

**REPORT OF THE WORKING GROUP
ON FISH STOCK ASSESSMENT**
(Hobart, Australia, 10 to 21 October 2005)

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¹ Appendices F to M have been published only in electronic format. Please refer to www.ccamlr.org/pu/E/e_pubs/fr/drt.htm for these reports.

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**REPORT OF THE WORKING GROUP
ON FISH STOCK ASSESSMENT**
(Hobart, Australia, 10 to 21 October 2005)

OPENING OF THE MEETING

1.1 The meeting of WG-FSA was held in Hobart, Australia, from 10 to 21 October 2005. It was opened by the Convener, Dr S. Hanchet (New Zealand), and participants were welcomed to the new Secretariat Headquarters and meeting venue.

ORGANISATION OF THE MEETING AND ADOPTION OF THE AGENDA

Organisation of the meeting

2.1 The agenda of the meeting was discussed and adopted with the addition of subitem 14.3 to consider a proposal to reorganise the work of the Scientific Committee.

2.2 The Agenda is included as Appendix A, the List of Participants as Appendix B and the List of Documents presented to the meeting as Appendix C.

2.3 The report was prepared by the participants.

Report restructure

2.4 WG-FSA noted that its report from the 2004 meeting was extremely long and resulted in considerable problems in translating and copying the report in time for the start of last year's meeting of the Scientific Committee. Subsequently, the Scientific Committee had discussed options for alleviating this problem (SC-CAMLR-XXIII, paragraphs 13.8 to 13.13). It concluded that management advice and information essential to the work of the Scientific Committee should be retained in the main body of the report, but that the remaining text, which provided background information and advice for future work of WG-FSA, should be placed in appendices. These appendices would be translated during the intersessional period and published with the report of WG-FSA.

2.5 The Scientific Committee offered the following guidance (SC-CAMLR-XXIII, paragraph 13.12):

- rapporteurs at WG-FSA should be encouraged to remove background documentation from the main body of the report;
- in cases where consensus is not reached, the report of WG-FSA should include a balanced presentation of the various views;
- the main body of the report should include the detail necessary to understand the development of each element of management advice.

2.6 WG-FSA considered various approaches to following the guidelines of the Scientific Committee. The Working Group agreed that each subgroup would prepare a stand-alone subgroup report by the end of the first week of the meeting. These subgroup reports would form appendices to the report of WG-FSA². Each subgroup report would be reviewed in plenary. The report of WG-FSA would reflect the plenary discussions and, where appropriate, the text of the report would contain background paragraphs, distilled from the relevant subgroup report, the key points discussed in plenary, and WG-FSA's advice to the Scientific Committee.

2.7 WG-FSA agreed that the approach outlined above would be extended to the Fishery Reports³ and the report of ad hoc WG-IMAF. It was also agreed that WG-FSA's report would contain the detail necessary to understand the development of each element of management advice. Guidance on the level of detail required, and consequently the extent of translation required prior to the meeting of the Scientific Committee, would be provided by participants.

REVIEW OF AVAILABLE INFORMATION

Data requirements specified in 2004

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 revised a number of databases and procedures used in support of the work of WG-FSA.

3.2 A new trial electronic version of CCAMLR's *Statistical Bulletin* (eSB) was developed as a Microsoft Access database (SC-CAMLR-XXIV/5). The work was undertaken by Mr S. Morgan (Database Administrator and Programmer). The eSB allows users to replicate the six sections which are published in the hard copy of the bulletin. In addition, the eSB allows users to access the complete dataset of statistics underlying the bulletin and to develop user-defined queries to summarise these data, generate tables and graphics, and extract selected data. The Working Group evaluated this development under Item 14.2.

3.3 The routine for generating catch-weighted length frequencies was reviewed and further developed following intersessional consultation (WG-FSA-05/6 Rev. 1). The Secretariat has simplified the operation of the routine by incorporating all of the procedures in a single Microsoft Access database. The routine (described in WG-FSA-99/15) was also expanded to include all types of length measurements reported in the CCAMLR database (previously only lengths reported to the nearest 1 cm below were included in the routine). Updated catch-weighted length frequencies are provided in the Fishery Reports (see Appendices F to M).

² Throughout this report, cross references to paragraphs, tables and figures in the appendices are prefixed by the letter of the appendix, e.g. paragraph N6 is paragraph 6 in Appendix N, Table M12 refers to Table 12 in Appendix M. Also, please note that Appendices D and E do not exist as they were subsumed into the main body of the report.

³ The Scientific Committee later agreed that the Fishery Reports be published in a separate electronic volume (SC-CAMLR-XXIV, paragraph 4.13) (see www.ccamlr.org/pu/E/e_pubs/fr/drt.htm).

3.4 The Secretariat developed a procedure for identifying hauls which matched the criteria of the research plan under Conservation Measure 41-01 (SC-CAMLR-XXIII, Annex 5, paragraph 5.20). The procedure selects hauls from the fine-scale effort data which meet the following criteria (WG-FSA-05/6): longline hauls with 3 500–10 000 hooks and soak times of not less than 6 hours; or trawl hauls with at least 30 minutes of effective fishing time. Selected hauls are then drawn at random and assigned as ‘research’ hauls if they are separated by not less than 5 n miles from any other ‘research’ haul, with the distance measured from the midpoint of each haul. The first ‘research’ haul in a sequence may be specified or chosen at random.

3.5 Quantifying the catch rates and biomass of by-catch species on CCAMLR’s fishing grounds is an essential component of the assessment advice prepared by WG-FSA. However, such analyses are problematic because the CCAMLR by-catch datasets are incomplete and have a high occurrence of ‘missing catch values’. The Secretariat is developing a method to treat ‘missing catch values’ for by-catch species using estimates derived from the mean weights of by-catch species by fishing gear, region and period (WG-FSA-SAM-05/4). In 2005, WG-FSA-SAM encouraged the Secretariat to develop the method, noting that further work would be required to address inconsistencies in the data (e.g. weight reported and numbers only partially reported), and uncertainties associated with using mean weights (WG-FSA-05/4, paragraphs 7.4 and 7.5).

3.6 Further developments were also undertaken in the tagging database, which is now populated with data (see WG-FSA-05/7 Rev. 1, Table 7) and the ageing database. These developments were considered by the Subgroup on Tagging (Appendix T) and the CCAMLR Otolith Network (paragraphs 9.5 to 9.7).

3.7 WG-FSA noted that the majority of the routine queries used to extract data analysed during the meeting are held in a database operated by the Secretariat. The Working Group requested the Secretariat to develop a manual, which can be updated each year, that specifies its procedures and equations, where appropriate, for the extraction and mathematical manipulation of data, and to make this reference information available at the start of future meetings.

3.8 The Data Manager reminded WG-FSA that all data provided by the Secretariat during the meeting are subject to the Rules for Access and Use of CCAMLR Data.

Data processing

3.9 The Working Group noted that all the available CCAMLR fishery and observer data from the 2004/05 season had been submitted by the time of the meeting; many of these data had been submitted 4–6 weeks prior to the meeting. In addition, fishery data from the French EEZs in Division 58.5.1 and Subarea 58.6 in 2004/05 (to August 2005) had also been submitted. Fine-scale data from the fishery in the South African EEZ around Prince Edward and Marion Islands in 2004/05 were unavailable.

3.10 The Working Group noted that some fisheries in 2004/05 were still operating (e.g. fishery for icefish in Subarea 48.3) and that the data arising from these activities would be considered at the 2006 meeting.

3.11 The fishery and observer data from 2004/05 had been received and processed by Mrs L. Millar (Data Administration Officer) and Mr E. Appleyard (Scientific Observer Data Analyst) in time for the meeting. Preliminary validation of these data had also been undertaken. The Working Group thanked Mrs Millar and Mr Appleyard for preparing these data in time for the meeting.

Fishery Plans

3.12 The Secretariat has maintained the database which holds the information on Fishery Plans (WG-FSA-SAM-04/4) and had updated data from 2004/05 to the time series.

Fisheries information

Catch, effort, length and age data reported to CCAMLR

3.13 Under the conservation measures in force in 2004/05, fishing took place in 13 fisheries targeting icefish (*Champscephalus gunnari*), toothfish (*Dissostichus 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.

3.14 In addition, four other managed longline fisheries targeting toothfish were conducted in the Convention Area in 2004/05:

- 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.

3.15 Catches of target species by region and gear reported from fisheries conducted in the CCAMLR Convention Area in the 2004/05 fishing season are summarised in Table 3.1.

3.16 The Working Group noted the Secretariat's work in monitoring fisheries and some of the difficulties encountered in 2004/05 (CCAMLR-XXIV/BG/13). The Secretariat had proposed various improvements which may be considered by the Commission.

3.17 At the request of the Convener of WG-FSA (August 2005), the Secretariat had mapped the general area of operation of each of the main CCAMLR fisheries (WG-FSA-05/6 Rev. 1). The Working Group found these maps to be helpful in understanding the distribution of fishing effort. However, it was decided not to include the haul locations in the fishery reports due to data confidentiality.

3.18 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-05/6 Rev. 1).

3.19 The Working Group recalled that the length-frequency plots for the fisheries in Division 58.5.2 included research data (SC-CAMLR-XXIII, Annex 5, Figures 5.17 and 5.22), and noted that the Secretariat had been working with Dr A. Constable and Mr T. Lamb (Australian Antarctic Division) to address this problem. Further work was required to separate the research data from the commercial fishery data and it was hoped that this would be completed during the forthcoming intersessional period. In the meantime, the Working Group agreed to use the catch-weighted length frequencies for *D. eleginoides* in Division 58.5.2 which had been provided by Dr Constable.

3.20 The Working Group also noted that the length-weight parameters used to generate the catch-weighted length frequencies were estimated from observer data (WG-FSA-05/6 Rev. 1, Table 2) and are not the same as those used in the assessments. WG-FSA agreed that the Subgroup on Biology and Ecology should review these coefficients and develop a set of agreed values for use in the length-frequency procedure (see also Items 3.4 and 9).

3.21 The Secretariat updated the catch histories for target species and managed by-catch species in the Convention Area (WG-FSA-05/6 Rev. 1). Catch histories for *Dissostichus* spp. included estimates of IUU catches (see below).

3.22 The Working Group noted WG-FSA-05/54 which described the autoline fishing method and the terminology for the fishing operation and gear. This paper was further discussed under Item 7. The Working Group thanked the authors for preparing this reference document and encouraged participants to develop a similar description for the Spanish longline fishing method.

3.23 The Working Group noted WG-FSA-05/26 which described a proposal to use vertical droplines in the exploratory fishery for *Dissostichus* spp. in Subarea 48.6 in 2005/06. This paper was further discussed under Item 7.

Estimates of catch and effort from IUU fishing

3.24 WG-FSA reviewed estimates of IUU catches in the Convention Area prepared by the Secretariat and based on information submitted by 1 October 2005 (Table 3.2 and SCIC-05/10 Rev. 1). The deterministic method presently used by the Secretariat to estimate IUU fishing effort was the same method as used in previous years. This method used information on the number of vessels sighted/apprehended and reports of port inspections. Ancillary information on fishing trips and catch rates is derived from CCAMLR data on licensed vessels. The estimates of IUU catch were discussed under Item 8.

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

3.25 Catches of *Dissostichus* spp. in CCAMLR waters 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 for the 2003/04 and 2004/05 seasons are summarised in Table 3.3.

3.26 WG-FSA noted that the catch of *Dissostichus* spp. outside the Convention Area in 2003/04 and 2004/05 was taken mostly in Areas 41 and 87. The total CDS-reported catch so far in 2004/05 from areas to the north of the Convention Area (8 511 tonnes) was lower than that reported over the comparable period in 2003/04 (10 966 tonnes to October 2004; SC-CAMLR-XXIII, Annex 5, Table 3.3).

3.27 Dr E. Balguerías (Spain) submitted catch data from Spanish-flagged vessels fishing for toothfish and finfish in the Atlantic and Indian Oceans outside the Convention Area. Spanish-flagged vessels had reported the following catches of *D. eleginoides*:

2004 calendar year:

Atlantic Ocean outside the SEAFO Convention Area – 242.6 tonnes

Indian Ocean – 0.9 tonnes

2005 calendar year:

Atlantic Ocean outside of the SEAFO Convention Area – 17.6 tonnes

Indian Ocean – no catch.

The Working Group thanked Dr Balguerías for submitting this information.

Scientific observer information

3.28 Scientific observers participated in a total of 47 cruises on board longliners (31 cruises), trawlers (14 cruises) and pot vessels (2 cruises) targeting toothfish or icefish in the Convention Area in 2004/05 (WG-FSA-05/7 Rev. 1, 05/8 and 05/10). In addition, six cruises were reported from trawlers in the krill fishery in Area 48. Scientific observations were discussed under Item 7 and 11.

Research information

Research surveys

3.29 Australia conducted a random stratified trawl survey in Division 58.5.2 in the vicinity of Heard Island between 31 May and 27 June 2005 continuing the time series started in 1990. The survey followed the revised design adopted in 2004 (Candy, 2004). All known areas of distribution of juvenile toothfish and icefish were surveyed on the Heard Island Plateau and Shell Bank. The icefish stations were completed during daytime only. In addition, all deeper water areas between 500 and 1 000 m surrounding the plateau were included in the toothfish

portion of the survey. A total of 158 and 57 valid hauls were completed for toothfish and icefish respectively. Preliminary assessments of toothfish and icefish using data from the survey are provided in WG-FSA-05/30 and 05/39 respectively.

3.30 New Zealand conducted a longline survey in Subarea 88.3. The sampling strategy was based on a two-phase approach targeting two areas of interest:

- Area 1: about the De Gerlache seamounts between 95°W and 85°W
- Area 2: on the main Antarctic shelf between 105°W and 95°W.

A New Zealand-flagged vessel carried out research activities between 11 and 20 February 2005. Due to unfavourable sea-ice conditions, research stations were limited to eight hauls in Area 1; six of these met the definition of a successful research line as defined in Annex 41-01/B. In Area 2, two successful stations were sampled before moving sea-ice curtailed activities. Preliminary results from these hauls are provided in WG-FSA-05/53.

3.31 The UK undertook a research survey in Subarea 48.3 during January 2005. The objectives of the survey were to:

- (i) refine methods for estimating icefish biomass using acoustics;
- (ii) examine temporal changes in the vertical distribution of icefish;
- (iii) assess precision of baited-camera-system estimates of crab density;
- (iv) ‘ground-truth’ the baited-camera-system estimates of crab density using comparisons with bottom trawls;
- (v) provide more information on the distribution of the benthos on the South Georgia shelf;
- (vi) monitor commercial fishing activities in the area.

3.32 Catches of icefish in both demersal and pelagic trawls were very small. Following the loss of the baited-camera system, the survey concentrated on using bottom trawls to investigate the ecology of the ichthyofauna and the distribution of benthos. Preliminary results from the survey are provided in WG-FSA-05/79.

Future surveys

Germany

3.33 Germany will conduct a bottom trawl survey in the Elephant Island–South Shetland Islands–Joinville/D’Urville Islands region (Subarea 48.1) with the RV *Polarstern* in November–December 2006. A commercially sized 140' bottom trawl with a mouth opening of 18–19 m and 3.5–4 m will be used. Survey depth (50–500 m) and survey design will be the same as during the *Polarstern* cruise in 2002 and the US AMLR cruises since 1998. Trawling time will be 30 min on the bottom. It is envisaged that 65–70 hauls will be

conducted in the Elephant Island–South Shetland Islands area while 12–15 hauls will be performed off Joinville/D’Urville Islands. Results of the survey will be submitted to CCAMLR in time for discussion at the 2007 WG-FSA meeting.

France

3.34 France expects to conduct a 45-day research survey on fish stocks in the Kerguelen EEZ (Division 58.5.1) during 2006/07. The targeted species will be *D. eleginoides*, *C. gunnari*, *Notothenia rossii* and *Lepidonotothen squamifrons*. Randomly stratified stations will be occupied in the shelf area of the northern part of the Kerguelen Plateau using a chartered commercial trawler. Determination of biomass will be completed. In addition, a tagging program for toothfish will be initiated in the French EEZ in Subarea 58.6.

USA

3.35 The USA will conduct a 30-day bottom trawl survey in Subarea 88.3 and possibly in Subarea 48.1 (if weather or sea-ice prohibits sampling in Subarea 88.3) during the period of February and March 2006. The ship will occupy randomly stratified stations and will target all finfish stocks, including pre-recruit *D. mawsoni*.

Australia

3.36 In the 2006 season Australia will again conduct its standard surveys for toothfish and icefish around the Heard and McDonald Islands. Survey design will be the same as used this year. Results will be presented at the 2006 WG-FSA meeting.

Tagging studies (see also Appendix T)

3.37 The Working Group welcomed reports of a number of studies investigating essential characteristics of tagging programs, such as tagging survivorship rates, tag shedding rates, possible reductions in growth rate immediately following tagging, tagging-related growth retardation, growth and movement. These estimates have been taken forward into assessments where appropriate. WG-FSA-05/19 reported results of the first large-scale experiment on toothfish immediate post-tagging mortality, coordinated by the UK in Subarea 48.3. Dr D. Agnew (UK) reported that smaller fish and those in better condition had higher post-tagging survivorship. The experiment confirmed that toothfish are relatively robust; most observers should be able to achieve a tagging survivorship of 95% or better, and a conservative estimate of survivorship across the fleet would be 90%.

3.38 Conservation Measure 41-01/C required that all exploratory fisheries tag toothfish at a rate of 1 toothfish per tonne green weight of catch throughout the season, up to a maximum of

500 fish per vessel. Tables T1 and T2 show that most Members achieved this target level in most fisheries, and the combined tagging rate of all Members achieved the target tagging level in all fisheries except in Divisions 58.4.1 and 58.4.3b and Subarea 88.2.

3.39 The Working Group noted that that mark–recapture data were being used in the assessments of toothfish in Subareas 48.3 and 88.1, and that there was a tagging program in Division 58.5.2; that tagging data were being gathered in all exploratory fisheries; that the UK proposed to initiate a mark–recapture program in Subarea 48.4 with the objective of achieving a tag-based stock assessment within three to five years (paragraphs 5.141 to 5.143; WG-FSA-05/57); and that France intended to initiate a tagging program at Crozet Island (Subarea 58.6).

3.40 Given the advances in knowledge of critical tagging parameters and the use of mark–recapture data in assessments, there is a real possibility that tagging data could lead to assessments of most exploratory fisheries within a few years of their initiation, but only if the following tag conditions are met:

- (i) Tags need to be released at a reasonable rate. Many Members are currently achieving rates of greater than 1 tag/tonne and this should be encouraged.
- (ii) Tagging programs should be considered as multi-year programs. There needs to be a long-term (three to five years) commitment to repeated tagging and fishing in exploratory fisheries.
- (iii) Considering the slow mixing rates for toothfish, releases should be widely distributed across all fishing areas and depths, and recapture fishing effort should be similarly distributed.

3.41 There has been concern that large toothfish are difficult to tag and have a lower survivorship than small fish. In terms of assessments, which require a known and preferably high survivorship of tagged fish, only the relatively smaller fish within the main body of the dome-shaped selectivities contribute significantly to the estimate of vulnerable biomass. These fish naturally have high survivorship. Thus for most purposes fish only need to be tagged in proportion to their occurrence in the catch, but only so long as they are in good condition.

3.42 The Working Group noted that skate tagging programs were under way in Subarea 88.1 and Division 58.5.2 (section 6), and encouraged the development of additional programs. It recognised that there may be a conflict between the requirement to cut off and release all skates at the water surface and the demands of successful skate tagging programs. Alternative approaches may be needed to resolve this conflict, for instance:

- (i) tagging a number of skates on deck after assessing their condition (paragraphs N87 and N88), rather than in the water, so that there is a subset of released animals for which condition and likely survivorship is known accurately;
- (ii) double tagging as many skates as possible;
- (iii) ensuring accurate reporting of all skates cut-off the line (paragraphs 6.11 to 6.15), and close examination of these skates for tags (paragraph N82);

- (iv) recovering all skates caught on some lines, rather than cutting them off at the water surface, to estimate the success of in-water observation of tagged fish. This may require an exception from the requirement to cut off all skates, and from the by-catch limits within appropriate conservation measures.

Biological information

3.43 Twelve papers provided new biological information of potential use in assessments.

3.44 The biological parameters used in the *D. eleginoides* assessment in Subarea 48.3 were reviewed in WG-FSA-05/18. The age–length data (WG-FSA-04/86) were reanalysed using the fishing selectivities, and following the method detailed in WG-FSA-SAM-05/13, to derive alternative von Bertalanffy growth parameters. A range of results was obtained, which depended on the model structure, and could, potentially, be used in sensitivity trials of the assessment. Examination of tagging data indicated that there is a post-tagging shock period of 180 days, when no growth occurs. The data also indicate an overestimate of 10 mm in the measurement of live toothfish. The probability of tag loss is estimated as 0.06 per year. Immediate post-tagging mortality, derived from multi-observer experiments, was found to be between 5 and 11% and a value of 10% was proposed for assessments. The fishery length–frequency data were adjusted to account for the different measurement units used at different stages of the fishery. Length–weight parameters were updated, based on the latest fishery data. It was proposed that the assessment use existing estimates of L_{m50} , but the paper noted that these were confounded by the mixture of males and females and it was proposed that separate growth and L_{m50} parameters be derived for males and females for future assessments. An examination of the current biological parameters and Beverton and Holt invariants suggested that the natural mortality range of 0.13 to 0.2 was too high (2–3 times K). The CPUE series were updated using the latest fishery data and the standard GLM and GLMM methods. The results showed a slight downward trend, but analysing Shag Rocks and South Georgia separately showed a decline in CPUE at Shag Rocks and a slight increase at South Georgia.

3.45 In WG-FSA-05/20 otoliths from juvenile *Macrourus whitsoni*, caught during the BioRoss cruise in Subarea 88.1, were aged to generate more accurate von Bertalanffy parameters. Studying otoliths from small *M. whitsoni* has given more confidence in the interpretation of the zone structure displayed in each year's growth. Von Bertalanffy parameters were derived for male and female fish, but did not differ much from the parameters previously used to estimate γ .

3.46 WG-FSA-05/23 summarised the state of knowledge on age determination in *C. gunnari* and assessed the validity of ageing. A workshop on age determination of this species is planned for the intersessional period, to be held in Kaliningrad, Russia.

3.47 WG-FSA-05/29 provided an overview of the eight years of the toothfish fishery in Subarea 88.1 and four years in Subarea 88.2. In 2004/05 the *D. mawsoni* catch was the highest to date, with the fishery benefiting from a relatively ice-free season. The size distribution of the catch strongly depended on depth; size increased steadily from 1998/99 to 2003/04 but decreased slightly in the last two years.

3.48 Differences between *D. mawsoni* caught near the seamounts in the north of Subarea 88.1 and those caught on the Ross Sea shelf to the south were described in WG-FSA-05/52. *D. mawsoni* from the northern part of the Ross Sea had a unimodal length distribution of a consistent size over all seasons, were in poorer condition, with more advanced reproductive development and with a consistently higher ratio of males to females. The results are consistent with a spawning migration from the southern areas to the north. The different length–weight coefficients between northern and southern areas have implications for stock assessment.

3.49 Examination of strontium chloride marked otoliths from tagged and recaptured *D. eleginoides* at Heard Island has confirmed the annual deposition of increments for fish aged between 5 and 18 years (WG-FSA-05/60). Daily growth rings were also counted in a small sample of *D. eleginoides* otoliths from Heard Island and confirmed that the first translucent increment succeeding the opaque centre region corresponds approximately with the end of the first year's growth (WG-FSA-05/61).

3.50 WG-FSA-05/63 reported on the utility of histological and microscopic analysis of ovary samples from *D. mawsoni* caught in the Ross Sea to improve estimates of size-at-maturity. Two methods were applied. The first used classic histological techniques to classify the state of oocyte development in histological sections to determine the proportion of fish maturing to spawn, and thus the mean size-at-maturity. The calculated L_{m50} of 113.0 cm was very close to the value of 115.2 cm estimated in 2000/01. GSI data collected from across the fleet, however, still raised doubt about the true L_{m50} . The second method examined ovaries to histologically identify fish that spawned the previous season, but this method requires ground truthing with fish that are known to have spawned.

3.51 In WG-FSA-05/64 Rev. 1 von Bertalanffy and segmented linear models, with and without fishing selectivity, were used to estimate growth parameters of *D. eleginoides* from Heard Island. A two-segment linear model, separated at age 6, gave the best fit to the data and for lengths above 557 mm was similar to growth increments obtained from mark–recapture data. For the 5- to 25-year age range, predicted lengths from the von Bertalanffy curve and the segmented linear model were almost identical.

3.52 In WG-FSA-05/65 length dependent selectivity of *D. eleginoides* in the Heard Island trawl fishery was estimated by comparison of trawl to longline length-frequency data. Using GLMMs fitted to length-frequency data, the upper arm of the trawl gear selectivity function was estimated as a linear decline in selectivity beginning from 1 at 800 mm to 0 at 1 731 mm length. Adjusting for gear type, the GLMM predicts the availability of large fish increases with increasing fishing depth.

3.53 WG-FSA-05/70 provided estimates of growth of 15 mm per year for the skate *Bathyraja eatonii* from tagging work at Heard Island. Updated length–weight parameters are provided for *B. eatonii*, *B. irrasa* and *B. murrayi*.

PREPARATION FOR ASSESSMENT AND ASSESSMENT TIMETABLE

Report of the Subgroup on Assessment Methods

4.1 The third meeting of WG-FSA-SAM was held immediately prior to WG-EMM-05, from 27 June to 1 July 2005, at the National Research Institute of Fisheries Science, Yokohama, Japan. WG-FSA-SAM was tasked to examine, develop and provide advice on the use of assessment methods to be implemented during WG-FSA-05. The meeting was convened by Dr C. Jones (USA). The full report of WG-FSA-SAM is provided in WG-FSA-05/4.

4.2 The Working Group noted that WG-FSA-SAM held discussions primarily relevant to advancements in assessment methods for *Dissostichus* spp. Topics included methods for estimation of recruitment, abundance indices, alternative assessment approaches and plausible operating models for use in evaluating assessment methods. The subgroup focused discussions principally on evaluation of alternative assessment approaches, including methods that use mark–recapture information, and integrated approaches for stock assessment.

4.3 With respect to mark–recapture methods (WG-FSA-05/4, paragraphs 2.15 to 2.22), the Working Group agreed that some advancements were made in understanding potential bias in estimates of stock size of *D. eleginoides* in Subarea 48.3 arising from imperfect mixing and uneven distribution of fishing effort. With respect to Subareas 88.1 and 88.2, the Working Group recognised that toothfish tagging efforts are now yielding a number of valuable results in terms of movement and growth, and that continued tagging studies will result in further knowledge of the Ross Sea *Dissostichus* stocks. The Working Group encouraged further work in understanding the robustness of mark–recapture data because they are useful not only by themselves, but also as inputs to integrated assessment methods.

4.4 The Working Group noted that the principal integrated assessment methods considered by WG-FSA-SAM were the age-structured production model (ASPM), and the C++ algorithmic stock assessment laboratory (CASAL) (WG-FSA-05/4, paragraphs 2.26 to 2.40).

4.5 The ASPM was applied to *D. eleginoides* in Subarea 48.3 and in Subareas 58.6 and 58.7. The Working Group agreed that the properties of the ASPM as an integrated modelling technique were being adequately explored in relation to these subareas (WG-FSA-05/4, paragraph 2.30).

4.6 The Working Group noted that model structure, assumptions and implementation for calculating precautionary yields of *Dissostichus* spp. using CASAL had been examined by WG-FSA-SAM. Using a point estimate, CASAL does not strictly reproduce precautionary yields by the method of the current GYM. However, using samples from the posterior distribution generated by Bayesian Monte Carlo Markov Chain (MCMC) runs of CASAL followed by future projections of each sample, a set of projections closer to the current GYM could be generated (WG-FSA-05/4, paragraph 2.35).

4.7 The Working Group was encouraged by the advancements and continued exploration of the behaviour and suitability of CASAL for *Dissostichus* spp. assessments, and recommended further development of CASAL models for Subareas 48.3 and 88.1 and Division 58.5.2.

4.8 The Working Group agreed that the comparability of yield estimates resulting from the GYM and CASAL would need to be investigated prior to implementation. The Working Group agreed that the development of any assessment methods include: (i) examination of whether the method had been applied correctly, as well as whether model construction is robust; (ii) a need to undertake comparison of methods; and (iii) evaluation of robustness to operating model uncertainties.

4.9 The Working Group reviewed advice from WG-FSA-SAM on refinement of parameter estimates for use during the course of the assessments (WG-FSA-05/4, paragraphs 4.1 to 4.20), including recommendations pertaining to natural mortality, recruitment, selectivity, age and growth, and movement.

4.10 The Working Group was encouraged by the progress made in the evaluation of assessment methods using operating models (WG-FSA-05/4, paragraphs 2.46 to 2.52) and strongly urged further evaluation in the intersessional period.

4.11 WG-FSA-SAM recommended integrated assessments be developed for toothfish in Subareas 48.3, 58.6, 58.7, 88.1 and 88.2 and Division 58.5.2 where possible and provided specific details for each area (WG-FSA-05/4, paragraphs 6.1 to 6.13).

Summary of the report from the invited expert to the 2005 WG-FSA-SAM meeting

4.12 Dr M. Maunder from IATTC attended the WG-FSA-SAM meeting as an invited outside assessment modelling expert. His report was submitted to WG-FSA, and appears as WG-FSA-05/5. The terms of reference for his participation included:

- (i) review usage and efficacy of the generalised yield model for estimating long-term precautionary yield of toothfish in the CCAMLR Convention Area;
- (ii) provide input on refining methods of estimating recruitment for toothfish stocks;
- (iii) examine potential for uniform approach of CPUE standardisation;
- (iv) 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.

4.13 Dr Maunder gave favourable remarks to the approach of WG-FSA-SAM. WG-FSA-05/5 addressed all the terms of reference with the exception of refining methods of estimating recruitment for toothfish. The Working Group noted that for this item, no new information was available from which to advance this work during the course of the WG-FSA-SAM meeting. The Working Group agreed that an alternative process may be needed to ensure all identified topics of importance are addressed.

4.14 The Working Group noted five major points from the discussion and conclusion of WG-FSA-05/5:

- (i) A consensus toward application of an integrated assessment for implementing the precautionary approach was achieved. The use of a Bayesian framework appears to be appropriate, as it would be consistent with GYM. The CASAL framework appears to fulfil the requirements necessary to carry out this type of analysis.
- (ii) The negative side of this approach is that models are computationally intensive, the assessment is difficult to interpret and evaluate, and this limits the number of sensitivities that can be performed. Thus, it would be useful to analyse the components of the data independently to evaluate their properties prior to integrating them into the model.
- (iii) Integrated analysis requires weighting of different datasets. Weighting assumptions can produce different results when different datasets provide conflicting information. There are several methods of determining effective sample size and weighting, though further research is needed to determine effectiveness of various methods.
- (iv) Full Bayesian integration can take extensive periods of time, and can reduce the amount of analysis that can be performed, though many diagnostics and sensitivities can be applied through estimating model parameters by finding the joint mode of the posterior distribution.
- (v) Management strategies, including the assessments, need to be evaluated for their robustness to uncertainties and errors.

4.15 The Working Group agreed that Dr Maunder's invitation and participation in the meeting was worthwhile and valuable toward the work of WG-FSA, and recommended that a letter of appreciation from WG-FSA thanking him for his time and participation would be appropriate.

4.16 WG-FSA-SAM noted that WG-FSA struggles to complete assessments within the course of its meeting and in the past had discovered errors near the end or even after the meeting had concluded. The integrated assessment methods now being proposed to be used for toothfish assessments are time-consuming and will be extremely difficult to run during the meeting. The subgroup also recalled the request of the Scientific Committee and Commission to provide consensus stock assessment advice as soon as possible for Subareas 48.3 and 88.1 (SC-CAMLR-XXIII, paragraphs 4.62, 4.63, 4.167 and 4.168; CCAMLR-XXIII, paragraphs 4.32 and 9.7).

4.17 To allow for more time for model and input parameter evaluations during the 2005 WG-FSA meeting, WG-FSA-SAM suggested: (i) the Convener of WG-FSA request members of the assessment subgroup to meet in Hobart during the week prior to the beginning of WG-FSA (beginning 6 October 2005) to investigate and evaluate proposed assessment models including proposed data inputs; and (ii) manuscripts submitted by the WG-FSA deadline (two weeks prior to the start of WG-FSA) would serve as the main source for review.

Status of assessment methods

Current assessment methods

Recruitment-based long-term yield assessment

4.18 A preliminary GYM assessment for the Heard Island (Division 58.5.2) toothfish fishery was provided in WG-FSA-05/30. The preliminary assessment of yield was calculated using the standard GYM and long-term projection methodology. Additional sensitivity analysis of the assessment was examined for: (i) further consideration of the survey series and the sensitivity to exclusion of observations of older cohorts in recent surveys, (ii) implementation of revised growth parameters, including the use of a length-at-age vector, (iii) consideration of a vulnerability function for the future projections based on full selection of adult fish, and (iv) consequences of reducing the range of natural mortality from 0.13–0.2 to 0.13–0.165, consistent with slower growth rates of fish.

Short-term projections

4.19 A preliminary assessment for the estimation of precautionary yield of icefish in the vicinity of Heard Island for the 2005/06 CCAMLR season was presented in WG-FSA-05/39. This paper provided a preliminary assessment of yield using standard short-term projection assessment methods previously employed for icefish. The paper proposed a one-year projection be used in the implementation of the CCAMLR assessment method because the fish are likely to disappear after they become four years old during the coming season.

New assessment methods

4.20 As recommended by WG-FSA-SAM, the assessment subgroup met to discuss and review integrated assessments over a three-day period from 6 to 8 October 2005 at the CCAMLR Headquarters, convened by Dr Jones.

4.21 During the course of the pre-meeting, attendees developed an integrated assessment checklist to assist both the individuals putting together the components and running the integrated assessment, as well as others who conduct the assessment review. This checklist included elements associated with:

- model structure
- observations and data inputs
- biological and fishery parameters
- internal consistency
- parameters to be estimated
- model diagnostics
- sensitivity trials
- management strategy procedures.

4.22 The presentations focused on the use of integrated assessment methods in four toothfish fisheries:

- Ross Sea (Subareas 88.1 and 88.2)
- South Georgia (Subarea 48.3)
- Heard Island and McDonald Islands (Division 58.5.2)
- Prince Edward Islands (Subareas 58.6 and 58.7).

4.23 Presentations provided detail to the participants 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. Presentations were made largely within the context of the developed assessment checklist.

CASAL

4.24 For the Subarea 88.1/88.2 toothfish fisheries, the Working Group examined the preliminary CASAL toothfish assessment provided in WG-FSA-05/31 and 05/33. The base-case scenario included separate shelf, slope and northern fisheries of Subarea 88.1 as recommended by WG-FSA-SAM (WG-FSA-05/4, paragraph 6.7). The Working Group considered likelihood profiles, model fits to CPUE indices, catch-at-age proportions, and mark-recapture fits for this base case for both Maximum Posterior Distribution (MPD) and MCMC runs. The analysis examined 10 sensitivity trials, including scenarios assuming absence of tagging data, modifications in assumptions regarding growth and tagging, equal selectivity shifts across fisheries, low natural mortality, revised maturity ogives, number of fisheries and fixing selectivities at MPD values.

4.25 The Working Group considered evaluation of yield estimates against the decision rules for the base case. Issues identified by the Working Group included methods for handling recruitment variability, and the consequences of selectivities and recruitment variability for the model, the projections, and the CCAMLR decision rules. The Working Group requested additional model runs examining sensitivity to recruitment variability, looking at the three areas separately, evaluating CCAMLR decision rules for SSRU 882E, and a retrospective analysis for the Ross Sea.

4.26 For the South Georgia (Subarea 48.3) toothfish fishery, diagnostics and model fits from the preliminary CASAL assessment (WG-FSA-05/16) were presented for consideration by the Working Group. The population model was a single-area three-season model. Two model runs were examined for the South Georgia fishery: a two-fleet model and a one-fleet model. The rationale for the two-fleet assessment was based on a change detected in the length-frequency data from 1992–1997 and 1998–2004. Here, separate selectivities were estimated for each of the fleets. The CPUE time-series was split into two, as the CPUEs are relative indices of the vulnerable biomass for two fleets with differing selectivities. The one-fleet assessment consisted of a model with a single selectivity ogive estimated, and CPUE data considered as one continuous relative vulnerable biomass index.

4.27 The Working Group examined fits to CPUE indices, length frequencies and selectivities for both models. The Working Group noted differences in all estimated model parameters between the two models, and agreed the two-fleet assessment demonstrated a

superior model fit. Sensitivities were examined by the Working Group for steepness, natural mortality, data removal (CPUE, recruitment survey, tagging data), as well as standard and tagging-only retrospective analysis.

4.28 Preliminary development work on the use of CASAL was also carried out in Division 58.5.2 (WG-FSA-05/69). The paper focused on a comparison of the characteristics of the GYM and CASAL approaches as applied to the toothfish fishery. The Working Group examined the differences in recruitment estimates, where the traditional method of maximum likelihood estimates provided using CMIX are replaced with a likelihood fit in CASAL. The Working Group agreed that similar trends in recruitment were estimated by CASAL and CMIX.

4.29 A direct comparison of CASAL and GYM projections for determining yield under the same conditions was attempted at WG-FSA. When the projections were examined, they yielded different results, in that number of trials in which depletion occurred was substantially higher for the GYM runs.

4.30 The difference between CASAL and GYM in these comparisons is the manner in which the spawning biomass was estimated. In GYM, all functions are modelled in continuous time, such that instantaneous rates of fishing mortality, natural mortality and growth enable spawning biomass to be estimated at any time in an unbiased way. In CASAL, a year is divided into a number of time steps in which various actions might occur. Natural mortality is modelled as a continuous rate function. A catch in the time step is modelled by subtracting the catch from the population in the middle of the time step. In this comparison, when the spawning biomass was estimated in a time step, the value was linearly interpolated between the magnitudes of the population at the beginning and end of the time step. The point within the time step when this is done is determined by the user. As a result, the spawning biomass was biased upwards compared to the continuous rate processes of the GYM unless it is estimated at the beginning or end of the time step.

4.31 Later in the meeting, it was identified that this problem could be resolved.

4.32 Under very similar assumptions WG-FSA agreed that projections from both models gave very similar results. The Working Group requested developers of CASAL consider whether an option could be included that could estimate the spawning biomass in a manner consistent with the GYM.

4.33 The Working Group noted that MCMC techniques allow a more full exploration of the posterior parameter space, provides more information as to the assessment uncertainty, and provides a potential method for calculating the long-term yield based on the CCAMLR decision rules.

ASPM

4.34 A presentation on the assessment of the Prince Edward Island (Subareas 58.6 and 58.7) toothfish fishery using the ASPM was given by Prof. D. Butterworth (South Africa). The preliminary assessment is presented in WG-FSA-05/58. The Working Group examined diagnostics and model fits from the Subarea 58.6/58.7 ASPM assessment which was generalised and allowed a second fleet to accommodate a pot fishery that was initiated in

November 2004. The Working Group noted that pots demonstrate a greater selectivity for larger toothfish. The Working Group further noted information that indicated frequent instances of depredation occurring in the longline fishery by cetaceans, where anecdotal evidence has suggested up to two out of three fish are taken off longlines by killer and sperm whales.

4.35 An application of the ASPM for the South Georgia (Subareas 48.3) toothfish fishery was presented to the Working Group and described in WG-FSA-05/73. The model demonstrated acceptable fits to standardised CPUE series, annual catches and observed catch-length proportions. The model included a function to estimate vulnerability patterns, with results similar to those presented in WG-FSA-SAM-05/5.

Assessment timetable

4.36 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 the assessment subgroup pre-meeting.

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

- (i) it was agreed that advice on precautionary yields would be based on assessments undertaken according to the decision rules adopted by the Commission;
- (ii) WG-FSA-SAM had met intersessionally in order for it to review and develop assessment methods prior to implementation by WG-FSA, thereby saving time at the Working Group meeting;
- (iii) the assessment subgroup had met for three days from 6 to 8 October 2005 to review and discuss the integrated assessments;
- (iv) evaluation of these methods includes:
 - (a) the validation of the implementing software, scripts or worksheets
 - (b) examination of the methods to see that the assumptions are met
 - (c) sensitivity trials to examine the robustness of consequent advice with respect to CCAMLR objectives.

4.38 All assessment work was undertaken with submitted preliminary assessments reviewed independently in consultation with the authors. The outcomes of the assessments were reported in the Fishery Reports.

4.39 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: toothfish and icefish
- (ii) Division 58.5.1: toothfish
- (iii) Division 58.5.2: toothfish and icefish
- (iv) Subareas 58.6 and 58.7: toothfish (South African EEZ)
- (v) Subarea 58.6: toothfish (French EEZ)
- (vi) Subareas 88.1 and 88.2: toothfish.

ASSESSMENTS AND MANAGEMENT ADVICE

New and exploratory fisheries in 2004/05 and notifications for 2005/06

New and exploratory fisheries in 2004/05

5.1 Last year the Commission agreed to seven exploratory longline fisheries for *Dissostichus* spp. in the 2004/05 season (Conservation Measures 41-04, 41-05, 41-06, 41-07, 41-09, 41-10 and 41-11). Activities in these fisheries are summarised in Table 5.1. There were no new fisheries notified for 2004/05. Catches of *Dissostichus* spp. in excess of 100 tonnes were reported in the exploratory fisheries in Divisions 58.4.1 (480 tonnes), 58.4.2 (127 tonnes), 58.4.3a (110 tonnes) and 58.4.3b (295 tonnes), and Subareas 88.1 (3 079 tonnes) and 88.2 (412 tonnes).

5.2 The exploratory fishery in Subarea 48.6 was undertaken by two Members with a total catch of 49 tonnes of *Dissostichus* spp. taken against a total catch limit of 900 tonnes (455 tonnes north of 60°S and 455 tonnes south of 60°S).

5.3 The exploratory fishery in Division 58.4.1 was undertaken by four Members with a total catch of 480 tonnes of *Dissostichus* spp. against a catch limit of 600 tonnes.

5.4 The exploratory fishery in Division 58.4.2 was undertaken by four Members with a total catch of 127 tonnes of *Dissostichus* spp. against a catch limit of 780 tonnes.

5.5 The exploratory fishery in Division 58.4.3a was undertaken for the first time. Three Members fished with a total catch of 110 tonnes of *Dissostichus* spp. against a catch limit of 250 tonnes. Some fishing took place outside the prescribed season, but this was in accordance with the conservation measures in force.

5.6 The exploratory fishery in Division 58.4.3b was undertaken by three Members with a total catch of 295 tonnes of *Dissostichus* spp. against a catch limit of 300 tonnes. Fishing took place outside the prescribed season, but this was in accordance with the conservation measures in force, and the fishery was closed on 14 February 2005. The closure was triggered by the catch of *Dissostichus* spp. (total catch was 98% of the catch limit).

5.7 The exploratory fishery in Subarea 88.1 was undertaken by six Members with a total catch of 3 079 tonnes of *Dissostichus* spp. taken against a catch limit of 3 250 tonnes. The fishery was closed on 27 March 2005 (see CCAMLR-XXIV/BG/13, Table 2). During the course of fishing, the following SSRUs were closed:

- SSRU B closed 31 December, triggered by the catch of *Dissostichus* spp. (total catch 70 tonnes; 87% of the catch limit);
- SSRU C closed 20 December, triggered by the catch of *Dissostichus* spp. (total catch 429 tonnes; 192% of the catch limit);
- SSRU E closed 20 March, triggered by the catch of *Dissostichus* spp. (total catch 59 tonnes; 104% of the catch limit);
- SSRU G closed 27 March, triggered by the catch of *Macrourus* spp. (total catch 16 tonnes; 78% of the catch limit);

- SSRU H closed 13 January, triggered by the catch of *Dissostichus* spp. (total catch 773 tonnes; 98% of the catch limit);
- SSRU I closed 27 January, triggered by the catch of *Macrourus* spp. (total catch 160 tonnes; 129% of the catch limit);
- SSRU J closed 2 March, triggered by the catch of *Macrourus* spp. (total catch 46 tonnes; 92% of the catch limit);
- SSRU K closed 7 February, triggered by the catch of *Macrourus* spp. (total catch 201 tonnes; 168% of the catch limit);
- SSRU L closed 12 March, triggered by the catch of *Dissostichus* spp. (total catch 169 tonnes; 94% of the catch limit).

5.8 The Working Group noted that the catch limit for *Dissostichus* spp. was exceeded by 92% (206 tonnes) in SSRU C in Subarea 88.1. This over-run illustrates the difficulty in forecasting closures when a number of vessels fish in an area where catch rates are high relative to the catch limits. The fishing events which resulted in the over-run in SSRU C are summarised in CCAMLR-XXIV/BG/13.

5.9 Another contributing factor to the over-run in SSRU C arose because that SSRU straddles the International Date Line. At the time of the closure in SSRU C, the Secretariat had inadvertently omitted to specify the closure date and time in relation to GMT. The closure was intended to be 20 December 2400 h local time GMT +12; some vessels had fished to the west of longitude 180 and interpreted the closure as 2400 h GMT -12. The Working Group noted that the Secretariat now includes the GMT time zone in all closure notices.

5.10 Catch limits were over-run on four other occasions in SSRUs in Subarea 88.1 (two catch limits for *Dissostichus* spp. and two catch limits for *Macrourus* spp.). Key factors in these over-runs included rapid changes in fishing effort and/or catches, and the late submission of catch and effort reports.

5.11 Despite these overruns, the Working Group noted that the total catch of *Dissostichus* spp. in Subarea 88.1 was only 95% of the overall catch limit. Given the 5-day reporting period and the relatively small size of SSRU catch limits, the Working Group agreed that both under-runs and over-runs of SSRU catch limits are inevitable. Provided these more or less balance over the season within subareas or divisions, and provided there is no trend for a preponderance of over-runs over time, these do not pose a conservation threat to the stocks.

5.12 The exploratory fishery in Subarea 88.2 was undertaken by three Members with a total catch of 412 tonnes of *Dissostichus* spp. (110% of the catch limit of 375 tonnes). The fishery was closed on 5 February.

5.13 Unstandardised CPUE data for *Dissostichus* spp. taken in exploratory longline fisheries in 1997–2005 are summarised in Table 5.3.

5.14 Under Conservation Measure 41-01 all vessels operating in exploratory fisheries are required to carry out a research plan which includes completing a minimum number of research sets on entering an SSRU. The Working Group analysed the performance of each

vessel using an extract of the fine-scale C2 data and the output from a new routine developed by the Secretariat (paragraph 3.4; see also WG-FSA-05/6 and SC-CAMLR-XXIII, Annex 5, paragraph 5.23).

5.15 The Working Group welcomed the results from some vessels which exceeded their required quota of research sets. However there were a number of instances where vessels failed to complete any research sets. There were also cases where a vessel conducted some research sets but failed to complete the required quota even though more commercial sets were completed.

5.16 The Working Group noted that the aim of requiring research sets with substantial biological sampling in new and exploratory fisheries was to obtain an understanding of the distribution and abundance of target and by-catch species on as wide a geographical scale as possible at an early stage of the fisheries' development. For most exploratory fisheries, this requirement is still relevant and should remain. The Working Group agreed, however, that for Subareas 88.1 and 88.2 the required geographical spread of fishing has already been achieved. Under these circumstances, the Working Group agreed that a more effective scheme for collecting biological samples from fisheries in those subareas would be to obtain random samples from catches on all sets carried out.

5.17 The Working Group recommended that to further this objective, the requirement to carry out specific research sets as defined in Annex 41-01/B of Conservation Measure 41-01 within Subareas 88.1 and 88.2 be removed.

5.18 The Working Group further recommended that there be a requirement that all fish of each *Dissostichus* spp. in a haul (up to 35 fish) be measured and randomly sampled for biological studies (cf. paragraphs 2(iv) to 2(vi) of Annex 41-01/A) from all lines hauled within Subareas 88.1 and 88.2, as proposed and justified in WG-FSA-05/49.

5.19 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 for implementation next year.

5.20 An additional requirement specified in Conservation Measure 41-01 is that each longline vessel fishing in exploratory fisheries for *Dissostichus* spp. is required to tag and release *Dissostichus* spp. at the rate of one toothfish per tonne of green-weight catch throughout the season. All vessels fishing reported tagging *Dissostichus* spp. in exploratory fisheries with a total of 4 858 *Dissostichus* spp. tagged in 2004/05. However, some vessels did not fulfil the requirements of Conservation Measure 41-01. The Working Group noted its concern that the tagging requirements, as specified in Conservation Measure 41-01, were not being met by all vessels. It reiterated the importance for Members to conduct tagging and to submit data in accordance with Conservation Measure 41-01 (see also Appendix T).

5.21 Analysis of tag-recapture data requires an ability to link accurately the observer data and C2 catch data. For the historical data held by the Secretariat, this is not always possible because of a lack of a unique identifier for each longline set used consistently in both observer and catch datasets. The Working Group recommended that vessels be asked to record a unique identifier on the C2 data forms for every set made and that observers ensure that this identifier is also recorded on their data forms.

New and exploratory fisheries in 2005/06

5.22 Notifications for exploratory fisheries in 2005/06 are summarised in Table 5.2. 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. Two Members submitted notifications after the deadline of 24 July 2005, however all payments were received by the deadline of 24 August 2005. There were no notifications for new fisheries, and no notifications were received for fisheries in closed areas.

5.23 The Working Group agreed that it would not attempt to determine whether all the notifications for new and exploratory fisheries satisfied the requirements of the relevant Conservation Measures 21-02 (paragraph 4), 21-02 (paragraph 5) and 21-02 (paragraph 7); this, it believed, should be done by SCIC.

5.24 There were a large number of notifications for fishing in Subareas 88.1 (9 notifications and 21 vessels) and 88.2 (8 notifications and 17 vessels), and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b (4–6 Members and 6–11 vessels). The Working Group recalled its advice from last year (SC-CAMLR-XXIII, Annex 5, paragraph 5.42). Depending on the size of the precautionary catch limits, this implies that if all vessels operated simultaneously, the available catch per vessel could be lower than that required for economic viability, especially for those vessels operating in high latitudes where fishing imposes considerable operational difficulties.

5.25 The Working Group noted that individual vessels may have notified for more than one subarea or division to increase operational flexibility and to provide access in the case of areas closed or constricted by factors such as heavy sea-ice.

5.26 In this context, the Working Group recommended that in cases where a vessel is notified for a number of subareas or divisions, the notification should include an indicative fishing plan including projected timings for fishing in different areas.

5.27 The Working Group noted that it is likely that, once again, there will be additional administrative problems in determining closure dates for fishing in SSRUs when many vessels are fishing simultaneously in a subarea or division (CCAMLR-XXIV/BG/13).

5.28 Given the importance of tag–recapture data to assessments, the Working Group recommended that Members be urged to continue to emphasise to their vessels the need to look out for recaptured tagged fish and to submit tag–recapture data to the Secretariat in a timely manner.

5.29 Issues related to the allocation of catch limits amongst SSRUs in Subareas 88.1 and 88.2 are discussed in Appendix F.

Progress towards assessments of new and exploratory fisheries

5.30 The Working Group agreed that substantial progress had again been made this year in assessing stocks of *Dissostichus* spp. in Subareas 88.1 and 88.2 (see Appendix F) to develop management advice.

5.31 For the other areas and divisions in which exploratory fisheries are conducted, the Working Group was unable to develop management advice based on assessments of yield and is therefore unable to provide any new advice on catch limits for these fisheries.

5.32 Given the large number of notifications for the 2005/06 fishing year, 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 Subareas 88.1 and 88.2.

Management advice for new and exploratory fisheries

5.33 Except for Subareas 88.1 and 88.2, the Working Group reiterated the necessity for Members fishing in exploratory fisheries to ensure that the required research sets are completed (Conservation Measure 41-01) and submitted to the Secretariat in a timely manner and accurate format. In addition, *Dissostichus* spp. should be tagged and data submitted in accordance with Conservation Measure 41-01.

5.34 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 tag–recapture data to the Secretariat in a timely manner.

5.35 In order to facilitate analysis of tag–recapture data, the Working Group recommended that vessels be asked to record a unique identifier on their C2 forms for every set made and that observers ensure that this identifier is also recorded on their data forms.

5.36 The Working Group did not attempt to determine whether all the notifications for new and exploratory fisheries satisfied the requirements of Conservation Measures 21-02 (paragraph 4), 21-02 (paragraph 5) and 21-02 (paragraph 7).

5.37 There has been a large number of notifications for Subareas 88.1 (9 notifications and 21 vessels) and 88.2 (8 notifications and 17 vessels), and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b (4–6 Members and 6–11 vessels). The Working Group recalled its advice from last year (SC-CAMLR-XXIII, Annex 5, paragraphs 5.96 and 5.97). Depending on the size of the precautionary catch limits, this implies that if all vessels operated simultaneously, the available catch per vessel could be lower than that required for economic viability, especially for those vessels operating in high latitudes where fishing imposes considerable operational difficulties.

5.38 The Working Group recommended that in cases where a vessel is notified for exploratory fisheries in a number of subareas or divisions, the notification should include an indicative fishing plan including projected timings for fishing in different areas.

5.39 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.

5.40 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 next year or two it may be possible to obtain mark–recapture estimates of abundance provided that sufficient tags are deployed each year.

Dissostichus spp. Subareas 88.1 and 88.2

5.41 The Fishery Report for *Dissostichus* spp. in Subareas 88.1 and 88.2 is in Appendix F⁴.

5.42 The catch limit of *Dissostichus* spp. in Subarea 88.1 for the 2004/05 season was 3 250 tonnes (Conservation Measure 41-09) for the period from 1 December 2004 to 30 November 2005. The catch reported for this subarea was 3 079 tonnes in 2004/05. The estimated IUU catch for the 2004/05 season was 144 tonnes.

5.43 The catch limit of *Dissostichus* spp. in Subarea 88.2 for the 2004/05 season was 375 tonnes (Conservation Measure 41-09) for the period from 1 December 2004 to 30 November 2005. The catch reported for this subarea was 412 tonnes in 2004/05. There was estimated to be no IUU catch for the 2004/05 season.

5.44 The catch-weighted length frequency showed that the catch of *D. mawsoni* ranged from 50 to 180 cm. There was an increased level of fishing on the hills and ridges of the Pacific-Antarctic Ridge in the north of the Ross Sea during the 2001/02 and 2002/03 seasons. This resulted in a greater proportion of larger fish in the catch. This trend has diminished over the last two years as a result of changed SSRU boundaries and reallocation of allowed catch.

5.45 A standardised CPUE analysis of *D. mawsoni* in Subarea 88.1 showed no significant trend from 1998/99 to 2002/03, a decline in 2003/04, and a sharp increase in 2004/05 (WG-FSA-05/32). 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.

5.46 In 2004/05, a total of 3 562 *Dissostichus* spp. were tagged in Subareas 88.1 and 88.2 (Table T2). Since 2000/01, a total of 5 346 toothfish have been tagged in Subareas 88.1 and 88.2 by New Zealand vessels (WG-FSA-05/34). Tag–release and recapture data from New Zealand vessels were used as inputs for the modelling. Data for other vessels were unavailable for the assessment.

5.47 The CASAL model, using catch-at-age, CPUE and tag–recapture data, and the *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.

5.48 The CASAL assessment split Subareas 88.1 and 88.2 into two areas: (i) the Ross Sea (Subarea 88.1 and SSRUs 882A–B), and (ii) SSRU 882E.

⁴ Appendix F is only available electronically at www.ccamlr.org/pu/E/e_pubs/fr/drt.htm.

Management advice

5.49 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 2 964 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 2 964 tonnes is therefore recommended.

5.50 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 273 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 273 tonnes is therefore recommended.

5.51 The Working Group recommended that tagging be continued as part of the Research and Data Collection Plan (Conservation Measure 41-01).

5.52 The Working Group noted that the aim of requiring research sets with substantial biological sampling in new and exploratory fisheries was to obtain an understanding of the distribution and abundance of target and by-catch species on as wide a geographical scale as possible at an early stage of the fisheries' development. However, the Working Group noted that, for Subareas 88.1 and 88.2, the required geographical spread of fishing has already been achieved. Hence, the Working Group agreed that a more effective scheme for collecting biological samples from fisheries in those subareas would be to obtain random samples from catches on all sets carried out.

5.53 The Working Group recommended that to further this objective, the requirement to carry out specific research sets as defined in Annex 41-01/B within Subareas 88.1 and 88.2 be removed.

5.54 The Working Group further recommended that there be a requirement that all fish of each *Dissostichus* spp. in a haul (up to 35 fish) be measured and randomly sampled for biological studies (cf. paragraphs 2(iv) to 2(vi) of Annex 41-01/A) from all lines hauled within Subareas 88.1 and 88.2, as proposed and justified in WG-FSA-05/49.

5.55 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.

5.56 WG-FSA-05/72 discussed a number of issues relating to the allocation of catch limits amongst SSRUs in Subarea 88.1. These included the small current size of SSRUs, which has led to difficulties with the conduct and management of the fisheries in them due to the sometimes very short fishing seasons, problem with representativeness of data collected in different SSRUs in different times of the year, the effect of poor ice years on southern SSRUs, and the methodology used to determine the allocations. The paper concluded that there is a need to amend the current allocation methods, particularly with a view to having fewer, larger SSRUs and avoiding SSRUs with zero catch limits.

5.57 In relation to the existing methodology for allocation, it was noted that last year (see SC-CAMLR-XXIII, Annex 5, paragraph 5.6), the analysis to estimate fish density in each SSRU was based on the total catch of *Dissostichus* spp. divided by total effort by all vessels in each SSRU over the history of the fishery, rather than on CPUE in Subarea 48.3 as suggested in WG-FSA-05/72.

5.58 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 that is not yet available. Such a revision should take account not only of the principal target species, but also by-catch species and ecosystem considerations. Also, if expansion of the size of existing SSRUs were to be considered, then ensuring the appropriate spreading of effort within SSRUs and by-catch management may need to be reconsidered. Some members recommended that these issues be considered intersessionally.

5.59 Other members noted that the SSRU definitions discussed in WG-FSA-03/29 that split Subarea 88.1 into five areas (i.e. four SSRUs formed by the boundaries at latitudes 65°S, 70°S and 76°S, with the central area between 70°S and 76°S split by a boundary at 180°E) might be more appropriate. In their view this proposal could resolve the issues noted in paragraph 5.58.

5.60 However, the Working Group recognised that SSRU 882E could be separated from the remaining SSRUs because it has an assessment of its own, and that advice needed to be provided for catch limit allocation amongst the other SSRUs for the coming season. Furthermore, the assessments conducted this year (for the Ross Sea and SSRU 882E) will require a different method of allocation than last year.

5.61 If a similar method to that used in 2003/04 and 2004/05 for allocating catch limits to SSRUs was applied for 2005/06, then the possible allocations of catch limits for Subarea 88.1 and SSRUs 882A–B are given in Table F22.

5.62 If the SSRU definitions considered in paragraph 5.61 were used, then the catch limits could be separated between five SSRUs in Subarea 88.1.

5.63 In relation to catch limit allocations, the following issues need to be considered:

- management of the possibly large numbers of vessels that may be fishing simultaneously in an SSRU;
- consideration of compliance issues resulting from the potential for over-runs and under-runs of catch limits for SSRUs;
- the fact that poor sea-ice conditions frequently restricted the ability to fish in the more southerly SSRUs. A discount factor to allow for this may possibly be considered;
- the utility of distribution of catch and research information for assessments should not be diminished as a result of SSRU allocations, e.g. consistency in the location of fishing will provide more reliable CPUE and tag–recapture estimates;

- the desire to retain zero catch limits so that effects of fishing on *Dissostichus* spp. populations can be distinguished from environmental effects;
- allocation of catch limits for by-catch species by SSRU.

5.64 Dr K. Shust (Russia) indicated that zero catch limits within an SSRU would not provide information on toothfish distribution and abundance in that SSRU.

Dissostichus eleginoides South Georgia (Subarea 48.3)

5.65 The Fishery Report for *D. eleginoides* in Subarea 48.3 is contained in Appendix G⁵.

5.66 In 2004, 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 2004/05.

5.67 The catch limits in the 2004/05 season for areas A, B and C were 0 (excepting 10 tonnes for research fishing), 915 and 2 135 tonnes respectively, with an overall catch for SGSR of 3 050 tonnes. The total declared catch was 3 018 tonnes. An additional 23 tonnes were taken by a single IUU vessel (the *Elqui*) reported by the UK prior to the fishery. The total removals were therefore 3 041 tonnes. Catches in areas A, B and C were 9, 910 and 2 122 tonnes respectively. The proportion of catches in areas A and B declined from 35% in 2003/04 to 30% in 2004/05.

5.68 The standardised GLM and GLMM CPUE analyses were updated. Standardised CPUE dropped only very slightly between 2004 and 2005. Separate GLMM analyses of CPUE data for Shag Rocks and South Georgia confirmed a relatively constant CPUE at South Georgia in recent years compared with the initial increase and then decrease at Shag Rocks.

5.69 During 2004/05, a further 3 944 tagged *Dissostichus* spp. have been released in SGSR, bringing the total number of tagged fish released to around 8 000. In 2005, 93 recaptures of tagged fish were reported. Estimates of vulnerable biomass for 2005 using the modified Petersen estimator were between 53 000 and 54 000 tonnes, with 95% confidence intervals of approximately 44 000–63 000 tonnes, depending on the selectivity curve used in the analysis.

5.70 Two separate assessments were considered by the Working Group, each using a different modelling strategy. The first was an integrated assessment, implemented in CASAL, that used data on catches, standardised catch rates, catches-at-length, recruitment indices-at-age and tag–recapture data. The base case involved two fleets with separate estimated selectivity curves and two catchability estimates across the time series of catch rates. The second assessment used an augmented ASPM, implemented in an Excel workbook, which used data on catches, standardised catch rates, and catches-at-length. The ASPM base case involved a single fleet with two periods of different selectivity (estimated outside the model) and a single catchability estimate across the catch rate time series plus estimation of the steepness of the recruitment relationship.

⁵ Appendix G is only available electronically at www.ccamlr.org/pu/E/e_pubs/fr/drt.htm.

5.71 Although the underlying basic age-structured population dynamics models assumed in CASAL and ASPM were similar, there were considerable differences in assumptions and implementation of the two methods (see table below). An initial test was carried out to check that the two approaches would produce sufficiently similar estimates when applied to the same datasets and when the assumptions made were as similar as possible without requiring substantial modifications to the methods. The results of this test were satisfactory and the Working Group agreed that subsequent differences in assessment results between the two methods could reasonably be attributed to differences in assumptions and input data, rather than fundamental differences in the assessment methods.

CASAL	ASPM
<p>Data</p> <ul style="list-style-type: none"> • Length-frequency data • GLMM CPUE (1987–1989, 1991–2004) • GLMM CPUE variance • Total catches • Mark–recapture data • Recruitment survey data 	<p>Data</p> <ul style="list-style-type: none"> • Length-frequency data • GLMM CPUE (1987–1989, 1991–1992, 1996–2005) • Total catches
<p>Base-case assumptions</p> <ul style="list-style-type: none"> • CPUE is an index of vulnerable biomass. • The discontinuity in the CPUE series was caused by a major shift in the fishing fleet and fishing strategy without any change in average recruitment or major reduction in biomass. • Two fleets are used, one prior to and one after 1998, each with a different selectivity and catchability. • Selectivity curves are fitted by the model. • Recruitment variability is estimated parametrically. • Growth had an L_{∞} of 194.6; natural mortality was 0.165. 	<p>Base-case assumptions</p> <ul style="list-style-type: none"> • CPUE is an index of vulnerable biomass. • The decline in the CPUE series was caused by a drop in vulnerable biomass which was a result of changes in recruitment and fishing. • One fleet is used with the same catchability across years, but with different selectivities according to different periods of the fishery. • Selectivity curves are calculated outside the model. • Interannual recruitment variability is estimated. • Growth had an L_{∞} of 194.6; natural mortality was 0.165.
<p>Sensitivities</p> <ul style="list-style-type: none"> • Sensitivity runs included tests of a single-fleet model, low L_{∞} and low natural mortality. 	<p>Sensitivities</p> <ul style="list-style-type: none"> • Sensitivity runs included tests of the full CPUE series, low L_{∞}, low natural mortality and different weights on different indices.

5.72 For the CASAL assessments, four separate assessment runs were identified by the Working Group:

- (i) a base case, assuming two fleets, and using the growth curve (with $L_{\infty} = 194.6$) and natural mortality rate (0.165) assumed in the 2004 assessment of this stock;
- (ii) as for (i), but with a growth curve with a lower L_{∞} (152.8) ('Low L_{∞} ');
- (iii) as for (i), but with $M = 0.13$ ('Low M ');
- (iv) as for (i), but assuming a single fleet, rather than two fleets.

5.73 For the ASPM, assessments considered included:

- (i) a base case, fitting to total catches, a reduced CPUE series, using externally fixed selectivity functions and the same growth curve and natural mortality as used in the 2004 assessment of this stock;
- (ii) as for (i) but using the Low L_{∞} growth curve;
- (iii) as for (i) but using the lower M ;
- (iv) other sensitivity trials, including alternative selectivities, CPUE series and data weightings.

5.74 A full description of the models, their assumptions, their diagnostics, their fits to the data, and their results is given in Appendix G.

Management advice

5.75 The Working Group recalled that it had been unable to agree on an assessment of toothfish in Subarea 48.3 at its 2004 meeting, and that the Scientific Committee had asked the Working Group to undertake work to address uncertainties in the assessment of this stock (SC-CAMLR-XXIII, paragraphs 4.62 and 4.63). The Working Group recognised that due to a large amount of work being carried out in the intersessional period, during the meeting of WG-FSA-SAM and during the course of the WG-FSA meeting, considerable progress had been made in addressing these issues.

