suggested that it would be useful to compare acoustic densities to determine whether total backscatter decreased at night or whether the change in mark type could be explained by dispersal of aggregations.

INFORMATION FROM OTHER SPECIES RELEVANT TO ISSUES IN ICEFISH ACOUSTICS

Target strength

23. Dr Macaulay gave an overview of methods for measuring and modelling acoustic TS (SG-ASAM-06/6). He described recent advances in TS modelling of non-swimbladder fish using realistic density profiles from computed tomography (CT) scans and showed an example of orange roughy (*Hoplostethus atlanticus*).

24. Dr Macaulay noted that the assumption of a linear relationship between TS and $\log_{10}$(length) is sometimes not supported by TS model results.

25. The TS modelling method based on CT scans is to be applied to icefish. The UK will provide CT scans of icefish collected at South Georgia to Dr Macaulay. There have been some initial problems with formatting of sample CT data, but these appear to have been resolved. Dr Macaulay indicated that CT scanning of icefish should begin soon and that modelling would probably be carried out before the end of 2006.

26. SG-ASAM welcomed this development and looked forward to seeing the results. SG-ASAM requested that TS models be run over a range of frequencies, in particular at 38, 70, 120 and 200 kHz to investigate the frequency dependence of acoustic scattering for icefish. This would potentially assist with multi-frequency identification of icefish marks (see paragraphs 35 to 39).

27. Dr Macaulay pointed out that surveys for abundance estimation require tilt-averaged TS. For model results to be applied, it is also necessary to have estimates of pitch and roll angles of fish under the survey vessel. SG-ASAM discussed possible methods of estimating fish tilt angles *in situ*. These include:

(i) direct observation using cameras

(ii) deriving tilt angles by comparing *in situ* and model TS results

(iii) estimating swimming angle from *in situ* acoustic observations with multiple pings of the same target. Swimming angle may be used as a proxy for tilt angle.

28. Dr D. Welsford (Australia) questioned whether differences in orientation could explain the variability in dB differences observed from different types of icefish marks. Dr Macaulay replied that differences in tilt angle could easily lead to 10 dB differences in icefish TS and changes with tilt angle were frequency dependent. Dr Fielding further noted that variability in tilt has greater effect at higher frequencies.

29. SG-ASAM considered the potential influence of the survey vessel on the tilt-angle distribution of icefish. It seems likely that icefish respond to trawls by diving, and it is possible that they may also react to the survey vessel. Dr Fielding reported that acoustic marks in the upper 50 m could be observed diving in response to the winches on the survey vessel being turned on during the 2006 UK survey, but noted that these marks were most likely not icefish. There was no information currently available on the response of icefish to a survey vessel.

30. Measurements of sound speed in icefish flesh and bone could potentially refine model estimates of icefish TS, which, at present, will rely on relationships between density and sound speed from the literature.

31. SG-ASAM emphasised that the proposed TS modelling will not provide a simple 'answer' to the question of icefish TS, and urged further collection of *in situ* TS data, *ex situ* experimental work and modelling. All of these methods require assumptions and may provide logistical challenges. SG-ASAM noted that acoustic TS is a difficult question and that it can take many years to get a robust and reliable estimate.

MARK IDENTIFICATION

32. Dr Korneliussen reviewed species identification using multi-frequency acoustics (SG-ASAM-06/7).

33. Several acoustic features and other features may be used alone or in combination to identify acoustic categories. Some of these features are the volume backscattering coefficient at 38 kHz, $s_v(38)$, the relative frequency response, $r(f) = s_v(f)/s_v(38)$, diurnal variation of the Nautical Area Scattering Coefficient, s_A or NASC, temperature variation, seasonal variation, geographical area, and general behaviour. r(f) seem to be the feature that best separates acoustic categories.

34. Backscatter from the swimbladder represents more than 90% of the total backscatter from those fish that have swimbladders. For non-swimbladder fish, the flesh, backbone and skull are the potential dominating scatterers. Atlantic mackerel is one of the fish species without swimbladder that have been investigated most. r(f), shown in Figure 1(c), is especially efficient at distinguishing mackerel from fish with swimbladders. Backscatter for mackerel at 200 kHz is four times larger than at 38 kHz. The frequencies 18 and 70 kHz are used to show that there is a lower frequency independent level. Note that the measurements of r(120 kHz) show especially large uncertainty compared with other frequencies. This may be explained by the thickness of the backbone. The thickness of the backbone depends on the size of the fish.

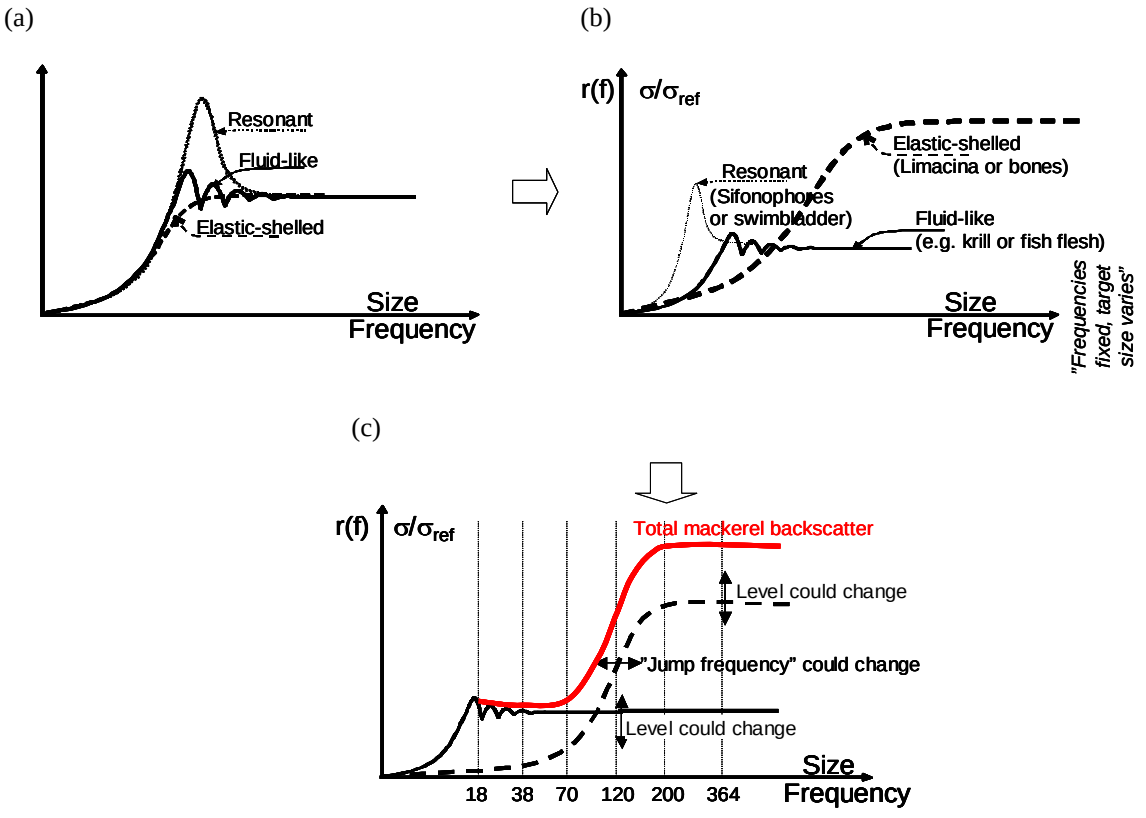

Figure 1: The three different backscattering mechanisms applied to Atlantic mackerel (*Scomber scombrus*): (a) general models: three scattering classes; (b) scattering from each class adjusted to comparable sizes; and (c) backscattering mechanisms of mackerel (intuitive). In (c), the thin solid line represents flesh, the thick dashed line represents bone, and the thick solid line represents the total mackerel backscatter.

