HARVESTED SPECIES

Krill

Distribution and Standing Stock

5.1 The Scientific Committee noted WG-EMM's deliberations on features of the distributional behaviour of krill that affect the interpretation of the results of surveys (Annex 4, paragraphs 3.1 to 3.18). Vertical migration, onshore–offshore patterns of abundance, and seasonal and interannual trends in distribution and abundance were seen to be important factors to be taken into account when conducting surveys.

5.2 The Scientific Committee endorsed WG-EMM's repeated request for the development of indices of local krill availability (Annex 4, paragraph 3.20) and it reiterated the importance that it placed on the development of such indices.

5.3 Dr E. Gubanov (Ukraine) advised the Scientific Committee of a research cruise by Ukraine in March/April 1997. A mesoscale study of the pelagic ecosystem in Subarea 48.2 was undertaken in the area 59–60°S and 42–48°W and a fine-scale study was undertaken in Subarea 48.1 at 60°S and 45–47°W. Acoustic and net sampling was undertaken to observe krill, larval fish and other zooplankton. Data have been submitted to CCAMLR. A further survey will be undertaken in the same areas in from January to March 1998 (SC-CAMLR-XVI/BG/9 Rev. 1).

Krill Recruitment

5.4 The Scientific Committee noted that WG-EMM had made considerable progress in assessing krill recruitment from net sampling surveys, particularly in the South Atlantic (Annex 4, paragraph 3.21 to 3.29). It also agreed that the estimation of the proportional recruitment index R_1 from such surveys be drafted as a standard method.

5.5 The Scientific Committee agreed that in addition to the development of a standard method for the assessment of proportional recruitment, another priority task was the development of a reliable predictor of krill recruitment with known statistical properties that could be used in assessments (Annex 4, paragraph 3.27).

5.6 Further, the Scientific Committee agreed that there was a need to determine whether existing recruitment indices for restricted areas reflect more global trends, and the extent to which large-scale environmental processes and smaller-scale population processes affect these indices (Annex 4, paragraph 3.28).

5.7 The Scientific Committee reiterated its request for further analyses to determine how well the measures of krill abundance and proportional recruitment are matched by the output of the krill yield model (Annex 4, paragraph 3.29; SC-CAMLR-XV, paragraph 4.18).

5.8 WG-EMM's considerable discussions on the krill–salp–sea-ice interactions (Annex 4, paragraphs 8.1 to 8.37) were noted with interest by the Scientific Committee and further analyses of these interactions, possibly through the use of multi-variate statistics, were encouraged.

CPUE

5.9 WG-EMM's continued discussions on the interpretation of CPUE data and their incorporation into management advice (Annex 4, paragraphs 3.30 to 3.40). The Scientific Committee encouraged further attempts to combine CPUE with other operational information from fishing vessels to provide an index of relative abundance for assessment purposes.

Methods

5.10 WG-EMM's deliberations on problems and biases in the net sampling of krill and on the developments in the acoustic determination of krill biomass (Annex 4, paragraphs 8.2 to 8.27) were noted. Recalling the quantity of information on these subjects in earlier working group reports, the Scientific Committee recommended that the Secretariat extract the collected advice on these methodologies from the reports of WG-Krill and WG-EMM and present them as a paper to the 1998 meeting of WG-EMM (Annex 4, paragraph 8.30).

5.11 Developments in the analysis of multifrequency acoustics that allow better target identification and progress in the fields of acoustic calibration and acoustic target strength were also noted with interest (Annex 4, paragraphs 8.6 to 8.27). The Scientific Committee welcomed these developments and encouraged further research in these areas.

5.12 The design of acoustic surveys was discussed in detail by WG-EMM (Annex 4, paragraphs 8.32 to 8.37). The Scientific Committee agreed that randomly-spaced parallel survey lines offer a conservative survey design and that this should be borne in mind when planning the synoptic survey for Area 48 (Annex 4, paragraph 8.129). However, this advice in no way reduces the urgency attached to the simulation study designed to determine the appropriate survey design for the planned synoptic survey (Annex 4, paragraphs 8.124 to 129).

Synoptic Survey in Area 48

5.13 Plans for the synoptic survey in Area 48 were well advanced. The Scientific Committee endorsed WG-EMM's recommendations (Annex 4, paragraph 8.121 to 8.129) that:

(i) the survey should proceed in the austral summer of 1999/2000;

(ii) the survey would concentrate its effort in Subareas 48.1, 48.2 and 48.3;

(iii) task groups and a survey steering committee should be set up to deal with specific aspects of the survey; and

(iv) the Secretariat should compile a list of previous agreements on acoustic survey design standardisation.

5.14 The Scientific Committee agreed that the proposed workshop on Area 48 (Annex 4, paragraphs 8.110 to 8.120) was critical for the design and implementation of the Area 48 B_0 survey (see also paragraphs 6.50 to 6.53).

5.15 The Scientific Committee endorsed WG-EMM's request that standard methods for net and acoustic sampling, data storage and analysis for the survey should be specified and developed (Annex 4, paragraphs 8.31 and 8.122).

5.16 Further, the Scientific Committee agreed that the task groups dealing with specific aspects of the survey should develop the survey work plan in time for the planned Area 48 workshop in mid-1998. The survey steering committee should meet in conjunction with the Area 48 workshop and should then prepare an outline survey plan to be considered at WG-EMM's 1998 meeting (Annex 4, paragraphs 8.126 and 10.14).

5.17 The results of the proposed simulation study to determine the appropriate survey design (particularly stratification and placement of transect lines) had not been presented to the Scientific Committee as had been requested by WG-EMM (Annex 4, paragraphs 8.124 to 8.129). Dr Everson reported that two members of the panel tasked with the simulation study, Drs B. Manly and A. Murray, were intending to meet in the UK in April to discuss results and progress on the simulation study.

5.18 The panel requested that the steering committee for the synoptic survey of Area 48 survey supply them with data and guidance as soon as possible so that their work could proceed. The Scientific Committee endorsed this request and urged the steering committee to contact Members with historic datasets so that the panel could continue its work. The results of this simulation should be forwarded to the various task groups and to WG-EMM as soon as possible.

5.19 The Scientific Committee agreed that every effort should be made in the planning for the survey of Area 48 to collect other relevant ecological, environmental and physical data to facilitate wider interpretation of the results (paragraphs 13.8 and 13.9; Annex 4, paragraph 8.109).

Fish Resources

Background Matters to Assessments

5.20 In 1996/97, research surveys were undertaken in Subareas 48.1 (Germany) and 48.3 (UK and Argentina) and Divisions 58.5.1 (France) and 58.5.2 (Australia) (Annex 5, paragraph 3.41).

5.21 Characteristics of the biology and demography of fish species are presented in Annex 5, paragraphs 3.43 to 3.63. Important points considered in the assessments are presented below.

Review of Biological Reference Points for Decision Criteria

5.22 At last year's meeting, the Scientific Committee endorsed the need for future work by WG-FSA to examine further the biological reference points used currently by CCAMLR (SC-CAMLR-XV, paragraph 4.42; Annex 5, paragraph 3.65). An overview prepared by the Secretariat of reference points and their use in other international fisheries management

bodies, mostly NAFO and FAO, indicated that: (i) few examples were available as to the methodologies used to identify critical reference points; and (ii) none were available for helping identify critical biological reference points on the status of populations, as required under Article II (Annex 5, paragraph 3.66). The Scientific Committee noted that the biological reference points used by CCAMLR are as advanced as any currently in use in fisheries management. Nonetheless, the Scientific Committee also recognised that further work needs to be undertaken to examine the properties of these reference points in relation to fish stocks with different life history characteristics.

