FISH RESOURCES

FISHERY STATUS AND TRENDS

2.1 The only species targeted in commercial fisheries in the 1993/94 season were *D. eleginoides* and *Electrona carlsbergi* (SC-CAMLR-XIII/BG/1). A catch of 603 tonnes of *D. eleginoides* was taken by longlines in Subarea 48.3 in accordance with Conservation Measure 69/XII[1]. 942 tonnes were reported by longliners and 4 141 tonnes by trawlers in Division 58.5.1. 12 tonnes of skates and rays were reported in Subarea 48.3 as by-catch in the *D. eleginoides* fishery. A catch of 114 tonnes of myctophids in Subarea 48.3 in October 1994 was reported to CCAMLR just prior to the meeting. There were no reports of commercial catches of *Champsocephalus gunnari* in Subarea 48.3, *D. eleginoides* in 48.4 or *Notothenia squamifrons* in Division 58.4.4, even though TACs had been set for these fisheries.

REPORT OF THE WORKING GROUP ON FISH STOCK ASSESSMENT

2.2 WG-FSA met from 11 to 19 October 1994 at CCAMLR Headquarters in Hobart. The Convener of the Working Group, Dr Everson, presented the report of the meeting.

2.3 The Report of the Working Group is attached in Annex 4.

Data Requirements Endorsed by the Commission in 1993

2.4 Various data were specifically requested by the Working Group in 1993 (SC-CAMLR-XII, Annex 5, Appendix D). Data submitted to the Secretariat in response to this request are listed in Annex 4, Appendix D.

2.5 Haul-by-haul and length frequency data from the fishery for *D. eleginoides* in Subarea 48.3 were reported in accordance with Conservation Measure 69/XII. France reported fine-scale and length frequency data from the fishery for *D. eleginoides* in Division 58.5.1 and Subarea 58.6. Other biological data were reported from the various research cruises in the 1993/94 season. However, most data requested by the Working Group are still outstanding.

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1 An additional 43 tonnes were reported as having been taken by Russian longliners from October to January.

Fish Biology/Demography/Ecology and Other Information

2.6 WG-FSA welcomed the data made available by observers of the *D. eleginoides* fishery in Subarea 48.3. These data were considered under a number of agenda items of the Working Group meeting (Annex 4, paragraphs 3.7 to 3.12). Dr K. Shust (Russia) explained that a report from a Russian observer on a Bulgarian longliner, who only recently returned to Russia, will be submitted to CCAMLR as soon as it is available.

2.7 WG-FSA discussed papers dealing with various aspects of fish biology/demography/ecology relevant to stock assessments. Topics included age and growth, reproduction and early life history, trophic relationships and stock separation (Annex 4, paragraphs 3.26 to 3.35).

2.8 Dr E. Fanta (Brazil) reported that the SCAR *Ad Hoc* Working Group on Evolutionary Genetics of Antarctic Marine Organisms is proposing to meet in Brazil in March/April 1995. This group seeks, *inter alia*, to promote the coordinated investigation of stock separation. This is of considerable interest to CCAMLR with respect to identifying the origin of seabirds caught in longline fisheries, as well as stock identity in a number of exploited fish species.

2.9 A revised bathymetric map of the Elephant Island area and estimates of seabed areas around the islands have been added to the CCAMLR database on seabed areas. In addition, the Secretariat has developed software to calculate seabed areas in the Convention Area (Annex 4, paragraphs 3.37 and 3.38).

New Fisheries

2.10 CCAMLR has had no notifications that Members intend to initiate a new fishery under Conservation Measure 31/X.

Assessments and Management Advice

2.11 Assessment summaries for the various fish stocks assessed by WG-FSA are presented in Appendix F of Annex 4.

Statistical Area 48 (South Atlantic)

Dissostichus eleginoides (Subarea 48.3)
(Annex 4, paragraphs 4.5 to 4.44)

2.12 Assessments of *D. eleginoides* in Subarea 48.3 were based on the re-analysis of the 1992/93 estimates of local densities, results of the 1994 depletion experiments in the fishery, examinations of annual CPUE data and length frequency distributions from commercial catches and estimated recruitment from survey data (Annex 4, paragraphs 4.8 to 4.25). The results provided no evidence of trends in the abundance or status of the stock and, as a consequence, no estimate of yield was made.