35. Icefish like Atlantic mackerel does not have a swimbladder. The skull, however, is thought to be larger for icefish than for mackerel. Thus, the first 'jump frequency' where r(f) increases most rapidly could be expected to start at a lower frequency for icefish than for similar sized mackerel. The use of the frequencies 18, 70 and 200 kHz in addition to 38 and 120 kHz could identify the frequency-span where the average backscatter is frequency independent, and could also be used to distinguish icefish from krill.

36. SG-ASAM agreed that more than two frequencies would be highly advantageous for discriminating icefish from other species.

37. Where the major problem is separating icefish from krill, 70 kHz would be the most useful additional frequency. SG-ASAM recalled the advice of its previous meeting that the use of 70 kHz transducers would improve krill detection, classification and estimation of B_0 (SC-CAMLR-XXIV, Annex 6, paragraph 39), and reiterated its recommendation that 70 kHz be used during acoustic surveys for both krill and icefish whenever possible.

38. If separating icefish from myctophids, it may be useful to have a lower frequency (e.g. 12 or 18 kHz) as fish with small swimbladders have been observed to resonate at these frequencies (Korneliussen and Ona, 2002). A problem with lower-frequency transducers is that they tend to have wider beam angles (since they otherwise would be very large). SG-ASAM noted the importance of having the same beam width for transducers of all frequencies to ensure backscatter is compared from the same sample volume.

39. Higher frequencies, such as 200 kHz, have been shown to be useful for separating Atlantic mackerel from fish with swimbladders. Members of SG-ASAM noted that it may not be possible to obtain 200 kHz data at the depths typically occupied by icefish (150–300 m). Dr Korneliussen reported that they had successfully collected 200 kHz data on mackerel down to almost 300 m from the Norwegian research vessels *G.O. Sars II*, *G.O. Sars III* and *Johan Hjort* with the transducer mounted on a drop keel. This large range relies on smoothing and noise-removal of the data (Korneliussen, 2000; Korneliussen and Ona, 2002, 2003). The maximum usable range for a 200 kHz hull-mounted transducer is likely to be shallower on other vessels. SG-ASAM discussed ways of reducing noise by mounting the transducer below the keel or in a towed body.

40. Dr Fielding pointed out that the UK research vessel *James Clark Ross* has collected acoustic data at 38, 120 and 200 kHz for seven years during krill surveys of the 'western core box', which is in the same area as high-density icefish marks were observed. SG-ASAM examined some 200 kHz data from the most recent survey and found that the depth range of acoustic data from the 200 kHz transducer on the *James Clark Ross* is not as extensive as that observed by Dr Korneliussen on the *G.O. Sars*. An alternative method of noise removal advised by Dr Korneliussen will be investigated to extend the range of the 200 kHz data. If possible, the 2006 western core box acoustic data will be examined with a view to locating icefish-like marks at 120 and 38 kHz and examining the 200 kHz data from these marks.

41. Dr O'Driscoll questioned whether a broadband acoustic system could be used to collect acoustic data across a range of frequencies. Dr Korneliussen pointed out that a major difficulty with most broadband systems was that they produced different beam widths at different frequencies, which makes quantitative comparison between frequencies difficult. He noted that there had been some attempts to build transducers with the same beam-width over a range of frequencies, but that these were generally inefficient.

42. SG-ASAM noted that, while there was a significant cost associated with installing additional transducers on a research vessel, this cost is low relative to the overall cost of carrying out an acoustic survey. Where additional frequencies are essential to the success of the survey, then their installation should be a priority.

43. SG-ASAM further noted that many issues with respect to mark identification are common to surveys of both krill and icefish. Improving mark identification of icefish would also improve the reliability of acoustic estimates of krill.

RECOMMENDATIONS FOR FUTURE WORK ON ICEFISH

44. SG-ASAM welcomed the TS modelling work in progress on icefish (see paragraph 25) and urged that the model is run for a range of frequencies including 38, 70, 120 and 200 kHz to investigate the frequency dependence of acoustic scattering by icefish.

45. SG-ASAM recommended that TS of icefish continues to be investigated using a variety of methods including *in situ* measurements, *ex situ* experiments on individuals and aggregations, and physics-based and empirical models.

46. SG-ASAM noted that estimates of TS depend on the *in situ* tilt-angle distribution of icefish. It therefore recommended that data be collected on icefish orientation, including changes in orientation due to vertical migration or in response to survey vessels.

47. SG-ASAM reiterated the recommendation of WG-FSA-03/14 (paragraph 9.4) that experimental work also be undertaken to determine frequency-dependent target strength of other abundant species in the CAMLR Convention Area. It noted that myctophids may be a particularly complicated group because of interspecific and intraspecific differences in physiology.

48. SG-ASAM recognised the difficulty of making measurements of *in situ* TS and orientation and encouraged further development of technology such as autonomous TS acoustic systems and net-mounted cameras and transducers.

49. SG-ASAM recommended that multiple frequencies be used in acoustic surveys of icefish, including 38, 70 and 120 kHz. The utility of higher and lower frequencies should also be investigated. It noted that it is important that the same beam angle and suitable power settings (Korneliussen and Ona, 2004) are used on all frequencies to ensure comparability of data between frequencies.

50. SG-ASAM recommended that a library of echograms with associated TS, catch and biological data for icefish and associated species should be available from CCAMLR. This library might adopt the framework adopted by the Species Identification Methods from Acoustic Multifrequency Information (SIMFAMI) project (EU project Q5RS-2001-02054) and could be incorporated into the existing CCAMLR acoustic database.

51. Icefish behaviour, including vertical distribution and response to survey vessels, should be further investigated as they impact on survey design, fish orientation, target

strength determination and species delineation. Repeated transects over the same aggregation during a 24-hour cycle would be a useful way of investigating diurnal changes in vertical distribution, mark type and TS.

52. SG-ASAM encouraged the experimental use of different types of trawl gear to investigate trawl selectivity and relative catchability of icefish and associated species.

GENERAL ISSUES RELEVANT TO ACOUSTIC SURVEYS IN CCAMLR WATERS

Survey design

53. In the absence of any krill acoustic experts at the meeting, SG-ASAM agreed to limit the discussion on survey design to studies of fish biomass. Specific recommendations for improvements to icefish surveys are described above (paragraphs 44 to 52). However, the group agreed that the components of an acoustic survey design are similar in most cases, with the major requirements being:

(i) the use of multiple frequencies
(ii) mark identification using directed trawls or other ground truthing methods
(iii) target strength determination by *in situ* measurements
(iv) calibration of acoustic gear used in the survey.

Documentation of survey methods

54. The documentation of survey methods is closely linked to the presentation of results. SG-ASAM noted that documentation of previous acoustic surveys had in general been better than for trawl surveys. WG-FSA-SAM has agreed to assemble a report this year on the protocols required to conduct and document trawl surveys. The minimum requirement for any survey report should be to provide sufficient details to allow independent assessment of the survey results.

55. Dr Fielding raised the issue of consistent definition of terminology in acoustic studies and referred the group to MacLennan et al. (2002) as an example. The group supported the need for consistent reporting and suggested this paper be used as a standard text to ensure consistency of CCAMLR acoustic reports with the wider acoustic community.

