ECOSYSTEM MONITORING AND MANAGEMENT

General Comments

3.1 Dr Hewitt reported that the 2002 meeting of WG-EMM-02 was held from 5 to 16 August in Big Sky, Montana, USA. Intersessional activities had been conducted by correspondence groups on the subdivision of CCAMLR statistical areas into ecological units, on modelling approaches and on the feasibility of conducting krill predator surveys. Just prior to the meeting the steering committee for next year's review of CEMP conducted a one-day planning session. During the meeting the Subgroup on Designation of CEMP Sites, the Subgroup on CEMP Methods and the Subgroup on Predator Surveys met. A major part of the meeting was concerned with a workshop to delineate small-scale management units (SSMUs) for the krill fishery.

3.2 Conveners of these subgroups were:

- Harvesting Units – Dr A. Constable (Australia), to be replaced in the future by Dr S. Nicol (Australia) and Dr M. Naganobu (Japan);
- Modelling Approaches – Dr Constable;
- CEMP Review – Prof. Croxall, to be co-convened in the future with Dr C. Southwell (Australia);
- Designation of CEMP Sites – Dr Penhale;
- Methods – Dr Reid;
- Predator Surveys – Dr Southwell; and
- SSMU Workshop – Dr Trivelpiece.

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

(i) report of WG-EMM-02 (Annex 4) containing a listing of 'Key Points for Consideration by Scientific Committee' at the end of each major agenda item, as well as the report of the SSMU Workshop (Annex 4, Appendix D) and the report of the Steering Committee for the CEMP Review (Annex 4, Appendix E);

(ii) synopses of working papers (SC-CAMLR-XXI/BG/15) considered at the meeting, each containing an abstract and a summary of the findings and/or conclusions as they related to a particular agenda item; and

(iii) report of the Convener of WG-EMM-02 to SC-CAMLR-XXI (SC-CAMLR-XXI/BG/16) containing appropriate references to paragraphs in the report of WG-EMM-02.

The last two documents were requested by the Scientific Committee as aides to its discussions (SC-CAMLR-XX, paragraphs 18.3 and 18.4).

3.4 The Scientific Committee took special note of four items in the report of WG-EMM-02:

(i) the delineation of SSMUs for the krill fishery in Area 48. These divisions can be used in the short term to subdivide the precautionary catch limit for krill (SC-CAMLR-XIX, paragraph 5.15), and in the long term in the development of a feedback management scheme for krill (SC-CAMLR-X, paragraph 3.56);

(ii) the elaboration of work plans in preparation for the review of CEMP to be conducted during the 2003 meeting of WG-EMM. This will be the second step (after the establishment of SSMUs) in the long-range work plan to establish a feedback management scheme for krill (SC-CAMLR-XX, paragraphs 6.20 and 6.21). As part of this process the ecosystem monitoring requirements of alternative management procedures will be reviewed;

(iii) the extreme difficulty of predicting trends in the krill fishery given the absence of reliable information; and

(iv) reaffirmation of the need for detailed data on catch and effort for the krill fishery, but an inability to agree on when to introduce such a requirement.

Status and Trends in the Krill-centric Ecosystem

3.5 The Scientific Committee noted that WG-EMM reviewed the status and trends apparent in the CEMP indices provided by the Secretariat and concluded that 2001/02 was an average year in comparison to the time series of data available, and that there were no apparent differences between subareas within Area 48. Based on the Secretariat's review and preliminary analysis of selected CEMP data, the Scientific Committee concurred with the Working Group recommendations that:

(i) data submitters use the most current data forms;

(ii) additional information be provided in the comment fields to assist in data validation;

(iii) guidelines be developed for automated data collection;

(iv) the Secretariat should assess the utility of various indices of fishery–predator overlap while discontinuing the use of the Agnew–Phegan index; and

(v) the Secretariat undertake a major redesign of the CEMP database after the CEMP Review Workshop in 2003 (Annex 4, paragraphs 3.1 to 3.15, 3.40, 3.41 and 3.124 to 3.127).

3.6 The Scientific Committee noted that several papers describing various aspects of the foraging ecology of land-based krill predators were reviewed by WG-EMM preparatory to the SSMU Workshop. Discussion was organised around four broad areas of interest: satellite-tracking studies of predator foraging, estimates of prey consumption, issues of spatial scale, and overlap between predators and krill fisheries (Annex 4, paragraphs 3.16 to 3.41).

3.7 The Scientific Committee welcomed the contribution of a life table for Adélie penguins based on 12 years of demographic studies and encouraged the development of CEMP standard methods for the collection and analyses of demographic data (Annex 4, paragraphs 3.46 to 3.48).