5.23 The Scientific Committee noted the difficulties in applying the current decision rules to some stocks (Annex 5, paragraphs 3.68 and 3.70) and agreed that WG-FSA continue to examine the implications of the following elements of the decision rules at its next meeting:

(i) the decision rule pertaining to the 10% probability of falling below 20% of the median unexploited stock biomass may not be suitable for species such as *C. gunnari*, which, for example in Division 58.5.2, has a probability of falling below this level of approximately 0.5 without fishing. In this case, a possible change would be to modify the decision rule so that the probability of falling below the 20% reference level is not substantially increased by the effects of fishing (see Annex 5, paragraph 3.68 for details);

(ii) the decision rule concerning escapement of species which are important prey species may need to be modified if the rate of natural mortality explicitly includes predation (e.g. *C. gunnari* in Subarea 48.3) (see Annex 5, paragraphs 3.70 and 4.172 to 4.174);

(iii) decision rules may need to cater for variation in predator–prey interactions between different age classes of fish (such as *D. eleginoides* in Division 58.5.2) as well as spatial and temporal variation in such interactions (see Annex 5, paragraphs 3.71); and

(iv) appropriate biological reference points need to be developed for stocks in which pre-exploitation levels of standing stock may be unable to be estimated (see Annex 5, paragraphs 3.72).

5.24 The Scientific Committee recognised that the current decision rules have biological reference points phrased in terms relative to estimates of the median unexploited spawning stock biomass. However, as the uncertainties in the status of the stocks and the relationships between stock size, recruitment and environmental variability are reduced, the biological reference points concerned with protecting stocks from declining recruitment may be able to be phrased in absolute terms of a minimum absolute biomass.

5.25 The Scientific Committee agreed that further development of the long-term management strategy for *C. gunnari* will help clarify these issues and that the biological reference points should remain under review.

5.26 In addition, the Scientific Committee endorsed the view that target levels of F, including $F_{0.1}$, are inappropriate as biological reference points for implementing Article II (see also paragraph 5.62).

Developments in Assessment Methods

5.27 The Scientific Committee noted the improvements in the implementation of the generalised yield model (GYM) since last meeting, including the addition of: (i) a parametric bootstrap procedure to enable the use of a table of estimates of recruitments rather than the use of a lognormal recruitment function; and (ii) functions to enable interannual variability in M (Annex 5, paragraphs 3.78 and 3.79).

5.28 The Scientific Committee endorsed the view that validation of the GYM should be given a high priority by the Secretariat in the intersessional period and that an improved user interface be developed by the authors of the model for use at the next meeting of WG-FSA (Annex 4, paragraph 7.3; Annex 5, paragraphs 3.78 to 3.80).

Consideration of Management Areas and Stock Boundaries

5.29 A change, proposed by South Africa, to the boundary between Subareas 58.6 and 58.7 (see Annex 5, Figure 2), to separate the fishing grounds around the Prince Edward Islands from those around Crozet Island was considered by WG-FSA (Annex 5, paragraphs 3.81 to 3.83). The Scientific Committee recognised that the original statistical boundaries were derived by FAO from the review by Everson (1977) based on the best available knowledge on the likely distribution of stocks in the Antarctic, although this was incomplete for some areas.

5.30 The Scientific Committee reiterated that management units should have a biological justification and agreed that management advice should be based on stocks rather than statistical areas. To this end, management advice may need to be identified for individual stocks based on small-scale areas, such as is necessary for two stocks of *C. gunnari* in the Heard Island area (Annex 5, paragraphs 3.44 and 3.82).

Management Advice

5.31 The Scientific Committee recommended the proposed change of the boundary between Subareas 58.6 and 58.7 be considered by the Commission because the proposed boundary is likely to coincide with a natural boundary between stocks in the shelf area of Prince Edward Islands and stocks in the shelf area around Crozet Island.

5.32 The Scientific Committee noted that if this recommendation is adopted then adjustments, although likely to be minor, will need to be made to the existing database and reports for statistical subareas. This change will have an impact on the allocation of precautionary yield between the affected areas (see Table 5).

Assessments and Management Advice

Antarctic Peninsula (Subarea 48.1)

Notothenia rossii, Gobionotothen gibberifrons, Chaenocephalus aceratus, Chionodraco rastrospinosus, Lepidonotothen squamifrons and Champsocephalus gunnari (Subarea 48.1)

5.33 A summary of background information for the assessment is available in Annex 5, paragraphs 4.135 to 4.138. A survey carried out by Germany in the vicinity of Elephant Island, one of the most important fishing grounds, showed a lower stock biomass than the previous survey in 1987, prior to the closure of the fishery in this area in 1989. The causes for this decline are unclear but are discussed in Annex 5, paragraph 4.137.

5.34 No assessment was undertaken because of the low abundance of these species.

Management Advice

5.35 The Scientific Committee noted that, given the low biomass estimates for the 1996/97 season and some of the uncertainties associated with decline in biomass compared to 1987, there appears to be little prospect for a substantial trawl fishery for these species. The Scientific Committee therefore recommended that Conservation Measure 72/XII should remain in force for trawl fisheries for the species considered in this section until future surveys indicate an increase in fish biomass in the subarea.

5.36 The Scientific Committee recognised that Conservation Measure 72/XII applies to all fisheries in this subarea. If the Commission approves proposals for new longline fisheries in this subarea (Annex 5, paragraphs 4.120 to 4.134) then Conservation Measure 72/XII will need to be modified to exempt the approved new fisheries.

South Orkney Islands (Subarea 48.2) – Management Advice

5.37 In the absence of new information on stocks in this subarea, the Scientific Committee recommended that trawl fisheries in Subarea 48.2 should remain closed in accordance with Conservation Measure 73/XII.

5.38 The Scientific Committee recognised that Conservation Measure 73/XII applies to all finfish fisheries in this subarea. If the Commission approves proposals for new longline fisheries in this subarea (Annex 5, paragraphs 4.120 to 4.134) then Conservation Measure 73/XII will need to be modified to exempt the approved new fisheries (paragraphs 9.31 to 9.38).

South Georgia (Subarea 48.3)

Dissostichus eleginoides (Subarea 48.3)

Standardisation of CPUE Indices

5.39 The Scientific Committee noted the re-analysis by WG-FSA of the CPUE data from the *D. eleginoides* fishery in Subarea 48.3 using generalised linear models (GLMs) (Annex 5, paragraphs 4.143 to 4.155). The re-analysis was required because of an error in last year's calculations arising from incomplete information available on how to use a feature of the software package. As such, the results in Table 17 and Figures 5 and 6 of last year's report (SC-CAMLR-XV, Annex 5) are incorrect and should be disregarded.

5.40 The re-analysis of annual trends in CPUE have been updated to include revised information from previous fishing seasons, as well as new information from the 1996/97 fishing season. Also, the time series effects of fishing season on kilogram per hook and numbers per hook were adjusted for the presence of hauls with zero catches (Annex 5, paragraphs 4.150 and 4.151). The Scientific Committee endorsed the request for zero catches to be recorded on form C2 and reported to CCAMLR.

5.41 The Scientific Committee endorsed the view that unstandardised catch rates are not reliable indicators of trends in CPUE.