56. The only acoustic survey data held in the CCAMLR acoustic database was from the CCAMLR 2000 Krill Synoptic Survey of Area 48. There was insufficient time available to compare the CCAMLR documentation of the CCAMLR-2000 Survey (SC-CAMLR-XIX, Annex 4, Appendix G) with the standards proposed by MacLennan et al. (2002).

Presentation of results

57. The methodology and results need to be adequately described to allow the reliability of the surveys to be evaluated. SG-ASAM concluded that these requirements should be discussed jointly for krill and fish.

Protocols for archiving data

58. Dr Ramm outlined recent developments in the CCAMLR acoustic database. The acoustic data are held within CCAMLR's survey database, and the overall objective of that database was to provide a secure archive of survey datasets of relevance to the Scientific Committee's work, and to provide sufficient data and information in a standard format to enable working groups and subgroups to undertake their analyses.

59. Following discussions during the WG-FSA-SFA meeting in Cambridge, UK, in 2003, the acoustic database had been developed using an event-driven model, with each event representing an acoustic transect, or a net tow, or a CTD cast. Other data in the survey database (e.g. trawl survey data) are also held using the event-driven model.

60. The CCAMLR-2000 Survey dataset is the only acoustic dataset currently held in the database. The CCAMLR-2000 Survey data are held in three formats:

- ping-by-ping data (ek5 files) which contain the direct binary output from the echo sounders. Currently these data are stored in a large number of files which are held in secure storage;

- EchoView files (EV files), also securely stored, contain processed data derived from ek5 files. Each EV file also contains information specific to the survey transects;

- tables in secure database format which contain the output from the EchoView analyses.

61. SG-ASAM was concerned that survey data were archived using proprietary formats (e.g. SonarData's ek5 and EV formats), and recommended that the Secretariat investigate the feasibility of archiving data in the HAC format (a global standard being developed for the storage of hydroacoustic data), and obtaining documentation on the ek5 and EV formats.

62. SG-ASAM agreed that other types of data should be archived by the Secretariat so as to allow detailed analysis (and reanalysis) of acoustic survey data. These additional data include:

(i) transducer configuration
(ii) echosounder configuration
(iii) calibration parameters
(iv) echogram library (paragraph 50).

Future work

63. Dr Ramm noted that another synoptic survey of krill is proposed for the International Polar Year (2007/08). SG-ASAM recommended that acoustic data are collected on at least four frequencies (38, 70, 120 and 200 kHz) whenever possible during the synoptic survey to improve classification of krill, icefish and other species (paragraph 49).

64. Dr O'Driscoll briefly outlined progress on acoustic data collection in the Ross Sea. Acoustic data were logged on two New Zealand longline vessels participating in the exploratory toothfish fishery in Subarea 88.1 from December 2005 to February 2006. Data were from uncalibrated commercial Simrad ES-60 echo sounders with hull-mounted 38 kHz transducers and were collected during normal fishing operations. Acoustic data were also collected during a swath-mapping and geological survey of the Ross Sea by the New Zealand research vessel *Tangaroa* in February–March 2006. Only 120 kHz data were available from the *Tangaroa* because other frequencies interfered with swath-mapping equipment. Some plankton trawls were carried out in conjunction with the acoustic data collection, and these caught mainly krill. All available acoustic data from the Ross Sea will be examined to qualitatively describe mesopelagic mark types.

SUGGESTIONS FOR TIMING/VENUE OF NEXT MEETING

65. SG-ASAM agreed that this meeting had benefited from being held in conjunction with a meeting of ICES's Working Group on Fisheries Acoustics, Science and Technology (WG-FAST). The SG-ASAM meeting had received significant contributions by two invited experts who were primarily in Hobart for the WG-FAST meeting. However, SG-ASAM also agreed that the high cost and time of travel to Hobart from the northern hemisphere had probably contributed to the low number of CCAMLR participants at its meeting.

66. SG-ASAM agreed that future meetings would be required to consider the results of ongoing acoustic research and new surveys. However, SG-ASAM was unable to determine the extent of new contributions by CCAMLR Members who were unable to attend the second meeting. Nevertheless, and in the light of the significant progress made during its second meeting, SG-ASAM recommended that a third meeting should be held in 2007 to consider development in TS modelling (paragraph 25) and contributions by CCAMLR Members who were unable to attend the second meeting.

67. SG-ASAM considered how it may be able to attract a wider range of participants at future meetings. It was agreed that SG-ASAM meetings would be more likely to be attended by acoustic experts if the meetings were held in conjunction with WG-FAST meetings, or other gatherings of acoustic experts (e.g. ICES Acoustic Conference, Bergen, Norway, 2008). It was understood that the 2007 meeting of WG-FAST was scheduled to be held in March–April 2007 in Ireland, and SG-ASAM recommended that its 2007 meeting should be held close to the time and location of the WG-FAST meeting.

68. SG-ASAM recommended that the Data Manager should attend future meetings of SG-ASAM, and that the Secretariat cost associated with attending meetings away from Hobart should be included in the Scientific Committee's budget.

69. SG-ASAM recognised that the development of the survey design and methodology for the proposed CCAMLR-IPY synoptic survey of krill in 2008 may require a planning meeting, and that such a meeting may be able to be held in association with the 2007 meeting of SG-ASAM. The survey design and related matters may also become a priority for SG-ASAM in 2007.

RECOMMENDATIONS TO THE SCIENTIFIC COMMITTEE

70. SG-ASAM recommended that multiple frequencies, including 38, 70 and 120 kHz, be used in acoustic surveys of icefish and krill whenever possible to improve mark classification. The utility of higher and lower frequencies should also be investigated.

71. SG-ASAM recommended that the efficiency of the current (120–38 kHz) dB difference method of taxa delineation be further evaluated in relation to discrimination of icefish from associated species.

72. SG-ASAM recommended that the TS of icefish and associated species continues to be studied using a variety of methods including *in situ* measurements, *ex situ* experiments on individuals and aggregations, and physics-based and empirical models.

73. SG-ASAM noted that estimates of TS depend on the *in situ* tilt-angle distribution of icefish. It therefore recommended that data be collected on icefish orientation, including changes in orientation due to vertical migration or in response to survey vessels.

74. SG-ASAM recommended that icefish behaviour should be further investigated, including vertical distribution and response to survey vessels, as they impact on survey design, fish orientation, target strength determination and species delineation.

75. SG-ASAM recommended that a library of echograms with associated TS, catch and biological data for icefish and associated species should be available from CCAMLR. This library should be incorporated into the existing CCAMLR acoustic database.

76. SG-ASAM emphasised the need for appropriate documentation and archiving of acoustic survey data, including consistency of terminology. It recommended that the Secretariat investigate the feasibility of archiving data in the HAC format, and agreed that other types of data, such as calibration parameters, should be archived by the Secretariat.

77. SG-ASAM recommended that a third meeting should be held in 2007 to consider developments in TS modelling and contributions by CCAMLR Members who were unable to attend the second meeting. The survey design and methodology for the proposed CCAMLR-IPY synoptic survey of krill in 2008 may also become a priority for SG-ASAM in 2007.

78. SG-ASAM recommended that the Data Manager should attend future meetings of SG-ASAM, and that the Secretariat cost associated with attending meetings away from Hobart should be included in the Scientific Committee's budget.