3.8 The Scientific Committee noted that the annual increase of fur seal pup production in the South Shetland Islands has slowed from 13.5% per year between 1987 and 1994, to 8.5% per year between 1994 and 1996, to 0.9% per year between 1996 and 2002. The Scientific Committee also noted that the recovery of fur seals in the South Shetland Islands is different in several aspects to that reported for South Georgia and warrants further investigation (Annex 4, paragraphs 3.49 and 3.50).

3.9 The Scientific Committee noted that the Working Group reviewed evidence that age-1 krill are transported by currents into different regions of the Scotia Sea, but that regional differences in growth and mortality might determine the relative abundances of older age classes. Several participants noted the potential importance of regional variations in demographic parameters, retention of krill in the vicinity of island groups, and genetic variability to understanding krill population dynamics in the southwest Atlantic and hence the estimated yield from the CCAMLR-2000 Survey (Annex 4, paragraphs 3.54 to 3.59, 3.64, 3.129 and 5.33).

3.10 The Scientific Committee considered evidence presented by WG-EMM that krill recruitment was correlated across the southwest Atlantic sector of the Southern Ocean, from the Bellingshausen Sea to South Georgia, but uncorrelated with the Indian Ocean. Similar to the southwest Atlantic, interannual variability in krill recruitment in the Ross Sea appears to be high, while it appears to be less so in the Indian Ocean (Annex 4, paragraphs 3.60 to 3.69, 3.129 and 5.34).

3.11 The Scientific Committee considered a review of the Ross Sea marine ecosystem and agreed that the region had experienced relatively little commercial exploitation, had a long history of scientific exploration, and constituted a unique natural location to study the effects of climate change on ecosystem processes (Annex 4, paragraphs 3.88 and 3.89). The Scientific Committee noted the review of an Italian design for a survey of krill in the Ross Sea in 2003/04, which had been compromised because of a reduction in available ship time. The Scientific Committee advised adoption of the CCAMLR-2000 Survey protocols, so that the surveys may be comparable, and encouraged Italy and New Zealand to pool their research vessel resources in order to do so (Annex 4, paragraphs 3.116 to 3.123).

3.12 The Scientific Committee endorsed the recommended revision of CEMP Standard Method C2, Procedure B (Antarctic fur seal pup growth), which clarified issues of sampling and interpretation of this index (Annex 4, paragraphs 3.103, 3.104 and 3.130).

3.13 The Scientific Committee noted several developments in the processing and interpretation of acoustic data, including methods for the identification of krill, determination of target strength and analysis of distribution and abundance. The Scientific Committee also noted that these developments could result in reanalysis of historical krill surveys, including the CCAMLR-2000 Survey (Annex 4, paragraphs 3.105 to 3.110 and 3.128).

Generalised Yield Model (GYM)

3.14 The Scientific Committee noted that work is continuing with the development and validation of the GYM and proposed that sensitivity analyses be conducted to determine the effects of regional differences in the growth and mortality of krill on estimates of yield. A new user interface has been developed for the GYM, which is currently available on CD-ROM from the Secretariat. In addition, the main modules of the GYM are being recoded by a programmer in the UK, which will enable further validation of the model. The Secretariat is currently developing a reference database on all analysis software used by CCAMLR (Annex 4, paragraphs 5.32 to 5.41 and 5.56).

Harvesting Units

3.15 The Scientific Committee noted that work is continuing on the subdivision of large CCAMLR statistical areas into ecologically based harvesting units. Harvesting units may be further defined as those areas over which CCAMLR conservation objectives will need to be achieved (Annex 4, paragraphs 5.17 to 5.20 and 5.53).

Small-Scale Management Units

3.16 The Scientific Committee noted the results of the SSMU Workshop. The aim of the workshop was to define these units in order to facilitate the subdivision of the precautionary yield in Area 48 as requested by the Scientific Committee and the Commission. The units were delineated after collating and comparing information on krill distribution, krill predator foraging areas and krill fishing grounds. The full report of the workshop is attached to the report of WG-EMM-02 (Annex 4, Appendix D).

3.17 The Scientific Committee endorsed the SSMUs outlined below, and recommended that the units be used by the Commission as a basis on which to subdivide the precautionary catch limit for krill in Area 48. The Scientific Committee also noted that these units may be useful in developing management procedures for krill fisheries that can adequately account for localised effects on krill predators. The SSMUs and their nested hierarchy, as described in the report (Annex 4, paragraphs 5.21 and 5.22), are:

(i) Subarea 48.1
  (a) 48.1 Pelagic Area
  (b) 48.1 Land-based Predator Area
    (i) Western Antarctic Peninsula
    (ii) Drake Passage
      1. West
      2. East
    (iii) Bransfield Strait
      1. West
      2. East
    (iv) Elephant Island

(ii) Subarea 48.2
    (a) 48.2 Pelagic Area
    (b) 48.2 Land-based Predator Area
        (i) West South Orkney
        (ii) East South Orkney
            1. North
            2. South

(iii) Subarea 48.3
    (a) 48.3 Pelagic Area
    (b) 48.3 Land-based Predator Area
        (i) West South Georgia
        (ii) East South Georgia

SSMUs are illustrated in Figures 1 to 3.

