ECOSYSTEM MONITORING AND MANAGEMENT (REPORT OF WG-EMM)

Environment

6.1 The Scientific Committee noted the analyses of environmental parameters undertaken by WG-EMM (Annex 4, paragraphs 6.1 to 6.10) and, in particular, the results concerning trends in environmental factors in Area 48 (Annex 4, paragraph 6.1):

(i) global ocean/atmosphere signals were evident in indices of the physical environment (sea-surface temperature (SST), air temperature, sea-level pressure, sea-ice extent etc.);

(ii) approximately four-year periodicity was evident in SST and the Antarctic Circumpolar Wave;

(iii) precession of SST anomalies across Scotia Sea was consistent with the FRAM advective transport model, suggesting transport of four to eight months between the Antarctic Peninsula and South Georgia;

(iv) global/atmospheric signals showed strongest coherence with South Georgia, weaker coherence with the Antarctic Peninsula and the South Orkneys implying different local influences; and

(v) a warming trend over the last seven years was apparent in the surface temperature data only at the Antarctic Peninsula and the South Orkneys.

CEMP Indices for Environmental Variables

6.2 The Scientific Committee recalled its deliberations on indices of environmental variables last year (SC-CAMLR-XVI, paragraphs 6.11 to 6.13) and welcomed the revised F2 (sea-ice) and F5 (SST) methods accepted by WG-EMM this year (Annex 4, paragraphs 9.39 to 9.46). These standard methods are now available for use in monitoring these parameters.

6.3 The Scientific Committee thanked South Africa, Russia, New Zealand, USA (Long Term Ecological Research program) and Australia (Australian Antarctic Division) for their contributions on long-term ice (F1 index), weather (F3 index) and snow (F4 index) observations at CEMP sites (Annex 4, paragraphs 9.47 and 9.48). The Scientific Committee noted that, not only were these Members the only ones to respond directly to the Scientific Committee circular in the intersessional period, they were also the major contributors of these data to CEMP. Others are known to have not responded because they did not have any data to contribute. Consequently, the Scientific Committee asked the Secretariat to proceed with the development of draft methods for the next meeting of WG-EMM using the data and methods now available.

Ecosystem Analysis

6.4 The Scientific Committee welcomed the continued development of Composite Standardised Indices (CSI) and noted that further development will require care in the choice of parameters to include in a CSI, including consideration of the correlation between indices, the time and space scales integrated by them, and the weighting factors that might be applicable (Annex 4, paragraphs 7.1 to 7.4).

6.5 The Scientific Committee also noted that these indices and other multivariate approaches are providing the means, at least in a preliminary way, by which results of CEMP can be used in assessing the status of the ecosystem. To this end, the Scientific Committee noted the two objectives for ecosystem analysis considered by WG-EMM (Annex 4, paragraph 7.6):

(i) understanding the autecological properties of species, and the interactions between ecosystem components; and

(ii) identifying predictive/operational models from which management advice can be derived.

6.6 The Scientific Committee endorsed the continued work of WG-EMM in developing further the multivariate approaches, including especially the exploration of the sensitivity of such analyses to the CSIs used.

Generalised Yield Model and Krill Yield Model

6.7 The Scientific Committee noted that the GYM is now available for general use (paragraph 5.36; Annex 4, paragraphs 7.9 and 7.10) and encouraged Members to undertake further testing of the program in the context of estimating yields for krill before its use in the assessments following the Area 48 synoptic survey. The Scientific Committee agreed that a high priority should be given to documenting and archiving the krill yield model so that it can be retained for cross-validation or for estimating yields should the need arise in the future (Annex 4, paragraph 7.11).

Krill-based Interactions

6.8 The Scientific Committee noted the general discussion on the coherence between results on temporal trends in krill abundance in different parts of the Scotia Sea and, in particular, the conclusions from the Workshop on Area 48 (Annex 4, paragraphs 7.12 to 7.18) that:

(i) proportional recruitment above an index value of approximately 0.3 was correlated with sea-ice extent in the Antarctic Peninsula;

(ii) krill density at South Georgia was associated with regional sea-ice and summer Southern Oscillation Index, in particular the low krill density, low sea-ice years of 1990/91 and 1993/94. In contrast, krill density at the Antarctic Peninsula was not associated with indices of physical variability; and

(iii) land-based and pelagic predator indices in Subarea 48.3 were correlated with summer krill densities but were also influenced independently by physical factors. In contrast, land-based predator indices in Subarea 48.1 were not correlated with krill or physical indices.