ADOPTION OF THE REPORT

79. This report was adopted by SG-ASAM at the meeting.

CLOSE OF MEETING

80. Dr O'Driscoll thanked participants for their contribution and closed the meeting.

REFERENCES

Korneliussen, R.J. 2000. Measurement and removal of echo integration noise. *ICES J. Mar. Sci.*, 57 (4): 1204–1217.

Korneliussen, R.J. and E. Ona. 2002. An operational system for processing and visualizing multi-frequency acoustic data. *ICES J. Mar. Sci.*, 59 (2): 293–313.

Korneliussen, R.J. and E. Ona. 2003. Synthetic echograms generated from the relative frequency response. *ICES J. Mar. Sci.*, 60 (3): 636–640.

Korneliussen, R.J. and E. Ona. 2004. Verified acoustic identification of Atlantic mackerel. ICES CM2004/R:20.

Korneliussen, R.J., N. Diner, E. Ona and P.G. Fernandes. 2004. Recommendations for the collection of multi-frequency acoustic data. ICES CM2004/R:36.

MacLennan, D.N., P.G. Fernandes and J. Dalen. 2002. A consistent approach to definitions and symbols in fisheries acoustics. *ICES J. Mar. Sci.*, 59 (2): 365–369.

ATTACHMENT A

AGENDA

Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM)
(Hobart, Australia, 23 and 24 March 2006)

1. Introduction
   - 1.1 Opening of meeting
   - 1.2 Meeting terms of reference and adoption of the agenda

2. Review of the findings of the Cambridge Workshop (WG-FSA-03/14)

3. New information available on icefish acoustics

4. Information from other species relevant to issues in icefish acoustics
   - 4.1 Target strength
   - 4.2 Mark identification

5. Recommendations for future work on icefish

6. General issues relevant to acoustic surveys in CCAMLR waters
   - 6.1 Survey design
   - 6.2 Documentation of survey methods
   - 6.3 Presentation of results
   - 6.4 Protocols for archiving data
   - 6.5 Future work

7. Suggestions for timing/venue of next meeting

8. Recommendations to Scientific Committee

9. Adoption of report

10. Close of the meeting.

ATTACHMENT B

LIST OF PARTICIPANTS
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(Hobart, Australia, 23 and 24 March 2006)

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ATTACHMENT C

LIST OF DOCUMENTS

Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM)
(Hobart, Australia, 23 and 24 March 2006)

SG-ASAM-06/1	Agenda
SG-ASAM-06/2	List of Participants
SG-ASAM-06/3	List of Documents
SG-ASAM-06/4	Introduction to icefish acoustics. Powerpoint presentation R.L. O'Driscoll
SG-ASAM-06/5	South Georgian groundfish survey 2006: *C. gunnari* acoustics. Powerpoint presentation S. Fielding, M. Collins, T. North, C. Jones, J. Moir-Clarke, J. Watts and W. Reid
SG-ASAM-06/6	Introduction to acoustic target strength estimation. Powerpoint presentation G.J. Macaulay
SG-ASAM-06/7	Species identification using multifrequency acoustics. Powerpoint presentation R.J. Korneliussen
Other Documents	
WAMI-01/5	Acoustic assessment of potential bias in abundance estimates of mackerel icefish from trawl surveys E. van Wijk, T. Pauly, A. Constable and R. Williams (Australia)
WG-FSA-02/44	Mackerel icefish biomass and distribution on the results of acoustic survey carried out in February–March 2002 S.M. Kasatkina, V.Yu. Sunkovich, A.P. Malyshko and Zh.A. Frolkina
WG-FSA-02/56	A study of UK and Russian surveys using acoustics to augment trawling methods in shelf waters off South Georgia (Subarea 48.3) S. Kasatkina, P. Gasyukov (Russia), C. Goss, I. Everson, M. Belchier, T. Marlow, A. North and M. Collins (United Kingdom)
WG-FSA-03/4	Species profile: mackerel icefish I. Everson (United Kingdom)

WG-FSA-03/14	Report of the Subgroup on Fisheries Acoustics (British Antarctic Survey, Cambridge, 18 to 22 August 2003)
WG-FSA-SAM-03/6	Methodical problems of trawl and acoustic surveys in mackerel icefish stock assessment S.M. Kasatkina, P. Gasyukov and Zh.A. Frolkina (Russia)
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-04/20	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-FSA-05/79	Experimental acoustic survey of icefish resources in Subarea 48.3, 2005 M. Belchier, M. Collins (United Kingdom), R. O'Driscoll (New Zealand), S. Clarke and W. Reid (United Kingdom)

ATTACHMENT D

REPORTS FROM INVITED EXPERTS
Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM)
(Hobart, Australia, 23 and 24 March 2006)

Report from Dr R. Korneliussen

The meeting targeted identification and target strength (TS) of one of the resources of the Antarctic Ocean, namely the mackerel icefish (*Champsocephalus gunnari*). There is strong evidence that bottom trawl surveys significantly underestimate *C. gunnari* biomass.

Dr G. Macaulay (NIWA, New Zealand) was invited as an expert on TS modelling and Dr R. Korneliussen (IMR, Norway) was invited as expert on species identification. Dr R. O'Driscoll (NIWA, New Zealand) chaired the meeting. Other participants of the meeting were Drs D. Ramm (CCAMLR), S. Fielding (BAS, UK), K. Sullivan (Ministry of Fisheries, New Zealand) and D. Welsford (AGAD, Australia).

Although there were only seven participants at the meeting, it seemed to be sufficient to reach the intended goal of the meeting. The meeting facilities were adequate. The meeting proceeded very harmoniously, and ran according to plan. The final report was discussed and adopted at the end of the meeting.

Dr Macaulay outlined the principles for modelling TS. He had used CT scans to visualise internal organs of fish, and used the morphology of these organs in modelling TS. The behaviour, i.e. tilt-angle distribution, was included in the modelling of average TS. Dr Macaulay emphasised the need for sound speed measurements of different parts of fish flesh to be able to model TS of any fish. Dr Fielding will provide CT scans for *C. gunnari* with modelling TS in mind.

Dr Korneliussen showed principles for identification of Atlantic mackerel (*Scomber scombrus*). Like *C. gunnari*, *S. scombrus* does not have a swimbladder, and the similarities between these two species were therefore considered to be close enough to be able to benefit species identification of *C. gunnari* from the experiences of *S. scombrus*.

Dr Korneliussen informed the group that there are three parts of a mackerel that are thought to be important: the flesh, the backbone and the skull. Although the sound-speed and the density of flesh are close to those of seawater and therefore give relatively low backscatter, the fish flesh is still important due to its size. Modelled backscatter shows strong fluctuations at low frequencies (<40 kHz), but averaged over the size distribution in a school, it is frequency independent. The backbone of a mackerel has a size that makes r(f) frequency dependent. r(f) is frequency independent below 100 kHz, and is predicted to be relatively frequency independent above 200 kHz, and although there are indications of this, it is not yet fully proven. r(f) = 1 < 100 kHz; r(f) = 4 > 200 kHz, but r(f) is predicted to increase rapidly with frequency between 100 and 200 kHz where the 'jump' is thought to depend on the thickness of the backbone, i.e. the size of the mackerel. The size of the skull indicates that backscatter from the head is not very frequency dependent, although the frequency dependency of the backscatter could to some extent depend on tilt-angle distribution.