5.76 The Working Group noted the various results, which are given in Tables G12, G13 and G16 and paragraph G92, along with the consideration of parameter inputs and conclusions in Appendix G, should be considered as the basis of advice on catch limits for 2005/06. For example, in respect of the CASAL results, the MCMC projections of yield (Table G13) are as follows:

- | | | |
|-------|------------------|---------------|
| (i) | base case | 5 629 tonnes |
| (ii) | low L_{∞} | 3 407 tonnes |
| (iii) | low M | 5 876 tonnes |
| (iv) | one fleet | 5 428 tonnes. |

In respect of the ASPM run, the GY projections of yield are as follows (paragraph G92):

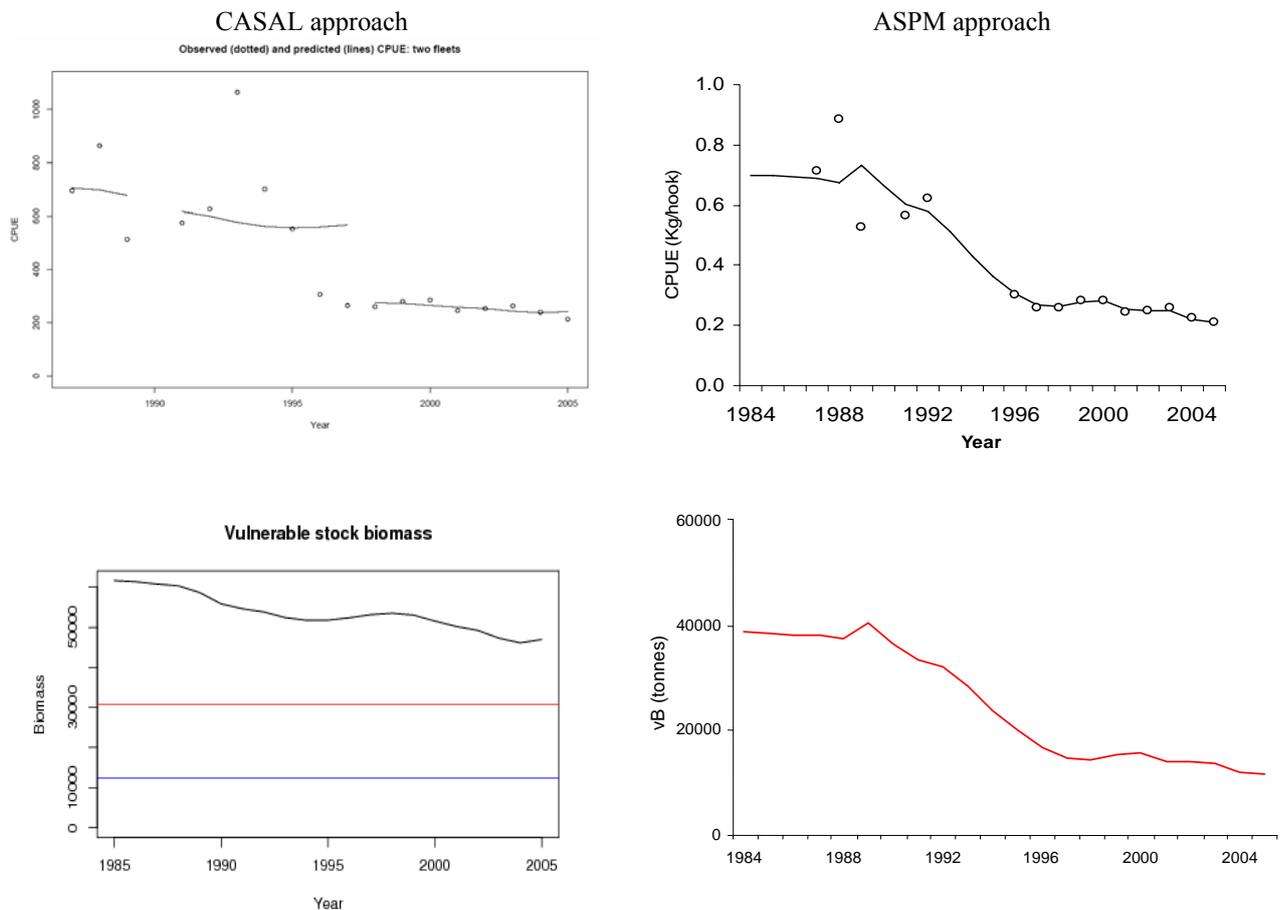
- | | | |
|-----|-----------|-------------|
| (v) | base case | 696 tonnes. |
|-----|-----------|-------------|

5.77 Because of the complexity of the modelling assumptions, hypotheses and model results, the Working Group was unable to provide advice on which of the base cases, or the sensitivity runs, was the best estimate of current stock status of toothfish and an appropriate yield. Accordingly, it could not recommend an appropriate catch limit in the 2005/06 season.

5.78 Taking account of its consideration of by-catch and other fisheries issues, the Working Group recommended the continuation of all other aspects of management under Conservation Measure 41-02 for the 2005/06 fishing season (Table G20).

5.79 Drs E. Marschoff and O. Wöhler (Argentina) made the following comments:

- (i) In the CASAL implementation, recruitment is derived from a fixed h value, without interannual variability. Under this condition, it is difficult to fit the model to the entire CPUE series. The definition of two fleets fishing from 1984 to 1997 and from 1998 to 2005 absorbs the observed decline in CPUE which is considered as a change in catchability (around 50% from 1997 to 1998). Finally, the selectivity function is estimated through the model, which ensures good fit to the catch proportions at length. Those restrictions combined determine that the vulnerable biomass estimated by the model cannot follow the entire CPUE standardised trend. In terms of the estimation, the consequence of this is an overestimation of spawning stock, vulnerable biomass and long-term estimation of yield.
- (ii) The ASPM assumes variable recruitment estimated from a fitted h parameter and a vector of recruitment variability. The absence of constraints in the stock recruitment relationship allows the vulnerable biomass to be fitted to the entire CPUE series. Thus, the estimated vulnerable biomass follows the decline in the CPUE series. The assumptions of two fixed selectivities-at-age, entered as input data, results in biased fits to the proportions of length in the catches in the last years. This results in an underestimation of the current spawning stock biomass and a consequent underestimation of long-term yield.



5.80 Drs G. Kirkwood, Agnew and R. Hillary (UK) pointed out several difficulties with the methodological approach, underlying hypotheses and fits of the ASPM that in their view invalidated that assessment of toothfish in Subarea 48.3:

- (i) The ASPM assumption that there is a single CPUE series takes no account of the major changes in fleet structure and behaviour that occurred in the middle of the CPUE series, and which have been detailed in Appendix G. This is an unlikely assumption given the major changes that have occurred. By contrast, the assumption of different fleets and catchabilities in the base-case CASAL model directly accounts for the known changes in the fishery.
- (ii) To examine the possibility that catchability and selectivity had not changed over the course of the fishery, a CASAL sensitivity run was performed which did assume a single fleet. This produced very similar results to the CASAL base case.
- (iii) The CASAL model fits to all the data available: length frequencies, CPUE, mark–recapture and recruitment indices. The fits to all the data except the early CPUE are good, including to the later CPUE series. By contrast, the ASPM effectively ignores all data except CPUE, by giving very high weighting to these data and hypothesises a strong declining recruitment to create the apparent drop in CPUE between 1995 and 1997. The fits to length-frequency data are poor, and the model does not make use of the tagging data.
- (iv) The authors of the ASPM did not express any doubt in the validity of the mark–recapture data, or the Petersen estimates of biomass arising from the use of these data. The lack of use of tagging data in the ASPM arose solely from an inability to incorporate the data within the model. Our experience in fitting both CPUE data and tagging data in CASAL would suggest that, once the tagging data are incorporated into the ASPM, the fit to CPUE will deteriorate.
- (v) The ASPM estimate of current vulnerable biomass of 11 600 tonnes is clearly an underestimate, for several reasons.
- (vi) The estimated length frequencies in the ASPM show a very poor fit to the data, particularly in the early and recent years. By contrast, good fits were achieved by all CASAL model runs. The ASPM fit gets progressively worse from 1997 to 2005. This is because the model is estimating a very strong decline in biomass, a removal of large animals from the population and high recruitment. The model predicts that the fishery should not be able to catch large fish, in direct contradiction of the actual catches made by the fishery.
- (vii) We note that the authors acknowledge that the model underestimates current biomass and that in discussion many members of the Working Group agreed with this conclusion.

- (viii) Since 1997 the fishery has experienced average annual removals of 4 700 tonnes, with only a minor effect on CPUE. It is most unlikely that such catches taken from a vulnerable biomass of about 13 000 tonnes would not have caused significant changes in CPUE.
- (ix) The selectivity used in the ASPM base case generates a similar mark–recapture estimate of current vulnerable biomass as the CASAL base-case selectivity does (Table G6). In the case of CASAL, estimates of the confidence limits of current vulnerable biomass overlap with the confidence limits estimated from tagging data alone (Table G6). In the case of ASPM, the estimates of current vulnerable biomass are substantially lower (11 600 tonnes) than the tagging estimates (53 400 tonnes), without overlapping confidence limits. The ASPM estimate of current biomass is clearly not supported by the tagging data.
- (x) CASAL estimates selectivities from the data. ASPM fixes the selectivities according to calculations made outside the model. Moreover, the fixed lower limit on selectivity at older ages used in the ASPM is completely arbitrary, and is not estimated by any data.
- (xi) The GLMM estimates very high observation error for the CPUE series in the early 1990s (Figure G5) and low error after 1996. The ASPM ignores this very significant change in variance, which leads to a very poor fit to the early 1990s CPUE and improbably perfect fits to the late 1990s CPUE. The fits to the early 1990s CPUE are no better than the fits of the CASAL model, which does take the differences in observation error into account.
- (xii) One of the most important parameters in the ASPM is annual recruitment, although there are no observational data to inform the estimation of these parameters. The only purpose of allowing interannual recruitment variations is to allow the model to fit very closely to the CPUE trend. Low recruitments are estimated in the period preceding the drop in CPUE (1990–1995), which depletes the stock as required to fit the decline in observed CPUE. Higher recruitment values are necessary in the late 1990s to create a stable CPUE. These trends are in direct opposition to the indications of the relative levels of recruitment in the survey data (Table G4).
- (xiii) The ASPM’s estimate of very low recruitment in the early 1990s, which is necessary to fit the sharp decline in CPUE, creates a depression of recruitment at high biomass. The resulting inverse relationship between stock and recruitment is not plausible, as was pointed out by several members of the Working Group.
- (xiv) In conclusion, the ASPM assumptions are not supported by the known history of the fishery, the assessment does not attempt to utilise all the data that are available, and does not fit some of the data well (the early CPUE series and the

length data). By contrast, the CASAL model is consistent with the known history of the fishery, it makes use of all the available data and obtains a good fit to each dataset (with the sole exception of early CPUE data, which have high CVs, and for which it obtains a fit as good as that obtained by ASPM). The base case and range of sensitivities run using CASAL are informative. It is plausible that natural mortality could be lower for toothfish, but less plausible that the single-fleet model accurately reflects the history of this fishery. It is unlikely that the L_{∞} is as low as that used in the Low L_{∞} trial.

Dissostichus eleginoides Kerguelen Islands (Division 58.5.1)

5.81 The Fishery Report for *D. eleginoides* in Division 58.5.1 is contained in Appendix H⁶.

5.82 The catch reported for this division as of 1 September 2005 was 3 186 tonnes. Only longlining occurs in the fishery. The estimated IUU catch for the 2004/05 season was zero inside the French EEZ. Some IUU may have occurred outside the EEZ as reported in SCIC-05/10 Rev. 1.

5.83 GLM analyses show a general decreasing trend in the standardised CPUE with two steps (i.e. 1999–2000 and 2002–2005). Mean weight declined from 1999 to 2003, but has been stable since then. No stock assessment has been carried out.

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

Management advice

5.85 The Working Group encouraged the estimation of biological parameters for toothfish at the Kerguelen Islands. 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.

5.86 As for other toothfish fisheries in the Convention Area, the Working Group recommended that tag–recapture experiments be conducted. It also noted that a recruitment survey in the Kerguelen area would be planned for 2006 and that this would be very beneficial for an assessment of toothfish stocks on the Kerguelen Plateau.

5.87 The Working Group recommended that, where possible, all rajids should be cut from the line while still in the water, except on the request of the observer. Areas with high by-catch rates should be avoided.

⁶ Appendix H is only available electronically at www.ccamlr.org/pu/E/e_pubs/fr/drt.htm.

5.88 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)

5.89 The Fishery Report for *D. eleginoides* in Division 58.5.2 is contained in Appendix I⁷.

5.90 The catch limit of *D. eleginoides* in Division 58.5.2 west of 79°20'E for the 2004/05 season was 2 787 tonnes (Conservation Measure 41-08) for the period from 1 December 2004 to 30 November 2005. The catch reported for this division as of 1 October 2005 was 2 783 tonnes. Of this, 2 170 tonnes (78%) was taken by trawl and the remainder by longline. The estimated IUU catch for the 2004/05 season, 0–265 tonnes, was the lowest since IUU fishing began in 1995/96.

5.91 The length-at-age vector was revised from 2004 using a two-segment linear model to take account of validated length-at-age readings and mark–recapture data. A von Bertalanffy growth curve was not used because of its failure to estimate the size of young and old fish reliably. The new vector better estimates the size of young fish. Young fish (less than 6 years old) are fast-growing. Fish older than 6 years are slower growing than previously estimated. The growth of fish older than 20 years requires more data in the future that will be obtained from the longline fishery. As a result of this new information, it seems unlikely that natural mortality is as high as 0.20 year⁻¹.

5.92 The estimate of mean recruitment was less than at the 2004 meeting, and the CV greater, as a result of the inclusion of the results of a trawl survey carried out in 2005. A review of the recruitment series needs to be undertaken to take account of uncertainties in the estimates of cohort strength using CMIX (positive and negative biases may arise under some circumstances).

5.93 The CPUE series and estimates of abundance from the mark–recapture program were not updated at the meeting.

5.94 Future catches from this fishery will have greater proportions of catch taken by longlines and pots. These gears will be taking larger fish because of their selectivity and that they will be operating in deeper water than the trawl fishery. Consequently, the overall vulnerability of the stock in future years is likely to include a greater proportion of larger fish than is currently the case in the trawl fishery. A vulnerability pattern that combines trawl, longline and pots was calculated for use in the assessments.

5.95 The GYM, using the updated time series of recruitment estimates and the updated length-at-age vector was used to estimate the long-term annual yield that would satisfy the CCAMLR decision rules.

⁷ Appendix I is only available electronically at www.ccamlr.org/pu/E/e_pubs/fr/drt.htm.

5.96 Three main model runs were carried out based on the parameters considered for the assessment and including the 2005 survey of juvenile fish and the revised length-at-age vector from the two-segmented linear model:

- (i) $M = 0.13\text{--}0.20 \text{ year}^{-1}$, trawl vulnerability in future projections;
- (ii) $M = 0.13\text{--}0.20 \text{ year}^{-1}$, combined gear (trawl, longline, pot) vulnerability in future projections;
- (iii) $M = 0.13\text{--}0.165 \text{ year}^{-1}$, trawl vulnerability in future projections.

Each of these was undertaken with IUU catch in the 2004/05 season at 0 tonnes and 265 tonnes.

Management advice

5.97 The Working Group recommended the Scientific Committee consider the following in providing advice to the Commission on Conservation Measure 41-08:

- (i) the validated length-at-age vector in these assessments has removed the uncertainty surrounding length-at-age in younger fish, the revised vulnerability is likely to be closer to the actual future vulnerability of toothfish to fishing because of the increase in the proportion of the catch to be taken by longlines and pots (increasing to two-thirds of the catch limit) compared to trawls (one-third), and a natural mortality rate of 0.2 is likely to be too high for *D. eleginoides* in this division (paragraph I34);
- (ii) the outcomes of the three scenarios should be used as the basis for setting catch limits in the 2005/06 season. The following estimates of long-term annual yield are for the IUU catch of 265 tonnes (paragraph I35):

(a) $M = 0.13\text{--}0.20 \text{ year}^{-1}$, trawl vulnerability in future projections;	2 303 tonnes
(b) $M = 0.13\text{--}0.20 \text{ year}^{-1}$, combined gear (trawl, longline, pot) vulnerability in future projections;	2 439 tonnes
(c) $M = 0.13\text{--}0.165 \text{ year}^{-1}$, trawl vulnerability in future projections.	2 440 tonnes

If SCIC decides that the IUU catch is lower than 265 tonnes, then the recommended limits could be revised upwards according to Table I12;

- (iii) the vulnerability for combined trawl, longline and pot gears was not combined with a range of lower natural mortality rates into a single assessment (paragraph I36). Such a combination would be expected to give a higher estimate of yield than those presented here;

- (iv) other conservative aspects of this assessment include (paragraph I37):
 - (a) age-7 fish have been included as being absent from the population in the 2004 and 2005 recruitment surveys. It is unlikely that they have disappeared from the population because they are being caught in the longline fishery (Figure I2);
 - (b) longline catches (including IUU catches, except for 1995/96) are incorporated in the assessments with a vulnerability equivalent to the trawl fishery, which will result in an impact on the assessment of IUU fishing greater than would be expected in reality due to the catching of larger fish by illegal fishers;
 - (c) the cohort at age-8 fish in the 1999 survey is likely to have been exploited by fishing in previous years and is therefore likely to be an underestimate;
- (v) these scenarios do not account for the uncertainty surrounding the estimation of cohort strength using CMIX, although the effects of this uncertainty are unlikely to result in a uniform positive or negative bias in estimates of cohort abundance across all surveys (paragraph I38).

5.98 Dr P. Gasyukov (Russia) gave an alternative interpretation of the dynamics of the spawning stock biomass (SSB) presented in Figure I10. In his view, this figure shows a high degree of uncertainty in the state of the stock of *D. eleginoides* in Division 58.5.2. The nature of the model is such that it is not possible to determine the real biomass estimate in any year but only the potential range of abundance of the spawning biomass. For example, the 95% confidence interval of the SSB in the 2005 season has the range of 19 885–93 507 tonnes. This might mean that the real biomass value can be 19 885 tonnes, the lower bound of that confidence interval. As a result, Dr Gasyukov made the following points:

- (i) Management advice should be given for 1–2 years from the current year, as in the case of *C. gunnari*; advice for the 2005/06 and 2006/07 seasons should be based on the SSB estimates in the 2004/05 season and should take into account its uncertainty. Using the approach for *C. gunnari*, the projection should be calculated on the basis of the one-sided lower 95% confidence interval of the spawning biomass derived from the GYM projections.
- (ii) He believes that this approach would be more likely to achieve target levels and avoidance of depletion for the stock when the confidence intervals suggest a low abundance of fish.
- (iii) It would be useful to include short-term assessments as well as long-term assessments in order to take account of the status of the stock in the most recent years.

5.99 Dr Constable welcomed suggestions on alternative methods for taking account of uncertainty. However, in this case, the existing projection framework takes uncertainty into account with the application of the current decision rules; the implications of low biomass for a given year in a trial are accounted for in the estimated probability of depletion

(paragraph I33). In that case, a low biomass in any year of the projection in the past, present or future will contribute to assessing the probability of depletion. A short-term assessment will require different decision rules and appropriate assessment methods. It will be important to evaluate the consequences of changes in the decision rules as well as evaluating methods for assessing yield in *D. eleginoides* in order to be confident that the advice derived from those assessments is robust to uncertainties.

5.100 Other elements of the conservation measure are recommended to follow the advice in paragraphs I43 to I51.

5.101 The Working Group recommended the following future work as described in section 12:

- (i) further development of an integrated assessment of *D. eleginoides* in CASAL, including an evaluation of the assessment methods and overall management strategy for this division (paragraph I41);
- (ii) the means by which recruitment cohort strength is estimated from toothfish survey data should be reviewed in the intersessional period, including investigating the possible effects of using the new two-segment growth model (paragraph I42);
- (iii) 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 (paragraph I42);
- (iv) studies on optimal sampling schemes for establishing age-length keys should be encouraged (paragraph I42).

Dissostichus eleginoides Prince Edward and Marion Islands
South African EEZ (Subareas 58.6 and 58.7)

5.102 The Fishery Report for *D. eleginoides* in Subarea 58.7 is contained in Appendix J⁸.

5.103 The catch limit of *D. eleginoides* in Subarea 58.7 for the 2004/05 season was 450 tonnes (Conservation Measure 41-08) for the period from 1 December 2004 to 30 November 2005. The catch reported for this subarea as of 5 October 2005 was 141 tonnes. Of this, 103.5 tonnes (73.4%) was taken by pots and the remainder by longline. The IUU catch for the 2004/05 season was estimated to be 156 tonnes.

5.104 The estimated total removals in 2004/05 was 297 tonnes, although cetacean predation 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 was reported to not be subject to cetacean predation.

⁸ Appendix J is only available electronically at www.ccamlr.org/pu/E/e_pubs/fr/drt.htm.

5.105 There was no catch-weighted length frequency information available for the 2004/05 season, although it was suggested that the pot fishery was selecting for larger fish than the longline fishery. The CPUE series was updated for the meeting.

5.106 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 sensitive to the relative weightings given to CPUE and catch-at-length data, because these two sources of data suggest different degrees of resource depletion. In addition, the model was sensitive to changes in the assumed natural mortality value and to whether or not cetacean predation was included in the calculations.

Management advice

5.107 The Working Group considered that the results of the ASPM remained very sensitive to the weightings used for different data sources. The Working Group also noted that the advice on the appropriate levels of future catch provided in the paper were not based on the CCAMLR decision rules. Therefore the Working Group was unable to provide management advice to the Scientific Committee for the fishery in the South African EEZ at the Prince Edward Islands.

5.108 The Working Group noted that the pot fishery is reported not to be subject to cetacean predation. As industry observations suggested that cetacean predation might be very high, the Working Group suggested that South Africa give consideration to this in formulating management measures for this fishery.

5.109 The Scientific Committee should note 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).

5.110 No new information was available on the state of fish stocks in Subareas 58.6 and 58.7 and Division 58.4.4 outside areas of national jurisdiction. The Working Group therefore recommended that the prohibition of directed fishing for *D. eleginoides*, described in Conservation Measures 32-11, 32-12 and 32-10, remains in force.

Dissostichus eleginoides Crozet Islands inside French EEZ (Subarea 58.6)

5.111 The Fishery Report for *D. eleginoides* in Subarea 58.6 (French EEZ) is contained in Appendix K⁹.

5.112 The catch reported for this subarea as of 1 September 2005 was 385 tonnes. Only longlining occurs in the fishery. The estimated IUU catch for the 2004/05 season was zero inside the French EEZ. Some IUU fishing may have occurred outside the EEZ as reported in SCIC-05/10 Rev. 1.

⁹ Appendix K is only available electronically at www.ccamlr.org/pu/E/e_pubs/fr/drt.htm.

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

5.114 GLM analyses show a general decreasing trend in the standardised CPUE to 2002/03 with no further decrease indicated between then and the present. Mean weight declined from 1999 to 2003, but has been stable since then. No stock assessment has been carried out.

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

Management advice

5.116 The Working Group encouraged the estimation of biological parameters for toothfish at Crozet. 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.

5.117 As for other toothfish fisheries in the Convention Area, the Working Group recommended that tag-recapture experiments be conducted. The Working Group was pleased to hear that tag-recapture experiments will be conducted by France in the 2005/06 season as a first step to assessing the stock.

5.118 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 stabilised since then. In the absence of a stock assessment, the Working Group agreed that it was unable to recommend appropriate levels of catch for this fishery.

5.119 The Working Group recommended that, where possible, all rajids should be cut from the line while still in the water, except on the request of the observer. Areas with high by-catch rates should be avoided.

5.120 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.

Chamsocephalus gunnari South Georgia (Subarea 48.3)

5.121 In the 2004/05 fishing season the catch limit set for icefish in Subarea 48.3 was 3 574 tonnes. The fishery caught 200 tonnes in December 2004 and early January 2005. The fishery will close on 14 November 2005.

5.122 There was no new bottom trawl survey for this species in Subarea 48.3 in 2005. The Working Group therefore used the results of the January 2004 biomass survey as the basis of

its assessment (Fishery Report, Appendix L¹⁰). Additional insight into the situation of the stock was gained through consideration of the results of an acoustic research survey that covered part of Subarea 48.3 in 2005; information from the fishery in 2004/05; and a recalculation of the mixture analysis of 2004 survey data undertaken by Dr Gasyukov (WG-FSA-05/78).

5.123 Neither the acoustic research survey nor the fishery found large concentrations of fish, and possible reasons for this are discussed in the Fishery Report (Annex L). The Working Group conducted assessments based on the following hypotheses:

- (i) Through some change in behaviour or distribution, possibly related to spawning, concentrations of icefish were not available to the fishery or the acoustic research survey, but icefish were dispersed over Subarea 48.3. Periodic dispersion and re-appearance of icefish has been noted before, for instance in 1989/99–1999/2000, and spawning behaviour and factors affecting distribution are not well understood for this species. The 2005/06 yield appropriate to this hypothesis was 4 760 tonnes.
- (ii) The difference in commercial length frequencies between 2003/04 and 2004/05 might indicate that most age 4+ fish were no longer present in the population at South Georgia, whether due to a mortality or other event. This event did not apply to age-3 fish (which were age-2 in the January 2004 survey). The 2005/06 yield appropriate to this hypothesis was 2 244 tonnes.

5.124 The Working Group noted that there are additional hypotheses consistent with the observation from the fishery and research survey in 2004/05. One hypothesis is that there has been a decline in the population across all age classes, whether due to an increase in mortality or other events.

Management advice

5.125 The Working Group did not have sufficient scientific information to determine which hypothesis on changes in the distribution and/or abundance of icefish was the most plausible (paragraphs 5.123 and 5.124).

5.126 Based on the results of the two hypotheses in paragraph 5.123, the Working Group recommended that the catch limit for icefish in Subarea 48.3 in the 2005/06 fishing season could be 2 244 or 4 760 tonnes.

5.127 Any catch taken between 1 October 2005 and the end of the 2004/05 fishing season (14 November 2005) should be counted against the catch limit for the 2005/06 fishing season.

5.128 All other components of Conservation Measure 42-01 should remain.

¹⁰ Appendix L is only available electronically at www.ccamlr.org/pu/E/e_pubs/fr/drt.htm.

5.129 Dr Gasyukov noted that his alternate analysis of age-class densities indicated a higher proportion of age-2 fish in the January 2004 survey than had been estimated by CMIX. As a consequence of this analysis Dr Gasyukov considered that the upper yield limit would be more appropriate.

5.130 Some members noted that, given the inability of the commercial fishery and the acoustic research survey to find concentrations of icefish in 2004/05, the yield suggested by hypothesis 1 (4 760 tonnes) would be inappropriate.

Champtocephalus gunnari Heard Island (Division 58.5.2)

5.131 The Fishery Report for *C. gunnari* in Division 58.5.2 is contained in Appendix M¹¹.

5.132 The catch limit of *C. gunnari* in Division 58.5.2 for the 2004/05 season was 1 864 tonnes (Conservation Measure 42-02) for the period from 1 December 2004 to 30 November 2005. The catch reported for this division as of 1 October 2005 was 1 791 tonnes.

5.133 Catch-weighted length frequencies in the 2004/05 season were dominated by a single year class of 3+ fish. This cohort was observed to dominate the population in the survey undertaken in June 2005.

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

Management advice

5.135 The Working Group recommended the Scientific Committee consider the following in providing advice to the Commission on Conservation Measure 42-02:

- (i) the projection of age 3+ fish from 2004/05 gives a projected yield of 647 tonnes in the 2005/06 season in the scenario of spreading the catch over two years. If all catch is taken in the first year and zero catch on this cohort in the second year, then the yield could be 1 210 tonnes in the coming season. The Working Group agreed that either of these approaches would satisfy the objectives of the Commission (paragraph M24);
- (ii) in considering these different options, the Working Group noted (paragraph M25):
 - (a) the cohort has been reproductive for one year and will have 75% escapement over the next two years, having the opportunity to reproduce again;

¹¹ Appendix M is only available electronically at www.ccamlr.org/pu/E/e_pubs/fr/drt.htm.

- (b) although it seems unlikely because of the absence of any indication of a strong 1+ year class in the 2005 survey, should a survey in 2006 show a 2+ cohort entering the fishable population then it may be difficult to have a fishery in the 2006/07 season that results in a negligible catch of the current cohort, which would be 4+ during that survey;
 - (c) that the strategy to date has been to spread risk over two years in order to provide greater opportunities for spawning by a cohort and, as such, it is not apparent what the consequence of changing that strategy might be in this case, given that it will be an older cohort, the natural mortality rate is variable between years and tends to increase substantially after age 4;
- (iii) other measures in the conservation measure be retained.

5.136 The Working Group recommended that further work on developing a management procedure for *C. gunnari* is a high priority (paragraph M26).

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)

5.137 CCAMLR closed commercial finfishing in the Antarctic Peninsula (Subarea 48.1) and the South Orkney Islands (Subarea 48.2) after the 1989/90 season. Both subareas should only be reopened to commercial fishing if scientific surveys had demonstrated that the condition of fish stocks had improved to the extent which would allow commercial harvesting.

5.138 The last surveys of the two areas occurred in 2003 (Subarea 48.1) and 1999 (Subarea 48.2). They showed no improvement in the condition of the stocks which would give rise to considerations of reopening the two areas for commercial finfishing. No new information has become available since then as no surveys were conducted in the 2004/05 season.

Management advice

5.139 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)

5.140 Prior to the current season, commercial fishing has not occurred at the South Sandwich Islands since exploratory longline fishing in 1993 by Bulgarian and Chilean vessels (Ashford et al., 1994). Following results from the 1993 cruise, CCAMLR set a catch limit of 28 tonnes of *Dissostichus* spp. for this subarea (Conservation Measure 41-03).

5.141 During the 2004/05 season, one UK-flagged vessel fished around the South Sandwich Islands and caught 27 tonnes of *D. eleginoides* (CCAMLR-XXIV/BG/13). During this time, fish were tagged in order to start a mark–recapture program to assess the toothfish population. Preliminary results from the survey were presented in WG-FSA-05/57 and indicated catch rates were similar to those experienced in Subarea 48.3.

5.142 The UK proposed to undertake a more extensive mark–recapture experiment in Subarea 48.4 during the 2005/06 and 2006/07 seasons in accordance with Conservation Measure 24-01. The objectives of the experiment will be to assess toothfish population structure, size, movement and growth. The research will be undertaken during April in each year by up to two vessels. The proposal is to tag 500+ fish while taking 100 tonnes of catch each year. The target species will be *D. eleginoides* but any *D. mawsoni* caught will also be tagged or retained for analysis as appropriate.

5.143 The Working Group welcomed this proposal and noted that:

- (i) the current catch limit is not based on an assessment;
- (ii) the proposed mark–recapture program will be a valuable tool for contributing to an assessment in the future;
- (iii) the proposed operation to facilitate the program will be restricted to the northern part of the island chain in Subarea 48.4, which is separated from the southern part of the chain by a channel approximately 2 000 m deep;
- (iv) the number of fish in good condition for tagging is limited by the rough operational conditions of the area but more than 500 tagged fish will be released if possible;
- (v) the proposed catch is for a fixed term and is only slightly greater than the total catch that might have been taken under the existing conservation measure had it been activated each year.

5.144 Based on results from the 2004/05 season, the Working Group agreed that the proposed experiment would provide useful data needed to undertake an assessment of toothfish in Subarea 48.4. It also agreed that the experiment needed to be conducted over a number of years (3–5 years) and that subject to operational access conditions (such as ice), all fishing in the subarea should follow the proposed experimental design and be restricted to the northern fishing grounds. It noted that some consideration will need to be given by the Commission to ensure that the experiment is not affected by other fishing activities and that the total catch in Subarea 48.4 does not exceed 100 tonnes at least in the 2005/06 fishing season.

5.145 The Working Group also noted that the research catches should count towards the catch limit set for this subarea. In addition, it was recommended that tagging efforts should ensure a distribution of effort so that the northern part of the subarea is effectively covered. However, it is recognised that ice coverage may prohibit fishing in some parts of the area. It was suggested that in later years some fishing might take place in the southern fishing grounds to investigate catch rates and possible movement of fish from north to south.

Management advice

5.146 The Working Group recommended that the mark–recapture program for *Dissostichus* spp. be established for the next three to five years in Subarea 48.4 with a 100 tonne limit to catches of those species, noting the comments in paragraph 5.143 and the need to ensure that the experiment is not affected by other fishing activities.

Electrona carlsbergi (Subarea 48.3)

5.147 The state of the stock was last assessed in 1994. A precautionary catch limit was set at as a result of the assessment. Since the average life span of this species is about five years, the 1994 assessment is no longer applicable, so the fishery was closed in 2003 (Conservation Measure 32-17).

Management advice

5.148 Due to the lack of new information on the current status of the stock, the Working Group recommended that the fishery remain closed. The Working Group agreed that no further consideration of this species was required until new survey data were available.

Stone crabs (*Paralomis* spp.) (Subarea 48.3)

5.149 Stone crabs were not exploited in the 2004/05 season. No proposal for the harvest of crabs has been received by CCAMLR for the 2005/06 season.

Management advice

5.150 Stone crabs are subject to Conservation Measures 52-01 and 52-02 regulating the fishery and experimental harvest of crabs. The Working Group recommended that these conservation measures should remain in force.

Squid (*Martialia hyadesi*) (Subarea 48.3)

5.151 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 2005/06.

Management advice

5.152 The Working Group recommended that the existing Conservation Measure 61-01 should remain in force.

FISH AND INVERTEBRATE BY-CATCH SUMMARY FOR WG-FSA

(see also Appendix N)

6.1 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.

Assessment of the status of by-catch species or groups

6.2 There were no new assessments of by-catch species or recommendations for revised catch limits in 2005.

6.3 In the absence of assessments for by-catch species, the Working Group recommended that precautionary measures, which place upper limits on by-catch and reduce the potential for localised depletion, be adopted.

6.4 The Working Group recommended that future work include research towards generating population parameters and estimates of standing stock for macrourids and rajids.

Estimation of by-catch levels and rates

6.5 Estimates of total removals derived from fine-scale reports of by-catch by area for the 2004/05 fishing season are presented for longline and trawl fisheries in Tables N2 and N3 respectively.

6.6 The Working Group strongly reiterated the need for accurate reporting of by-catch in all data formats.

6.7 The Working Group noted that IUU fishing is also likely to result in mortality of by-catch species. Therefore the estimates of total removals presented here should be treated as minimum estimates.

By-catch reporting

Information from scientific observers

6.8 Observer by-catch data was extracted by the Secretariat by fishery for the 2004/05 fishing season and summarised in WG-FSA-05/7 (longline fisheries) and 05/8 (trawl fisheries). These documents include tables of the species composition of the observed catch and biological data collected.

6.9 WG-FSA-05/24 reported that it was very difficult to estimate total levels of by-catch for Subareas 88.1 and 88.2 from observer data. The most common recurring problem was incomplete recording.

6.10 The Working Group recommended a modification of the L5 catch composition form for observers. Additional fields should be added that record 'number of hooks observed for fish by-catch', and the total estimated number and weight of each species retained and discarded for the set (i.e. observed number and weight scaled by proportion of hooks observed). These additional fields would help to validate and cross-check the by-catch data being recorded.

Reporting of cut-offs of rajids

6.11 The Working Group noted that information on cut-offs of rajids is still not uniformly and accurately recorded and therefore it is still not possible to calculate estimates of cut-offs for all fisheries.

6.12 The Working Group further noted that some Members have collected data on rajid cut-offs using their own national databases which indicate that releases comprise a significant proportion of the total catch (WG-FSA-05/24 and 05/68).

6.13 The Working Group recommended that all vessels be required to report the number of rajids cut from longlines through the addition to the fine-scale C2 form, of a new field: 'Number of rajids released (including tagged animals)'.

6.14 The Working Group reiterated that rajids cut from, or tagged and released from, longlines and reported as part of the fine-scale data should not be counted against by-catch limits.

6.15 The Working Group strongly recommended that observers fill out the L11 forms correctly, including information on rajid cut-offs. The Working Group noted that whilst it was desirable for this form to be completed for each set, the minimum requirement would be the completion of this form for at least one observation period every 48 hours.

Assessment of risk, both in terms of geographical areas and population demography

Identification of levels of risk

6.16 WG-FSA-05/21 presented risk categorisation tables for *M. whitsoni* and *Amblyraja georgiana*, which are the major by-catch species in the exploratory fishery for toothfish in the Ross Sea (Subareas 88.1 and 88.2) (Tables N5 and N6).

6.17 The Working Group encouraged Members to collate information to allow risk categorisation for major by-catch species in the Convention Area.

6.18 The Working Group urged Members to consider how such risk assessments should be linked to assessment and management considerations in the future. It noted that this concept should be further explored in conjunction with ad hoc WG-IMAF (paragraphs 14.1 to 14.6).

Consideration of mitigation measures

Factors affecting by-catch rates

6.19 Understanding factors that affect by-catch rates may yield information that could be used to develop mitigation and avoidance measures for by-catch.

6.20 The major factors influencing macrourid by-catch in Subareas 88.1 and 88.2 were vessel, area and depth (Figure N1). Catch rates of *M. whitsoni* were highest along the shelf edge (SSRUs 881E, 881I, 881K and 882E) in depths from 600 to 1 000 m, and there was an order of magnitude difference in macrourid catch rates between different vessels. Examination of vessel characteristics (Figure N2) showed that catch rates of macrourids were lower with the Spanish line system than with the autoline system. This effect was confounded by the bait type, as Spanish line vessels tended to use the South American pilchard as bait, whereas autoline vessels used varying species of squid and/or mackerel. However, the difference in macrourid catch rates between the few Spanish line vessels that used squid and mackerel for bait and the majority that used pilchards was much less than the overall difference between Spanish line and autoline vessels. Russian and Korean vessels had extremely low catch rates compared to other vessels fishing in the same location.

6.21 It was not possible to reliably determine factors influencing catch rates of rajids in Subareas 88.1 and 88.2 from either fine-scale or observer data because a high proportion of rajids are cut free and released at the surface and these are not accurately recorded or reported in either dataset (paragraphs N42 to N53). However, there was no obvious difference in by-catch rates of rajids between autoline and Spanish line vessels.

6.22 The Working Group recommended that further work should be carried out in the intersessional period to compare by-catch levels arising from different gear configurations and to determine whether this information could be used to develop mitigation and avoidance measures for by-catch.

6.23 The Working Group requested that Members and observers, where feasible, provide a report to the Secretariat on methods or strategies of fishing that minimise non-target fish by-catch.

6.24 The Working Group recommended that a field specifying whether integrated weighting was used for longlines be added to the C2 data form.

Release of rajids

6.25 The Working Group recommended that vessels be advised that, where possible, all rajids should be cut from the lines whilst still in the water, except on the request of the observer during the observer's biological sampling period.

6.26 Data from Member countries indicate that large numbers of rajids are cut off longlines (paragraphs N47 and N48). The effectiveness of releasing rajids as a mitigation measure will depend very strongly on the survivorship of released animals. In the absence of information on survivorship of cut-off rajids, the effectiveness of this type of mitigation measure is unknown.

6.27 No new information on the survivorship or vulnerability of rajids was available at WG-FSA-05. The Working Group noted that estimates of survivorship of rajids cut from longlines is limited and encouraged Members to undertake further survivorship experiments in the future.

6.28 The Working Group recommended that a relaxation of the requirement to cut all rajids from longlines be applied in the case where observers carried out specific tasks to gather more information on rajids during their biological sampling period. Examples of tasks include:

- (i) biological data collection – i.e. measurements of length, weight, sex, maturity, stomach contents and vertebral columns/thorns for age analysis;
- (ii) landing rajids in order to assess condition, as if these animals had been released whilst still in the water. It would be necessary to observe the hauling and landing procedure to ensure that injuries were not sustained through hauling;
- (iii) assessing the probability of detecting tagged rajids. It may be difficult to detect tagged animals that are released whilst in the water, particularly in rough sea states.

6.29 The Working Group recommended the adoption of a new 4-category scale (paragraph N87) for assessing rajid release condition by observers. These data should be accurately recorded for at least one observation period every 48 hours.

INCIDENTAL MORTALITY OF MAMMALS AND SEABIRDS
ASSOCIATED WITH FISHING
(see also Appendix O)

Advice to the Scientific Committee

General
(see also paragraphs O1 to O5)

7.1 The plan of intersessional work for 2005/06 (SC-CAMLR-XXIV/BG/28) summarises requests to Members and others for information of relevance to the work of the Working Group (paragraphs O1 to O4). Members are particularly invited to review the membership of the Working Group, to suggest additional members and to facilitate attendance of their representatives at meetings (paragraph O5).

Incidental mortality of seabirds during regulated longline
and pot fishing in the Convention Area in 2005
(see also paragraphs O6 to O16)

7.2 The total number of observed mortalities was 56, and consisted of 6 (11%) yellow-nosed albatrosses, 1 (2%) wandering albatross, 43 (76%) white-chinned petrels and 6 (11%) southern giant petrels. The total extrapolated mortality for 2004/05 was 97 birds split between Subareas 48.3 (13 birds), 58.6 and 58.7 (76 birds) and Division 58.4.1 (8 birds) (Table 2). This was a 65% increase from the extrapolated 58 mortalities for 2003/04. The vast majority of the extrapolated mortality (78%) is attributed to one vessel fishing in Subareas 58.6 and 58.7 (paragraphs O6 to O9).

- (i) For Subarea 48.3, the total extrapolated seabird mortality was 13 birds compared with 27, 8, 27 and 30 birds in the last four years (Table O3). The overall catch rate was 0.0011 birds/thousand hooks, compared to the rates of 2004 and 2001 (0.0015 birds/thousand hooks) and the rate for 2003 (0.0003 birds/thousand hooks). The four birds observed killed were southern giant petrels (Table O4). Total extrapolated captures decreased between 2003/04 and 2004/05 (paragraph O12).
- (ii) For Subarea 58.4, the total extrapolated seabird mortality was eight birds, with a catch rate of <0.001 birds/thousand hooks, from one vessel operating in Division 58.4.1 (Table O3). In 2003/04 longline fishing was undertaken for the first time in Subarea 58.4. No mortalities had been reported prior to 2004/05 (paragraph O13).
- (iii) Within the South African EEZ in Subareas 58.6 and 58.7, the total extrapolated mortality was 76 seabirds from the one vessel that fished there. The catch rate for this area was 0.149 birds/thousand hooks, compared to 0.025 and 0.003 in 2003/04 and 2002/03 respectively (Table O3). In previous years (1997 to 2001) extrapolated mortalities and rates ranged between 834–156 birds and 0.52–0.018 birds/thousand hooks respectively (paragraph O14).

- (iv) In Subareas 48.4, 48.6, 88.1 and 88.2 and Division 58.5.2, no seabird mortalities were observed on longline vessels. Incidental mortality of seabirds in Subareas 88.1 and 88.2 has been very low over the past eight years, with only one bird observed killed in 2003/04 (Table O3, paragraph O15).

7.3 The Working Group noted that the reports of seabirds being caught injured and uninjured indicates that seabirds are being caught on the haul; this accounts for at least 68% of seabird captures in 2004/05 (Table O1). This indicates that an increased focus on haul mitigation measures is required (paragraphs O10 and O11).

7.4 No incidental mortalities were recorded on two cruises in Subareas 58.6 and 58.7 undertaking pot fishing for *D. eleginoides* (paragraph O16).

French EEZs in Subarea 58.6 and Division 58.5.1
(see also paragraphs O17 to O43)

7.5 Data requested for 2000/01 were received for Division 58.5.1 (paragraph O17). The total seabird mortality reported by captains in 2000/01 was 1 917 birds (Table O5). The corresponding catch rate (reported birds/total hooks set) was 0.092 birds/thousand hooks, of which approximately 94% were white-chinned petrels. Data for Subarea 58.6 will be submitted next year (paragraphs O19 and O20).

7.6 In 2004/05 the total reported seabird mortality from observers for Subarea 58.6 and Division 58.5.1 was 61 and 1 054 birds respectively (Table O8). The corresponding incidental mortality rates were 0.047 and 0.161 birds/thousand hooks. The total seabird mortality reported by captains in Subarea 58.6 and Division 58.5.1 was 137 and 1 901 birds respectively (Table O7). The corresponding incidental mortality rates were 0.028 and 0.071 birds/thousand hooks (paragraphs O22 and O23).

7.7 Comparing this year's to last year's data is complicated by different count methods. Data submitted to CCAMLR from 2000 to mid-2004 were collected by captains. Beginning April 2004, on-board observers collected seabird incidental mortality and mitigation-related information (paragraph O21). Data were therefore compared where available in the same format for the same period. Comparing 2003/04 and 2004/05 for the period from April to August, observers' incidental mortality rates showed an increase of 87% (0.006 to 0.011 birds/thousand hooks) and 21% (0.058 to 0.070 birds/thousand hooks) respectively in Subarea 58.6 and Division 58.5.1 (paragraph O24). Differences between captain and observer-reported data are addressed in CCAMLR-XXIV/BG/24 (paragraph O25).

7.8 The Working Group noted that in order to be consistent with CCAMLR procedures, the use of observer data only is recommended. From 2005/06 all French data on incidental mortality of seabirds will be collected only by observers, thereby allowing direct comparison with other CCAMLR areas (paragraph O26).

7.9 The seabird data recorded by observers were used to extrapolate total seabird mortality (Table O9). The mean proportions of hooks observed in Subarea 58.6 and Division 58.5.1 were 25.5 and 24.5% respectively. For Subarea 58.6, the observed incidental mortalities

of 61 birds extrapolates to a mortality of 242 seabirds (0.049 birds/thousand hooks). For Division 58.5.1, the observed incidental mortalities of 1 054 birds extrapolates to a mortality of 4 387 seabirds (0.164 birds/thousand hooks) (paragraphs O28 and O29, Table O11).

7.10 The Working Group noted that 30% of seabirds captured were caught alive, indicating that they were taken on the haul. It was recognised that attention to mitigating captures on the haul would be required as part of efforts to achieve a continuing reduction in seabird mortality (paragraph O30).

7.11 The Working Group noted that the CCAMLR totals included the dead and mortally injured birds in the 'total caught dead' numbers, whereas the French data included only 'dead' and 'alive' categories, the latter including both mortally injured and live birds. The Working Group recommended the use of the CCAMLR methodology by French observers to allow for better estimates of overall mortality and to facilitate comparison with other fisheries in the Convention Area (paragraph O31).

7.12 The Working Group noted the continued efforts to use and develop effective mitigation measures in the French EEZ fisheries. Following recommendations made by the Scientific Committee last year, new regulations entered into force in 2005 and include weighting regimes, multiple streamer lines, an area closure, and prohibition of hook discard and use of black hookline. New measures will continue to be tested (e.g. hook design, reconstituted colour bait, line shooter, laser technology) (paragraphs O36 and O37).

7.13 The Working Group commended the initiatives taken by France for research and management relating to the incidental mortality of seabirds in its EEZs. It recommended that:

- (i) observers continue to be deployed on 100% of vessels (paragraph O26);
- (ii) consideration be given to increasing the proportion of hooks observed (e.g. to 40–50%) (paragraphs O32 and O33);
- (iii) data collection protocols be improved including incorporating the CCAMLR distinctions and definitions relating to dead and live seabird by-catch (paragraph O42);
- (iv) appropriate analysis of the 2005 data be undertaken (paragraphs O38 and O39).

Information relating to the implementation of
Conservation Measures 25-01, 25-02 and 25-03
(see also paragraphs O44 to O62)

7.14 This year the level of reported compliance has increased for all elements. With respect to Conservation Measure 25-02, this is summarised as follows:

- (i) Line weighting (Spanish system) – for the first time there was 100% compliance with the required line-weighting regime in all subareas and divisions (paragraph O46, Table O13).

- (ii) Line weighting (autoline system) – all vessels fishing in Subareas 88.1, 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 (paragraph O48, WG-FSA-05/9 Rev. 2, Table 6; SC-CAMLR-XXIII, Annex 5, paragraph 7.57).
- (iii) Night setting – in Subareas 58.6 and 58.7, 100% of sets occurred at night, an increase from the 83% night-setting rate last year; in Subarea 48.3, 99% of sets occurred at night (98% in 2004) (Table O13). In Subareas 48.6, 88.1, 88.2 and Division 58.4.2 and 58.4.3b, all vessels demonstrated a consistent minimum line sink rate of 0.3 m/s and hence fished under Conservation Measure 24-02, which provides exemptions to night setting south of 60°S (paragraph O49, WG-FSA-05/9 Rev. 2, Table 6).
- (iv) Offal discharge – a single vessel discharged offal during one set and one haul in Subarea 88.1 (offal discharge is prohibited in this subarea); in Subarea 48.3, a single vessel discharged offal during one set (offal discharge during setting is prohibited under Conservation Measure 25-02) (paragraph O50, Table O1).
- (v) Discard of hooks – hooks were present in discards on six vessels; on three of these this was a rare event (WG-FSA-05/9 Rev. 2, Table 1). However, on one vessel it was a daily occurrence during the first half of the season; following a mid-season crew change the discarding of hooks stopped (paragraph O51).
- (vi) Streamer lines – the number of cruises complying with streamer line specifications increased from 64 to 74% this year (Table O12), although this is not as high as the 92% in 2003. In Subareas 48.6, 58.6, 58.7 and Divisions 58.4.2 and 58.4.3b, all vessels used streamer lines on all sets; in Subarea 48.3, only 1 of 1847 sets was undertaken without using a streamer line; in Subareas 88.1 and 88.2, one vessel undertook a single set without using a streamer line (Table O1) (paragraphs O52 to O54 and O60, Table O12).
- (vii) Haul scaring devices – in Subarea 48.3, three vessels did not use haul scaring devices on all of the hauls; in Subareas 58.6 and 58.7, 100% of hauls used scaring devices; in Division 58.5.2 the only longline vessel fishing in that area was equipped with a moonpool hence no devices were required (paragraphs O57 to O59, Table O12).

7.15 With respect to Conservation Measure 25-01, 9 of the 10 vessels which had packaging bands on board complied with the requirement to dispose of them using on-board incineration. One vessel was observed disposing plastic packaging bands overboard and therefore did not comply with Conservation Measure 25-01 (paragraph O46; WG-FSA-05/9 Rev. 2, Table 1).

7.16 With respect to Conservation Measure 25-03, 2 of 9 (22%) vessels did not comply with the prohibition of discharge of offal during the shooting or hauling of trawl gear (paragraph O62, Table O14). This level of compliance is higher than 2004, when 4 of 8 (50%) vessels discharged offal.

7.17 In relation to overall compliance with Conservation Measure 25-02, 12 of 25 vessels (48%) fully complied with all measures at all times throughout the Convention Area, compared to 33% last year (Tables O1 and O12). Some vessels failed to comply by small margins, and the Working Group re-emphasised that vessels should be advised to exceed the standards to prevent compliance failure (paragraph O61).

7.18 During the meeting, the Working Group undertook an evaluation of the data prepared by the Secretariat on the implementation of Conservation Measures 25-01, 25-02 and 25-03. During this process some examples of potential non-compliance were identified by the Working Group and in some cases corrected following a dialogue between the Secretariat and technical coordinators of observer programs. The Working Group noted that such dialogue may avoid the erroneous interpretation of ambiguous reporting leading to a misrepresentation of the level of compliance by individual vessels (paragraphs O45, O55 and O56).

Research pertaining to the revision of Conservation
Measures 24-02 and 25-02 and related matters
(see also paragraphs O63 to O95)

7.19 The Working Group, recollecting previous Scientific Committee and Commission recommendations and endorsements (paragraphs O65 and O67), strongly supported the proposal to develop improved Spanish longline mitigation measures (paragraphs O68 to O70). The research is intended to test the effectiveness of Spanish longline weighting regimes in reducing incidental mortality of seabirds including in high-risk areas at high-risk times of year, and test methods to reduce the substantial amounts of fishing gear lost (paragraphs O66 and O70). The stepwise research plan (paragraphs O68 to O70), with initial tests outside the Convention Area in fisheries where Convention Area seabirds range, was endorsed, including implications for future tests in the Convention Area (paragraph O71).

7.20 With respect to future improvements to Conservation Measure 25-02, the Working Group recommended:

- (i) routine collection of longline sink rate data for a wide range of line-weighting scenarios including related vessel setting speed and aerial extent of streamer line information to allow the determination of potential access by seabirds to baited hooks behind longline vessels (paragraphs O72 to O76 and O93);
- (ii) collection of data, at least every seven days, of streamer line features including streamer line aerial extent; the height of streamer lines at the stern; the length of streamer lines; and the number, spacing and length of individual branched streamers. These data should be collected on a diagram-based form to be developed by the Secretariat. Where sink rate data collection is required according to Conservation Measure 24-02, paragraph B2(ii), the Working Group recommended that streamer line data be collected in the course of sink rate data collection (paragraphs O77 to O79);
- (iii) appropriate experiments on the design features of streamer lines with a view to being able to recommend refinements to the streamer line requirements (paragraph O80);

- (iv) development of effective haul scaring devices for use throughout the Convention Area (paragraph O84);
- (v) haul mitigation devices, such as the BED, should be encouraged in all CCAMLR areas regardless of risk status to reduce the large proportion of bird captures during line hauling (paragraph O86).

7.21 With respect to the Japanese proposal for the *Shinsei Maru* bottom-line system, the Working Group recognised the potential for the fishing method to minimise exposure of baited hooks to seabirds during setting operations and therefore expressed support for the proposal. The Working Group strongly recommended that Conservation Measures 25-02 and 24-02 be applied to this fishing system novel to the Convention Area (paragraph O82). In addition, some details were lacking that might have allowed a complete evaluation of the potential threats to seabirds in the Convention Area. The Working Group recommended that the fishery observer assigned to this vessel describe how the gear is deployed and retrieved with special attention to gear and seabird behaviour during the haul and set as this would enable understanding the performance of this fishing gear and its appropriateness for continued use in the Convention Area (paragraphs O81 and O83).

7.22 In response to a Commission request (CCAMLR-XXIII, paragraph 10.24), the Working Group reviewed available data on the maximum length of longlines used in the Convention Area with respect to Conservation Measure 24-02 and longline sink rate testing prior to entering the CCAMLR Convention Area (paragraph O87).

7.23 The Working Group recommended that the requirement for line sink rate testing prior to entering the Convention Area should be changed from the current requirement to test the maximum length of longlines to that of testing the average length, being 6 000 m for auto longline system vessels and 16 000 m for Spanish longline system vessels (paragraph O89).

7.24 Accordingly, the Working Group recommended that Conservation Measure 24-02 be revised as follows (paragraphs O94 and O95):

Replace paragraph A1(i) with:

- (i) set a minimum of two longlines with a minimum of four TDRs on the middle one-third of each longline, where:
 - (a) for vessels using the auto longline system, each longline shall be at least 6 000 m in length;
 - (b) for vessels using the Spanish longline system, each longline shall be at least 16 000 m in length.

Replace paragraph B1(i) with:

- (i) set a minimum of two longlines with a minimum of four bottle tests (see paragraphs B5 to B9) on the middle one-third of each longline, where:
 - (a) for vessels using the auto longline system, each longline shall be at least 6 000 m in length;

- (b) for vessels using the Spanish longline system, each longline shall be at least 16 000 m in length.

Replace paragraph C1(i) with:

- (i) set a minimum of two longlines with either a minimum of four TDRs, or a minimum of four bottle tests (see paragraphs B5 to B9) on the middle one-third of each longline, where:
 - (a) for vessels using the auto longline system each longline shall be at least 6 000 m in length;
 - (b) for vessels using the Spanish longline system each longline shall be at least 16 000 m in length.

7.25 In reviewing its advice from 2004 (SC-CAMLR-XXIII, Annex 5, paragraphs 7.91 to 7.93), the Working Group noted that the proposed changes to Conservation Measure 25-02 with respect to mandatory line-weighting prescriptions for autoline vessels were no longer considered appropriate. The rapid adoption of IWLs and the line sink rate testing regime had largely superseded the need for an external line-weighting regime for autoline vessels (paragraph O91).

7.26 Although no additional information on the specification of IWLs had been provided, and a revision of Conservation Measure 25-02 at this time would be premature, the Working Group agreed that IWLs should continue to be endorsed as a viable line weighting alternative (paragraphs O90 and O92).

7.27 The Working Group recommended that research be undertaken on IWLs to allow revision of Conservation Measure 25-02 with the intention of combining Conservation Measures 24-02 and 25-02 if possible (paragraph O93).

Incidental mortality of seabirds during unregulated
longline fishing in the Convention Area
(see also paragraphs O96 to O106)

7.28 The overall estimated total for the whole Convention Area in 2004/05 indicates a potential seabird by-catch in the unregulated fishery of 4 415 (95% confidence interval range of 3 605 to 12 400) seabirds (SC-CAMLR-XXIV/BG/27). The values for this and previous years are summarised in respect of different parts of the Convention Area in Table 18 (paragraph O101).

7.29 In comparison with estimates for previous years, calculated in identical fashion, the value for 2004/05 is similar to the value estimated for 2003/04 (SC-CAMLR-XXIII/BG/23). 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 (paragraph O102).

7.30 Nevertheless, the Working Group reiterated its conclusions of recent years that even these levels of IUU incidental mortality of seabirds were of substantial concern and likely unsustainable for some of the populations concerned (paragraph O105). The Commission was encouraged to continue to take action in respect of incidental mortality of seabirds caused by IUU fishing (paragraph O106).

Incidental mortalities of seabirds during longline fishing
outside the Convention Area
(see also paragraphs O107 to O111)

7.31 As requested in 2004 (paragraph O108), Brazil provided new data on mortality of seabirds outside the Convention Area relevant to fisheries and/or seabirds within the Convention Area. Cruises on Brazilian domestic vessels were observed with an average catch rate of 0.09 birds/thousand hooks between 2000 and 2005, and species from the Convention Area were among those captured (paragraph O107). These data indicate a high risk of capture of birds from the Convention Area in Brazilian fisheries, especially during winter (paragraph O108).

7.32 The Working Group noted the progress on the implementation of mitigation measures in Brazil (paragraph O109) and encouraged reporting of new information in 2006.

7.33 Data from the Falklands/Malvinas toothfish longline fishery were also reported (paragraph O110); however, there were no direct implications for Convention Area breeding species (paragraph O111).

Research into the status and distribution of seabirds
(see also paragraphs O112 to O143)

7.34 Data were reported on winter foraging areas off the Brazilian coast of species that breed in the Convention Area (paragraph O112). Data from a recent satellite-tracking study of albatross populations on Heard Island (light-mantled sooty and black-browed albatrosses) indicates an overlap of foraging areas with new and exploratory fisheries in Divisions 58.4.1, 58.4.2 and 58.4.3 (paragraph O114). The satellite-tracking study provided important information for the understanding and management of incidental mortality of black-browed albatrosses in fisheries adjacent to Heard Island (paragraph O115). Several population studies and analyses are under way for the petrel populations on Crozet and Kerguelen Islands and results are anticipated in early 2007 (paragraph O130).

7.35 A requested analysis by BirdLife International of albatross and petrel distribution relevant to the Convention Area indicated that the subareas with the highest proportion of albatross and petrel distribution were Subareas 48.3 and 58.6, but the breeding ranges extend across the majority of the Convention Area. Data acquisition priorities were identified (paragraph O123) and the spatial risk assessments for CCAMLR subareas were revised based on this new and relevant information on the distribution of albatrosses and petrels vulnerable to interactions with fisheries (SC-CAMLR-XXIV/BG/26) (paragraphs O120 and O121).

7.36 The Working Group requested holders of new information on Procellariiform distribution to submit these to the BirdLife International global database initiative for application to fisheries management initiatives (paragraph O119) and that BirdLife International provide summary data to the Secretariat on the distribution of Southern Ocean seabirds from its tracking database at approximately three-year intervals, or when accumulation of data warrants (paragraph O123).

7.37 The Working Group welcomed the ACAP observer and received and reviewed ACAP's preliminary report on albatross and petrel populations protected under ACAP, which includes all the Procellariiform seabirds occurring in the Convention Area (paragraphs O131 to O140). The Working Group agreed that such information is best compiled and reviewed by ACAP and, to avoid duplication, suggested that ACAP be the single repository for these data. ACAP would be requested to submit summary documents of albatross and petrel population status to the Secretariat annually, or as appropriate (paragraph O141).

International and national initiatives relating to incidental mortality of seabirds in relation to longline fishing
(see also paragraphs O166 to O179)

7.38 Information was reported on current international initiatives under the auspices of:

- (i) ACAP – items of particular relevance to CCAMLR (paragraph O145);
- (ii) FAO (NPOA-Seabirds) – noting the near completion of plans by Brazil and Chile (paragraphs O147 and O149);
- (iii) RFMOs – responses received to CCAMLR Resolution 22/XXIII by CCSBT, IATTC and ICCAT; initial progress with IOTC, ICCAT and WCPFC (paragraphs O155 to O167);
- (iv) NGOs – a new BirdLife International initiative was noted (paragraph O154) and a Southern Seabirds Solution fisher exchange between New Zealand and Chile (paragraphs O152 and O153);
- (v) a workshop resulting in recommendations for best-practice data collection on protected species in longline fisheries at the Fourth International Fisheries Observer Conference was noted (paragraphs O150 and O151).

7.39 The Working Group reviewed requested papers tabled at CCSBT's Fifth Meeting of the ERS WG, taking particular note of CCSBT members' reports on mitigation and estimates of seabird incidental mortality. Data from the RTMP observer program of the Japanese southern bluefin tuna longline fishery estimated the annual incidental takes of seabirds for the 2001 and 2002 fishing years at 6 000 to 9 000 birds per year and suggested these levels have been stable since 1995. Species composition sampling indicated approximately 75% of the species taken were albatrosses and 20% petrels, most of which breed in the Convention Area (paragraphs O166 to O173).

7.40 Noting that the Japanese southern bluefin tuna fleet probably represents about two-thirds of the longline fishing effort in the overall CCSBT fishery, the total annual

mortality of seabirds could approach, or even exceed, 13 500 seabirds, including about 10 000 albatrosses, the Working Group expressed substantial concern and re-emphasised a need for effective mitigation, its evaluation, and a more extensive and detailed program of data collection by observers (paragraphs O175 and O176).

7.41 At the 26th Session of COFI, Japan proposed a joint meeting of the secretariats of the tuna RFMOs and their members. The Working Group expressed strong support of the proposal and requested Members of CCAMLR, especially those also members of the participating RFMOs, to support a thorough review of by-catch-related initiatives and requirements at this meeting (paragraphs O177 and O178).

Incidental mortality of seabirds in relation
to new and exploratory fisheries
(see also paragraphs O180 to O195)

7.42 Of the 35 applications for exploratory longline fisheries for 2003/04, 25 were undertaken (paragraph O184). No incidental mortality of seabirds was observed in fisheries in Subareas 48.6, 88.1 and 88.2 and Divisions 58.4.2, 58.4.3a and 58.4.3b. Two seabird mortalities and one bird released alive were observed in Division 58.4.1 (paragraph O185).

7.43 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-XXIV/BG/26). There were seven changes to levels of risk this year (paragraphs O183 and O186).

7.44 The 39 proposals by 12 Members for exploratory fisheries in seven subareas/divisions of the Convention Area in 2005/06 were addressed in relation to the advice in SC-CAMLR-XXIV/BG/26, Figure 1 and Table 19. The results, summarised in Table 20, involve two categories: those that provide sufficient information and are assessed as conforming with advice relating to incidental mortality of seabirds (paragraph O190(i)), and those that contain insufficient information to determine whether they conform with advice relating to incidental mortality of seabirds (paragraph O190(ii)). Applications by Argentina (CCAMLR-XXIV/12), Chile (CCAMLR-XXIV/27, 28), Norway (CCAMLR-XXIV/11), Republic of Korea (CCAMLR-XXIV/22), Russia (CCAMLR-XXIV/31) and Uruguay (CCAMLR-XXIV/23, 24, 29, 30) fall into the latter category. The Working Group noted that as for last year (SC-CAMLR-XXIII, Annex 5, paragraph 7.273) these inconsistencies should be able to be resolved during the Scientific Committee meeting (paragraph O193).

7.45 The Working Group requested that Members take greater care in future submissions to ensure the intent to comply with relevant seabird by-catch measures was clear (paragraph O192) and recommended that to assist in the review of notifications for new and exploratory fisheries in future years a checklist be developed by the Secretariat for Members to complete when submitting notifications (paragraph O193).

7.46 Issues relating to:

- (i) exemptions from setting longlines at night;
- (ii) exemptions in respect of closed seasons;
- (iii) 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;
- (iv) including reference to the definition of birds caught in all relevant conservation measures;

are addressed in paragraphs O194 and O195.

Other incidental mortality
(see also paragraphs O196 to O230)

Interactions involving marine mammals
and longline fishery operations

7.47 Three southern elephant seal mortalities were reported in the toothfish fishery in Division 58.5.2 (paragraph O196). Two Antarctic fur seals entangled in a longline in the Subarea 48.3 toothfish fishery were both released alive (paragraph O197).

Interactions involving seabirds and marine mammals
and trawl finfish fishery operations

7.48 In 2005, 11 seabirds were observed killed in the Subarea 48.3 icefish fishery and another 14 released alive and uninjured (Table O16), an order of magnitude decrease in the mortality rate for this subarea compared to previous years (0.04 birds per tow in 2005 and 0.37 and 0.20 birds per tow in 2004 and 2003 respectively (Table O17)) (paragraph O201). Eight seabirds were observed killed in the Division 58.5.2 icefish/toothfish fishery, with the mortality rate increasing from zero in 2004 and 0.005 birds per tow in 2003 to 0.01 birds per tow in 2005 (paragraph O202). An additional five seabirds, including two black-browed albatrosses, were reported killed (paragraph O203).