5.42 The Scientific Committee noted that the adjusted, standardised catch rates increased between the 1992 and 1993 fishing seasons, but declined after 1993. The decline was faster for kilogram/hook than it was for numbers/hook, indicating that the average size of fish in the catch has decreased over time. The Scientific Committee noted the trends with concern. The rapid decline in CPUE between 1993 and 1995 coincided with the period of substantial unreported catches. Since that time the level of unreported catches is believed to be low. The decline of both CPUE indices slowed between the 1995 and 1997 fishing seasons.

5.43 The Scientific Committee also noted that the results of the analysis of monthly trends in CPUE suggest that delaying the start of the *D. eleginoides* fishing season until 1 May of each year would not have a negative impact of catch rates (Annex 5, paragraph 4.155).

Assessment of Yield

5.44 The Working Group had not intended to undertake a reassessment of precautionary yield of *D. eleginoides* in Subarea 48.3 at this meeting. However, due to the discovery of an error in the procedure for estimating cohort densities from survey data using the swept-area method applied at meetings in 1995 and 1996, a revised analysis was undertaken. The revisions are detailed in Annex 5, paragraph 4.160.

5.45 Prof. J. Beddington (UK) noted that the estimates of recruitment in Table 18 of Annex 5 suggest that there may be a trend of increasing recruitment over the period covered by the surveys. Caution had been expressed by WG-FSA in 1996 that such trends could introduce bias into the log-normal recruitment function and, consequently, that care should be taken to examine the data for such trends (SC-CAMLR-XV, Annex 5, paragraph 4.73).

5.46 The Scientific Committee recommended that possible trends in estimates of recruitment be reviewed, as a matter of priority, at next year's meeting of WG-FSA, to determine whether these trends may be biological in origin or a function of the types of

surveys and variability in results. The Scientific Committee requested the submission of any additional research survey data that would help in assessing the characteristics of recruitment in this area.

5.47 WG-FSA reviewed new information on maturity ogives for male and female *D. eleginoides* which confirmed earlier observations that males and females have different sizes at sexual maturity (Annex 5, paragraphs 4.156 to 4.159). These new results indicate that a high proportion of females in catches of *D. eleginoides* may be immature, which suggests this species may be vulnerable to recruitment overfishing. However, the Scientific Committee noted that the estimates of recruitment in Table 18 of Annex 5 provided no evidence for recruitment overfishing, although the most recent cohort in the analysis was from 1993.

5.48 The Scientific Committee endorsed the recommendation of the Working Group that more emphasis should be given to age and growth studies of this species and that a high priority be given to undertaking assessments using a two-sex model. Thus, modifications to the GYM for this task should be undertaken as a matter of urgency. Also, the Scientific Committee endorsed the recommendation that Members inform the Secretariat of the location and availability of scales and otoliths collected by scientific observers to facilitate analysis of this material.

5.49 After the close of WG-FSA, some small errors were detected in the analyses of precautionary yields. Corrected tables were presented to the Scientific Committee and these were inserted into the report of WG-FSA.

5.50 An assessment of the precautionary yield estimated using the GYM was undertaken by WG-FSA, incorporating the revised estimates of the parameters for recruitment as well as a revised maturity ogive and the catch for split-year 1996/97 (see Annex 5, paragraphs 4.161 to 4.162). The decision rule concerning the probability of depletion was binding (Annex 5, paragraph 4.161). The yield at which there is a probability of 0.1 of the spawning biomass falling below 20% of the median pre-exploitation spawning biomass level over 35 years was 3 540 tonnes. The median escapement for this catch level was 0.51.

Trends in Stock Status

5.51 The Working Group presented trends in median biomasses from the GYM, which predicts that the current median spawning biomass is 62% of the pre-exploitation median level and the fishable biomass potentially at 60% of the pre-exploitation median level. The Scientific Committee noted that this stock is therefore above, but approaching, one of the reference points used in

CCAMLR decision rules which holds that the median spawning stock should not be allowed to fall below 50% of its unexploited median level (Annex 5, paragraphs 4.162 and 4.165).

5.52 The Scientific Committee noted the concern of WG-FSA that standardised CPUEs have fallen more rapidly than the median fishable biomasses predicted by the GYM (see Annex 5, paragraphs 4.164 to 4.167 for discussion). The Scientific Committee considered that this discrepancy could be the result of greater total removals than currently estimated, although it was acknowledged that there were difficulties in comparing these two kinds of data. The Scientific Committee endorsed the need to examine this further at future meetings, with a modification to the GYM that enables the use of estimates of recruitment and catches specified

for particular years. Nonetheless, the Scientific Committee considered that it would still be appropriate (and more risk averse) to view the trend of declining CPUE as an indication that stock size had declined rapidly over the period 1993 to 1995.

Management Advice

5.53 The revised estimate of precautionary yield from the GYM was 3 540 tonnes.

5.54 The Scientific Committee recommended that the catch limit for 1997/98 should be less than the 3 540 tonnes in order to maintain a degree of caution appropriate to the uncertainty indicated by the results of the CPUE analysis.

5.55 The Scientific Committee had difficulty, however, in advising on how much lower the catch limit should be in the forthcoming season. This was because there are no elements in the decision rules to reconcile conflicting indicators such as in this case, where the GYM suggests the stock is approaching a decision rule reference point, while the CPUE trend suggests it may already have exceeded it. A high priority task is to develop advice to deal with such situations.

5.56 Nevertheless, the Scientific Committee agreed that the following points can be taken into consideration in setting a catch limit for the 1997/98 season:

(i) recruitment overfishing is unlikely to be a problem at this time; and

(ii) a modest reduction of the catch limit below the estimate of precautionary yield would be appropriate.

5.57 The Scientific Committee noted that delaying the start of the *D. eleginoides* fishing season from 1 March until 1 May in line with the recommendation arising from the analysis of incidental mortality of seabirds in longline fisheries in this subarea (Annex 5, paragraph 4.155) was unlikely to have a negative impact on catch rates. The Scientific Committee also noted that problems associated with reducing the overall length of the fishing season could be mitigated by extending the end of the season to the end of September.

Champsocephalus gunnari (Subarea 48.3)

Development of a Long-term Management Strategy

5.58 The Scientific Committee welcomed progress on the consideration of long-term management strategies for *C. gunnari* arising from work in Subarea 48.3 and Division 58.5.2 (see Annex 5, paragraphs 4.171 to 4.178).

5.59 The Scientific Committee endorsed the view of WG-FSA that the following components should be evaluated for their inclusion in an integrated long-term management procedure:

(i) appropriate biological reference points for *C. gunnari* in Subarea 48.3 and Division 58.5.2 (see Annex 5, paragraphs 3.65 to 3.73);

(ii) the level of catch appropriate as a long-term precautionary yield when no recent surveys are available;

(iii) methods for adjusting catch levels based on recent survey results to take advantage of strong year classes recruiting to the fishery;

(iv) use of CEMP data and other knowledge of predator/prey interactions to predict adjustments in natural mortality, recruitment and growth parameters for use in assessments; and

(v) methods for achieving target levels of fishing mortality.

5.60 The Scientific Committee endorsed the future work proposed by the Working Group for the development of the assessment and management strategy for *C. gunnari* in Subarea 48.3, in particular:

(i) to analyse all available survey data to investigate the possible magnitude and frequency of periodic increases in M at South Georgia;

(ii) to examine the potential for deriving recruitment estimates directly from trawl survey results, rather than using the VPA results; and

(iii) to examine the sensitivity of assessments of yield to variations in growth parameters.

5.61 The Scientific Committee agreed that there is an urgent need to develop further the progress made at this year's meeting on long-term management strategies for *C. gunnari* fisheries and endorsed the holding of a three-and-a-half 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 1998. The decision to hold the workshop will be taken by the Convener of WG-FSA, in consultation with the Chairman of the Scientific Committee and the Data Manager.