The frequency dependency of the backscatter for *C. gunnari* is expected to follow the same lines as *S. scombrus*. Potential differences in r(f) between equally sized *C. gunnari* and

mackerel could be due to the thickness of the backbone, size of the skull and differences in the flesh. In practice these differences could lead to a different frequency of most rapid increase in r(f), the 'jump frequency', and possibly also to an additional 'jump frequency'. Since the use of additional frequencies is important for identifying *C. gunnari*, the recommendation from SG-ASAM of adding frequencies for acoustic investigations in the Southern Ocean is considered important. The recommendation of adding especially the frequency 70 kHz was also recommended by SG-ASAM with identification of Antarctic krill (*Euphausia superba*).

Figures 1 and 2 illustrate the backscattering mechanisms, although only intuitive.

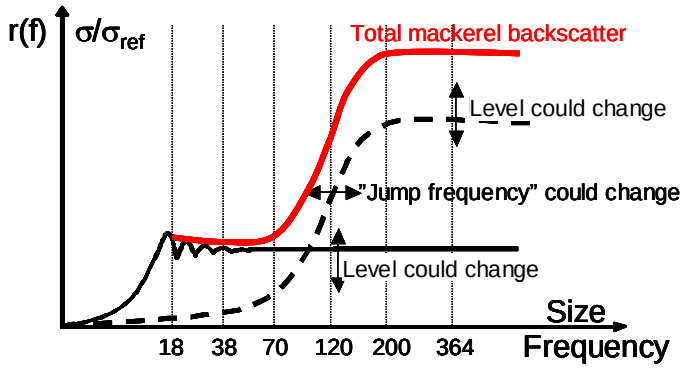

Figure 1: Backscattering mechanisms of Atlantic mackerel (*Scomber scombrus*) (intuitive).

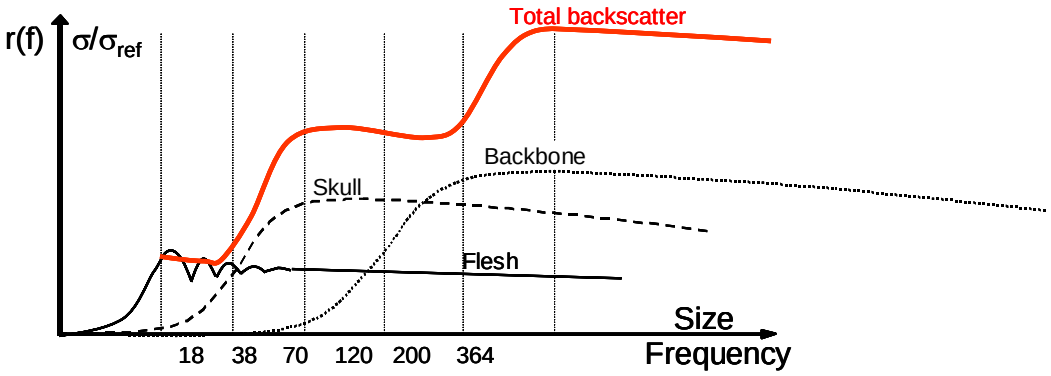

Figure 2: Potential backscattering mechanisms of *Champsocephalus gunnari* (intuitive).

Report from Dr G. Macaulay

The agenda for this meeting included consideration of future work on acoustic surveys of mackerel icefish (*Champsocephalus gunnari*). My expertise in this area is the estimation of target strength, particularly fish without a gas-filled swimbladder, as well as acoustic surveys in general and management of the resulting data.

The recommendations in the subgroup report are reasonable and realistic and, if carried out, will advance the knowledge of *C. gunnari* target strength, and thence estimates of biomass.

Estimates of target strength of fish take some time to obtain, and to develop confidence in. The only *in situ* target strength data available for *C. gunnari* comes from some measurements taken in 1975 (Orlowski, 1984, Hydroacoustic investigations of the Kerguelen Islands area. *Reports of the Sea Fisheries Institute*, 19: 101–108) and 2002 (see WG-FSA-02/44). These appear to have been done in a reasonable manner, but should not be regarded as a definitive answer. There are many factors that can affect the target strength of fish and a number of measurements taken over time are required to give confidence in the results, and it is convenient and prudent to take *in situ* measurements during each survey.

I am in the process of running models of *C. gunnari* target strength at a range of frequencies and this will provide additional data. However these are for individual fish and the dB difference observed between two different schooling behaviours of the fish (as presented by Dr Fielding at the meeting) suggested that the results for isolated *C. gunnari* may not be universally applicable to aggregations.

In my view the meeting worked well, the participants each made a worthwhile contribution to the discussion and the meeting provided a clear statement of the work that is now required to improve acoustic surveys of *C. gunnari*.

ANNEX 7

SPECIFIC TASKS IDENTIFIED BY THE SCIENTIFIC COMMITTEE FOR THE 2006/07 INTERSESSIONAL PERIOD

SPECIFIC TASKS IDENTIFIED BY THE SCIENTIFIC COMMITTEE FOR THE 2006/07 INTERSESSIONAL PERIOD

No.	Task	Reference to paragraphs in SC-CAMLR-XXV	Deadline	Action required	
				Secretariat	Members
1.	**Scheme of International Scientific Observation**				
1.1	Update the Scientific Observer logbooks, instructions and cruise reports and send to Technical Coordinators for distribution and briefing of observers.	2.5, 4.230, 5.31	Feb 2007	Implement	Communicate to Technical Coordinators
1.2	Develop protocols to estimate levels of depredation in *Dissostichus* spp. fisheries.	2.5	Sep 2007	Assist	Implement
1.3	Increase the scientific observer coverage in the krill fishery to allow for adequate and representative sampling.	2.5	Ongoing	Assist	Implement
1.4	Compile a standard methodology for sampling for fish by-catch and an identification guide for larval/juvenile fish likely to be found in krill trawls.	2.5	Jun 2007	Implement	Implement
1.5	Determine whether methods could be developed in which the scheme could be used to determine levels of reporting and detection of tag–recapture events on board fishing vessels.	2.5	Sep 2007	Assist	Implement
1.6	Undertake a review of how education and training of observers is undertaken and to develop an approach for achieving a common level of education and training amongst observers.	2.11	Sep 2007	Implement	Technical Coordinators to assist
1.7	Review the priorities of the observer program to ensure that the expectations and workloads of observers remain achievable.	2.21	Ongoing	Coordinate	Implement
2.	**Ecosystem monitoring and management**				
2.1	Undertake tasks identified by WG-EMM.	Annex 4, Section 6	Jun 2007	Implement	Implement
2.2	Consider what the potential effects of climate change on Antarctic marine ecosystems might be, and how this knowledge could be used in the management of the krill fishery.	3.7	Ongoing	Assist	Implement
2.3	Include a review of the technical modelling issues surrounding the procedures for subdividing the catch limit for krill among SSMUs in Area 48, and explore the application of the integrated assessment approach for krill.	3.15	Jun 2007	Assist	WG-SAM to consider
2.4	Consider the requirement to review CEMP site protection under conservation measures.	3.17	Jun 2007	Assist	WG-EMM to consider