7.49 The reduction in seabird mortality in the icefish fishery in Subarea 48.3 could be due to a combination of reduced seabird abundance, associated with the reduction in icefish catches, and the continued adoption of mitigation measures, but insufficient data were available to investigate this further (paragraphs O204 to O206).

7.50 The Working Group noted that binding the net with sisal string is a potentially highly effective and easily implemented mitigation measure for the icefish trawl fleet (paragraphs O207 and O208).

7.51 One Antarctic fur seal was caught and released alive in the toothfish trawl fishery in Division 58.5.2 (paragraph O216).

Interactions involving marine mammals and seabirds and krill fishing operations

7.52 In 2005 in Subareas 48.2 and 48.3 one incidental mortality of a Cape petrel was recorded and one Antarctic fulmar was caught on a warp splice and released uninjured. Information from the report of a scientific observer from the krill fishery in Subarea 48.3 included anecdotal records of seabird collisions with trawl warps during hauling (paragraph O209).

7.53 In 2004/05, 95 Antarctic fur seals were observed caught during krill fishing operations in Area 48 (WG-FSA-05/8, Table 4), of which 74 were released alive, compared to 156 of which 12 were released alive in 2004 (paragraph O217). The observer coverage was not sufficient to extrapolate a total Antarctic fur seal mortality in the krill fishery (paragraphs O223 and O224).

7.54 The Working Group recollected the Scientific Committee advice from last year that until such time as marine mammal mitigation measures specific to this fishery could be incorporated into the relevant conservation measures, every vessel fishing for krill should employ a device for excluding seals or facilitating their escape from the trawl net (paragraphs O218 to O222(i)).

7.55 The Working Group reiterated the recommendations made by the Scientific Committee last year, that observers on krill vessels collecting reliable data on seal entrapment and on the effectiveness of devices to mitigate this (SC-CAMLR-XXIII, paragraph 5.37) should allow a very substantial resolution of the problem. A minimum requirement would be to have observations from each vessel in the fishery in order to assess the type and efficacy of the mitigation measures employed on a vessel-by-vessel basis. This would also provide an opportunity to provide information on the rate of trawl warp strikes by birds in this fishery (paragraphs O209, O222(ii), O224 and O225).

7.56 The Working Group recommended 100% observer coverage on krill trawl vessels to obtain reliable data on seal entrapment and on the effectiveness of associated mitigation devices (paragraph O226).

General

7.57 The Working Group intends to develop detailed warp strike data collection protocols during the intersessional period to allow a more comprehensive assessment of the incidental mortality of seabirds in trawl fisheries to be undertaken in future (paragraphs O211 to O214).

7.58 The Working Group recommended that at future meetings assessments of incidental mortality of seabirds and marine mammals in the icefish, toothfish and krill trawl fisheries be undertaken collectively as a part of a generic review of the trawl methodology for mitigation purposes (paragraph O215).

Other business
(see also paragraphs O231 to O240)

7.59 The Working Group reviewed SC-CAMLR-XXIV/8, a proposal for testing new streamer line designs (paragraphs O231 to O234) and made three general recommendations on the testing of seabird mitigation measures:

- (i) that further testing of modifications to mitigation methods which would require exemption from the provisions of current conservation measures should require prior provision to CCAMLR of full details of the proposed research and experiments (paragraph O235);
- (ii) to avoid confusion, that the Scientific Committee confirm that the role of scientific observers does not include the ability to agree to fishing-related practices that are in contravention of CCAMLR conservation measures without relevant prior exemptions having been agreed by CCAMLR (paragraph O235(i));
- (iii) that the Scientific Committee confirm that full proposals for any such testing must be notified to WG-FSA in advance of the fishing season in which the trials are proposed to be conducted (paragraph O235(ii));

and three specific recommendations on the proposal (paragraph O236):

- (i) it was not feasible or appropriate for the Working Group to devise specific experimental protocols for applicants;
- (ii) the Working Group was prepared to comment on the content and design of experiments proposed by applicants provided these were available two weeks in advance of the start of its meeting so that there was sufficient time for appropriate expert consultation;
- (iii) consequently it was not recommended that a test of the streamer line designs outlined in Annex 1 of SC-CAMLR-XXIV/8 should proceed in the 2005/06 fishing season.

7.60 The Working Group provided additional comments on the proposal should the applicant wish to resubmit it next year (paragraphs O237 and O238).

7.61 With respect to the UK proposal for a toothfish mark-recapture experiment in Subarea 48.4, the Working Group noted that, despite the change in risk assessment for incidental mortality of seabirds in this subarea for 2005 (paragraph O186), the proposal conformed with the advice of the Working Group in respect of avoidance of incidental mortality of seabirds (paragraphs O239 and O240).

EVALUATION OF THREATS ARISING FROM IUU ACTIVITIES (see also Appendix P)

Current estimate of IUU catches

8.1 The Working Group examined the calculations of IUU made by the Secretariat in SCIC-05/10 Rev. 1 (Table 3.2). As in previous years, information supplied to the Secretariat by Members on the number of IUU vessels active in an area (subarea/division), was combined with 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.

$$\text{IUU catch} = \frac{[\text{number of observations of activity}] \times [\text{trip duration (days)}]}{[\text{number of trips per year}] \times [\text{catch rate (tonnes/day)}]}$$

8.2 Currently the Secretariat makes an assessment of IUU activity up to the beginning of October, and provides both these estimates (column 11 of Table 1 of SCIC-05/10 Rev. 1) and extrapolations to the end of the fishing season (column 12). The table needs to be updated at the end of each fishing season, when the final sightings information is available, so that all figures for a fishing season are based on estimation rather than extrapolation. The Working Group requested the Secretariat do this intersessionally for the current and all previous fishing seasons so that the best estimates of IUU catch can be used in assessments.

8.3 The estimates made by the Secretariat for the 2004/05 fishing season will be reviewed by SCIC after the conclusion of the WG-FSA meeting. In case SCIC was to decide that the figures or the method used are in some way inappropriate, WG-FSA agreed that it should use two alternative IUU scenarios, to provide the Scientific Committee and Commission with appropriate alternative assessments of toothfish catch limits. Bearing in mind the discussion in paragraph 8.2, these two scenarios would assume:

- (i) that the estimates given in Table 1 are correct up to the point of 1 October 2005, i.e. to the point of extrapolation, and therefore that the figures in column 11 should be used for IUU estimated catch in the 2004/05 fishing season;
- (ii) that the estimates given in column 11 of Table 1 are uncertain, and therefore that IUU catch could be assumed to be zero in the 2004/05 fishing season.

8.4 The Working Group recommended that SCIC give consideration to the viability and priority of further developing estimation methods as well as undertaking additional work with simulated and historical data to better understand the effectiveness of different levels of observation in detecting levels of IUU activity, particularly for situations where evasion of detection might be a real possibility.

Trends in IUU catch

8.5 There has been a decline in IUU catches over the last three years, although estimates for 2005 are at similar levels to 2004. Table 3.2 shows that the pressure from surveillance operations in traditional fishing areas within the Convention Area has forced IUU fishing on to high-seas areas within the Convention Area. The consequence of this is that methods of

assessing IUU catch, previously developed and applied primarily to non-high-seas areas of the Convention Area, now need to be applied if possible to high-seas areas. The Working Group requested that the Scientific Committee and SCIC consider how these estimates are best made, which body or which combination of bodies of CCAMLR is required to best make an accurate assessment of IUU catch, and how data required for the assessment may be acquired.

8.6 There is now very little catch being reported in the CDS from Areas 47, 51 and 57, and in 2005 the CDS catch declared from these areas was lower than the estimated IUU catch (Tables 3.2 and 3.3). If significant IUU catches were mis-reported as having come from Areas 47, 51 and 57 in the past, this would no longer appear to be the case. WG-FSA requested that SCIC consider the possibility that the CDS, previously assumed to be capturing the world trade in toothfish reasonably well, may now be less accurately capturing trade in IUU catch.

8.7 WG-FSA emphasised that its assessments required the best estimates of IUU fishing rather than 'conservative' or 'precautionary' estimates, because the use of these latter estimates may not necessarily result in precautionary estimates of sustainable yield, depending on the assessment method being used. For instance, in the newer CASAL assessments, where the current exploitable biomass is directly estimated from tagging data, the addition of 'precautionarily' high levels of historical IUU fishing might artificially increase the apparent productivity of the stock, whereas in the forward-projection of GYM the reverse would be true.

8.8 The Working Group noted that the historical series of IUU catches might need to be reviewed by SCIC because of the sensitivity of historical estimates to assumptions about catch rates, trip duration and observations of IUU activity. As an example, the Working Group examined the sensitivity of the results to assumed catch rates of IUU vessels (Appendix P), particularly in the 1998/99 to 2000/01 fishing seasons, which would have consequences for historical estimates of IUU catches. The Working Group requested that SCIC review these issues and determine whether a review of the IUU catch series is needed. The Working Group emphasised that the best estimates of IUU are required for its work in assessing and determining sustainable yields for Convention Area fish stocks.

8.9 The Working Group requested that the Scientific Committee ask the Commission which body is responsible for estimating and reviewing the IUU catch in each statistical area and by what method this might be achieved. For example, it will be important to determine the values for input parameters to these calculations, such as:

- (i) how to use the sightings information (some of which cannot be adequately verified) currently submitted to the Secretariat by Members without requiring explicit information on surveillance operations to be made available;
- (ii) what fishing time might be represented by an observation (i.e. the number of vessels fishing, the duration that they might be fishing in the area, the potential fishing time). One option might be to provide a weighting for each type of observation, such as whether a vessel is observed near to, or far away from, fishing grounds;
- (iii) how surveillance activity might be used to estimate IUU fishing activity from observations;

- (iv) how these values might be influenced by different kinds of sightings;
- (v) what other factors may need to be taken into account to make this approach viable.

8.10 WG-FSA noted that compliance and enforcement experts are needed to determine this information and reiterated its request last year (SC-CAMLR-XXIII, Annex 5, paragraph 8.6) for SCIC to consider whether qualitative information could be provided for each of the regions suitable so that they can be classified as either unmonitored, slightly monitored or heavily monitored with an indication as to whether the level of monitoring has increased or decreased significantly from the previous year.

BIOLOGY, ECOLOGY AND DEMOGRAPHY OF TARGET AND BY-CATCH SPECIES (see also Appendix Q)

New biological information

9.1 In addition to information which was pertinent to the assessment of stocks and dealt with in Fishery Reports and paragraphs 3.43 to 3.53, 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 our biological understanding of these species. These papers address the following subject areas:

- (i) distribution of *C. gunnari* in relation to oceanography and temperature in Subarea 48.3 (WG-FSA-05/76, 05/77);
- (ii) reproductive biology of *D. mawsoni* (WG-FSA-05/28, 05/52, 05/63);
- (iii) diet of *D. eleginoides* at South Georgia and Shag Rocks (WG-FSA-05/P6);
- (iv) age estimation and maturity of the grenadier *M. whitsoni* in Subarea 88.1 (WG-FSA-05/20);
- (v) the biology of *D. eleginoides* at Kerguelen (WG-FSA-05/27);
- (vi) biology of skate species caught in the toothfish fishery in Division 58.5.2 (WG-FSA-05/70);
- (vii) the biology of toothfish and by-catch species in the exploratory fishery for *Dissostichus* spp. in Divisions 58.4.1 and 58.4.2 (WG-FSA-05/62);
- (viii) validation of ageing in *D. eleginoides* (WG-FSA-05/60, 05/61);
- (ix) development of a database of bones from Antarctic fish for identification of fish prey (WG-FSA-05/35).

Matters arising from biology and ecology papers

9.2 The Working Group welcomed the papers from Russia examining the influence of temperature and oceanography on the distribution of *C. gunnari* in Subarea 48.3 (WG-FSA-05/76 and 05/77). The papers indicated that during winter distribution is confined to water temperatures of 1.6–1.7°C, in water deeper than 250 m. During the summer the distribution expands to cover temperatures of 0–1.9°C, with feeding aggregations associated with frontal zones where food is concentrated. Temperatures in excess of 2°C are avoided as they cause physiological processes to slow.

9.3 WG-FSA-05/52 highlighted differences between the size distribution, sex ratio and reproductive condition of *D. mawsoni* in the north and south of Subarea 88.1 with larger fish, a higher proportion of females and higher GSI values in fish in the northern area. The data suggest a possible spawning movement from the southern area to the north.

Species profiles

9.4 The Working Group noted that the icefish species profiles have not been updated since 2003 and that updating the profiles is a major task. The Working Group considered that the species profiles be maintained for *C. gunnari*, *D. eleginoides* and *D. mawsoni*, concentrating on biology and ecology. The species profiles will be coordinated by Dr Hanchet (*D. mawsoni*), Dr M. Collins (UK) (*D. eleginoides*) and Drs K.-H. Kock (Germany) and M. Belchier (UK) (*C. gunnari*). The Working Group noted that it would also be useful to develop profiles for key by-catch species such as skates and macrourids.

CCAMLR Otolith Network (CON)

9.5 In 2004, WG-FSA requested that members of CON provide all age–length data to the Secretariat to assist with the development of a central CCAMLR age-reading database (SC-CAMLR-XXIII, Annex 5, paragraphs 3.59 and 3.60).

9.6 All CON facilities currently involved in toothfish ageing have indicated a willingness to submit their data to such a database. It was agreed that the development of a new age-reading database linked to the existing CCAMLR observer and research survey databases would be the best way to proceed. The vast majority of fish aged to date appear on these databases. However, it was noted that there are age-reading data available for specimens (usually juveniles) that have been obtained from surveys and shore-based sampling programs for which associated biological and related information is not currently available on the CCAMLR databases.

9.7 The Working Group and the Secretariat discussed possible structures for the new database. It was agreed that, in addition to the biological and capture information held for each fish on the current CCAMLR databases, several new fields would be required. These include fields to identify individual laboratories, readers, ring count number, birth date used, quality or readability of otolith preparation and assigned age. The database should also be able to accept multiple readings for individual otoliths thus enabling readings from reference

otolith sets to be submitted. It was also recognised that the sampling strategy used to select individuals for ageing needs to be clearly identified in the database and linked, where possible to the relevant sampling documentation.

9.8 The Secretariat produced an outline of the new database structure (Table Q1 and Figure Q1) to be assessed by CON ageing facilities and encouraged CON members to submit their age data to the Secretariat as soon as possible.

9.9 Data access and ownership issues were discussed and the Working Group noted that data ownership resides with Members rather than with the ageing facilities. The Working Group recalled a discussion at WG-EMM about rules for data access (SC-CAMLR-XXI, Annex 4, paragraphs 6.44 and 6.45) and considered that the Rules for Use and Access of CCAMLR Data should provide a framework for access and use of data held in the otolith database.

Ageing workshop of mackerel icefish in 2006

9.10 Age estimates of mackerel icefish differ considerably between laboratories involved in ageing Antarctic fish. These differences could not be reconciled even after an 'Age Determination Workshop' was held in Moscow, Russia, in 1986 and subsequently an exchange of otoliths between laboratories was established (Kock, 1989). The 'Workshop on Approaches to the Management of Icefish' held in Hobart, Australia, in October 2001 recommended further growth studies of this species at South Georgia and Shag Rocks (SC-CAMLR-XX, Annex 5, Appendix D). Following the 'Age Determination Workshop on *Dissostichus eleginoides*' in 2001 (SC-CAMLR-XXI, Annex 5, Appendix H) and considering new ageing techniques which have been developed since the CCAMLR workshop was held in 1986 (Campaña, 2001) and which might be applied to *C. gunnari*, WG-FSA recommended that a second workshop on the ageing of *C. gunnari* be held in the first half of 2006.

9.11 In preparation for the workshop, a paper has been compiled summarising existing knowledge on the ageing of the species (WG-FSA-05/23). Following the meeting of WG-FSA, and after further discussion with the Vice-Director of AtlantNIRO (V. Sushin) on the organisation of the workshop, the Convener will write a letter to the Russian Fisheries Agency in order to seek permission to hold such a workshop in AtlantNIRO in Kaliningrad (Russia) between early April and the end of June 2006.

CONSIDERATIONS OF ECOSYSTEM MANAGEMENT

(see also Appendix R)

Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM)

10.1 In 2004, the Working Group supported the proposal by WG-EMM to establish a standing Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM) to advise the Scientific Committee on protocols to be used in acoustic surveys and analyses (SC-CAMLR-XXIII, Annex 5, paragraph 10.8). The Working Group also proposed to extend the terms of reference for SG-ASAM (SC-CAMLR-XXIII, Annex 5, paragraph 13.7).

10.2 Although both WG-EMM and WG-FSA recognised that the acoustic protocol for assessing *C. gunnari* in Subarea 48.3 is an immediate issue to be addressed by SG-ASAM (SC-CAMLR-XXIII, Annex 4, paragraph 4.94; Annex 5, paragraph 13.8), the Scientific Committee agreed that the terms of reference for the first meeting of SG-ASAM would be restricted to issues with respect to krill surveys, namely: (i) alternative models of krill target strength, and (ii) delineation of volume backscattering attributed to krill versus other taxa (SC-CAMLR-XXIII, paragraph 13.5).

10.3 SG-ASAM met in La Jolla, USA, from 31 May to 2 June 2005 (SC-CAMLR-XXIV/BG/3).

10.4 The issue of delineation of volume backscattering strength from krill and other taxa has wider implications for WG-FSA. For example, an acoustic survey for *C. gunnari* needs to discriminate this species from other acoustic scatterers, including krill. The Working Group noted with interest that the conclusion of SG-ASAM was that the ‘dB difference’ (ΔS_v) technique continues to represent the most objective and pragmatic technique for classifying volume backscattering by taxon (SC-CAMLR-XXIV/BG/3).

10.5 The Working Group recalled the tasks identified for SG-ASAM in its report of last year (SC-CAMLR-XXIII, Annex 4, paragraph 4.94; Annex 5, paragraph 13.8) and that these remained a high priority for the Working Group.

Ecological interactions

10.6 The Working Group considered the ecological interactions arising with respect to fisheries and considered papers that addressed fish by-catch in the krill fishery (WG-EMM-05/19), the fish diet of Antarctic shags (Casaux and Barrera-Oro, 2005), benthos by-catch from the trawl survey (WG-FSA-05/79), and cetacean–fisheries interactions (Kock et al., 2005) (Appendix R).

10.7 The Working Group suggested that a system to quantify the interactions between marine mammals and the longline fishery in a systematic fashion be developed in the intersessional period. This should include direct observations of fish being removed from the line and indirect observations of depredated fish, lost hooks and broken gear, as well as systematic reporting of the presence of killer whales and sperm whales.

Dependent species and ecosystem considerations

10.8 The Working Group considered the broader ecosystem approach to fisheries and in particular consideration of the effects of fisheries on non-target species, through both direct effects, such as incidental mortality, and through trophodynamic changes brought about by fishing. With respect to the ecosystem approach, the Working Group considered that the management of fisheries as two complementary components would be useful:

- firstly, the setting of catch limits for the target species in a fishery
- secondly, the implementation and conduct of that fishery.

10.9 The Working Group agreed that CCAMLR had made progress on both of these components, including implementing the precautionary approach for assessing catch limits. However, beyond adopting escapement levels that endeavour to take account of dependent species, there are currently no adopted tools or assessment procedures used by the Scientific Committee to advise on catch limits according to the requirements of predators on small or large scales. Nor are there adopted tools and assessment procedures for assessing the impacts of existing harvest strategies on dependent species.

10.10 The Working Group highlighted the need to use field observations in an adaptive feedback management procedure in order to proactively monitor the consequences of different management advice and change management strategies before problems arise. This is compared to reactive management, where management measures are implemented in response to unwanted impacts of the fishery.

10.11 In order to help develop such adaptive feedback management procedures, simulation models that characterise important properties of the food webs and ecosystem can be used to help evaluate the robustness of the management strategy to uncertainties arising from natural variability, model structure, the data acquisition program, the assessment methods and the implementation of management measures. In order to provide the data required to develop a simulation environment within which management procedures can be evaluated, the Working Group encouraged the broader consideration of the biology of the exploited species as well as key dependent and related species. Such considerations should include key trophodynamic interactions and life-history parameters in order to aid the development of appropriate ecosystem models.

10.12 In recognising the importance of this work to the development of the ecosystem approach, the Working Group noted that the Steering Committee on Antarctic Plausible Ecosystem Modelling Efforts (APEME) (SC-CAMLR-XXIII, Annex 4, paragraph 5.62) was established by the Scientific Committee to assist with this work. WG-EMM reviewed the nature of this group at its 2005 meeting and has suggested to the Scientific Committee a revised name, Subgroup on Development of Operating Models, along with a revision to the terms of reference for the group (Annex 4, paragraphs 6.30 to 6.32, 6.53 and 6.54). These changes are suggested to better capture the intended function of the group. The Working Group also noted the proposal from WG-EMM to have a workshop coordinated by the Scientific Committee on parameters for use in large-scale models of Antarctic food webs. A proposal for such a workshop, that is intended to benefit the work of both WG-EMM and WG-FSA, will be considered by the Scientific Committee this year (Annex 4, paragraphs 6.33 to 6.47 and 6.55). The Working Group encouraged Members to participate in the work of the subgroup and this workshop and for the Conveners of WG-EMM and WG-FSA to work with the subgroup to provide opportunities for the development of models for use by both working groups.

SCHEME OF INTERNATIONAL SCIENTIFIC OBSERVATION

(see also Appendix S)

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 in 2004/05. A total of 47 observation cruises was undertaken (31 trips on longliners, 14 trips on trawlers and 2 trips on vessels fishing with pots). In addition, six observation cruises were carried out on board krill fishing vessels in accordance with the scheme.

11.2 Details of the Working Group discussions on issues related to the Scheme of International Scientific Observation are contained in Appendix S. Specific areas and relevant paragraphs were as follows:

- (i) general matters (paragraphs S1 to S9);
- (ii) observer conference (paragraphs S10 to S14);
- (iii) data collected during the 2004/05 season (paragraph S15);
- (iv) conversion factors (paragraphs S16 to S19);
- (v) by-catch (paragraph S21);
- (vi) tagging programs (paragraph S22);
- (vii) *Shinsei Maru* bottom-line system (paragraph S23);
- (viii) incidental mortality in fisheries – current and additional requirements (paragraphs S24 to S29);
- (ix) scientific observation on krill vessels (paragraphs S30 and S31);
- (x) electronic monitoring (paragraphs S32 to S34);
- (xi) review of the *Scientific Observers Manual* (paragraphs S35 to S42).

Advice to the Scientific Committee

11.3 Advice provided to the Scientific Committee by the Working Group on the areas outlined above was as follows:

- (i) Additional operational requirements of the scheme including, in particular, additions and modifications to the *Scientific Observers Manual* logbook data recording and reporting sheets, and instructions to scientific observers and technical coordinators, should be made in respect of:
 - (a) only current versions of the cruise reports and logbook forms be used for reporting to CCAMLR, and electronically wherever possible (paragraph S3);
 - (b) collection of observer data in such a way as to distinguish between haul and set captures (paragraph O10);

- (c) the collection of data by observers on longline vessels of vessel setting speed, longline sink rate and streamer line aerial extent remain priority tasks for observers (paragraph O76);
- (d) where sink rate data collection is required according to Conservation Measure 24-02, the streamer line data should be collected at the same time as sink rate data where possible (paragraph O79);
- (e) improvement in the recording of net cleaning procedures in trawl fisheries (paragraph O205);
- (f) accurate reporting of trawl fishery operations including number of tows in voyage, number of tows observed, number of incidental mortalities observed by species per tow and number of incidental mortalities reported from non-observed tows (paragraph S28);
- (g) the continued use of the definition of the status of birds ‘caught’ (SC-CAMLR-XXII, Annex 5, paragraphs 6.214 to 6.217);
- (h) an amendment to the krill logbook questionnaire to include a number of additional questions with diagrams of the vessel track and position of krill aggregations (paragraph S34; Annex 4, paragraph 3.36);
- (i) accurate reporting of fish by-catch in all data formats (paragraph N36);
- (j) modification of the L5 catch composition form for observers to include ‘number of hooks observed for fish by-catch’ and the total estimated number and weight of each species retained and discarded for a set (paragraph 6.10);
- (k) correct completion of L11 forms including information on rajid cut-offs. The minimum requirement would be the completion of this form for at least one observation period every 48 hours (paragraph 6.15);
- (l) providing a report to the Secretariat on methods or strategies of fishing that minimise non-target fish by-catch (paragraph 6.23);
- (m) advising vessels that all rajids should be cut from the lines whilst still in the water, except on the request of the observer during the observer’s biological sampling period (paragraph 6.25);
- (n) adoption of a new 4-category scale for assessing rajid release condition by observers. These data should be accurately recorded for at least one observation period every 48 hours (paragraph 6.29);
- (o) measurements of fish that are to be tagged and released should not be considered to be part of the observer’s random length-frequency sample (i.e. if a fish is to be released as a tagged fish, then this fish should be excluded from the random sample of the catch taken by the observer) (paragraph T12);

- (p) measurements of tagged fish that are recaptured should be added to the commercial catch length frequency (where they would normally be a part of the random selection of the observed catch) and landed catch weights (paragraph T12).
- (ii) Funding for the participation of CCAMLR observers at the next International Fisheries Observer Conference should be considered (paragraph S13).
- (iii) Observer coverage should be required on all vessels participating in Convention Area krill fisheries (paragraph S31).
- (iv) Instructions and logbooks from the *Scientific Observers Manual* should be compiled as separate electronic documents. The manual itself would then consist of a comprehensive range of observation guidelines and reference materials which would not necessarily require annual updates (paragraph S42). Furthermore, logbooks should be recorded and submitted in electronic format and the manual should be distributed electronically.

FUTURE ASSESSMENTS

12.1 The Working Group considered future assessment work in light of the discussion and outcomes of this year's meeting. It was agreed that there is a need to continue the development of integrated assessment approaches for toothfish fisheries in the Convention Area.

12.2 In order to improve the efficiency of the work of WG-FSA, the Working Group considered matters of importance to progress the assessment process, data requirements, inputs to these and for each assessed fishery, 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.

Subarea 48.3 – toothfish

12.3 The Working Group noted a number of other issues that require further examination, including:

- (i) Continue development of an integrated assessment for toothfish, including:
 - (a) different sexes
 - (b) fleet structure
 - (c) age–length key
 - (d) evaluation of recruitment functions, e.g. stock-recruitment relationship, recruitment variability σ_R .
- (ii) ASPM
 - (a) methods for including tagging data in ASPM.

- (iii) Assessment inputs
 - (a) review of biological parameters
 - (b) movement.
- (iv) Standardisation of CPUE.

Division 58.5.1 – toothfish

12.4 The Working Group encouraged the estimation of biological parameters for toothfish at 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.

12.5 As for other toothfish fisheries in the Convention Area, the Working Group recommended that tag–recapture experiments be conducted. It also noted that the carrying out of a recruitment survey in the Kerguelen area would be planned for 2006 and would be very beneficial for a fuller assessment of toothfish stocks on the Kerguelen Plateau.

12.6 The Working Group noted a number of other issues that require further examination, including:

- (i) standardisation of CPUE
- (ii) estimating biological parameters.

Division 58.5.2 – toothfish

12.7 The Working Group noted the progress in developing an integrated assessment of *D. eleginoides* in CASAL and in evaluating the assessment methods and overall management strategy for this division (WG-FSA-05/69). It agreed that this work should be regarded as a high priority because:

- (i) it will enable separating longline fishing from trawl fishing in the historical series as well as using other data such as length composition of catches and the mark–recapture data;
- (ii) both short-term and long-term assessments, such as CASAL and GYM, should be evaluated.

12.8 The Working Group also recommended that:

- (i) the means by which recruitment cohort strength is estimated from toothfish survey data should be reviewed in the intersessional period, including investigating the possible effects of using the new two-segment growth model;
- (ii) 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;

- (iii) studies on optimal sampling schemes for establishing age–length keys should be encouraged.

12.9 The Working Group further noted a number of other issues that require further examination, including:

- (i) Complete development of an integrated assessment for toothfish
 - (a) incorporation of survey data, mark–recapture data, catch data
 - (b) evaluation of recruitment functions, e.g. stock-recruitment relationship, recruitment variability σ_R .
- (ii) Assessment inputs
 - (a) review of recruitment series
 - (b) development of the use of age–length keys if possible
 - (c) methods for combining selectivities of different gear types
 - (d) reviewing biological parameters
 - (e) movement.
- (iii) Standardisation of CPUE.

Subarea 58.6 (Crozet) – toothfish

12.10 The Working Group encouraged the estimation of biological parameters for toothfish at Crozet. 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.

12.11 As for other toothfish fisheries in the Convention Area, the Working Group recommended that tag–recapture experiments be conducted.

12.12 The Working Group noted a number of other issues that require further examination, including:

- (i) assessment inputs, including estimating biological parameters
- (ii) standardisation of CPUE.

Subarea 58.7 (Prince Edward and Marion Islands) – toothfish

12.13 While making some suggestions for further investigations related to the assessment, the Working Group noted that the limited (and conflicting) data available for such analyses meant that considerable uncertainty would remain associated with the results for some time. For this reason, the Working Group encouraged further development of the feedback control management procedure approach of which an initial account is given in WG-FSA-SAM-05/15, particularly as this might also prove informative for other toothfish fisheries.

12.14 The Working Group encouraged South Africa to consider:

- (i) requesting the scientific observers on board its vessels to report on the extent of cetacean activity and to collect data on toothfish remains on longline hooks evidencing cetacean predation;
- (ii) in the absence of research surveys to consider a ‘commercial survey’ conducted as a component of commercial operations whereby certain locations are fished in a systematic manner each year to provide an index that is comparable over time.

12.15 The Working Group noted a number of other issues that require further examination, including:

- (i) ASPM model advancement;
- (ii) evaluation of recruitment functions, e.g. stock-recruitment relationship, recruitment variability σ_R ;
- (iii) assessment inputs;
- (iv) estimating biological parameters;
- (v) methods for combining selectivities of different gear types;
- (vi) standardisation of CPUE.

Subareas 88.1 and 88.2 – toothfish

12.16 The Working Group welcomed the development of stock models in the Ross Sea and SSRU 882E, and thanked New Zealand for the work that had gone into the development of the integrated modelling approach for the assessment of toothfish in Subareas 88.1 and 88.2.

12.17 The Working Group recommended that future work include investigation and inclusion of the tag and recapture data from all nations operating in Subareas 88.1 and 88.2. The Working Group further recommended that future research consider the movement and stock structure of toothfish, and perhaps investigate such issues using simulation and/or multiple area models.

12.18 The Working Group noted a number of other issues that require further examination:

- (i) Continued development of integrated assessments for toothfish, including:
 - (a) evaluation of recruitment functions, e.g. stock-recruitment relationship, recruitment variability σ_R .
- (ii) Assessment inputs
 - (a) review of biological parameters.
- (iii) Standardisation of CPUE.
- (iv) Development of fisheries research data collection plan for assessments.

12.19 The Working Group also identified issues common to all CCAMLR fisheries, including research needs in the following areas:

- (i) By-catch:
 - tagging of skates
 - survivorship of rajids released from longlines
 - age estimation for rajids
 - standing stock estimates for rajids and *Macrourus* spp.
 - risk assessments
 - improved by-catch reporting (cut-offs of rajids).
- (ii) Tagging:
 - Continued evaluation of bias, parameter inputs such as growth challenged, initial mortality, tag loss, tag detection etc.
- (iii) Reporting:
 - Trawl survey report pro forma.

General research toward advancing assessments

12.20 The Working Group agreed that evaluation of management strategies, alternative decision rules and assessment methods for toothfish should be addressed.

12.21 Other topics which the Working Group agreed on include:

- (i) the use of alternative approaches to undertake assessments of yield using the outputs of an integrated assessment, e.g. alternative approaches of using MPD combined with multivariate normal approximations of uncertainty compared with using MCMC outputs for toothfish;
- (ii) the necessity to have the most up-to-date fisheries data for assessments in the year of assessment;
- (iii) determining whether advice could be given on catch limits with data only being complete up to the previous year;
- (iv) evaluation of management strategies, alternative decision rules, assessment methods for icefish;
- (v) design of age-length key sampling program for toothfish;
- (vi) evaluation of the *Scientific Observers Manual* and role of observers from the perspective of data requirements for assessments;
- (vii) documenting inputs for assessments, including a review of the essential content of Fishery Reports;

(viii) timetable of assessments:

- (a) the timing of agreement on parameter inputs and methodologies for providing advice;
- (b) agreement on method at WG-FSA-SAM but incorporate latest available data at WG-FSA;
- (c) role of the Secretariat in preparing for assessments, 'newsgroup' for preparing for assessments between WG-FSA-SAM and WG-FSA, secure web location for depositing initial input files for review.

12.22 The Working Group also recommended the following future work:

- (i) further development of an integrated assessment of *D. eleginoides* in CASAL, including an evaluation of the assessment methods and overall management strategy for this division (paragraph I41);
- (ii) the means by which recruitment cohort strength is estimated from toothfish survey data should be reviewed in the intersessional period, including investigating the possible effects of using the new two-segment growth model (paragraph I42);
- (iii) 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 (paragraph I42);
- (iv) studies on optimal sampling schemes for establishing age-length keys should be encouraged (paragraph I42).

Intersessional work for 2006

12.23 The Working Group agreed on the need for WG-FSA-SAM to meet in July 2006. The Working Group agreed that there is a sufficient amount of work to occupy more than one week.

12.24 Three main areas of work needed (agenda will depend on the time available):

- (i) review stock assessment methods for the 2006 WG-FSA meeting (~3 days) – (as in WG-FSA-05 pre-meeting);
 - (a) review data inputs
 - (b) determine an agreed methodology/structure
 - (c) initial MPD trials to review sensitivities etc. in order to determine work plan for preparing for WG-FSA meeting;
- (ii) continue development and evaluation work (~3 days);
- (iii) estimation of parameters (~2 days).

12.25 The Working Group agreed that the invited expert who participated in the 2005 WG-FSA-SAM meeting was very valuable to the work of the group, and requested that an external expert be invited to the 2006 WG-FSA-SAM meeting.

12.26 The Working Group developed terms of reference for the participation of the invited expert during the 2006 WG-FSA-SAM meeting. They are 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.

12.27 The Working Group noted that the Scientific Committee will need to consider a budget for the invited expert.

FUTURE WORK

Intersessional Work

13.1 Future work identified by the Working Group is summarised in Table 13.1 and SC-CAMLR-XXIV/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 that had worked during 2004/05. These subgroups, with the support of the Secretariat, had produced valuable work and information that had contributed to the assessments and review of information available at the meeting. WG-FSA agreed that these groups should continue their work during the forthcoming intersessional period. Where possible, each subgroup would focus on a small number of key issues. The subgroups would also provide a conduit for information on a wide range of related research. In addition, other tasks were specifically assigned to the Secretariat and/or Members.

13.3 The Working Group reminded participants that membership to the subgroups was open.

13.4 The 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 Collins) 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 A. Dunn (New Zealand) and Dr Agnew) will review and further develop the treatment of tagging data, the structure of the tagging database and the tagging protocol.
- Subgroup on the Observer Program (Drs Balguerías and Belchier) 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 development of species profiles.
- Subgroup on Ecosystem Interactions (Drs Kock and K. Reid (UK)) will review the literature and develop a work plan for the subgroup.
- CCAMLR Otolith Network (Dr Belchier) will review and further develop ageing techniques and age estimation, the structure of the CCAMLR ageing database and the protocols for submitting data to CCAMLR, and coordinate the submission of data.
- Subgroup on IUU Fishing (Dr Agnew and 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.
- Subgroup on New and Exploratory Fisheries (Dr R. Holt (USA)) will further develop the methods used to monitoring and assessing new and exploratory fisheries and review the Research and Data Collection Plans.
- Subgroup on Fisheries Acoustics (Drs R. O’Driscoll (New Zealand) and S. Kasatkina (Russia)) will further develop the application of acoustic methods for estimating finfish biomass (see below, and paragraphs 10.21 and 10.22).

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 The responsibilities for coordinating the intersessional activities of ad hoc WG-IMAF are set out in SC-CAMLR-XXIV/BG/28.

Meeting of WG-FSA-SAM

13.7 The Working Group agreed to hold a meeting of WG-FSA-SAM in 2006, in association with the meeting of WG-EMM. The work plan for WG-FSA-SAM and the meeting arrangements are discussed in paragraphs 12.21 to 12.25.

Age Determination Workshop on *Champocephalus gunnari*

13.8 The Working Group agreed that an Age Determination Workshop on *C. gunnari* will be held in 2006 (see paragraphs 9.10 and 9.11).

Meeting of SG-ASAM

13.9 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 2004 (SC-CAMLR-XXIII, Annex 5, paragraph 13.7):

- (i) to develop, review and update as necessary, protocols on:
 - (a) the design of acoustic surveys to estimate biomass of nominated species;
 - (b) the analysis of acoustic survey data to estimate the biomass of nominated species, including estimation of uncertainty (bias and variance) in those estimates;
 - (c) the archiving of acoustic data, including data collected during acoustic surveys, acoustic observations during trawl surveys, and *in situ* target strength measurements;
- (ii) to evaluate results of acoustic surveys carried out in the CCAMLR Convention Area during the previous year;
- (iii) to estimate target strength and its statistical characteristics for key species in the CCAMLR Convention Area;
- (iv) to use data from acoustic surveys to investigate ecological interactions and produce information for ecosystem monitoring and management.

13.10 The Working Group noted that the ICES Working Group on Fisheries Acoustic Science and Technology (ICES-FAST) is meeting in Hobart, Australia, from 27 to 30 March 2006 (with associated subgroups meeting on 25 and 26 March and 31 March to 2 April 2006). The Working Group recommended that the Scientific Committee investigate the possibility of holding the second meeting of SG-ASAM in conjunction with the ICES-FAST meeting. Representatives of several Members will already be attending ICES-FAST.

13.11 The Working Group reiterated that an immediate issue for WG-FSA to be addressed by SG-ASAM is the acoustic protocol for assessing *C. gunnari* in Subarea 48.3, including:

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

Fishery Reports

13.12 The Working Group agreed that the newly established Fishery Reports provide concise reference documents for use by participants as well as other readers of the report of WG-FSA. For completeness, the Working Group agreed that the management advice developed during plenary discussion should be reported in the main section of the report of WG-FSA as well as in the relevant Fishery Reports. This has resulted in some duplication of text.

13.13 For other parts of the report, the Working Group strived to avoid duplication. As a result, the management advice developed by subgroups, and later agreed in plenary discussions, is reported only in the main section of the report of WG-FSA.

13.14 The Working Group sought feedback and advice from the Scientific Committee and Commission on the approach adopted in 2005, and on ways to further improve its reports.

OTHER BUSINESS

Matters of importance to WG-FSA and ad hoc WG-IMAF regarding by-catch

14.1 As agreed last year (SC-CAMLR-XXIII, Annex 5, paragraph 6.38), WG-FSA and ad hoc WG-IMAF came together to discuss the development of risk assessments for fish by-catch, based on the model developed by WG-IMAF for seabirds.

14.2 The Working Group recalled the progress achieved last year when an example of risk categorisation for sleeper sharks (*Somniosus* spp.) in Division 58.5.2 was developed based on information presented in WG-FSA-03/69 (SC-CAMLR-XXIII, Annex 5, paragraphs 6.53 to 6.58 and Table 6.5).

14.3 WG-FSA-05/21 presented new summaries for *M. whitsoni* and *A. georgiana* in the Ross Sea based on published and unpublished literature and data from the exploratory fishery up to and including 2004/05. *Amblyraja georgiana* was placed in risk category 3. The risk to *A. georgiana* was considered to be mitigated by CCAMLR's recommendation to cut and release all skates from longlines whilst still in the water. *Macrourus whitsoni* was placed in risk category 2–3. These categories are described in paragraph N55.

14.4 WG-FSA and WG-IMAF considered ways to develop such risk assessments and how these assessments may be used in the future. It was recognised that at present the risk assessments undertaken by the WG-FSA subgroup and by WG-IMAF are rather different in terms of criteria and scope. Thus WG-FSA criteria related mainly to life-history characteristics (especially demography) and to distribution (especially in terms of overlap with existing fisheries and with exploited target species) whereas WG-IMAF criteria principally related to overlap with fisheries and to global conservation status (incorporating demography and population trends) as defined by IUCN criteria. It was agreed that, as feasible, harmonisation of risk assessment principles and procedures would be desirable. In addition, risk categories should be linked to assessment and management considerations. For example, a by-catch species in risk category 3 may require the development of a long-term assessment of its biomass and vulnerability to fishing.

14.5 WG-FSA and WG-IMAF agreed that this concept should be further explored and then applied, initially, to major by-catch groups.

CCAMLR Statistical Bulletin

14.6 The Working Group considered the eSB which the Secretariat had developed at the request of WG-FSA (SC-CAMLR-XXI, Annex 5, paragraph 13.8). This development was reported in SC-CAMLR-XXIV/5 (see also paragraph 3.2).

14.7 The eSB, which supports all four official languages, allows users to replicate the six sections which are published in the hardcopy of the bulletin, namely:

Section A Maps and standard abbreviations.

Section B Catch and effort data based on STATLANT data which are reported by Members. Catch statistics are presented for all taxa of fish and invertebrates reported in the STATLANT data.

Section C Catch histories for species which have a total reported catch in any one season of more than 2 000 tonnes. Catches are taken from the STATLANT data.

Section D Fine-scale catches of target species, plotted by fine-scale rectangle (0.5° latitude by 1° longitude) and three-month period (quarter), in Area 48 based on aggregated fine-scale data.

Section E Landing and trade data reported under the CDS for *Dissostichus* spp.

Section F Seabed areas used in fishery assessments conducted by WG-FSA. These areas are mostly derived from the global and seafloor topography dataset of Sandwell and Smith.

14.8 In addition, the eSB allows users to access the complete dataset of statistics underlying Sections B to E and to develop user-defined queries to summarise these data, generate tables and graphics, and extract selected data (as requested by WG-FSA).

14.9 Users of the eSB may access and extract the following datasets:

(i) STATLANT data, as submitted by Members.

(ii) Aggregated fine-scale data. These data are highly aggregated and do not allow users to obtain vessel-specific, location-specific or country-specific information. The aggregated fine-scale data available in the eSB are limited to the following fields:

- species (code, name)
- area (subarea, division)
- coordinates of the fine-scale rectangle
- season
- month
- quarter
- catch (tonne).

(iii) Aggregated CDS data, as presented in tables in Section E of the hardcopy.

(iv) Seabed areas, as presented in Section F of the hardcopy.

14.10 The Working Group noted that aggregated fine-scale data for target species in Area 48 have been published in the bulletin in graphic form since 1990, and in digital format since 2002 (in the Excel version of the electronic volume). These data did not contain any effort information and could not be used to calculate catch rates.

14.11 Some participants expressed concern that the aggregated fine-scale data available in the eSB, although aggregated, may provide information which may be used by IUU fishing vessels. Some participants were concerned that the aggregated fine-scale data may divulge proprietary information.

14.12 The Working Group considered three options for addressing these concerns:

- (i) accept that the aggregated fine-scale data were sufficiently aggregated to protect the interests of Members;
- (ii) categorise the catch reported in the aggregated fine-scale data using a scale similar to that used in the plots in the hardcopy (e.g. 0–5, 5–25, 25–125, 125–625, 625–3 000 and >3 000 tonnes); or
- (iii) make the eSB available to Members only.

14.13 The Working Group agreed that choosing one of these options would involve a trade-off between protecting confidential information and providing detailed information to users. The Working Group requested the Scientific Committee and Commission address this issue and decide on an appropriate approach concerning fine-scale data.

14.14 The Working Group thanked the Secretariat for developing the eSB and providing an advanced version of the database for evaluation.

Proposal to reorganise the work of the Scientific Committee

14.15 Dr Constable presented a proposal to reorganise the work of the Scientific Committee and its working groups. This proposal was initially presented to WG-EMM (WG-EMM-05/35; Annex 4, paragraphs 7.21 to 7.28) and a revised version would be presented to SC-CAMLR-XXIV.

14.16 The proposal is to rearrange the intersessional timetable of the Scientific Committee and its working groups to better accommodate the generic structure of the work of the Scientific Committee and to remove unnecessary overlap currently existing across the two working groups – WG-FSA and WG-EMM. The generic structure contains elements of:

- biology and ecology
- fisheries information
- quantitative modelling and assessment methods
- assessment of harvest controls
- implementation of the precautionary approach
- conservation requirements
- scientific observer program
- advice to the Commission.

14.17 This new structure would be designed to provide a greater focus to specific intersessional meetings that deal with general issues in a single forum rather than having to be discussed across many meetings that are currently designed around specific species, thereby allowing participants to focus their work and participation in areas of need, expertise and interest. Improved focus would also allow conveners and meeting organisers to draw more readily on experts to contribute in key areas of CCAMLR's work.

14.18 The Working Group noted that the present workload during its meetings and during the intersessional periods was very high. This was because all aspects of the work of the Scientific Committee were endeavoured to be covered every year. As a result, work was progressing in areas of immediate need (e.g. WG-FSA-SAM) at the expense of having greater longer-term strategic activity. Increasing the workload of participants was not considered feasible. Yet, it has become clear that biology and ecology is not given much attention at meetings. Similarly, there is an increasing need to consider conservation issues with no time available to do so without extra meetings in the existing calendar.

14.19 Dr Constable proposed that the focus of the Scientific Committee's work could be improved by rearranging the manner in which the Committee manages the current five weeks of intersessional work (currently – 2 weeks of WG-EMM, 1 week of WG-FSA-SAM and 2 weeks of WG-FSA including ad hoc WG-IMAF). It is proposed that a three-week meeting block be held in the middle of the intersessional period comprising:

- a meeting on biology, ecology and conservation (including protected areas) in week 1;
- a workshop on management procedures allowing interaction between biologists, statisticians and modellers in week 2;
- a meeting on assessment, analytical and modelling methods in week 3.

14.20 Meeting participants could then choose whether to attend for 1, 2 or 3 weeks according to their expertise and interests. This arrangement would not preclude participants in the meeting in the first week from continuing deliberations into the second week. Similarly, the meeting on methods in the third week could begin earlier if need be to facilitate satisfactory conclusions in the main meeting.

14.21 In addition, it may be possible to reduce some of the current workload on providing advice to the Scientific Committee by reducing the frequency of revisions and updates of information and assessments. For example, assessment and management advice may be provided to the Scientific Committee:

- every two years for assessed toothfish fisheries
- every five years for krill fisheries
- on request for icefish fisheries (i.e. following a survey)
- every two years for by-catch species
- every five years for the ecosystem
- every year for an update on the conduct, status and future of CCAMLR fisheries, including new and exploratory fisheries.

As a result of altering the frequency of activities, the meeting of WG-FSA and WG-IMAF might be able to achieve satisfactory outcomes in one week rather than two, provided that adequate time was available by participants and the Secretariat for preparation of meeting reports. If special preparations are required, then a pre-meeting preparatory session could be arranged for appropriate experts.

14.22 Dr Constable also proposed that the Scientific Committee may wish to consider an enhanced role for the Secretariat in preparing preliminary assessments for the working groups.

14.23 These arrangements would leave one week on the intersessional calendar for the Scientific Committee to have a workshop on strategic issues as needed.

14.24 In terms of structure, Dr Constable proposed that three working groups could be designed to accommodate the intersessional activities:

- Working Group on Biology, Ecology and Conservation
- Working Group on Statistical, Assessment and Modelling Methods
- Working Group on Assessments.

The Scientific Committee would be responsible for appointing conveners and coordinating the workshops.

14.25 The Working Group thanked Dr Constable for looking ahead and developing a proposal to improve the allocation of the Scientific Committee's and its participants' work and time commitments. However, it was difficult to see how such a re-focus may be achieved given the very high work load of WG-FSA.

14.26 The Working Group recommended that the Scientific Committee establish an ad hoc group during SC-CAMLR-XXIV to further consider Dr Constable's proposal and investigate the feasibility, acceptability and logistics of reorganising its work.

14.27 The Working Group agreed that the integrated toothfish assessments are in a state of development. These assessments will require annual review in the short term. Consequently, it will be several years before such assessments could be reviewed at less frequent intervals.

Submission of meeting documents

14.28 At the request of the Scientific Committee, the Secretariat prepared a single reference document which provides guidelines for the submission of meeting documents to the Scientific Committee, WG-EMM and WG-FSA (including ad hoc WG-IMAF).

14.29 In doing so, the Secretariat noted some working group-specific differences in relation to: submission deadline; exception to the deadline; and approach to accepting revised documents.

14.30 WG-EMM agreed that standardising the working groups' guidelines in relation to the submission of meeting documents would simplify and unite the guidelines which participants to both WG-EMM and WG-FSA are required to follow. Standardisation would also simplify the Secretariat's work in preparing information and documents for meetings. Consequently, WG-EMM agreed to a proposal to standardise the specific differences which relate to the submission of documents to its meetings (WG-EMM-05/10).

14.31 In revising its guidelines, WG-EMM also agreed to the following points (Annex 4, paragraphs 7.14 to 7.20):

- (i) papers would not be limited to 15 pages, but authors should note that long papers may not be given full attention if there is limited time;
- (ii) in relation to the submission of published papers to the meeting, WG-EMM agreed that authors should continue to provide an electronic version of the published paper. It was also agreed that the author of the published paper was responsible for any copyright issue arising from the submission to the meeting;
- (iii) papers that were 'in press' at the time of the meeting should be considered as published documents with respect to copyright;
- (iv) references to in-press and published papers should continue to be listed under 'Other Documents' in the 'List of Documents' which is appended to the report;
- (v) there is a need for easily identifying published papers for which the authors have requested consideration by the Working Group. The Secretariat was asked to consider a simple method for identifying such papers, for the purpose of the meeting;
- (vi) all meeting documents distributed by the Secretariat should be in locked pdf format to avoid any unauthorised use or incidental change to the text. However, in order to facilitate the work of the rapporteurs, it was agreed that the one-page synopses should be made available separately and in unlocked pdf during the meeting.

14.32 WG-FSA noted that the Secretariat had illustrated points (ii) to (v) by extending the document numbering system used at WG-FSA-05 to include a category for published papers (e.g. WG-FSA-05/P1). This category uses a modified one-page synopsis which provides details of the authors and summary findings as related to nominated agenda items; published papers submitted to the meetings are to be listed under 'Other Documents'.

14.33 The Working Group considered this matter and agreed to amend its submission guidelines to include points (i) to (vi) above.

Access to meeting documents

14.34 Dr Constable proposed that documents submitted at previous meetings be made available electronically in a reference library at future meetings of WG-FSA and, generally, CCAMLR working groups.

14.35 The Working Group recalled that, under the Rules for Access and Use of CCAMLR Data, meeting documents shall not be cited or used for purposes other than the work of the CCAMLR Commission, Scientific Committee or their subsidiary bodies without the written permission of the originators and/or owners of the data therein. These documents are presented for consideration by CCAMLR and may contain unpublished data, analyses and/or conclusions subject to change.

14.36 The Working Group noted that WG-FSA participants had access, through the Secretariat's library, to the bound hardcopy volumes of all meeting documents submitted to the Scientific Committee and its working groups.

14.37 The Working Group considered Dr Constable's proposal and agreed to refer this matter to the Scientific Committee. The Scientific Committee's advice was sought as to whether or not an electronic reference library of meeting documents could be made available generally to meeting participants under the Rules for Access and Use of CCAMLR Data.

Other

14.38 Dr Marschoff stated that, regarding incorrect references to the territorial status of the Malvinas Islands made in WG-FSA-05/56 (paragraphs O110 and O111), Argentina reserves its position as to its sovereignty rights on the Malvinas Islands and surrounding waters. The Malvinas Islands, South Georgia and the South Sandwich Islands and the surrounding waters are an integral part of the Argentine national territory.

ADOPTION OF THE REPORT

15.1 The report of the meeting and associated background documents SC-CAMLR-XXIV/BG/26, BG/27 and BG/28 were adopted.

CLOSE OF MEETING

15.2 In closing the meeting, the Convener thanked all participants, rapporteurs and subgroup coordinators for furthering the work of WG-FSA, and the Secretariat for their contribution and support. Substantial progress had been achieved during the meeting, including the first assessment of an exploratory fishery (toothfish in Subareas 88.1 and 88.2).

15.3 Drs Constable and Kirkwood, on behalf of WG-FSA, thanked Dr Hanchet for his work in the intersessional period and during the meeting; his convenership had ensured the success of the meeting.

15.4 The meeting was closed.

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Table 3.1: Total reported catches (tonnes) of target species in fisheries in the Convention Area in the 2004/05 season. Source: catch and effort reports submitted by 21 September 2005 unless otherwise indicated.

Target species	Region	Fishery	Fishing season		Conservation measure	Catch (tonnes) of target species		Reported catch (% limit)
			Start	End		Reported	Limit	
<i>Champocephalus gunnari</i>	48.3	Trawl	15-Nov-04	14-Nov-05	42-01 (2004)	200	3 574	6
	58.5.2	Trawl	01-Dec-04	30-Nov-05 ¹	42-02 (2004)	1 791	1 864	96
<i>Dissostichus eleginoides</i>	48.3	Longline and pot	01-May-05	29-Aug-05 ²	41-02 (2004)	3 018	3 034 ³	99
	48.4	Longline	01-May-05	1-Aug-05 ^b	41-03 (1999)	27	28	96
	58.5.1	Longline in French EEZ ⁴	ns	ns	ns	3 186	ns	-
	58.5.2	Longline and trawl	01-May-05	30-Nov-05 ¹	41-08 (2004)	2 783	2 787	100
	58.6	Longline in French EEZ ⁴	ns	ns	ns	385	ns	-
	58.6	Longline in South African EEZ	ns	ns	ns	31	ns	-
	58.7	Longline in South African EEZ	ns	ns	ns	92	ns	-
<i>Dissostichus</i> spp.	48.6	Exploratory longline	01-Dec-04	30-Nov-05	41-04 (2004)	49	910	5
	58.4.1	Exploratory longline	01-Dec-04	30-Nov-05	41-11 (2004)	480	600	80
	58.4.2	Exploratory longline	01-Dec-04	30-Nov-05	41-05 (2004)	127	780	16
	58.4.3a	Exploratory longline	01-May-05	31-Aug-05	41-06 (2004)	110	250	44
	58.4.3b	Exploratory longline	01-May-05	14-Feb-05 ^{2,5}	41-07 (2004)	295	300	98
	88.1	Exploratory longline	01-Dec-04	27-Mar-05 ²	41-09 (2004)	3 079	3 250	95
	88.2	Exploratory longline	01-Dec-04	5-Feb-05 ²	41-10 (2004)	412	375	110
<i>Euphausia superba</i>	48	Trawl	01-Dec-04	30-Nov-05	51-01 (2002)	124 535	4 000 000	3
	58.4.1	Trawl	01-Dec-04	30-Nov-05	51-02 (2002)	0	440 000	0
	58.4.2	Trawl	01-Dec-04	30-Nov-05	51-03 (2002)	0	450 000	0
Lithodidae	48.3	Pot	01-Dec-04	30-Nov-05	52-01 (2004)	0	1 600	0
<i>Martialia hyadesi</i>	48.3	Exploratory jig	01-Dec-04	30-Nov-05	61-01 (2004)	0	2 500	0

¹ Closure under review.

² Fishery closed on advice from the Secretariat.

³ Catch limit of 3 050 tonnes was reduced by 16 tonnes to take account of the IUU catch from the vessel *Elqui*.

⁴ Data reported by France for fishing to August 2005.

⁵ Fishing allowed under exemption to prescribed season.

ns Not specified by CCAMLR.

Table 3.2: Estimated effort, catch rates and total catches from IUU fishing for *Dissostichus* spp. in the Convention Area in the 2004/05 season. Detailed calculations are in SCIC-05/10 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 2005	Estimated no. of IUU fishing vessels	Estimated no. of days per fishing trip	No. trips per year	Estimated effort (days fished), no extrapolation	Estimated effort in days fishing 2005	Mean catch rate (tonnes/ day)	Estimated IUU catch to 30 Sep 2005, no extrapo- lation	Estimated IUU catch (9) x (10) extrapolated to 30 Nov 2005
(column)		1	2	3	4	5	6	7	8	9	10	11	12
48.3	1991	1		1	0.2	1.2	15	1.0	15	15	1.6	23	23
58.4.2	2002		2	2	0.4	2.4	41	1.5	123	148	0.7	86	103
58.4.3a	2003	2		2	0.4	2.4	41	1.5	123	148	0.8	98	118
58.4.3b	2003	6	4	10	2.0	12.0	41	1.5	615	738	1.5	923	1107
58.4.4a	1996	2		2	0.4	2.4	40	2.5	200	240	1.1	220	264
58.5.1	1996		1	1	0.2	1.2	30	1.9	57	68	4.7	268	321
58.5.2	1997		1	1	0.2	1.2	30	2.0	59	71	4.5	265	318
58.6	1996	1		1	0.2	1.2	40	1.0	40	48	0.3	12	14
58.7	1996	2		2	0.4	2.4	40	1.5	120	144	0.5	60	72
88.1	2002	1		1	0.2	1.2	40	1.0	40	48	3.6	144	173
Subtotal												2100	2515
Including undocumented landings of toothfish which cannot be attributed to a sighting or an area												508	508
Total												2608	3023

Notes on the columns

1. From reports of vessel sightings submitted by Members.
2. From information reported via other sightings, port inspections or fishing vessels/traders.
4. Calculated pro rata for 1 October to 30 November 2005.
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 taken from the five-day catch and effort database, where available. CDS data used otherwise.

Undocumented landings = 730 tonnes not included in total. Vessels were *Golden Sun*, *Lucky Star*, *Keta/Julius/Sherpa Uno*, *Lugalpesca/Hoking/Sargo* and *Ross*. *Sargo* and *Ross* were included in sightings which accounts for an estimated 222 tonnes (although *Ross* actually had 160 tonnes but may have accepted transhipped catch). Therefore, 508 tonnes were added to the overall total.

Details of sighted vessels

Column 1	48.3	<i>Elqui</i> (15/3/05)
Column 2	58.4.2	<i>Sargo</i> , <i>Keta</i> ?
Column 1	58.4.3a	<i>Hammer</i> (22/2/05 and 28/4/05)
Column 1	58.4.3b	<i>Condor</i> (25/2/05), <i>Koko</i> (22/4/05), <i>Jian Yuan</i> (26/2/05), <i>Kang Yuan</i> (24/1/05 and 24/2/05), <i>Ross</i> (23/2/05 and 17/3/05)
Column 2	58.4.3b	4 x unidentified (31/1/05, 9/1/05, 10/1/05, 9/3/05)
Column 1	58.4.4a	<i>Condor</i> (2/8/05), <i>Red Lion</i> (1/8/05 – sighted in Division 58.4.4b, but advised that it intended to fish in Division 58.4.4a)
Column 2	58.5.1	<i>Condor</i> (29/12/04)
Column 2	58.5.2	<i>Condor</i> (30/12/04)
Column 1	58.6	<i>Sea Storm</i> (29/7/05)
Column 1	58.7	<i>Aldabra</i> (10/8/05), 1 x unidentified (9/2/05 – gear and marker buoys found)
Column 1	88.1	<i>Taruman</i> (15/6/05 – 145 tonnes offloaded)

Table 3.3: Reported catch (tonnes) of *Dissostichus* spp. and estimated catch from IUU fishing in the Convention Area, and catch reported in the CDS in areas outside the Convention Area in the 2003/04 and 2004/05 seasons.

2003/04 season

Inside	Subarea/Division	Reported catch	IUU catch	Total CCAMLR	Catch limit
	48.3	4 497	0	4 497	4 420
	48.4	0		0	28
	48.6	7		7	910
	58.4.2	20	197	217	500
	58.4.3 (a and b)	7	246	253	550
	58.4.4	0	0	0	0*
	58.5.1	5 171	643	5 814	0*
	58.5.2	2 864	637	3 501	2 873
	58.6	607	456	1 063	0*
	58.7	133	58	191	0*
	88.1	2 197	240	2 437	3 250
	88.2	375	0	375	375
	Area unknown	0	145	145	-
	Total inside	15 877	2 622	18 500	
Outside	Area	CDS catch EEZ	CDS catch high seas	Total Outside CCAMLR	
	41	3 811	4 600	8 411	-
	47	0	798	798	-
	51	25	364	389	-
	57	0	18	18	-
	81	362	0	362	-
	87	5 565	263	5 828	-
	Total outside	9 763	6 043	15 806	-
Global Total				34 306	

2004/05 season (to October 2005)

Inside	Subarea/Division	Reported catch	IUU catch	Total CCAMLR	Catch limit
	48.3	3 018	23	3 041	3 050
	48.4	27		27	28
	48.6	49		49	910
	58.4.1	480		480	600
	58.4.2	127	103	230	780
	58.4.3 (a and b)	405	1 225	1 630	550
	58.4.4	0	264	264	0*
	58.5.1	3 186	321	3 507	0*
	58.5.2	2 783	318	3 101	2 787
	58.6	416	14	430	0*
	58.7	91	72	163	0*
	88.1	3 079	173	3 252	3 250
	88.2	412	0	412	375
	Area unknown	0	508	508	-
	Total inside	14 074	3 023	17 094	

(continued)

Table 3.3 (continued)

Outside	Area	CDS catch EEZ	CDS catch high seas	Total outside CCAMLR	
	41	2 741	1 724	4 465	-
	47	0	78	78	-
	51	8	33	41	-
	57	0	0	0	-
	81	54	0	54	-
	87	3 870	3	3 873	-
	Total outside	6 673	1 838	8 511	-
Global total				25 605	

* Outside EEZs

Reported catch: 2003/04 from STATLANT data

2004/05 catch and effort reports to 21 September 2005, except data for France reported to August 2005

IUU catch: From SCIC-05/10 Rev. 2

CDS estimate: Data submitted to the Catch Documentation Scheme by 4 October 2005. 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 5.1: Summary table for exploratory fisheries in 2004/05. Source: WG-FSA-05/6 Rev. 1.

Exploratory fisheries in Area 48 (Atlantic Ocean sector)				
Subarea/Division	Member	Number of vessels		Reported catch (tonnes) of <i>Dissostichus</i> spp.
		Notified	Fished	
48.6 north of 60°S	Japan	1	1	
	Republic of Korea	2	0	
	New Zealand*	4	0	
Total		7	1	47
48.6 south of 60°S	Republic of Korea	2	1	
	New Zealand*	4	0	
	Total	6	1	2
Exploratory fisheries in Area 58 (Indian Ocean sector)				
Subarea/Division	Member	Number of vessels		Reported catch (tonnes) of <i>Dissostichus</i> spp.
		Notified	Fished	
58.4.1	Chile ⁺	3	1	
	Republic of Korea	2	2	
	New Zealand	4	1	
	Spain	2	2	
	Ukraine*	1	0	
	Total		12	6
58.4.2	Chile ⁺	2	1	
	Republic of Korea	2	1	
	New Zealand	4	1	
	Spain	2	1	
	Ukraine*	1	0	
	Total		11	4
58.4.3a	Australia	1	1	
	Republic of Korea	2	1	
	Spain	2	2	
Total		5	4	110
58.4.3b	Australia	1	0	
	Chile ⁺	2	1	
	Japan*	1	0	
	Republic of Korea	2	1	
	Spain	2	2	
	Total		8	4

Exploratory fisheries in Area 88 (Southwest Pacific sector)

Subarea/Division	Member	Number of vessels		Reported catch (tonnes) of <i>Dissostichus</i> spp.
		Notified	Fished	
88.1	Argentina	2	1	
	Australia*	1	0	
	New Zealand	5	3	
	Norway	1	1	
	Russia	2	2	
	South Africa	2	0	
	Spain	2	0	
	Ukraine*	1	0	
	UK	1	1	
	Uruguay	4	2	
Total		21	10	3079
88.2	Argentina	2	0	
	New Zealand	5	1	
	Norway	1	1	
	Russia	2	2	
Total		10	4	412

* Withdrawn from fishery

+ Vessel withdrawn from fishery

Table 5.2: Number of vessels (a) notified by Members in exploratory longline fisheries for *Dissostichus* spp. in the 2005/06 season, and (b) corresponding number of vessels and catch limits agreed in conservation measures in force in the 2004/05 season. Source: SC-CAMLR-XXIV/BG/5.

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 <i>Dissostichus</i> spp. in the 2005/06 season							
Argentina						2	2
Australia		1	1	1	1		
Chile ¹		2	2	2	2		
Japan	1						
Republic of Korea		2	1	1	2	2	1
New Zealand	1	3	2			5	5
Norway						1	1
Russia						2	2
South Africa ²						1	
Spain		2	2	2	2	3	3
UK						2	2
Uruguay		1			1	3	1
Number of Members	2	6	5	4	5	9	8
Number of vessels	2	11	8	6	8	21	17
(b) Conservation measures in force in the 2004/05 season							
Number of Members	3	5	5	3	5	10	4
Number of vessels	3*	9	8	3*	5*	21	10
Target species catch limit (tonnes)	910	600	780	250	300	3250	375

¹ Notifications received 23 August 2005

² Notification received 4 August 2005

* Maximum number of vessels allowed to fish at any one time

Table 5.3: Unstandardised CPUE (kg/hook) of *Dissostichus* spp. in exploratory longline fisheries between the 1996/97 (1997) and 2004/05 (2005) fishing seasons. Source: fine-scale data from commercial and fishery-based research hauls.

