

## ECOSYSTEM MONITORING AND MANAGEMENT

8.1 The Seventh Meeting of the Working Group on the CCAMLR Ecosystem Monitoring Program (WG-CEMP) was held in Seoul, Republic of Korea, from 16 to 23 August 1993 under the convenership of Dr Bengtson. The report of the meeting is attached as Annex 6.

8.2 The Scientific Committee noted that attendance at the Seventh Meeting had significantly improved on recent meetings, possibly reflecting the Convener's intersessional activities in soliciting enhanced participation. However, the absence of scientists from Brazil, France and New Zealand, all of whom have active programs of research in the Convention Area relative to the work of WG-CEMP, was regretted.

8.3 The Scientific Committee endorsed the suggestion that a newsletter describing the major results and conclusions of the work of WG-CEMP should be prepared by the Convener and distributed annually to interested individuals, initially comprising members of relevant groups within SCAR and scientists on the current mailing lists of WG-CEMP and WG-Krill.

## MONITORING PROCEDURES

8.4 The Draft Management Plan for the Protection of Cape Shirreff and San Telmo Islands, South Shetland Islands (SSSI No. 32) as a site included in CEMP, prepared by Chile and the USA, had been revised following discussions at WG-CEMP and was submitted as SC-CAMLR-XII/9. The Scientific Committee approved the Management Plan and authorised its submission to the Commission.

8.5 The Scientific Committee noted that no other proposals for protection of CEMP sites, for revision of existing standard monitoring methods, for new standard methods or for the inclusion of new species in CEMP had been received.

8.6 Specifically, the Scientific Committee felt that it would now be timely to receive Members' proposals regarding methods for those selected species for which no standard methods yet exist (viz, crabeater seals, Antarctic petrel, cape petrel). Given the extent of recent current research on breeding population size and breeding success of the two petrel species by, *inter alia*, Australia, France, Norway and South Africa, it should be possible to prepare draft standard methods for these parameters. The Members named above, in conjunction with other Members as appropriate, were urged to undertake this as a matter of some priority.

8.7 The Scientific Committee welcomed the progress made with initiatives designed to lead to the development of standard methods for studying, recording and reporting on diving behaviour and foraging performance of penguins and seals using data collected by time-depth recorders and related instruments. It endorsed the proposal of the Working Group (Annex 6, paragraphs 4.20 and 4.21) and approved including the suggested workshop as an item in the projected 1995 budget of the Scientific Committee, pending a formal recommendation from WG-CEMP next year.

8.8 Dr Croxall noted that the UK had tabled a paper on delimitation and analysis of Antarctic fur seal foraging bouts and indices derived therefrom requested in Annex 6, paragraph 4.14. It had also supplied Dr Boveng with all the data requested in Annex 6, paragraph 4.21. He suggested that prompt circulation of this paper and data submission might be of assistance to other Members who were preparing their own submissions.

8.9 The Scientific Committee congratulated the USA on its initiative in convening the workshop on researcher-seabird interactions and encouraged WG-CEMP to evaluate the implications of the workshop findings for CEMP Standard Methods; it endorsed the recommendation that Members maintain a detailed register of the use of implanted electronic tags, especially until a central database can be developed by SCAR (see Annex 6, paragraph 4.27).

8.10 The Scientific Committee noted with interest the research by Argentinian scientists into the use of otoliths retrieved from shag pellets as potential indices of the abundance of certain fish species in inshore waters. Discussions of this topic by WG-CEMP and WG-FSA (Annex 6, paragraphs 4.32 and 4.33; Annex 5, paragraph 7.8) indicated the need for detailed validation studies; the Scientific Committee encouraged Members to undertake such research.

8.11 The Scientific Committee noted the intention of WG-CEMP to consider at its next meeting the topic of expanding CEMP beyond its exclusive focus on the krill-based system. Some Members were concerned that there were at present insufficient time and resources adequately to undertake the work of WG-CEMP as currently circumscribed. Incorporating additional species and interactions might detract from the attention given to the topics of highest priority.

8.12 It was recalled, however, that amongst the reasons given by some Members for limited or no participation in the work of WG-CEMP was that their research was focussed on predator-prey interactions involving species and sites where krill was not, or not the main, dietary component of predators. This particularly applied to much research in the sub-Antarctic Indian Ocean sector.

8.13 In addition, the fish *Pleuragramma antarcticum* is a species selected by WG-CEMP as suitable for monitoring yet its principal predators, on which considerable research is being conducted, are not themselves species selected within the CEMP Program. It was possible,

therefore, that expansion of the scope of CEMP would not necessarily detract from the attention being given to existing priorities.