No.	Task	Reference to paragraphs in SC-CAMLR-XXV	Deadline	Action required	
				Secretariat	Members
2.5	Convene a workshop to review estimates of B_0 and precautionary catch limits for krill.	3.26	Jun 2007	Assist	WG-EMM to implement, with assistance from WG-SAM and SG-ASAM
2.6	Convene a Bioregionalisation Workshop.	3.32–3.36	Aug 2007	Assist	Steering Committee to implement, Members to support
2.7	Convene a one-day workshop to consider the development of ecosystem models to examine the effects of fisheries in fish-based ecosystems.	3.58	Jul 2007	Assist	Conveners of WG-EMM and WG-FSA to implement
3.	**Harvested species including by-catch species**				
3.1	Undertake tasks identified by WG-FSA.	Annex 5, Table 14	Sep 2007	Implement	Implement
3.2	Translate a manual for assessing larval and juvenile fish in krill by-catch.	4.9	Jun 2007	-	Dr K. Shust (Russia) to implement
3.3	Convene a correspondence group to develop an interim standardised protocol for the assessment of the incidence of larval fish in krill catches.	4.10	Jun 2007	Assist	Dr S. Kawaguchi (Australia) to coordinate
3.4	Provide detailed information on fishing methodologies, technology and fishing operations.	4.18	Ongoing	Assist	Contracting Parties to implement
3.5	Check the reported positions in the data, especially near longitudes 0º (Subarea 48.6) and 180º (Subarea 88.1).	4.25	Ongoing	Assist	Implement
3.6	Conduct statistical evaluation of new methods to reduce incidental mortality and by-catch using rigorous experimental design, to assess the performance of new gear, its selectivity and impact on ecosystem components.	4.32	Ongoing	Assist	Implement
3.7	Document and report any changes in tagging procedure.	4.43	Ongoing	Assist	Implement
3.8	Submit catch, effort, length and biological data from fisheries in the French EEZs in CCAMLR format.	4.76, 4.101	Ongoing	Assist	France to implement
3.9	Apply the CCAMLR decision rules in estimating yields for the toothfish fishery in the South African EEZ.	4.92	Ongoing	Assist	South Africa to implement
3.10	Further develop the management procedure for *C. gunnari.*	4.122	Ongoing	Assist	Implement

No.	Task	Reference to paragraphs in SC-CAMLR-XXV	Deadline	Action required	
				Secretariat	Members
4.	**New and exploratory fisheries**				
4.1	Conduct the fishery-based research outlined in Conservation Measure 41-01 and submit data in a timely manner.	4.142	Ongoing	Assist	Implement
4.2	Conduct tagging and to submit data as part of the Research and Data Collection Plan, and inspect captured fish for tags and submit accurate tag–recapture data in a timely manner.	4.143	Ongoing	Assist	Implement
4.3	Coordinate the tagging programs in new and exploratory fisheries starting from the 2007/08 season.	4.39	Sep 2007	Implement	WG-FSA Subgroup on Tagging to assist
4.4	All tags used by Members in exploratory fisheries should be purchased from the Secretariat for use in the 2007/08 season onwards.	4.39	Ongoing	Implement	Implement
4.5	Investigate the spatial distribution of the two species of *Dissostichus* in Subarea 48.6.	4.153	Ongoing	Assist	Implement
4.6	In regions where both species occur, tag fish at a rate in proportion to the species and sizes of *Dissostichus* spp. present in the catches, and report ramifications associated with this requirement.	4.157	Ongoing	Assist	Implement
4.7	Report information from the vessels and observers operating in Subarea 58.4 on the reasons for low tagging rates, including operational constraints or poor condition of toothfish caught.	4.182	Ongoing	Assist	Implement
4.8	Consider how to acquire appropriate data for assessments of stock status and yield of *D. mawsoni* in the Indian Ocean sector.	4.190	Sep 2007	Assist	Implement
4.9	Submit information on stock structure, biological parameters (e.g. growth, length–weight relationship, maturity), recruitment and methods for assessment of *D. mawsoni* stocks in the Indian Ocean sector.	4.191	Sep 2007	Assist	Implement
4.10	Correspond in order to implement appropriate methods for achieving the required level of tagging in all divisions.	4.192	Ongoing	Assist	Implement
4.11	Incorporate a one-page summary of notifications to include a checklist to address Members' intentions to comply with mitigation measures.	5.38	Apr 2007	Implement	Implement

No.	Task	Reference to paragraphs in SC-CAMLR-XXV	Deadline	Action required	
				Secretariat	Members
5.	**Incidental mortality**				
5.1	Undertake tasks identified by ad hoc WG-IMAF.	SC-CAMLR-XXV/BG/28	Sep 2007	Implement	Implement
5.2	Assess the use of net binding in pelagic trawl fisheries and develop guidelines to assist in a uniform uptake of this mitigation measure.	5.18	Sep 2007	Assist	Implement
5.3	See also tasks identified in Sections 1 and 4.				
6.	**Secretariat supported activities**				
6.1	Disseminate *CCAMLR Science* via the CCAMLR website, and include a searchable index of papers.	12.20	Ongoing	Implement	Support
6.2	Revise the preface of the *CCAMLR Scientific Abstracts.*	12.21	Mar 2007	Implement	
7.	**Other tasks**				
7.1	Submit data on marine debris in accordance with CCAMLR protocols.	6.12	Aug 2007	Assist	Implement
7.2	Participate in selected international meetings and report to SC-CAMLR.	9.25	Ongoing	Implement	Implement
7.3	Establish a long-term science plan which would set the priorities of WG-SAM and the other working groups and subgroups.	13.13	Sep 2007	Assist	Conveners of Working Groups to initiate
7.4	Determine as a matter of urgency if research vessels engaged in other IPY projects would be available to measure krill acoustic biomass and conduct net sampling and CTD casts.	13.34	Apr 2007	Assist	CCAMLR-IPY steering group to coordinate
7.5	Revise the Rules of Procedure for the Scientific Committee.	15.18	Jan 2007	Implement	Apply

ANNEX 8

GLOSSARY OF ACRONYMS AND ABBREVIATIONS USED IN SC-CAMLR REPORTS

GLOSSARY OF ACRONYMS AND ABBREVIATIONS USED IN SC-CAMLR REPORTS

AAD	Australian Government Antarctic Division
ACAP	Agreement on the Conservation of Albatrosses and Petrels
ACC	Antarctic Circumpolar Current
ACW	Antarctic Circumpolar Wave
ADCP	Acoustic Doppler Current Profiler (mounted on the hull)
ADL	Aerobic Dive Limit
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
ALK	Age–length Key
AMD	Antarctic Master Directory
AMES	Antarctic Marine Ecosystem Studies
AMLR	Antarctic Marine Living Resources
APBSW	Bransfield Strait West (SSMU)
APDPE	Drake Passage East (SSMU)
APDPW	Drake Passage West (SSMU)
APEC	Asia-Pacific Economic Cooperation
APEI	Elephant Island (SSMU)
APEME Steering Committee	Steering Committee on Antarctic Plausible Ecosystem Modelling Efforts
APIS	Antarctic Pack-Ice Seals Program (SCAR-GSS)
APW	Antarctic Peninsula West (SSMU)
ASI	Antarctic Site Inventory
ASIP	Antarctic Site Inventory Project
ASMA	Antarctic Specially Managed Area

ASOC	Antarctic and Southern Ocean Coalition
ASPA	Antarctic Specially Protected Area
ASPM	Age-Structured Production Model
ATCM	Antarctic Treaty Consultative Meeting
ATCP	Antarctic Treaty Consultative Party
ATSCM	Antarctic Treaty Special Consultative Meeting
AVHRR	Advanced Very High Resolution Radiometry
BAS	British Antarctic Survey
BED	Bird Excluder Device
BIOMASS	Biological Investigations of Marine Antarctic Systems and Stocks (SCAR/SCOR)
BROKE	Baseline Research on Oceanography, Krill and the Environment
CAC	Comprehensive Assessment of Compliance
cADL	calculated Aerobic Dive Limit
CAF	Central Ageing Facility
CAML	Census of Antarctic Marine Life
CAML SSC	CAML Scientific Steering Committee
CASAL	C++ Algorithmic Stock Assessment Laboratory
CBD	Convention on Biodiversity
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCAMLR-2000 Survey	CCAMLR 2000 Krill Synoptic Survey of Area 48
CCAMLR-IPY-2008 Survey	CCAMLR-IPY 2008 Krill Synoptic Survey in the South Atlantic Region
CCAS	Convention on the Conservation of Antarctic Seals
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CCSBT-ERS WG	CCSBT Ecologically Related Species Working Group
CDS	Catch Documentation Scheme for *Dissostichus* spp.