Subarea/ Division	SSRU	Season								
		1997	1998	1999	2000	2001	2002	2003	2004	2005
48.6	486A								0.04	0.07
	486E									0.08
58.4.2	5842A									0.07
	5842C							0.10		0.07
	5842D							0.19	0.06	
	5842E							0.21	0.11	0.14
58.4.3a	5843A									0.05
58.4.3b	5843B								0.09	0.16
88.1	881A	0.01				0.02		0.15		
	881B	0.05	0.03			0.16	0.25	0.27	0.11	0.55
	881C					0.44	0.87	0.58	0.31	0.53
	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
	881H		0.17	0.26	0.38	0.41	0.72	0.45	0.21	0.73
	881I		0.37	0.23	0.28	0.28	0.43	0.20	0.16	0.44
	881J			0.09	0.18	0.04			0.04	0.22
	881K		0.32	0.15	0.39		0.45		0.01	0.32
	881L					0.12			0.10	0.13
88.2	882A						0.82		0.11	0.44
	882B								0.06	
	882E							0.35	0.42	0.70

Table 13.1: List of tasks identified by WG-FSA for the 2005/06 intersessional period. Tasks identified by ad hoc WG-IMAF are listed in SC-CAMLR-XXIV/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-06 in accordance with the guidelines.	14.33	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. Continue tagging rajids.	E	1	Members to implement	
4. Provide accurate and consistent data on by-catch.	E	1	Members to implement	Assist
5. Submit data in a timely manner and using current CCAMLR formats.	E	1	Members to implement	Assist
6. Process fishery, observer and survey data submitted to CCAMLR.	E	1		Implement
7. Further develop routine validation procedures for database extractions.	E	1		Implement
8. Update time series of data in the Fishery Reports.	E	1		Implement
9. 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
10. Update estimates of catches reported in CDS data by season and area outside the Convention Area.	E	1		Implement
11. Update information on scientific observations.	E	1		Implement
12. Update Fishery Plans.	E	1		Implement
13. Develop a manual on database extractions used by WG-FSA.	3.7	1		Implement
14. Notify research surveys.	E	1	Members to implement	
Assessments and management advice				
15. Review and provide additional information for Fishery Reports.	E	2	Members to implement	Update

Task	Ref.	Priority	Action required	
			Members/Subgroups	Secretariat
Fish and invertebrate by-catch				
16. Compare by-catch levels arising from different longline configurations.	6.22	2	Members to implement	Assist
17. Report to the Secretariat on methods or strategies of fishing that minimise by-catch catches.	6.23	1	Members to implement	Assist
18. Cut all rajids from fishing lines whilst still in the water, except on the request of the observer during biological sampling periods.	6.25, 6.28	1		
19. Undertake further experiments to estimate the survivorship of rajids cut from longlines.	6.27	1		
20. Develop a framework for risk assessments.	14.4–14.5	1	Members to develop	Assist
Evaluation of threats arising from IUU activities				
21. Further develop estimation methods.	8.4–8.9	1	SCIC to consider, Members to implement	Coordinate and implement
Biology, ecology and demography of target and by-catch species				
22. Update the species profile for <i>D. eleginoides</i> .	9.4	1		Assist
23. Update the species profile for <i>D. mawsoni</i> .	9.4	1		Assist
24. Update the species profile for <i>C. gunnari</i> .	9.4	1		Assist
25. Develop a central CCAMLR age-reading database.	9.5–9.9	1	CON to coordinate	Implement
26. Convene a workshop on the age determination of icefish.	9.10–9.11	1		Assist
Consideration of ecosystem management				
27. Progress the work program of the Steering Committee on Antarctic Plausible Ecosystem Modelling Efforts.	10.12	1	Members to implement	Assist

Task	Ref.	Priority	Action required	
			Members/Subgroups	Secretariat
New and Exploratory Fisheries				
28. Develop a more structured research plan for 2006/07.	5.19	1	Members to develop proposals	
29. Tag toothfish under the research plan and submit the data to the Secretariat.	5.33	1	Members to implement	Assist
30. Look out for tagged fish and submit data from recaptured fish.	5.34	1	Members to implement	Assist
31. Vessels to record a unique haul identifier on the C2 data form, observers to ensure that the identifier is recorded on their data form.	5.35	1	Members to implement	Assist
32. Ensure that the required number of research sets is completed and submitted to the Secretariat.	5.33	1	Members to implement	Assist
Scheme of International Scientific Observation				
33. Use only current versions of CCAMLR data forms.	11.3	1	Members to implement	Assist
34. Report experience with sub-sampling methods.	11.3	1	Members to implement	Assist
35. Collect data according to the revised procedure.	11.3	1	Members to implement	Assist
36. Update the <i>Scientific Observers Manual</i> and data forms.	11.3	1		Implement
37. Accurately report by-catch in all data forms.	11.3	1	Members to implement	Assist
38. Accurately report rajid cut-offs.		1	Members to implement	Assist
39. Update the <i>Scientific Observers Manual</i> to include a new 4-category scale for assessing the condition of rajids released from longlines.	11.3, 6.29	1		Implement
40. Implement a new 4-category scale for assessing the condition of rajids released from longlines.	11.3, 6.29	1	Members to implement	Assist
41. Compile observer instructions and logbooks as separate documents.	11.3	1		Implement

Task	Ref.	Priority	Action required	
			Members/Subgroups	Secretariat
Future Assessments				
42. Convene a meeting of WG-FSA-SAM.	12.23– 12.26	1	Members to implement	Assist
43. Further develop assessments for toothfish in Subarea 48.3.	12.3	1	Members to implement	Assist
44. Further develop assessments for toothfish in Division 58.5.1.	12.4–12.6	2	Members to implement	Assist
45. Further develop assessments for toothfish in Division 58.5.2.	12.7–12.9, 5.101	1	Members to implement	Assist
46. Further develop assessments for toothfish at Crozet Islands.	12.10– 12.12	2	Members to implement	Assist
47. Further develop assessments for toothfish at Prince Edward and Marion Islands.	12.13– 12.15	2	Members to implement	Assist
48. Further develop assessments for toothfish in Subareas 88.1 and 88.2.	12.16– 12.19	1	Members to implement	Assist
49. Conduct general research towards advancing assessments.	12.20	2	Members to implement	Assist
50. Convene a meeting of SG-ASAM.	13.9–13.11	1	SC-CAMLR-XXIV to consider, Members to implement	Assist
51. Liaise with data owners and extend the catch-weighted length frequencies for toothfish in Subarea 48.3 prior to 1992/93.	App. G: 6	1	Members to assist	Implement

AGENDA

Working Group on Fish Stock Assessment
(Hobart, Australia, 10 to 21 October 2005)

1. Opening of the meeting
2. Organisation of the meeting and adoption of the agenda
 - 2.1 Organisation of meeting
 - 2.2 Report restructure
3. Review of available information
 - 3.1 Data requirements specified in 2004
 - 3.1.1 Development of the CCAMLR database
 - 3.1.2 Data processing
 - 3.1.3 Fishery plans
 - 3.1.4 Other
 - 3.2 Fisheries information
 - 3.2.1 Catch, effort, length and age data reported to CCAMLR
 - 3.2.2 Estimates of catch and effort from IUU fishing
 - 3.2.3 Catch and effort data for toothfish fisheries in waters adjacent to the Convention Area
 - 3.2.4 Scientific observer information
 - 3.3 Research information
 - 3.3.1 Research surveys
 - 3.3.2 Tagging studies
 - 3.3.3 Stock structure and management areas
 - 3.3.4 Other
 - 3.4 Biological parameters for use in stock assessment
4. Preparation for assessments and assessment timetable
 - 4.1 Report from the Subgroup on Assessment Methods
 - 4.2 Status of assessment methods
 - 4.2.1 Current assessment methods
 - Recruitment-based long-term yield assessment
 - Short-term projections
 - 4.2.2 New assessment methods
 - ASPM, CASAL
 - Other methods
 - 4.3 Assessment timetable

5. Assessments and management advice
 - 5.1 New and exploratory fisheries in 2004/05 and notifications for 2005/06
 - 5.1.1 New and exploratory fisheries in 2004/05
 - 5.1.2 New and exploratory fisheries notified for 2005/06
 - 5.1.3 Progress towards assessments of new and exploratory fisheries
 - 5.1.3.1 Update Fishery Report for Subarea 88.1
 - 5.2 Update or develop 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* Prince Edward and Marion Islands (Subarea 58.7) and Crozet Islands (Subarea 58.6)
 - 5.2.5 *Champtocephalus gunnari* South Georgia (Subarea 48.3)
 - 5.2.6 *Champtocephalus 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 Estimation of by-catch levels and rates
 - 6.2 Progress on methods for monitoring abundance and/or stock status
 - 6.3 Assessment of risk
 - 6.4 Consideration of 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 (Fish + IMAF)
 - 8.1 Development of approaches for estimating total removals of toothfish
 - 8.2 Review of historical trends in IUU activity
 - 8.3 Advice to the Scientific Committee
9. Biology, ecology and demography of target and by-catch species
 - 9.1 Review information available to the meeting
 - 9.2 Update species profiles
 - 9.3 Identify gaps in the knowledge

10. Considerations of ecosystem management
 - 10.1 Interactions with WG-EMM
 - 10.2 Ecological interactions (e.g. multi-species, benthos etc.)
11. Scheme of International Scientific Observation
 - 11.1 Summary of information extracted from observer reports and/or provided by technical coordinators
 - 11.2 Implementation of observer program
 - 11.2.1 *Scientific Observers Manual*
 - 11.2.2 Sampling strategies
 - 11.2.3 Priorities
 - 11.3 Advice to the Scientific Committee
12. Future assessments
13. Future work
 - 13.1 Data requirements
 - 13.2 Organisation of intersessional activities in subgroups
 - 13.3 Plans for WG-FSA-06
14. Other business
 - 14.1 Matters of importance to WG-FSA and WG-IMAF regarding by-catch
 - 14.2 *CCAMLR Statistical Bulletin*
 - 14.3 Proposal to reorganise the work of the Scientific Committee
15. Adoption of the report
16. Close of the meeting.

LIST OF PARTICIPANTS

Working Group on Fish Stock Assessment
(Hobart, Australia, 10 to 21 October 2005)

- | | |
|---|--|
| AGNEW, David (Dr) | Renewable Resources Assessment Group
Royal School of Mines Building
Imperial College
Prince Consort Road
London SW7 2BP
United Kingdom
d.agnew@imperial.ac.uk
d.agnew@mrags.co.uk |
| ALDERMAN, Rachael (Ms) | Biodiversity Conservation Branch
Department of Primary Industries,
Water and Environment
GPO Box 44
Hobart Tasmania 7001
Australia
rachael.alderman@dpiwe.tas.gov.au |
| BAKER, Barry (Mr) | Australian Antarctic Division
Department of Environment and Heritage
Channel Highway
Kingston Tasmania 7050
Australia
barry.baker@aad.gov.au |
| BALGUERÍAS, Eduardo (Dr) | Instituto Español de Oceanografía
Centro Oceanográfico de Canarias
Apartado de Correos 1373
Santa Cruz de Tenerife
España
eduardo.balguerias@ca.ieo.es |
| BALL, Ian (Dr)
(including early session) | Australian Antarctic Division
Department of Environment and Heritage
Channel Highway
Kingston Tasmania 7050
Australia
ian.ball@aad.gov.au |

BELCHIER, Mark (Dr)
British Antarctic Survey
Natural Environment Research Council
High Cross, Madingley Road
Cambridge CB3 0ET
United Kingdom
markb@bas.ac.uk

BUTTERWORTH, Doug (Prof.)
(early session, 7–8 October 2005)
Department of Applied Mathematics
University of Cape Town
Rondebosch 7701
South Africa
dll@maths.uct.ac.za

CANDY, Steve (Dr)
(including early session)
Australian Antarctic Division
Department of Environment and Heritage
Channel Highway
Kingston Tasmania 7050
Australia
steve.candy@aad.gov.au

CHOI, Seok-Gwan (Dr)
(including early session)
Distant-water Fisheries Resources
National Fisheries Research
and Development Institute
408-1, Shirang-ri
Gijang-up, Gijang-gun
Busan
Korea 619-902
sgchoi@nfrdi.re.kr

COLLINS, Martin (Dr)
British Antarctic Survey
Natural Environment Research Council
High Cross, Madingley Road
Cambridge CB3 0ET
United Kingdom
macol@bas.ac.uk

CONSTABLE, Andrew (Dr)
(including early session)
Australian Antarctic Division
Department of Environment and Heritage
Channel Highway
Kingston Tasmania 7050
Australia
andrew.constable@aad.gov.au

CROXALL, John (Prof.)
British Antarctic Survey
Natural Environment Research Council
High Cross, Madingley Road
Cambridge CB3 0ET
United Kingdom
j.croxall@bas.ac.uk

DUHAMEL, Guy (Prof.)
Museum national d'histoire naturelle
Département des milieux et peuplements
aquatiques
Biodiversité et dynamique des communautés
aquatiques (USM 403)
Case postale 26
43 rue Cuvier
75231 Paris Cedex 05
France
duhamel@mnhn.fr

DUNN, Alistair (Mr)
(including early session)
National Institute of Water and
Atmospheric Research (NIWA)
Private Bag 14-901
Kilbirnie
Wellington
New Zealand
a.dunn@niwa.co.nz

FANTA, Edith (Dr)
Chair, Scientific Committee
Departamento Biologia Celular
Universidade Federal do Paraná
Caixa Postal 19031
81531-970 Curitiba, PR
Brazil
e.fanta@terra.com.br

FENAUGHTY, Jack (Mr)
Silvifish Resources Ltd
PO Box 17-058
Karori
Wellington
New Zealand
jmfenaughty@clear.net.nz

GALES, Rosemary (Dr)
Biodiversity Conservation Branch
Department of Primary Industries,
Water and Environment
GPO Box 44
Hobart Tasmania 7001
Australia
rosemary.gales@dpiwe.tas.gov.au

<p>GASCO, Nicolas (Mr)</p>	<p>Chemin de Soyan 26160 Pont de Barret France nicopec@hotmail.com</p>
<p>GASYUKOV, Pavel (Dr) (including early session)</p>	<p>AtlantNIRO 5 Dmitry Donskoy Street Kaliningrad 236000 Russia pg@atlant.baltnet.ru</p>
<p>HADDON, Malcom (Assoc. Prof.) (including early session)</p>	<p>Tasmanian Aquaculture and Fisheries Institute University of Tasmania Marine Research Laboratories Nubeena Crescent Taroona Tasmania 7053 Australia malcom.haddon@utas.edu.au</p>
<p>HANCHET, Stuart (Dr) (Convener) (including early session)</p>	<p>National Institute of Water and Atmospheric Research (NIWA) PO Box 893 Nelson New Zealand s.hanchet@niwa.co.nz</p>
<p>HILLARY, Richard (Dr) (including early session)</p>	<p>Renewable Resources Assessment Group Royal School of Mines Building Imperial College Prince Consort Road London SW7 2BP United Kingdom r.hillary@imperial.ac.uk</p>
<p>HOLT, Rennie (Dr)</p>	<p>US AMLR Program Southwest Fisheries Science Center 8604 La Jolla Shores Drive La Jolla, CA 92037 USA rennie.holt@noaa.gov</p>
<p>JONES, Christopher (Dr) (Convener, WG-FSA-SAM) (including early session)</p>	<p>US AMLR Program Southwest Fisheries Science Center 8604 La Jolla Shores Drive La Jolla, CA 92037 USA cdjones@ucsd.edu</p>

KASHIWAGI, Shuji (Mr) Japan Deep Sea Trawlers Association
NK Bldg, 6F
3-6 Kanda Ogawa-cho
Chiyoda-ku Tokyo 101-0052
Japan
kani@tafco-ltd.co.jp

KIRKWOOD, Geoff (Dr)
(including early session) Renewable Resources Assessment Group
Royal School of Mines Building
Imperial College
Prince Consort Road
London SW7 2BP
United Kingdom
g.kirkwood@imperial.ac.uk

KOCK, Karl-Hermann (Dr) Federal Research Centre for Fisheries
Institute for Sea Fisheries
Palmaille 9
D-22767 Hamburg
Germany
karl-hermann.kock@ish.bfa-fisch.de

MARSCHOFF, Enrique (Dr) Instituto Antártico Argentino
Cerrito 1248
1010 Buenos Aires
Argentina
marschoff@dna.gov.ar

MCNEILL, Malcolm (Mr) Sealord Group Ltd
Vickerman Street
PO Box 11
Nelson
New Zealand
mam@sealord.co.nz

MATTLIN, Rob (Dr) Ministry of Fisheries
PO Box 1020
Wellington
New Zealand
mattlinr@fish.govt.nz

MELVIN, Ed (Dr) Washington Sea Grant Program
University of Washington
206B Fishery Sciences
Box 355020
Seattle, WA 98195-5020
USA
emelvin@u.washington.edu

MICOL, Thierry (Dr) Territoire des Terres Australes
et Antarctiques Françaises
BP 400
1, rue Gabriel Dejean
97548 Saint-Pierre
La Réunion
thierry.micol@taaf.fr

MONTENEGRO, Carlos (Dr) Instituto de Fomento Pesquero
Blanco 839
Valparaíso
Chile
cmontene@ifop.cl

NAGANOBU, Mikio (Dr) National Research Institute of Far Seas Fisheries
Orido 5-7-1, Shimizu
Shizuoka 424-8633
Japan
naganobu@affrc.go.jp

NEVES, Tatiana (Mrs) Projeto Albatroz
Av. Rei Alberto I
450 sl 05
Ponta da Praia – Santos SP
CEP 11030-380
Brazil
tneves@iron.com.br

O'DRISCOLL, Richard (Dr) National Institute of Water
and Atmospheric Research (NIWA)
Private Bag 14-901
Kilbirnie
Wellington
New Zealand
r.odriscoll@niwa.co.nz

PAPWORTH, Warren (Dr) ACAP Interim Secretariat
Suite 25–26 Salamanca Square
GPO Box 824
Hobart Tas. 7001
warren.papworth@acap.aq

PIERRE, Johanna (Dr) Marine Conservation Unit
PO Box 10-420
Wellington
New Zealand 6001
jpierre@doc.govt.nz

PSHENICHNOV, Leonid (Mr) YugNIRO
2 Sverdlov str.
983000 Kerch
Ukraine
lkp@bikent.net

REID, Keith (Dr) British Antarctic Survey
Natural Environment Research Council
High Cross, Madingley Road
Cambridge CB3 0ET
United Kingdom
k.reid@bas.ac.uk

RIVERA, Kim (Ms) National Marine Fisheries Service
(Co-Convener, WG-IMAF) PO Box 21668
Juneau, Alaska 99802
USA
kim.rivera@noaa.gov

ROBERTSON, Graham (Dr) Australian Antarctic Division
Department of Environment and Heritage
Channel Highway
Kingston Tasmania 7050
Australia
graham.robertson@aad.gov.au

SHUST, Konstantin (Dr) VNIRO
17a V. Krasnoselskaya
Moscow 107140
Russia
antarctica@vniro.ru

SMITH, Neville (Mr) Ministry of Fisheries
(Co-Convener, WG-IMAF) PO Box 1020
(including early session) Wellington
New Zealand
smithn@fish.govt.nz

SULLIVAN, Ben (Dr) Birdlife Global Seabird Programme
Royal Society for the Protection of Birds
The Lodge
Sandy
Bedfordshire
United Kingdom
ben.sullivan@rspb.org.uk

VACCHI, Marino (Dr)

Universita di Genova
Viale Benedetto XV16132 Genoa
Italy
m.vacchi@unige.it

VAN WIJK, Esmee (Ms)

Australian Antarctic Division
Department of Environment and Heritage
Channel Highway
Kingston Tasmania 7050
Australia
esmee.vanwijk@aad.gov.au

WAUGH, Susan (Dr)

Ministry of Fisheries
PO Box 1020
Wellington
New Zealand
susan.waugh@fish.govt.nz

WILCOX, Chris (Dr)
(including early session)

CSIRO
GPO Box 1538
Hobart Tasmania 7001
chris.wilcox@csiro.au

WÖHLER, Otto (Dr)

Instituto Nacional de Investigación
y Desarrollo Pesquero (INIDEP)
Paseo Victoria Ocampo No. 1
7600 Mar del Plata
Argentina
owohler@inidep.edu.ar

SECRETARIAT

Executive Secretary

Denzil Miller

Science/Compliance and Enforcement

Science/Compliance Officer

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Eric Appleyard

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Russian Translator

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Spanish Translator/Team Coordinator

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Spanish Translator

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Spanish Translator

Marcia Fernández

Website and Information Services

Website and Information Services Officer

Rosalie Marazas

Information Services Assistant

Philippa McCulloch

Information Technology

Information Technology Manager

Fernando Cariaga

Information Technology Support Specialist

Tim Byrne

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(Executive summary and full paper)
- WG-EMM-05/18 Developing a carbon-budget trophic model of the Ross Sea, Antarctica: work in progress M. Pinkerton, S. Hanchet, J. Bradford-Grieve and P. Wilson (New Zealand)
- CCAMLR-XXIV/9 Notification of Spain’s proposal to conduct exploratory fisheries for toothfish (*Dissostichus* spp.) in CCAMLR Subareas 88.1 and 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b in the 2005/06 season
Delegation of Spain
- CCAMLR-XXIV/10 Notification of exploratory fisheries for *Dissostichus* spp. in the 2005/06 season in CCAMLR Subarea 48.6
Delegation of Japan
- CCAMLR-XXIV/11 Notification of exploratory fisheries for *Dissostichus* spp. in the 2005/06 season in CCAMLR Subareas 88.1 and 88.2
Delegation of Norway
- CCAMLR-XXIV/12 Notification of Argentina’s intention to conduct exploratory fisheries for *Dissostichus* spp. in CCAMLR Subareas 88.1 and 88.2
Delegation of Argentina
- CCAMLR-XXIV/13 New Zealand notification to undertake exploratory fishing for *Dissostichus* spp. in CCAMLR Subarea 48.6 in the 2005/06 season
Delegation of New Zealand
- CCAMLR-XXIV/14 New Zealand notification to undertake exploratory fishing for *Dissostichus* spp. in CCAMLR Divisions 58.4.1 and 58.4.2 in the 2005/06 season
Delegation of New Zealand

CCAMLR-XXIV/15	New Zealand notification to undertake exploratory fishing for <i>Dissostichus</i> spp. in CCAMLR Subareas 88.1 and 88.2 in the 2005/06 season Delegation of New Zealand
CCAMLR-XXIV/16	Notification of exploratory fisheries for <i>Dissostichus</i> spp. in the 2005/06 season in CCAMLR Subarea 88.1 Delegation of South Africa
CCAMLR-XXIV/17	Notification of Australia's intention to conduct an exploratory longline fishery in Division 58.4.1 for <i>Dissostichus</i> spp. Delegation of Australia
CCAMLR-XXIV/18	Notification of Australia's intention to conduct an exploratory longline fishery in Division 58.4.2 for <i>Dissostichus</i> spp. Delegation of Australia
CCAMLR-XXIV/19	Notification of Australia's intention to conduct an exploratory longline fishery in Division 58.4.3a for <i>Dissostichus</i> spp. Delegation of Australia
CCAMLR-XXIV/20	Notification of Australia's intention to conduct an exploratory longline fishery in Division 58.4.3b for <i>Dissostichus</i> spp. Delegation of Australia
CCAMLR-XXIV/21	Notification by the United Kingdom of its intention to participate in the exploratory fishery for <i>Dissostichus</i> spp. in CCAMLR Subareas 88.1 and 88.2 during the 2005/06 season Delegation of the United Kingdom
CCAMLR-XXIV/22	Notification of exploratory fisheries for <i>Dissostichus</i> spp. in the 2005/06 season in Subareas 88.1 and 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b Delegation of the Republic of Korea
CCAMLR-XXIV/23	Notification of an exploratory fishery in Division 58.4.3b Delegation of Uruguay
CCAMLR-XXIV/24	Notification of an exploratory fishery in Subarea 88.2 Delegation of Uruguay
CCAMLR-XXIV/25	Notification to conduct an exploratory longline fishery in Division 58.4.1 for <i>Dissostichus</i> spp. on board of the <i>Globalpesca I</i> and <i>II</i> in the 2005/06 season Delegation of Chile

CCAMLR-XXIV/26	Notification to conduct an exploratory longline fishery in Division 58.4.2 for <i>Dissostichus</i> spp. on board of the <i>Globalpesca I</i> and <i>II</i> in the 2005/06 season Delegation of Chile
CCAMLR-XXIV/27	Notification to conduct an exploratory longline fishery in Division 58.4.3a for <i>Dissostichus</i> spp. on board of the <i>Globalpesca I</i> and <i>II</i> in the 2005/06 season Delegation of Chile
CCAMLR-XXIV/28	Notification to conduct an exploratory longline fishery in Division 58.4.3b for <i>Dissostichus</i> spp. on board of the <i>Globalpesca I</i> and <i>II</i> in the 2005/06 season Delegation of Chile
CCAMLR-XXIV/29	Notification of an exploratory fishery in Statistical Division 58.4.1 Delegation of Uruguay
CCAMLR-XXIV/30	Notification of an exploratory fishery in Subarea 88.1 Delegation of Uruguay
CCAMLR-XXIV/31	Notification by Russia of its intention to continue an exploratory fishery for <i>Dissostichus</i> spp. in CCAMLR Subareas 88.1 and 88.2 for the 2005/06 season Delegation of Russia
CCAMLR-XXIV/BG/12	Summary of current conservation measures and resolutions in force 2004/05 Secretariat
CCAMLR-XXIV/BG/13	Implementation of fishery conservation measures in 2004/05 Secretariat
CCAMLR-XXIV/BG/21	Plan d'action pour l'évaluation du stock de légine dans les Terres australes et antarctiques françaises (une campagne de chalutage scientifique) Délégation française
CCAMLR-XXIV/BG/22	État des mesures mises en œuvre par les armements à la pêche français impliqués dans la pêcherie palangrière de légine des TAAF, pour maîtriser la mortalité accidentelle d'oiseaux Délégation française
CCAMLR-XXIV/BG/23	Étude relative aux pétrels Délégation française

CCAMLR-XXIV/BG/24	Note de commentaires sur les chiffres communiqués par la France concernant la mortalité aviaire accidentelle Délégation française
CCAMLR-XXIV/BG/26	Expérimentations relatives à la lutte contre la mortalité aviaire Délégation française
CCAMLR-XXIV/BG/28	Modification de la réglementation relative à la mortalité aviaire dans les Terres australes et antarctiques françaises Délégation française
CCAMLR-XXIV/BG/33	Agreement on the Conservation of Albatross and Petrels, summary of the First Session of the Meeting of Parties Delegation of Australia
SC-CAMLR-XXIV/5	Development of the electronic volume of the <i>Statistical Bulletin</i> Secretariat
SC-CAMLR-XXIV/8	Proposal to test a new streamer line as a mitigation method to reduce incidental mortality of seabirds in longline fishing Delegation of Spain
SC-CAMLR-XXIV/BG/1	Catches in the Convention Area in the 2003/04 and 2004/05 seasons Secretariat
SC-CAMLR-XXIV/BG/3	Report of the First Meeting of the Subgroup on Acoustic Survey and Analysis Methods (SG-ASAM) (La Jolla, USA, 31 May to 2 June 2005)
SC-CAMLR-XXIV/BG/5	Summary of notifications for new and exploratory fisheries in 2005/06 Secretariat
SC-CAMLR-XXIV/BG/10	Report on the 4th International Fisheries Observer Conference CCAMLR Observer (Secretariat)
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WG-FSA-SAM-05/1	Agenda
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WG-FSA-SAM-05/3	List of documents
WG-FSA-SAM-05/4	Estimating by-catch from CCAMLR data Secretariat

WG-FSA-SAM-05/5 Rev. 1	Exploring the ASPM as an alternative method to estimate the Patagonian toothfish biomass at CCAMLR Subarea 48.3 O.C. Wöhler, P.A. Martínez and A. Aubone (Argentina)
WG-FSA-SAM-05/6 Rev. 1	Investigation of bias in the mark–recapture estimate of toothfish population size at South Georgia D.J. Agnew, G.P. Kirkwood, J. Pearce and J. Clark (United Kingdom) (<i>CCAMLR Science</i> , submitted)
WG-FSA-SAM-05/7	Implementation of the modified Petersen mark–recapture method in S-Plus A. Payne, D.J. Agnew and R. Hillary (United Kingdom)
WG-FSA-SAM-05/8	Stratification of catch-at-length data using tree based regression: an example using Antarctic toothfish (<i>Dissostichus mawsoni</i>) in the Ross Sea N.L. Phillips, A. Dunn and S.M. Hanchet (New Zealand)
WG-FSA-SAM-05/9	Simulation experiments and CCAMLR yield estimates using CASAL A. Dunn (New Zealand)
WG-FSA-SAM-05/10	Descriptive analysis of the Antarctic toothfish (<i>Dissostichus mawsoni</i>) tagging scheme in the Ross Sea for the years 1997/98 to 2003/04 A. Dunn, S.M. Hanchet and K. Maxwell (New Zealand)
WG-FSA-SAM-05/11	Computer program for the calculation and validation of Verhoeff check digits A. Dunn (New Zealand)
WG-FSA-SAM-05/12	Further development and progress towards evaluation of an Antarctic toothfish (<i>Dissostichus mawsoni</i>) stock model for the Ross Sea A. Dunn, D.J. Gilbert and S.M. Hanchet (New Zealand)
WG-FSA-SAM-05/13	Fitting a von Bertalanffy growth model to length-at-age data accounting for length-dependent fishing selectivity and length-stratified sub-sampling of length frequency samples S.G. Candy (Australia)
WG-FSA-SAM-05/14	Testing the performance of a recompiled version of TrawlCI to calculate confidence intervals of abundance in surveys of Patagonian toothfish (<i>Dissostichus eleginoides</i>) and mackerel icefish (<i>Champscephalus gunnari</i>) T.D. Lamb, W.K. de la Mare and A.J. Constable (Australia)

- WG-FSA-SAM-05/15 Initial development of operating models for testing management procedures for the toothfish (*Dissostichus eleginoides*) resource in the Prince Edward Islands vicinity
A. Brandão and D.S. Butterworth (South Africa)
- WG-FSA-SAM-05/16 Developing integrated assessments for *Dissostichus eleginoides* based on the CCAMLR precautionary approach
I. Ball and A.J. Constable (Australia)
- WG-FSA-SAM-05/17 Examination of the characteristics of the fishery for *Dissostichus eleginoides* in the CCAMLR Statistical Subarea 48.3 and its implications on estimating trends in catch per unit effort
A.J. Constable, S.G. Candy and B. Raymond (Australia)
- WG-FSA-SAM-05/18 Age-structured production model for toothfish at South Georgia
A. Payne, G.P. Kirkwood, R. Hillary and D.J. Agnew (United Kingdom)
- WG-FSA-SAM-05/19 Selectivity-induced bias in growth parameter estimates
G.P. Kirkwood (United Kingdom)

APPENDICES D–E

**Appendices D–E do not exist –
they were subsumed into the main body of the report.**

APPENDICES F–M

Appendices F–M (Fishery Reports) are only available electronically at:
www.ccamlr.org/pu/E/e_pubs/fr/drt.htm

SUBGROUP ON FISH AND INVERTEBRATE BY-CATCH

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SUBGROUP ON FISH AND INVERTEBRATE BY-CATCH

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.

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.

ASSESSMENT OF THE STATUS OF BY-CATCH SPECIES OR GROUPS

3. There were no new assessments of by-catch species or recommendations for revised catch limits in 2005.

4. 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

Bathyraja spp. in Division 58.5.2

5. WG-FSA-05/70 presented new biological information for rajids in Division 58.5.2, including growth from tagging data, length–weight relationships, length-at-maturity, composition of the catch by fishery and depth, and estimates of abundance from research trawl surveys. Estimates of growth from trawl-tagged recaptured *Bathyraja eatonii* were 15 mm per year in length, and 0.15 kg per year in mass, indicating that this species is very slow growing. Length–weight relationships relating total length (TL) to mass are updated for three species: *B. irrasa*, *B. eatonii* and *B. murrayi*. *Bathyraja irrasa* is the only species that

appears to show sexual dimorphism with females attaining a larger mass per length and larger maximum sizes than males. The length at sexual maturity (L_{50}) was estimated for *B. irrasa* at 865 mm (TL) and the length at first spawning (L_{m50}) at 1 210 mm (TL).

6. The combined abundance of all three rajid species in the survey area ranged from 2 076 to 10 507 tonnes, with an average of 4 717 tonnes (Table 1). *Bathyraja eatonii* is the most abundant rajid in the survey area with total abundance estimates ranging from 536 to 3 549 tonnes. The next most abundant rajid was *B. irrasa* with estimates ranging from 377 to 2 760 tonnes. *Bathyraja murrayi* was the least common rajid with abundance estimates between 59 and 1 165 tonnes. Coefficients of variation for the abundance estimates varied from 0.28 to 0.55 for *B. eatonii*, 0.36 to 0.59 for *B. irrasa*, and 0.21 to 0.39 for *B. murrayi*.

7. The composition of the rajid by-catch was described by fishery and depth zone. The catch in the longline fishery operating at depths between 800 and 1 600 m comprised almost exclusively *B. irrasa* (97%). These are large fish with total lengths ranging from 740 to 1 320 mm. The trawl fishery for *Dissostichus eleginoides*, operating at depths of 400 to 1 300 m, catches predominantly *B. eatonii* (61%), *B. murrayi* (26%) and *B. irrasa* (12.5%). This fishery catches predominantly large *B. eatonii* with total lengths between 600 and 1 200 mm and mostly larger *B. irrasa* ranging in length from 900 to 1 360 mm (TL) with a small contribution of smaller *B. irrasa*. The fishery for *Champscephalus gunnari* operating on the plateau at depths of 160 to 330 m catches predominantly *B. eatonii* (76%), *B. murrayi* (21%) and a very small amount of *B. irrasa* (2.5%). *Bathyraja eatonii* are mostly small fish ranging in size from 340 to 600 mm TL. Similarly, the *B. irrasa* catch consists mostly of small fish with lengths between 160 and 580 mm (TL). The size range of *B. murrayi* is similar between the two trawl fisheries.

Macrourus spp.

M. whitsoni in Subarea 88.1

8. Updated biological parameters for *M. whitsoni* in Subarea 88.1 were presented in WG-FSA-05/20. Intensive analysis of otoliths from juvenile *M. whitsoni* collected on the BioRoss research cruise in 2004 greatly increased confidence in the interpretation of the zone structure displayed in the early growth rings. The findings of WG-FSA-05/20 supported the interpretation protocols used in previous work on this species (Marriott et al., 2003). Revised von Bertalanffy parameters including the new juvenile data were $L_{\infty} = 76.12$ cm TL, $K = 0.065$ and $t_0 = -0.159$ for males and $L_{\infty} = 92.03$ cm TL, $K = 0.055$ and $t_0 = 0.159$ for females. Revised estimates of the mean total length-at-maturity and mean age-at-maturity were 38.8 cm and 10.6 years for males, and 46.4 cm and 13.6 years for females.

9. There was no significant difference between revised von Bertalanffy growth curves from WG-FSA-05/20 and the previous results from Marriott et al. (2003). The subgroup therefore decided that it was not necessary to update the estimate of γ for *M. whitsoni* in Subarea 88.1 (SC-CAMLR-XXII, paragraph 4.132), which was based on these previous biological parameters (SC-CAMLR-XXII, Annex 5, Table 5.20).

10. WG-FSA-05/24 updated the standardised CPUE for *M. whitsoni* in Subareas 88.1 and 88.2 based on an analysis of fine-scale data from all vessels in the exploratory fishery from

1997/98 to 2004/05. Standardised CPUE increased to a peak in 2002 and 2003, dropped in 2004, before increasing again in 2005 (Figure 1a). This pattern was consistent for a range of response variables as well as for subsets of the data based on core vessels only. The updated CPUE series was similar to the results of the previous standardised CPUE analysis (WG-FSA-02/40).

11. CPUE is unlikely to provide a reliable method of monitoring rattail abundance in the Ross Sea because of changes in fishing area due to variability in ice and changes with fisher behaviour with increasing experience (WG-FSA-05/22). The subgroup noted that even if the CPUE series monitored abundance, it would need to show a reasonable level of contrast to provide reliable estimates of biomass and yield in a stock assessment. This is not the case currently, as CPUE is increasing or stable.

APPROACHES TOWARDS ASSESSMENT OF BY-CATCH SPECIES IN SUBAREA 88.1

12. WG-FSA-05/22 presented results from a desktop study to consider approaches to monitoring and assessing macrourids and rajids in Subarea 88.1. Seven approaches were evaluated: standardised CPUE analysis, quantitative research longline surveys, experimental manipulation of fishing effort, catch-curve analysis, tagging programs, bottom trawl surveys and acoustic surveys.

13. WG-FSA-05/22 recommended that a random bottom trawl survey would be the best approach towards obtaining abundance estimates for macrourids and rajids in Subarea 88.1. The major advantage of this approach is that preliminary stock assessments could be carried out for both species groups after only one successful trawl survey. Simulations indicated that only 35–40 trawls would be required in the depth range 600–1 500 m to obtain a precise estimate of by-catch abundance in the area of highest densities (SSRUs 881E, G, H, I, J and K). A trawl survey could also be used in conjunction with other methods of monitoring abundance, e.g. rajids caught during the trawl survey could be tagged, macrourids could be aged for catch-curve analysis. The main limitations of this approach are the variable ice cover in the Ross Sea, which may restrict access to some areas, the rough bottom topography, and concerns about the environmental impact of bottom trawling on benthic communities. Tag-recapture experiments for rajids and experimental manipulation of fishing effort are alternative methods which show some promise for monitoring abundance.

14. The subgroup noted that 35–40 trawls seemed a low number for the proposed survey area of nearly 100 000 km². It urged further work on survey design before a trawl survey was carried out in Subarea 88.1.

15. The subgroup also noted that gear type is an important factor in rajid catchability in bottom trawls and that catchability is likely to be less than 1.

16. The subgroup further noted that an earlier study (WG-FSA-SAM-04/7) concluded that a trawl survey for juvenile *D. mawsoni* in Subarea 88.1 would be very difficult because of extensive and variable ice cover. A trawl survey for by-catch species is more feasible for three reasons. First, the spatial and depth distribution of macrourids and rajids is quite well understood from the exploratory longline fishery, whereas the location of juvenile toothfish in

the Ross Sea is largely unknown. This means that the trawl survey area and depth boundaries for a survey of macrourids and rajids are relatively well defined. Consequently the number of trawls required is much lower than the 200–300 stations that may be needed for a juvenile toothfish survey (WG-FSA-SAM-04/7). Second, ice appears to be less of a problem over by-catch depths of 600–1 500 m than in the shallower areas (0–600 m) where juvenile toothfish are likely to occur. Between 25 and 84% of the area from 600–1 500 m was fishable in 2002–2004 (WG-FSA-05/22), while only 11–69% of the area shallower than 600 m had less than 3/10 ice cover in the same years (WG-FSA-SAM-04/7). Third, a trawl survey of macrourids and rajids would be a ‘one-off’ to obtain estimates of adult standing stock, with estimates of precautionary yield based on a γ assessment. A trawl survey of juvenile toothfish would provide estimates of cohort strength, and would need to be repeated at regular intervals to provide a robust estimate of mean recruitment (SC-CAMLR-XXII, Annex 5, paragraph 5.55).

17. The subgroup thanked New Zealand for the work that had gone into the examination of alternative approaches for assessing abundance of macrourids and rajids during the intersessional period. It encouraged New Zealand to carry out a trawl survey for macrourids and rajids in Subarea 88.1.

ESTIMATION OF BY-CATCH LEVELS AND RATES

18. In 2003, WG-FSA compared by-catch information from STATLANT data (reported by Flag State at the end of the season), fine-scale data (haul-by-haul), and catch and effort data (reported by vessel in 5-day, 10-day or monthly periods) and concluded that fine-scale data is the most comprehensive of the three datasets for estimating levels of total removals of by-catch (SC-CAMLR-XXII, Annex 5, paragraph 5.283).

19. Estimates of total removals derived from fine-scale reports of by-catch by area for the 2004/05 fishing season are presented for longline and trawl fisheries in Tables 2 and 3 respectively.

20. The subgroup noted that there were no fine-scale data available on by-catch in the South African EEZ in Subareas 58.6 and 58.7 and urged South Africa to make these data available to the Secretariat.

21. Macrourid by-catch (as a percentage of *Dissostichus* spp. catch) in longline fisheries during 2004/05 ranged from 1.7 to 24.9%, with the highest reported by-catch rates in Subareas 58.6 and 88.1 and Divisions 58.4.2 and 58.5.1.

22. Reported rajid by-catch (as a percentage of *Dissostichus* spp. catch) in longline fisheries during 2004/05 was less than 3% in all areas except in Divisions 58.4.3a and 58.5.1 and Subarea 58.6. The subgroup emphasised that the estimates for rajids are conservative and do not include those cut or lost from longlines (paragraphs 42 to 53). In Division 58.5.1 and Subarea 58.6, almost all rajids are retained and processed and this accounts for the higher reported by-catch of rajids in these areas.

23. The other major by-catch species caught in longline fisheries during 2004/05 was *Antimora rostrata*. The by-catch rate of *A. rostrata* was 14.3% of the catch of *Dissostichus* spp. in Subarea 58.6.
24. By-catch rates of macrourids and rajids were much lower in trawl fisheries than in longline fisheries, jointly contributing less than 0.5% of the target catch in all areas in 2004/05. The major by-catch species in trawl fisheries were *Channichthys rhinoceratus* in fisheries for *D. eleginoides* and *C. gunnari* in Division 58.5.2 and *Pseudochaenichthys georgianus* in the fishery for *C. gunnari* in Subarea 48.3.
25. Present and historical information about levels of by-catch from fine-scale data for some managed fisheries were also presented in WG-FSA-05/6 and are included in individual Fishery Reports.
26. Further information on levels of by-catch is available from observer data and this is discussed in paragraphs 37 to 41.
27. Table 2 of CCAMLR-XXIV/BG/13 provided summaries of total removals of managed species, including macrourids and rajids, by area for CCAMLR fisheries in 2004/05 from catch and effort reports submitted by 21 September 2005. The subgroup noted that these estimates were generally similar to estimates from fine-scale data in Tables 2 and 3.
28. WG-FSA-05/68 presented by-catch information for the Australian fisheries in Division 58.5.2 for the 2003/04 and 2004/05 seasons. By-catch in the trawl fisheries was low, generally less than 1% of the total catch (target plus by-catch). Higher percentage by-catch rates occurred in trawling grounds where the fishing effort and therefore target catch was low. By-catch in the longline fisheries was higher, ranging from 6 to 13% of the total catch when only landed by-catch was considered and ranging between 11 and 26% when rajids and macrourids cut and lost from longlines were included. The main by-catch species were rajids and macrourids in the *D. eleginoides* fishery and rajids and *C. rhinoceratus* in the *C. gunnari* fishery. The total landed catch of rajids in the longline fishery in Division 58.5.2 was 13 tonnes in 2003/04 and 3 tonnes in 2004/05. The total landed catch of macrourids in the longline fishery in Division 58.5.2 was 42 tonnes in 2003/04 and 35 tonnes in 2004/05.
29. Data on by-catch in the exploratory fishery in Subareas 88.1 and 88.2 were described and analysed in WG-FSA-05/24 and 05/29. The main by-catch species is *M. whitsoni*, which comprised 4–16% (mean 10%) of the annual catch since 1997/98. By-catch of *M. whitsoni* varies considerably between SSRUs, with highest by-catch rates along the shelf edge (SSRUs 881E, I, K and 882E) and lower by-catch in the northern and southern SSRUs. Length-frequencies for *M. whitsoni* were similar in the last four seasons, with most fish between 13 and 30 cm snout–vent length. The next most important by-catch group is rajids (mainly *A. georgiana*), which made up 1–9% of the annual catch since 1997/98. The lower recorded by-catch percentage of rajids in recent years is due to the release of rajids at the surface, which were not included in estimates of total removals (paragraphs 42 to 53).
30. The subgroup noted with concern that catch limits for macrourids were exceeded in SSRUs 881I and K during 2004/05. Closures of SSRUs 881G and J were also triggered by the by-catch limits for macrourids (CCAMLR-XXIV/BG/13).

31. WG-FSA-05/53 presented results from a New Zealand research longline survey in Subarea 88.3. Only 10 research hauls were completed. Major by-catch species were *M. whitsoni* (1 341 kg), *M. holotrachys* (218 kg) and *A. rostrata* (183 kg). The catch of macrourids was 94% of the target *Dissostichus* spp. catch (1 667 kg). No rajids were caught.

32. Data on by-catch composition from two New Zealand vessels in the exploratory fishery for *Dissostichus* spp. in Divisions 58.4.1 and 58.4.2 in 2004/05 are presented in WG-FSA-05/62.

Methods for estimating by-catch

33. WG-FSA-SAM-05/4 proposed a method to improve estimates of by-catch by interpolating missing catch values using estimates derived from the mean weights of by-catch species by fishing gear, region and period (WG-FSA report, paragraph 3.5). This method would improve the consistency of the CCAMLR datasets.

34. The subgroup encouraged the Secretariat to develop and adopt this method. It also recommended that the Secretariat conduct some validation work during the intersessional period.

35. The subgroup further noted the Secretariat has developed standard methods to summarise by-catch removals by area and species prior to WG-FSA, and that the extraction and documentation of by-catch data has improved considerably in 2005. The subgroup thanked the Secretariat for these improvements, which considerably reduced its workload.

BY-CATCH REPORTING

36. 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

37. Observer by-catch data was extracted by the Secretariat by fishery for the 2004/05 fishing season and summarised in WG-FSA-05/7 Rev. 1 (longline fisheries) and 05/8 (trawl fisheries). These documents included tables of the species composition of the observed catch and biological data collected.

38. WG-FSA-05/24 compared total reported catches of macrourids and rajids from fine-scale and observer data in Subareas 88.1 and 88.2. Total observed catches for both groups were of a similar magnitude to fine-scale catches, but there were large differences in some years. For the macrourids, observer catches were 11.4% greater than the fine-scale catch in 2004 and 19.8% less than the fine-scale catch in 2005. A zero catch of macrourids was reported in 18% of all sets in the fine-scale data, but only 5% of sets in the observer data. For rajids, observer catches were 44% higher than the fine-scale catches in 2000 and 56% higher in 2004. Observed and fine-scale catches of rajids were similar in 2005.

39. WG-FSA-05/24 reported that it was very difficult to estimate total levels of by-catch for Subareas 88.1 and 88.2 from observer data. The most common recurring problem was incomplete fields. Although almost all longline sets reported in the observer database were observed, the proportion of the hooks observed for fish by-catch could often not be determined. The field 'Estimated percentage of haul observed for by-catch' was blank for 14–29% of sets in 2003 to 2005. In some cases this may indicate that the entire haul was observed (i.e. 100%), but this could not be assumed. In addition, some observers recorded observed catch weights (i.e. catch weights in that portion of the haul that was observed), while others scaled catch weights up to the total haul. In these cases, although the 'Estimated percentage of haul observed for by-catch' was recorded correctly, the estimated catch of the by-catch species was incorrect (already scaled up to 100%). Because of the missing values and inconsistencies in recording, estimates of total removals could not be reliably scaled up to fishery level. In addition, the recording of retained and discarded fish was inconsistent between vessels and trips in the observer data.

40. On the L5 catch composition form, observers currently record the estimated percentage of the haul observed for by-catch, and the number and weight of each species retained and discarded. To improve the consistency of data reporting for by-catch, the subgroup recommended that additional fields should be added that record 'number of hooks observed for fish by-catch', and the total estimated number and weight of each species retained and discarded for the set (i.e. observed number and weight scaled by proportion of hooks observed). These additional fields would help to validate and cross-check the by-catch data being recorded.

41. Incomplete recording may be due to uncertainty by observers about by-catch data recording protocols. The subgroup 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 subgroup reiterated the importance of using the most up-to-date forms.

Reporting of cut-offs of rajids

42. It is not possible to reliably estimate by-catch of rajids in all longline fisheries. This is particularly the case with rajids cut free and released at the surface. These released rajids are usually not recorded on the fine-scale forms and are often not recorded by observers.

43. The revised observers' logbooks and forms distributed by the Secretariat to technical coordinators in February 2003 included fields that specify discard methods (landed then discarded, retained, cut off, shaken or gaffed off, lost at surface or dropped off).

44. Available observer data on the number and fate of rajids recorded on these new (L11) forms in 2004/05 is given in Table 4.

45. The subgroup noted with concern that this represented a very limited number of observations. For example, in Subareas 88.1 and 88.2 only 10.6% of the observed catch of rajids was recorded on the L11 form (WG-FSA-05/24). Also, observers have often failed to record the proportion of the line observed for rajids, and so numbers cannot be scaled up to estimate catch.

46. The subgroup further noted that some Members have collected data on rajid cut-offs using their own national databases which indicate that releases comprise a significant proportion of the total catch.

47. WG-FSA-05/68 presented estimates of cut-off rajids for the longline fisheries in Division 58.5.2. Estimates of rajids cut from longlines were reported by both observers and the vessel. These estimates were generally similar. Including rajids cut from longlines resulted in an estimated rajid catch of 80 tonnes in 2003/04 and 54 tonnes in 2004/05, (observer estimates) or 65 tonnes in 2003/04 and 63 tonnes in 2004/05 (vessel estimates). Regardless of the method of estimation, rajids cut from longlines comprised between 80 and 95% of the total rajid catch.

48. In 2004/05, the New Zealand Ministry of Fisheries collected additional data on the number of rajids released from New Zealand vessels in the exploratory fishery for *Dissostichus* spp. in Subareas 88.1 and 88.2, by adding the field 'Number of rajids released but not tagged' in the C2 data form given to these vessels. Data presented by WG-FSA-05/24 indicated that a total of 4 405 rajids (equivalent to 34.2 tonnes) were released by four New Zealand vessels in 2004/05. This was 13 times greater than the landed rajid catch reported by the same four vessels in 2004/05 of 2.6 tonnes and illustrates the magnitude of the released catch.

49. The subgroup welcomed this information, and encouraged other Members to submit any available information on by-catch cut-offs to WG-FSA.

50. The subgroup made the following two recommendations to improve the reporting of the number of rajids cut from longlines.

51. The subgroup recommended that all vessels be required to report the number of rajids cut from longlines through the addition to the fine-scale C2 form, of a new field 'Number of rajids released (including tagged animals)'. This vessel data would provide a useful check given the current inconsistent reporting of cut-offs through observer forms.

52. The subgroup reiterated that rajids cut from, or tagged and released from longlines and reported as part of the fine-scale data, should not be counted against by-catch limits.

53. The subgroup further recommended that observers fill out the L11 forms correctly, including information on rajid cut-offs. The subgroup noted that whilst it was desirable for this form to be completed for each set, due to high observer workloads it may be preferable to reduce the frequency of observation to obtain a smaller but higher-quality dataset on rajid cut-offs. This could be achieved by recommending that observers complete the L11 form specifically for rajids for at least one observation period every 48 hours. Information required would include the number of rajids released from longlines, including tagged animals and the proportion of the set observed, if not the entire set.

ASSESSMENT OF RISK, BOTH IN TERMS OF GEOGRAPHICAL AREAS AND POPULATION DEMOGRAPHY

Identification of levels of risk

54. In 2004, WG-FSA considered the possibility of producing risk assessments for fish and invertebrate by-catch species in a similar way to the assessment of seabirds (SC-CAMLR-XXIII, Annex 5, paragraph 6.53). The Working Group prepared a risk assessment table for the sleeper shark (*Somniosus antarcticus*) in Division 58.5.2 based on WG-FSA-03/69 as an example of the type of information that might be included in a risk categorisation for other by-catch species (SC-CAMLR-XXIII, Annex 5, Table 6.5).

55. Risk status categories were based on Castro et al. (1999):

Category 1: Exploited species that cannot be placed on any of the subsequent categories, because of lack of data.

Category 2: Species pursued in directed fisheries, and/or regularly found in by-catch, whose catches have not decreased historically, probably due to their higher reproductive potential.

Category 3: Species that are exploited by directed fisheries or by-catch, and have a limited reproductive potential, and/or other life history characteristics that make them especially vulnerable to overfishing, and/or that are being fished in their nursery areas.

Category 4: Species in this category show substantial historical declines in catches and/or have become locally extinct.

Category 5: Species that have become rare throughout the ranges where they were formerly abundant, based on historical records, catch statistics, or experts' reports.

56. The subgroup encouraged Members to collate information during the intersessional period to allow risk categorisation for other major by-catch species in the CAMLR Convention Area (SC-CAMLR-XXIII, Annex 5, paragraph 6.57).

57. WG-FSA-05/21 presented risk categorisation tables for *M. whitsoni* and *A. georgiana*, which are the major by-catch species in the exploratory fishery for toothfish in the Ross Sea (Subareas 88.1 and 88.2). These tables are included as Tables 5 and 6.

58. *Amblyraja georgiana* were categorised as risk category 3. The risk to *A. georgiana* is potentially mitigated due to the requirement to cut rajids from longlines whilst still in the water and release them. *Macrourus whitsoni* were categorised as between risk category 2 and 3. Although life-history characteristics may make this species vulnerable to overfishing, catch rates in the toothfish fishery have not declined, juveniles are not selected by the fishery, and comparison of longline and trawl catch rates with other Antarctic areas suggest that the population in the Ross Sea may be relatively large.

59. The subgroup thanked New Zealand for this contribution and encouraged Members to collate information during the intersessional period to allow risk categorisation for other

major by-catch species in the CAMLR Convention Area. It also recommended that alternatives to, and refinements of, this categorisation be considered during the intersessional period.

60. The subgroup noted that tables of the type shown in Tables 5 and 6 provide indicators of potential risk, not real and proven risk. It further noted that the comprehensiveness of the information provided would not equate with the level of risk, pointing out lack of information does not mean lack of risk.

61. The subgroup urged Members to consider how such risk assessments should be linked to assessment and management considerations in the future. It noted that this concept should be further explored in conjunction with WG-IMAF (WG-FSA report, paragraphs 14.1 to 14.5).

CONSIDERATION OF MITIGATION MEASURES

Factors affecting by-catch rates

62. Understanding factors that affect by-catch rates may yield information that could be used to develop mitigation and avoidance measures for by-catch.

63. In 2004, WG-FSA analysed by-catch by vessel in Subarea 88.1 during the 2003/04 season. This preliminary analysis suggested that the Spanish longline system may have lower by-catch rates of *Macrourus* spp. than the autoline system (SC-CAMLR-XXIII, Annex 5, paragraph 6.63). However, before this conclusion could be reached, the Working Group felt it was important to examine the spatial vessel/gear-type patterns and by-catch rates in greater detail, and recommended that this work be conducted in the intersessional period (SC-CAMLR-XXIII, Annex 5, paragraph 6.64).

64. WG-FSA-05/24 used a standardised CPUE analysis to determine factors affecting by-catch rates of macrourids and rajids in the exploratory fishery for toothfish in Subareas 88.1 and 88.2. The analysis was based on fine-scale haul-by-haul data and observer data from all vessels in the fishery from 1997/98 to 2004/05.

65. The major factors influencing macrourid by-catch in Subareas 88.1 and 88.2 were vessel, area and depth (Figure 1). Catch rates of *M. whitsoni* were highest along the shelf edge (SSRUs 881E, I, K and 882E) in depths from 600 to 1 000 m, and there was an order of magnitude difference in macrourid catch rates between different vessels. Examination of vessel characteristics (Figure 2) showed that catch rates of macrourids were lower with the Spanish longline system than with the autoline system. This effect was confounded by the bait type, as Spanish longline vessels tended to use the South American pilchard as bait, whereas autoline vessels used varying species of squid and/or mackerel. However, the difference in macrourid catch rates between the few Spanish longline vessels that used squid and mackerel for bait and the majority that used pilchards was much less than the overall difference between Spanish longline and autoline vessels. Russian and Korean vessels had extremely low catch rates compared to other vessels fishing in the same location.

66. It was not possible to reliably determine factors influencing catch rates of rajids in Subareas 88.1 and 88.2 from either fine-scale or observer data because a high proportion of

rajids are cut free and released at the surface and these are not accurately recorded or reported in either dataset (paragraphs 42 to 53). However, there was no obvious difference in by-catch rates of rajids between autoline and Spanish longline vessels.

67. Higher macrourid by-catch was also observed for autoline vessels fishing for *D. eleginoides* in the South Atlantic outside the Convention Area (V. Leptikhovskiy, Falkland Islands Fisheries Department, pers. comm.). From 1995 to 2000, observer records showed that macrourids made up 21.7% of the catch taken by autoline vessels, but only 10.5% of the catch taken by Spanish longline vessels. Rajids made up 5.4% of the catch of autoline vessels and 6.9% of the catch of Spanish longline vessels from 1995 to 2000.

68. The subgroup welcomed these contributions and considered explanations which may account for the differences in by-catch rates between vessels.

69. One potential biological explanation for the observed difference in by-catch rates of macrourids between the two line configurations is that hooks on an autoline will tend to be closer to the bottom. This is particularly true for autolines with integrated weighted lines (IWLs). Several of the vessels with high macrourid catch rates in Subareas 88.1 and 88.2 are known to use IWLs. WG-FSA-05/24 attempted to examine the influence of IWLs on macrourid catch rates, but there were insufficient data about when vessels began using IWLs.

70. The subgroup suggested that, if hooks are closer to the bottom, higher catch rates of rajids on autolines than on Spanish longlines could be expected. This did not seem to be the case in Subareas 88.1 and 88.2 (WG-FSA-05/24).

71. The subgroup noted that the use of integrated line weighting was not currently recorded as part of the fine-scale data for longlines and recommended that this option be added to the C2 data form.

72. Size and type of bait may also affect catch rates of by-catch species. Dr D. Agnew (UK) informed the subgroup that preliminary results from the longline fishery in Subarea 48.3 suggested that fishing area, vessel, depth and bait were all significant factors in influencing rajid catch rates.

73. Some vessels had much lower rates of by-catch than other vessels fishing in the same area in Subarea 88.1 (WG-FSA-05/24). The subgroup urged Members to describe aspects of their gear or fishing behaviour which may have led to this very low by-catch.

74. The subgroup suggested that an experimental approach might also be used to investigate potential methods of reducing by-catch. It recalled that, in 2004, Russia proposed conducting an experimental set-up of combined bottom-vertical longlines for the exploratory fisheries for *D. mawsoni* in Subareas 88.1 and 88.2 in order to determine whether *D. mawsoni* occur in the meso- and bathypelagic areas (SC-CAMLR-XXIII/BG/19). This experiment was not carried out in 2004/05, but the subgroup encouraged work of this kind, noting that it would also improve understanding about the behaviour and vulnerability of by-catch species.

75. It might be possible to reduce by-catch of macrourids in Subareas 88.1 and 88.2 by avoiding fishing in the depth ranges and areas where by-catch rates are highest. However, the

subgroup noted that there is a considerable overlap with the spatial and depth distribution of *Dissostichus* spp. and area and/or depth restrictions would also impact the ability of the fleet to catch *Dissostichus*.

Release of rajids

76. In 2002, WG-FSA noted that information was required on (SC-CAMLR-XXI, Annex 5, paragraph 5.196):

- the vulnerability of rajids to capture
- methods for adequately assessing survivorship of animals released
- methods for handling rajids that maximise survivorship
- methods for adequately documenting the biological characteristics, including size, of rajids hooked but not landed.

77. Data from Members indicated that large numbers of rajids are cut off longlines (paragraphs 47 and 48). The effectiveness of releasing rajids as a mitigation measure will depend very strongly on the survivorship of released animals. In the absence of information on survivorship of cut-off rajids the effectiveness of this type of mitigation measure is unknown.

78. No new information on the survivorship or vulnerability of rajids was available at WG-FSA-05. The subgroup noted that estimates of survivorship of rajids cut from longlines are limited and encouraged Members to undertake further survivorship experiments in the future.

79. Dr Agnew informed the subgroup that the UK was continuing with its program of research on rajids at South Georgia following on from that previously reported in Endicott and Agnew (2004). This program includes assessment of discard survivorship, species distribution, abundance, growth and maturity. Initial results had confirmed the general pattern of decreasing survivorship with increasing depth reported in Endicott and Agnew (2004). Research is continuing, and when completed will be reported to WG-FSA.

80. Research is also required on methods for handling rajids that maximise survivorship (SC-CAMLR-XXI, Annex 5, paragraph 5.196). Mr J. Fenaughty (New Zealand) described a method for releasing rajids from New Zealand longliners that attempts to maximise survivorship. A small cutting knife attached to the end of a long tagging pole cuts the snood to release the rajid at water level. Damage to mouthparts is reduced as rajids are not hauled upwards. The subgroup encouraged Members to document methods for releasing rajids that maximise survivorship.

81. WG-FSA-05/70 described a sampling program conducted by one longline vessel in Division 58.5.2 where observers were asked to sample 10 sequential rajids per longline set for biological analysis, with over 1 000 rajids sampled for length, weight, sex, maturity and age. The subgroup noted that this type of sampling strategy could be undertaken in conjunction with assessments of rajid condition and other biological data collection.

82. The subgroup recommended that a relaxation of the requirement to cut all rajids from longlines be applied in the case where observers carried out specific tasks to gather more information on rajids during their biological sampling period. Examples of tasks include:

- (i) biological data collection – i.e. measurements of length, weight, sex, maturity, stomach contents and vertebral columns/thorns for age analysis;
- (ii) landing rajids in order to assess condition, as if these animals had been released whilst still in the water. It would be necessary to observe the hauling and landing procedure to ensure that injuries were not sustained through hauling;
- (iii) assessing the probability of detecting tagged rajids. It may be difficult to detect tagged animals that are released whilst in the water, particularly in rough sea states.

83. These tasks could be carried out independently of one another, although the subgroup recommended that, if rajids are to be sacrificed for biological data collection, that the observers assess the condition of the animal prior to sampling (paragraph 87). An indicative number of rajids could be 10 sequential animals per longline set, with samples to be taken randomly throughout the line, however in cases where few rajids were caught this figure may need to be revised.

84. The current observer form requires the observers to assess the release condition of rajids cut from longlines in one of the following three categories:

- (i) dead
- (ii) injured and unlikely to survive
- (iii) alive and likely to survive.

85. The subgroup noted very little useable data had been returned on rajid condition. It suggested that the quality of the information might be improved by providing more detailed descriptions about the type of injuries in each category.

86. The subgroup further noted that it is extremely difficult to assess the condition of rajids whilst still in the water. It recommended that observers discontinue assessing the condition of rajids released from longlines whilst in the water and instead assess the condition of rajids brought on board during an experimental sampling period (paragraph 83) as if they were going to be released. Careful observation by observers during hauling would be required to ensure that injuries to rajids were not sustained during hauling or landing operations. If a rajid was observed to be damaged during hauling or landing then the condition of this rajid should not be included in the dataset.

87. The subgroup recommended that the following four categories and descriptions (adapted from Endicott and Agnew, 2004), be adopted in the observer protocol for assessing condition of rajids once brought on board the vessel:

1. Rajid is dead. No movement of spiracles (gill openings). No response when touched.

2. Rajid is alive. Life-threatening injuries. Examples of injuries are crushed or missing jaws/mouthparts, prolapsed intestines, severely ripped muscles in the oesophagus and mouthparts.
3. Rajid is alive. Injuries serious enough to possibly reduce survival post release. Examples of injuries include large areas of ripped soft tissue in the oesophagus and mouthparts, and small areas of ripped muscle.
4. Rajid is alive and in good condition or may have some small injury that is not deemed to be life threatening. Examples include small areas of observed ripped tissue and muscles of the pectoral fins; hook puncture wounds in the soft tissue of the mouthparts.

88. The subgroup noted that observers may have trouble distinguishing between categories 2 and 3 and recommended that further work be undertaken during the intersessional period to improve the description of these categories or provide alternative assessments of condition. Suggestions included: providing to observers example photographs of different types of injuries or providing a checklist or table of different injuries that allows for various combinations of injury types.

89. The subgroup recognised that the observers already have an extensive workload at sea and suggested that information on release condition is not necessary for all observed rajids. Rather, the subgroup recommended that data on release condition are accurately recorded for at least one observation period every 48 hours (paragraph 53).

90. In addition to an assessment of rajid condition, observers should be encouraged to collect data for biological measurements on length, weight, sex, maturity and vertebral column samples for age analysis from retained rajids.

MANAGEMENT ADVICE

91. Management advice is provided in section 6 of the main text of WG-FSA's report.

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Table 1: Estimates of total abundance in tonnes (CV in parentheses) of rajids by species by year from trawl surveys in Division 58.5.2 (from WG-FSA-05/70).

Survey year	<i>B. irrasa</i>	<i>B. eatonii</i>	<i>B. murrayi</i>	<i>Bathyraja</i> spp.	Total
2005	1 039 (0.357)	3 549 (0.309)	59 (0.261)	-	4 647
2004	376 (0.442)	536 (0.547)	1 165 (0.266)	-	2 076
2002	888 (0.586)	2 652 (0.362)	713 (0.214)	-	4 253
2001	2 760 (0.473)	2 091 (0.282)	359 (0.387)	79	5 289
1999	1 148 (0.409)	1 923 (0.433)	154 (0.338)	-	3 225
1993*					2 370
1992*					10 507
1990*					5 372
Average	1 242	2 150	490	-	4 717

* Analyses of early surveys were not separated by species.

Table 2: By-catch estimates from longline fisheries for the 2004/05 season. The table provides information for macrourids, rajids and other species (including other managed species), and is derived from fine-scale (haul-by-haul) data. Catches are given in tonnes and as a percentage of the catch of *Dissostichus* spp. TOP – *Dissostichus eleginoides*, TOT – *Dissostichus* spp. Rajids cut from longlines and released are not included in these estimates. Data for some areas are incomplete because fisheries were ongoing at the time of the meeting.