2.13 The Scientific Committee noted that the assessments conducted in 1993 using the De Lury method were superseded by the 1994 analysis - the analyses done in 1993 involved a number of errors and inappropriate choice of subsets of available data. Re-analysis of the full data set showed, contrary to the conclusions reached in 1993, that there was no evidence of stock depletion. The Working Group had concluded that the assumption of the model, that the level of immigration was very small, was invalid. As a result, no conclusion regarding stock size could be drawn from the 1992/93 CPUE data.

2.14 The results of a De Lury analysis of the CPUE data from the depletion experiments in 1994 were not conclusive. Hence, estimates of biomass were considered unreliable.

2.15 There were no demonstrable declines in CPUE over the last four years that could be attributed to fishing. Three alternative explanations for this were considered:

(i) the stock may not have become depleted (Annex 4, paragraph 4.31) and, as a consequence, the catches may be sustainable at current levels;

(ii) the relationship between stock size and CPUE may be weak. For example, the overall stock may be declining under fishing but movement of the fish into the fishing area may keep the CPUE relatively constant (Annex 4, paragraph 4.27); and

(iii) a relationship between stock abundance and CPUE may exist but is masked by natural variation in the annual CPUE; the variability in performance of longline fishing may be such as to prevent an estimate of the decline in abundance before depletion has occurred (Annex 4, paragraph 4.31).

2.16 The Scientific Committee agreed that work needs to be carried out to determine whether constant CPUE in this fishery is a reliable indicator that the catch level is sustainable.

2.17 The Scientific Committee agreed that there is an urgent need to develop methods of assessing the biomass of *D. eleginoides* and endorsed the holding of a three-day workshop in association with the next meeting of WG-FSA. The Scientific Committee recommended that the workshop should go ahead, pending the submission of data and appropriate papers by 1 August 1995. The decision to hold the workshop will be taken by the Convener of WG-FSA, the Chairman of the Scientific Committee and the Data Manager. The Scientific Committee approved the following terms of reference for the workshop:

(i) to review catch information, including trends in catches of individual vessels and including the location and extent of catches both inside and outside the Convention Area;

(ii) to review and evaluate available information on stock identity over the entire range of the species and in particular the relationships between stocks in Subarea 48.3 and neighbouring areas;

(iii) to review and evaluate methods of conducting surveys of stocks targeted using longlines;

(iv) to review and evaluate methods of assessing the status of stocks and for determining appropriate yields, including the utility of CPUE data from the longline fishery in these assessments;

(v) to determine the data required from the longline fishery; and

(vi) to provide advice to the Working Group on stock identity and on stock survey and assessment procedures.

2.18 The Scientific Committee recommended that funds be made available to pay for two invited experts to participate in the workshop. The Scientific Committee noted that experience from other *D. eleginoides* fisheries outside the Convention Area would benefit the workshop.

2.19 The Scientific Committee was aware of reports of potentially large catches being taken from Subarea 48.3 and which were not recorded in official statistics. Also, catches outside but adjacent to the Convention Area may be from the same stock. The Scientific Committee agreed that the best information available on total catch should be used in stock assessments, provided the data

are well documented and the sources reliable, as is common practice in many fisheries management authorities.

Management Advice

2.20 The Scientific Committee agreed that, should fishing be conducted for *D. eleginoides* in the coming season, fishing effort should be distributed in such a way as to ensure that catch and effort data are able to contribute to assessments of the stock.

2.21 Some Members suggested that it would be beneficial to distribute effort throughout the subarea and over a period longer than a single reporting period, but consistent with periods fished in previous seasons.

2.22 The Scientific Committee noted the success of the scientific observer program in the 1994 fishery in providing important fisheries data for consideration by WG-FSA. Consequently, it recommended that all vessels participating in the fishery should have scientific observers on board.

2.23 The Scientific Committee recommends that, in addition to the required information already listed in the *Inspectors Manual* and according to Conservation Measure 71/XII, the following information should be requested from commercial fishing operations:

(i) conversion factors from processed to whole weight;
(ii) bottom depths at both start and end of a longline set;
(iii) direction of haul;
(iv) percentage of hooks baited;
(v) amounts of discarded fish;
(vi) design of longline gear (e.g., Spanish, traditional);
(vii) an unequivocal measure of the depth at which hooks were set off the bottom; and
(viii) information allowing unique identification of individual vessels across years within the CCAMLR Database.