5.62 The Scientific Committee approved the following terms of reference for the workshop:

(i) to review the fisheries on *C. gunnari* in various subareas and divisions, including trends in catches and changes in stock composition in terms of length and age;

(ii) to review information on the biology and demography of the species, including age, growth, and reproduction and diet;

(iii) to review information on stock identity, structure and movements, including distribution, movements, segregation by age and stock separation;

(iv) to review estimates of absolute and relative abundance and year class strength (Annex 5, paragraph. 4.209);

(v) to review the historical assessment methods, including short- and long-term methods and highlight their shortcomings;

(vi) to evaluate interactions of *C. gunnari* with other components of the ecosystem, including krill and fur seals, to investigate past fluctuations in natural mortality and explore the potential to predict changes in M (Annex 5, paragraph. 4.178); and

(vii) to develop long-term management strategies for the fisheries on *C. gunnari.* These might include:

(a) taking account of any new development since the last meeting of WG-FSA;

(b) the evaluation of appropriate biological reference points;

(c) the level of catch appropriate as a long-term precautionary yield;

(d) methods for adjusting catch levels in the short term; and

(e) methods for achieving target levels of fishing mortality (Annex 5, paragraph 4.178).

5.63 The Scientific Committee recommended that participants at the workshop provide extensive reviews on items (i) to (v) in order to be able to keep discussions on these matters at the workshop as brief as possible.

5.64 The workshop would possibly require access to results from past bottom trawl surveys. Therefore, the Scientific Committee reiterated its recommendation (paragraph 10.6; Annex 5, paragraph 3.9) that high priority should be given to the development of a research trawl database in the Secretariat.

5.65 In light of the tasks listed in paragraphs 5.62(vi) and (vii), the Scientific Committee requested that WG-EMM considers at its next meeting in 1998 the following questions and provide the relevant information to the workshop:

(i) What is the importance of *C. gunnari* to predators?

(ii) What is the intensity and variability of predation on *C. gunnari* and the mechanisms that cause this variability?

(iii) From the time series of historical data, what is the nature, magnitude and frequency of ecologically important values which may be linked to effects on the production and mortality of *C. gunnari* stocks?

Assessment of Yield

5.66 There was no commercial catch of *C. gunnari* in Subarea 48.3 during the 1996/97 season, although there was a catch limit of 1 300 tonnes in accordance with Conservation Measure 107/XV. There has now been no substantial reported commercial catch since March 1990.

5.67 The Scientific Committee noted that precautionary catch limits for *C. gunnari* cannot be evaluated until further studies on the properties of possible reference points and decision criteria have been considered for this species (see Annex 5, paragraphs 3.68 and 3.69).

5.68 Background information considered in the assessment is described in Annex 5, paragraphs 4.186 to 4.198. The Scientific Committee endorsed the recommendation of the Working Group that a standardisation of the trawl survey time series using GLMs should be undertaken (Annex 5, paragraph 4.198), although it was noted that this might be problematic due to limited overlap in key factors in the dataset.

5.69 The Scientific Committee noted that recent surveys show that the population of *C. gunnari* in Subarea 48.3 has recovered from recent low levels and that the current stock comprises fish mostly in age classes 2 and 3 (Annex 5, paragraphs 4.199 to 4.201). Although recruitment in the current stock is greater than the mean recruitment arising from VPA run 5 in 1993 (Annex 5, Table 3), the Scientific Committee noted the uncertainty in VPA results and other indicators of stock status currently available (e.g. the estimate of current biomass from the recent UK survey is about 50% of the accumulated catch from the early 1980s), as well as the large variations in abundance known to occur naturally in this species. In light of this, the Scientific Committee noted that the status and potential of the stock in the long term needs to be reassessed and that this would be considered at a short workshop just prior to the next meeting of WG-FSA (see paragraph 5.61 above).

5.70 The Scientific Committee endorsed the short-term methodology used by WG-FSA to assess yield for the coming year (see Annex 5, paragraph 4.179 to 4.182 for details). This methodology used the lower 95% confidence bound from the UK survey in Subarea 48.3 in September 1997 as a basis for a short-term (two-year) projection of yield and stock size (Annex 5, paragraphs 4.199 to 4.202). The calculations are described in Annex 5, paragraphs 4.202 to 4.208.

5.71 The Scientific Committee noted the assessment of yield assumes one stock in Subarea 48.3. Marked differences in age structure between South Georgia and Shag Rocks warrants further examination with a view to resolving questions of stock structure in the region (Annex 5, paragraph 4.200).

Management Advice

5.72 The Scientific Committee noted that recent surveys show that the population of *C. gunnari* in Subarea 48.3 has recovered from recent low levels. However, given the continued uncertainty about the potential yield of *C. gunnari* in Subarea 48.3, the Scientific Committee considered that a conservative approach to management is appropriate in the immediate future.

5.73 The Scientific Committee noted that the yield estimated from the short-term projections undertaken at this year's meeting were based on the lower 95% confidence bound of the survey undertaken by the UK in September 1997 and that this constituted a conservative estimate of yield. Accordingly, the Scientific Committee recommended that fishing in the 1997/98 season should be limited to a total catch of 4 520 tonnes.

5.74 In order to protect the stock from directed fishing on juvenile fish, the Scientific Committee recommended that the approach recommended for Division 58.5.2 to limit the catch of small *C. gunnari* should be applied to Subarea 48.3 in the 1997/98 season (paragraph 5.118). Small *C. gunnari* should be defined as those of less than 240 mm total length.

5.75 No new information was available on the proportion of by-catch species in the commercial catch. The recommended catch limit is substantially below the implied ceilings on both a bottom trawl and pelagic trawl fishery (8 800 and 9 200 tonnes respectively) considered in SC-CAMLR-XI, Annex 5, paragraphs 6.67 to 6.74.

5.76 The Scientific Committee recalled that a pelagic trawl fishery would result in a lower proportion of by-catch and would avoid the possible adverse effects of bottom trawling on the benthic community (e.g. SC-CAMLR-XII, Annex 5, paragraph 6.61). Accordingly, it is recommended that the fishery in 1997/98 be undertaken by pelagic trawling only.

5.77 The fishing season set for 1996/97 by Conservation Measure 107/XV closed on 1 May 1997. The Scientific Committee noted that this represented a one-month extension of the season applied in previous seasons and was adopted by the Commission on the understanding that it would apply for the 1996/97 season only. In accordance with earlier seasons, the Scientific Committee recommended that the fishing season in the 1997/98 season be closed on 1 April to reduce fishing directed at spawning concentrations.

5.78 In order to provide the information required for assessment of the fishery, the Scientific Committee recommended that reporting requirements for the commercial fishery should include the submission of haul-by-haul data in accordance with standard CCAMLR formats and that an international scientific observer be on board every vessel participating in the fishery in the 1997/98 season.

5.79 The Scientific Committee emphasised that the assessment for the coming year is a short-term assessment based on a recent survey and should not be viewed as a long-term assessment. In this respect and as a result of the need for developing further the long-term management strategy, the Scientific Committee recommended that a survey be undertaken during the 1997/98 season.

5.80 The Scientific Committee noted the progress made towards developing a long-term management strategy for this species and recommended the holding of a workshop prior to the next meeting of WG-FSA to develop this further (paragraphs 5.61 to 5.64).