8.14 It was agreed that it was appropriate to review this whole topic at the 1994 meeting of WG-CEMP, ideally as one of the items to be considered in conjunction with the work of WG-Krill.

8.15 The Scientific Committee commended the work of the Data Manager in the analysis of sea-ice data to provide indices contributing to the environmental monitoring within CEMP. It approved the recommendation of WG-CEMP that all available historical data should be added to the database and noted that the creation of this database represented a valuable service to all Members of the Commission.

#### MONITORING RESULTS

8.16 The Scientific Committee noted the detailed review of the submitted data (Annex 6, paragraphs 5.3 to 5.20). It echoed the concern of WG-CEMP that only three Members (Australia, UK and USA) had submitted data this year and that only the UK had submitted any historical data.

8.17 Members collecting data under WG-CEMP procedures were reminded that they have an obligation to provide these data in time for analysis prior to the annual meeting of WG-CEMP. The work of WG-CEMP is being significantly impaired by the continuing failure of Members to provide data and it was agreed that the Commission should be asked to remind Members of the importance of submitting their data in a timely fashion.

8.18 The Scientific Committee welcomed the provision to WG-CEMP of a substantial volume of relevant information on prey in response to a request for:

- (i) fine-scale catch data, and particularly their distribution with respect to predator colonies;
- (ii) estimates of krill biomass in the Integrated Study Regions (ISRs); and
- (iii) results of fine-scale surveys and research on distribution, movements and behaviour of krill, especially in the vicinity of CEMP sites.

8.19 Of particular importance in this regard was the analysis by Japanese scientists of fine-scale fishery data from the 1991/92 season. The Scientific Committee commended this work and

endorsed the suggestion of WG-CEMP that similar analyses of the Japanese data for previous years should be made available and encouraged Russia and Ukraine to follow suit, especially for data from fishing grounds near CEMP sites.

8.20 Dr Shust indicated his interest in undertaking this task but noted that it would involve re-processing of existing fishery data. He stated that efforts are continuing to secure sufficient resources to allow this work to proceed.

8.21 The Scientific Committee noted the request of WG-CEMP for information on the availability of:

- (i) fine-scale fisheries data within 50 km and 100 km of CEMP sites;
- (ii) indices of krill availability to the fishery, product quality and catch length composition; and
- (iii) indices of krill cohort strength and recruitment derived from length frequency data (Annex 6, paragraphs 5.33 and 5.34).

8.22 Some Members noted that information and data answering these questions was already available in the reports of earlier discussions by WG-Krill (e.g., with reference to CPUE and related matters). Other Members, however, noted that it was not always clear from these reports the extent to which reliable annual indices were actually or potentially available. In any case, there was an obvious need for joint discussions between WG-Krill and WG-CEMP on this topic.

8.23 The Scientific Committee welcomed the considerable volume of data presented in relation to fine-scale surveys of krill in ISRs (Annex 4, paragraphs 5.35 to 5.45), noting especially the work of scientists from Germany, Japan, Republic of Korea and USA.

#### ECOSYSTEM ASSESSMENT

8.24 The Scientific Committee noted the large number of reports tabled under the WG-CEMP review of background information (Annex 6, paragraphs 6.3 to 6.28), representing much valuable research data from studies of predator population dynamics, predator-prey interactions, at-sea behaviour of birds and seals, krill population dynamics and interactions with the environment and surveys (including remote sensing) of the physical and biological properties of the marine environment.

8.25 The methods employed in the overall assessment of predator, prey, environment and fishery data (Annex 6, Table 5) by WG-CEMP were basically very similar to those used last year. That is, for some sites the assessments are based on the submitted quantitative data but for others they are based mainly on subjective assessments from other sources. Few, even subjective, environmental data are currently available and assessment of the krill catch and related data had been deferred for the attention of WG-Krill.

8.26 Nevertheless, even with these constraints, the Scientific Committee agreed that the assessment provided a valuable survey of available data. The Scientific Committee further noted the discussion by WG-CEMP of the performance of predators in 1993 and their conclusion that, generally, it was a year of normal-to-good conditions.

8.27 The Scientific Committee endorsed the view of WG-CEMP that it was desirable, at least for the predator data, to move to objective assessment based on the calculation of year-to-year changes and associated statistical significance of differences. This required a more rigorous process for the consideration of data by WG-CEMP and the Scientific Committee approved the guidelines set out in Annex 6, paragraph 6.35.