2.24 In addition, the Scientific Committee recommended that the Secretariat acquire from FAO, Member countries and Acceding States data on catches of *D. eleginoides* in areas adjacent to the Convention Area. The Scientific Committee also recommended that historical haul-by-haul data for this fishery be compiled together with information allowing unique identification of individual vessels across years (Annex 4, paragraphs 4.32 and 4.43).

2.25 With regard to catch levels for 1994/95, the Scientific Committee endorsed the Working Group's comments that 'In none of the data examined were there indications that the current and recent levels of catches had had any detectable effect on the fishery. However, given the concerns expressed previously about interpretation of longline CPUE and the probable high vulnerability of toothfish to overfishing, the Working Group agreed that a precautionary approach should be taken to the setting of any TACs until a reliable stock assessment has been completed.' (Annex 4, paragraph 4.40).

2.26 In the absence of a reliable stock assessment for the 1993/94 season, the Scientific Committee reviewed previous assessments and advice for this stock, and catches, TACs and conservation measures from previous years (Tables 1 and 2; paragraphs 9.65 to 9.68).

2.27 It was recognised that the estimates contained in Table 1 do not exclude the setting of a zero TAC as one of the options for the management of this fishery.

2.28 The advice arising from the assessments of last year, which indicated a significant depletion of the stock, was not considered because it was found to be invalid. The previous assessments have not been invalidated, but the Scientific Committee noted the need to treat them with caution because they each carry a suite of assumptions that may not have been addressed adequately (see footnotes to Table 1).

2.29 There was no agreement on how these assessments could be used to recommend a TAC because each new method had been applied in an effort to overcome the problems with previous methods.

Table 1: Assessments of yield (in tonnes) for the longline fishery for *D. eleginoides* in Subarea 48.3 provided by the Scientific Committee in previous years on the basis of a number of stock assessment methods and yield-per-recruit calculated at $F_{0.1}$.

Assessment Method	SC-VIII (1989)	SC-IX (1990)	SC-X (1991)[1]	SC-XI (1992)[2]	SC-XII (1993)
Area fished per hook				1790-5370[3]	
Area fished per longline				750-1910[4]	
Length-based cohort analysis			8819[5]	assessment not completed[6]	
Trawl survey of young fish	240-1200[14]	1200-8000[7]	794-11700[8]	assessment not completed [9]	
De Lury method - annual CPUE			481-8438[10]	1130-1430[11]	
De Lury method - local CPUE				920-1170[12]	900-1700 (invalid)[13]

1 no agreement on estimates to be used (SC-CAMLR-X, paragraphs 4.64 to 4.66)

2 considerable uncertainty about stock size and its sustainable yield, stock biomass in excess of 45 000 tonnes considered unlikely (SC-CAMLR-XI, paragraph 3.79)

3 estimates sensitive to the range of influence of each hook and the relationship between CPUE and stock biomass (SC-CAMLR-XI, Annex 5, paragraphs 6.165 to 6.170)

4 estimates sensitive to effective width of area fished by a longline, extrapolation from local density to whole region, relationship between CPUE and stock abundance; further caveats in the estimates of biomass using this method described in SC-CAMLR-XI, Annex 5, paragraphs 6.160 to 6.165

5 not tuned to independent data; run under the assumption that the fishing mortality in the most recent year was equal to longterm average fishing mortality (SC-CAMLR-X, Annex 6, paragraph 7.99)

6 sensitive to M and K; see SC-CAMLR-XI, Annex 6, paragraph 6.141

7 no direct estimate of biomass available (SC-CAMLR-IX, Annex 5, paragraph 160); biomass estimated from young cohorts with unquantifiable uncertainty attached to the results (SC-CAMLR-IX, Annex 5, paragraph 167); TAC recommended to be in lower part of the range (USSR expressed view that TAC should be in middle of range) (SC-CAMLR-IX, paragraphs 3.59 and 3.60)

8 TACs derived from MSY rather than $F_{0.1}$; CV of estimate used was great because of single large catch in 1991 (SC-CAMLR-X, Annex 6, paragraph 7.96); highest recent catch was close to lower estimates of biomass (SC-CAMLR-X, Annex 6, paragraph 7.97)

9 problems using survey results; see SC-CAMLR-XI, Annex 6, paragraphs 6.167 and 6.168