CDW	Circumpolar Deep Water
CEMP	CCAMLR Ecosystem Monitoring Program
CEP	Committee for Environmental Protection
CF	Conversion Factor
CircAntCML	Circum-Antarctic Census of Antarctic Marine Life
CITES	Convention on International Trade in Endangered Species
CMIX	CCAMLR's Mixture Analysis Program
CMS	Convention on the Conservation of Migratory Species of Wild Animals
COFI	Committee on Fisheries (FAO)
COLTO	Coalition of Legal Toothfish Operators
CoML	Census of Marine Life
COMM CIRC	Commission Circular (CCAMLR)
COMNAP	Council of Managers of National Antarctic Programs (SCAR)
CON	CCAMLR Otolith Network
CPD	Critical Period–Distance
CPPS	Permanent Commission on the South Pacific
CPUE	Catch-per-unit-effort
CQFE	Center for Quantitative Fisheries Ecology (USA)
CS-EASIZ	Coastal Shelf Sector of the Ecology of the Antarctic Sea-Ice Zone (SCAR)
CSI	Combined Standardised Index
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
CTD	Conductivity Temperature Depth Probe
CV	Coefficient of Variation
C-VMS	Centralised Vessel Monitoring System
CWP	Coordinating Working Party on Fishery Statistics (FAO)

DCD	*Dissostichus* Catch Document
DVM	Diel vertical migration
DPM	Dynamic Production Model
DPOI	Drake Passage Oscillation Index
DWBA	Distorted wave Born approximation model
EASIZ	Ecology of the Antarctic Sea-Ice Zone
E-CDS	Electronic Web-based Catch Documentation Scheme for *Dissostichus* spp.
ECOPATH	Software for construction and analysis of mass-balance models and feeding interactions or nutrient flow in ecosystems (see www.ecopath.org)
ECOSIM	Software for construction and analysis of mass-balance models and feeding interactions or nutrient flow in ecosystems (see www.ecopath.org)
EEZ	Exclusive Economic Zone
EIV	Ecologically Important Value
ENSO	El Niño Southern Oscillation
EoI	Expression of Intent (for activities in the IPY)
EPOC	Ecosystem, productivity, ocean, climate
EPOS	European *Polarstern* Study
EPROM	Erasable Programmable Read-Only Memory
eSB	Electronic version of CCAMLR's *Statistical Bulletin*
FAO	Food and Agriculture Organization of the United Nations
FFA	Forum Fisheries Agency
FFO	Foraging–Fishery Overlap
FIBEX	First International BIOMASS Experiment
FIGIS	Fisheries Global Information System (FAO)
FIRMS	Fishery Resources Monitoring System (FAO)
FPI	Fishing-to-Predation Index

FRAM	Fine Resolution Antarctic Model
FV	Fishing Vessel
GAM	Generalised Additive Model
GATT	General Agreement on Tariffs and Trade
GEBCO	General Bathymetric Chart of the Oceans
GIS	Geographic Information System
GIWA	Global International Waters Assessment (SCAR)
GLM	Generalised Linear Model
GLMM	Generalised Linear Mixed Model
GLOBEC	Global Ocean Ecosystems Dynamics Research
GLOCHANT	Global Change in the Antarctic (SCAR)
GMT	Greenwich Mean Time
GOOS	Global Ocean Observing System (SCOR)
GOSEAC	Group of Specialists on Environmental Affairs and Conservation (SCAR)
GOSSOE	Group of Specialists on Southern Ocean Ecology (SCAR/SCOR)
GPS	Global Positioning System
GRT	Gross Registered Tonnage
GTS	Greene et al., (1990) linear TS versus length relationship
GYM	Generalised Yield Model
HIMI	Heard Island and McDonald Islands
IAATO	International Association of Antarctica Tour Operators
IASOS	Institute for Antarctic and Southern Ocean Studies (Australia)
IASOS/CRC	IASOS Cooperative Research Centre for the Antarctic and Southern Ocean Environment
IATTC	Inter-American Tropical Tuna Commission
ICAIR	International Centre for Antarctic Information and Research

ICCAT	International Commission for the Conservation of Atlantic Tunas
ICED	Integrating Climate and Ecosystem Dynamics in the Southern Ocean
ICES	International Council for the Exploration of the Sea
ICES WGFAST	ICES Working Group on Fisheries Acoustics Science and Technology
ICFA	International Coalition of Fisheries Associations
ICSEAF	International Commission for the Southeast Atlantic Fisheries
ICSU	International Council for Science
IDCR	International Decade of Cetacean Research
IFF	International Fishers' Forum
IGBP	International Geosphere-Biosphere Programme
IGR	Instantaneous Growth Rate
IHO	International Hydrographic Organisation
IKMT	Isaacs-Kidd Midwater Trawl
IMAF	Incidental Mortality Associated with Fishing
IMALF	Incidental Mortality Arising from Longline Fishing
IMBER	Integrated Marine Biogeochemistry and Ecosystem Research (IGBP)
IMO	International Maritime Organization
IMP	Inter-moult Period
IOC	Intergovernmental Oceanographic Commission
IOCSOC	IOC Regional Committee for the Southern Ocean
IOFC	Indian Ocean Fisheries Commission
IOTC	Indian Ocean Tuna Commission
IPHC	International Pacific Halibut Commission
IPOA	International Plan of Action
IPOA-Seabirds	FAO International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries
IPY	International Polar Year

IRCS	International Radio Call Sign
ISO	International Organization for Standardization
ISR	Integrated Study Region
ITLOS	International Tribunal for the Law of the Sea
IUCN	International Union for the Conservation of Nature and Natural Resources – the World Conservation Union
IUU	Illegal, Unreported and Unregulated
IW	Integrated Weight
IWC	International Whaling Commission
IWC-IDCR	IWC International Decade of Cetacean Research
IWL	Integrated Weighted Line
IYGPT	International Young Gadoids Pelagic Trawl
JAG	Joint Assessment Group
JARPA	Japanese Whale Research Program under special permit in the Antarctic
JGOFS	Joint Global Ocean Flux Studies (SCOR/IGBP)
KPFM	Krill–Predatory–Fishery Model (used in 2005)
KPFM2	Krill–Predatory–Fishery Model (used in 2006)
KYM	Krill Yield Model
LADCP	Lowered Acoustic Doppler Current Profiler (lowered through the water column)
LMM	Linear Mixed Model
LMR	Living Marine Resources Module (GOOS)
LTER	Long-term Ecological Research (USA)
MARPOL Convention	International Convention for the Prevention of Pollution from Ships
MBAL	Minimum Biologically Acceptable Limits
MCMC	Monte Carlo Markov Chain
MCS	Monitoring Control and Surveillance