Chaenocephalus aceratus, Pseudochaenichthys georgianus, Gobionotothen gibberifrons, Notothenia rossii, Patagonotothen brevicauda guntheri and *Lepidonotothen squamifrons* (Subarea 48.3)

5.81 New biomass estimates of *Chaenocephalus aceratus, Pseudochaenichthys georgianus, Gobionotothen gibberifrons, Notothenia rossii, Patagonotothen brevicauda guntheri* and *Lepidonotothen squamifrons* were available to WG-FSA from Argentinian and UK biomass surveys conducted around Shag Rocks and South Georgia. The Scientific Committee noted the apparently low abundances of most of these stocks which were largely in line with previous results (see Annex 5, paragraphs 4.218 to 4.222 for details).

Management Advice

5.82 The Scientific Committee reiterated its advice from previous years concerning these species and therefore recommended that Conservation Measures 2/III, 3/IV and 95/XIV remain in force and that Conservation Measure 100/XV be extended to the 1997/98 season.

Electrona carlsbergi (Subarea 48.3) – Management Advice

5.83 In the absence of any new information (Annex 5, paragraph 4.224) the Scientific Committee recommended that Conservation Measure 103/XV be carried forward for the 1997/98 season.

South Sandwich Islands (Subarea 48.4)

5.84 Although a small fishery for *D. eleginoides* was open in this area with a catch limit of 28 tonnes (Conservation Measure 101/XV), no catches were reported (Annex 5, paragraph 4.231).

Management Advice

5.85 In the absence of any new information on this species, the Scientific Committee recommended that Conservation Measure 101/XV for this stock be carried forward for the 1997/98 season.

5.86 This subarea is subject to notification of new fisheries (Annex 5, paragraphs 4.120 to 4.134).

Bouvet Island (Subarea 48.6)

5.87 This area was subject to notification of new fisheries for *D. eleginoides* (Annex 5, paragraph 4.234). No fishing took place.

5.88 No information was available to make any assessment on other stocks occurring in this subarea (Annex 5, paragraph 4.235).

5.89 This subarea is subject to notification of new fisheries (Annex 5, paragraphs 4.120 to 4.134).

Antarctic Coastal Areas (Divisions 58.4.1 and 58.4.2)

5.90 No new information was available to the Working Group to undertake any assessment on the stocks in these divisions (Annex 5, paragraph 4.237).

5.91 The Scientific Committee noted that fisheries for *Pleuragramma antarcticum*, *Chaenodraco wilsoni* and *Trematomus eulepidotus* had occurred in these divisions in the past and that these could now be considered to be lapsed fisheries. The Scientific Committee recommended that prior to the resumption of these fisheries, WG-FSA should be asked to examine all data available on these fisheries in order to make an assessment of future catch levels.

BANZARE and Elan Banks (Division 58.4.3)

Dissostichus spp. (Division 58.4.3)

5.92 This division is subject to notification of new and exploratory fisheries (Annex 5, paragraphs 4.120 to 4.134).

Ob and Lena Banks (Division 58.4.4)

Dissostichus eleginoides (Division 58.4.4)

5.93 This division is subject to notification of new fisheries (Annex 5, paragraphs 4.120 to 4.134).

Lepidonotothen squamifrons (Division 58.4.4)

5.94 A conservation measure to allow a commercial catch of 1 150 tonnes of *L. squamifrons* to be caught over a two-year period (Conservation Measure 87/XIII) was approved and extended over three consecutive seasons at the successive requests made by Ukraine, provided a biomass survey was undertaken. Apparently no biomass survey was carried out during the 1994/95, 1995/96 and 1996/97 seasons, and therefore no data were available to the Working Group to assess the state of this stock.

Management Advice

5.95 Conservation Measure 87/XIII, allowing a catch of 1 150 tonnes of *L. squamifrons* on the two banks provided an approved biomass survey is undertaken, was extended until the end of the 1996/97 season (Conservation Measure 105/XV). The Scientific Committee noted that the survey proposed by Ukraine did not take place and therefore recommended that the fishery should be closed until a biomass survey of the design approved by the Scientific Committee shows that the stock could support a sustainable fishery.

Kerguelen Islands (Division 58.5.1)

Dissostichus eleginoides (Division 58.5.1)

Standardisation of CPUE Indices

5.96 As for Subarea 48.3, the results from last year's meeting of WG-FSA were found to be in error, and Table 22 and Figure 7 of SC-CAMLR-XV, Annex 5 are not correct.

5.97 Details of the reanalysis of CPUE data are described in Annex 5, paragraphs 4.242 to 4.251. The year effect was the most significant component of variability in CPUE, and the month effect was the next most significant component of variability in catch rates. The effects of year and month on standardised catch rates from the trawl fishery were adjusted for the presence of hauls with zero catches. Adjusted, standardised catch per unit effort has decreased over the course of the time series, and CPUEs in the 1997 split-year were the lowest on record.

5.98 The Scientific Committee was concerned at the declining trend in adjusted, standardised catch rates and noted that the trend in unstandardised catch rates mirrored that of standardised catch rates. There was no clear pattern in standardised CPUE by month.

Management Advice

5.99 The Scientific Committee endorsed the advice of WG-FSA (Annex 5, paragraphs 4.252 to 4.257):

(i) the declining trend in CPUE in the trawl fishery demonstrated by the GLM analysis confirms previous studies of this stock. Annual reductions of the French catch limit (3 800 tonnes for the 1996 season, 3 500 tonnes for the 1997 season and 3 000 tonnes for the 1998 season) shows the concern in the management of the fishery in the French EEZ;

(ii) the French authorities have allocated a catch limit for trawling for the 1997/98 season. A maximum of 3 000 tonnes applies for the whole area, including a 1 000-tonne limit in the eastern sector;

(iii) the longlining catch limit in the western sector has already been established up to the end of 1997 (October–December). A catch limit of 500 tonnes applies for two vessels only. The total value for 1997/98 season in this sector will not exceed the value of the long-term sustainable yield estimated at the 1994 meeting (1 400 tonnes);

(iv) a catch limit of 600 tonnes will apply for 1997/98 season for one French longliner in the eastern sector outside the area used by trawlers; and

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

5.100 The Scientific Committee noted that illegal fishing could severely compromise the management of this stock. The estimated unreported catch of *D. eleginoides* by longliners in 1996/97 was 1.4 times the estimated sustainable level of fishing and four times greater than the legal limit for longliners in this division over that period. Thus, the Scientific Committee noted with concern that, when combined with the reported catches, this level of fishing was likely to be unsustainable.

Champsocephalus gunnari (Division 58.5.1)

5.101 As recommended by the Scientific Committee at last year's meeting (SC-CAMLR-XV, paragraph 4.96), there were no commercial catches on the shelf stock during the 1996/97 season (Annex 5, paragraph 4.258).

5.102 As requested by the Scientific Committee (SC-CAMLR-XV, paragraph 4.96), two pre-recruit biomass surveys were conducted during the summer/autumn of 1996/97 to evaluate the abundance of age 3 fish (Annex 5, paragraph 4.259 to 4.261). Three-year-old fish of the cohort born in 1994 were present in nearly all the catches. However, no aggregations of fish were detected despite indications from the previous year of a strong cohort entering the fishable stock. The abundance of other age classes was low.

5.103 The Scientific Committee noted that the Working Group was unable to explain the unexpectedly low biomass at this stage (Annex 5, paragraph 4.263). The French authorities have indicated that they plan to continue to monitor the stock with the help of the French trawlers on the basis of an allocation of very limited catches (not more than 1 to 5% of the present standing stock).