10 this estimate will be affected by the relationship between the start of the CPUE series and the pre-exploitation biomass which is unknown (SC-CAMLR-X, Annex 6, paragraphs 7.120 and 7.121)

11 based on a single estimate of biomass, range is an exploration into effect on yield of different values of M (SC-CAMLR-XI, Annex 6, paragraphs 6.171 and 6.172); assumes no immigration or emigration and direct relationship between CPUE and stock biomass (SC-CAMLR-XI, Annex 6, paragraph 6.146); CPUE could not be calibrated for hook type (SC-CAMLR-XI, Annex 6, paragraph 6.148)

12 requires re-examination; based on a single estimate of biomass, range is an exploration into effect on yield of different values of M (SC-CAMLR-XI, Annex 6, paragraphs 6.171 and 6.172); estimates sensitive to effective width of area fished by a longline, extrapolation from local density to whole region, relationship between CPUE and stock abundance (SC-CAMLR-XI, Annex 5, paragraphs 6.164 and 6.165)

13 method invalidated by WG-FSA, 1994

14 yield derived from Gulland formula $Y = 0.5\ M.B_0$. Range of B_0 was FRG biomass survey (lower bound) and five times the FRG biomass survey (upper bound) (SC-CAMLR-VIII, Annex 6, paragraphs 115 to 120).

Table 2: Catches and TACs applying to the longline fishery for *D. eleginoides* in Subarea 48.3.

Year	Catch (tonnes)	TAC (tonnes)	Conservation Measure
1990	8 311	-	
1991	3 641	2 500	24/IX
1992	3 703	3 500	35/X
1993	3 049	3 350	55/XI
1994	652	1 300	69/XII

Champsocephalus gunnari (Subarea 48.3)
(Annex 4, paragraphs 4.45 to 4.83)

2.30 No catches were reported for icefish, *C. gunnari*.

2.31 Two research surveys aimed at estimating the abundance of *C. gunnari* in Subarea 48.3 were conducted during the 1993/94 season, one by the UK and one by Argentina. The Working Group evaluated the methods used during these surveys and found that the results of the surveys were not comparable because different survey designs, sampling equipment and estimation methodology had been used (Annex 4, paragraphs 3.18 to 3.20). The Working Group decided to use the results of the UK survey for their assessment of this stock as it used the same methods as those employed in surveys of previous years. The survey series therefore provides an indication of trends in stock abundance.

2.32 The results of the UK survey indicated a very much lower standing stock of *C. gunnari* than had been expected using stock projections from the 1992/93 survey results. A number of explanations for the decline was considered in detail by the Working Group and these are summarised below:

(i) uncertainty in the 1992/93 and the 1993/94 survey estimates - while this may contribute in part to the difference in the estimates, the Working Group agreed that other factors are likely to be important;

(ii) unreported fishing mortality - there was no evidence to support this possibility;

(iii) variability in recruitment - this would not fully explain the lower-than-expected abundance of age classes older than two years; and

(iv) dramatic change in natural mortality - the Working Group agreed that interannual variation in M was likely and that M may increase with age.

2.33 The Working Group concluded that, as in 1991, there had been a genuine decline in standing stock of *C. gunnari* in Subarea 48.3. Both declines had occurred around times when krill, the staple food of *C. gunnari*, was scarce. Krill are also the dominant component in the diet of Antarctic fur seals and, since fur seals also eat fish, predominantly *C. gunnari*, they could have affected the *C. gunnari* stock. When krill are scarce, fur seals may change diet and feed predominantly on fish (Annex 4, paragraphs 4.73 to 4.77). The Working Group noted that the prey requirements of fur seals, particularly during periods of low krill availability, may need to be considered in future management advice for the *C. gunnari* fishery in Subarea 48.3.

2.34 The Scientific Committee accepted WG-FSA's assessment. Furthermore, the Scientific Committee endorsed the development of a longterm management plan for this fishery which would account for uncertainty in biomass estimates, variability in recruitment and variability in natural mortality with age and between years (Annex 4, paragraphs 4.78 and 4.79).

2.35 The Scientific Committee agreed that biomass surveys just prior to the meeting of WG-FSA would be beneficial for developing management advice based on information from the stock in the season to which that advice would apply.

2.36 The Scientific Committee endorsed the conclusions of the Working Group that, given the uncertainties outlined above, the calculation of yield on the basis of $F_{0.1}$ as done in the past is no longer appropriate for this stock and that the escapement of the spawning stock should be high for the 1994/95 season (Annex 4, paragraphs 4.81 and 4.82).