Area	Target species	<i>Dissostichus</i> catch (tonnes)	Macrourids		Rajids		Other	
			Catch (tonnes)	%	Catch (tonnes)	%	Catch (tonnes)	%
48.3	TOP	3029.5	120.7	4.0	8.4	0.3	19.7	0.7
48.4	TOP	26.9	3.4	12.8	0.0	0.0	0.4	1.4
48.6	TOT	49.4	5.8	11.8	0.0	0.1	0.1	0.2
58.4.1	TOT	479.7	16.9	3.5	0.1	0.0	1.4	0.3
58.4.2	TOT	111.3	17.8	16.0	2.3	2.1	2.3	2.0
58.4.3a	TOT	105.3	1.8	1.7	16.7	15.9	2.1	2.0
58.4.3b	TOT	297.5	6.6	2.2	5.6	1.9	0.5	0.2
58.5.1	TOP	3185.5	485.4	15.2	724.3	22.7	11.1	0.3
58.5.2	TOP	665.2	71.7	10.8	8.4	1.3	2.9	0.4
58.6*	TOP	385.0	95.8	24.9	70.2	18.2	55.0	14.3
88.1	TOT	3064.9	461.9	15.1	68.9	2.2	24.4	0.8
88.2	TOT	418.7	20.6	4.9	0.0	0.0	3.5	0.8

* Only includes French EEZ in Subarea 58.6.

Table 3: By-catch estimates from trawl fisheries for the 2004/05 season. The table provides information for macrourids, rajids and other species (including other managed species), and is derived from fine-scale (haul-by-haul) data. Catches are given in tonnes and as a percentage of the catch of the target species. ANI – *Champscephalus gunnari*, KRI – *Euphausia superba*, TOP – *Dissostichus eleginoides*. Data for some areas are incomplete because fisheries were ongoing at the time of the meeting.

Area	Target species	Target catch (tonnes)	Macrourids		Rajids		Other	
			Catch (tonnes)	%	Catch (tonnes)	%	Catch (tonnes)	%
48.2	KRI	41 183.4	0.0	0.0	0.0	0.0	0.6	0.0
48.3	KRI	23 199.2	0.0	0.0	0.0	0.0	0.0	0.0
48.3	ANI	200.9	0.0	0.0	0.2	0.1	28.5	14.2
58.5.2	ANI	1 790.8	0.0	0.0	5.1	0.3	36.1*	2.0
58.5.2	TOP	2 144.5	2.2	0.1	3.4	0.2	10.0	0.5

* Excludes by-catch of *D. eleginoides* of 93.9 tonnes.

Table 4: Number and fate of rajids reported by observers on the L11 observer form for 2004/05. Data for some areas are incomplete because fisheries were ongoing at the time of the meeting.

Fate	Area					
	58.4.1	58.4.3a	58.4.3b	58.5.2	88.1	88.2
Cut off line (snood cut)	39	116	26	6927	741	4
Shaken or gaffed off line	0	148	0	-	0	0
Retained	0	0	0	643	208	1
Landed then discarded	0	82	23	-	0	0
Lost at surface or dropped off	0	0	0	-	33	0
Tagged and released	0	0	0	1149	86	0
Unknown	0	2	0	-	16	0
Total	39	348	49	8719	1084	5

Table 5: Risk categorisation for *Macrourus whitsoni* in Subareas 88.1 and 88.2 (from WG-FSA-05/21).

Life history characteristics	
Geographical distribution	<p><i>M. whitsoni</i> is found throughout the Southern Ocean and on the continental slopes of Antarctica (Gon and Heemstra, 1990).</p> <p>In the Ross Sea, <i>M. whitsoni</i> appears to be concentrated along the continental slope. Catch rates in the toothfish longline fishery are highest in SSRUs 881E, G, H, I and K and 882E but lower in the northern and southern SSRUs (WG-FSA-04/20).</p>
Depth distribution	<p>Depth range from about 400 m to over 3 000 m, but most often found in depths of 600–1 500 m (Gon and Heemstra, 1990).</p> <p>Over 95% of rattails caught in the longline fishery in the Ross Sea are taken from depths of 600–1 500 m (WG-FSA-05/22).</p>
Age/growth	<p>Appears to be a slow-growing and long-lived species, living to at least 55 years (Marriott et al., 2003). Females appear to attain a larger size at age than males. Von Bertalanffy parameters are L_{∞} 76.12, K 0.065 and t_0 -0.159 for males and L_{∞} 92.03, K 0.055 and t_0 0.159 for females (WG-FSA-05/20), where L_{∞} is expressed as TL length in cm.</p> <p>Estimates of M based on the oldest 1% of aged individuals were 0.08 for males and 0.09 for females (Marriott et al., 2003). However, because the longline fishery is unlikely to provide an unbiased estimate of population numbers at age, these estimates are very uncertain. Marriott et al. (2003) recommend a range of M from 0.05 to 0.12.</p>
Reproduction	<p>Observers have recorded fish with ripe gonads throughout the period of the fishery in December–March. Some spent females have also been recorded during this period (Marriott et al., 2003; WG-FSA-04/89).</p> <p>Estimates of TL at 50% maturity are 38.8 cm for males and 46.4 cm for females, corresponding to mean age-at-maturity of 10.6 years for males and 13.6 years for females (WG-FSA-05/20).</p>
Diet	<p>Feeds on pelagic crustaceans (especially euphausiids), small fish and polychaetes (Gon and Heemstra, 1990).</p>
Vulnerability to fishing	
Overlap between distribution and fishing	<p>Occurs mostly within the depth range and area of the longline fishery in the Ross Sea.</p>
Co-occurrence with exploited species	<p>Overlap in geographical and depth distribution with <i>Dissostichus</i> spp. <i>Macrourus whitsoni</i> is the most important prey species of <i>D. mawsoni</i> caught in the Ross Sea (Fenaughty et al., 2003).</p>

(continued)

Table 5 (continued)

Trawl or longline catchability	<p>Few small fish (less than 40 cm TL and about 9 years old) are taken in the longline fishery, probably because of selectivity related to hook size. Smaller specimens were caught in research trawls, especially around the Balleny Islands (WG-FSA-05/20).</p> <p>TL of 50% selectivity estimated as 44–47 cm (SC-CAMLR-XXII, 2003).</p>
Catch	<p>Total catch in the Ross Sea has increased from 9 tonnes in 1997/98 to 482 tonnes in 2004/05 (WG-FSA-05/22). Contributes 4–16% of the total longline catch by weight.</p>
Population status	<p>Population status is unknown.</p> <p>No assessments have been carried out of the impact of the target toothfish fishery on <i>M. whitsoni</i>. The estimate of the precautionary pre-exploitation harvest level (γ) based on biological data was 0.01439 (SC-CAMLR-XXII, 2003). This indicates that this species has relatively low productivity and thus may be vulnerable to overexploitation.</p> <p>There is no evidence for a decline in standardised CPUE over the course of the fishery (WG-FSA-05/24). Unstandardised longline catch rates of <i>M. whitsoni</i> by autoline vessels <i>Janas</i> and <i>San Aotea II</i> in the Ross Sea (<i>Janas</i> = 0.053 kg/baited hook, <i>San Aotea II</i> = 0.036 kg/baited hook) were twice as high as by-catch rates of <i>Macrourus</i> spp. by the same vessels in other CCAMLR areas (<i>Janas</i> in Division 58.5.2 = 0.024 kg/baited hook, <i>San Aotea II</i> in Subarea 48.3 = 0.017 kg/baited hook).</p> <p>Mean trawl catch rates of <i>M. whitsoni</i> deeper than 600 m in SSRUs 881H and E during the BioRoss survey in 2004 were 4 235 kg/km² ($n = 6$) and 103 kg/km² ($n = 4$) respectively. The mean catch rate in SSRU 881H was an order of magnitude greater than the estimate of the mean density of <i>Macrourus</i> spp. (176 kg/km²) from a research trawl survey of BANZARE Bank (van Wijk et al., 2000). WG-FSA decided that trawl catch rates from the BioRoss survey did not provide good estimates of B_0 for <i>M. whitsoni</i> in SSRUs 881H and E because the small number of stations did not provide a representative sample of the overall area in the depth range 600–1 800 m in each SSRU (SC-CAMLR-XXIII, 2004).</p>

(continued)

Table 5 (continued)

Conservation measures and mitigation	<p>A total catch limit of 520 tonnes in Subarea 88.1 and 60 tonnes in Subarea 88.2 in 2004/05.</p> <p>Catch limits in each SSRU are based on the following rule from Conservation Measure 33-03 (2004): <i>Macrourus</i> spp. 16% of the catch limit of <i>Dissostichus</i> spp. or 20 tonnes whichever is greater. The 16% ratio of the catch limit of <i>Macrourus</i> spp. to the catch limit of <i>Dissostichus</i> spp. is based on the ratio of the by-catch limit for <i>Macrourus</i> spp. to the catch limit for <i>Dissostichus</i> spp. in Division 58.5.2 in 2002/03 (CCAMLR-XXI, 2002).</p> <p>There is also a ‘move-on’ rule, which requires a vessel to move to another location at least 5 n miles distant if the by-catch in any one haul is greater than 1 tonne. The vessel is not allowed to return to any point within 5 n miles of the location where the by-catch exceeded 1 tonne for a period of at least five days (Conservation Measure 33-03 (2004)).</p>
Category	<p>2–3</p> <p>Although life history characteristics may make this species vulnerable to overfishing, catch rates in the toothfish fishery have not declined, juveniles are not selected by the fishery, and comparison of longline and trawl catch rates with other Antarctic areas suggest that the population in the Ross Sea may be relatively large.</p>

Table 6: Risk categorisation for *Amblyraja georgiana* in Subareas 88.1 and 88.2 (from WG-FSA-05/21).

Life history characteristics	
Geographical distribution	<p><i>Amblyraja georgiana</i> is abundant on the shelf and upper slope around South Georgia (Gon and Heemstra, 1990; WG-FSA-03/59). In the Ross Sea, <i>A. georgiana</i> is one of the two main skate species (with <i>Bathyraja eatonii</i>) caught in the toothfish fishery. Catch rates of skates are highest along the shelf edge in SSRUs 881E–J, and lower in the northern and southern SSRUs in Subarea 88.1, and in Subarea 88.2 (WG-FSA-05/22).</p> <p>Recovery of tagged skates suggests that there is only limited movement in the Ross Sea (WG-FSA-02/42). Fourteen recaptures of <i>A. georgiana</i> were reported by WG-FSA-02/42. Most (12) were in-season recaptures, with a period at liberty of 10–120 days, moving between 9 and 74 km. The longest period at liberty was 733 days, during which the individual only moved about 7 km.</p> <p>Preliminary DNA results indicate that <i>A. georgiana</i> in the Ross Sea is one species, but the genetic relationship with <i>A. georgiana</i> and another recently described species (<i>Amblyraja</i> sp. anon) in the Atlantic is unknown (WG-FSA-04/27). Initial comparisons revealed some morphological differences between specimens of <i>A. georgiana</i> from the Ross Sea and South Georgia (WG-FSA-01/45).</p>
Depth distribution	<p>Over 95% of skates caught in the longline fishery in the Ross Sea are taken from depths of 600–1 300 m, with highest catch rates from 800–1 100 m (WG-FSA-05/22). Only three specimens of <i>A. georgiana</i> were caught during the BioRoss trawl survey in 2004, and none were caught shallower than 500 m. Around South Georgia, <i>A. georgiana</i> is frequently caught as shallow as 150 m (WG-FSA-03/59).</p>
Age/growth	<p>Longevity of <i>A. georgiana</i> is estimated as at least 14 years based on caudal thorn bands (WG-FSA-04/29). However this should be regarded as a conservative estimate because of the possibility that thorn growth ceases in large individuals.</p> <p>There are no obvious differences in growth between the sexes. Von Bertalanffy growth parameters were estimated as L_{∞} 70.8, K 0.308 and t_0 1.10 for both sexes combined (WG-FSA-04/29), where L_{∞} is expressed as pelvic length in cm. This growth rate is moderately fast compared with other skates.</p> <p>WG-FSA noted that these estimates of age and growth were unreliable due to the uncertain and unvalidated age estimates (SC-CAMLR-XXIII, 2004). The relatively fast growth rates reported for <i>A. georgiana</i> also contrasted with the much slower growth by tagged <i>B. eatonii</i> in Division 58.5.2 (WG-FSA-04/68).</p>

(continued)

Table 6 (continued)

Reproduction	<p><i>Amblyraja georgiana</i> is oviparous. The timing of spawning in the Ross Sea is unknown. Egg cases and newly hatched juveniles have been caught during trawl surveys around South Georgia in January (e.g. WG-FSA-03/59).</p> <p>The total length at 50% maturity for male <i>A. georgiana</i> from the Ross Sea is about 92 cm (64 cm pelvic length), and females appear to mature at a slightly greater total length of 95–100 cm (66–69 cm pelvic length) (WG-FSA-03/42).</p>
Diet	Diet is unknown.
Vulnerability to fishing	
Overlap between distribution and fishing	Occurs mostly within the depth range and area of the longline fishery in the Ross Sea.
Co-occurrence with exploited species	Overlap in geographical and depth distribution with <i>Dissostichus</i> spp.
Trawl or longline catchability	Most skates caught in the longline fishery in the Ross Sea are between 40 and 120 cm total length, with a median of 92 cm.
Catch	Reported catch of skates in the Ross Sea has ranged from 5 tonnes in 1997/98 to 66 tonnes in 2004/05, of which <i>A. georgiana</i> is the major component (WG-FSA-05/22). The reported catch of skates is underestimated since 2000 due to a tagging program and a by-catch mitigation program. In both programs, skates are returned to the water and are not usually reported in catch and effort (C2) data. Skates made up 9–10% of the total catch by weight in the Ross Sea in 1997/98 and 1998/99.
Population status	<p>Population status is unknown.</p> <p>No assessments have been carried out of the impact of the target toothfish fishery on <i>A. georgiana</i>. There is insufficient information to estimate the precautionary pre-exploitation harvest level (γ) because of uncertain and unvalidated age estimates.</p> <p>CPUE cannot be used to monitor abundance because of inadequate reporting of skates that are cut-off longlines and released (WG-FSA-05/24).</p> <p>Insufficient skates have been tagged and recaptured to estimate abundance. There is also considerable uncertainty about survival following release, tag retention, tag detection and catch reporting (WG-FSA-05/22).</p>

(continued)

Table 6 (continued)

Conservation measures and mitigation	<p>A total catch limit of 163 tonnes in Subarea 88.1 and 50 tonnes in Subarea 88.2 in 2004/05.</p> <p>Catch limits in each SSRU are based on the following rule from Conservation Measure 33-03 (2004):</p> <ul style="list-style-type: none"> • skates and rays 5% of the catch limit of <i>Dissostichus</i> spp. or 50 tonnes whichever is greater. <p>There is also a ‘move-on’ rule which requires a vessel to move to another location at least 5 n miles distant if the by-catch in any one haul is greater than 1 tonne. The vessel is not allowed to return to any point within 5 n miles of the location where the by-catch exceeded 1 tonne for a period of at least five days (Conservation Measure 33-03 (2004)).</p> <p>Vessels are advised that, where possible, they should cut all skates from their lines whilst still in the water, except on the request of the observer during the observer’s biological sampling period. Tagging in the Ross Sea (WG-FSA-02/42) and in other Antarctic areas (e.g. Division 58.5.2, WG-FSA-04/68) has shown that some skates survive the capture and release event, but survivorship may be depth related (Endicott and Agnew, 2004)</p>
Category	<p>3</p> <p><i>Amblyraja georgiana</i> likely have a limited reproductive potential and other life history characteristics, such as limited movement, that may make them vulnerable to overfishing. The risk to <i>A. georgiana</i> is mitigated due to a CCAMLR program to cut all skates from longlines whilst still in the water and release them.</p>

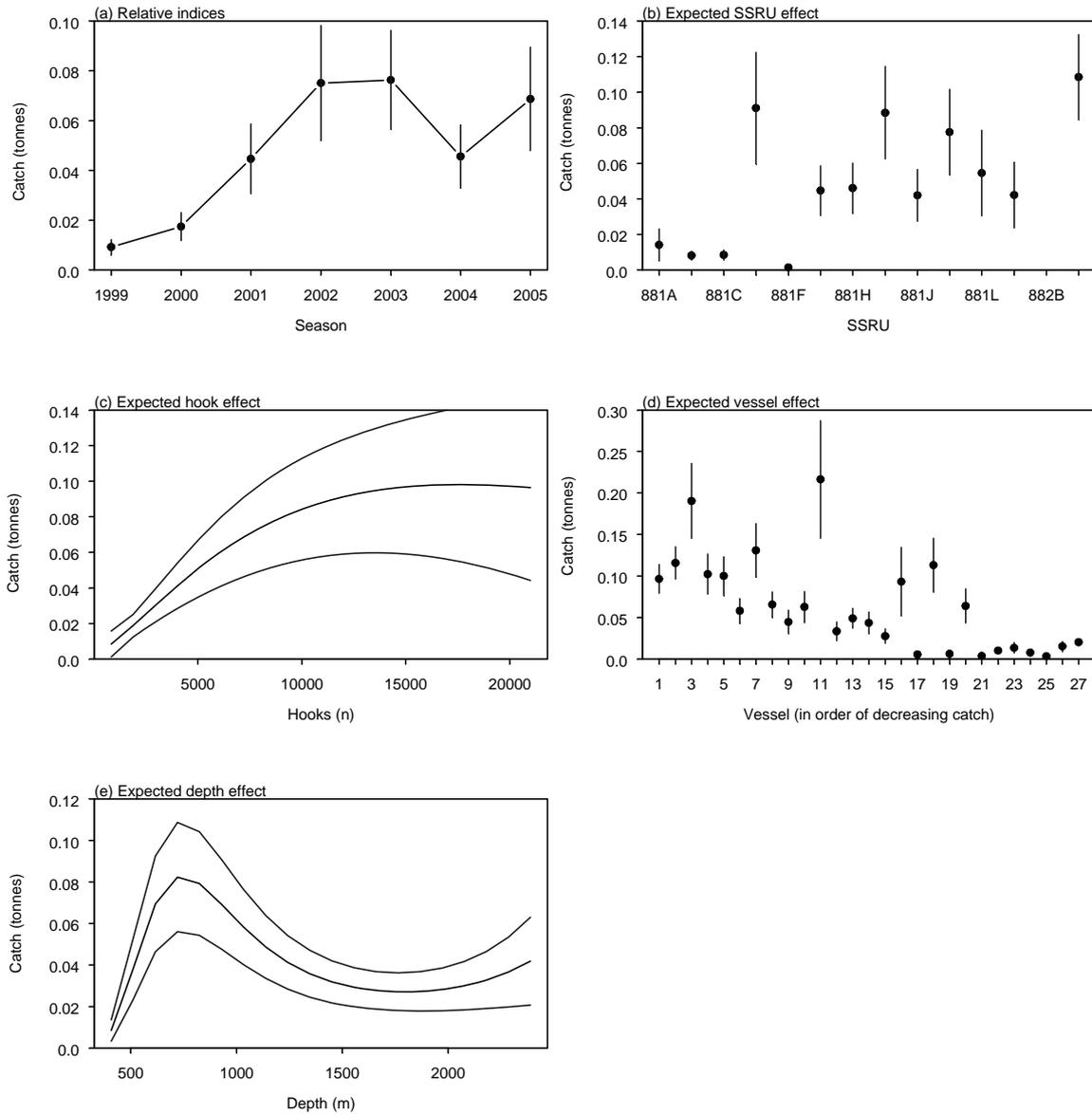


Figure 1: Expected catch of rattails (tonnes) for median values of fixed parameters from all vessels involved in the exploratory fishery for toothfish in Subareas 88.1 and 88.2 from 1998/99 to 2004/05 showing effects of: (a) year, (b) area, (c) number of hooks, (d) vessel and (e) depth. Outer lines indicate approximate 95% confidence intervals (from WG-FSA-05/24).

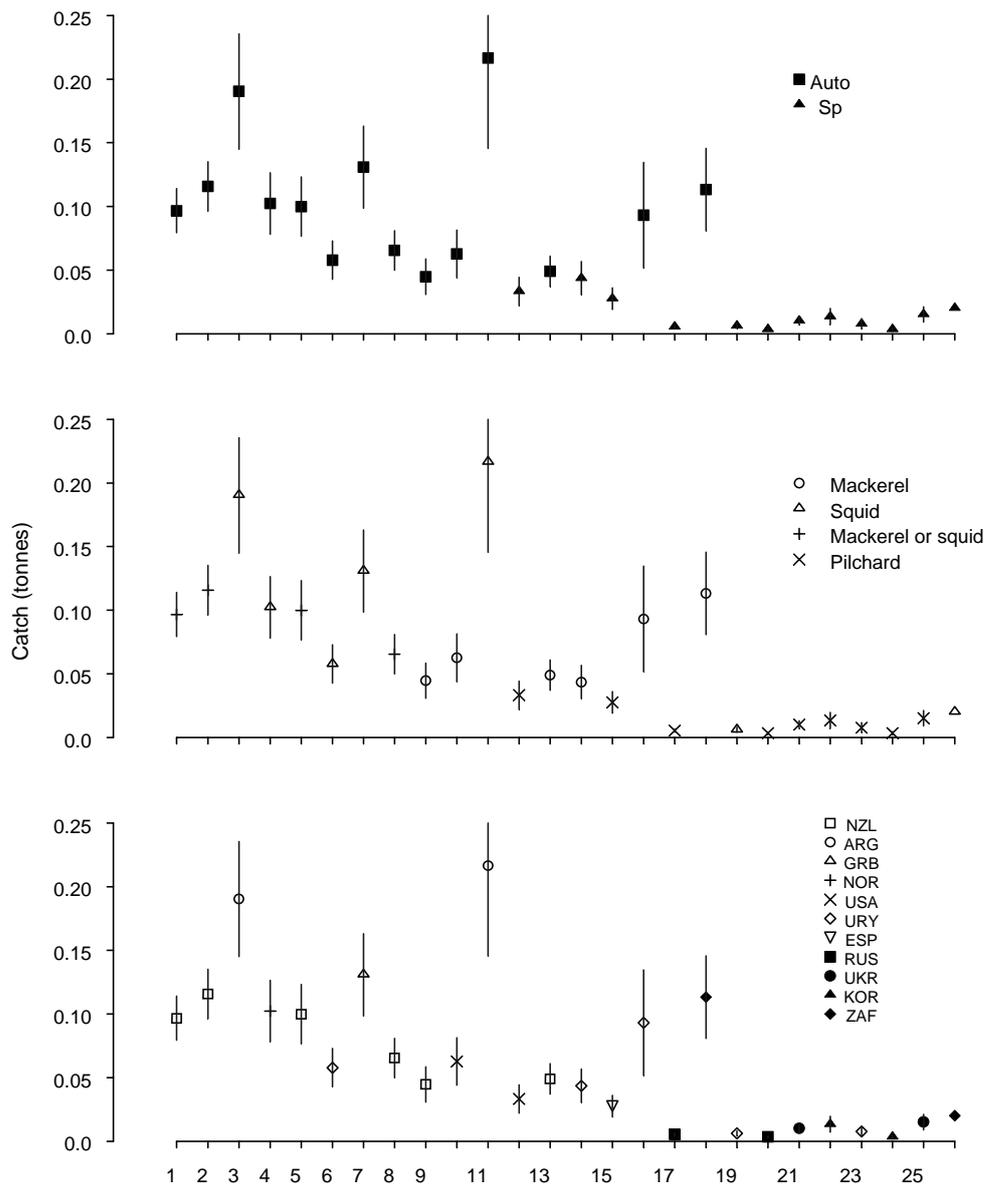


Figure 2: Expected catch (tonnes) of rattails for median vessel effects (in order of decreasing rattail catch) using the lognormal model for all vessels involved in the exploratory fishery for toothfish in Subareas 88.1 and 88.2 from 1998/99 to 2004/05. Plots are labelled with longline type (autoline or Spanish line), bait species and vessel nationality. Lines indicate approximate 95% confidence intervals (from WG-FSA-05/24). NZL – New Zealand, ARG – Argentina, GRB – United Kingdom, NOR – Norway, USA – United States of America, URY – Uruguay, ESP – Spain, RUS – Russia, UKR – Ukraine, KOR – Republic of Korea, ZAF – South Africa.

**INCIDENTAL MORTALITY OF MAMMALS AND SEABIRDS
ASSOCIATED WITH FISHING (AD HOC WG-IMAF REPORT)**

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INCIDENTAL MORTALITY OF MAMMALS AND SEABIRDS ASSOCIATED WITH FISHING (AD HOC WG-IMAF REPORT)

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 2004/05 (SC-CAMLR-XXIII, Annex 5, Appendix D). The report contained records of all activities planned and results of their completion 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 activities and the technical coordinators for their extensive support. It also thanked the Scientific Observer Data Analyst for his work on the processing and analysis of data submitted to the Secretariat by international and national observers during the course of the 2004/05 fishing season.

3. The Working Group concluded that most tasks planned for 2004/05 had been successfully implemented. The list of current intersessional tasks was reviewed and a number of changes were agreed in order to consolidate specific tasks in future plans. The Working Group agreed that the plan of intersessional activities for 2005/06, compiled by the co-conveners and the Science Officer, be appended to its report (SC-CAMLR-XXIV/BG/28).

4. The Working Group noted that no intersessional work took place on issues identified last year on the development of the *Scientific Observers Manual* (SC-CAMLR-XXIII, Annex 5, Appendix D, task 6.6), however, the work proposed by WG-IMAF was subject to plans for a major review of the *Scientific Observers Manual* which had not yet been finalised by the Scientific Committee and its working groups. If required, this task could be carried forward to the next intersessional period.

5. The Working Group especially welcomed to the meeting Drs R. Mattlin (New Zealand) and J. Pierre (New Zealand) and Mr W. Papworth (ACAP) who were attending the meeting for the first time. The Working Group continued to appreciate Mr M. McNeill's (New Zealand) expert advice on operational aspects of fishing and encouraged analogous input from other Members, including in relation to trawl fisheries. Members were asked to review their representation on WG-IMAF intersessionally, to suggest additional members and to facilitate the attendance of their representatives at the meetings.

Incidental mortality of seabirds during regulated longline and pot fishing in the Convention Area

6. Data were available from all 31 longline cruises conducted within the Convention Area during the 2004/05 season (WG-FSA-05/7 Rev. 1).

7. The Working Group noted that the proportions of hooks observed were similar to those observed for last year for Subareas 48.3 (31% (range 20-62) compared with 28% (range 18-50)) and 88.1 and 88.2 (51% (range 23-100) compared with 61% (range 30-99)). For all other areas the observation rates and ranges increased from last year: Subarea 48.6, 31% (one

vessel) compared with 23%; Subarea 58.4, 56% (range 28–94) compared with 39% (one vessel); Division 58.5.2, 36% (range 31–41) compared with 34% (range 33–34); Subareas 58.6 and 58.7, 65% (one vessel) compared with 32% (range 27–37).

8. As usual, the total observed seabird catch rate was calculated using the total number of hooks observed and the total seabird mortality observed (Table 1). The estimated total catch of seabirds by vessel was calculated using each vessel's observed catch rate multiplied by the total number of hooks set.

9. The total number of observed mortalities was 56, and consisted of 6 (11%) yellow-nosed albatrosses, 1 (2%) wandering albatross, 43 (76%) white-chinned petrels and 6 (11%) southern giant petrels. The total extrapolated mortality for 2004/05 was 97 birds split between Subareas 48.3 (13 birds), 58.6 and 58.7 (76 birds), and Division 58.4.1 (8 birds) (Table 2). This was a 65% increase from the extrapolated 58 mortalities for 2003/04. The vast majority of the extrapolated mortality (78%) is attributed to one vessel, *Koryo Maru 11*, fishing in Subareas 58.6 and 58.7.

Mortality during the haul

10. The Working Group noted that extrapolations of incidental mortality combining data from seabirds caught on either the haul or the set are appropriate for quantifying total removals; however, data need to be split between haul and set to allow analysis of mitigation effectiveness.

11. 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 68% of seabird captures in 2004/05 (Table 1). The proportion of seabirds caught on the haul suggests that an increased focus on haul mitigation measures is required.

Subarea 48.3

12. The total extrapolated seabird mortality was 13 birds compared with 27, 8, 27 and 30 birds in the last four years (Table 3). The overall catch rate was 0.0011 birds/thousand hooks compared to the rates of 2004 and 2001 (0.0015 birds/thousand hooks) and the rate for 2003 (0.0003 birds/thousand hooks). The four birds observed killed were southern giant petrels (Table 4). Total extrapolated captures decreased between 2003/04 and 2004/05. Changes in extrapolated capture totals presented to the Working Group in 2005 differed from those presented in 2004 for the 2003/04 year because the 2004 totals were produced using vessel capture rates with three decimal places, compared to using four decimal places in 2003 and 2005.

Subarea 58.4

13. The total extrapolated seabird mortality was eight birds, with a catch rate of <0.001 birds/thousand hooks from one vessel operating in Division 58.4.1 (Table 3). In 2003/04 longline fishing was undertaken for the first time in Subarea 58.4. No mortalities had been reported prior to 2004/05.

South African EEZ in Subareas 58.6 and 58.7

14. The total extrapolated seabird mortality for these subareas was 76 seabirds from the one vessel that fished there. The catch rate for this area was 0.149 birds/thousand hooks, compared to 0.025 and 0.003 in 2003/04 and 2002/03 respectively (Table 3). In earlier years (1997 to 2001) extrapolated mortalities and rates ranged between 834–156 birds and 0.52–0.018 birds/thousand hooks respectively.

Subareas 48.4, 48.6, 88.1 and 88.2 and Division 58.5.2

15. No seabird mortalities on longline vessels were observed in these areas. Incidental mortality of seabirds in Subareas 88.1 and 88.2 has been very low over the past eight years, with only one bird observed killed in 2003/04 (Table 3).

Incidental mortality of seabirds during regulated pot fishing in the Convention Area

16. No incidental mortalities were recorded during fishing for *Dissostichus eleginoides* on two cruises in Subareas 58.6 and 58.7.

Evaluation of levels of incidental mortality

French EEZs in Subarea 58.6 and Division 58.5.1

17. The requested French data for 2000/01 (SC-CAMLR-XXIII, paragraph 5.7) and 2004/05 have been submitted to the Secretariat in tabulated form analogous to the summaries prepared by the Secretariat for the rest of the Convention Area (WG-FSA-05/7 Rev. 1). Dr T. Micol (France) presented the French data on seabird incidental mortality and supporting papers (CCAMLR-XXIV/BG/22, BG/23, BG/24, BG/26 and BG/28).

18. CCAMLR-XXIV/BG/24 presented 2004/05 data involving observations of seabird mortality reported by captains (Tables 7 and 10), and national observers (Tables 8, 9 and 11).

2000/01 fishing season

19. The total reported (by captains) seabird mortality in 2000/01 for Division 58.5.1 was 1 917 birds (Table 5). The corresponding catch rate (reported birds/total hooks set) was 0.092 birds/thousand hooks. Data for Subarea 58.6 were not presented as they have not yet been analysed; these data will be submitted next year.

20. The reported seabird by-catch in Division 58.5.1 comprised 94% white-chinned petrels and 5% grey petrels. The remaining 1% comprised giant petrels, grey-headed albatrosses and black-browed albatrosses (Table 6).

2004/05 fishing season

21. Observers recorded seabird mortality on a proportion of the hooks set in the 2004/05 season. This recording was done in the same way as in the last six months of 2003/04 and differs in only minor detail from CCAMLR observer specifications.

22. The total reported seabird mortality from observers for Subarea 58.6 and Division 58.5.1 was 61 and 1 054 birds respectively (Table 8). The corresponding incidental mortality rates were 0.047 and 0.161 birds/thousand hooks.

23. The total seabird mortality reported by captains in Subarea 58.6 and Division 58.5.1 was 137 and 1 901 birds respectively (Table 7). The corresponding incidental mortality rates were 0.028 and 0.071 birds/thousand hooks.

24. Comparing the full year to last year's data is not possible directly as count methods are different. Data were compared when available in the same format for the same period. March was excluded as a period where 2003/04 data were a mix of both reporting methods. Comparing 2003/04 and 2004/05 for the period from September to February, captains' incidental mortality rates showed a decrease of 35% (0.071 to 0.047 birds/thousand hooks) and 57% (0.126 to 0.055 birds/thousand hooks) respectively in Subarea 58.6 and Division 58.5.1. Comparing 2003/04 and 2004/05 for the period from April to August, observers' incidental mortality rates showed an increase of 87% (0.006 to 0.011 birds/thousand hooks) and 21% (0.058 to 0.070 birds/thousand hooks) respectively in Subarea 58.6 and Division 58.5.1.

25. The discrepancy between the results presented in Tables 7 and 8 was addressed in CCAMLR-XXIV/BG/24. This paper suggested that French fishers should be commended for their degree of application of methods to manage seabird mortality. It also noted the relatively important difference this year between the data from observation of all longlines by captains and data from observation of 25% of lines by observers. The paper suggested that care is required in interpreting the extrapolated results and that the attention of captains may be less focussed on the observation of seabird mortality than that of observers.

26. The Working Group noted that in order to be consistent with CCAMLR procedures, the use of observer data only is recommended. Dr Micol indicated that from 2005/06 all French data on incidental mortality of seabirds will be collected only in a format that allows direct comparison with other CCAMLR areas and other fisheries outside the Convention Area (e.g. WG-FSA-04/72).

27. CCAMLR-XXIV/BG/24 suggested that the reduction to zero of IUU vessels in the French EEZs may have increased the abundance of birds around the small number of remaining authorised vessels, possibly increasing interactions, and thereby counteracting the improvements in mitigation measures.

28. The data on birds recorded by observers can be converted to estimates of total seabird mortality using reported data on the proportion of hooks observed (Table 9). The mean proportions of hooks observed in Subarea 58.6 and Division 58.5.1 were 25.5% ($n = 20$; range 19.3–38.0%) and 24.5% ($n = 26$; range 14.3–31.0%). For the 20 cruises in Subarea 58.6, the observed incidental mortality of 61 birds converts to an estimated mortality of 242 birds (0.049 birds/thousand hooks). For the 26 cruises in Division 58.5.1, the observed incidental mortality of 1 054 birds converts to an estimate of 4 387 birds killed (0.164 birds/thousand hooks).

29. The reported seabird by-catch in Subarea 58.6 comprised 89% white-chinned petrels and 11% grey petrels; in Division 58.5.1 it comprised 94% white-chinned petrels and 6% grey petrels (Table 10). Dr Micol pointed out that no albatrosses were caught during the past two years, probably due to use of mitigation measures such as night setting and use of several streamer lines.

30. The Working Group noted that an important proportion of birds (30%) was caught alive, indicating that they were caught on the haul. It was recognised that, in future, attention to mitigating captures on the haul would be required as part of efforts to achieve a continuing reduction in seabird mortality. The Working Group is in the process of developing improved recommendations for haul mitigation.

31. The Working Group noted that the CCAMLR totals included the dead and mortally injured birds in the ‘total caught dead’ numbers, whereas the French data included only ‘dead’ and ‘alive’ categories, the latter including both mortally injured and live birds. From raw data, 3 of 334 live birds were reported injured, and the remainder were released unharmed. The Working Group recommended the use of the CCAMLR methodology by French observers to allow for better estimates of overall mortality and to facilitate comparison with other fisheries in the Convention Area.

32. The Working Group had traditionally considered that in analogous CCAMLR areas, 25% of hooks observed was acceptable for the purposes of monitoring seabird incidental mortality rates and estimating total captures. However, for new and exploratory fisheries in high-risk areas, 40–50% hooks observed is suggested (SC-CAMLR-XXIII, Annex 5, Table 7.17) and this may be more appropriate in the circumstances of this fishery of high incidental mortality rates. Dr Micol indicated that increasing these rates may not be compatible with other observer tasks.

33. The Working Group noted that higher levels of coverage of hauls within a trip may also be needed to provide robust estimates of capture rates and their variances. The Working Group suggested that methods similar to those developed in WG-FSA-05/50 might be useful in this context.

34. The Working Group noted that there was considerable variation between vessels in the levels of reported seabird incidental mortality (Table 9). In Subarea 58.6, 120 birds (49% of the total) were reported from *Ship 3* (53 birds) and *Ship 6* (67 birds). In Division 58.5.1, 2 517 birds (57% of the total) were taken by *Ship 6* (1 403 birds) and *Ship 7* (1 114 birds).

35. Only one French vessel (*Ship 11*) was using integrated weighted lines (IWLs) for all sets, with an estimated 210 birds caught. This is a lower number than the other vessels in the same fishery but a higher rate (0.065 birds/thousand hooks) than catch rates of vessels using IWLs observed in other fisheries (0.01 birds/thousand hooks; WG-FSA-04/72).

36. CCAMLR-XXIV/BG/28 pointed out that new regulations entered into force in the French EEZ on 1 September 2005; and followed recommendations from the Scientific Committee (SC-CAMLR-XXIII, paragraph 5.7):

- (i) weighting regimes as specified in Conservation Measure 25-02 are now applicable to autoliners, with fishers obliged to comply fully by 1 January 2006;
- (ii) at least two streamer lines meeting the CCAMLR specification are compulsory. Some vessels use up to seven streamer lines;
- (iii) in 2004/05 all vessels had observers on board who observed 25% of hooks set. This level of observer effort will be continued in 2005/06;
- (iv) closure of Division 58.5.1, classified as a high-risk area, is maintained in February during the main seabird breeding season.

In addition, the discard of hooks is now forbidden, as is the use of black lines which were shown to catch more birds than white lines in the analysis of 2001–2003 data by Delord et al. (2005). Dr Micol indicated that as a result of the new regulations set out in CCAMLR-XXIV/BG/28, all vessels would use integrated line-weighting gear from 1 January 2006. The Working Group commended this initiative.

37. CCAMLR-XXIV/BG/22 discussed measures used by fishers to mitigate incidental mortality in the French EEZs. Among new measures, a new hook design will be tested as well as reconstituted coloured baits. Only the autoline vessel using Mustad gear has a lineshooter. As this equipment appears to decrease incidental mortality, other vessels will adopt it as soon as such gear is commercially available. New laser technology is also currently under trial as a potential deterrent to birds.

38. The Working Group noted that better understanding of the continuing high rates of seabird incidental mortality in the French EEZs would require a thorough analysis of recent data, similar to that carried out by Delord et al. (2005). This should assist in allowing further improvements to be made in reducing mortalities in the French EEZ fisheries.

39. The Working Group recommended that analysis of the 2005 data should include:

- (i) consideration, as feasible, 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 or wind, observer and vessel;

- (ii) special attention to circumstances associated with sets or hauls where a large number of birds are caught.

40. It was requested that France report the results of this analysis to the next meeting of the Working Group.

41. Future analyses should also take account of the life status (alive, dead, injured) and mode of capture (e.g. hooked, foul-hooked, entangled) of the birds. Use of the CCAMLR definitions to determine the life status of the birds would allow consistent comparison with other Convention Areas of catch rates and circumstances.

42. In addition, the acquisition of data on all variables listed above should be considered in the development of improved data collection protocols for seabird incidental mortality in those areas.

43. The Working Group commended the initiatives taken by France for research and management relating to the incidental mortality of seabirds in its EEZs. It recommended that in future:

- (i) observers continue to be deployed on 100% of vessels;
- (ii) consideration be given to increasing the proportion of hooks observed (e.g. to 40–50%);
- (iii) data collection protocols be improved, including incorporating the CCAMLR distinctions and definitions relating to dead and live seabird by-catch;
- (iv) undertaking appropriate analysis of the 2005 data.

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

44. Information from observer reports relating to the implementation of Conservation Measures 25-01, 25-02 and 25-03 in 2004/05 were provided by the Secretariat in WG-FSA-05/7 Rev. 1, 05/8, 05/9 Rev. 2 and are summarised in Tables 1, 12 and 14 with a comparison with similar data from previous years provided in Table 13.

45. During the meeting, the Working Group undertook an evaluation of the data prepared by the Secretariat on the implementation of Conservation Measures 25-01, 25-02 and 25-03. During this process some examples of potential non-compliance were identified by the Working Group and in some cases corrected following a dialogue between the Secretariat and national coordinators of observer programs. The Working Group agreed that such dialogue may avoid the erroneous interpretation of ambiguous reporting leading to a misrepresentation of the level of compliance by individual vessels.

Conservation Measure 25-01 (1996) 'Regulation of the use and disposal of plastic packaging bands on fishing vessels'

46. Conservation Measure 25-01 requires that the use of plastic packaging bands is restricted to those vessels with on-board incineration facilities and that all bands be cut and disposed of using this facility. Information from observer reports indicated that whilst plastic packaging bands were disposed of appropriately on 10 vessels, on one vessel, the *Punta Ballenas*, some plastic packaging bands were disposed of overboard (WG-FSA-05/9 Rev. 2, Table 1).

Conservation Measure 25-02 (2003) 'Minimisation of the incidental mortality of seabirds in the course of longline fishing or longline fishing research in the Convention Area'

Line weighting – Spanish system

47. For the first time there was 100% compliance with the required line-weighting regime in all subareas and divisions (Table 13).

Line weighting – autoline system

48. All vessels fishing in Subareas 88.1, 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 (WG-FSA-05/9 Rev. 2, Table 6; SC-CAMLR-XXIII, Annex 5, paragraph 7.57).

Night setting

49. In Subareas 58.6 and 58.7, 100% of sets occurred at night, an increase from the 83% night-setting rate last year. In Subarea 48.3, 99% of sets occurred at night (98% in 2004) (Table 13); the *Protegat* undertook six of its 258 sets during the day. In Subareas 48.6, 88.1, 88.2 and Divisions 58.4.2 and 58.4.3b, all vessels demonstrated a consistent minimum line sink rate of 0.3 m/s and hence fished under Conservation Measure 24-02, which provides exemptions to night setting south of 60°S (WG-FSA-05/9 Rev. 2, Table 6).

Offal discharge

50. A single vessel, the *Antarctic III*, was observed discharging offal during one set and one haul in Subarea 88.1; offal discharge is prohibited in this subarea. In Subarea 48.3, the *Jacqueline* was observed discharging offal during one set; offal discharge during setting is prohibited under Conservation Measure 25-02 (Table 1).

Discard of hooks

51. Observers reported hooks being present in discards on six vessels; on three of these this was reported as a rare event. However, the observer report for the *Argos Georgia* indicated that this was a daily occurrence during the first half of the season; following a mid-season crew change the discarding of hooks stopped (WG-FSA-05/9 Rev. 2, Table 1).

Streamer lines

52. Compliance with streamer line design has increased from 64% (28 of 44 cruises) to 74% (23 of 31 cruises) this year, although this is not as high as the 92% (34 of 37 cruises) in 2003 (Table 12).

53. The cruises where streamer lines did not comply failed on streamer line lengths (7 cruises), attachment height (1 cruise), total length (1 cruise) and branched streamer spacing (1 cruise). One vessel failed on three different streamer line specifications (*Viking Bay*) and one vessel did not comply on two specifications (*Punta Ballena*).

54. Vessels fishing in Subareas 48.6, 58.6, 58.7 and Divisions 58.4.2 and 58.4.3b, used streamer lines on all sets. In Subarea 48.3, of 1 847 sets only one was undertaken without using a streamer line (*Protegat*). In Subareas 88.1 and 88.2, the *Antarctic III* undertook a single set without using a streamer line. On some occasions the *Protegat* used non-compliant streamers in Subarea 48.3 (Table 12).

55. Mr McNeill suggested that some instances of non-compliance with respect to streamer line length may result from the use of additional streamers on the seaward part of the line where the distance between the water and the line is less than 1 m, i.e. shorter than the minimum length specified in Conservation Measure 25-02.

56. The Working Group agreed that where the seaward part of the line had additional short streamers attached, in the absence of which the streamer lines would otherwise be fully compliant, measuring and reporting them as the minimum streamer length would provide a misleading indication of non-compliance.

Haul-scaring devices

57. 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.

58. In Subarea 48.3, three vessels (*Jacqueline* (99 %), *Argos Georgia* (91%) and *Viking Bay* (53%)) did not use haul-scaring devices on all the hauls. In Subareas 58.6 and 58.7, 100% of hauls used scaring devices and in Division 58.5.2 the only longline vessel fishing in that area was equipped with a moonpool; hence no devices were required (Table 12).

59. The *Argos Georgia* and the *Viking Bay* were, coincidentally the only two vessels that killed birds in Subarea 48.3 and the detailed status of these birds (Table 12) indicated that they were killed during hauling.

General

60. In its report last year the Commission noted its concern regarding the reduced compliance with several elements of Conservation Measure 25-02 (CCAMLR-XXIII, paragraph 5.6); this year the level of compliance had increased for all elements, in particular in Subarea 48.3 with line weighting increasing to 100% from 87% last year and with overall streamer requirements increasing to 75% from 69% last year (Table 13).

61. The Working Group noted that if compliance with Conservation Measure 25-02 is interpreted strictly (i.e. 100% in all elements of the conservation measure), 12 of 25 vessels (48%) fully complied with all measures at all times throughout the Convention Area. This compares to 33% last year (Tables 1 and 12; WG-FSA-05/9 Rev. 2, Table 1). The fully compliant vessels were the *Argos Helena*, *Arnela*, *Avro Chieftain* (Australia), *Frøyanes*, *Galaecia*, *Globalpesca II*, *Janas*, *No. 707 Bonanza*, *Polarpesca I*, *San Aotea II*, *Shinsei Maru 3* and *Yantar*. As was noted last year, some vessels failed to comply by small margins, and the Working Group recommended that vessels should be advised to exceed the standards to prevent compliance failure (SC-CAMLR-XXIII, Annex 5, paragraph 7.253).

Conservation Measure 25-03 (2003) 'Minimisation of the incidental mortality of seabirds and marine mammals in the course of trawl fishing in the Convention Area'

62. The discharge of offal during the shooting or hauling of trawl gear is prohibited under Conservation Measure 25-03; however, two vessels fishing in Subarea 48.3 discharged offal at these times, the *Robin M Lee* (22% shots) and *InSung Ho* (13% shots and 4% hauls) (Table 14). For both of these vessels the incidence of offal discharge was higher than last year (SC-CAMLR-XXIII, Annex 5, paragraph 7.62).

Research into and experience with mitigation measures

63. WG-FSA-05/13 reported work in progress in an Australian tuna fishery of general relevance to seabird conservation in global tuna fisheries, including fisheries where Convention Area seabirds range. The report described the results of experiments testing the effects of line-weighting regimes and bait types on the sink rate of tuna branchlines. The research plan includes assessment of the effectiveness of bird-scaring streamer lines (in addition to efforts to expedite gear sink rates) as deterrent to *Puffinus* shearwaters, the importance of which was highlighted by the Working Group in 2004 (SC-CAMLR-XXIII, Annex 5, paragraph 7.88). Empirical evidence of the effectiveness of streamer lines as a deterrent to *Puffinus* shearwaters and other deep-diving species, such as white-chinned

petrels, is lacking. The Working Group welcomed progress in developing seabird by-catch mitigation for pelagic longline gear and recognised its importance in efforts to reduce seabird mortality in tuna fisheries operating in the migration ranges of Convention Area seabirds.

64. WG-FSA-05/P8 provided a review of mitigation of seabird–fisheries interactions in New Zealand’s EEZ as well as international and high-seas fisheries with methodological similarities to those in New Zealand. The mitigation method, results of any trials or perceptions of efficacy, costs, benefits and recommendations for future research and management are included. Recommendations for mitigation in pelagic and demersal longline fisheries included: combinations of mitigation are likely to work best; offal (and fish waste) retention, paired streamer lines, line weighting and night setting were the most consistently effective methods at reducing seabird incidental mortality. Future research recommendations include refining existing methods that seem promising such as underwater setting, side setting, and novel methods still in the preliminary stages of testing (e.g. fish oil). The review also emphasised the importance of conducting mitigation research using properly designed controlled experiments.

Proposed research plan for Spanish system line weighting

65. In 2000, the Scientific Committee endorsed further work to develop line-weighting regimes to ensure sink rates that will preclude seabirds accessing bait. Such work could enhance the likelihood of permitting exemption from several of the mitigating measures currently in use in the Convention Area, noting in particular that the ultimate aim in managing seabird by-catch in the Convention Area will be to allow fishing at any time of day without seasonal closure of fishing grounds (SC-CAMLR-XIX, paragraphs 4.40 and 4.41; SC-CAMLR-XIX, Annex 5, paragraph 7.147).

66. WG-FSA-05/12 presented a research plan to improve the seabird by-catch mitigation effectiveness of the Spanish system of longline fishing. The plan also aims to explore methods to reduce the substantial amounts of fishing gear lost (and ghost fishing) by Spanish system vessels in the Convention Area. A similar proposal was submitted in 2001 (WG-FSA-01/29) which recognised that fishing in some high-risk areas of the Convention Area occurs only in winter, a low-risk time of year, and that effectiveness must be determined in high-risk areas at times of high risk to seabirds (e.g. summer).

67. In 2001, the Scientific Committee recommended that Members should accord this proposal high priority, noting its importance as a means to improving Conservation Measure 29/XIX (now Conservation Measure 25-02), and that the research would also contribute to advice on appropriate mitigation measures for use by vessels employing the Spanish system of longlining in other parts of the world, including in areas where birds from the Convention Area are currently being killed in large numbers (SC-CAMLR-XX, paragraph 4.63). The Commission endorsed the Scientific Committee’s recommendation (CCAMLR-XX, paragraph 6.26), but opportunities and resources to conduct the proposed experiment have been lacking until now.

68. WG-FSA-05/12 proposed to conduct an experiment on a chartered vessel in Chile to determine the effects of setting speed, line-weight spacing and weight of line weights on the sink rate of Spanish system longlines. A new weight spacing (30 m) will be tested in an effort

to reduce the degree of lofting of the hookline from that which occurs with 40 m spacings as required by Conservation Measure 25-02. Lofting occurs when Spanish system gear is deployed and the hookline between weights lofts in the propeller turbulence, thereby allowing seabirds access to baited hooks and increasing the likelihood that they will be caught. A new line-weighting spacing/line weight/setting speed combination will then be tested, along with streamer lines, as a deterrent to black-browed albatrosses in the *D. eleginoides* fishery in southern Chile.

69. If the new regime eliminates albatross mortality, it will then be important to test the gear against white-chinned petrels, the most commonly killed seabird in Convention Area fisheries. Reducing white-chinned petrel by-catch is considered the best current indicator for efforts to improve seabird by-catch mitigation effectiveness for Convention Area seabirds.

70. It will be important to test the new line-weighting configuration against white-chinned petrels at a high-risk location in the Convention Area. The exact nature and timing of the tests will become clear following provision of a report from the vessel charter experiment and trial against black-browed albatrosses. Trials against white-chinned petrels in the Convention Area could conceivably take place in a conservative, step-wise manner involving (i) day-setting trials during winter, (ii) night-setting trials in the seabird breeding season, and (iii) day-setting trials in the seabird breeding season. Progress with this series of trials would be contingent on being able to achieve conservative predetermined seabird mortality targets before progressing to the next stage of the trials.

71. The Working Group strongly endorsed the research proposed in WG-FSA-05/12 to reduce seabird mortality in Spanish system fisheries operating in areas where Convention Area seabirds range. It noted that if these trials are successful in Chile, the conduct of subsequent trials in the Convention Area in a high-risk area for incidental mortality of seabirds and at a high-risk time of year would be appropriate.

Factors influencing line sink rate

72. WG-FSA-05/36 determined the '2-m access window', or the distance astern that longline hooks sink to a depth of 2 m, on eight small vessels (>7.9 to 16.8 m) for two demersal gear types (fixed gear and snap-on gear) used in Alaska. Seabirds in Alaska are most vulnerable to hooking while longlines are within 2 m of the surface. The capability of these vessels to deploy streamer lines and buoys according to performance standard guidelines was also determined. Vessel speed was found to be a primary determinant of both the distance astern that longline hooks were accessible to surface-foraging seabirds, and the performance standards of streamer lines. Using gear with similar sink rates, the 2-m access window ranged from 28 to 38 m for vessels setting gear at slower speeds (2 to 3.5 knots) to a mean of 90 m for vessels setting gear at faster speeds (up to 7.4 knots). Given the reduced size of the access window for vessels setting snap-on gear at slow speeds, the reduced aerial extent requirement for this gear type was shown to be justified in terms of risk to seabirds and practical to use, especially with a lighter streamer line.

73. The Working Group noted that these data suggest that ‘the 2-m access window’, which incorporates vessel speed and hookline sink rate into a single measure, provides an improved measure of risk to seabirds rather than sink rate alone, and that vessel speed is an important component of seabird risk to longline gear.

74. The Working Group then analysed vessel speed data for 4 715 longline gear deployments in 2004/05 for both Spanish and IWLs and estimated the 2-m access window for both gear types operating in the Convention Area (Figure 2). Assuming a sink rate to a depth to 2 m of 0.13 m/s for Spanish gear and a sink rate of 0.20 m/s to 2 m for IWLs, IWLs produced access windows that ranged from a low of 20.6 m at the minimum setting speed of 4 knots and a high of 41 m at the maximum setting speed of 8 knots and 32 m at the autoline average setting speed of 6.2 knots. In contrast, Spanish gear produced 2-m access windows ranging from a low of 32 m at the slowest setting speed of 4 knots and a high of 79 m at the maximum setting speed of 10 knots and 60 m at the average setting speed of 7.6 knots.

75. It is clear from this analysis that the 2-m access window, where birds are most vulnerable to hooklines, can vary at least two-fold depending on vessel speed for both gear types and that Spanish longline gear presents more risk to seabirds than IWLs.

76. Noting that vessel speed data are routinely collected for all longline sets and that sink rate data are available for a wide range of line-weighting scenarios, the Working Group recommended that the ‘2-m access window’ analysis be used in concert with sink rate data to evaluate the merits of line-weighting scenarios and prescriptions for the aerial extent of streamer lines in future refinements of conservation measures. Accordingly, the collection of data by observers on vessel setting speed, longline sink rate and streamer line aerial extent remain priority tasks for observers.

Streamer line aerial extent

77. Following a Commission endorsement (CCAMLR-XXIII, paragraph 5.12(iii)) of requests for key data to allow for the eventual improvement of Conservation Measure 25-02, data on the aerial extent of streamer lines were collected uniformly for the first time in 2004/05. These data were collected once for each cruise by fishery observers. The aerial extent of the streamer line, which is the part of the line supporting the streamers, is the effective seabird deterrent component of the streamer line, and therefore, of great interest to the Working Group.

78. The Working Group noted that data on the aerial extent of streamer lines reported in Table 15 were highly variable across the fleet, ranging from a low of 7 m to a maximum of 150 m and further noted that most vessels (16 of 31) achieved an aerial extent of ≥ 50 m. Given the wide range of distances reported, in some cases for the same vessel fishing in different areas, the Working Group recommended that aerial extent data and other compliance features of streamer lines be collected more frequently according to a specific protocol in order to yield a reliable representation of how effectively streamer lines are deployed and a more realistic evaluation of streamer line compliance in CCAMLR longline fisheries.

79. The Working Group proposed that data on streamer line aerial extent and other streamer line features including the height of streamer lines at the stern, the length of streamer

lines, the number, spacing and length of individual branched streamers, be collected once every seven days. Further, it was suggested that these data be collected on a diagram-based data collection form to be developed by CCAMLR. Where sink rate data collection is required according to Conservation Measure 24-02, paragraph B2(ii), the Working Group recommended that streamer line data be collected in the course of sink rate data collection.

Individual branched streamers of streamer lines

80. The Working Group also discussed the most appropriate material for individual streamers noting that if the material used for streamers is too lightweight streamers may be rendered ineffective in moderate to high winds. In the Working Group's assessment of compliance to streamer line requirements in Conservation Measure 25-02, it was recognised that empirical information on the seabird deterrent effectiveness of various types of streamer line configurations against selected seabird species (e.g. black-browed albatross, white-chinned petrel) is lacking. It is therefore not currently possible to recommend adoption of streamer line configurations other than that recommended in Conservation Measure 25-02. The Working Group recognised the importance of the provision of such information and encouraged Members to conduct appropriate experiments on the design features of streamer lines with a view to being able to recommend refinements to the streamer line requirements in the conservation measure.

Shinsei Maru bottom-line system

81. The Working Group noted that the *Shinsei Maru* bottom-line system proposed in WG-FSA-05/26 appears similar to trot-line fishing gear used in other fisheries, but that details were lacking (mass of weights used, stern or side setting, setting speed, rate of loss of weights) to fully evaluate potential threats to seabirds in the Convention Area. The Working Group recommended that the scientific observer assigned to this vessel report how the gear is deployed and retrieved with special attention to gear and seabird behaviour during the haul and set. Ultimately a description of the gear similar to that in WG-FSA-05/54 would be beneficial to understanding the strengths and weaknesses of this fishing gear and its appropriateness for use in the Convention Area.

82. Moreno et al. (in press) characterised seabird interactions with similar gear in the Chilean artisanal fishery for toothfish. While heavily weighted individual vertical longlines sank quickly during line setting with minimal interactions with seabirds, hooklines were often exposed to seabird interactions during hauling, resulting in a substantial number of seabird fatalities. Given the substantial catch of seabirds during the haul in Convention Area longline fisheries (paragraph 10), the potential for increased interactions with the proposed gear during the haul is considerable.

83. The Working Group recognised the potential for the fishing method proposed in WG-FSA-05/26 to minimise exposure of baited hooks to seabirds during setting operations and therefore expressed support for the proposal; however, the Working Group strongly recommended that Conservation Measures 24-02 and 25-02 be applied to this fishing system novel to the Convention Area.

Seabird mitigation during the haul

84. Most seabirds were caught during the haul of longline operations, as indicated by their 'injured' or 'uninjured' status (Table 1). Thus, the Working Group suggested that development of effective haul scaring devices with prescribed standards are appropriate throughout the Convention Area and once developed could result in refinements to Conservation Measure 25-02. Currently Conservation Measure 25-02 (2003), paragraph 8, requires that a device designed to discourage birds from accessing baits during the haul of longlines be used in higher-risk areas for seabird by-catch (Subareas 48.3, 58.6 and 58.7 and Divisions 58.5.1 and 58.5.2), however, a specific haul mitigation device is not prescribed.

85. A Bird Excluder Device (BED) was used very successfully on the FV *Janas* while fishing in Division 58.5.2 to reduce seabird interactions with the hookline during hauling (Figure 3) in 2003 and 2004. No birds were captured during the haul while using this device. The concept of the BED is to prevent birds from swimming and flying towards the area where hooks emerge from the surface of the water. It consists of two arms hinged above the hauling area. Three-metre fluorescent streamers attached to the arms and suspended between the ends of each arm reach down to the water surface, effectively excluding birds from the hauling area. A line with purse seine floats on the surface of the water (also attached to the ends of the arms) forms a boundary fence surrounding the hauling area, preventing birds from swimming towards the danger zone. This setup cordons off the line-hauling area while eliminating the potential for fouling the BED with the hookline as it is hauled. The hinged arms allow for easy retrieval and deployment.

86. The Working Group recommended that haul mitigation devices such as the BED used on the *Janas* should be encouraged in all CCAMLR areas regardless of risk status to reduce the large proportion of bird captures during line hauling.

Longline sink rate testing prior to entering the CCAMLR Convention Area

87. In response to a Commission request (CCAMLR-XXIII, paragraph 10.24), the Working Group reviewed available data on the maximum length of longlines used in the Convention Area with respect to Conservation Measure 24-02 and longline sink rate testing prior to entering the CCAMLR Convention Area.

88. The data on the maximum length of the longline used showed a clear distinction between the Spanish longline system and the auto longline system (WG-FSA-05/80). Given the wide variation in maximum lengths exhibited in the data, it was considered more appropriate to use the mean longline length for fleet-wide application of line sink rate testing.

89. Noting the differences between the two longline fishing systems, the expert opinion of those involved in the development of line-weighting regimes and the review in WG-FSA-05/80, the Working Group recommended that the requirement for testing line sink rate prior to entering the Convention Area should be changed from the current requirement of the maximum length to be used in the Convention Area for all vessels to a minimum of 6 000 m for auto longline system vessels and 16 000 m for Spanish longline system vessels.

Revision of Conservation Measures 24-02 (2004)
and 25-02 (2003)

90. The Working Group agreed that IWLs should continue to be endorsed as a viable alternative and that the revisions to the provisions of Conservation Measure 24-02 made in 2004 were successfully implemented in 2005.

91. In reviewing its advice from 2004 (SC-CAMLR-XXIII, Annex 5, paragraphs 7.91 to 7.93), the Working Group noted that proposed changes to Conservation Measure 25-02 with respect to mandatory line-weighting prescriptions for autoline vessels were no longer considered appropriate. The rapid adoption of IWLs and the line sink rate testing regime had largely superseded the need for an external line-weighting regime for autoline vessels.

92. The Working Group considered proposing changes to Conservation Measure 25-02 to accommodate IWL provisions for autoline vessels, but recognised that no additional information on the specification of IWLs had been provided and suggested that a revision of Conservation Measure 25-02 in 2005 would be premature.

93. The Working Group recommended that research be undertaken in 2005/06 on IWLs to allow a more informed revision of Conservation Measure 25-02 in 2006, with the intention of combining Conservation Measures 24-02 and 25-02, if possible. It noted that research to relate the current values of line sink rate to values that include both vessel speed, streamer line aerial extent and sink rate is planned. This would allow more flexible prescriptions to be developed for the conservation measure (paragraph 73).

94. The Working Group recommended that Conservation Measure 24-02 be revised, via introduction of a specification of the length of longline to be tested prior to entering the CCAMLR Convention Area (paragraph 89).

95. The Working Group recommended that Conservation Measure 24-02 be revised as follows:

Replace paragraph A1(i) with:

- (i) set a minimum of two longlines with a minimum of four TDRs on the middle one-third of each longline, where:
 - (a) for vessels using the auto longline system, each longline shall be at least 6 000 m in length;
 - (b) for vessels using the Spanish longline system, each longline shall be at least 16 000 m in length.

Replace paragraph B1(i) with:

- (i) set a minimum of two longlines with a minimum of four bottle tests (see paragraphs B5 to B9) on the middle one-third of each longline, where:
 - (a) for vessels using the auto longline system, each longline shall be at least 6 000 m in length;

- (b) for vessels using the Spanish longline system, each longline shall be at least 16 000 m in length.

Replace paragraph C1(i) with:

- (i) set a minimum of two longlines with either a minimum of four TDRs, or a minimum of four bottle tests (see paragraphs B5 to B9) on the middle one-third of each longline, where:
 - (a) for vessels using the auto longline system each longline shall be at least 6 000 m in length;
 - (b) for vessels using the Spanish longline system each longline shall be at least 16 000 m in length.

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

96. 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.

97. 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.

98. 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-XXIV/BG/27 and in SC-CAMLR-XXII, Annex 5, paragraphs 6.112 to 6.117.

99. 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 2005 (SCIC-05/10 Rev. 2), 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-XXIV/BG/27) has been used. Thus, because a regulated fishery has never existed in Division 58.4.3, the rate applied is that for Division 58.4.4.

Subarea/Division	Season	Lower 95%	Median	Upper 95%
48.3	Summer	0.39	0.741	11.641
	Winter	0	0	0.99
58.6, 58.7, 58.5.1, 58.5.2	Summer	0.45	0.55	1.45
	Winter	0.01	0.01	0.07
58.4.2, 58.4.3, 58.4.4	Summer	0.27	0.33	0.87
	Winter	0.006	0.006	0.042
88.1	Summer	0.27	0.33	0.87
	Winter	Not applicable, access not possible in winter		

100. 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-XXIV/BG/27.

101. The overall estimated total for the whole Convention Area in 2004/05 indicates a potential seabird by-catch in the unregulated fishery of 4 415 (95% confidence interval range of 3 605 to 12 400) seabirds. The values for this and previous years are summarised in respect of different parts of the Convention Area in Table 18.

102. In comparison with estimates for previous years, calculated in identical fashion, the value for 2004/05 is similar to the value estimated for 2003/04 (SC-CAMLR-XXIII/BG/23). 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.

103. Based on the data since 1996 (SC-CAMLR-XXIV/BG/27), an estimated total of 180 623 (95% confidence interval range of 147 013 to 529 722) seabirds have been killed by these vessels. Of these:

- (i) 40 469 (95% confidence interval range of 32 728 to 128 460) were albatrosses, including individuals of four species listed as globally threatened using the IUCN threat classification criteria (BirdLife International, 2004);
- (ii) 7 155 (95% confidence interval range of 5 844 to 20 054) were giant petrels, including one globally threatened species;
- (iii) 113 270 (95% confidence interval range of 92 343 to 325 210) were white-chinned petrels, a globally threatened species.

104. 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.

105. 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.

106. Many albatross and petrel species are facing potential extinction as a result of longline fishing. 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.

Incidental mortalities of seabirds during longline fishing outside the Convention Area

107. Ms T. Neves (Brazil) presented information from a study conducted from 2000 to 2005 of captures of seabirds in Brazilian waters (WG-FSA-05/67). Fishing trips were observed with an average catch rate of 0.09 birds/thousand hooks during the period. In 2002, the catch rate was 0.2 birds/thousand hooks with 105 300 hooks observed, in 2003, 0.18 birds/thousand hooks with 56 700 hooks observed and in 2004, 0.03 birds/thousand hooks with 90 858 hooks observed. Species from the Convention Area were among those captured and among species returned by fishers from trips where observers were not present. Observations were from Brazilian domestic vessels only. It was noted that fishing captains were likely to adopt different practices when observers were present. Therefore, results represent minimum catch rates. Pelagic fishing effort by both Brazilian and foreign vessels in winter is concentrated south of 20°S and relatively close to the coast, where the propensity for bird capture is highest. Effort by foreign fishing vessels is higher than that of domestic vessels, particularly during the winter when birds are most likely to be caught.

108. The Working Group thanked Ms Neves for the presentation of the new information from Brazil as requested last year (SC-CAMLR-XXIII, Annex 5, paragraph 7.129), which shows that there is a high risk of capture of birds from the Convention Area, especially during winter.