6.9 The Scientific Committee welcomed the discussion concerning the models of krill recruitment and looked forward to the development of a predictive model of krill recruitment based on variation in environmental parameters (Annex 4, paragraphs 7.19 and 7.20).

6.10 The Scientific Committee noted the discussions concerning the interaction of krill with plankton (Annex 4, paragraphs 7.22 to 7.26), fisheries (Annex 4, paragraphs 7.27 to 7.29) and predators (Annex 4, paragraphs 7.30 and 7.31).

6.11 The Scientific Committee considered that the two indices currently available for examining the potential localised effects of krill fishing on predators, the Schroeder index and the Agnew–Phegan model, need to be further evaluated by statistical experts before asking the Secretariat to begin analysing the performance of these models. It noted that these two approaches monitor different components of the fishery–krill–predator interaction. The Schroeder index monitors the geographic overlap of the foraging range of predators and fishing while the Agnew–Phegan index compares the relative consumption of krill by the fishery with the consumption of krill by predators. The Scientific Committee noted that a means of combining these indices, i.e. combining the degree of overlap in range of consumption with the magnitudes of consumption, may be a useful index to CCAMLR. Consequently, the Scientific Committee requests such work be submitted to WG-EMM for review as soon as practicable.

6.12 In addition, the Scientific Committee noted that other initiatives need further development in order to address issues relating to the potential localised effects of krill fishing on predators. These include:

(i) improving estimates of krill consumption by predators at appropriate spatial and temporal scales;

(ii) further development of existing models addressing predator–krill interactions (especially Mangel and Switzer, 1998) and functional relationships between predators and prey (e.g. Butterworth and Thomson, 1995); and

(iii) continuing investigation of the consequences of various types of conservation measure associated with precautionary approaches to management in these situations (e.g. SC-CAMLR-XII, paragraph 6.57). This will require a fresh dialogue with fishers to determine the manner in which fishing practices may be varied in local areas important to predators (SC-CAMLR-XII, paragraphs 6.65 to 6.69; CCAMLR-XII, paragraphs 8.39 to 8.45).

Fish- and Squid-based Interactions

6.13 The Scientific Committee noted the discussion concerning fish- and squid-based interactions (Annex 4, paragraphs 7.32 and 7.33).

Assessment of the Status of the Ecosystem

6.14 The Scientific Committee welcomed the progress made at the Workshop on Area 48 and the recent WG-EMM meeting in developing the tools (CSI and multivariate indices) for carrying out an ecosystem assessment and methods for presenting such an assessment (Annex 4, paragraphs 8.2 to 8.20). It noted that these methods are still being developed and require further work to fully understand how to interpret them (Annex 4, paragraph 8.20).

6.15 The Scientific Committee endorsed the development of the diagrammatic presentation of summaries of these data (Annex 4, Tables 1 to 5). Each parameter is represented as a bar graph of standardised normal deviates over time. In this way wide deviations from the norm as well as trends can be clearly seen. Additionally, some of the parameters have a five-year running mean alongside the graph to indicate general trends in the dataset.

6.16 The Scientific Committee noted that some of the interpretations and inferences in the WG-EMM report should be viewed with caution, especially where reference to correlations (e.g. Annex 4, paragraph 8.7), relationships between population size and breeding success (e.g. Annex 4, paragraphs 8.8 and 8.9) and conclusions in relation to the proximate causes of

population changes (e.g. Annex 4, paragraphs 8.8 and 8.16) are concerned. Greater use of CSI indices should improve future interpretations. In addition, the completeness of knowledge available to interpreters of these diagrams can affect their conclusions. For example, the rapid increase and subsequent decrease of gentoo penguins in Subarea 48.3 attributed by WG-EMM to migrations in relation to krill abundance (Annex 4, paragraph 8.11) had been analysed in considerable detail, especially in relation to deferred breeding in and after years of low krill availability, by Croxall and Rothery (1995). The Scientific Committee agreed that more rigorous methods for assessing trends portrayed in these diagrams need to be developed. It also agreed that WG-EMM should maintain assessment histories for each area, which would include details of published works explaining trends in these indices or associated factors. These would be very useful in order to help ensure that the absence of experts from particular meetings of the Working Group in the future would not prevent correct interpretation of these indices.