Management Advice

2.37 The Scientific Committee recommends that the fishery for *C. gunnari* be closed for the 1994/95 fishing season.

2.38 The Scientific Committee endorsed the recommendation of the Working Group that a survey be carried out during the coming season to monitor the status of the stock and to provide more information for the development of the longterm management approach.

Electrona carlsbergi (Subarea 48.3)
(Annex 4, paragraphs 4.84 to 4.93)

2.39 No new survey or fishery information for *E. carlsbergi* in Subarea 48.3 has been submitted to CCAMLR since the last meeting.

2.40 The Working Group undertook a new assessment of yield by applying a generalised version of the yield model being developed by WG-Krill. The Scientific Committee endorsed the application of this approach to *E. carlsbergi* because this species shares a number of population and trophic characteristics with krill (see Annex 4, paragraphs 4.86 to 4.90). In particular, this approach helps overcome the problem of formulating advice on the basis of biomass estimates derived from a survey older than the life expectancy of the fish. This is achieved by incorporating estimates of the pre-exploitation variability in biomass in the estimates of yield.

2.41 This approach uses stock projections to estimate yields for *E. carlsbergi* given the uncertainties in the characteristics of the stock and meets the objectives in Article II. This approach was endorsed previously by the Scientific Committee (SC-CAMLR-IX, paragraph 8.11). WG-Krill and WG-FSA have adopted three decision rules for determining yield (where $Y = \gamma.B_0$) (see paragraphs 5.18 to 5.26 for a detailed presentation of these rules).

2.42 The Scientific Committee endorsed the use of these decision rules for estimating γ for the *E. carlsbergi* fishery.

2.43 The Working Group agreed that, using the available biological information and pending refined estimates of the stock parameters and biomass, the estimate of γ of 0.091 for *E. carlsbergi* is the best available.

Management Advice

2.44 The most recent estimate of *E. carlsbergi* biomass was from a survey in 1987/88. This was used as the basis for calculating a TAC of 200 000 tonnes (Conservation Measure 67/XII) in 1993/94. Using these estimates of biomass and the new estimate of γ from the generalised krill yield model, the corresponding precautionary catch levels would be 109 000 tonnes for Subarea 48.3 and 14 500 tonnes for the region around Shag Rocks.

2.45 The Scientific Committee endorsed the advice of the Working Group on the need for a new biomass survey and for precautionary catch limits on the fishery (Annex 4, paragraphs 4.91 to

4.93). Consequently, it recommended that Conservation Measure 67/XII be retained indefinitely, but that some consideration should be given to a revision of the TACs in paragraphs 2 and 3 of the measure.

2.46 Dr Shust had some reservations about the analysis. He indicated that the role of *E. carlsbergi* as prey in Subarea 48.3 was uncertain. Thus, the level of escapement required in Decision Rule 2 (see paragraph 5.18) may be too high. Also, the parameters used in the yield model for this species are uncertain and need to be refined. On this basis Dr Shust stated that Conservation Measure 67/XII could be retained in its current form.

2.47 The view adopted by the Working Group and accepted by many Members of the Scientific Committee was that the uncertainties in the parameter and biomass estimates had been accounted for in the calculation of γ, and that this was in line with the general request that uncertainties be accounted for in stock assessments (CCAMLR-XII, paragraph 4.26; SC-CAMLR-XII, paragraph 3.96). In this case, the revised estimates of yield were appropriate, pending revision of the parameters (Annex 4, paragraph 4.91). It was noted that, for *E. carlsbergi*, Decision Rule 1 was the important rule for determining γ. Consequently, a revision of Decision Rule 2 would be unlikely to have any effect even though there is sufficient evidence to indicate the importance of myctophids to some predators.

2.48 In this case, Conservation Measure 67/XII would need to be revised to include the revised estimates of yield as precautionary TACs for Subarea 48.3 and Shag Rocks respectively.

Notothenia gibberifrons, Chaenocephalus aceratus, Pseudochaenichthys georgianus, Notothenia rossii, Patagonotothen guntheri and *Notothenia squamifrons* (Subarea 48.3) (Annex 4, paragraphs 4.94 to 4.103)

2.49 The Scientific Committee endorsed the advice of WG-FSA and recommended that all conservation measures for these species should remain in force.