109. Ms Neves noted that mitigation had been developed in cooperation with industry, including raising awareness of the issue through an education program, developing streamer lines, and developing blue-dyed bait. Both measures were voluntarily adopted during at least three years by part of the Brazilian domestic fleet. She indicated that concurrent to finalising the Brazilian NPOA-Seabirds, the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) is also creating regulations and incentives for Brazilian fishers to mitigate incidental seabird mortality. It is hoped that this approach will ensure that voluntary measures adopted by the fleet thus far are encouraged and spread to the rest of the

fleet. In addition, the Special Secretariat of Aquaculture and Fisheries of the Presidency of the Republic (SEAP) is introducing sea turtle and seabird mitigation measures into the criteria for granting fishing licences to new foreign vessels. Some of these measures are obligatory for the National Funding Programme for the National Fishing Fleet (Profrota Pesqueira).

110. Prof. J. Croxall (UK) presented WG-FSA-05/56, a summary of seabird mortalities from the last two years for toothfish longlining from the Falkland/Malvinas Islands. Observer coverage was 59% of sets. All mortalities were black-browed albatrosses with estimated mortalities of 45 and 80 birds in 2002/03 and 2003/04 respectively. Rates of capture were 0.011 and 0.0005 birds/thousand hooks respectively. Target maximum rates of seabird by-catch for the fishery in the Falklands/Malvinas NPOA-Seabirds were 0.01 birds/thousand hooks by 2004/05 and 0.002 birds/thousand hooks by 2006/07. The rates measured meet these targets.

111. The Working Group noted there was no direct implication of the findings for the Convention Area breeding species, as all of the individuals reported in this study were likely to come from breeding sites outside. The fishery has moved to standardised steel weights, which improve the efficiency of line-weighting procedures, and are less likely to result in loss of fishing gear. The Working Group further noted that in the one case where a streamer line had temporarily not been used, high bird by-catch had resulted, indicating the need to continue to use streamer lines.

Research into the status and distribution of seabirds

112. Ms Neves presented information on seabird abundance off the Brazilian coast obtained through the Projeto Albatroz observer program between 2000 and 2005 (WG-FSA-05/67). Many of the species recorded in this study were species of importance to CCAMLR, including wandering albatrosses, white-chinned petrels, Cape petrels, southern fulmars, giant petrels and Wilson's storm petrels. Overall, the southern region of Brazil is an important foraging area, particularly during the autumn and winter months when seabird abundance is higher than during the breeding season. The results showed that the southern Brazilian area is important for the conservation of birds from four main breeding areas, including CCAMLR areas, Falkland/Malvinas Islands, Tristan da Cunha and New Zealand.

113. WG-FSA-05/14 presented results of a recent tracking study of albatrosses on Heard Island. In the summer of 2003/04, five light-mantled sooty albatrosses and 10 black-browed albatrosses breeding on Heard Island were tracked. The black-browed albatrosses foraged over shelf slope waters within 150 km of Heard Island and concentrated their foraging effort over the Gunnari Ridge which lies to the east of Heard Island. There is considerable spatial overlap with trawl and longline fisheries operations within the EEZ. The light-mantled sooty albatrosses foraged over 1 000 km to the south in productive waters between the southern boundary of the Antarctic Circumpolar Current and the northern edge of the pack-ice. This was the first time either albatross population from Heard Island had been tracked.

114. Specifically, the light-mantled sooty albatrosses from Heard Island foraged along the Antarctic shelf break/pack-ice edge, including in areas where new and exploratory fisheries operate in Divisions 58.4.1, 58.4.2 and 58.4.3. This new information has been incorporated into the risk assessments for these areas.

115. Considering the recent mortality of seven adult black-browed albatrosses in the icefish trawl fishery operating adjacent to Heard Island in Division 58.5.2 (WG-FSA-05/8) and the small size of this population (c. 600 pairs), it was noted that this satellite-tracking information provided important information for the understanding and management of incidental mortality in fisheries adjacent to Heard Island.

116. Dr S. Waugh (New Zealand) presented new research on the foraging ecology of albatrosses in relation to fishing activity. GPS loggers were used to track royal albatrosses foraging within the New Zealand EEZ and linked with real-time fishing locations from trawl fisheries. Linking individual's behaviour with fishing locations indicates a degree of attraction between birds and vessels actively fishing, and thus a wider range of target-species fisheries were potentially involved in interactions with royal albatrosses than had been previously indicated based on recoveries of dead birds from fisheries. In particular, royal albatrosses associated with deep-water vessels to a high degree than expected. A management response to this information has been an improved targeting of observer coverage to examine bird interactions.

117. The Working Group noted the important technological advances of the application of GPS technology to seabird foraging studies. Unlike information derived from satellite or geolocation information, there has been no global synthesis of Procellariiform distribution using GPS-derived spatial information. Importantly, GPS spatial assessments enable consideration of interactions between birds and fishing operations at much finer scales than previously possible. The Working Group envisaged the need for a workshop in the future to harmonise and consolidate practices and analyses in the rapidly increasing application of GPS technology to seabirds and the application of such studies to fisheries management.

118. As requested by the Working Group last year, BirdLife International submitted 'Tracking Ocean Wanderers: the Global Distribution of Albatrosses and Petrels', a report describing its global Procellariiform tracking initiative (WG-FSA-05/P10). The initiative was introduced last year (SC-CAMLR-XXIII, Annex 5, paragraph 7.144) and the full report is now available (www.birdlife.org). The Working Group congratulated BirdLife International and the data contributors for providing a comprehensive global assessment for the remote-tracking distributions of albatrosses and petrels.

119. Dr B. Sullivan (UK) reiterated a request for holders of new information on Procellariiform distribution to submit these to the database to ensure that it remains as relevant and up-to-date as possible for application to fisheries management initiatives.

120. As requested by the Working Group last year (SC-CAMLR-XXXIII, Annex 5, paragraph 7.145) BirdLife International provided an analysis of albatross and petrel distribution relevant to the CCAMLR Convention Area (WG-FSA-05/75). The results of this analysis highlight the importance of the Convention Area, particularly for breeding distributions of populations of wandering, grey-headed, light-mantled, black-browed and sooty albatrosses, and populations of both northern and southern giant petrels and white-chinned petrels. The distribution data also emphasise the importance for breeding albatrosses and petrels of regions north of Convention Area boundaries.

121. The CCAMLR subareas with the highest proportion of albatross and petrel distribution were Subareas 48.3 and 58.6, but the breeding ranges extend across the majority of the

Convention Area. The spatial risk assessments for CCAMLR subareas were revised based on this new and relevant information on the distribution of albatrosses and petrels vulnerable to interactions with fisheries (SC-CAMLR-XXIV/BG/26).

122. This new tracking information on Procellariiform seabirds enabled the Working Group to undertake a provisional gap analysis of albatross and petrel distribution data with respect to their occurrence in the Convention Area.

123. In this regard, and taking particular account of the size and location of populations and the likelihood of obtaining distributional data relevant to improving existing risk assessments, the Working Group suggested the following priorities for data acquisition:

(i) Breeding birds:

Priority A:

Grey-headed albatross	Crozet Islands, Kerguelen Islands
Indian yellow-nosed albatross	Crozet Islands, Prince Edward Islands
Light-mantled albatross	Auckland Islands, Campbell Island, Crozet Islands, Kerguelen Islands
Northern giant petrel	Chatham Islands, Crozet Islands, Kerguelen Islands, Macquarie Island
Southern giant petrel	Antarctic Peninsula, South Orkney Islands, Heard and MacDonald Islands
White-chinned petrel	Antipodes Island, Auckland Islands, Kerguelen Islands

Priority B:

Black-browed albatross	Crozet Islands
Campbell albatross	Campbell Island
Sooty albatross	Prince Edward Islands
Northern giant petrel	Campbell Island
Southern giant petrel	Falkland/Malvinas Islands, Macquarie Island, Prince Edward Islands, South Sandwich Islands

(ii) Non-breeding birds:

With the exception of data for grey-headed and black-browed albatrosses from South Georgia, acquisition of data from the at-sea distribution of non-breeding adults and juvenile birds from all major populations of each species breeding in the Convention Area is a very high priority.

The Working Group recommended that BirdLife International be requested to provide summary data on distribution of Southern Ocean seabirds from its tracking database at approximately three-year intervals, or when accumulation of data warrants.

124. WG-FSA-05/42 presented a review of research on seabird–fishery interactions commissioned by the New Zealand Ministry of Fisheries. The review considered recent research (from 1990 onwards) in five main topic areas (estimation of incidental mortality, methods for estimating population size and trends, the utility of genetic research, management efficacy and foraging information).

125. The aim of the review was to assist the New Zealand NPOA-Seabirds Science Advisory Group (SAG). SAG’s objective was to advise the government on the research appropriate to meet the objectives of the NPOA. The group reviewed six research areas (population estimation and modelling, estimation of incidental mortality, molecular ecology, mitigation, foraging ecology, monitoring management efficacy) and considered two reviews by Ms R. Alderman (WG-FSA-05/42) and Dr L. Bull (WG-FSA-05/P8). The main findings, methodological recommendations and gaps were identified and set out for each research domain. Priorities were specified for seabird–fishery research. These latter items are subject to ongoing development and were used in the development of a five-year research plan undertaken by the Ministry of Fisheries and the Department of Conservation.

126. The Working Group noted that New Zealand’s activities on research and conservation of albatrosses and petrels are of high significance to CCAMLR as this Member has the greatest diversity of breeding Procellariiform species. The Working Group congratulated New Zealand’s initiative, especially the ongoing and full engagement of the Ministry of Fisheries in seabird conservation issues.

127. Information summarising national research on seabirds (albatrosses and *Macronectes* and *Procellaria* petrels) was presented by Australia (WG-FSA-05/55), USA (WG-FSA-05/44) and New Zealand (WG-FSA-05/51). Reference to some research on petrels by France was included in CCAMLR-XXIV/BG/23. The UK submitted an electronic summary of national research to the Working Group. It was encouraged also to submit the data in hard-copy format in future.

128. Of countries known to be conducting relevant research, no reports were received from Argentina, France or South Africa. These countries were encouraged to provide input about their work that has relevance to the Convention Area.

129. It was noted that the UK data submission included reference to a multinational project undertaking molecular analyses of taxonomic relationships of *Macronectes* and *Procellaria* petrels; this study being coordinated by Dr P. Ryan (South Africa).

130. Dr Micol presented information on petrel populations on Crozet and Kerguelen Islands (CCAMLR-XXIV/BG/23). In order to assess the impact of the incidental mortality in the French EEZ, particularly on white-chinned and grey petrels, a study funded by fishing companies and France has been initiated by CNRS of Chizé. The two-year study, which started in 2004, aims to determine population trends, examine the impact of current and historical levels of fisheries-related seabird mortalities, and compare the relative impact of incidental mortality and fluctuations due to environmental variables. The work includes a complete census of white-chinned petrels on Possession Island (Crozet) with comparisons to 1983 population estimates. As no previous population estimates are available for Kerguelen, population sizes will be assessed over the two-year period. Analyses will also consider long-term demographic data, as well as new information on diet, satellite monitoring and fisheries interactions. Results are expected in early 2007.

131. ACAP agreed at the First Meeting of Parties (MOP1) in November 2004 that ACAP's Advisory Committee would review the population status, trends and demography of albatrosses (21 species) and petrels (7 species) listed in Annex 1 of the Agreement. Thus, an ACAP working group, chaired by Dr R. Gales (Australia), was formed to collect and collate information on breeding numbers and critical population and demographic parameters for each species. It was anticipated that this synthesis would enable gaps in information to be identified and facilitate the prioritisation of actions to collect information to fill these gaps.

132. Information provided by four Parties (Australia, New Zealand, South Africa and the UK) to ACAP consisted of population-specific data for 19 albatross and seven petrel species. The ACAP working group's preliminary review was provided to the first ACAP Advisory Committee meeting in July 2005. Information from Argentina was subsequently made available at the ACAP meeting but has not yet been incorporated in the review.

133. The review provided to WG-IMAF (WG-FSA-05/P2) includes information on breeding populations for ACAP species within Australian jurisdiction (Tasmania, Heard and Macquarie Islands). Demographic studies are under way for four of the albatross species and there are ongoing long-term population monitoring studies for albatrosses and petrels breeding on Macquarie Island and in Tasmania. Current trends for the ACAP species breeding on Macquarie Island indicate that these populations are either increasing or stable in numbers. Fewer data are available for the species breeding on Heard Island; in particular there is a lack of reliable information on population trends for the species breeding at this site.

134. Extensive information was provided by New Zealand for species breeding within its jurisdiction. Population estimates are available for most breeding sites, although for some species (e.g. light-mantled albatross), the reliability of these estimates is low. Very little information is available for a number of species including Pacific, white-capped and Salvin's albatrosses and Westland petrel. Information for these species is essentially restricted to limited point estimates of population size with no robust information on population trends. Population trend information is available for 18 of the 40 populations in the New Zealand region. Of these, 16 (89%) are reported as being either stable or increasing. The two populations that are reported to be in decline are Salvin's albatrosses at the Bounty Islands and grey-headed albatrosses breeding on Campbell Island.

135. South Africa submitted comprehensive information for the nine ACAP species breeding at both Marion and Prince Edward Islands. Considerably greater knowledge exists for the eight species breeding at Marion Island. The population trends of seven species at this

site are known with at least moderate reliability and, of these, four are stable and three (sooty albatross, southern giant petrel and white-chinned petrel) are decreasing. Information is most limited for grey and white-chinned petrels. Much less information was presented for species breeding at Prince Edward Island, with information essentially restricted to population estimates conducted in 2001/02.

136. The UK submitted data for Tristan da Cunha and Gough, the Falkland/Malvinas Islands and South Georgia. The most comprehensive dataset was available for South Georgia, derived largely from long-term demographic studies from Bird Island, but also with recent archipelago-wide surveys of wandering, black-browed and grey-headed albatrosses confirming long-term declines. There are reliable estimates of productivity, adults and juvenile survival from Bird Island for these three species and this will be available in the future for both giant petrels. Population trend information for six ACAP species breeding at South Georgia showed that most (five) are in decline, with only southern giant petrels being stable in numbers. There is very little information on demography, current population size and status of the light-mantled albatross and white-chinned petrel, except that the latter is in long-term decline.

137. Similarly, little is known about long-term demographic processes or status of the three Falkland/Malvinas Islands ACAP species except that the black-browed albatross has recently undergone a rapid decline, and a survey in 2004 of the southern giant petrel recorded many more birds than anticipated. At Tristan da Cunha/Gough the limited data on population size suggests that the Tristan, Atlantic yellow-nosed and sooty albatrosses are in decline, and the southern giant petrel and spectacled petrel are apparently increasing. With the exception of two (of three) albatross species breeding on Gough, there is very little data on vital rates.

138. Information from all sites is consistent in showing that considerably more information is available for albatross and giant petrel species, with very little information being available for *Procellaria* species.

139. Comparing the available regional data on population trends suggests that populations in the Australian and New Zealand region are generally more secure than populations elsewhere. For other ACAP populations the situation is more serious. The most extensive suite of data for ACAP species is from South Georgia, and at this site five of the six species for which data are available are in decline. This regional comparison highlights the serious predicament of populations breeding in the CCAMLR Convention Area compared with the generally less precarious situation of populations elsewhere.

140. The Working Group thanked ACAP and the chair of the Status and Trends Working Group for providing the information. The preliminary review indicates excellent progress toward a global revision of population status and underscores the considerable interest and relevance of the ACAP work to CCAMLR. It was noted that, with the exception of Argentina, all breeding species of most concern to CCAMLR are represented by signatories to ACAP. Thus, the Working Group recognised it was not necessary to update SC-CAMLR-XXIV/BG/22 'Summary of population data, conservation status and foraging range of seabird species at risk from longline fisheries in the Convention Area'.

141. The Working Group agreed that such information is best compiled and reviewed by ACAP and to avoid duplication, it was agreed that ACAP be the single repository for these data. ACAP would be requested to submit summary documents of albatross and petrel population status to WG-IMAF annually, or as appropriate.

142. The Working Group considered the potential for similar cooperation between WG-IMAF and ACAP in the area of taxonomic revision and molecular research. It was agreed that, at this stage, WG-IMAF would maintain the request to Members for information on relevant national seabird genetic research.

143. In relation to international initiatives coordinated by Prof. H. Caswell and Dr C. Hunter (USA) to develop new population models for albatrosses (see SC-CAMLR-XXIII, Annex 5, paragraph 7.153), Prof. Croxall reported that a second meeting of the working group had been held in March 2005 in the USA. The main developments at this meeting were: (i) fitting and evaluation of models using nine datasets for six albatross species; (ii) refining questions of interest into three broad groupings, viz: (a) life-history issues, primarily involving interactions between breeding frequency, productivity and survival; (b) management issues, especially consequences of 'catastrophe' years, estimation of potential biological removals, power to detect change and possible provision of best-practice advice; and (c) other issues involving effects such as density-dependence, environment, dispersal etc. The group's report will be tabled at the next ACAP meeting. The next meeting of the group will take place in France in May 2006.

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

ACAP

144. WG-FSA-05/25 reported on the first meeting of the Advisory Committee of ACAP held in Hobart, Australia, from 20 to 22 July 2005 with four Parties (Australia, New Zealand, South Africa and UK), two Signatory States (Argentina and France) and three Range States (Norway, Ukraine and USA) in attendance. All are Members of CCAMLR, which was also represented as an invited observer (together with SCAR, BirdLife International and IASOS). The meeting was informed of recent ratifications by France and Peru and of progress towards ratification by Argentina, Chile and Norway. A full report of the meeting is available at www.acap.aq/index.php/acap/advisory_committee/first_advisory_committee_meeting.

145. Items of particular relevance to CCAMLR included:

- (i) the review of data relevant to the assessment of status and trends of albatross populations by the ACAP Status and Trends Working Group (see paragraphs 131 to 141);
- (ii) the establishment of a Taxonomy Working Group to review the status of existing and potential ACAP-listed taxa;
- (iii) the establishment of a Working Group on Breeding Sites, to develop an inventory and assess the conservation status of all breeding sites of ACAP species;

- (iv) commendation of the work CCAMLR has undertaken to address mitigation of seabird by-catch and recognition of the need for substantial progress in areas of application of other organisations with responsibility for the management of fisheries in which incidental mortality of ACAP species occurs;
- (v) the desire to maintain a close working relationship with CCAMLR.

FAO IPOA-Seabirds

146. At the 26th (2005) meeting of FAO COFI 11 members reported on aspects of IPOA-Seabirds implementation. Reports ranged from implementation under way (Japan (which submitted a revised NPOA-Seabirds), New Zealand and the USA), NPOAs near completion (Brazil, Chile, Namibia and South Africa), IPOA-Seabird relevant activity (Australia, Canada, Peru and Uruguay) and two assessments (Mexico, El Salvador) which had concluded that an NPOA-Seabirds was unnecessary.

147. WG-FSA-05/38 reported on further substantial progress in the development of the Chilean NPOA with the completion of the second (of three) steps, involving development and testing of mitigation measures for each longline fishery (Patagonian toothfish, austral hake and swordfish) operating in the Chilean EEZ. For Patagonian toothfish the mitigation specifications include using streamer lines on all sets, weights of 8.5 kg every 40 m on the motherline and a setting speed of 6.5 knots. Further tests on the line-weighting specification and of paired streamer lines are also planned. The hake (and ling) fishery will only set at night and trials of streamer lines and line weighting are planned. The swordfish fishery will set at night, use a streamer line (≥ 100 m) and use 60 g weights at the swivel (sink rates of ≥ 0.23 m/s). Further tests of streamer lines and of interactions between line weighting and setting speed are proposed.

148. The main aim of the Chilean NPOA is to reduce, by 90% over three years, the rate and level of incidental mortality of seabirds observed in 2002. Analysis of data from 2004/05 suggests a 72% reduction but indicates that by-catch rates for black-browed albatross, of 0.113 birds/thousand hooks observed in 2004/05, suggest that further improvements in design and use of mitigation measures are needed to reduce this level to the nominal target of 0.05 birds/thousand hooks.

149. Ms Neves noted that the Brazilian NPOA-Seabirds (see SC-CAMLR-XXIII, Annex 5, paragraph 7.161) is about to be published; this version will incorporate some revision to statistics that have changed during the period in press.

Other international organisations and initiatives, including non-governmental organisations

150. Ms K. Rivera (USA) introduced WG-FSA-05/45 reporting on a workshop held in November 2004 at the Fourth International Fisheries Observer Conference, to facilitate research and analysis of factors influencing by-catch of marine mammals, sea turtles and seabirds in longline fisheries, including by recommending the best practice in respect of data collection.

151. The Working Group noted that CCAMLR already requires the provision of the data recommended by the workshop. Nevertheless the recommendations would represent very valuable advice to RFMOs generally and the authors were encouraged to facilitate submission of the documentation and recommendations to all relevant RFMOs, especially those with areas of application adjacent to the Convention Area.

152. Dr Waugh presented WG-FSA-05/47 which reported on an initiative to provide training exchanges in seabird mitigation. The aim was to provide a placement for a fisher from a Latin-American country on board a vessel, with a proven record of seabird-friendly fishing techniques, in the New Zealand demersal longline ling fishery. The report of the selected fishing captain, Luis Uribe from Chile, indicated the benefit of the experience and contained important recommendations for informing other fishers of how to implement cost-effective techniques for reducing seabird by-catch.

153. The Working Group commended the New Zealand and USA sponsors of this initiative which had provided valuable insight into how to transmit conservation messages across language and cultural barriers. The Working Group would be interested to learn of any longer-term benefits within Chilean and Latin-American fishing constituencies.

154. Dr Sullivan informed the Working Group of a BirdLife International workshop held in Hobart, Australia, in October 2005 to develop an implementation plan for an international initiative (Operation Ocean Task Force) to work at sea and in onshore workshops to undertake mitigation research and collect baseline by-catch data, where required, and to assist fishers in the correct use of a range of mitigation measures available to reduce seabird mortality in longline and trawl fisheries. Many of the fisheries to be targeted in southern Africa and South America have incidental mortality of seabirds that breed in the Convention Area.

RFMOs, tuna commissions and international governmental organisations

155. The Working Group noted the review and analysis by BirdLife International (WG-FSA-05/P9), conducted during 2004 and launched at the FAO COFI meeting in March 2005, of the duties and performance of 14 RFMOs in reducing by-catch of albatross and other species. The evaluation criteria were based on the principles established in the Code of Conduct for Responsible Fisheries and the United Nations Fish Stock Agreement. Of the five RFMOs most important in terms of overlap with albatross distribution (in order of priority CCSBT, WCPFC, IOTC, ICCAT and CCAMLR), CCAMLR scored the most highly in almost every category (participation and transparency; target fish data and assessment; target fish management and status; combatting IUU fishing; commitment to reducing by-catch; by-catch data collection and by-catch mitigation).

156. The Working Group appreciated the value and importance of this independent external review and the testimony it provided to the effective, extensive and pioneering work of CCAMLR. The low performance levels of other RFMOs, especially the three tuna commissions, reinforced the concerns expressed by CCAMLR in recent years.

157. The Working Group recollected that for several years the Commission had strongly supported collaboration with those RFMOs with responsibilities for areas adjacent to the Convention Area where seabirds from the Convention Area, are, or may be, killed, in order to promote the adoption by these RFMOs of appropriate mitigation measures for the fisheries actually or potentially involved (e.g. CCAMLR-XXII, paragraph 5.17). The Working Group recollected its earlier advice, endorsed by the Commission, that the greatest threats confronting the conservation at sea of albatrosses and petrels breeding in the Convention Area are the levels of mortality likely to be associated with IUU longline fishing inside the Convention Area, and with longline fishing for species other than *Dissostichus* in areas adjacent to the Convention Area (CCAMLR-XX, paragraph 6.33; CCAMLR-XXIII, paragraph 5.22).

158. Last year, as a result of continuing failure to establish constructive dialogue with the main RFMOs responsible for regulating longline fishing (and associated by-catch of non-target species including seabirds) in areas adjacent to the Convention Area (CCAMLR-XXIII, paragraphs 5.26 to 5.29), the Commission adopted Resolution 22/XXIII:

- (i) requesting the relevant RFMOs to implement and develop mechanisms for collecting, reporting and disseminating data on seabird incidental mortality;
- (ii) urging CCAMLR Members also members of relevant RFMOs¹ (and especially new and developing ones) to ensure that the topic of seabird incidental mortality is placed on the agendas of the pertinent RFMO meetings, that areas of unknown or potential by-catch and the most effective mitigation measures to be used in these areas and circumstances are identified and that appropriate observer programs are in place to provide sufficient data for evaluation purposes.

159. To date (and since 18 November 2004) responses to the CCAMLR resolution and the accompanying letter from the Chair of the Commission have been received from CCSBT, IATTC and ICCAT.

160. However, it was noted that appreciable initial progress had been made intersessionally in terms of communication on by-catch (including seabird) issues with RFMOs (see paragraph 179).

161. Thus IOTC had now established a by-catch subgroup, the inaugural meeting of which had been attended by BirdLife International, presenting a paper on known and potential seabird–fishery interactions. IOTC had welcomed this input and further presentations, including advice on mitigation measures, were scheduled for the next meeting.

¹ CCSBT: Australia, Japan, Republic of Korea and New Zealand.

WCPFC: Australia, European Community, France, Japan, Republic of Korea and New Zealand; USA as a Signatory; UK as a Participating non-member.

IOTC: Australia, European Community, France, India, Japan, Republic of Korea and the UK; South Africa as a Cooperating non-member.

ICCAT: Brazil, European Community, France, Japan, Republic of Korea, Namibia, Norway, Russia, South Africa, UK and the USA.

IATTC: France, Japan, Spain and the USA; European Community and the Republic of Korea as Cooperating non-members.

162. Similarly, for the recent meeting (October 2005) of ICCAT's by-catch subcommittee, BirdLife International tabled a paper on overlap of albatrosses and petrels with ICCAT longline fishing effort. About 10% (30–40 million hooks) of ICCAT's annual longline fishing effort overlaps albatross habitat, being greatest in the second and third quarters of the year and mainly involving Taiwanese and Japanese vessels.

163. In respect of ICCAT's resolution (of 2002), requesting members to provide its by-catch subcommittee with data to assess the impact of incidental catches of seabirds, proposals had been made to hold a workshop on this topic.

164. The response from ICCAT to the CCAMLR letter and Resolution 22/XXIII included a summary of fishing effort data south of 40°S in 2000–2002 which indicated that the main fleets involved are those of Taiwan (for albacore) and Taiwan and Spain (for swordfish).

165. In respect of WCPFC, Mr N. Smith (New Zealand) reported progress by this newly formed Commission on matters relating to the incidental mortality of seabirds. The WCPFC held its inaugural Commission meeting in December 2004. At that meeting the Commission directed its scientific experts to prepare estimates of the mortality of non-target species with an initial focus on seabirds, sea turtles and sharks.

166. In response, at its first Scientific Committee meeting in August 2005, the WCPFC established an Ecosystem and By-catch Specialist Working Group (EB-SWG). At its first meeting during August 2005 the EB-SWG considered two papers of interest to WG-IMAF:

- (i) a paper, compiled by the Secretariat of the Pacific Community Oceanic Fisheries Programme, containing estimates of the incidental mortality of seabirds in the WCPFC Convention Area based on observer data;
- (ii) a paper, compiled by Birdlife International, describing the distribution of albatrosses and petrels in the Western and Central Pacific and potential overlap with WCPFC longline fisheries.

167. The key recommendations resulting from the review of these papers by the EB-SWG and WCPFC Scientific Committee were that:

- (i) current levels of observer data were inadequate to produce reliable estimates of incidental mortality of seabirds in the WCPFC Convention Area. Accordingly it would be necessary to implement higher levels of observer coverage, especially in longline fisheries in the more temperate waters of the WCPFC Convention Area, to allow reliable estimates of seabird incidental mortality to be made in future;
- (ii) an ecological risk analysis should be conducted in order to prioritise species of sea turtles, sharks and seabirds and non-target fish species for future research.

The WCPFC Commission will consider these recommendations at its next meeting in December 2005.

168. In respect of CCSBT, the Working Group noted that the report and tabled papers from the Fifth Meeting of the ERS WG (February 2004 in New Zealand) had been approved by the CCSBT Commission and made available to CCAMLR.

169. The Working Group thanked CCSBT for this and noted that the papers contained valuable data on the timing, area and extent of fishing effort and estimates (from reports by national observers) of seabird by-catch and on the nature of mitigation methods currently in use.

170. The annual report from the Republic of Korea indicated that no data on seabird by-catch were reported and that there were no mandatory mitigation measures in use, though some vessels voluntarily used streamer lines. Some educational materials with respect to mitigation of by-catch of seabirds and sea turtles were in development.

171. The report from Chinese Taipei indicated that there is currently no reporting of seabird by-catch data, but that use of streamer lines is mandatory on all vessels fishing for southern bluefin tuna south of 30°S. The report also noted the workshop convened jointly with BirdLife International on seabird by-catch and mitigation which was reported to CCAMLR last year (SC-CAMLR-XXIII, Annex 5, paragraph 7.176).

172. The reports from Japan were particularly commended for the provision of data on effort and by-catch and on extensive research to investigate the utility of various mitigation measures, especially dyed bait. The Japanese reports indicated that:

- (i) use of streamer lines (which may vary in design and detail of use) is mandatory on all vessels fishing for southern bluefin tuna south of 30°S;
- (ii) all vessels use thawed bait and bait-casting machines;
- (iii) virtually all vessels experience incidental mortality of seabirds;
- (iv) enforcement of compliance with mitigation measures involved enforcement vessels observing 637 fishing operations on 31 vessels in 2002;
- (v) observer coverage in 2001 and 2002 was 5.7–6.8% of cruises, 3.6–3.7% of sets and 2.9–3.2% of hauls.

173. The analysis of the level and rate of seabird by-catch indicates that in 2001 and 2002 respectively the estimated total seabird by-catch levels and rates were 6 516 (95% CI 3 376–10 378) birds (with an average rate of 0.139 birds/thousand hooks) and 6 869 (95% CI 3 811–10 213) birds (with an average rate of 0.181 birds/thousand hooks). The report suggested that the levels of by-catch have been broadly stable since 1995 at 6 000–9 000 birds per year with the estimated value of c. 14 000 birds in 2000 probably due to sampling error. Catch rates have varied by season and area and ranged from 0.026 to 0.312 birds/thousand hooks. The main areas fished in 2001 and 2002 were south of 40°S off South Africa (mainly in quarters 2 and 3), south of 40°S east of Australia (mainly in quarter 2) and from 25°S to 45°S west and southwest of Australia (mainly quarters 3 and 4). Seabird by-catch composition, based on a sample of 467 birds from 2001 and 2002 combined, comprised 74.1% albatrosses (amongst those identified to species ($n = 281$), 45.2% grey-headed albatross, 20.6% black-browed albatross, 10.0% shy albatross, 4.3% wandering albatross), 7.8% giant petrel and 13.7% smaller petrels (at least 50% of which were *Procellaria* species).

174. The Working Group expressed concern at the levels and rates of seabird (especially albatross) by-catch in the CCSBT fisheries. Given the low level of observer coverage, and that reports derived from birds brought on board vessels underestimate (sometimes substantially so) the number of birds actually killed, it is perfectly conceivable that if up to at least 9 000 seabirds are killed annually, this could represent 6 670 albatrosses (including c. 3 000 grey-headed albatrosses and 1 370 black-browed albatrosses), 690 giant petrels and at least 600 *Procellaria* petrels. Most of these birds are likely to be from populations breeding in the Convention Area.

175. Noting that the Japanese southern bluefin tuna fleet probably represents about two-thirds of the longline fishing effort in the overall CCSBT fishery, the total annual mortality of seabirds could approach, or even exceed, 13 500 seabirds including about 10 000 albatrosses.

176. The Working Group, while acknowledging the very approximate nature of these estimates and the substantial extrapolations involved, viewed these numbers with substantial concern. It re-emphasised the need for effective mitigation of seabird by-catch, not simply confined to the mandatory use of streamer lines but involving some combination of improved line weighting, night setting and offal management. Evaluation of the effectiveness of the improved mitigation, together with acquiring better estimates of seabird by-catch levels and rates, would require a more extensive and detailed program of data collection by observers.

177. In this context, the Working Group noted that the 26th Session of COFI (March 2005) had expressed strong support for a proposal by Japan that, with FAO technical cooperation, Japan and possibly other sponsors convene a joint meeting of the secretariats of the tuna RFMOs and their members. It had been agreed that the meeting should be held in January or February 2007 in Japan.

178. The Working Group noted that the provisional agenda for the meeting includes reviewing incidental catch-related measures and could be a valuable opportunity to explore implementation of consistent best-practice provisions for collection, analysis and dissemination of by-catch data, together with improved implementation of mitigation measures appropriate to the areas, times and target species involved. Members of CCAMLR, especially those also members of the participating RFMOs, were requested to support a thorough review of by-catch-related initiatives and requirements at this meeting. The Working Group also noted that it would be a valuable opportunity to promote knowledge of CCAMLR's work and concerns in this field.

179. Overall, the Working Group recognised that there had been a considerably enhanced level of interaction with tuna commissions during the last year and thanked all involved, especially Members of CCAMLR and non-governmental organisations for their role and assistance in achieving some progress in furthering the goals of CCAMLR. The importance of moving rapidly to interactive involvement in the collection of appropriate data and the application of appropriate mitigation throughout all relevant fleets was re-emphasised.

Incidental mortality of seabirds in relation to new and exploratory fisheries

Assessment of risk in CCAMLR subareas and divisions

180. As in previous years, the Working Group assessed the numerous proposals for new and exploratory fisheries and the potential for these fisheries to lead to substantial increases in seabird incidental mortality.

181. In order to address these concerns, the Working Group reviewed its assessments for relevant subareas and divisions of the Convention Area in relation to:

- (i) timing of fishing seasons
- (ii) need to restrict fishing to night time
- (iii) magnitude of general potential risk of by-catch of albatrosses and petrels.

182. 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-XXIV/BG/26).

183. This year new data derived from an analysis of the distribution of albatrosses and petrels in the CCAMLR Convention Area (areas, subareas, divisions and subdivisions), based on data from BirdLife International's Global Procellariiform Tracking Database (WG-FSA-05/75) provided substantial information on the foraging ranges of seabirds that breed within the Convention Area. Additional information on the distribution of black-browed and light-mantled albatrosses from Heard Island was also provided (WG-FSA-05/14). This information was used to update the assessment of potential risk of interactions between seabirds and longline fisheries for Subareas 48.2, 48.4, 88.1 and 88.3 and Division 58.4.2. The revised assessments incorporating new information made available at the meeting (with changes/additions underlined) have been issued as SC-CAMLR-XXIV/BG/26.

New and exploratory longline fisheries operational in 2004/05

184. Of the 35 proposals last year for new and exploratory longline fisheries in seven subareas and divisions, only 25 were actually undertaken: by Japan and the Republic of Korea in Subarea 48.6; Chile, Republic of Korea, New Zealand and Spain in Division 58.4.1; Chile, Republic of Korea, New Zealand and Spain in Division 58.4.2; by Australia, Republic of Korea and Spain in Division 58.4.3a; by Chile, Republic of Korea and Spain in Division 58.4.3b; by Argentina, New Zealand, Norway, Russia, UK and Uruguay in Subarea 88.1; and by New Zealand, Norway and Russia in Subarea 88.2.

185. No seabird by-catch was reported to have been observed in fisheries in Subareas 48.6, 88.1 and 88.2, and Divisions 58.4.2, 58.4.3a and 58.4.3b. Two seabird mortalities and another bird released alive were observed caught on one vessel during day sets in Division 58.4.1. All birds were southern giant petrels. Clearly, the strict adherence in Subareas 48.6, 88.1 and 88.2, and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b 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 incidental by-catch of seabirds.

New and exploratory longline fisheries proposed for 2005/06

186. Following the annual review of the actual levels of risk adopted last year in SC-CAMLR-XXIII/BG/21, the Working Group suggested the following changes:

Subarea/Division	Current level of risk	Proposed level of risk
48.2	Average (3)	Average to high (4)
48.4	Low (1)	Average (3)
58.4.2	Average (3)	Average to low (2)
88.1 Overall risk	Average (3)	Average (3)
No change		
88.1 Northern sector	Average (3)	Average (3)
No change		
88.1 Southern sector	Average to low (2)	Low (1)
88.3	Low (1)	Average to low (2)

187. The assessment of the risk to seabirds posed by new and exploratory longline fisheries in the Convention Area is incorporated into the revised assessment SC-CAMLR-XXIV/BG/26 (an update of SC-CAMLR-XXIII/BG/21) and summarised in Figure 1 and Table 19, and also includes an assessment of recommended levels of observer coverage.

188. Thirty-nine applications for exploratory longline fisheries, submitted by 12 countries, were received by CCAMLR in 2005. No applications for new longline fisheries were received. The areas for which these proposals were received were:

Subarea 48.6	Japan, New Zealand
Division 58.4.1	Australia, Republic of Korea, New Zealand, Spain, Russia, Uruguay
Division 58.4.2	Australia, Chile, Republic of Korea, New Zealand, Spain
Division 58.4.3a	Australia, Chile, Republic of Korea, Spain
Division 58.4.3b	Australia, Chile, Republic of Korea, Spain, Uruguay
Subarea 88.1	Argentina, Republic of Korea, New Zealand, Norway, Russia, South Africa, Spain, UK, Uruguay
Subarea 88.2	Argentina, Republic of Korea, New Zealand, Norway, Russia, Spain, UK, Uruguay.

189. 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-XXIV/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 2005, is set out in Table 20.

190. 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-XXIV/17, 18, 19, 20), Chile (CCAMLR-XXIV/25, 26),

Japan (CCAMLR-XXIV/10), New Zealand (CCAMLR-XXIV/13, 14, 15), South Africa (CCAMLR-XXIV/16), Spain (CCAMLR-XXIV/9) and the UK (CCAMLR-XXIV/21) 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-XXIV/12), Chile (CCAMLR-XXIV/27, 28), Republic of Korea (CCAMLR-XXIV/22), Norway (CCAMLR-XXIV/11), Russia (CCAMLR-XXIV/31) and Uruguay (CCAMLR-XXIV/23, 24, 29, 30) fall into this category.

191. 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.

192. In cases where Members were intending to fish using multiple vessels operated by more than one company, there were inconsistencies in the level of information provided within subareas or divisions, and hence the level of compliance with relevant seabird by-catch minimisation conservation measures, provided in the applications. Members were requested to take greater care in future submissions to ensure the intent to comply with relevant seabird by-catch measures was clear.

193. 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. To assist in this for this year and submissions in future years, a checklist was developed by the Working Group. Members are requested to advise that their applications:

- (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.

194. 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 recommended that any vessel operating under the provisions of this conservation measure, and which catches a total of three (3) seabirds, as defined in SC-CAMLR-XXII, Annex 5, paragraphs 6.214 to 6.217, shall revert to night setting in accordance with Conservation Measure 25-02. Similar provisions were specified in previous years.

195. With respect to the prescription of a seabird by-catch level, the Working Group noted the successful implementation of the definition of the status of birds 'caught' (SC-CAMLR-XXII, Annex 5, paragraph 6.214 to 6.217). The Working Group recommended the continued use of the definition and requested feedback from scientific observers on the ability to apply this definition whilst at sea.

Other incidental mortality

Interactions involving marine mammals with longline fishing operations

196. WG-FSA-05/7 Rev. 1 indicated that three southern elephant seal mortalities were observed on the *Avro Chieftain*. While fishing in Division 58.5.2, one was caught by a hook in the mouth and another fell off the line prior to reaching the surface and was of unknown life status. The third was entangled in a longline in Division 58.4.3a.

197. WG-FSA 05/9 Rev. 2 reported that two Antarctic fur seals became entangled in a longline on the vessel *Viking Bay* in Subarea 48.3; both were released alive.

198. WG-FSA-05/11 reviewed interactions between cetaceans and longline fishing operations. The most frequent types of interactions were of sperm whales and killer whales taking fish from lines; there were only two occurrences of incidental mortality of cetaceans reported: one dolphin and one small whale; both unidentified.

199. The interactions between toothed whales and longline vessels appear to present a very limited risk of incidental mortality of cetaceans, perhaps because sperm and killer whales are capable of breaking longlines.

200. However, the Working Group noted that the loss of fish and gear as a result of interactions with cetaceans may have two implications:

- (i) the risk to cetaceans from entanglement in broken sections of longlines;

- (ii) the number of hooks that enter the water may increase to compensate for reduced catches and therefore increase the risk to non-target species.

Interactions involving seabirds with trawl fishing operations

Finfish

201. In 2005, 11 bird mortalities (9 black-browed albatrosses, 1 white-chinned petrel and 1 southern giant petrel) were reported in the Subarea 48.3 icefish fishery from four vessels; in addition, 14 birds were released alive, uninjured (Table 16). This compares to 87 bird mortalities (and 132 released alive) in 2004 and 36 bird mortalities (and 15 released alive) in 2003. The rate of mortalities for this subarea in 2005 was 0.04, compared to the 0.37 and 0.20 birds per tow recorded in 2004 and 2003 respectively (Table 17).

202. In 2005, eight bird mortalities were observed in the icefish/toothfish fishery in Division 58.5.2 from two vessels (5 black-browed albatrosses and 3 white-chinned petrels (Table 16)). The capture rate in this division was 0.01, compared to zero in 2004 and 0.005 birds per tow in 2003.

203. Mr B. Baker (Australia) reported that a further five bird mortalities had occurred in the icefish/toothfish trawl fishery in Division 58.5.2 (2 black-browed albatrosses and 3 white-chinned petrels). These were reported to the observer by the vessel crew and hence have not been included in the capture totals. The Working Group noted that the substantial increase in black-browed albatross mortalities in this division was a concern, given the proximity of the small population of this species at Heard Island, and its vulnerability to population decrease through fisheries mortalities (WG-FSA-05/14).

204. The Working Group noted that the reduction in seabird mortality in the icefish fishery in Subarea 48.3 could be due to a combination of a reduced seabird abundance, associated with the reduction in icefish catches, and the continued adoption of mitigation measures. Information from the description of mitigation measures from the reports of scientific observers indicated that in addition to streamer lines, the *Insung Ho* and the *Betanzos* also used a Brady Baffler and the *Dongsan Ho* also used a water cannon.

205. The Working Group also noted that there was a reduced level of reporting by observers on the effort of crews to thoroughly clean the net before shooting operations; changes should be made to the Cruise Report Forms to improve this situation.

206. There were two new trawl mitigation measures trialled in the 2005 season that showed potential to reduce seabird entanglements. A system of net binding (paragraph 207) was used on the *Sil* and *Robin M Lee* to reduce entanglements and mortality that occur during shooting operations, and the *Argos Vigo* used a free floating panel attached over the top of the net to cover mesh sizes ranging from 135 to 400 mm. There were insufficient data to determine the effectiveness of these methods but it was noted that both methods had potential to further reduce seabird mortality in the fishery.

207. WG-FSA-05/59 reported on the trials of the effectiveness of net binding, streamer lines and net modifications to reduce seabird interactions with trawl nets in the *Champocephalus gunnari* fishery in Subarea 48.3:

- (i) The use of 3–ply sisal string with a breaking strength of 110 kg to bind the net prior to setting prevented the net from spreading and lofting at the surface and increased the net sink rate; the string broke when the trawl doors were paid away.
- (ii) Streamer lines failed to protect the net 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.
- (iii) Reducing mesh size from 200 to 140 mm in an effort to reduce seabird interactions with the net and adding chains to each side of the body of the net to sink the net more quickly caused damage to the net.

208. The Working Group noted that binding the net with sisal string is potentially highly effective, easily accomplished and should be easily implemented as a mitigation measure by the icefish trawl fleet.

Krill

209. In krill fisheries in 2005 in Subareas 48.2 and 48.3 only one incidental mortality of a Cape petrel was recorded; one Antarctic fulmar was caught on a warp splice and released uninjured. The rate of capture was 0.003 birds per tow in Subarea 48.2. Information from the report of a scientific observer from the krill fishery in Subarea 48.3 included anecdotal records of collisions with trawl warps during hauling; collisions generally appeared to be light.

General

210. The Working Group noted that currently there appeared to be a relatively limited level of offal discharge in the trawl fisheries in the Convention Area; however, observer reports indicated that more information is required to assess the extent and timing of offal discharge and the potential interactions with seabirds.

211. The Working Group recalled (WG-FSA-04/79) that observations of trawl warp strike rates require dedicated observer effort with an appropriate level of coverage, given the high level of within- and between-tow variance, to accurately estimate seabird interactions and mortality. In order to better understand the interactions between seabirds and vessels in relation to discharge when the trawl warps are in the water, i.e. in addition to the times of setting and hauling, the following forms should be included in the observer cruise report:

- (i) deck discards – including all discarded fish and associated waste discarded from the deck during all trawling operations;
- (ii) factory discharge – all materials discarded from the factory during all trawling operations.

212. During the intersessional period the Working Group will develop data collection protocols for the investigation of interactions between seabirds and trawl warps for consideration by WG-IMAF in 2006.

213. Pilot trials to test a range of mitigation measures to reduce seabird strikes on warp cables and net sonde cables in the Bering Sea pollock trawl fishery identified several promising methods. A boom with straps hanging to the water placed in the offal stream forward of the warps was considered to have potential at reducing warp cable strikes. Paired streamer lines were also identified as potentially reducing strikes with warp cables (as reported in WG-FSA-04/79 outside the Convention Area in the South Atlantic). Streamer lines were also effective at reducing contacts with the net sonde cable, as was a snatch block system that lowered the exit point of the netsonde cable to the trawl deck level. Trials are planned to further test these methods.

214. Detailed data collection protocols designed to monitor seabird interactions with both the warps and net developed for the New Zealand southern squid trawl fishery (WG-FSA-05/41) were tested using data collected in the summer of 2004/05 (WG-FSA-05/40). It was noted that of the 106 dead or injured birds recorded during the trials, approximately half occurred on the warp cable and half were due to net entanglements. Data modelling identified the presence and rate of offal discharge as the primary factor related to warp cable strikes.

215. The Working Group recommended that at future meetings, assessments of incidental mortality of seabirds and marine mammals in the icefish, toothfish and krill trawl fisheries be undertaken collectively as part of a generic review of the trawl methodology for mitigation purposes. This approach, assessing the gear rather than the target fishery, has been useful in the development of mitigation methods in longline fisheries. Fishery-specific and species-specific attributes would be considered when appropriate.

Interactions involving marine mammals and trawl fishing operations

Toothfish

216. There was a single Antarctic fur seal caught and released alive in the toothfish trawl fishery in Division 58.5.2.

Krill

217. In 2004/05, 95 Antarctic fur seals were observed caught during krill fishing operations in Area 48, of which 74 were released alive (WG-FSA-05/8, Table 4) compared to 156 of which 12 were released alive last year (SC-CAMLR-XXIII, Annex 5, paragraph 7.229). The observer coverage was not sufficient to extrapolate a total mortality in the fishery.

218. The Working Group recalled that in considering this subject last year it was unable to recommend a particular source of mitigation (SC-CAMLR-XXIII, Annex 5, paragraph 7.243) and welcomed the paper by Hooper et al. (2005) in which various seal-exclusion devices, with information regarding their success, were described.

219. Information from observer reports with details of the mitigation methods used in 2004/05 were available from three vessels:

- (i) the *Insung Ho* used a net bag at the opening of the net that was designed to prevent entry into the net (as described in Hooper et al., 2005). This vessel caught 69 seals of which 64 were released alive;
- (ii) the *Top Ocean* used a seal excluder device that consisted of a mesh panel sewed diagonally inside the posterior intermediate sections of the trawl nets intended to conduct pinnipeds upward toward one of three approximately 75 cm diameter oval holes cut into the top of the net. However, the manner in which seals were entangled, in both the excluder panel and side meshes of the intermediate net (usually with their heads forced through the mesh or their snouts and flippers entangled), suggested that the holes at the top of the net may not have been apparent to the seals. There were 24 Antarctic fur seal captures reported from this vessel, of which 16 were dead;
- (iii) the *Niitaka Maru* implemented the MARUHA system (SC-CAMLR-XXIII, Annex 5, paragraph 7.239), although the report of the observer indicated that the opening in the roof of the net was smaller than described last year. There were two fur seals caught and released alive on this vessel.

220. The observer report from the *Foros* indicated that it did not implement any specific mitigation measures and no Antarctic fur seal mortality was reported. However, the observer pointed out that it was not possible to observe the codend emptying process and therefore the recording of seal mortality is likely to have been compromised.

221. The Working Group discussed the information on the mitigation devices used in the fishery this year, and acknowledged that, as last year, there was insufficient information available with which to evaluate the relative design and efficacy of different seal mitigation systems.

222. The Working Group recalled that, given the increasing evidence of seal entrapment in krill fisheries and the apparent efficacy of some of the seal exclusion methods tested last year, the Scientific Committee last year recommended that:

- (i) every vessel fishing for krill should employ a device for excluding seals or facilitating their escape from the trawl net;
- (ii) observers should be required on krill trawl vessels to collect reliable data on seal entrapment and on the effectiveness of devices used to mitigate this (SC-CAMLR-XXIII, paragraph 5.37).

223. In 2004/05 observer reports were received from four of the nine vessels fishing for krill in Area 48. Observer data from the *Top Ocean* (USA) covered 100% of its fishing period predominantly in Subarea 48.2. The reports from UK observers on the other three vessels were from the period of time that those vessels were fishing in Subarea 48.3 and covered a smaller proportion of their overall time fishing in Area 48 (*Insung Ho* 23%, *Niitaka Maru* 17% and *Foros* 16%).

224. Based on the experience of WG-IMAF in addressing the design and implementation of mitigation measures for the reduction of incidental mortality of seabirds in longline fisheries, concern was expressed that the current level of observer coverage is likely to be insufficient to allow resolution of seal entanglement problems. In addition, the Working Group felt that, given this low level of observer coverage, it is not feasible to estimate the total Antarctic fur seal mortality in the krill fishery.

225. The Working Group reiterated the recommendations made by the Scientific Committee last year, in particular for observers on krill vessels to collect reliable data on seal entrapment and on the effectiveness of devices to mitigate this (SC-CAMLR-XXIII, paragraph 5.37), which should allow a very substantial resolution of the problem. A minimum requirement would be to have observations from each vessel in the fishery in order to assess the type and efficacy of the mitigation measures employed on a vessel-by-vessel basis. This would also enable provision of information on the rate of seabird trawl warp strikes by birds in this fishery (see paragraph 209).

226. The Working Group recommended 100% observer coverage on krill trawl vessels to obtain reliable data on seal entrapment and on the effectiveness of associated mitigation devices.

227. In circumstances where a short-term solution to the current problem is not available, the Working Group considered potential criteria relevant to developing solutions in the future based on experience with sea lion mitigation in New Zealand (WG-FSA-05/48). The Working Group noted that attempts to develop seal mitigation devices for use in trawl fisheries should consider the following points or issues:

- (i) any mitigation device should be tested, preferably in a flume tank, to ensure that it does not adversely affect the dynamics of the net during deployment, tow and retrieval, i.e. that the system is implementable;
- (ii) the device must be easy to use and must comply with all applicable health and safety standards in order to achieve operator buy-in;
- (iii) the excluder device must not have a significant adverse effect on the quantity and quality of the target species;
- (iv) the device must be shown to successfully expel the non-target species;
- (v) animals that are directed out of the net through the device must be shown to survive, i.e. the device must have a negligible effect on survivability.

228. Without successfully addressing the first three points, it is unlikely that the fishing industry will fully implement the exclusion device. Without addressing the last two points, there is no way to demonstrate post-release survivability, i.e. the efficacy of the device to release non-target species safely and efficiently.

229. In the present circumstances however, the Working Group recognised that the effectiveness of existing measures could be adequately assessed if sufficient data and reports from observers were available. Devices currently in use in the krill fishery already appear to

be implementable, safe and without discernable effect on the target species. More data are needed on exclusion/expulsion of non-target species, together with information on potential survivorship of ejected animals.

230. While welcoming consideration of principles derived from experience with sea lions in New Zealand, the Working Group:

- (i) observed that the species involved is classified as globally threatened, unlike Antarctic fur seals;
- (ii) noted that within an overall goal of eliminating non-target by-catch, the management actions involved should be consistent with the level of risk to populations and species concerned. It recollected the discussion on the topic last year (SC-CAMLR-XXIII, paragraphs 5.25 to 5.33).

Other business

Proposal for testing new streamer line designs

231. The Working Group reviewed SC-CAMLR-XXIV/8. In doing so it recognised that comments were necessary in respect of:

- (i) procedures involving the role and responsibilities of observers;
- (ii) procedures for proposals to test mitigation measures which would require exemption from some element of existing conservation measures;
- (iii) the details of the proposal itself.

232. The Working Group expressed concern that this proposal had arisen from circumstances wherein the observer had given a fishing master 'permission to trial [a] vessel streamer line' which did not meet the specification of the conservation measure, despite the fact that streamer lines complying with the CCAMLR specification were on board.

233. The Working Group recollected the long history of development of streamer line design and application and the very extensive review in 2003 that had led to the latest revision of the specifications for streamer line design and use.

234. In regard to proposals to test new mitigation methods (or modifications thereof) it recollected that up to 2002 the relevant conservation measure (e.g. 25-02 (2002)) contained a clause specifying that 'other variations in the design of streamer lines may be tested on vessels carrying two observers' and that 'testing should be carried out independently of actual commercial fishing'.

235. When the conservation measure was comprehensively revised in 2003 this clause was no longer included and this may have led to some confusion. The Working Group recommended that further testing of modifications to mitigation methods which would require exemption from the provisions of current conservation measures should require prior

provision to CCAMLR of full details of the proposed research and experiments, as had been done in relation to line-weighting experiments. The Working Group therefore recommended that, to avoid any further confusion, the Scientific Committee confirm that:

- (i) the role of scientific observers does not include the ability to agree to fishing-related practices that are in contravention of CCAMLR conservation measures without relevant prior exemptions having been agreed by CCAMLR;
- (ii) full proposals for any such testing shall be notified to WG-FSA in advance of the fishing season in which the trials are proposed to be conducted.

236. In respect of the specific proposal in SC-CAMLR-XXIV/8, the Working Group noted that:

- (i) it was not feasible or appropriate for the Working Group to devise specific experimental protocols for applicants;
- (ii) it was prepared to comment on the content and design of experiments proposed by applicants provided these were available two weeks in advance of the start of the meeting so that there was sufficient time for appropriate expert consultation;
- (iii) consequently it was not recommended that a test of the streamer line designs outlined in Annex 1 of SC-CAMLR-XXIV/8 should proceed in the 2005/06 fishing season.

237. The Working Group further noted, in respect of the proposed streamer line designs, that:

- (i) the existing conservation measure would allow the use of the colours, number and spacing of streamers being proposed for testing;
- (ii) the absence of swivels would certainly lead to the operational problems described. In areas and times of higher risk of seabird by-catch than at the time of year when the design had been used, mitigation performance would likely be substantially reduced;
- (iii) an important objective of Conservation Measure 25-02 is to ensure optimal aerial coverage, and a line only half the length of that currently recommended would likely be seriously defective in this regard;
- (iv) proper testing of the proposed streamer line designs would need to include circumstances of much higher risk of seabird by-catch than that applying in Subarea 48.3 during the currently approved fishing season in winter months.

238. Accordingly, the applicants were advised to consider carefully whether it was worthwhile seeking to conduct in future appropriate trials of streamer lines of the designs proposed.

Toothfish fishing proposal for Subarea 48.4

239. WG-FSA-05/57 proposed a mark–recapture experiment to estimate toothfish population size in Subarea 48.4 which would involve longline fishing in April.

240. The risk assessment in respect of seabird by-catch for this subarea was revised in 2005 from level 1 to level 3 (SC-CAMLR-XXIV/BG/26 and paragraph 186). The new risk-assessment level would require longline fishing to be prohibited during the breeding season of southern giant petrel (October to March), except when fishing is undertaken under Conservation Measure 24-02. This advice would not appear to conflict with the timing of fishing proposed in the application.

Management Advice

241. Management advice is provided in section 7 of the main text of WG-FSA's report.

References

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- Moreno, C.A., J.A. Arata, P. Rubilar, R. Hucke-Gaete and G. Robertson. 2005. Artisanal longline fisheries in Southern Chile: lessons to be learned to avoid incidental seabird mortality. *Biol. Cons.*: 10 pp. (in press).

Table 1: Observed incidental mortality of seabirds in the longline fisheries for *Dissostichus* spp. in Subareas 48.3, 48.6, 58.6, 58.7, 88.1, 88.2 and Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b and 58.5.2 during the 2004/05 season, including related mitigation information. Sp – Spanish method; Auto – autoliner; N – night-time setting; D – daytime setting (including nautical dawn and dusk); O – opposite side to hauling; S – same side as hauling; * – information obtained from cruise report.

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks (thousands)			No. of birds observed caught				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 (%)			
Subarea 48.3																						
<i>Argos Georgia</i>	1/5–28/8/05	Sp	280	0	280	100	451.2	1452.4	31	0	0	1	0	12	0	0.002	0	0.002	100		(0)	O (10)
<i>Isla Santa Clara</i>	10/5–4/8/05	Sp	185	0	185	100	278.2	1145.4	24	0	0	0	0	0	0	0	0	0	100		(0)	O (100)
<i>Jacqueline</i>	2/5–24/8/05	Sp	204	0	204	100	292.2	1406.2	20	0	0	0	0	1	0	0	0	0	100		(1)	O (99)
<i>Koryo Maru No. 11</i>	2/5–16/8/05	Sp	186	0	186	100	399.9	1638.0	24	0	0	0	0	0	0	0	0	0	100		(0)	O (97)
<i>Polarpesca I</i>	13/5–21/8/05	Sp	221	0	221	100	255.1	1262.4	20	0	0	0	0	0	0	0	0	0	100		(0)	O (99)
<i>Protegat</i>	1/5–21/8/05	A	252	6	258	98	937.4	1510.9	62	0	0	3	0	0	0	0	0	0	99.6	100	(0)	O (90)
<i>Viking Bay</i>	1/5–21/8/05	Sp	222	0	222	100	387.5	1224.9	31	0	0	0	0	3	0	0.007	0	0.007	100		(0)	O (83)
<i>Argos Helena</i>	1/5–29/8/05	A	297	0	297	100	451.2	2228.4	28	0	0	0	0	0	0	0	0	0	100		(0)*	S (0)*
Total						99	11868.5	11868.5	31							0.0011	0	0.0011				
Subarea 48.6																						
<i>Shinsei Maru No. 3</i>	23/1–18/3/05	Sp	33	85	118	28	224.3	709.2	31	0	0	0	0	1	1	0	0	0	100	100	(0)*	O (0)*
Total						28	224.3	709.2	31							0	0	0				
Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b																						
<i>Arnela</i>	3/12–16/3/05	Sp	11	161	172	6	605.9	1614.9	37	0	0	0	2	0	1	0	0.005	0.005	100	100	(0)	O (65)
<i>Globalpesca II</i>	19/12–2/3/05	Sp	0	90	90	0	647.1	1090.2	59	0	0	0	0	0	0	0	0	0	100	100	(0)	O (0)
<i>Galaecia</i>	16/12–10/3/05	Sp	5	113	118	4	413.1	1445.9	28	0	0	0	0	0	0	0	0	0	100	100	(0)	O (23)
<i>No. 829 Yeon Seong</i>	20/12–21/2/05	Sp	19	89	108	17	911.7	1191.1	76	0	0	0	0	0	0	0	0	0	100	100	(0)	S (0)
<i>Janas</i>	5/3–29/3/05	Ao	6	40	46	13	127.6	235.6	54	0	0	0	0	0	0	0	0	0	100	100	(0)	(0)
<i>Avro Chieftain</i>	4/9–7/9/05	Ao	10	0	10	100	25.3	67.0	37	0	0	0	0	0	0	0	0	0	100	100	(0)	O (0)
<i>Galaecia</i>	15/4–6/7/05	Sp	41	72	113	36	979.2	1673.5	58	0	0	0	0	0	0	0	0	0	100	100	(0)	O (100)
<i>No. 707 Bonanza</i>	26/12–10/3/05	Sp	5	105	110	4	986.0	1043.7	94	0	0	0	0	0	0	0	0	0	100	100	(0)	O (0)
Total						26	4695.9	8361.9	56							0	<0.001	<0.001				
Division 58.5.2																						
<i>Avro Chieftain</i>	25/7–1/9/05	A	57	54	111	50	236.0	756.3	31	0	0	0	0	0	0	0	0	0	100	100	(0)	O (0)
<i>Avro Chieftain</i>	10/5–1/7/05	A	-	-	150		350.9	851.5	41	0	0	0	0	0	0	0	0	0	100*	100*	(0)	O (0)
Total							586.9	1607.8	36							0	0	0				
Subareas 58.6, 58.7																						
<i>Koryo Maru No. 11</i>	24/2–1/4/05	Sp	72	0	72	100	336.0	510.0	65	25	0	25	0	2	0	0.149	0	0.149	100		(0)	O (99)
Total						100	336.0	510.0	65							0.149	0	0.149				
Subareas 88.1, 88.2																						
<i>Antartic III</i>	5/12–5/2/05	A	0	168	168	0	415.0	671.2	61	0	0	0	0	0	0	0	0	0		99	(1)	S (1)
<i>Argos Helena</i>	4/12–4/3/05	A	2	160	162	1	202.3	869.1	23	0	0	0	0	0	0	0	0	0	100	100	(0)	(0)
<i>Janas</i>	1/12–6/2/05	A	0	172	172	0	335.6	782.8	42	0	0	0	0	0	0	0	0	0	100	100	(0)	(0)
<i>Paloma V</i>	27/12–1/3/05	Sp	0	132	132	0	461.5	1184.6	38	0	0	0	0	0	0	0	0	0		98	(0)	(0)
<i>Punta Ballena</i>	14/1–13/3/05	A	0	124	124	0	585.1	747.6	78	0	0	0	0	0	0	0	0	0		100	(0)	(0)
<i>San Aotea II</i>	4/12–14/2/05	A	0	196	196	0	313.2	743.2	42	0	0	0	0	0	0	0	0	0		100	(0)	(0)
<i>Frøyanes</i>	29/12–1/3/05	A	0	191	191	0	251.7	804.1	31	0	0	0	0	0	0	0	0	0		100	(0)	(0)
<i>Volna</i>	18/12–18/3/05	Sp	0	132	132	0	1181.2	1181.2	100	0	0	0	0	0	0	0	0	0		100	(0)	(0)
<i>Yantar</i>	18/12–18/3/05	Sp	-	-	168		474.1	1142.1	41	0	0	0	0	0	0	0	0	0		100*	(0)	(0)
<i>Avro Chieftain</i>	31/12–6/2/05	A	0	83	83	0	143.3	365.1	39	0	0	0	0	0	0	0	0	0		100	(0)	(0)
<i>San Aspiring</i>	25/12–23/2/05	A	2	114	116	1	313.6	647.5	48	0	0	0	0	0	0	0	0	0		100	(0)	(0)
Total							4676.5	9138.4	51							0	0	0				

¹ Birds 'caught' as defined by the Commission in 2004 (CCAMLR-XXIII, paragraphs 10.30 and 10.31).

Table 2: Extrapolated incidental mortality of seabirds, for those vessels on which incidental mortalities of seabirds were observed, in Subareas 48.3, 58.6 and 58.7 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b during the 2004/05 season.

Vessel	Hooks observed (thousands)	Hooks set (thousands)	Percentage of hooks observed	% Night sets	Extrapolated number of incidental seabird mortalities		
					Night	Day	Total
Subarea 48.3							
<i>Argos Georgia</i>	451.2	1 452.4	31	100	4	0	4
<i>Viking Bay</i>	387.5	1 224.9	31	100	9	0	9
Subtotal					13	0	13
Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b							
<i>Arnela</i>	605.9	1 614.9	37	6	0	8	8
Subtotal					0	8	8
Subareas 58.6, 58.7							
<i>Koryo Maru No. 11</i>	336.0	510.0	65	100	76	0	76
Subtotal					76	0	76
Total					89	8	97

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 2005 (- indicates no fishing occurred).

Subarea	Year								
	1997	1998	1999	2000	2001	2002	2003	2004	2005
Subarea 48.3									
Extrapolated mortality	5 755	640	210*	21	30	27	8	27	13
Observed mortality rate	0.23	0.032	0.013*	0.002	0.002	0.0015	0.0003	0.0015	0.0011
Subarea 48.4									
Extrapolated mortality	-	-	-	-	-	-	-	-	0
Observed mortality rate	-	-	-	-	-	-	-	-	0
Subarea 48.6									
Extrapolated mortality	-	-	-	-	-	-	-	0	0
Observed mortality rate	-	-	-	-	-	-	-	0	0
Subareas 58.6, 58.7									
Extrapolated mortality	834	528	156	516	199	0	7	39	76
Observed mortality rate	0.52	0.194	0.034	0.046	0.018	0	0.003	0.025	0.149
Subareas 88.1, 88.2									
Extrapolated mortality	-	0	0	0	0	0	0	1	0
Observed mortality rate	-	0	0	0	0	0	0	0.0001	0
Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b									
Extrapolated mortality	-	-	-	-	-	-	-	0	8
Observed mortality rate	-	-	-	-	-	-	-	0	<0.001
Division 58.5.2									
Extrapolated mortality	-	-	-	-	-	-	0	0	0
Observed mortality rate	-	-	-	-	-	-	0	0	0

* Excluding *Argos Helena* line-weighting experiment cruise.

Table 4: Species composition of seabird mortalities (injured and dead)¹ in longline fisheries in Subareas 48.3, 58.6 and 58.7 and Divisions 58.4.1, 58.4.2, 58.4.3a and 58.4.3b, during the 2004/05 season. N – night-time setting; D – daytime setting (including nautical dawn and dusk); DCR – yellow-nosed albatross; DIX – wandering albatross; MAI – southern giant petrel; PRO – white-chinned petrel; () – % composition.