MEA	Multilateral Environmental Agreement
MFTS	Multiple-Frequency Method for in situ TS Measurements
MIA	Marginal Increment Analysis
MIZ	Marginal Ice Zone
MODIS	Moderate Resolution Imaging Spectroradiometer
MPA	Marine Protected Area
MPD	Maximum of the Posterior Density
MRAG	Marine Resources Assessment Group (UK)
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
MV	Merchant Vessel
MVBS	Mean Volume Backscattering Strength
MVP	Minimum Viable Populations
MVUE	Minimum Variance Unbiased Estimate
NAFO	Northwest Atlantic Fisheries Organization
NASA	National Aeronautical and Space Administration (USA)
NASC	Nautical Area Scattering Coefficient
NCAR	National Center for Atmospheric Research (USA)
NEAFC	Northeast Atlantic Fisheries Commission
NIWA	National Institute of Water and Atmospheric Research (New Zealand)
nMDS	non-Metric Multidimensional Scaling
NMFS	National Marine Fisheries Service (USA)
NMML	National Marine Mammal Laboratory (USA)
NOAA	National Oceanic and Atmospheric Administration (USA)
NPOA	National Plan of Action
NPOA-Seabirds	FAO National Plans of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries

NRT	Net Registered Tonnage
NSF	National Science Foundation (USA)
NSIDC	National Snow and Ice Data Center (USA)
OCCAM Project	Ocean Circulation Climate Advanced Modelling Project
OECD	Organisation for Economic Cooperation and Development
PBR	Permitted Biological Removal
PCA	Principal Component Analysis
PCR	Per Capita Recruitment
pdf	Portable Document Format
PDF	Probability Density Function
PFZ	Polar Frontal Zone
PS	Paired Streamer Line
PTT	Platform Terminal Transmitter
RFB	Regional Fishery Body
RFMO	Regional Fishery Management Organisation
RMT	Research Midwater Trawl
ROV	Remotely-Operated Vehicle
RPO	Realised Potential Overlap
RTMP	Real-Time Monitoring Program
RV	Research Vessel
SACCF	Southern Antarctic Circumpolar Current Front
SAER	State of the Antarctic Environment Report
SAF	Sub-Antarctic Front
SBWG	Seabird Bycatch Working Group (ACAP)
SCAF	Standing Committee on Administration and Finance (CCAMLR)
SCAR	Scientific Committee on Antarctic Research

SCAR-ASPECT	Antarctic Sea-Ice Processes, Ecosystems and Climate (SCAR Program)
SCAR-BBS	SCAR Bird Biology Subcommittee
SCAR-CPRAG	Action Group on Continuous Plankton Recorder Research
SCAR-EASIZ	Ecology of the Antarctic Sea-Ice Zone (SCAR Program)
SCAR-EBA	Evolution and Biodiversity in Antarctica (SCAR Program)
SCAR-GEB	SCAR Group of Experts on Birds
SCAR-GOSEAC	SCAR Group of Specialists on Environmental Affairs and Conservation
SCAR-GSS	SCAR Group of Specialists on Seals
SCAR-MarBIN	SCAR Marine Biodiversity Information Network
SCAR/SCOR-GOSSOE	SCAR/SCOR Group of Specialists on Southern Ocean Ecology
SCAR WG-Biology	SCAR Working Group on Biology
SC-CAMLR	Scientific Committee for CCAMLR
SC CIRC	Scientific Committee Circular (CCAMLR)
SC-CMS	Scientific Committee for CMS
SCIC	Standing Committee on Implementation and Compliance (CCAMLR)
SC-IWC	Scientific Committee for IWC
SCOI	Standing Committee on Observation and Inspection (CCAMLR)
SCOR	Scientific Committee on Oceanic Research
SD	Standard Deviation
SDWBA	Stochastic Distorted-wave Born Approximation
SEAFO	South East Atlantic Fisheries Organisation
SeaWiFS	Sea-viewing Wide field-of-view Sensor
SG-ASAM	Subgroup on Acoustic Survey and Analysis Methods
SGE	South Georgia East
SGSR	South Georgia–Shag Rocks

SIBEX	Second International BIOMASS Experiment
SIC	Scientist-in-Charge
SIOFA	Southern Indian Ocean Fisheries Agreement
SIR Algorithm	Sampling/Importance Resampling Algorithm
SMOM	Spatial Multispecies Operating Model
SO GLOBEC	Southern Ocean GLOBEC
SOI	Southern Oscillation Index
SO JGOFS	Southern Ocean JGOFS
SOOS	Southern Ocean Observing System
SOW	South Orkney West (SSMU)
SOWER	Southern Ocean Whale Ecology Research Cruises
SPA	Specially Protected Area
SPC	Secretariat of the Pacific Community
SSB	Spawning Stock Biomass
SSG-LS	The Standing Scientific Group on Life Sciences (SCAR)
SSMU	Small-scale Management Unit
SSMU Workshop	Workshop on Small-scale Management Units, such as Predator Units
SSRU	Small-scale Research Unit
SSSI	Site of Special Scientific Interest
SST	Sea-Surface Temperature
STC	Subtropical Convergence
SWIOFC	Southwest Indian Ocean Fisheries Commission
TDR	Time Depth Recorder
TEWG	Transitional Environmental Working Group
TIRIS	Texas Instruments Radio Identification System
ToR	Term of Reference

TrawlCI	Estimation of Abundance from Trawl Surveys
TS	Target Strength
TSVPA	Triple Instantaneous Separable VPA
TVG	Time Varied Gain
UBC	University of British Columbia (Canada)
UCDW	Upper Circumpolar Deep Water
UN	United Nations
UNCED	UN Conference on Environment and Development
UNEP	UN Environment Programme
UNEP-WCMC	UNEP World Conservation Monitoring Centre
UNCLOS	UN Convention on the Law of the Sea
UNFSA	the United Nations Fish Stock Agreement is the 1995 United Nations Agreement for the Implementation of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks
US AMLR	United States Antarctic Marine Living Resources Program
US LTER	United States Long-term Ecological Research
UV	Ultra-Violet
UW	Unweighted
UWL	Unweighted Longline
VMS	Vessel Monitoring System
VPA	Virtual Population Analysis
WAMI	Workshop on Assessment Methods for Icefish (CCAMLR)
WCO	World Customs Organization
WFC	World Fisheries Congress
WCPFC	Western and Central Pacific Fisheries Convention
WG-CEMP	Working Group for the CCAMLR Ecosystem Monitoring Program (CCAMLR)

WG-EMM	Working Group on Ecosystem Monitoring and Management (CCAMLR)
WG-FSA	Working Group on Fish Stock Assessment (CCAMLR)
WG-FSA-SAM	Subgroup on Assessment Methods
WG-FSA-SFA	Subgroup on Fisheries Acoustics
WG-IMALF	ad hoc Working Group on Incidental Mortality Arising from Longline Fishing (CCAMLR)
WG-IMAF	ad hoc Working Group on Incidental Mortality Associated with Fishing (CCAMLR)
WG-Krill	Working Group on Krill (CCAMLR)
WG-SAM	Working Group on Statistics, Assessments and Modelling (provisional name)
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
WSC	Weddell–Scotia Confluence
WS-Flux	Workshop on Evaluating Krill Flux Factors (CCAMLR)
WS-MAD	Workshop on Methods for the Assessment of *D. eleginoides* (CCAMLR)
WSSD	World Summit on Sustainable Development
WTO	World Trade Organization
WWD	West Wind Drift
WWW	World Wide Web
XBT	Expendable Bathythermograph
XML	Extensible Mark-up Language
Y2K	Year 2000