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

Champsocephalus gunnari, *Notothenia gibberifrons*, *Chaenocephalus aceratus*, *Pseudochaenichthys georgianus*, *Chionodraco rastrospinosus* and *Notothenia kempi* (Subareas 48.1 and 48.2) (Annex 4, paragraph 4.116)

2.50 The Working Group reiterated the advice offered in 1993 that the fisheries in Subareas 48.1 and 48.2 should remain closed until a survey is conducted to provide more accurate estimates of the status of the stocks in these subareas.

Management Advice

2.51 The Scientific Committee endorsed the recommendations of the Working Group and recommended that the conservation measures in force for the above species should be maintained.

South Sandwich Islands (Subarea 48.4)
(Annex 4, paragraph 4.117)

2.52 No catches were reported from this area.

Management Advice

2.53 In the absence of further information, the Scientific Committee recommended that Conservation Measures 70/XII and 71/XII should remain in force.

Statistical Area 58 (Indian Ocean Sector)

2.54 Catches from the 1994 season are shown in Table 9, Annex 4. Catches of *D. eleginoides* in Division 58.5.1 were taken in the directed French and Ukrainian trawl and longline fisheries. Catches in Subarea 58.6 were taken in a French exploratory trawl fishery around the Crozet Islands.

Dissostichus eleginoides (Division 58.5.1)
Kerguelen Islands (Annex 4, paragraphs 4.131 to 4.135)

2.55 The fishery for this species continued in the 1993/94 season in the two traditional areas, a longline fishery on the western slope (942 tonnes) and a trawl fishery on the northern shelf (4 141 tonnes).

2.56 No other new data were provided.

2.57 French authorities have set a limit of 1 000 tonnes for the western area longline fishery in 1994/95.

2.58 A precautionary catch limit of 3 000 tonnes in the northern area for the trawl fishery has been set by French authorities for the 1994/95 season.

Management Advice

2.59 In the absence of any new data, the Scientific Committee endorsed the French conservation measures. These are consistent with the Working Group's previous advice that a longterm sustainable yield for the western area of the Kerguelen shelf is estimated at 1 400 tonnes, and that a precautionary approach should be taken with the northern area to prevent the spawning stock size falling to low levels before the stock has been adequately assessed.

2.60 The Scientific Committee endorsed the view of the Working Group that for proper assessment of these stocks, trawl surveys of the entire stocks would provide indices of abundance to model the stock dynamics and sustainable yield.

Notothenia rossii (Division 58.5.1)
Kerguelen Islands (Annex 4, paragraphs 4.120 to 4.123)

2.61 More information has been submitted on the increase in juvenile *N. rossii* abundance. However, the Working Group noted that these data were for a part of the stock not on the fishing grounds and, therefore, not representative of the overall stock. The current biomass is very much less than the biomass before the fishery commenced.

Management Advice

2.62 The Scientific Committee endorsed the recommendation of WG-FSA that the commercial fishery for *N. rossii* remain closed until a biomass survey demonstrates that the stock has recovered to a level that will support a fishery.

Notothenia squamifrons (Division 58.5.1)
Kerguelen Islands (Annex 4, paragraphs 4.124 and 4.125)

2.63 No new data are available for this fishery.

Management Advice

2.64 The Scientific Committee endorsed the recommendation of WG-FSA that the fishery for *N. squamifrons* on the Kerguelen Shelf remain closed.

Champsocephalus gunnari (Division 58.5.1)
Kerguelen Plateau (Annex 4, paragraphs 4.126 to 4.130)

2.65 The results of a recruitment study support the previously stated idea that the population is dominated by a single cohort that survives for three years. Other cohorts are present but in lower abundance. This is likely to be a result of variable recruitment.

2.66 At its last meeting, the Scientific Committee endorsed the recommendation of WG-FSA that fishing on the strong cohort being recruited should be delayed until the 1994/95 season, by which time it would have had the opportunity to spawn. Also, only restricted fishing in the 1994/95 season should be allowed, to enable sufficient escapement of fish to spawn a second time and because a declining trend in the strength of previous strong cohorts had been detected. The objective of the first part of last year's recommendation, i.e. no fishing in the 1993/94 season, was met. However, the Working Group could not recommend a catch limit for the 1994/95 season because no data on the biomass of this cohort were available.