Management Advice

5.104 The Scientific Committee recalled its advice from the 1995 meeting (SC-CAMLR-XIV, paragraph 4.83) that the fishery for *C. gunnari* in Division 58.5.1 should be closed until at least the 1997/98 season when the cohort born in 1994 would have had an opportunity to spawn. The recommended pre-recruit biomass survey conducted this season has shown that the strength of this cohort (age 3) is lower than expected and no conclusive explanation for this situation is presently available.

5.105 The Scientific Committee supported the plan of action proposed by the French authorities as outlined in Annex 5, paragraph 4.263.

Notothenia rossii (Division 58.5.1) – Management Advice

5.106 No new data on the stocks of this species in the division were available. The Scientific Committee reiterated its advice that the fishery for *N. rossii* in Division 58.5.1 remain closed until new information demonstrating the recovery of the stock to a level that allows for its exploitation is submitted for analysis.

Lepidonotothen squamifrons (Division 58.5.1) – Management Advice

5.107 No new data were available to assess this stock. In the absence of a new assessment the Scientific Committee recommended that the Kerguelen fishery for *L. squamifrons* should remain closed.

Heard and McDonald Islands (Division 58.5.2)

Dissostichus eleginoides (Division 58.5.2)

Impact of Illegal Catches on Catch Limit

5.108 The Scientific Committee endorsed the re-evaluation of the precautionary yield (currently 3 800 tonnes) to examine the effect on the long-term annual yield of the estimates of unreported catches from this division in the last fishing season (Annex 5, paragraph 4.270). Two catch levels were used in these reassessments, being the reported catch (1 861 tonnes) plus the lower and higher estimates of unreported catches respectively (10 200 and 18 400). The future long-term annual yield at which median escapement is 0.5 was 3 720 tonnes for the lower estimate of catch and 3 700 tonnes for the upper estimate, provided that high levels of unreported catches do not continue. The respective probabilities of depletion below the 0.2 median pre-exploitation biomass over 35 years were 0.039 and 0.045.

Management Advice

5.109 In view of the large illegal catches estimated to have been taken from this division, the Scientific Committee recommended that the catch limit should be revised to 3 700 tonnes, the yield estimated given the higher estimate of illegal catches.

5.110 The Scientific Committee stressed that this catch limit should be used on the assumption that total catches are reduced to 3700 tonnes or less in the near future. If total catches continue at levels similar to those estimated by WG-FSA for the 1996/97 season (i.e. at 5.5 times the revised long-term annual yield), there will be a much greater affect on the catch limit in future years than has been estimated at this meeting.

5.111 The Scientific Committee requested that WG-FSA examine how long the stock can sustain the current level of total catch and its long-term effect on standing stock and spawning biomass.

Champsocephalus gunnari (Division 58.5.2)

5.112 A commercial catch of 216 tonnes was taken by one vessel from Australia in Division 58.5.2 during the 1996/97 season, which was less than the precautionary catch limit of 311 tonnes set by Conservation Measure 110/XV.

Assessment of Yield

5.113 The short-term methodology used by WG-FSA to assess yield for the coming year (see Annex 5, paragraph 4.179 to 4.182 for details) was applied to the results from the Australian survey in August 1997 and used biological parameters derived from surveys around Heard Island (see Annex 5, paragraphs 4.274 and 4.275).

5.114 The Scientific Committee endorsed the assessments of *C. gunnari* in two regions – Heard Island plateau and Shell Bank (see Annex 5, paragraphs 4.276 and 4.277 for explanation). The bootstrap lower 95% confidence interval was used to estimate the initial age structure for the projection. This resulted in a combined catch over two years from the two abundant cohorts of 1 500 tonnes, comprising 900 tonnes in the first year and 600 tonnes in the second year.

Management Advice

5.115 The Scientific Committee recommended a catch limit of 900 tonnes for *C. gunnari* on the plateau at Heard Island for the 1997/98 season.

5.116 The Scientific Committee noted that the lower 95% confidence limit for the abundance estimate of *C. gunnari* on Shell Bank reported to WG-FSA was only 592 tonnes (Annex 5, paragraph 4.280). Accordingly, the Scientific Committee recommended that commercial fishing on this bank should be avoided in the 1997/98 season.

5.117 The Scientific Committee noted the value of having up-to-date surveys on which to base assessments of a species such as *C. gunnari* which has widely fluctuating abundance. Thus, it recommended that such surveys should be conducted regularly.

5.118 The Scientific Committee noted the conclusion of WG-FSA that there appears to be no compelling requirement to protect juvenile fish from the effects of fishing at levels that may be proposed for precautionary catch limits (see Annex 5, paragraph 4.282). However, this has not been established for the higher catch limits from the interim procedure for estimating catch limits for abundant cohorts. For this reason, the Scientific Committee agreed that it would be advisable to continue a procedure for limiting the proportion of small fish taken by the fishery. It recommended that a fishing vessel should move to another location when the proportion of small fish exceeds 10% of the total (provided the catch of small *C. gunnari* is above a minimum threshold such as 100 kg). Small *C. gunnari* should be defined as those of less than 240 mm total length. Further, the Scientific Committee requested that WG-FSA examine further the necessity of this requirement for when catch levels are raised above the precautionary limit.

Channichthys rhinoceratus, *Lepidonotothen squamifrons* and Skates (*Bathyraja* spp.) (Division 58.5.2)

5.119 The Scientific Committee endorsed the assessments of the long-term annual yield and potential by-catch of two species, and a group of species, caught as by-catch in the commercial trawl fishery in the Heard Island area: *C. rhinoceratus*, *L. squamifrons* and skates (*Bathyraja* spp.). These assessments are detailed in Annex 5, paragraphs 4.283 to 4.285 and paragraphs 4.313 to 4.315. Where possible, biological characteristics of the stocks used as inputs to the GYM were obtained from data of research surveys conducted in the division. However, when not available this data were extracted from information contained in the literature on related species occurring in other geographical areas (sometimes in very distant waters). Consequently, the yields derived from these results are uncertain, especially for skates for which very little information is available.

5.120 The long-term estimates of yield for C. rhinoceratus, L. squamifrons and skates were 69 to 97 tonnes (average 80 tonnes), 7 to 911 tonnes (average 325 tonnes) and 50 to 210 tonnes (average 120 tonnes) respectively. These ranges arise from the assessments of g for three different survey estimates. WG-FSA noted that the by-catch of these species in the Heard Island trawl fishery did not exceed the lowest estimates of yield for each species and therefore it does not seem to be negatively affecting their stocks. It also stated that while further work is needed to refine the estimates of long-term annual yields, especially for skates, these results could be used as a basis to set precautionary catch limits for these stocks in Division 58.5.2.

Management Advice

5.121 The Scientific Committee noted that, although the estimates of yield are based on biological parameters extrapolated from the literature, in many cases they provide a guide to long-term annual yield appropriate for these species. Thus, until more refined estimates are available, the Scientific Committee recommended the following precautionary catch limits for these species:

L. squamifrons	325 tonnes
C. rhinoceratus	80 tonnes
Bathyraja spp.	120 tonnes

5.122 The Scientific Committee also recommended that no directed fishing be allowed on these species. Consequently, the by-catch of these species in the trawl fishery for *C. gunnari* will be unlikely to exceed these limits.