3.18 The Scientific Committee noted that:

(i) this assessment is the first of its kind in CCAMLR;

(ii) this assessment used a variety of datasets that enabled the detailed analyses presented here, such that deficiencies in one dataset could be compensated by strengths in others;

(iii) fine-scale fisheries data were very important to the success of this assessment;

(iv) a number of uncertainties remain regarding the relationships between predators, krill and the fishery and further information on krill, krill movement, predator demand and predator foraging grounds may provide opportunities to refine these boundaries in the future;

(v) the next step is to develop an understanding of the linkages and dynamics between these areas in order to facilitate the subdivision of the precautionary catch limit for krill in Area 48, taking account of the oceanography and the environmental variability of the region;

(vi) this assessment has demonstrated the utility of satellite-tagging programs for an understanding of the relationships between predators, krill and the fishery, and, as a result, the workshop highly recommended further studies of this kind; and

(vii) the manner in which these proposed SSMUs are used may have implications for monitoring that would need to be considered by the Commission (Annex 4, paragraph 5.26).

3.19 The Scientific Committee further recommended that:

(i) the subdivisions described in the maps be considered the best available advice on SSMUs in the region (Annex 4, Appendix D, paragraph 5.31);

(ii) refinements to the boundaries may be required over time to fully meet the requirements of the Commission and that such proposals be considered as they arise;

(iii) submission of haul-by-haul krill fishery data is necessary for future assessments of activities in these units, and that concerns regarding data confidentiality should be addressed while maintaining the spirit and intent of the Rules for Access and Use of CCAMLR Data; and

(iv) consideration be given to using the proposed SSMUs as an alternative structure to the Integrated Study Areas for organising future work on the relationships between krill, krill predators and the fishery (Annex 4, paragraphs 5.27 to 5.31).

3.20 Prof. Croxall noted that the critical next step in the use of the SSMUs to subdivide the precautionary catch limit of krill in Area 48 appeared to rely on proposals from Working Group participants (Annex 4, paragraph 5.29). He suggested that it might be advisable to establish a subgroup with the task of clarifying the necessary procedures. Dr Hewitt replied that discussions on this topic were planned for future Working Group meetings with an expected recommendation for the Scientific Committee in 2004, that he expected these discussions to arise from consideration of working papers tabled at the meetings, that it was certainly possible to task a subgroup but that such a subgroup would still be dependent on contributions from individuals, and renewed his plea to Members to send experts to the meetings of WG-EMM so that progress can be ensured.

3.21 Dr Constable drew the attention of the Scientific Committee to the work plan of WG-EMM and that consideration of a subdivision of the precautionary catch limit would occur in 2004, in parallel with consideration of ecosystem models at a workshop of WG-EMM in that year.

3.22 Dr Kawaguchi noted the importance of high-resolution fishery data to the development and use of SSMUs for managing the krill fishery in Area 48. He noted that Japan was prepared to provide data for this work, but also noted that the rights of data owners must be acknowledged. He suggested the following conditions for use of haul-by-haul data:

(i) use of haul-by-haul data be limited to work in regard to SSMUs;
(ii) all copies of data must be returned to the owner; and
(iii) data analyses to be conducted in the presence of the data owner.

Dr Holt noted that access to fishery data was part of a broader topic of access to CCAMLR data and referred this issue to a subgroup for discussion (paragraph 15.1).

Future Work of WG-EMM

3.23 The Scientific Committee reviewed the report of the Interim Steering Committee for the CEMP Review (Annex 4, Appendix E) and endorsed the intersessional work plan. A Workshop on the Review of CEMP will be held during the 2003 meeting of WG-EMM with the following terms of reference:

(i) Are the nature and use of the existing CEMP data still appropriate for addressing the original objectives?

(ii) Do these objectives remain appropriate and/or sufficient?

(iii) Are additional data available which should be incorporated in CEMP or be used in conjunction with CEMP data?

(iv) Can useful management advice be derived from CEMP or be used in conjunction with CEMP data?

The Interim Steering Committee considered the terms of reference, the appropriate data and analyses required to address them, and the need to invite experts on the linkage of statistical and ecological models.