2.67 The Scientific Committee endorsed the view of the Working Group that a proportion of the cohort should be allowed to survive another year to spawn a second time, in the hope that this will contribute to establishing a population with more than one strong cohort and a reduced variability in biomass.

Management Advice

2.68 The Scientific Committee recommended that the fishery in the 1994/95 season be kept to a low level to allow the present strong cohort to spawn a second time.

Heard Island (Division 58.5.2)
(Annex 4, paragraphs 4.147 to 4.159)

2.69 The results of three trawl surveys in the area since 1990 were reviewed by the Working Group.

2.70 The Scientific Committee endorsed the decision of the Working Group to determine precautionary catch levels using an approach similar to that adopted for *E. carlsbergi* in Subarea 48.3 (Annex 4, paragraphs 4.150 to 4.158). The Scientific Committee noted that these assessments will be refined following revision of the biological parameters for these stocks in the Heard Island area.

Management Advice

2.71 The Scientific Committee recommends that a precautionary TAC be set for *C. gunnari* at 311 tonnes and a precautionary TAC for a trawl fishery on *D. eleginoides* at 297 tonnes.

Coastal Areas of the Antarctic Continent
(Divisions 58.4.1 and 58.4.2)

2.72 No new information was available to WG-FSA to allow assessment of the stocks in these areas (Annex 4, paragraph 4.160).

Ob and Lena Banks (Division 58.4.4)
(Annex 4, paragraphs 4.136 to 4.146)

2.73 The Scientific Committee welcomed the latest submission by Ukraine of data on catches from these banks (SC-CAMLR-XIII/BG/13). New stock assessments will be undertaken using these data at the next meeting of WG-FSA. No new data were available for these banks at the recent meeting of WG-FSA.

2.74 Dr V. Yakovlev (Ukraine) informed the Scientific Committee that Ukraine wished to undertake the research proposed in recent years to survey fish stocks on the Ob and Lena Banks in November this year (WG-FSA-94/32). He welcomed the participation of observers from Members.

2.75 The Scientific Committee noted the details of the trawl survey proposal (see Annex 4, paragraphs 6.9 to 6.15 for details). The survey will be conducted using a commercially-sized bottom trawl with a mesh size (diamond mesh) of 40 mm in the codend. The duration of hauls will be 60 minutes. The Scientific Committee expressed particular concern at the use of a net monitor cable. The Scientific Committee noted that the vessel would be undertaking commercial fishing in addition to the research survey, and considered that this commercial fishing should not be exempt from conservation measures.

Management Advice

2.76 The Scientific Committee endorsed the advice of the Working Group that a biomass survey is likely to improve considerably assessments of the fish stocks on the two banks.

2.77 The Scientific Committee endorsed the Working Group's recommendations that:

(i) the research trawl survey by Ukraine be conducted according to the information contained in Annex 4, paragraphs 6.9 to 6.15;

(ii) a TAC of 1 150 tonnes for *N. squamifrons* (715 tonnes for Lena Bank and 435 tonnes for Ob Bank) as previously set in Conservation Measure 59/XI be reinstituted for the seasons 1994/95 and 1995/96 combined;

(iii) data reporting should follow the CCAMLR Database format and data recording should be in accordance with the requirements set out in Conservation Measure 64/XII. This information should include all species caught;

(iv) in the event that the proposed survey is postponed by one year, the TAC recommended may need to be revised in the light of new assessments by the Working Group based on the revised catch figures provided in SC-CAMLR-XIII/BG/13;

(v) the occurrence of seabirds close to the ship should be monitored and any incidental mortality, in particular that caused by the net monitor cable, must be reported;

(vi) an international scientific observer should be present during these activities; and

(vii) exemptions to conservation measures for research purposes should only apply at the designated research stations.

Management Under Conditions of Uncertainty
Concerning Stock Size and Sustainable Yield

2.78 Discussions of this topic in WG-FSA are reported in Annex 4, paragraphs 4.161 to 4.164.

2.79 The Scientific Committee endorsed the approach of the Working Group to develop management options under conditions of uncertainty on a species-by-species basis. In particular, the Scientific Committee noted the moves by WG-FSA to consider options for a longterm management plan for *C. gunnari* in Subarea 48.3 (see paragraph 2.34). Also, the Scientific Committee noted that WG-FSA had applied the approach adopted by WG-Krill for krill to *E. carlsbergi* in Subarea 48.3 (paragraphs 2.41 and 2.42) and *C. gunnari* and *D. eleginoides* in Division 58.5.2 (paragraph 2.70). The techniques and models being used by the Working Group operate in such a way that calculated yields and catch limits usually decrease as uncertainty in any of the parameters increases.