Vessel	Dates of fishing	No. seabird mortalities by group						Species composition (%)							
		Albatrosses		Petrels		Total		DCR	DIX	MAI	PRO				
		N	D	N	D	N	D								
Subarea 48.3															
<i>Argos Georgia</i>	1/5–28/8/05	0	0	1	0	1	0			1	(100)				
<i>Viking Bay</i>	1/5–21/8/05	0	0	3	0	3	0			3	(100)				
Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b															
<i>Arnela</i>	3/12/04–16/3/05	0	0	0	2	0	2			2	(100)				
Subareas 58.6 and 58.7															
<i>Koryo Maru No. 11</i>	24/2–1/4/05	7	0	43	0	50	0	6	(12)	1	(2)	43	(86)		
Total (%)		3	0	8	2	11	2	6	(11)	1	(2)	6	(11)	43	(76)

¹ Birds ‘caught’ as defined by the Commission in 2004 (CCAMLR-XXIII, paragraphs 10.30 and 10.31).

Table 5: Observed incidental mortality, reported by captains, of seabirds in the longline fisheries for *Dissostichus* spp. in Division 58.5.1 during the 2000/01 season (September to August). Sp – Spanish method; Auto – autoliner; N – night-time setting; D – daytime setting (including dawn and dusk); NC – not collected.

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks (thousands)			Hooks baited (%)	No. of birds caught ¹						Reported seabird mortality (birds/1 000 hooks)			Streamer line in use %		Offal discharge during haul (%)
			N	D	Total	%N	Reported	Set	% Observed		Dead		Alive		Total		N	D	Total	N	D	
											N	D	N	D	N	D						
<i>Ship 3</i>	4/10–18/11/00	Auto	83	0	83	100	3 568.9	3 568.9	100	NC	0	0	NC	0	0	0	0.000	0	0.000	NC	0	(0)
<i>Ship 3</i>	26/1–10/2/01	Auto	32	0	32	100	1 241.1	1 241.1	100	NC	294	0	NC	0	294	0	0.237	0	0.237	NC	0	(0)
<i>Ship 8</i>	21/10–2/12/00	Auto	174	0	174	100	2 234.2	2 234.2	100	NC	0	0	NC	0	0	0	0.000	0	0.000	NC	0	(0)
<i>Ship 8</i>	12/2–18/3/01	Auto	122	0	122	100	1 546.6	1 546.6	100	NC	363	0	NC	0	363	0	0.235	0	0.235	NC	0	(0)
<i>Ship 8</i>	17/4–14/5/01	Auto	61	0	61	100	1 908.4	1 908.4	100	NC	191	0	NC	0	191	0	0.100	0	0.100	NC	0	(0)
<i>Ship 8</i>	15/6–29/6/01	Auto	27	0	27	100	925.2	925.2	100	NC	3	0	NC	0	3	0	0.003	0	0.003	NC	0	(0)
<i>Ship 9</i>	8/10–20/11/00	Sp	34	0	34	100	2 862.6	2 862.6	100	100	458	0	NC	0	458	0	0.160	0	0.160	NC	0	(0)
<i>Ship 9</i>	14/12/00–28/1/01	Sp	42	0	42	100	1 477.5	1 477.5	100	100	47	0	NC	0	47	0	0.032	0	0.032	NC	0	(0)
<i>Ship 9</i>	23/4–2/5/01	Sp	10	0	10	100	381.2	381.2	100	100	0	0	NC	0	0	0	0.000	0	0.000	NC	0	(0)
<i>Ship 9</i>	24/5–28/6/01	Sp	33	0	33	100	2 243.4	2 243.4	100	100	54	0	NC	0	54	0	0.024	0	0.024	NC	0	(0)
<i>Ship 10</i>	14/2–12/4/01	Sp	54	0	54	100	2 346.1	2 346.1	100	100	507	0	NC	0	507	0	0.216	0	0.216	NC	0	(0)
Total						100	20 735.2	20 735.2	100		1 917						0.092	0	0.092			

1 Birds 'caught' as defined by the Commission in 2004 (CCAMLR-XXIII, paragraphs 10.30 and 10.31).

Table 6: Species composition, as reported by captains, of incidental mortality of seabirds in longline fisheries in Division 58.5.1 during the 2000/01 season (September to August). N – night-time setting; D – daytime setting (including dawn and dusk); PRO – white-chinned petrel; MAH – northern giant petrel; PCI – grey petrel; DIC – grey-headed albatross; DIM – black-browed albatross; () – % composition.

Vessel	Dates of fishing	No. birds killed by group								Species composition (%)				
		Petrels		Albatrosses		Penguins		Total		PRO	MAH	PCI	DIC	DIM
		N	D	N	D	N	D	N	D					
<i>Ship 3</i>	4/10–18/11/00	0	0	0	0	0	0	0	0					
<i>Ship 3</i>	26/1–10/2/01	292	0	2	0	0	0	294	0	292 (99.3)			2 (0.7)	
<i>Ship 8</i>	21/10–2/12/00	0	0	0	0	0	0	0	0					
<i>Ship 8</i>	12/2–18/3/01	363	0	0	0	0	0	363	0	363 (100)				
<i>Ship 8</i>	17/4–14/5/01	191	0	0	0	0	0	191	0	145 (74.9)	2 (1.0)	44 (23.0)		
<i>Ship 8</i>	15/6–29/6/01	3	0	0	0	0	0	3	0			3 (100)		
<i>Ship 9</i>	8/10–20/11/00	458	0	0	0	0	0	458	0	458 (100)				
<i>Ship 9</i>	14/12/00–28/1/01	44	0	3	0	0	0	47	0	44 (93.6)				3 (6.4)
<i>Ship 9</i>	23/4–2/5/01	0	0	0	0	0	0	0	0					
<i>Ship 9</i>	24/5–28/6/01	54	0	0	0	0	0	54	0		2 (3.7)	52 (96.3)		
<i>Ship 10</i>	14/2–12/4/01	507	0	0	0	0	0	507	0	507 (100)				
Total (%)		1912	0	5	0	0	0	1917	0	1809 (94.4)	4 (0.2)	99 (5.2)	2 (0.1)	3 (0.2)

Table 7: Incidental mortality, reported by captains, of seabirds in the longline fisheries for *Dissostichus* spp. in Subarea 58.6 and Division 58.5.1 during the 2004/05 season (September to August). Sp – Spanish method; Auto – autoliner; N – night-time setting; D – daytime setting (including nautical dawn and dusk); NC – not collected.

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks (thousands)			Hooks baited (%)	No. of birds caught						Reported seabird mortality (birds/1 000 hooks)			Streamer line in use %		Offal discharge during haul (%)
			N	D	Total	%N	Reported	Set	% Observed		Dead		Alive		Total		N	D	Total	N	D	
											N	D	N	D	N	D						
Subarea 58.6																						
<i>Ship 1</i>	9/9–13/9/04	Auto	10	0	10	100	90.9	90.9	100.0	85.0	0	0	0	0	0	0.0000	0	0.0000	100	0	0	
<i>Ship 1</i>	4/2–9/2/05	Auto	12	0	12	100	104.8	104.8	100.0	NC	8	0	1	0	9	0	0.0763	0	0.0763	100	0	0
<i>Ship 1</i>	15/2–23/2/05	Auto	19	0	19	100	197.4	197.4	100.0	NC	1	0	4	0	5	0	0.0051	0	0.0051	100	0	0
<i>Ship 1</i>	19/5–25/6/05	Auto	71	0	71	100	674.1	674.1	100.0	89.9	3	0	1	0	4	0	0.0045	0	0.0045	100	0	0
<i>Ship 2</i>	5/11–11/11/04	Auto	14	0	14	100	104.9	104.9	100.0	85.0	0	0	31	0	31	0	0.0000	0	0.0000	100	0	0
<i>Ship 2</i>	4/2–10/2/05	Auto	20	0	20	100	126.5	126.5	100.0	95.0	9	0	1	0	10	0	0.0711	0	0.0711	100	0	0
<i>Ship 2</i>	10/5–18/5/05	Auto	23	0	23	100	201.3	201.3	100.0	96.0	0	0	3	0	3	0	0.0000	0	0.0000	100	0	0
<i>Ship 2</i>	23/7–11/8/05	Auto	48	0	48	100	335.9	335.9	100.0	90.4	0	0	7	0	7	0	0.0000	0	0.0000	100	0	0
<i>Ship 3</i>	20/1–22/2/05	Auto	65	0	65	100	672.0	672.0	100.0	95.0	50	0	6	0	56	0	0.0744	0	0.0744	100	0	0
<i>Ship 4</i>	1/9–3/9/04	Sp	4	0	4	100	31.2	31.2	100.0	100.0	0	0	0	0	0	0	0.0000	0	0.0000	100	0	0
<i>Ship 5</i>	3/9–8/9/04	Auto	13	0	13	100	101.7	101.7	100.0	95.0	0	0	0	0	0	0	0.0000	0	0.0000	100	0	0
<i>Ship 5</i>	6/2–9/2/05	Auto	7	0	7	100	77.9	77.9	100.0	NC	0	0	0	0	0	0	0.0000	0	0.0000	100	0	0
<i>Ship 5</i>	15/2–25/2/05	Auto	32	0	32	100	183.5	183.5	100.0	NC	14	0	0	0	14	0	0.0763	0	0.0763	100	0	0
<i>Ship 5</i>	31/5–21/6/05	Auto	43	0	43	100	427.5	427.5	100.0	94.0	2	0	3	0	5	0	0.0047	0	0.0047	100	0	0
<i>Ship 6</i>	20/11–29/11/04	Auto	35	0	35	100	175.5	175.5	100.0	85.6	18	0	0	0	18	0	0.1026	0	0.1026	100	0	0
<i>Ship 6</i>	2/2–23/2/05	Auto	45	0	45	100	363.5	363.5	100.0	92.4	15	0	17	0	32	0	0.0413	0	0.0413	100	0	0
<i>Ship 7</i>	4/2–25/2/05	Auto	54	0	54	100	381.2	381.2	100.0	NC	12	0	15	0	27	0	0.0315	0	0.0315	100	0	0
<i>Ship 7</i>	17/6–29/6/05	Auto	30	0	30	100	232.3	232.3	100.0	95.0	0	0	1	0	1	0	0.0000	0	0.0000	100	0	0
<i>Ship 11</i>	16/2–25/2/05	Auto	26	0	26	100	136.8	136.8	100.0	96.1	1	0	0	0	1	0	0.0073	0	0.0073	100	0	0
<i>Ship 11</i>	20/6–12/7/05	Auto	61	0	61	100	304.0	304.0	100.0	96.2	4	0	2	0	6	0	0.0132	0	0.0132	100	0	0
Total						100	4 922.7	4 922.7	100.0		137		92		229							

(continued)

Table 7 (continued)

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks (thousands)			Hooks baited (%)	No. of birds caught						Reported seabird mortality (birds/1 000 hooks)			Streamer line in use %		Offal discharge during haul (%)
			N	D	Total	%N	Reported	Set	% Observed		Dead		Alive		Total		N	D	Total	N	D	
											N	D	N	D	N	D						
Division 58.5.1																						
<i>Ship 1</i>	17/9–16/11/04	Auto	166	0	166	100	1369.3	1369.3	100.0	85.0	47	0	12	0	59	0	0.0343	0	0.0343	100	0	0
<i>Ship 1</i>	22/12/04–31/01/05	Auto	100	0	100	100	903.2	903.2	100.0	NC	18	0	22	0	40	0	0.0199	0	0.0199	100	0	0
<i>Ship 1</i>	1/3–13/3/05	Auto	33	0	33	100	348.5	348.5	100.0	NC	61	0	10	0	71	0	0.1750	0	0.1750	100	0	0
<i>Ship 1</i>	18/4–14/5/05	Auto	72	0	72	100	645.9	645.9	100.0	88.5	27	0	1	0	28	0	0.0418	0	0.0418	100	0	0
<i>Ship 2</i>	8/9–2/11/04	Auto	153	0	153	100	1185.6	1185.6	100.0	85.0	16	0	74	0	90	0	0.0135	0	0.0135	100	0	0
<i>Ship 2</i>	30/11/04–31/1/05	Auto	161	0	161	100	1198.1	1198.1	100.0	95.8	32	0	61	0	93	0	0.0267	0	0.0267	100	0	0
<i>Ship 2</i>	1/3–6/5/05	Auto	175	0	175	100	1498.8	1498.8	100.0	96.4	108	0	23	0	131	0	0.0721	0	0.0721	100	0	0
<i>Ship 2</i>	5/6–19/7/05	Auto	126	0	126	100	1000.8	1000.8	100.0	91.8	25	0	15	0	40	0	0.0250	0	0.0250	100	0	0
<i>Ship 3</i>	25/9–12/12/04	Auto	158	0	158	100	2070.6	2070.6	100.0	90.3	98	0	15	0	113	0	0.0473	0	0.0473	100	0	0
<i>Ship 3</i>	1/3–13/4/05	Auto	83	0	83	100	1122.5	1122.5	100.0	95.0	64	0	1	0	65	0	0.0570	0	0.0570	100	0	0
<i>Ship 3</i>	19/5–27/6/05	Auto	79	0	79	100	1082.6	1082.6	100.0	NC	39	0	17	0	56	0	0.0360	0	0.0360	100	0	0
<i>Ship 5</i>	11/9–8/11/04	Auto	146	0	146	100	1217.0	1217.0	100.0	95.0	131	0	11	0	142	0	0.1076	0	0.1076	100	0	0
<i>Ship 5</i>	15/12/04–30/1/05	Auto	142	0	142	100	1057.3	1057.3	100.0	NC	44	0	23	0	67	0	0.0416	0	0.0416	100	0	0
<i>Ship 5</i>	1/3–6/3/05	Auto	22	0	22	100	140.1	140.1	100.0	NC	54	0	6	0	60	0	0.3854	0	0.3854	100	0	0
<i>Ship 5</i>	14/4–29/5/05	Auto	107	0	107	100	1071.9	1071.9	100.0	92.7	65	0	34	0	99	0	0.0606	0	0.0606	100	0	0
<i>Ship 6</i>	4/9–16/11/04	Auto	199	0	199	100	1666.8	1666.8	100.0	88.4	165	0	15	0	180	0	0.0990	0	0.0990	100	0	0
<i>Ship 6</i>	11/1–29/1/05	Auto	46	0	46	100	429.3	429.3	100.0	88.2	78	0	7	0	85	0	0.1817	0	0.1817	100	0	0
<i>Ship 6</i>	1/3–30/3/05	Auto	78	0	78	100	694.5	694.5	100.0	90.9	190	0	15	0	205	0	0.2736	0	0.2736	100	0	0
<i>Ship 6</i>	8/5–5/7/05	Auto	159	0	159	100	1315.5	1315.5	100.0	93.2	57	0	12	0	69	0	0.0433	0	0.0433	100	0	6
<i>Ship 7</i>	13/9–6/12/04	Auto	189	0	189	100	1975.4	1975.4	100.0	91.7	19	0	NC	0	NC	0	0.0096	0	0.0096	100	0	0
<i>Ship 7</i>	12/1–31/1/05	Auto	50	0	50	100	450.9	450.9	100.0	NC	127	0	4	0	131	0	0.2817	0	0.2817	100	0	0
<i>Ship 7</i>	1/3–5/4/05	Auto	98	0	98	100	840.0	840.0	100.0	NC	276	0	24	0	300	0	0.3286	0	0.3286	100	0	0
<i>Ship 7</i>	11/5–13/6/05	Auto	88	0	88	100	755.5	755.5	100.0	95.0	8	0	16	0	24	0	0.0106	0	0.0106	100	0	0
<i>Ship 11</i>	29/10/04–13/1/05	Auto	202	0	202	100	1377.0	1377.0	100.0	NC	39	0	0	0	39	0	0.0283	0	0.0283	100	0	0
<i>Ship 11</i>	1/3–15/5/05	Auto	174	0	174	100	1286.1	1286.1	100.0	95.7	107	0	2	0	109	0	0.0832	0	0.0832	100	0	0
<i>Ship 11</i>	10/6–14/6/05	Auto	12	0	12	100	86.0	86.0	100.0	97.7	6	0	1	0	7	0	0.0698	0	0.0698	100	0	0
Total						100	26 789.1	26 789.1	100.0		1 901		421		2 303							

Table 8: Observed incidental mortality of seabirds in the longline fisheries for *Dissostichus* spp. in Subarea 58.6 and Division 58.5.1 during the 2004/05 season (September to August). Sp – Spanish method; Auto – autoliner; N – night-time setting; D – daytime setting (including nautical dawn and dusk); NC – not collected.

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks (thousands)			Hooks baited (%)	No. of birds caught						Reported seabird mortality (birds/1 000 hooks)			Streamer line in use %		Offal discharge during haul (%)
			N	D	Total	%N	Reported	Set	% Observed		Dead		Alive		Total		N	D	Total	N	D	
											N	D	N	D	N	D						
Subarea 58.6																						
Ship 4	1/9–3/9/04	Sp	4	0	4	100	8.0	31.2	25.6	100.0	0	0	0	0	0	0	0.0000	0	0.0000	100	0	0
Ship 5	3/9–8/9/04	Auto	13	0	13	100	26.7	101.7	26.2	95.0	0	0	0	0	0	0	0.0000	0	0.0000	100	0	0
Ship 2	5/11–11/11/04	Auto	14	0	14	100	20.3	104.9	19.3	85.0	0	0	0	0	0	0	0.0000	0	0.0000	100	0	0
Ship 1	9/9–13/9/04	Auto	10	0	10	100	22.6	90.9	24.8	85.0	0	0	0	0	0	0	0.0000	0	0.0000	100	0	0
Ship 6	20/11–29/11/04	Auto	35	0	35	100	44.0	175.5	25.1	85.6	6	0	0	0	6	0	0.1364	0	0.1364	100	0	0
Ship 2	4/2–10/2/05	Auto	20	0	20	100	26.9	126.5	21.2	95.0	3	0	1	0	4	0	0.1117	0	0.1117	100	0	0
Ship 5	6/2–9/2/05	Auto	7	0	7	100	20.0	77.9	25.7	NC	0	0	0	0	0	0	0.0000	0	0.0000	100	0	0
Ship 5	15/2–25/2/05	Auto	32	0	32	100	49.0	183.5	26.7	NC	9	0	0	0	9	0	0.1837	0	0.1837	100	0	0
Ship 1	4/2–9/2/05	Auto	12	0	12	100	27.1	104.8	25.8	NC	5	0	1	0	6	0	0.1848	0	0.1848	100	0	0
Ship 1	15/2–23/2/05	Auto	19	0	19	100	48.2	197.4	24.4	NC	0	0	3	0	3	0	0.0000	0	0.0000	100	0	0
Ship 6	2/2–23/2/05	Auto	45	0	45	100	85.2	363.5	23.4	92.4	10	0	17	0	27	0	0.1173	0	0.1173	100	0	0
Ship 7	4/2–25/2/05	Auto	54	0	54	100	100.3	381.2	26.3	NC	7	0	12	0	19	0	0.0698	0	0.0698	100	0	0
Ship 3	20/1–22/2/05	Auto	65	0	65	100	166.1	672.0	24.7	95.0	13	0	2	0	15	0	0.0782	0	0.0782	100	0	0
Ship 11	16/2–25/2/05	Auto	26	0	26	100	45.5	136.8	33.3	96.1	1	0	0	0	1	0	0.0220	0	0.0220	100	0	0
Ship 2	10/5–18/5/05	Auto	23	0	23	100	46.8	201.3	23.2	96.0	0	0	1	0	1	0	0.0000	0	0.0000	100	0	0
Ship 1	19/5–25/6/05	Auto	71	0	71	100	256.3	674.1	38.0	89.9	2	0	1	0	3	0	0.0078	0	0.0078	100	0	0
Ship 5	31/5–21/6/05	Auto	43	0	43	100	96.5	427.5	22.6	94.0	2	0	1	0	3	0	0.0207	0	0.0207	100	0	0
Ship 7	17/6–29/6/05	Auto	30	0	30	100	55.5	232.3	23.9	95.0	0	0	1	0	1	0	0.0000	0	0.0000	100	0	0
Ship 11	20/6–12/7/05	Auto	61	0	61	100	76.3	304.0	25.1	96.2	3	0	2	0	5	0	0.0393	0	0.0393	100	0	0
Ship 2	23/7–11/8/05	Auto	48	0	48	100	84.2	335.9	25.1	90.4	0	0	7	0	7	0	0.0000	0	0.0000	100	0	0
Total						100	1305.3	4922.7	25.5		61						0.0467		0.0467			

(continued)

Table 8 (continued)

Vessel	Dates of fishing	Method	Sets deployed				No. of hooks (thousands)			Hooks baited (%)	No. of birds caught						Reported seabird mortality (birds/1 000 hooks)			Streamer line in use %		Offal discharge during haul (%)	
			N	D	Total	%N	Reported	Set	% Observed		Dead		Alive		Total		N	D	Total	N	D		
											N	D	N	D	N	D							N
Division 58.5.1																							
<i>Ship 5</i>	11/9–8/11/04	Auto	146	0	146	100	356.5	1217.0	29.3	95.0	66	0	11	0	77	0	0.1851	0	0.1851	100	0	0	
<i>Ship 2</i>	8/9–2/11/04	Auto	153	0	153	100	367.3	1185.6	31.0	85.0	6	0	31	0	37	0	0.0163	0	0.0163	100	0	0	
<i>Ship 1</i>	17/9–16/11/04	Auto	166	0	166	100	337.0	1369.3	24.6	85.0	24	0	6	0	30	0	0.0712	0	0.0712	100	0	0	
<i>Ship 6</i>	4/9–16/11/04	Auto	199	0	199	100	444.7	1666.8	26.7	88.4	104	0	10	0	114	0	0.2339	0	0.2339	100	0	0	
<i>Ship 7</i>	13/9–6/12/04	Auto	189	0	189	100	491.3	1975.4	24.9	91.7	14	0	8	0	22	0	0.0285	0	0.0285	100	0	0	
<i>Ship 3</i>	25/9–12/12/04	Auto	158	0	158	100	450.5	2070.6	21.8	90.3	61	0	5	0	66	0	0.1354	0	0.1354	100	0	0	
<i>Ship 11</i>	29/10/04–13/1/05	Auto	202	0	202	100	326.8	1377.0	23.7	NC	11	0	6	0	17	0	0.0337	0	0.0337	100	0	0	
<i>Ship 2</i>	30/11/04–31/1/05	Auto	161	0	161	100	274.1	1198.1	22.9	95.8	9	0	23	0	32	0	0.0328	0	0.0328	100	0	0	
<i>Ship 5</i>	15/12/04–30/1/05	Auto	142	0	142	100	283.5	1057.3	26.8	NC	20	0	23	0	43	0	0.0705	0	0.0705	100	0	0	
<i>Ship 5</i>	1/3–6/3/05	Auto	22	0	22	100	36.6	140.1	26.1	NC	27	0	5	0	32	0	0.7377	0	0.7377	100	0	0	
<i>Ship 1</i>	22/12/04–31/1/05	Auto	100	0	100	100	210.8	903.2	23.3	NC	11	0	20	0	31	0	0.0522	0	0.0522	100	0	0	
<i>Ship 1</i>	1/3–13/3/05	Auto	33	0	33	100	85.8	348.5	24.6	NC	19	0	10	0	29	0	0.2214	0	0.2214	100	0	0	
<i>Ship 6</i>	11/1–29/1/05	Auto	46	0	46	100	84.9	429.3	19.8	88.2	41	0	7	0	48	0	0.4831	0	0.4831	100	0	0	
<i>Ship 6</i>	1/3–30/3/05	Auto	78	0	78	100	156.3	694.5	22.5	90.9	170	0	15	0	185	0	1.0877	0	1.0877	100	0	0	
<i>Ship 7</i>	12/1–31/1/05	Auto	50	0	50	100	115.0	450.9	25.5	NC	98	0	3	0	101	0	0.8522	0	0.8522	100	0	0	
<i>Ship 7</i>	1/3–5/4/05	Auto	98	0	98	100	215.7	840.0	25.7	NC	171	0	24	0	195	0	0.7928	0	0.7928	100	0	0	
<i>Ship 3</i>	1/3–13/4/05	Auto	83	0	83	100	160.8	1122.5	14.3	95.0	30	0	1	0	31	0	0.1866	0	0.1866	100	0	0	
<i>Ship 11</i>	1/3–15/5/05	Auto	174	0	174	100	310.2	1286.1	24.1	95.7	35	0	2	0	37	0	0.1128	0	0.1128	100	0	0	
<i>Ship 2</i>	1/3–6/5/05	Auto	175	0	175	100	330.5	1498.8	22.1	96.4	32	0	7	0	39	0	0.0968	0	0.0968	100	0	0	
<i>Ship 1</i>	18/4–14/5/05	Auto	72	0	72	100	195.7	645.9	30.3	88.5	12	0	1	0	13	0	0.0613	0	0.0613	100	0	0	
<i>Ship 5</i>	14/4–29/5/05	Auto	107	0	107	100	261.9	1071.9	24.4	92.7	38	0	15	0	53	0	0.1451	0	0.1451	100	0	0	
<i>Ship 7</i>	11/5–13/6/05	Auto	88	0	88	100	189.3	755.5	25.1	95.0	2	0	15	0	17	0	0.0106	0	0.0106	100	0	0	
<i>Ship 3</i>	19/5–27/6/05	Auto	79	0	79	100	273.8	1082.6	25.3	NC	31	0	17	0	48	0	0.1132	0	0.1132	100	0	0	
<i>Ship 6</i>	8/5–5/7/05	Auto	159	0	159	100	315.4	1315.5	24.0	93.2	12	0	4	0	16	0	0.0381	0	0.0381	100	0	6	
<i>Ship 11</i>	10/6–14/6/05	Auto	12	0	12	100	22.3	86.0	25.9	97.7	1	0	1	0	2	0	0.0449	0	0.0449	100	0	0	
<i>Ship 2</i>	5/6–19/7/05	Auto	126	0	126	100	236.2	1000.8	23.6	91.8	9	0	15	0	24	0	0.0381	0	0.0381	100	0	0	
Total						100	6 532.8	26 789.1	24.5		1 054						0.1613	0.1613					

Table 9: Extrapolated incidental mortality of seabirds for those vessels on which seabird mortalities were observed in Subarea 58.6 and Division 58.5.1 during the 2004/05 season (September to August).

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							
<i>Ship 1</i>	22.6	90.9	24.8	100	0	0	0
<i>Ship 1</i>	27.1	104.8	25.8	100	19	0	19
<i>Ship 1</i>	48.2	197.4	24.4	100	0	0	0
<i>Ship 1</i>	256.3	674.1	38.0	100	5	0	5
<i>Ship 2</i>	20.3	104.9	19.3	100	0	0	0
<i>Ship 2</i>	26.9	126.5	21.2	100	14	0	14
<i>Ship 2</i>	46.8	201.3	23.2	100	0	0	0
<i>Ship 2</i>	84.2	335.9	25.1	100	0	0	0
<i>Ship 3</i>	166.1	672.0	24.7	100	53	0	53
<i>Ship 4</i>	8.0	31.2	25.6	100	0	0	0
<i>Ship 5</i>	26.7	101.7	26.2	100	0	0	0
<i>Ship 5</i>	20.0	77.9	25.7	100	0	0	0
<i>Ship 5</i>	49.0	183.5	26.7	100	34	0	34
<i>Ship 5</i>	96.5	427.5	22.6	100	9	0	9
<i>Ship 6</i>	44.0	175.5	25.1	100	24	0	24
<i>Ship 6</i>	85.2	363.5	23.4	100	43	0	43
<i>Ship 7</i>	100.3	381.2	26.3	100	27	0	27
<i>Ship 7</i>	55.5	232.3	23.9	100	0	0	0
<i>Ship 11</i>	45.5	136.8	33.3	100	3	0	3
<i>Ship 11</i>	76.3	304.0	25.1	100	12	0	12
					242	0	242
Division 58.5.1							
<i>Ship 1</i>	337.0	1369.3	24.6	100	98	0	98
<i>Ship 1</i>	210.8	903.2	23.3	100	47	0	47
<i>Ship 1</i>	85.8	348.5	24.6	100	77	0	77
<i>Ship 1</i>	195.7	645.9	30.3	100	40	0	40
<i>Ship 2</i>	367.3	1185.6	31.0	100	19	0	19
<i>Ship 2</i>	274.1	1198.1	22.9	100	39	0	39
<i>Ship 2</i>	330.5	1498.8	22.1	100	145	0	145
<i>Ship 2</i>	236.2	1000.8	23.6	100	38	0	38
<i>Ship 3</i>	450.5	2070.6	21.8	100	280	0	280
<i>Ship 3</i>	160.8	1122.5	14.3	100	209	0	209
<i>Ship 3</i>	273.8	1082.6	25.3	100	123	0	123
<i>Ship 5</i>	356.5	1217.0	29.3	100	225	0	225
<i>Ship 5</i>	283.5	1057.3	26.8	100	75	0	75
<i>Ship 5</i>	36.6	140.1	26.1	100	103	0	103
<i>Ship 5</i>	261.9	1071.9	24.4	100	156	0	156
<i>Ship 6</i>	444.7	1666.8	26.7	100	390	0	390
<i>Ship 6</i>	84.9	429.3	19.8	100	207	0	207
<i>Ship 6</i>	156.3	694.5	22.5	100	755	0	755
<i>Ship 6</i>	315.4	1315.5	24.0	100	50	0	50
<i>Ship 7</i>	491.3	1975.4	24.9	100	56	0	56
<i>Ship 7</i>	115.0	450.9	25.5	100	384	0	384
<i>Ship 7</i>	215.7	840.0	25.7	100	666	0	666
<i>Ship 7</i>	189.3	755.5	25.1	100	8	0	8
<i>Ship 11</i>	326.8	1377.0	23.7	100	46	0	46
<i>Ship 11</i>	310.2	1286.1	24.1	100	145	0	145
<i>Ship 11</i>	22.3	86.0	25.9	100	4	0	4
					4387	0	4387

Table 10: Species composition of birds killed in longline fisheries in Subarea 58.6 and Division 58.5.1 during the 2004/2005 season (September to August) as reported by captains. N – night-time setting; D – daytime setting (including nautical dawn and dusk); PRO – white-chinned petrel; PCI – grey petrel; () – % composition.

Vessel	Dates of fishing	No. birds killed by group						Species composition (%)	
		Albatross		Petrels		Total		PRO	PCI
		N	D	N	D	N	D		
Subarea 58.6									
<i>Ship 1</i>	9/9–13/9/04	0	0	0	0	0	0		
<i>Ship 1</i>	4/2–9/2/05	0	0	0	0	0	0		
<i>Ship 1</i>	15/2–23/2/05	0	0	0	0	0	0		
<i>Ship 1</i>	19/5–25/6/05	0	0	0	0	0	0		
<i>Ship 2</i>	5/11–11/11/04	0	0	0	0	0	0		
<i>Ship 2</i>	4/2–10/2/05	0	0	14	0	14	0	14 (100)	
<i>Ship 2</i>	10/5–18/5/05	0	0	8	0	8	0	8 (100)	
<i>Ship 2</i>	23/7–11/8/05	0	0	1	0	1	0	1 (100)	
<i>Ship 3</i>	20/1–22/2/05	0	0	15	0	15	0	15 (100)	
<i>Ship 4</i>	1/9–3/9/04	0	0	12	0	12	0	12 (100)	
<i>Ship 5</i>	3/9–8/9/04	0	0	50	0	50	0	50 (100)	
<i>Ship 5</i>	6/2–9/2/05	0	0	1	0	1	0	1 (100)	
<i>Ship 5</i>	15/2–25/2/05	0	0	0	0	0	0		
<i>Ship 5</i>	31/5–21/6/05	0	0	3	0	3	0		3 (100)
<i>Ship 6</i>	20/11–29/11/04	0	0	2	0	2	0		2 (100)
<i>Ship 6</i>	2/2–23/2/05	0	0	0	0	0	0		
<i>Ship 7</i>	4/2–25/2/05	0	0	4	0	4	0		4 (100)
<i>Ship 7</i>	17/6–29/6/05	0	0	0	0	0	0		
<i>Ship 11</i>	16/2–25/2/05	0	0	18	0	18	0	18 (100)	
<i>Ship 11</i>	20/6–12/7/05	0	0	9	0	9	0	9 (100)	
Division 58.5.1									
<i>Ship 1</i>	17/9–16/11/04	0	0	131	0	131	0	126 (96.2)	5 (3.8)
<i>Ship 1</i>	22/12/04–31/1/05	0	0	16	0	16	0	12 (75.0)	4 (25.0)
<i>Ship 1</i>	1/3–13/3/05	0	0	47	0	47	0	45 (95.7)	2 (4.3)
<i>Ship 1</i>	18/4–14/5/05	0	0	165	0	165	0	164 (99.4)	1 (0.6)
<i>Ship 2</i>	8/9–2/11/04	0	0	32	0	32	0	32 (100)	
<i>Ship 2</i>	30/11/04–31/1/05	0	0	44	0	44	0	44 (100)	
<i>Ship 2</i>	1/3–6/5/05	0	0	54	0	54	0	52 (96.3)	2 (3.7)
<i>Ship 2</i>	5/6–19/7/05	0	0	18	0	18	0	18 (100)	
<i>Ship 3</i>	25/9–12/12/04	0	0	61	0	61	0	61 (100)	
<i>Ship 3</i>	1/3–13/4/05	0	0	78	0	78	0	78 (100)	
<i>Ship 3</i>	19/5–27/6/05	0	0	190	0	190	0	187 (98.4)	3 (1.6)
<i>Ship 5</i>	11/9–8/11/04	0	0	127	0	127	0	127 (100)	
<i>Ship 5</i>	15/12/04–30/1/05	0	0	276	0	276	0	270 (97.8)	6 (2.2)
<i>Ship 5</i>	1/3–6/3/05	0	0	64	0	64	0	61 (95.3)	3 (4.7)
<i>Ship 5</i>	14/4–29/5/05	0	0	107	0	107	0	104 (97.2)	3 (2.8)
<i>Ship 6</i>	4/9–16/11/04	0	0	108	0	108	0	99 (91.7)	9 (8.3)
<i>Ship 6</i>	11/1–29/1/05	0	0	27	0	27	0	16 (59.3)	11 (40.7)
<i>Ship 6</i>	1/3–30/3/05	0	0	65	0	65	0	43 (66.2)	22 (33.8)
<i>Ship 6</i>	8/5–5/7/05	0	0	8	0	8	0	8 (100)	
<i>Ship 7</i>	13/9–6/12/04	0	0	39	0	39	0	39 (100)	
<i>Ship 7</i>	12/1–31/1/05	0	0	57	0	57	0	1 (1.8)	56 (98.2)
<i>Ship 7</i>	1/3–5/4/05	0	0	6	0	6	0		6 (100)
<i>Ship 7</i>	11/5–13/6/05	0	0	25	0	25	0		25 (100)
<i>Ship 11</i>	29/10/04–13/1/05	0	0	19	0	19	0	18 (94.7)	1 (5.3)
<i>Ship 11</i>	1/3–15/5/05	0	0	98	0	98	0	98 (100)	
<i>Ship 11</i>	10/6–14/6/05	0	0	39	0	39	0	39 (100)	
Total (%)		0	0	2038	0	2038	0	1870 (91.8)	168 (8.2)

Table 11: Species composition of birds observed killed in longline fisheries in Subarea 58.6 and Division 58.5.1 during the 2004/05 season (September to August). N – night-time setting; D – daytime setting (including nautical dawn and dusk); PRO – white-chinned petrel; PCI – grey petrel; () – % composition.

Vessel	Dates of fishing	No. birds killed by group						Species composition (%)	
		Albatross		Petrels		Total		PRO	PCI
		N	D	N	D	N	D		
Subarea 58.6									
<i>Ship 1</i>	9/9–13/9/04	0	0	0	0	0	0		
<i>Ship 1</i>	4/2–9/2/05	0	0	5	0	5	0	5 (100)	
<i>Ship 1</i>	15/2–23/2/05	0	0	0	0	0	0		
<i>Ship 1</i>	19/5–25/6/05	0	0	2	0	2	0		2 (100)
<i>Ship 2</i>	5/11–11/11/04	0	0	0	0	0	0		
<i>Ship 2</i>	4/2–10/2/05	0	0	3	0	3	0	3 (100)	
<i>Ship 2</i>	10/5–18/5/05	0	0	0	0	0	0		
<i>Ship 2</i>	23/7–11/8/05	0	0	0	0	0	0		
<i>Ship 3</i>	20/1–22/2/05	0	0	13	0	13	0	13 (100)	
<i>Ship 4</i>	1/9–3/9/04	0	0	0	0	0	0		
<i>Ship 5</i>	3/9–8/9/04	0	0	0	0	0	0		
<i>Ship 5</i>	6/2–9/2/05	0	0	0	0	0	0		
<i>Ship 5</i>	15/2–25/2/05	0	0	9	0	9	0	9 (100)	
<i>Ship 5</i>	31/5–21/6/05	0	0	2	0	2	0		2 (100)
<i>Ship 6</i>	20/11–29/11/04	0	0	6	0	6	0	6 (100)	
<i>Ship 6</i>	2/2–23/2/05	0	0	10	0	10	0	10 (100)	
<i>Ship 7</i>	4/2–25/2/05	0	0	7	0	7	0	7 (100)	
<i>Ship 7</i>	17/6–29/6/05	0	0	0	0	0	0		
<i>Ship 11</i>	16/2–25/2/05	0	0	1	0	1	0	1 (100)	
<i>Ship 11</i>	20/6–12/7/05	0	0	3	0	3	0		3 (100)
Division 58.5.1									
<i>Ship 1</i>	17/9–16/11/04	0	0	24	0	24	0	22 (91.7)	2 (8.3)
<i>Ship 1</i>	22/12/04–31/1/05	0	0	11	0	11	0	11 (100)	
<i>Ship 1</i>	1/3–13/3/05	0	0	19	0	19	0	19 (100)	
<i>Ship 1</i>	18/4–14/5/05	0	0	12	0	12	0	7 (58.3)	5 (41.7)
<i>Ship 2</i>	8/9–2/11/04	0	0	6	0	6	0	4 (66.7)	2 (33.3)
<i>Ship 2</i>	30/11/04–31/1/05	0	0	9	0	9	0	9 (100)	
<i>Ship 2</i>	1/3–6/5/05	0	0	32	0	32	0	29 (90.6)	3 (9.4)
<i>Ship 2</i>	5/6–19/7/05	0	0	9	0	9	0		9 (100)
<i>Ship 3</i>	25/9–12/12/04	0	0	61	0	61	0	61 (100)	
<i>Ship 3</i>	1/3–13/4/05	0	0	30	0	30	0	29 (96.7)	1 (3.3)
<i>Ship 3</i>	19/5–27/6/05	0	0	31	0	31	0	31 (100)	
<i>Ship 5</i>	11/9–8/11/04	0	0	66	0	66	0	62 (93.9)	4 (6.1)
<i>Ship 5</i>	15/12/04–30/1/05	0	0	20	0	20	0	20 (100)	
<i>Ship 5</i>	1/3–6/3/05	0	0	27	0	27	0	26 (96.3)	1 (3.7)
<i>Ship 5</i>	14/4–29/5/05	0	0	38	0	38	0	23 (60.5)	15 (39.5)
<i>Ship 6</i>	4/9–16/11/04	0	0	104	0	104	0	103 (99.0)	1 (1.0)
<i>Ship 6</i>	11/1–29/1/05	0	0	41	0	41	0	41 (100)	
<i>Ship 6</i>	1/3–30/3/05	0	0	170	0	170	0	167 (98.2)	3 (1.8)
<i>Ship 6</i>	8/5–5/7/05	0	0	12	0	12	0		12 (100)
<i>Ship 7</i>	13/9–6/12/04	0	0	14	0	14	0	13 (92.9)	1 (7.1)
<i>Ship 7</i>	12/1–31/1/05	0	0	98	0	98	0	98 (100)	
<i>Ship 7</i>	1/3–5/4/05	0	0	171	0	171	0	169 (98.8)	2 (1.2)
<i>Ship 7</i>	11/5–13/6/05	0	0	2	0	2	0	2 (100)	
<i>Ship 11</i>	29/10/04–13/1/05	0	0	11	0	11	0	11 (100)	
<i>Ship 11</i>	1/3–15/5/05	0	0	35	0	35	0	33 (94.3)	2 (5.7)
<i>Ship 11</i>	10/6–14/6/05	0	0	1	0	1	0		1 (100)
Total (%)		0	0	1115	0	1115	0	1044 (93.6)	71 (6.4)

Table 12: Compliance, as reported by observers, of streamer lines with the minimum specifications set out in Conservation Measure 25-02 (2003) during the 2004/05 season. Y – yes; N – no; - – no information; A – autoliner; Sp – Spanish; 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. streamers per line	Spacing of streamers per line (m)		Night	Day	
Subarea 48.3											
<i>Argos Georgia</i>	1/5–28/8/05	Sp	Y	Y (7)	Y (152)	6	Y (5)	Y (1–6.7)	100		91
<i>Isla Santa Clara</i>	10/5–4/8/05	Sp	Y	Y (7)	Y (151)	8	Y (5)	Y (1–7)	98		100
<i>Jacqueline</i>	2/5–24/8/05	Sp	Y	Y (8)	Y (150)	9	Y (5)	Y (1–7)	100		99
<i>Koryo Maru 11</i>	2/5–16/8/05	Sp	Y	Y (8)	Y (150)	10	Y (5)	Y (1–8)	100		100
<i>Polarpesca I</i>	13/5–21/8/05	Sp	Y	Y (7.5)	Y (162)	7	Y (5)	Y (2–7)	100		100
<i>Protegat</i>	1/5–21/8/05	A	N	Y (7.5)	Y (150)	12	Y (5)	N (0.5–7)	99	100	100
<i>Viking Bay</i>	1/5–21/8/05	Sp	N	N (6.5)	N (83)	50	Y (2)	N (0.8)	100		53
<i>Argos Helena</i>	1/5–29/8/05	A	Y	Y (7.4)	Y (150)	13	Y (5)	Y (1–8)	100		MP
Subarea 48.6											
<i>Shinsei Maru 3</i>	23/1–18/3/05	Sp	Y	Y (7.1)	Y (155)	6	Y (5)	Y (5–7)	100	100	100*
Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b											
<i>Arnela</i>	3/12/04–16/3/05	Sp	Y	Y (7.5)	Y (152)	13	Y (5)	Y (1–7)	100	100	48*
<i>Globalpesca II</i>	19/12/04–2/3/05	Sp	Y	Y (7)	Y (150)	12	Y (5)	Y (1–6.5)	100		0*
<i>Galaecia</i>	16/12/04–10/3/05	Sp	Y	Y (7.1)	Y (150)	6	Y (2)	Y (1–6.5)	100	100	0*
<i>829 Yeon Seong</i>	20/12/04–21/2/05	Sp	N	Y (7)	Y (150)	10	Y (5)	N (1–4)	100	100	100*
<i>Janas</i>	5/3–29/3/05	A	Y	Y (7)	Y (165)	19	Y (1.5)	Y (1–7)	100	100	0*
<i>Avro Chieftain</i>	4/9–7/9/05	A	Y	Y (7)	Y (150)	10	Y (4.5)	Y (1–7)	100		MP*
<i>Galaecia</i>	15/4–6/7/05	Sp	Y	Y (7)	Y (162)	9	Y (5)	Y (1–6.5)	100	100	0*
<i>No. 707 Bonanza</i>	26/12/04–10/3/05	Sp	Y	Y (7)	Y (150)	25	Y (5)	Y (1–6.5)	100	100	100*
Division 58.5.2											
<i>Avro Chieftain</i>	25/7–1/9/05	A	Y	Y (7)	Y (150)	10	Y (4.5)	Y (1–7)	100	100	MP
<i>Avro Chieftain</i>	10/5–1/7/05	A	Y	Y (7)	Y (150)	10	Y (4.5)	Y (1–7)	100	100	MP
Subareas 58.6, 58.7											
<i>Koryo Maru 11</i>	24/2–1/4/05	Sp	N	Y (8)	Y (150)	7	N (6.5)	Y (3–7.5)	100		100
Subareas 88.1, 88.2											
<i>Antarctic III</i>	5/12/04–5/2/05	A	Y	Y (8)	Y (150)	5	Y (5)	Y (7)		99	0*
<i>Argos Helena</i>	4/12/04–4/3/05	A	Y	Y (7)	Y (150)	7	Y (5)	Y (1–9)	100	100	MP*
<i>Janas</i>	1/12/04–6/2/05	A	Y	Y (7)	Y (165)	26	Y (1.5)	Y (1–7)		100	0*
<i>Paloma V</i>	27/12/04–1/3/05	Sp	Y	Y (8)	Y (150)	11	Y (5)	-		98	0*
<i>Punta Ballena</i>	14/1–13/3/05	A	N	Y (7)	Y (150)	5	N (6)	N (2–6)		100	0*

(continued)

Table 12 (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. streamers per line	Spacing of streamers per line (m)		Night	Day	
Subareas 88.1, 88.2											
<i>San Aotea II</i>	4/12/04–14/2/05	A	Y	Y (7)	Y (165)	14	Y (5)	Y (1–7)	100	1*	
<i>Frøyanes</i>	29/12/04–1/3/05	A	Y	Y (7)	Y (150)	16	Y (5)	Y (1–8)	100	0*	
<i>Volna</i>	18/12/04–18/3/05	Sp	N	Y (7)	Y (150)	5	Y (5)	N (2–5)	100	0*	
<i>Yantar</i>	18/12/04–18/3/05	Sp	Y	Y (7)	Y (150)	8	Y (5)	Y (1–6.5)	-	0*	
<i>Avro Chieftain</i>	31/12/04–6/2/05	A	N	Y (7.6)	Y (242)	17	Y (2)	N (2–6.3)	100	MP*	
<i>San Aspiring</i>	25/12/04–23/2/05	A	N	Y (7.5)	Y (169)	17	Y (5)	N (0.5–7.5)	100 100	0*	

Table 13: Summary of scientific observations relating to compliance with Conservation Measure 25-02 (2003), based on data from scientific observers from the 1996/97 to the 2004/05 season. Values in parentheses are % of observer records that were complete. 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					
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					
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					
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					
Subareas 58.6, 58.7																	
1996/97	0 (60)	6	35	52	69 (87)	10 (66)	100 (60)	10 (66)	90 (66)	60 (66)	0.52	0.39					
1997/98	0 (100)	6	55	93	87 (94)	9 (92)	91 (92)	11 (75)	100 (75)	90 (83)	0.08	0.11					
1998/99	0 (100)	8	50	84 ²	100 (89)	0 (100)	100 (90)	10 (100)	100 (90)	100 (90)	0.05	0					
1999/00	0 (83)	6	88	72	100 (93)	8 (100)	91 (92)	0 (92)	100 (92)	91 (92)	0.03	0.01					
2000/01	18 (100)	5.8	40	78	100 (100)	64 (100)	100 (100)	64 (100)	100 (100)	100 (100)	0.01	0.04					
2001/02	66 (100)	6.6	40	99	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	0	0					
2002/03	0 (100)	6.0	41	98	50 (100)	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	<0.01	0					
2003/04	100 (100)	7.0	20	83	100 (100)	50 (100)	50 (100)	100 (100)	⁷	100 (100)	0.03	0.01					
2004/05	100 (100)	6.5	20	100	100 (100)	0 (100)	100 (100)	100 (100)	⁷	0 (100)	0.0149	0					

(continued)

Table 13 (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 88.1, 88.2																	
1996/97	Auto only	na	na	50	0 (100)	100 (100)	100 (100)	100 (100)	100 (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)	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)	100 (100)	100 (100)	100 (100)	100 (100)	0	0	
1999/00	Auto only	na	na	6 ⁴	No Discharge	67 (100)	100 (100)	100 (100)	67 (100)	100 (100)	100 (100)	100 (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)	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)	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)	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)	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)	100 (100)	⁷		64 (100)	100 (100)	0	0		

¹ Includes daytime setting – and associated seabird by-catch – as part of line-weighting experiments on *Argos Helena* (WG-FSA-99/5).

² Includes some daytime setting in conjunction with use of an underwater-setting funnel on *Eldfisk* (WG-FSA-99/42).

³ Conservation Measure 169/XVII allowed New Zealand vessels to undertake daytime setting south of 65°S in Subarea 88.1 to conduct a line-weighting experiment.

⁴ Conservation 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 five 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 14: Offal discharge observed during net shooting and hauling operations in the Convention Area during the 2004/05 season.

Vessel name	Area	Cruise dates	Offal discharged during (%)	
			Net shooting	Net hauling
<i>No. 207 Insung</i>	48.3	7/12–30/12/04	9 (13)	3 (4)
<i>Robin M Lee</i>	48.3	17/12/04–23/1/05	6 (22)	

Table 15: Aerial extent of streamer lines reported by observers during the 2004/05 season. * – information from observer cruise reports.

Vessel name	Dates of fishing	Fishing method	Aerial extent of streamer line
Subarea 48.3			
<i>Argos Georgia</i>	1/5–28/8/05	Spanish	30*
<i>Isla Santa Clara</i>	10/5–4/8/05	Spanish	40
<i>Jacqueline</i>	2/5–24/8/05	Spanish	37
<i>Koryo Maru 11</i>	2/5–16/8/05	Spanish	20
<i>Polarpesca I</i>	13/5–21/8/05	Spanish	30*
<i>Protegat</i>	1/5–21/8/05	Auto	70
<i>Viking Bay</i>	1/5–21/8/05	Spanish	25
<i>Argos Helena</i>	1/5–29/8/05	Auto	45
Subarea 48.6			
<i>Shinsei Maru 3</i>	23/1–18/3/05	Spanish	30
Divisions 58.4.1, 58.4.2, 58.4.3a, 58.4.3b			
<i>Arneta</i>	3/12/04–16/3/05	Spanish	70
<i>Globalpesca II</i>	19/12/04–2/3/05	Spanish	75
<i>Galaecia</i>	16/12/04–10/3/05	Spanish	10
<i>No. 829 Yeon Seong</i>	20/12/04–21/2/05	Spanish	-
<i>Janas</i>	5/3–29/3/05	Auto	65
<i>Avro Chieftain</i>	4/9–7/9/05	Auto	80
<i>Galaecia</i>	15/4–6/7/05	Spanish	7
<i>No. 707 Bonanza</i>	26/12/04–10/3/05	Spanish	150
Division 58.5.2			
<i>Avro Chieftain</i>	25/7–1/9/05	Auto	80
<i>Avro Chieftain</i>	10/5–1/7/05	Auto	80
Subareas 58.6, 58.7			
<i>Koryo Maru 11</i>	24/2–1/4/05	Spanish	50
Subareas 88.1, 88.2			
<i>Antarctic III</i>	5/12/04–5/2/05	Auto	-
<i>Argos Helena</i>	4/12/04–4/3/05	Auto	45
<i>Janas</i>	1/12/04–6/2/05	Auto	65
<i>Paloma V</i>	27/12/04–1/3/05	Spanish	-
<i>Punta Ballena</i>	14/1–13/3/05	Auto	50
<i>San Aotea II</i>	4/12/04–14/2/05	Auto	70
<i>Frøyanes</i>	29/12/04–1/3/05	Auto	60
<i>Volna</i>	18/12/04–18/3/05	Spanish	125
<i>Yantar</i>	18/12/04–18/3/05	Spanish	90
<i>Avro Chieftain</i>	31/12/04–6/2/05	Auto	45
<i>San Aspiring</i>	25/12/04–23/2/05	Auto	60

Table 16: Seabird mortality totals and rates (BPT: birds/trawl) and species composition of incidental mortality, recorded by observers in the CAMLR Convention Area trawl fisheries for the 2004/05 season. KRI – *Euphausia superba*; ANI – *Champrocephalus gunnari*; TOP – *Dissostichus eleginoides*; DIC – grey-headed albatross; DIM – black-browed albatross; PRO – white-chinned petrel; MAH – northern giant petrel; PWD – Antarctic prion; DAC – Cape petrel; MAI – southern giant petrel.

Season	Area	Vessel	Cruise dates	Trawls observed	BPT	Dead						Total dead	Alive (combined)
						DIC	DIM	PRO	MAH	PWD	DAC		
2005	48.2	<i>Top Ocean</i> (KRI)	5/5–31/5/05	156	0.01						1	1	0
		<i>Atlantic Navigator</i> (KRI)	28/1–11/5/05	157	0.00							0	0
		Total		313	0.003						1	0	
48.3		<i>Betanzos</i> (ANI)	20/12/04–26/1/05	37	0.03		1					1	2
		<i>Dongsan Ho</i> (ANI)	20/12/04–7/1/05	33	0.15		4	1				5	0
		<i>InSungHo</i> (ANI)	4/12/04–7/1/05	45	0.07		3					3	6
		<i>No. 207 Insung</i> (ANI)	7/12–30/12/04	34	0.03		1					1	6
		<i>Argos Vigo</i> (ANI)	17/12–31/12/04	40	0.00							0	0
		<i>Robin M Lee</i> (ANI)	17/12/04–23/1/05	26	0.00							0	0
		<i>Sil</i> (ANI)	27/11/04–22/1/05	38	0.03				1			1	0
		Total		253	0.04						11	14	
48.3		<i>Niitaka Maru</i> (KRI)	19/6–22/7/05	257	0.00							0	0
		<i>InSungHo</i> (KRI)	10/7–19/8/05	97	0.00							0	1
		<i>Foros</i> (KRI)	20/6–9/7/05	75	0.00							0	0
		<i>Niitaka Maru</i> (KRI)	16/8–19/8/05	25	0.00							0	0
		Total		454	0.00								
58.5.2		<i>Austral Leader</i> (ANI/TOP)	16/1–12/2/05	224	0.00							0	0
		<i>Austral Leader</i> (ANI/TOP)	24/3–12/4/05	67	0.03		2					2	0
		<i>Southern Champion</i> (ANI/TOP)	22/1–6/2/05	163	0.00							0	0
		<i>Southern Champion</i> (ANI/TOP)	2/3–31/3/05	262	0.02		3	3				6	0
		<i>Southern Champion</i> (ANI/TOP)	22/4–25/5/05	103	0.00							0	0
		<i>Southern Champion</i> (ANI/TOP)	30/5–6/7/05	303	0.00							0	0
				Total		1122	0.01						8

Table 17: Seabird mortality totals and rates (BPT: birds/trawl) and species composition of incidental mortality, recorded by observers in the CAMLR Convention Area trawl fisheries over the last five seasons. DIC – grey-headed albatross; DIM – black-browed albatross; PRO – white-chinned petrel; MAH – northern giant petrel; PWD – Antarctic prion; DAC – cape petrel; MAI – southern giant petrel.

Season	Area	Target species	Trips observed	Trawls observed	BPT	Dead						Total dead	Alive (combined)
						DIC	DIM	PRO	MAH	PWD	DAC		
2001	48.1	<i>E. superba</i>	2	427	0							0	0
	48.3	<i>C. gunnari</i>	6	350	0.26	5	46	41				92	40
	58.5.2	<i>D. eleginoides</i> and <i>C. gunnari</i>	7	1387	0.00							0	0
2002	48.3	<i>E. superba</i>	5	755	0.00							0	0
	48.3	<i>C. gunnari</i>	5	431	0.16		18	49		1		68	52
	58.5.2	<i>D. eleginoides</i> and <i>C. gunnari</i>	6	1111	0.00							0	1
2003	48.3	<i>E. superba</i>	6	1073								0	0
	48.3	<i>C. gunnari</i>	3	182	0.20	1	7	28				36	15
	58.5.2	<i>D. eleginoides</i> and <i>C. gunnari</i>	8	1309	0.005		2	2			2	6	11
2004	48	<i>E. superba</i>	1	521	0.00							0	0
	48.3	<i>E. superba</i>	6	566	0.00							0	0
	48.3	<i>C. gunnari</i>	6	238	0.37	1	26	59			1	87	132
	58.5.2	<i>D. eleginoides</i> and <i>C. gunnari</i>	5	1215	0.00							0	13
2005	48.2	<i>E. superba</i>	2	313	0.003						1	1	0
	48.3	<i>C. gunnari</i>	7	253	0.04		9	1	1			11	14
	48.3	<i>E. superba</i>	5	454	0.00								
	58.5.2	<i>D. eleginoides</i> and <i>C. gunnari</i>	6	1122	0.01		5	3				8	0

Table 18: Extrapolated potential incidental mortality of seabirds in the IUU *Dissostichus* spp. fishery in the Convention Area from 1996 to 2005. Lower and upper refer to 95% confidence limit.

Subarea/ Division	Year	Extrapolated potential incidental mortality of seabirds		
		Lower	Median	Upper
48.3	2005	24	45	736
	1996–2004	1 811	3 441	56 031
58.4.2	2005	171	209	557
	1996–2004	537	655	1 748
58.4.3	2005	1 225	1 495	3 992
	1996–2004	522	636	1 699
58.4.4	2005	1 020	1 244	3 321
	1996–2004	2 866	3 497	9 338
58.5.1	2005	444	542	1 446
	1996–2004	46 988	57 332	153 081
58.5.2	2005	204	248	663
	1996–2004	31 857	38 870	103 787
58.6	2005	39	48	128
	1996–2004	44 888	54 769	146 238
58.7	2005	382	466	1 243
	1996–2004	12 475	15 221	40 640
88.1	2005	97	119	314
	1996–2004	392	479	1 264
Totals	2005	3 605	4 415	12 400
	1996–2004	142 335	174 899	513 826
Total		145 941	179 314	526 226

Table 19: 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	<ul style="list-style-type: none"> • Strict compliance with standard seabird by-catch conservation measure¹. • No need for restriction of longline fishing season. • Daytime setting permitted subject to line sink rate requirement². • No offal dumping. 	20% of hooks hauled 50% of hooks set
2 – average to low	<ul style="list-style-type: none"> • Strict compliance with standard seabird by-catch conservation measure¹. • 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	<ul style="list-style-type: none"> • Strict compliance with standard seabird by-catch conservation measure¹. • 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	<ul style="list-style-type: none"> • Strict compliance with standard seabird by-catch conservation measure¹. • 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	<ul style="list-style-type: none"> • Strict compliance with standard seabird by-catch conservation measure¹. • 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 20: Summary of IMAF risk assessment in relation to proposed new and exploratory longline fisheries in 2005/06 (five-point risk scale as defined in SC-CAMLR-XXIII/BG/21).

Area	Risk scale	Mitigation requirements	Proposal assessment
48.6 north of ca. 55°S	2 – average to low	<ul style="list-style-type: none"> • 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. 	<p>Proposal from Japan (WG-FSA-05/26 and CCAMLR-XXIV/10) conflicts with the IMAF assessment.</p> <p>Proposal from New Zealand (CCAMLR-XXIV/13) does not conflict with the IMAF assessment.</p>
48.6 south of ca. 55°S	1 – low	<ul style="list-style-type: none"> • 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. 	<p>Proposal from Japan (WG-FSA-05/26 and CCAMLR-XXIV/10) conflicts with the IMAF assessment.</p> <p>Proposal from New Zealand (CCAMLR-XXIV/13) does not conflict with the IMAF assessment.</p>
58.4.1	2 – average to low	<ul style="list-style-type: none"> • 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. 	<p>Proposals from Australia (CCAMLR-XXIV/17), Chile (CCAMLR-XXIV/25), Spain (CCAMLR-XXIV/9) and New Zealand (CCAMLR-XXIV/14) do not conflict with the IMAF assessment.</p> <p>Proposals from the Republic of Korea (CCAMLR-XXIV/22) and Uruguay (CCAMLR-XXIV/29) do not contain sufficient information to be certain they do not conflict with the IMAF assessment.</p>
58.4.2	2 – average to low	<ul style="list-style-type: none"> • 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. 	<p>Proposals from Australia (CCAMLR-XXIV/18), Chile (CCAMLR-XXIV/26), Republic of Korea (CCAMLR-XXIV/22), Spain (CCAMLR-XXIV/9) and New Zealand (CCAMLR-XXIV/14) do not conflict with the IMAF assessment.</p> <p>Proposal from the Republic of Korea (CCAMLR-XXIV/22) does not contain sufficient information to be certain it does not conflict with the IMAF assessment.</p>

(continued)

Table 20 (continued)

Area	Risk scale	Mitigation requirements	Proposal assessment
58.4.3a	3 – average	<ul style="list-style-type: none"> • Strict compliance with standard seabird by-catch conservation measure. • Restrict longline fishing to May through 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. 	<p>Proposals from Australia (CCAMLR-XXIV/19) and Spain (CCAMLR-XXIV/9) do not conflict with the IMAF assessment.</p> <p>Proposals from Chile (CCAMLR-XXIV/27) and the Republic of Korea (CCAMLR-XXIV/22) do not contain sufficient information to be certain they do not conflict with the IMAF assessment.</p>
58.4.3b	3 – average	<ul style="list-style-type: none"> • Strict compliance with standard seabird by-catch conservation measure. • Restrict longline fishing to May through 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. 	<p>Proposals from Australia (CCAMLR-XXIV/20) and Spain (CCAMLR-XXIV/9) do not conflict with the IMAF assessment.</p> <p>Proposals from Chile (CCAMLR-XXIV/28), Republic of Korea (CCAMLR-XXIV/22) and Uruguay (CCAMLR-XXIV/23) do not contain sufficient information to be certain they do not conflict with the IMAF assessment.</p>
88.1 north of 65°S	3 – average	<ul style="list-style-type: none"> • 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. 	<p>Proposals from New Zealand (CCAMLR-XXIV/15), South Africa (CCAMLR-XXIV/16), Spain (CCAMLR-XXIV/9) and the UK (CCAMLR-XXIV/21) do not conflict with the IMAF assessment.</p> <p>Proposals from Argentina (CCAMLR-XXIV/12), Republic of Korea (CCAMLR-XXIV/22), Norway (CCAMLR-XXIV/11), Russia (CCAMLR-XXIV/31) and Uruguay (CCAMLR-XXIV/30) do not contain sufficient information to be certain they do not conflict with the IMAF assessment.</p>

(continued)

Table 20 (continued)

Area	Risk scale	Mitigation requirements	Proposal assessment
88.1 south of 65°S	1 –low	<ul style="list-style-type: none"> • 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. 	<p>Proposals from New Zealand (CCAMLR-XXIV/15), South Africa (CCAMLR-XXIV/16), Spain (CCAMLR-XXIV/9) and the UK (CCAMLR-XXIV/21) do not conflict with the IMAF assessment.</p> <p>Proposals from Argentina (CCAMLR-XXIV/12), Republic of Korea (CCAMLR-XXIV/22), Norway (CCAMLR-XXIV/11), Russia (CCAMLR-XXIV/31) and Uruguay (CCAMLR-XXIV/30) do not contain sufficient information to be certain they do not conflict with the IMAF assessment.</p>
88.2	1 – low	<ul style="list-style-type: none"> • 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. 	<p>Proposals from New Zealand (CCAMLR-XXIV/15), Spain (CCAMLR-XXIV/9) and UK (CCAMLR-XXIV/21) do not conflict with the IMAF assessment.</p> <p>Proposals from Argentina (CCAMLR-XXIV/12), Republic of Korea (CCAMLR-XXIV/22), Norway (CCAMLR-XXIV/11), Russia (CCAMLR-XXIV/31) and Uruguay (CCAMLR-XXIV/30) do not contain sufficient information to be certain they do not conflict with the IMAF assessment.</p>

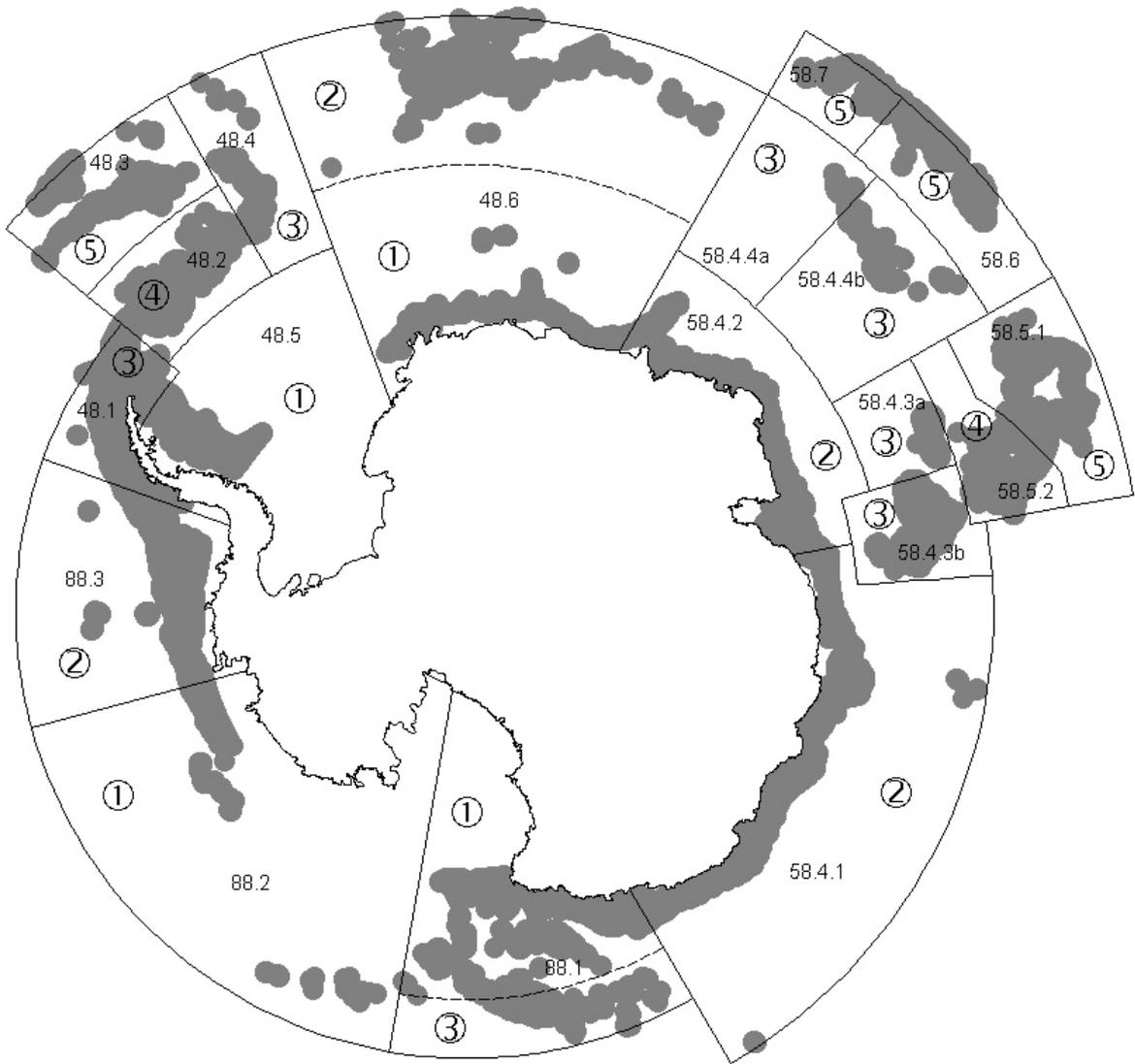


Figure 1: Assessment of the potential risk of interaction between seabirds, especially albatrosses, and longline fisheries within the Convention Area. 1: low, 2: average to low, 3: average, 4: average to high, 5: high. Shaded patches represent seabed areas between 500 and 1 800 m.