6.17 The Scientific Committee endorsed the program of work for further developing these methods by WG-EMM (in particular Annex 4, paragraphs 8.17(ii) and (iii) and 8.18) and, in particular, the Scientific Committee agreed that the properties of all CEMP parameters need to be understood in order to ensure that they are able to be interpreted correctly. It was noted that duplication of existing work should be avoided and that, where possible, previous work (e.g. the Workshop on Area 48) should be used as the basis for developing the assessment methods in WG-EMM.

6.18 The Scientific Committee recognised that the interpretation of some indices will be influenced by the spatial and temporal scales of sampling. As a first step to addressing this issue, the Scientific Committee requested that WG-EMM investigate the utility of presenting the annual trends in CSIs according to two times of the year, summer and winter, and two spatial scales, small (local) and large scale.

The Ecosystem Approach as Applied in Other Parts of the World

6.19 The Scientific Committee welcomed the introduction of this agenda item to the work of WG-EMM by Dr Everson and endorsed the aims to ensure that ideas and practices that are currently used elsewhere in the world can be considered for incorporation into the CCAMLR program and to ensure that the scientific work undertaken by CCAMLR receives consideration by other organisations, thus improving the awareness of its activities.

6.20 Mr Shotton offered the cooperation and support of FAO to hold an international meeting on the ecosystem approach to management and how various national and international bodies incorporate this approach into management of fisheries. He noted that FAO recognises CCAMLR has considerable expertise in this area, which could form the basis of such a meeting. The Scientific Committee welcomed this offer and asked that WG-EMM consider whether such a meeting would be possible soon after 2000. It also noted that the 1999 ICES/SCOR Symposium on Ecosystem Effects of Fishing should address ecosystem management issues.

Organisation of Future Meetings and Work of WG-EMM

6.21 The Scientific Committee noted the consideration given by WG-EMM to the organisation of future meetings, particularly the merits of having a major theme associated with the next meeting in order to minimise costs associated with meetings of specialists (Annex 4, paragraphs 13.2 to 13.7). It was noted that the work of WG-EMM will be concentrated on the Area 48 synoptic survey through planning in 1999 and analysis in 2000. Consequently,

additional themes may not be possible in the near future. Workshops provide another opportunity to bring together specialists on outstanding items of work requiring concentrated work.

6.22 The Scientific Committee noted the membership of two subgroups of WG-EMM established by the former WG-CEMP to carry out intersessional work (Annex 4, paragraphs 13.8 and 13.9):

(i) designation and protection of CEMP sites: Drs Penhale and Kerry, Prof. Torres and Dr P. Wilson (New Zealand); and

(ii) practical aspects of standard monitoring methods: Drs I. Boyd (UK), W. Trivelpiece (USA), V. Siegel (Germany), E. Murphy (UK) and Constable.

6.23 These subgroups are not exclusive and can involve others interested in participating in their work. The Scientific Committee agreed that Dr Fanta should be added to the subgroup dealing with the designation and protection of CEMP sites. The Scientific Committee agreed that the issue of membership of subgroups could be considered as a part of the agenda of WG-EMM in order that the work and membership of those groups can remain under review.

Interactions between WG-EMM and WG-FSA

6.24 The Scientific Committee noted the extensive work undertaken by the Secretariat to establish a comprehensive database on fish by-catch in the krill fishery (Annex 5, paragraphs 5.5 to 5.8). It was noted that WG-FSA was still unable to provide a clear indication of the likely impact of krill harvesting on larval and juvenile fish but that the Working Group reiterated the view that even a relatively low incidence of larval/juvenile fish in krill catches could result in a substantial impact on future abundance of key species in some areas. Scientific observations of krill fishing vessels, dialogue with fishers and sampling of blocks of frozen whole krill once landed would facilitate further assessment of this issue (Annex 5, paragraphs 5.9 to 5.12). Also, the Scientific Committee noted that studies on the distribution and abundance of larval/juvenile fish during the 1999/2000 synoptic survey for krill being planned by WG-EMM would be useful in this regard.

Convenership of WG-EMM

6.25 The Scientific Committee thanked Dr Everson for four excellent years as Convener of WG-EMM as well as his previous roles as Chairman of the Scientific Committee and Convener of WG-FSA, and expressed its appreciation to Dr Everson for agreeing to undertake a fifth and last year as Convener.