Crozet Island (Subarea 58.6)

Dissostichus eleginoides (Subarea 58.6)

Standardisation of CPUE Indices

5.123 The Scientific Committee endorsed the analysis of CPUE data from the joint French–Japanese longline survey conducted around Crozet Island presented in Annex 5, paragraphs 4.288 to 4.296. It noted that this fishery takes significant by-catch of grenadiers, and that there may be an inverse relationship between catches of *D. eleginoides* and grenadiers. While depth was an important factor in explaining variation in CPUE, there was a significant relationship between CPUE and month. Standardised catch rates of *D. eleginoides* were highest in December 1996 and declined through April 1997.

5.124 The Scientific Committee noted that the declining trend in CPUE may have resulted from the substantial unreported catches taken from Subarea 58.6 since its last meeting in 1996. In this regard, the Scientific Committee noted that the median pre-exploitation spawning biomass estimated from the GYM for Subarea 58.6 (according to the proposed new boundaries which separate Crozet Island from the Prince Edward Islands) was 52 290 tonnes and the total estimated catch from this subarea with the proposed new boundary was 12 822 tonnes (Table 5). The Scientific Committee further noted that the total estimated catch from Subarea 58.6 was thus about 25% of the predicted median pre-exploitation spawning biomass. The Scientific Committee agreed that such a large proportion of the estimated spawning biomass being taken in a single year is a very serious situation. If this catch rate continues then the stock is likely to fall to 10% of pre-exploitation levels in the next four years. It is even more disturbing considering that last season was the first known occasion of a significant level of exploitation, and that very little is known of the fish stock in this region.

5.125 The Scientific Committee endorsed the view of the Working Group that since the declining trend in CPUE is likely to be a result of the substantial catches taken from Subarea 58.6, the information in this figure could not be used to assess how delaying the start of the fishing season until the beginning of May (as a means of reducing incidental mortality to seabirds) would affect the fishery.

5.126 The Scientific Committee noted that these assessments are difficult because of the absence of data on these species in this area. It therefore recommended that further work be undertaken as a matter of urgency to determine the biological parameters of *D. eleginoides* in this subarea.

5.127 The Scientific Committee noted the large by-catch of grenadier in this fishery and recommended that work be undertaken to assess the stock of grenadier in this area.

Management Advice

5.128 This subarea is subject to notification of new and exploratory fisheries (Annex 5, paragraphs 4.120 to 4.134).

5.129 The assessment of yield is considered for new fisheries in paragraphs 9.53 to 9.71.

5.130 The Scientific Committee agreed that the rapid decline in the CPUE and that the spawning stock may have been reduced by 25% from the median pre-exploitation level in the last year are cause for serious concern. It noted that the current catch rates are approximately nine times the precautionary level calculated for new fisheries for the existing subarea and 12.5 times the precautionary catch limits calculated for the subarea with the proposed new boundaries. The Scientific Committee agreed that the stock is severely threatened because of the illegal fishing activities.

Other Stocks (Subarea 58.6)

5.131 No information was available on other stocks occurring in this subarea.

Prince Edward Islands (Subarea 58.7)

Dissostichus eleginoides (Subarea 58.7)

Standardisation of CPUE Indices

5.132 The Scientific Committee endorsed the analysis of CPUE data from the longline fishery around Prince Edward Islands (see Annex 5, paragraphs 4.303 to 4.306). The Scientific Committee noted that there was not a clear pattern to the standardised series of CPUE by month.

5.133 The Scientific Committee requested that the Working Group undertake a more thorough analysis of the Prince Edward Islands data at its next meeting once all the haul-by-haul data are entered into the CCAMLR database.

5.134 The Scientific Committee noted that for this subarea, as in Subarea 58.6, the estimated total of reported and illegal catches is a high proportion of the median unexploited spawning biomass estimated from the GYM (according to proposed new boundaries). For this subarea the predicted median unexploited total biomass was 102 210 tonnes and the total estimated catch was 18 839 tonnes (Table 5), or approximately 18% of the median pre-exploitation total biomass. The Scientific Committee agreed that the situation in Subarea 58.7 was equally serious to that in Subarea 58.6 because such a considerable proportion of the estimated spawning stock biomass has been taken in a single year. Again, it is particularly disturbing

that last season was the first known occasion of a significant level of exploitation, and that very little is known of the fish stock in this region.

5.135 The Scientific Committee noted that these assessments are difficult because of the absence of data on these species in this area. It therefore recommended that further work be undertaken as a matter of urgency to determine the biological parameters of *D. eleginoides* in this subarea.

Management Advice

5.136 This subarea is subject to notification of new and exploratory fisheries (Annex 5, paragraphs 4.120 to 4.134).

5.137 The assessment of yield is considered for new fisheries in paragraphs 9.53 to 9.71.

5.138 The Scientific Committee agreed that the rapid decline in the CPUE and that the spawning stock may have been reduced by 20% from the median pre-exploitation level in the last year are cause for serious concern. It noted that the current catch rates are approximately 30 times the precautionary level calculated under new fisheries for the existing subarea and 12.5 times the precautionary catch limits calculated for the subarea with the proposed new boundaries. The Scientific Committee agreed that the stock is severely threatened because of the illegal fishing activities.

5.139 The Scientific Committee recommended that a bottom trawl survey be carried out during the forthcoming season in order to obtain biological data on this species.

Other Stocks (Subarea 58.7)

5.140 No information was available on other stocks occurring in this subarea.

Pacific Ocean Sector (Area 88)

5.141 This subarea is subject to notification of new and exploratory fisheries (Annex 5, paragraphs 4.120 to 4.134).

5.142 No information was available on other stocks occurring in this sector.

General Management Advice on Assessments

5.143 The Scientific Committee noted with concern the escalation in illegal fishing in Area 58 (see paragraph 2.13). The uncertainty in the levels of total catches of *D. eleginoides* by longlining makes the assessments of yields of this species in this area very difficult. The Scientific Committee agreed that the levels of illegal catch used in these assessments are likely to be minimum estimates in most cases.

General By-catch Provisions

5.144 The Scientific Committee noted the deliberations of WG-FSA on issues associated with the by-catch of fish and endorsed the analysis of the implications of the current by-catch rules on fishing operations and the status of stocks (Annex 5, paragraphs 4.312 to 4.319).

5.145 The Scientific Committee agreed that in general it is preferable to evaluate levels of by-catch in relation to stock productivity rather than using arbitrary rules that restrict the level of by-catch. The Scientific Committee acknowledged, however, that there will often be instances where information is not available to estimate yield for by-catch species, which will require the use of different types of rules.

5.146 The Scientific Committee noted that there are practical problems with the by-catch provisions outlined in Conservation Measures 109/XV, 110/XV and 111/XV because the provisions of these three conservation measures make it difficult for fishermen to prospect for suitable trawling grounds. This is because the fishermen are frequently required to leave areas when catches of by-catch species were less than 100 kg.

5.147 The Scientific Committee endorsed the proposal by WG-FSA that the by-catch provisions in the three conservation measures be modified so that vessels are not forced to move if catches of any single by-catch species are less than 100 kg in any single haul. The Scientific Committee agreed that the 100-kg threshold for by-catch in a single haul would probably not cause stocks of by-catch species to become overexploited but agreed that there should also be an upper limit to the number of 100-kg by-catches that could occur in a single year. Ideally, this upper limit should be determined by the potential yield of each by-catch species.

Management Advice on Measures involving By-catch

5.148 The Scientific Committee recommended that the following mixed strategy (consisting of two components) be applied to by-catch species:

(i) total removals of each by-catch species are limited by estimates of potential yield; and

(ii) haul-specific by-catch limits are set at levels that permit prospecting but are not likely to cause the potential yield from Component (i) to be exceeded.