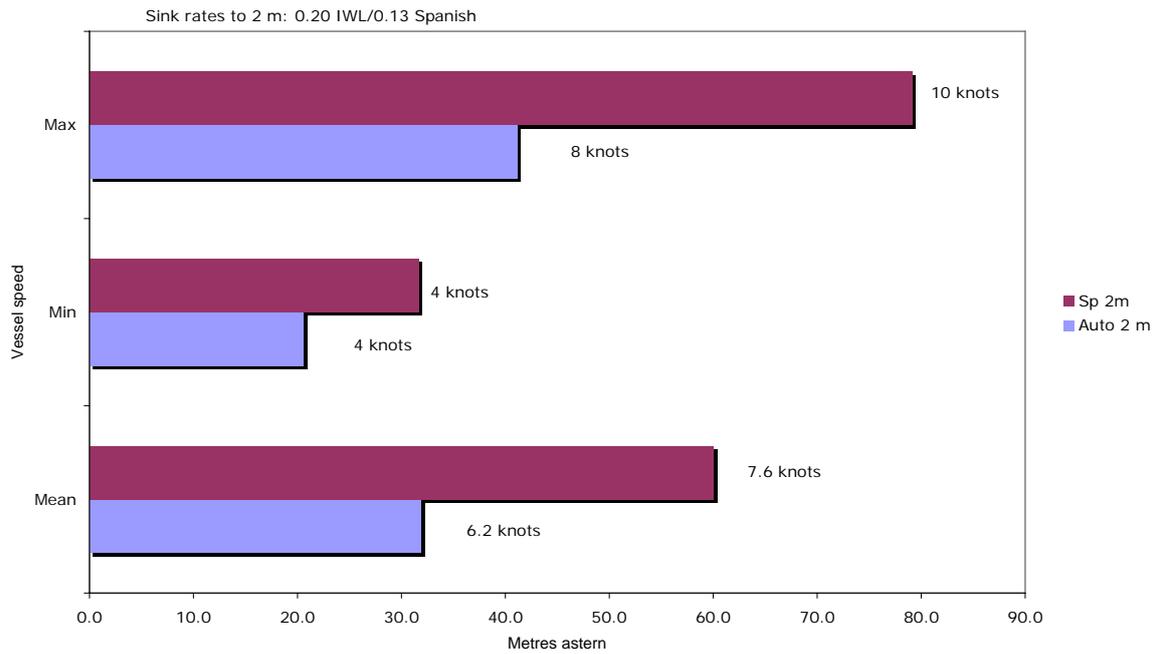


Figure 2: Two-metre access window for IW autoline and Spanish longline gear for maximum, minimum and average vessel speeds for each gear type in the 2004/05 CCAMLR fisheries. Seabirds are most vulnerable to capture when hooklines are within 2 m of the surface.



Figure 3: Bird Excluder Device used on the FV *Janas*.

SUBGROUP ON IUU FISHING

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SUBGROUP ON IUU FISHING

IUU ESTIMATES FOR THE CURRENT SEASON

The subgroup examined the calculations of IUU made by the Secretariat in SCIC-05/10. As in previous years, information supplied to the Secretariat by Members on the number of IUU vessels active in an area (subarea/division), was combined with 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.

$$\text{IUU catch} = [\text{number of observations of activity}] \times [\text{trip duration (days)}] \times [\text{number of trips per year}] \times [\text{catch rate (tonnes/day)}].$$

2. For the 2005 fishing season, IUU activity was derived exclusively from sightings (visual, radar, satellite or VMS) although other intelligence and information from found fishing gear may also be used; trip length was based on the average trip length for non-IUU vessels; and catch rates were matched with non-IUU vessel catch rates.

3. Currently the Secretariat makes an assessment of IUU activity up to the beginning of October, and provides both these estimates (column 11 of Table 1 of SCIC-05/10) and extrapolations to the end of the fishing season (column 12). The table needs to be updated at the end of each fishing season, when the final sightings information is available, so that all figures for a fishing season are based on estimation rather than extrapolation. The Working Group recommended that the Secretariat do this intersessionally for the current and all previous fishing seasons so that the best estimates of IUU catch can be used in assessments.

4. The estimates made by the Secretariat for the 2004/05 fishing season will be reviewed by SCIC after the conclusion of the WG-FSA meeting. In case SCIC was to decide that the figures or the method used are in some way inappropriate, WG-FSA agreed that it should use two alternative IUU scenarios, to provide the Scientific Committee and Commission with appropriate alternative assessments of toothfish catch limits. Bearing in mind the discussion in paragraph 3, these two scenarios would assume:

- (i) that the estimates given in Table 1 of SCIC-05/10 are correct up to the point of 1 October 2005, i.e. to the point of extrapolation, and therefore that the figures in column 11 should be used for IUU-estimated catch in the 2004/05 fishing season;
- (ii) that the estimates given in column 11 of Table 1 are uncertain, and therefore that IUU catch could be assumed to be zero in the 2004/05 fishing season.

5. WG-FSA emphasised that its assessments require the best estimates of IUU fishing rather than 'conservative' or 'precautionary' estimates, because the use of these latter estimates may not necessarily result in precautionary estimates of sustainable yield, depending on the assessment method being used. For instance, in the newer CASAL assessments, where the current exploitable biomass is directly estimated from tagging data, the addition of 'precautionarily' high levels of historical IUU fishing might artificially increase the apparent productivity of the stock, whereas in the forward-projection of GYM the reverse would be true.

6. The Working Group recognised that there was some possibility that the FV *Taruman*, currently assumed to have been fishing exclusively in Subarea 88.1, had in fact been fishing elsewhere. It suggested that the Australian authorities might usefully undertake genetic analysis of the catch, to determine the species, and if possible the stock from which the fish were taken.

REVIEW OF HISTORICAL IUU ACTIVITY

7. Accurate historical, as well as current, estimates of IUU catches are required by WG-FSA both to assess the current status of fish stocks and their historical productivity. The subgroup noted that the historical series of IUU catches might need to be reviewed by SCIC because of the sensitivity of historical estimates to assumptions about catch rates, trip duration and observations of IUU activity (see above). It also noted that estimates may be derived each year from national sources, which may not equate directly with the assumed calculations used by the Secretariat, and that these two estimates should, if possible, be reconciled.

8. As an example, Table 1 shows the catch rates that have been used for this calculation since 1996/97. The catch rates used for Area 58 are lower for the assessments of the 1998/99–2000/01 split-years than the catch rates either earlier or later, such as in Divisions 58.5.1 and 58.5.2. Thus, there was a decline in IUU catches estimated for that period, although the overall estimates of assumed effort were constant (Figure 1). The subgroup noted that the result may, or may not, be an accurate reflection of IUU catches for those years.

9. The Working Group recalled that at the time that the calculations were originally made, a variety of sources had been used to estimate catch rates, including in 1999 an expert group of compliance and fisheries officers (SC-CAMLR-XVIII, Annex 5; WG-FSA-99/51). One way to investigate the sensitivity of the calculations to catch rates would be to examine catch rates from licensed vessels, reported later on in the CDS but unavailable at the time that the calculations were originally performed (Table 1). Figure 2 shows the effect of these alternative catch rates, which would lead to a different interpretation of the historical IUU catch series.

10. Some Members indicated that the decline in IUU catch in Area 58 may be a product of the assumed parameter values used in the calculations. Other Members noted that throughout the historical series compliance and enforcement activities have varied, and that these or other factors may have resulted in changes in IUU activities.

11. It has long been suspected that catches reported in the CDS from Areas 47, 51 and 57 were in fact largely misreported IUU catches taken from the Convention Area. Areas of fishable ground are very small in these areas and licensed vessels report very low catch rates (≤ 1 tonne/day) compared to the catch rates reported by suspected misreporting IUU vessels (SC-CAMLR-XXIII, Annex 5, paragraph 8.12). Notwithstanding that several Members have reported licensed catches from these areas (including Spain and the Republic of Korea), the majority of catches are likely to be misreported. The Working Group noted last year that these misreported catches may be accounted for in the estimates of IUU catches from within the Convention Area (SC-CAMLR-XXIII, Annex 5, paragraph 8.13) because they match the

estimated IUU catches reasonably well (Table 1). However, there are very limited data that can be used to reliably estimate the proportion of those catches which were misreported that could be reassigned to other statistical areas within the Convention Area.

12. The Working Group requested that SCIC review these issues and determine whether a review of the IUU catch series is needed. The Working Group emphasised that the best estimates of IUU are required for its work in assessing and determining sustainable yields for Convention Area fish stocks.

CONSIDERATION OF IUU ESTIMATION METHODOLOGY

13. WG-FSA recognised that sightings information could be treated as indicative or actual estimates of IUU activity. If they were treated as actual estimates of IUU, each sighting would be accompanied by an estimate of the actual IUU catch that could have been taken by that vessel, using a mixture of verifiable factual data (e.g. hold capacity) and assumptions about various other aspects (e.g. where and for how long it fished, whether it returned to port with a full hold etc). No other information would be required. If they were treated as indicative, each would be a sampled 'observation' of the general IUU activity. Indications of the level of effective monitoring, and the behaviour of IUU vessels, would be used to generate an estimated IUU catch, again using a mixture of verifiable factual data and also assumed inputs. This is the approach explicitly taken by the Agnew and Kirkwood (2005) and Ball (2005) simulation models.

14. The current method attempts to treat the sightings as indicative, but this is hampered, amongst other aspects, by the lack of information on the proportion of fishable time or area which could be considered to be under effective monitoring for IUU activity. WG-FSA requested this information from SCIC last year (SC-CAMLR-XXIII, Annex 5, paragraphs 8.5 and 8.6). For instance, the percentage of the year in which surveillance observations were made – the number of days a patrol vessel, overflight or satellite surveillance operated compared to the effective fishing season.

15. The subgroup requested that the Scientific Committee ask the Commission which body is responsible for estimating and reviewing the IUU catch in each statistical area and by what method this might be achieved. For example, it will be important to determine the values for input parameters to these calculations such as:

- (i) how to use the sightings information currently submitted to the Secretariat, some of which cannot be adequately verified, that would not require explicit information on surveillance operations to be made available;
- (ii) what fishing time might be represented by an observation (i.e. the number of vessels fishing, the duration that they might be fishing in the area, the potential fishing time). One option might be to provide a weighting for each type of observation, such as whether a vessel is observed near to, or far away from, fishing grounds;
- (iii) how surveillance activity might be used to estimate IUU fishing activity from observations;

- (iv) how these values might be influenced by different kinds of sightings;
- (v) what other factors may need to be taken into account to make this approach viable.

16. The subgroup noted that compliance and enforcement experts are needed to determine this information and reiterated WG-FSA's request from last year (SC-CAMLR-XXIII, Annex 5, paragraph 8.6) for SCIC to consider whether qualitative information could be provided for each of the regions suitable so that they can be classified as either unmonitored, slightly monitored or heavily monitored with an indication as to whether the level of monitoring has increased or decreased significantly from the previous year.

17. Results presented in Ball (2005) from the application of the IUU estimation model described in WG-FSA-04/63 were considered. This work suggested that there was a level of observation below which the uncertainty surrounding estimation of IUU activity was extremely high and above which it was much more stable. The point at which this happens was highly dependent on the input parameters to the model and the study was only preliminary. Therefore, at the moment the subgroup cannot advise on an appropriate level of surveillance in the Convention Area.

MANAGEMENT ADVICE

18. Management advice is provided in section 8 of the main text of WG-FSA's report.

REFERENCES

- Agnew, D.J. and G.P. Kirkwood. 2005. A statistical method for estimating the level of IUU fishing: application to CCAMLR Subarea 48.3. *CCAMLR Science*, 12: 119–141.
- Ball, I. 2005. An alternative method for estimating the level of illegal fishing using simulated scaling methods on detected effort. *CCAMLR Science*, 12: 143–161.

Table 1: Possible implications of recalculating estimated IUU catch in Area 58. Panel 1 is IUU catch rates (tonnes/day) used in IUU estimation calculations in past working groups. The boxed figures are inferred from the estimated IUU catches alone which were made independently of any calculation based on catch rates. The grey boxes indicate years for which there is an apparent dip in assumed CPUE. Panel 2 contains suggested new CPUE data, based either on the previous values (simple text), on CDS data (bold) or interpolated (italics). Panel 3 presents the current IUU estimates by season compared to the CDS data from Areas 47, 51 and 57. Note that only partial CDS data are available for 1999/2000 and 2004/05, so the figures here have been pro-rata increased to a whole year.

	<i>Estimates reported by split-year</i>					<i>Estimates reported by season</i>				
IUU assumed catch rates (tonnes/day)	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	
58.7	7.7	2.5	1.4	1.1	1.5	1.3	1	0.8	0.5	
58.6	8.5	3.5	1.9	1.8	1.1	1.2	0.6	1.9	0.3	
58.5.1	8.5	5	2	3	3	2.6	5.5	4.7	4.7	
58.5.2	8.8	5	2	2	3.3	9.3	4.5	4.5	4.5	
58.4.2						1.2	0.8	0.8	0.7	
58.4.3								0.8	1.15	
58.4.4	5	5	1.5	1.5	2.2	2.2	1.1	1.1	1.1	
58	5		1.5							
	<i>Estimates reported by split-year</i>					<i>Estimates reported by season</i>				
Alternative CPUE	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	
58.7	7.7	2.5	2	1.5	0.94	1	1.3	1.4	0.5	
58.6	8.5	3.5	<i>3.1</i>	2.7	2	1.7	1.05	0.4	0.3	
58.5.1	8.5	5	<i>5.95</i>	6.9	5.5	2.6	3.95	3.3	4.7	
58.5.2	8.8	5			3.3	9.3	4.5	4.5	4.5	
58.4.2						1.4	1.4	0.8	0.7	
58.4.3								0.8	1.15	
58.4.4	5	5	<i>3.1</i>	1.2	0.9	2.2	1.1	1.1	1.1	
58			<i>3.1</i>							
CCAMLR season	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	
48	0	146	667	1 015	196	3	0	0	0	
58	32 673	14 960	5 201	6 629	8 606	11 762	10 070	2 237	1 932	
88	0	0	0	0	0	92	0	240	144	
CDS (Areas 47, 51, 57)				9 586	15 409	15 080	8 352	1205	142	

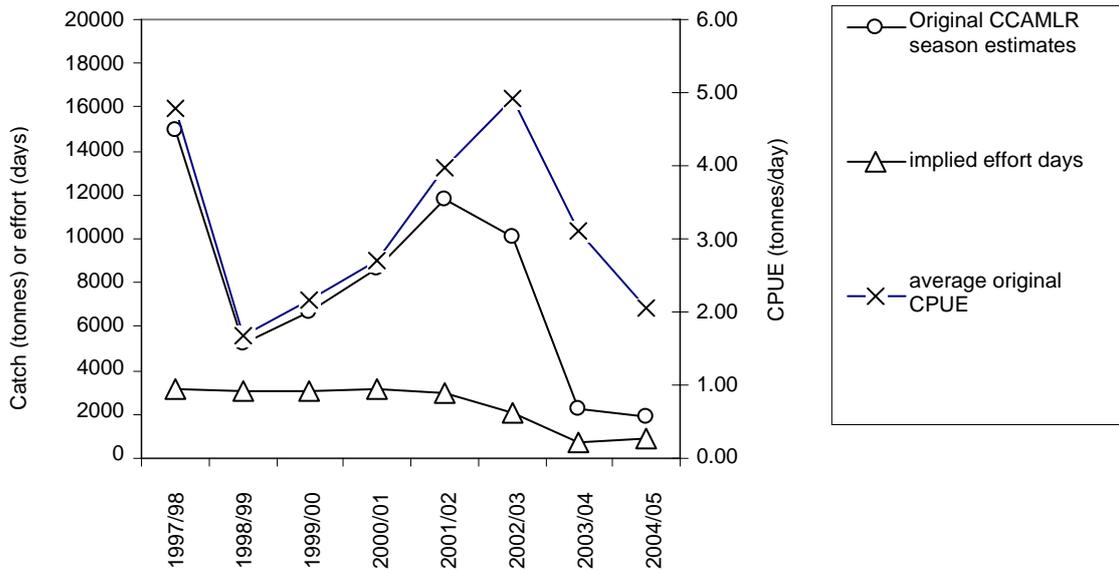


Figure 1: Comparison of current CCAMLR estimates of IUU catch with the implied effort (days IUU fishing) and average IUU CPUE (tonnes/day), both calculated from the IUU estimation tables (e.g. SC-CAMLR-XXIII, Annex 5, Table 3.2).

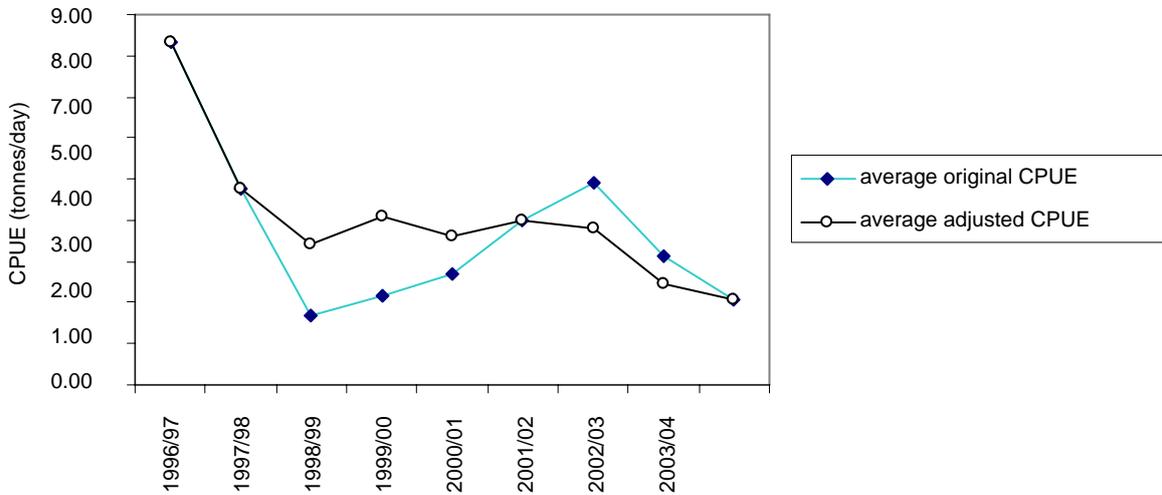


Figure 2: Comparison of original and adjusted average CPUE in Area 58.

**SUBGROUP ON BIOLOGY, ECOLOGY AND DEMOGRAPHY
OF TARGET AND BY-CATCH SPECIES**

SUBGROUP ON BIOLOGY, ECOLOGY AND DEMOGRAPHY OF TARGET AND BY-CATCH SPECIES

SUMMARIES OF PAPERS

WG-FSA-05/27: **The Patagonian toothfish fishery (*Dissostichus eleginoides*) in the Kerguelen Islands (Indian Ocean sector of the Southern Ocean).** Analyses of *D. eleginoides* length-frequency data (LFD) from the longline fishery at Kerguelen confirm an increase in mean length with depth, with the majority of adults present below 500 m. LFDs differ between the sexes, with females having a larger range than males. Size of sexual maturity has been estimated and differs between males and females (63 and 85 cm respectively). The maturity stages followed all year round show differences between the eastern and western parts of the shelf. The eastern shelf appears to be a recruitment area and the western part is where spawning concentrations occur in winter (June).

WG-FSA-05/28: **New data on Antarctic toothfish and some other by-catch fishes fecundity with gonads histological pictures from Ross Sea region and data on Patagonian toothfish from the Argentina Sea.** The paper presents data on reproduction and oogenesis of Antarctic toothfish and a number of by-catch species in January to March 2005. Absolute fecundity in *Dissostichus mawsoni* ranged from 500 000 to 1.7 million eggs (15–41 eggs g⁻¹). *Macrourus whitsoni* had an egg size at spawning of 3.5 mm. *Chionobathyscus dewitti* were in pre-spawning condition in January to March. A female close to spawning had a GSI of 23.9. Some females with resting gonads were observed in the pre-spawning period, which were unlikely to spawn in the current season. Absolute fecundity ranged from 3 200 to 6 100 eggs (5–12 eggs g⁻¹) in 38–49 cm fish. Females of *Cryodraco antarcticus* were in pre-spawning condition with oocytes of 3–3.5 mm size. Egg size at spawning was 4.5 mm. Absolute fecundity varied from 10 000 to 13 000 eggs (58–64 cm fish). *Chionodraco hamatus* were found in pre-spawning condition with oocyte diameters of 4 mm. Fish in spawning condition had egg sizes of 4.5–4.8 mm, with absolute fecundity of 4 200–6 400 (4–6 eggs g⁻¹) in 42–50 cm fish. Ovaries of *Muraenolepis microps* in pre-spawning condition contained eggs of 1 mm diameter, with absolute fecundity 92 000 to 230 000 oocytes (150–200 eggs g⁻¹) in 40–50 cm fish. In *Lepidonotothen kempfi* (squamifrons) oocyte diameter was 1 mm and GSI was 11.5. Absolute fecundity was 86 000 eggs in a female of 34 cm (190 eggs g⁻¹).

WG-FSA-05/35: **Project of a software catalogue of skeletal elements from Antarctic fish species, including some identification facilities.** Skeletal elements from fish species of the Antarctic waters were extracted by bioenzyme to provide a computer-supported identification system, including a database of bone pictures. In the database most of the skeletal elements of the cranial and axial skeleton (apart from a few bones of the neurocranium) are represented by pictures, with otoliths and vertebrae also included. Cooperation with other institutions is needed to extend the existing work.

WG-FSA-05/52: **Geographical differences in the condition, reproductive development, sex ratio and length distribution of Antarctic toothfish (*Dissostichus mawsoni*) from the Ross Sea, Antarctica (CCAMLR Subarea 88.1).** Morphological and reproductive data collected on Antarctic toothfish (*Dissostichus mawsoni*) during the 2000/01 to 2004/05 fishing seasons indicate differences between toothfish found on the Ross Shelf proper and

those from the more isolated seamounts and features to the north. Average sampling depth north of 70°S was 1 226–1 621 m, while it was 937–1 389 m south of 70°S. Median length of females was 150–153 cm and thus 10 cm larger than length in males (140–143 cm). Females dominated the catches south of 70°S: 59.2–62.3% while females were less dominant north of 70°S: 27.3–49.5%. The reason for this remains unclear. There has been consistently lower mean weight for length in the northern area than in the south over all seasons (2000/01–2004/05). Overall, Fulton's index of condition K was higher for females than for males. K was generally higher south of 70°S than further north. The gonadosomatic index (GSI) increased from January to March for fish in the north, but remained low in fish in the southern area. A running ripe female caught out of season in December had a GSI of 30. Mature fish apparently increased in condition for spawning in the south and then moved north to spawn.

WG-FSA-05/62: Results from the New Zealand exploratory fishery for *Dissostichus* spp. in Divisions 58.4.1 and 58.4.2 in the 2004/05 season. Exploratory fishing for *Dissostichus* spp. was undertaken in Divisions 58.4.1 (February) and 58.4.2 (March). *D. mawsoni* caught in Division 58.4.1 were mainly adult, with a similar size distribution to that found in Subarea 88.1. In Division 58.4.2 there was a bimodal distribution, with a significant part of the catch being 70–90 cm pre-recruit fish. The larger fish in both areas were dominated by females. In Division 58.4.1 in late February most fish of both sexes were maturing to spawn, but none were fully mature. The gonadosomatic indices (GSI) for females ranged from 0.35 to 7.5%. In Division 58.4.2 (SSRU E), the majority of the fish (64%) were still immature while the other 36% were evenly spread between resting and developing. The GSI for female *D. mawsoni* ranged from 0.04 to 11.61%. In contrast, the fish caught in SSRU A were mostly found to be maturing. One running ripe female and nine ripe males were taken in SSRU A during the voyage. This is the first evidence we are aware of that identifies potential spawning grounds in this division. The GSI for females ranged from 0.25% to a maximum of 16.2%. The heaviest ovary weighed 7.3 kg. Most of the fish found in this division, especially in SSRU A, were in poor condition (skinny/'axe handle' fish) similar to those found in SSRU 881C in some years.

WG-FSA-05/63: Size-at-maturity and histological procedures explored to determine spawning activity of female *Dissostichus mawsoni* from samples collected from the Ross Sea in January 2004, December 2004 and January 2005. Gonad samples from female Antarctic toothfish (*Dissostichus mawsoni*), collected during the 2003/04 and 2004/05 commercial fishing seasons in the Ross Sea were examined macroscopically and histologically to improve estimates of size-of-maturity. Two methods were applied. The first used classic histological techniques to classify ovary stages by the most advanced state of oocyte development visible in histological sections of the 2003/04 samples to determine the proportion of fish maturing to spawn, and thus the mean size at maturity. The calculated L_{m50} of 113.0 cm was very close to the value of 115.2 cm estimated in 2000/01. GSI data collected from across the fleet, however, still raise doubt about the true L_{m50} . The second method examined ovaries to identify histologically fish that spawned the previous season, but requires further ground truthing.

WG-FSA-05/71: Two species of toothfish in two basic longline fisheries regions – Patagonian toothfish in Subarea 48.3 (South Atlantic) and Antarctic toothfish in Subareas 88.1 and 88.2 (South Pacific). Analysis of the depth distribution of catches showed that smaller fish prevailed closer to the shelf and to the Balleny Islands while larger individuals were found in deepwater areas of the Ross Sea. These observations confirmed earlier observations by Hanchet et al. (2003, 2004). Antarctic toothfish appear to grow faster

than Patagonian toothfish. At the same age, Antarctic toothfish were 120–150 cm long while Patagonian toothfish were 105–120 cm long. Analysis of stomach content of Antarctic toothfish showed that macrourids (18.8% frequency of occurrence), cephalopods (12.0%) and icefish (8.9%) formed the predominant part of the diet. The composition of the diet varied considerably from the diet of fish collected near McMurdo Sound in the late 1970s/early 1980s (Eastman, 1985) when primarily notothenioids (*Pleuragramma antarcticum* and others) and mysids were found in the diet.

WG-FSA-05/76: Oceanological factors affecting formation of mackerel icefish aggregations in the South Georgia area during different seasons of the year. At South Georgia icefish occupy a limited temperature range and are intolerant of temperatures greater than 2°C. During winter the fish are not feeding and occupy a limited temperature range of 1.6–1.7°C at depths greater than 250 m. In spring/summer icefish occupy a wider range of depth and temperature (0.0–1.9°C in the South Georgia area and to 2.0°C near Shag Rocks). Autumn includes the feeding and pre-spawning periods, with fish migrating to the spawning grounds, which occur in the near-bottom layer. The impulse of the spawning migration beginning is when the near-bottom water warming in the spawning ground increases to 1.6°C.

WG-FSA-05/77: Reasons of differences between distribution and density of mackerel icefish (*Champscephalus gunnari*) aggregations in the South Georgia area during summer and autumn periods in different years from the bottom trawl survey data. During the feeding period, icefish aggregations are confined to frontal zones between opposite flows (coastal circumfluent current and ACC) or formed inside quasi-stationary circulations, where the largest aggregations of food organisms are concentrated at the beginning of the spring period. Such a confinement of fish aggregations to dynamically active zones arises from a concentration of food organisms in these areas rather than as a result of favourable oceanographic conditions for the fish. The presence of a cold intermediate layer may have a negative effect on the formation of aggregations as it impedes descending food to the horizons inhabited by icefish and inhibits migration of fish to the upper 100 m layer. Very high water temperature (above 1.8–2.0°C) for this area in the places of food organism aggregation is another obstacle to vertical migrations by foraging fish. All physiological processes of icefish begin to recede at such a temperature, and at a higher temperature the fish evidently falls into a condition close to anabiosis. In such locations the fish are distributed deeper than this temperature layer, most often near the ground. As a rule, transition of icefish to pre-spawning condition is conditioned by visceral fat content (over 2 points).

WG-FSA-05/P6: Dietary composition of juvenile *Dissostichus eleginoides* (Pisces, Nototheniidae) around Shag Rocks and South Georgia, Antarctica. The diet of Patagonian toothfish (predominantly 30–70 cm TL) was investigated from animals trawled in the South Georgia area in March–April 1996. Using frequency of occurrence (F%) and coefficient Q (%), fish was by far the main food on the shelves of Shag Rocks and South Georgia, accounting for about 70% of prey. Krill appeared as secondary food, although its importance was overestimated by the frequency of occurrence method. *Lepidonotothen kempfi*, *Champscephalus gunnari* and *Chaenocephalus aceratus* constituted the main fish prey and their variability between Shag Rocks and South Georgia depended on their local abundance.

Table 1: New CCAMLR ageing database structure.

Table name	Field	Type	Description
FISH_AGE	Database	'R' or 'O'	Used to determine whether the link is to Observer or Research Data
	DataOwner	Text	Identity of the data owner
	CruiseID	Number	Linked to Observer or Research CruiseID
	SetID	Number	Linked to Observer or Research CruiseID
	FishID	Number	Unique identifier for the fish
	SpeciesCode	3-alpha code	Linked to Species Codes tables
	Length	Number	Length (in cm) of the fish
	Weight	Number	Weight (in g) of the fish
	Sex	M/F/U	Gender of the fish
	Maturity	1-alpha	Maturity Stage of the fish – linked to Maturity Codes table
	CaptureDate	Date	Date of capture
BirthDate	Date	Estimated birth date	
FISH_AGE_READING	ReadingID	Number	Unique identifier for the reading
	FishID	Number	Linked to FISH_AGE FishID
	ReaderID	Number	Linked to AGE_READER table. Details of the reader
	Reading	Number	Otolith reading
AGE_READER	ReaderID	Number	Unique identifier for the reader
	ReaderName	Text	Name of the reader
	ReaderCode	Number	Quality of the reader – linked to ReaderCode table
READER_CODE	Code	Number	Number for identifier
	Meaning	Text	Meaning of the code

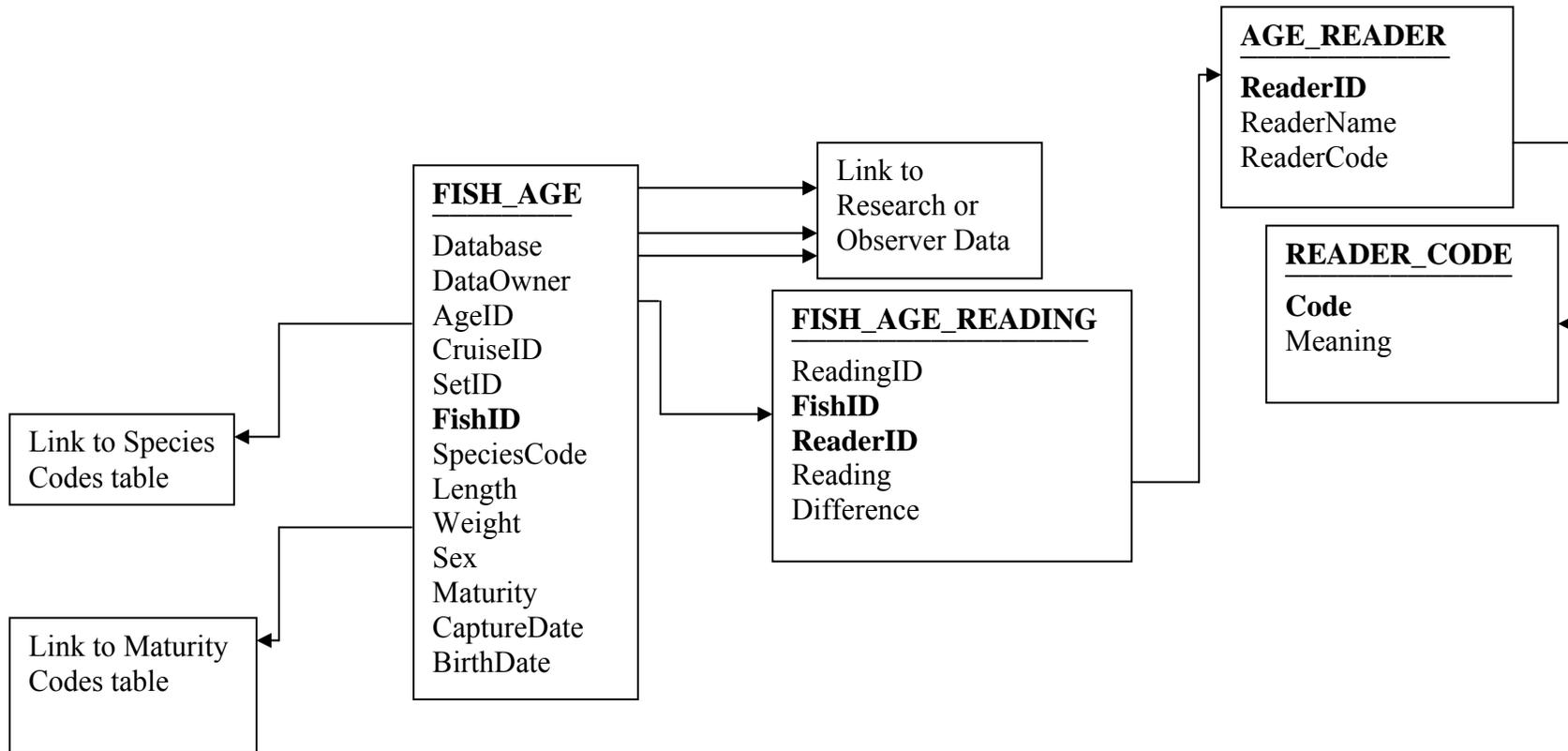


Figure 1: Outline of CCAMLR ageing database.

SUBGROUP ON ECOSYSTEM MANAGEMENT

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SUBGROUP ON ECOSYSTEM MANAGEMENT

CONSIDERATIONS OF ECOSYSTEM MANAGEMENT

In order to satisfy requirements of CCAMLR Articles II.3(b) and (c), an ecosystem approach to management is needed.

2. This subgroup report summarises information relevant to interactions with WG-EMM and ecological interaction.

Interactions with WG-EMM

3. There was little interaction between WG-EMM and WG-FSA in 2005. WG-EMM provided some information on the by-catch of fish in the krill fishery in Area 48. Based on the analysis of 4 431 tows, the by-catch of fish was 0.05% by weight. *Champscephalus gunnari* was the dominant by-catch species with 69% by number and 39% by weight. No account has been made of differences between the fish by-catch in the various CCAMLR subareas.

4. The fish by-catch from Japanese-flagged krill trawlers at South Georgia was described in WG-EMM-05/19. During 100 hauls, conducted from 6 August to 8 September 2004, 12 species of six families were caught. Lanternfish (Myctophidae) were the most abundant occurring in 61% of the hauls. The most abundant notothenioid species in the catches was *Lepidonotothen larseni* with three different age classes present. There was some indication for less fish being found in large krill hauls (CPUE > 20 tonnes/hour) and fish being more abundant in smaller krill hauls (CPUE < 5 tonnes/hour). However, the authors cautioned that a negative correlation between krill CPUE and the by-catch of fish had not been statistically evaluated.

5. A Ukrainian krill trawler fished in Subarea 48.1 from 3 to 17 May 2005 conducting 69 sets. Five fish species of two families were caught. The largest catch (5 kg) consisted of *Pleuragramma antarcticum*. Two size groups were present at 7–8.2 and 14.7–19.2 cm. Channichthyid species were caught occasionally. Two Ukrainian trawlers fished for krill in Subarea 48.3 from 23 May to 18 August 2005. During the 534 sets observed, eight species of four families were caught. The two most abundant species were *L. larseni* (present in 4% of the hauls) and *C. gunnari* (present in 10% of the hauls). The length of *L. larseni* in krill catches was 4.6–6.0 cm. The length of *C. gunnari* in krill catches was 7.6–11.9 cm. In one catch it was 19–25.2 cm when the entire catch of the species in the haul was 42 kg (extract from National Scientific Observer Logbooks provided by L. Pshenichnov, Ukraine).

6. The subgroup thanked Ukraine for this information and encouraged it to submit this analysis to WG-EMM next year as it provided useful information on the broader ecological impacts of the krill fishery.

Ecological interactions

Fish as predator and prey

7. Like other sub-Antarctic shags, the Antarctic shag (*Phalacrocorax bransfieldensis*) and the South Georgia shag (*P. georgianus*) are bottom feeders (Casaux and Barrera-Oro, 2005). In inshore shallow waters, shags are the main predators of demersal fish and play an important role as regulators of their main fish prey. Their prey consisted predominantly of demersal fish. In the southern Scotia Arc and the western Antarctic Peninsula the nototheniid *Notothenia coriiceps* constituted their main prey. The decline in the number of breeding pairs in some areas has been partly attributed by the authors to the effects of the commercial fishery on the shags' preferred prey.

8. In discussion, the subgroup questioned that the decline in the number of breeding shags is accountable to the fishery-induced decline of certain fish species in the area for two reasons:

- (i) The main species in the fishery were *C. gunnari* and, to a lesser extent, *N. rossii*, *Gobionotothen gibberifrons* and two other icefish species. These species have been fished heavily and their biomass was largely depleted in the late 1970s/early 1980s. Their decline does not match the decline in the number of breeding shags which occurred from the mid-1990s onwards.
- (ii) The fishery in the southern Scotia Arc (Subareas 48.1 and 48.2) was closed after the 1989/90 fishing season and stocks should have started to slowly recover.

9. *Dissostichus eleginoides* is an important predator of other fish species. The dietary composition of juvenile *D. eleginoides* was investigated around South Georgia in March/April 1996 (Barrera-Oro et al., 2005). *Lepidonotothen squamifrons*, *C. gunnari* and *Chaenocephalus aceratus* formed the main part of the fish diet. Their variability between Shag Rocks and South Georgia mirrored differences in the local abundance of fish species. No difference in the diet between male and female toothfish was observed.

Cetacean–fisheries interactions

10. Based on a review of fishery–cetacean interactions (WG-FSA-05/11) the subgroup noted that the two cetacean species primarily involved in interactions with longline fisheries were orcas (*Orcinus orca*) and male sperm whales (*Physeter macrocephalus*). Both species took substantial numbers of fish from the line primarily during daylight hours. Catch rates of longliners declined to less than 50% when orcas occurred close to longline vessels while the loss to sperm whales was much less obvious. They were seen diving close to the line down to 400 m where they apparently took fish. Their impact on catch rates was much less notable. Sperm whales became frequently entangled in the line and part of the line was lost in a number of cases. Other cetaceans were rarely seen in the vicinity of longline vessels. They became entangled in the line only occasionally and one whale (presumably a minke whale) died in 2003 (Kock et al., 2005).

11. The subgroup recognised that killer whales, unlike sperm whales, do not have the diving capability to feed on toothfish at the depth at which the fish are caught by the fishery,

therefore, these fish are only available to killer whales because of the action of the fishery. These fish are currently not included as ecological removals from the fish population. The predation by killer whales is likely to be a learned behaviour, hence, it may increase with time and consideration for how it is included in removals should be given in the future.

12. Depredation of fish from longlines in the Prince Edward Islands has escalated in recent years and had reached saturation by 2002 (WG-FSA-05/58). Cetaceans consume two out of every three toothfish caught. Since 2004 one of the vessels involved in the fishery used pots to catch toothfish. There are no indications of toothfish lost to cetaceans in the pot fishery since pots were introduced.

13. The subgroup also noted high instances of depredation by killer whales in the Crozet longline toothfish fishery (WG-FSA report, paragraph 5.113).

14. The subgroup suggested that a system to quantify the interactions between marine mammals and the longline fishery in a systematic fashion be developed in the intersessional period. This should include direct observations of fish being removed from the line and indirect observations of depredated fish, lost hooks and broken gear, as well as systematic reporting of the presence of killer whales and sperm whales.

Benthos

15. Bottom trawling was banned in the early 1990s at South Georgia to protect benthic communities (see SC-CAMLR-XXIII, Annex 5, paragraphs 5.26 to 5.39). The benthos by-catch from the 2004 bottom trawl survey around South Georgia was recorded in WG-FSA-05/79. The by-catch, which accounted for nearly one-third of the total catch, was split into the major taxa and recorded (WG-FSA-05/79). Benthos by-catch ranged from 3.97 to 614 kg/tow. Average catch size did not differ significantly between depth zones (0–150, 151–250 and 251–500 m) or areas (Shag Rocks, South Georgia). Catches were often diverse with as many as 17 classes of invertebrates represented in individual hauls. Catches were dominated by echinoderms and poriferans, with large numbers of cnidarians and tunicates.

16. The subgroup thanked the UK for providing more detailed information on the benthos by-catch in bottom trawls, although this came from research trawls. It will enhance the information available on the effects of bottom trawling on benthic communities should bottom trawling be reintroduced.

Management advice

17. Management advice is provided in section 10 of the main text of WG-FSA's report.

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**SUBGROUP ON THE SCHEME OF INTERNATIONAL
SCIENTIFIC OBSERVATION**

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SUBGROUP ON THE SCHEME OF INTERNATIONAL SCIENTIFIC OBSERVATION

GENERAL MATTERS

Current observation requirements as detailed in conservation measures have not changed from those presented in last year's report (SC-CAMLR-XXIII, Annex 5, Table 11.1).

2. Following the recommendations of WG-FSA at its 2004 meeting, updated versions of the observer logbook forms and cruise report format were placed on the CCAMLR website and distributed to all Members and technical coordinators on 16 February 2005 (COMM CIRC 05/15). All the observer logbooks were submitted using the electronic versions, however the use of outdated logbooks remains a problem when requested data fields are not completed (e.g. by-catch data). It has been recognised that for some new and exploratory fisheries, where the season commences before the official distribution of the updated observer logbook forms, there may be a 12-month delay in obtaining the updated forms. Where possible, the Secretariat issues draft versions of the updated logbook forms, in English, to the relevant technical coordinators prior to the commencement of these fisheries.

3. The subgroup reiterated the advice of the Scientific Committee (SC-CAMLR-XXIII, paragraph 2.7) that all technical coordinators ensure that only the current versions of cruise reports and logbook forms be used by observers in order that all requested data fields are completed.

4. Information collected by scientific observers was summarised in WG-FSA-05/7 Rev. 1, 05/8, 05/9 Rev. 2 and 05/10.

5. A total of 31 longline cruises were conducted during the 2004/05 season, with scientific observers (international and national) on board all vessels. Eight cruises were undertaken in Subarea 48.3 by eight vessels (with one vessel undertaking several sets in Subarea 48.4), one cruise was undertaken by one vessel in Subarea 48.6, eight cruises were undertaken by seven 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, one cruise was conducted by one vessel in Subareas 58.6 and 58.7 and 11 cruises were undertaken in Subareas 88.1 and 88.2 by 11 vessels.

6. During the 2004/05 fishing season, nine vessels conducted 14 trawl operations targeting finfish. In accordance with the conservation measures in force, there was 100% observer coverage on all finfish trawl vessels. In total, seven national scientific and seven internationally designated scientific observers participated in these operations.

7. By the commencement of the WG-FSA meeting, six scientific observation programs were reported from five of the nine krill vessels operating in the fishery. These observation programs were undertaken by one national and five internationally appointed scientific observers. The estimated overall observer coverage, based on the number of days when an observer was present, for the krill fishery in 2004/05 was 19% (paragraph O223).

8. Two pot fishing cruises were conducted during the 2004/05 season, both targeting *Dissostichus eleginoides*. These cruises were undertaken in Area 51 (South African EEZ) and Subareas 58.6 and 58.7 by the South African-flagged vessel *South Princess*, with national scientific observers on board.

9. The quality of submitted observer logbook data was high. The subgroup commended all the observers that worked in the CAMLR Convention Area in 2004/05 for their hard work.

OBSERVER CONFERENCE

10. In accordance with the decision of the Scientific Committee (SC-CAMLR-XXIII, paragraph 2.18), two officers from the Secretariat (Dr E. Sabourenkov – Science and Compliance Officer and Mr E. Appleyard – Scientific Observer Data Analyst) attended the Fourth International Fisheries Observer Conference which was hosted in Sydney, Australia. Details of the conference were provided in SC-CAMLR-XXIV/BG/10.

11. CCAMLR was the only Regional Fisheries Management Organisation (RFMO) represented at the conference. The conference considered a number of topics of direct relevance to CCAMLR observer programs. CCAMLR representatives participated in two pre-meeting workshops and presented a talk on scientific observation in CCAMLR fisheries.

12. The Conference:

- (i) noted that the CCAMLR Scheme of International Scientific Observation has proven to be an indispensable source of a wide spectrum of fishery-related data required for CCAMLR conservation and fisheries management purposes;
- (ii) agreed to expand the scope of the next conference to include consideration of observer programs on high seas in areas of responsibility of RFMOs and to convene a special workshop to consider the matter.

13. The subgroup recommended that the Scientific Committee consider funding the participation of CCAMLR observers at the next International Fisheries Observer Conference.

14. The next International Fisheries Observer Conference is planned to be convened in May 2007 in Canada.

DATA COLLECTED DURING THE 2004/05 SEASON

15. Data collected by scientific observers during the 2004/05 season were used in stock assessments, by-catch estimation and analyses of seabird and marine mammal mortality arising from fishing operations.

CONVERSION FACTORS

16. The main processing method for *D. eleginoides* and *D. mawsoni* reported by observers in longline fisheries (WG-FSA-05/7 Rev. 1) was headed, gutted and tailed (HGT), with some being processed as headed and gutted (HAG) product (WG-FSA-05/7 Rev. 1, Table 5). The average observed HGT conversion factor for *D. eleginoides* in Subarea 48.3 was 1.75 (± 0.19), in Subarea 48.6 was 1.64 (± 0.15) and 1.63 (± 0.13) in Subareas 58.6 and 58.7. The average HAG conversion factor for *D. eleginoides* in Division 58.5.2 was 1.68 (± 0.07) and 1.50 (± 0.29) in Subareas 88.1 and 88.2. The average observed HGT conversion factor for *D. mawsoni* in Subareas 88.1 and 88.2 was 1.82 (± 0.17), and the average HAG conversion factor was 1.64 (± 0.111).

17. Observers also provided information on processing and conversion factors from the trawl fishery in Division 58.5.2 (WG-FSA-05/8). The main processing method for *D. eleginoides* was HGT, with calculated conversion factors ranging from 1.72 to 1.78. All vessels in this fishery used a standard conversion factor of 1.74 for *D. eleginoides* processed as HGT. All *Champscephalus gunnari* caught in this division were processed as a whole fish product.

18. The processing method for *D. eleginoides* in the pot fishery was HGT, with observer-calculated conversion factors of 1.62 in Area 51 (South African EEZ) and 1.66 in Subareas 58.6 and 58.7. No vessel-derived conversion factor was recorded (WG-FSA-05/10).

19. Dr D. Agnew (UK) reported that, using data presented in WG-FSA-05/7 Rev. 1, the catch-weighted average conversion factor measured by observers in Subarea 48.3 (1.775) was very close to the conversion factor used by the vessels (1.77).

20. For the krill fishery in Area 48, the main processing methods were whole, boiled, peeled and mealed. The conversion factor used by the vessels for peeled product was 10.0 and mealed product ranged from 6.5 to 10.0. Observers reported that due to the operation of the mealing and boiling factories it was not possible for them to calculate conversion factors (WG-FSA-05/8).

BY-CATCH

21. Discussions of the subgroup related to by-catch and observer data are contained in paragraphs N37 to N53 and advice to the Scientific Committee is summarised in the WG-FSA report, paragraph 11.3.

TAGGING PROGRAMS

22. Discussions of the subgroup related to tagging and observer data are presented in paragraphs T12 and T15.

SHINSEI MARU BOTTOM-LINE SYSTEM

23. The subgroup requested that the fishery observer assigned to this vessel provide a report describing how the gear is deployed and retrieved with special attention to gear and seabird behaviour during the haul and set (paragraph O81).

INCIDENTAL MORTALITY IN FISHERIES – CURRENT AND ADDITIONAL REQUIREMENTS

24. The subgroup noted that to support extrapolations of incidental mortality of seabirds caught in trawl and longline fisheries, observer data need to be collected in such a way as to distinguish between haul and set captures (paragraph O10).

25. The subgroup noted that to support future analysis of the ‘2-m access window’ the collection of data by observers on longline vessels of vessel setting speed, longline sink rate and streamer line aerial extent remain priority tasks for observers (paragraph O76).

26. The subgroup proposed that for longline vessels, data on streamer line aerial extent and other streamer line features, including the height of streamer line at the stern, the length of streamer lines, the number, spacing and length of individual branched streamers, be collected once every seven days on a diagram-based data collection form to be developed by the Secretariat. Where sink rate data collection is required according to Conservation Measure 24-02, the streamer line data should be collected at the same time as sink rate data where possible (paragraph O79).

27. With respect to trawl fisheries, the Working Group noted a reduced level of reporting by observers on the effort of crews to thoroughly clean the net before shooting operations, and recommended that changes should be made to the observer data collection forms to improve this situation (paragraph O205).

28. With respect to all trawl fisheries (icefish, toothfish and krill) the subgroup reiterated that the following data are required to be accurately reported for all observed cruises to allow extrapolation of incidental mortality per trip and for each relevant management area:

- (i) number of tows during voyage;
- (ii) number of tows observed specifically for incidental mortality (marine mammals and/or seabirds) during voyage;
- (iii) number of incidental mortalities observed by species per tow;
- (iv) number of incidental mortalities reported from non-observed tows;
- (v) whether offal was discharged at any time during the tow.

29. The subgroup recalled that last year the Scientific Committee endorsed the decision of WG-FSA that, in future, proposals for adding data collection tasks should be submitted in a standard format including a description of the data collection objectives, data collection protocols and data usage (SC-CAMLR-XXIII, Annex 5, paragraph 11.39).

30. The subgroup recommended the continued use of the definition of the status of birds 'caught' (SC-CAMLR-XXII, Annex 5, paragraphs 6.214 to 6.217) and requested feedback from scientific observers on the ability to apply this definition whilst at sea (paragraph O195).

SCIENTIFIC OBSERVATION ON KRILL VESSELS

31. The subgroup recommended that observer coverage be required on all vessels participating in Convention Area krill fisheries to allow incidental mortality levels of seabirds and marine mammals and the effectiveness of mitigation measures to be determined, and asked the Scientific Committee to consider how this might be achieved (paragraphs O222 to O226).

32. Since the 2004 fishing season, a questionnaire on krill fishing strategies has been incorporated in the Krill Trawl Fishing Observer Logbook. At its recent meeting, WG-EMM recommended that the questionnaire be amended to include a number of additional questions together with diagrams of the vessel track and position of krill aggregations (Annex 4, paragraphs 3.35 and 3.53).

ELECTRONIC MONITORING

33. Trials conducted by the Australian Fisheries Management Authority to test an Archipelago Marine Research video monitoring system on board the *Avro Chieftain* (WG-FSA-05/74) to monitor setting and hauling had some interesting preliminary results.

34. After initial lighting problems, the video system and the events that trigger activation worked well at capturing the hauling process in a moonpool environment. However, due to the frequency of night setting during the trial period, a limited field of view and frame capture rate, the system had a reduced success at capturing baiting efficiency, streamer line performance and bird behaviour during setting operations.

35. Further trials and technical adaptations are required to refine the method for setting operations. These issues were further complicated by vessel pitching during rough sea conditions. Adaptations being considered to reduce the time and cost of analysis include a fast scanning technique and a randomisation process to enable sub-sampling.

REVIEW OF THE *SCIENTIFIC OBSERVERS MANUAL*

36. The subgroup noted that there had been little progress with the proposed major review of the *Scientific Observers Manual* (SC-CAMLR-XXIII, paragraph 2.8).

37. The subgroup considered that before any review of the *Scientific Observers Manual* is undertaken the following three areas should be considered:

- (i) a review of research priorities for different fisheries, target species and by-catch species and the type of data to be collected to allow research priorities to be met;

- (ii) a review of whether existing data collection and recording protocols meet the identified data collection requirements. This phase should also include development of clear guidance on prioritisation of observer tasks where requested data collection exceeds time available to the observer at sea;
- (iii) a consideration of the most appropriate structure, format and contents of the manual.

38. The subgroup agreed that items (i) and (ii) above should be reviewed annually by WG-FSA incorporating the recommendations and advice of WG-FSA-SAM and ad hoc WG-IMAF with respect to the Scheme of International Scientific Observation. The Scientific Committee will need to take these recommendations into account along with requests for priority data collection from WG-EMM (and SCIC) in deciding the final list of priorities for the observer scheme.

39. The subgroup felt that changes recommended annually by the Scientific Committee and its working groups (item (iii) above) should be implemented as appropriate by the Secretariat following the annual review process.

40. Consequently, the subgroup agreed that a major review of the *Scientific Observers Manual* was currently unnecessary as the mechanisms for its continual update and review are already in place and work effectively.

41. The subgroup identified the following procedures for reviewing the observer logbook forms, instructions, sampling procedures and observer work priorities:

- (i) scientific observers should provide comments on the use of the logbooks and instructions to technical coordinators;
- (ii) technical coordinators should collate and forward all relevant comments and suggested changes to the Secretariat in one concise document by 1 September on an annual basis;
- (iii) the Secretariat will present a summary of all recommended changes to WG-FSA for consideration;
- (iv) WG-FSA will consider the proposed changes, evaluate them in view of existing research properties and data collection protocols, and prepare recommendations to the Scientific Committee as required;
- (v) recommendations from working groups (WG-EMM and WG-FSA) relating to observer research priorities and data collection requirements will be submitted as part of their advice to the Scientific Committee;
- (vi) once the Scientific Committee has approved the changes considering also requests from WG-EMM (and as appropriate SCIC) together with the research priorities, the Secretariat will update the logbook forms and distribute them to all Members as soon as possible.

42. The Secretariat proposed that the manual's current format could be substantially improved if paper-based observer logbooks and instructions were removed and be replaced

with electronic logbooks which could easily be amended as required. The manual itself would then consist of a comprehensive range of observation guidelines and reference materials which would not necessarily require annual updates.

43. The subgroup strongly supported this proposal.

MANAGEMENT ADVICE

44. Management advice is provided in section 11 of the main text of WG-FSA's report.

SUBGROUP ON TAGGING

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SUBGROUP ON TAGGING

TAGGING STUDIES

Toothfish

The subgroup noted that tagging programs in Subareas 48.3, 88.1 and 88.2 and Division 58.5.2 have been continuing in the current season. These data have been included in integrated assessments of toothfish for Subareas 48.3 (WG-FSA-05/16), 88.1 (WG-FSA-05/33) and 88.2 (WG-FSA-05/31), and in the development of integrated assessments in Division 58.5.2 (WG-FSA-05/69).

2. WG-FSA-05/17 and 05/18 presented some results from the tagging program in Subarea 48.3. Tagging data were used by the authors to examine the possibility of there being reduced growth rates of fish immediately following the shock of tagging, to calculate tag-shedding rates and to estimate the selectivity of longlines and to derive estimates of current vulnerable biomass. The results were used in the CASAL assessment of toothfish in Subarea 48.3 (WG-FSA-05/16; WG-FSA report, paragraphs 5.65 to 5.80, and Appendix G). The subgroup agreed that these methods were promising, but more years of tagging data would be required to improve the accuracy of the estimates, especially for the estimation of selectivity.

3. The subgroup welcomed the first large-scale experiment on the immediate post-tagging mortality of toothfish, coordinated by the UK in Subarea 48.3 (WG-FSA-05/19). Dr D. Agnew (UK) reported that smaller fish and those in better condition had higher post-tagging survivorship. The experiment confirmed that toothfish are relatively robust; most observers should be able to achieve a toothfish tagging survivorship of 95% or better, and a conservative estimate of survivorship across the fleet would be 90%.

4. Dr A. Constable (Australia) informed the subgroup that Australia would be undertaking studies of post-tagging mortality utilising pots. Dr Agnew recalled that a similar method had been used to assess the survivorship of crabs at South Georgia (Purves et al., 2003).

5. WG-FSA-05/35 reported the results of New Zealand mark and recaptures in the Ross Sea. The results confirmed the results obtained elsewhere, that movement rates are low (80% of fish moved less than 50 km/year), that tag-shedding rates are 0.06 tags/year and that tagging appears to have some immediate effect on the growth of toothfish. These results are similar to those obtained in Subarea 48.3 (WG-FSA-05/18).

Tagging in exploratory fisheries

6. Conservation Measure 41-01/C required that all exploratory fisheries tag toothfish at a rate of 1 toothfish per tonne green weight of catch throughout the season, up to a maximum of 500 fish per vessel.

7. Table 1 shows that most Members achieved this target level in most fisheries. Table 2 shows that the tagging rate of all Members combined achieved an average tagging level of 1 fish/tonne in all exploratory fisheries except for Divisions 58.4.1 and 58.4.3b and Subarea 88.2.

8. The subgroup noted that mark–recapture data were being used in the assessments of toothfish in Subareas 48.3, 88.1 and 88.2, and that the UK proposed to initiate a mark–recapture program in Subarea 48.4 with the objective of achieving a tag-based stock assessment within three to five years (WG-FSA report, paragraphs 5.141 to 5.143; WG-FSA-05/57). The knowledge of critical rates, such as tag shedding and post-tagging mortality, has also improved. There is therefore a real possibility that tagging data could lead to assessments of all exploratory fisheries within a few years of their initiation, but only if the following tag conditions are met:

- Tags need to be released at a reasonable rate. Many Members are currently achieving rates of greater than 1 tag/tonne and this should be encouraged.
- Tagging programs should be considered as multi-year programs. There needs to be a long-term (three to five year) commitment to repeated tagging and fishing in exploratory fisheries.
- Considering the slow mixing rates for toothfish, releases should be widely distributed across all fishing areas and depths, and recapture fishing effort should be similarly distributed.

9. There has been concern that large fish are difficult to tag and have a lower survivorship than small fish. In terms of assessments, which require a known and preferably high survivorship of tagged fish, only the relatively smaller fish within the main body of the dome-shaped selectivities contribute significantly to the estimate of vulnerable biomass. These fish naturally have high survivorship. The subgroup recommended that, for most purposes, fish should be tagged in proportion to their occurrence in the catch, but only so long as they are in good condition.

10. The subgroup recognised that there may be some confusion between the Flag State, which has responsibility for undertaking the tagging program in Conservation Measure 41-01/C and reporting the data, and the observer in whose database the tagging data will be held. It recommended that observers should deposit a copy of their data with the Flag State immediately after they leave the vessel, so that if the Secretariat does not receive the observer's data and report within the required deadline they may additionally contact the Flag State.

11. With so many Members now issuing tags to their observers and vessels, there is a risk that number sequences will be duplicated. The subgroup recommended that when ordering tags in future, Members specify the number sequences to include their three-letter code as a part of the tag number sequence.

12. Minor revisions to the tagging protocol were made by the subgroup. In addition it was agreed that:

- (i) C2 records of numbers of fish released should include tagged fish in addition to cut-off skates (WG-FSA report, section 6);
- (ii) measurements of fish that are to be tagged and released should not be considered to be part of the observer's random length-frequency sample (i.e. if a fish is to be released as a tagged fish, then this fish should be excluded from the random sample of the catch taken by the observer);
- (iii) measurements of tagged fish that are recaptured should be added to the commercial catch length frequency (where they would normally be a part of the random selection of the observed catch) and landed catch weights.

Skates

13. WG-FSA-05/70 presented results of the Australian skate tagging program in Division 58.5.2. This program is opportunistic, including releases from trawlers and longliners. In the trawl fishery, 1 057 tags have been deployed since 2001 and 2 026 in the longline fishery since 2003. There have only been 21 recaptures to date, 19 of trawl-tagged *Bathyraja eatonii*, one of trawl tagged *B. murrayi* and two of longline-tagged *B. irrasa*. The average distance between release and recapture was only 6.7 km. Growth in total length of recaptured tagged *B. eatonii* was 15 mm per year.

14. New Zealand has been tagging skates in Subarea 88.1 for [3] years. Animals are tagged in the water prior to cut-off. This method appears to be successful and a number of animals have been recovered. Dr Agnew informed the subgroup that the UK intended to undertake an intensive skate tagging program in Subarea 48.3, starting in 2006, to investigate skate movement, growth and population size.

15. The subgroup recognised that there may be a conflict between the requirement to cut off and release all skates at the water surface and the demands of successful tagging programs (paragraph N82). Alternative approaches may be needed to resolve this conflict, for instance:

- (i) tagging a number of skates on deck after assessing their condition, rather than in the water, so that there is a subset of released animals for which condition and likely survivorship is known accurately (paragraphs N87 to N90);
- (ii) double tagging as many skates as possible;
- (iii) ensuring accurate reporting of all skates cut-off the line (paragraphs N42 to N53), and close examination of these skates for tags;
- (iv) recovering all skates caught on some lines, rather than cutting them off at the water surface, to estimate the success of in-water observation of tagged fish (paragraph N82). This may require an exception from the requirement to cut off all skates from longlines.

Using tag data to estimate movement

16. WG-FSA-05/66 described a model able to infer movement of tagged fish by building an underlying model of movement, and then considering spatially variable sampling of marked fish moving according to this model. This may have some advantages over simple calculations of distance moved when there is uneven sampling at different locations.

17. The subgroup noted that a model of toothfish movement in Subarea 48.3, used to investigate potential bias in the Petersen mark–recapture estimate of toothfish population size, had been presented to WG-FSA-SAM (WG-FSA-SAM-05/6), and that it had encouraged the further development of models of toothfish movement (WG-FSA-05/4, paragraph 2.16).

MANAGEMENT ADVICE

18. Management advice is provided in section 3 of the main text of WG-FSA’s report.

REFERENCE

Purves, M.G., D.J. Agnew, G. Moreno, T. Daw, C. Yau and G. Pilling. 2003. Distribution, demography and discard mortality of crabs caught as by-catch in an experimental pot fishery for toothfish in the South Atlantic. *Fish. Bull.*, 101: 874–888.

Table 1: Tagging rates by Member and area in exploratory fisheries in the 2004/05 fishing season. NZL – New Zealand; JPN – Japan; KOR – Republic of Korea; CHL – Chile; ESP – Spain; AUS – Australia; ARG – Argentina; GBR – United Kingdom; NOR – Norway; RUS – Russia; URY – Uruguay.

Fishery	Area	Member	Catch (tonnes)	Tags (<i>n</i>)	Rate (<i>n</i> /tonne)
Closed	88.3	NZL	2	8	4.78
Exploratory	48.6	JPN	47	57	1.21
Exploratory	48.6	KOR	2	5	2.21
Exploratory	58.4.1	CHL	146	94	0.65
Exploratory	58.4.1	ESP	145	159	1.09
Exploratory	58.4.1	KOR	167	184	1.10
Exploratory	58.4.1	NZL	22	25	1.15
Exploratory	58.4.2	CHL	25	145	5.79
Exploratory	58.4.2	ESP	8	11	1.34
Exploratory	58.4.2	KOR	55	141	2.57
Exploratory	58.4.2	NZL	38	45	1.17
Exploratory	58.4.3a	AUS	1	4	2.75
Exploratory	58.4.3a	ESP	100	163	1.64
Exploratory	58.4.3a	KOR	9	32	3.72
Exploratory	58.4.3b	CHL	39	13	0.33
Exploratory	58.4.3b	ESP	243	217	0.89
Exploratory	58.4.3b	KOR	13	1	0.08
Exploratory	88.1	ARG	253	291	1.15
Exploratory	88.1	GBR	260	381	1.46
Exploratory	88.1	NOR	207	317	1.53
Exploratory	88.1	NZL	1500	1536	1.02
Exploratory	88.1	RUS	492	285	0.58
Exploratory	88.1	URY	367	411	1.12
Exploratory	88.2	NOR	4	0	0.00
Exploratory	88.2	NZL	268	269	1.01
Exploratory	88.2	RUS	141	72	0.51

Table 2: Tagging rates for all Members combined in exploratory fisheries in the 2004/05 fishing season.

Fishery	Area	Catch (tonnes)	Tags (<i>n</i>)	Rate (<i>n</i> /tonne)
Closed	88.3	2	8	4.78
Exploratory	48.6	49	62	1.26
Exploratory	58.4.1	480	462	0.96
Exploratory	58.4.2	127	342	2.70
Exploratory	58.4.3a	110	199	1.82
Exploratory	58.4.3b	295	231	0.78
Exploratory	88.1	3079	3221	1.05
Exploratory	88.2	412	341	0.83