3.24 The Scientific Committee noted that the species profile and time-series data on *C. gunnari*, developed as part of the work of WG-FSA, may be useful in expanding the scope of the CEMP review. Of greatest value in this context would be long-term time series of data on standing stock and indices such as condition index, gonadosomatic index and diet.

3.25 The Scientific Committee noted the budgetary implications of the intersessional work plan in preparation for the Workshop on the CEMP Review. These include costs associated with invited experts and those associated with additional work required of the CCAMLR Data Manager (Annex 4, paragraphs 6.10, 6.12 and 6.13).

3.26 The Scientific Committee noted that substantial progress was made by the subgroup established last year to investigate the possibility of a synoptic survey of krill predator surveys. The subgroup laid out a long-range work plan that included reviews of existing methods and data, evaluation of new and emerging technologies, assessment of survey designs, and detailed logistic planning. It was agreed that the best strategy would be a series of staged regional surveys to be conducted over several years. Considering the substantial amount of preliminary work required, it is reasonable to expect actual survey work to begin in 2008/09 (Annex 4, paragraphs 6.17 to 6.26).

3.27 The Scientific Committee noted a number of ecosystem modelling activities currently under way in various parts of the world that may be useful to CCAMLR when considering appropriate models to underpin a feedback management scheme for krill. The Working Group agreed to maintain the correspondence group on modelling approaches to develop an agenda and prepare for a workshop on modelling to be held in conjunction with WG-EMM-04 (Annex 4, paragraphs 6.27 to 6.31).

3.28 The Scientific Committee reviewed progress by WG-EMM toward its long-term goal of developing a feedback management scheme for the krill fishery, by which management measures are adjusted in response to ecosystem monitoring. The Scientific Committee also noted progress toward the shorter-term request of the Commission to subdivide the precautionary catch limit of krill in Area 48 (Annex 4, paragraphs 6.33 and 6.34).

3.29 The Scientific Committee endorsed the long-range work plan of WG-EMM in the form of Table 1, which outlines the major issues and a timetable for addressing them. Activities include discussion of working papers, planning sessions for workshops, formal workshops with specified products, and the generation of recommendations to the Scientific

Committee (Annex 4, paragraphs 6.35 to 6.39). This table is an update of the timeline in SC-CAMLR-XX, paragraph 6.20.

3.30 Dr Hewitt noted progress on the four issues outlined in the table. He also noted that an essential element in the development of a revised krill management procedure was the definition of reporting requirements from the fishery, but that the Working Group had been unable to make progress on this topic (see also Annex 4, paragraph 2.74).

Management of Protected Areas

3.31 The Scientific Committee considered the management advice of WG-EMM with regard to deliberations of the Subgroup on Designation and Protection of CEMP Sites (SC-CAMLR-XXI, Annex 4, paragraphs 5.1 to 5.16).

3.32 The Scientific Committee recommended that the Commission (Annex 4, paragraph 5.52):

(i) approve the four management plans (WG-EMM-02/56, 02/57, 02/58 and 02/59) for protected sites containing marine areas that sought protection as Antarctic Specially Protected Areas (ASPAs) under the Antarctic Treaty (Annex 4, paragraphs 5.2 to 5.10);

(ii) transmit recommendations for improvements to the originators of the four plans (Annex 4, paragraphs 5.8 to 5.10);

(iii) endorse the following future tasks for the subgroup:

(a) review guidance for the production of maps of protected areas (Annex 4, paragraphs 5.11 and 5.12);

(b) review a paper to be produced by the Secretariat that summarises CCAMLR decisions related to the evaluation of Antarctic Treaty management plans containing marine areas that are submitted to CCAMLR for approval (Annex 4, paragraph 5.15);

(c) produce a paper summarising its current terms of reference (Annex 4, paragraph 5.15); and

(d) endorse revision of the subgroup name 'Advisory Subgroup on Protected Areas' (Annex 4, paragraph 5.16).

3.33 Dr Constable informed the Scientific Committee that Australia had recently proclaimed the Heard Island and McDonald Islands (HIMI) Marine Reserve and Conservation Zone (SC-CAMLR-XXI/BG/18). He indicated that Australia applies CCAMLR conservation measures in the region and that this proclamation would give additional capacity to conserve and monitor Antarctic marine living resources in its EEZ beyond the provisions of CCAMLR conservation measures.

3.34 Dr Constable referred to the advice of WG-FSA, which noted that the stock assessments in the region would not be adversely affected by the proclamation (Annex 5, paragraph 5.90).

3.35 Some questions regarding the applicability of this marine reserve designation to overall CCAMLR procedures followed. The Chair of the Scientific Committee noted that the reserve is located within the Australian EEZ and thus is subject to Australian law.

3.36 Several Members and observers congratulated Australia on its approach to marine conservation as evidenced by the establishment of the HIMI reserve.