Considerations of Ecosystem Management

2.80 The Working Group addressed a number of issues concerning ecosystem management: monitoring of coastal fish populations (Annex 4, paragraphs 5.1 to 5.3); incidental mortality of birds in longline fisheries (this topic was referred to WG-IMALF for discussion - Annex 4, paragraph 5.4); interactions among fur seals, *C. gunnari* and krill (Annex 4, paragraph 5.5); the by-catch of young and larval fish in the krill fishery (Annex 4, paragraphs 5.6 to 5.10); and interactions between the longline fishery and marine mammals (Annex 4, paragraphs 3.12 and 5.11).

2.81 The Scientific Committee welcomed two recent studies on the by-catch of young fish in krill catches. While these studies were not directly comparable, they both provided an opportunity to assess rates of by-catch in Subareas 48.1 and 48.3. The Scientific Committee noted the Working Group's conclusion that the largest by-catches in these studies occurred when the krill catch was comparatively low. The Working Group concluded that, given the variability in estimates of by-

catch, the rate of by-catch was likely to be of the same order of magnitude in Subareas 48.1, 48.2 and 48.3. This contrasts with information presented by WG-Krill (Annex 5, paragraph 3.12) that the by-catch around the South Shetland Islands was an order of magnitude less than the by-catch reported by the Ukrainian fishery in South Georgia. The Scientific Committee noted there is a need to account for spatial and temporal variability in the results when considering the scale of this problem.

2.82 The Scientific Committee endorsed the recommendation of WG-FSA that these studies be continued in the future following closely the instructions set out in the *Scientific Observers Manual*, and that they provide information on spatial, seasonal and diurnal differences in the by-catch of fish (Annex 4, paragraph 5.10).

Research Surveys (Annex 4, paragraphs 6.3 to 6.15)

Trawl Survey Simulation Studies

2.83 No new submissions were received by the Working Group. The Scientific Committee endorsed the comments made by WG-FSA on the need for more work on trawl survey simulation models and for the validation of models already submitted to WG-FSA to continue (Annex 4, paragraphs 6.1, 6.2 and 7.3).

Recent and Proposed Surveys

2.84 The UK has notified CCAMLR of its intention to undertake a fish survey in Subarea 48.3 in January/February 1995 using a design similar to those employed in previous years.

2.85 Argentina hopes to undertake, at some time between January and March 1995, a demersal fish survey in Subarea 48.3. If favourable ice conditions prevail, the cruise will also investigate krill in Subarea 48.2.

2.86 A Ukrainian demersal trawl survey of fish stocks on the Ob and Lena Banks is proposed to begin in November 1994. This is discussed above (paragraphs 2.76 and 2.77).

2.87 In response to the Commission's request (CCAMLR-XII, paragraph 6.10) to review the applicability of the 50 tonne catch limit for research prescribed by Conservation Measure 64/XII, the

Scientific Committee endorsed the advice of the Working Group that this limit appears applicable for crabs given the relatively tight provisions under Conservation Measures 74/XII and 75/XII.

DATA REQUIREMENTS

2.88 The Scientific Committee endorsed the list of data requirements specified by WG-FSA and set out in Annex 4, Appendix D.

2.89 In addition to these requirements, the Scientific Committee endorsed the requests of the Working Group that:

(i) data collected by observers be submitted to the Secretariat in approved reporting formats whenever possible; and

(ii) the format for reporting longline data to CCAMLR (Format C2) be updated to include the items identified in paragraph 2.23.

2.90 The Scientific Committee noted that the new submission date for STATLANT data, 31 August, had enabled the Secretariat to acquire all STATLANT data prior to the Working Group meeting, with the result that all catches could be reported to the group.

Software and Analyses Required for the 1995 Meeting
(Annex 4, paragraphs 7.3 and 7.4)

2.91 The Scientific Committee endorsed the recommendations made by WG-FSA.

WORKING GROUP ORGANISATION

2.92 The Scientific Committee noted the discussion of WG-FSA on its function and terms of reference (Annex 4, paragraphs 7.5 to 7.8) and endorsed the view of WG-FSA that its terms of reference did not need to be changed at this time.