5.149 The Scientific Committee recommended that haul-specific by-catch limits in Component (ii) of the mixed strategy should be set on a case-by-case basis and noted that such a strategy has already been implemented in the *C. gunnari* fishery in Subarea 48.3 (Conservation Measure 107/XV).

Resumption of Closed or Lapsed Fisheries

5.150 The Scientific Committee welcomed the review by the Secretariat of the types of fisheries operating in the CCAMLR area (SC-CAMLR-XIV/BG/16 Rev. 2) in response to a

recommendation last year that the Commission maintain a register of lapsed fisheries (SC-CAMLR-XV, Annex 5, paragraph 4.251). The paper identified five types of fisheries: new, exploratory, established, closed and lapsed. Currently, formal definitions only exist for new, exploratory and closed fisheries.

5.151 The Scientific Committee noted the discussion by WG-FSA on this topic (Annex 5, paragraphs 4.320 to 4.323). WG-FSA noted that the lack of consistent quality between the various notifications of new and exploratory fisheries received at this year's meeting indicated that Members applied different interpretations to the various requirements in the current conservation measures on new and exploratory fisheries (Conservation Measures 31/X and 65/XII). The Scientific Committee agreed that a standard framework for dealing with various types of fisheries would make it easier for Members to provide the information necessary to evaluate new and exploratory fishery notifications.

5.152 The Scientific Committee endorsed the recommendation of WG-FSA that information and procedures similar to those required for the initiation of a new fishery and/or for the execution of an exploratory fishery should be required during the resumption of a closed fishery. In this regard, the Scientific Committee agreed that before the resumption of a lapsed fishery (e.g. those recommended by the Scientific Committee for Divisions 58.4.1 and 58.4.2 – paragraph 5.91), WG-FSA should be asked to examine all data available on these fisheries in order to make an assessment of future catch levels. In order for this to be achieved the Scientific Committee recommended that a system be established for notifying the Commission that such an assessment is required and for the submission of appropriate data.

Ecosystem Interactions

5.153 The Scientific Committee noted the continued work investigating the by-catch of fish in the krill fishery (Annex 5, paragraphs 5.2 to 5.6) and that this will come to a close with the establishment of the final database by 1 March 1998 followed by subsequent data analyses and review of methodology during the next intersessional period by Members of WG-FSA (Annex 5, paragraph 5.6).

5.154 The Scientific Committee noted the development of a new method for monitoring the interaction between Antarctic blue-eyed shags (*Phalacrocorax bransfieldensis*) and inshore fish species (paragraph 4.12; Annex 5, paragraphs 5.7 to 5.9).

Research Surveys

5.155 The Scientific Committee noted the developments in research surveys discussed by WG-FSA in Annex 5, paragraphs 6.1 to 6.12, including proposed surveys in Subarea 48.1 (USA), Subareas 48.2 and 48.3 (Argentina), Subarea 48.6 and Division 58.4.4 (Spain), Division 58.5.1 (France) and Division 58.5.2 (Australia).

5.156 The Scientific Committee noted that the acoustic survey database being developed by the Secretariat for the synoptic survey of krill in Area 48 should be developed in such a way

to accommodate data from acoustic surveys of fish, such as the Russian survey (Annex 5, paragraph 4.190).

Future Work of WG-FSA

5.157 The Scientific Committee endorsed the future work of WG-FSA on fish as set out in Annex 5, paragraphs 9.1 to 9.7. The Scientific Committee gave the following tasks a high priority:

(i) develop a data format and procedure for handling research survey data submitted to CCAMLR;

(ii) develop electronic forms and formats for the submission of data, reports and meeting documents;

(iii) consolidate and validate methodology and datasets used by WG-FSA;

(iv) arrange for data for WG-FSA analyses from the previous split-year to be prepared as a matter of priority;

(v) validate GYM and prepare documentation for the next meeting of WG-FSA;

(vi) develop routines to extract length frequencies for *D. eleginoides* corrected for size of catch and sample size;

(vii) extend current technical coordination by Members in the provision of scientific observers' data to encompass catch and effort data and CEMP data; and

(viii) consider conducting bottom trawl surveys in Subareas 58.6 and 58.7 for assessing stock abundance and biological parameters of *D. eleginoides*.

5.158 In addition, the Scientific Committee noted that future work should include, for *D. eleginoides*, collections of age/length data and a register of scales and otoliths should be obtained for research cruises as well as from observers on commercial vessels.

5.159 The Scientific Committee agreed that the work of the Secretariat detailed in Annex 5, paragraph 9.4 should be modified to:

(i) contact the Secretariat of the CMS and inform it of CCAMLR's work on albatross conservation and that Dr Kock will follow this up if required; and

(ii) encourage the adoption of provisions of Conservation Measure 29/XV for minimising by-catch of seabirds in fisheries in areas adjacent to the CCAMLR Convention Area.

Crab Resources

5.160 No vessels have fished for crabs in Subarea 48.3 since January 1996, and no vessels have expressed an interest in participating in this fishery during the 1997/98 crab fishing season (Annex 5, paragraphs 4.226 and 4.227).

5.161 The Scientific Committee endorsed WG-FSA's view that it was not necessary to conduct an assessment of the crab stock in Subarea 48.3 (Annex 5, paragraph 4.227) and noted that Conservation Measures 90/XV and 104/XV were in force for the 1996/97 crab fishing season.

5.162 The Scientific Committee noted that, currently, the crab fishery is not considered commercially viable (Annex 5, paragraph 4.227). At present, the viability of the fishery is related to various economic factors rather than to stock abundance, and the Scientific Committee agreed that the fishery could become commercially viable in the future. In this regard, the Scientific Committee endorsed WG-FSA's view that a conservative management scheme as contained in Conservation Measure 104/XV is still appropriate for this fishery (Annex 5, paragraph 4.229).

5.163 The Scientific Committee further noted that Conservation Measure 90/XV expires after the 1997/98 crab fishing season so there is currently a need to re-evaluate the experimental crab harvest regime. Although the fishery is not currently commercially viable, such a re-evaluation seems especially pertinent since the conservation measure is very complex. The Scientific Committee commented that Conservation Measure 90/XV should not prohibit the development of a commercially viable fishery.

5.164 The Scientific Committee advised that Conservation Measure 90/XV should remain in force for the 1997/98 crab fishing season, but agreed that WG-FSA should re-evaluate Conservation Measure 90/XV at its next meeting. In respect of such a re-examination, the Scientific Committee reiterated the view that if new vessels enter the Antarctic crab fishery it would not be useful for these vessels to conduct depletion experiments during Phase 2 of the experimental harvest regime. Rather, it might be useful to redraft Phase 2 of the regime and require each vessel to repeat Phase 1 or to conduct a tagging study during its second season of participation in the crab fishery (SC-CAMLR-XV, Annex 5, paragraph 4.183).

Squid Resources

5.165 The Scientific Committee noted that WG-EMM had responded to its request to evaluate aspects of paper WG-FSA-96/20. This paper examined the potential impact of a fishery for *M. hyadesi* on predators. While WG-EMM did not feel that there was sufficient information available to conclude how the development of such a fishery was likely to influence predators (Annex 4, paragraph 6.83), WG-EMM did support the precautionary approach set out in the paper (Annex 4, paragraph 6.87). This approach includes the currently adopted practice of setting a squid catch limit at 1% of estimated predator demand (such a catch limit was implemented in Conservation Measure 99/XV).

5.166 The Scientific Committee further noted that the fishery for *M. hyadesi* was a new fishery, and additional, detailed discussions on this fishery can be found in the Agenda Item 9 (paragraphs 9.15 to 9.18).