8.28 The success of this procedure will depend on the availability of adequate data of good quality. The Scientific Committee noted that WG-CEMP will be unable to perform adequate assessments unless more Members submit data.

8.29 The fact that WG-CEMP had finally reached the stage where, at least for some sites, it would be able to produce quantitative interannual comparisons of predator population characteristics and reproductive performance, re-emphasised the need to make progress with linking these predator-derived indices to the conventional management approaches being applied to the krill fishery. Some work on this topic has been initiated at the Joint Meeting of WG-Krill and WG-CEMP in 1992 but it should receive further consideration at the proposed joint meeting in 1994.

8.30 The Scientific Committee reiterated its concern that, despite the development of detailed guidelines for the conduct of standard surveys to estimate krill biomass in ISRs and in particular in the vicinity of CEMP sites, very few such data had been collected. The experiences of those Members who had undertaken such work would be of particular interest in respect of:

- (i) analysing and reporting the results of such data to facilitate interannual comparisons;
- and

- (ii) suggesting improvements to the existing recommended survey methods.

#### POTENTIAL IMPACT OF LOCALISED KRILL CATCHES

8.31 The magnitude and significance of the persistent geographical overlap between the krill harvests and the foraging range of krill-dependent predators during their breeding season, particularly in Subarea 48.1, have been the subject of considerable discussion and concern at previous meetings of WG-CEMP and the Scientific Committee. A thorough review of past discussions of the widespread concern about the situation and of the differing views about the requirements for precautionary action can be found in SC-CAMLR-XI, Annex 7, paragraphs 6.37 to 6.57 and SC-CAMLR-XI, paragraphs 5.24 to 5.37.

8.32 Up to and including 1992/93, the assessment of geographical overlap between the fishery and predators in Subarea 48.1 has been based on comparison of the fishery data at a scale of  $0.5^\circ \times 1^\circ$ , with the foraging ranges of predators (mainly penguins) based on the assumption of uniform distribution out to a nominal mean maximum distance. The analysis of the 1992/93 data in WG-Krill-93/10 indicates that the situation was broadly similar to that in previous years.

8.33 For the 1993 meetings of WG-CEMP and WG-Krill, Japanese scientists had, for the first time, used the very fine-scale data (10 x 10 n miles) for the krill fishery to investigate the spatial overlap between fishing and penguin foraging ranges (WG-Krill-93/7). The results indicated that at this finer scale of resolution, there was much less spatial overlap than hitherto calculated between fishing locations and penguin foraging areas, with the bulk of the krill catches coming from areas with smaller populations of penguins (and hence smaller krill requirements) and less of the catch being located in areas adjacent to high concentrations of penguins (WG-Krill-93/7).

8.34 The authors concluded that the present fishery is unlikely to have an adverse impact on the penguin populations for the following reasons:

- (i) the spatial overlap between the foraging areas of the majority of local penguin populations and the areas from which the main catch of krill by the fishery is taken is low; and
- (ii) the current catch by the krill fishery is low compared with the local krill biomass.

8.35 Furthermore, Mr T. Ichii (Japan) indicated that he intended to submit a revision of WG-Krill-93/7 to take account of some of the points raised by WG-CEMP (Annex 6, paragraph 6.53).

8.36 Notwithstanding this, some Members felt that, despite their recognition of the valuable contribution made in WG-Krill-93/7, their fundamental concerns over the situation have not changed significantly. In particular:

- (i) that the current catch in the area is low compared with local krill biomass does not mean that krill availability in the very restricted area open to predators with dependent offspring is sufficiently high to remain unaffected by krill catches in the same or adjacent areas; and
- (ii) even accepting that the analysis in WG-Krill-93/7 indicates reduced spatial overlap between fishing and predators would not mean that the smaller penguin populations associated with the larger local harvests were not adversely affected.

8.37 Consequently, some Members still felt that the Scientific Committee should recommend the establishment of additional precautionary measures to offer some prospect of mitigating potential problems for predators without imposing unnecessary or unacceptable restrictions on the krill fishery, given the assessment by some Members that:

- (i) at least some penguin populations were likely to be potentially significantly affected by fishing close to their breeding colonies;
- (ii) the likelihood of establishing whether or not any impact actually occurred without a decade or more of detailed research was low; and
- (iii) existing precautionary catch limits at area or subarea scale was inadequate to provide protection to these limited areas at critical times of year.

8.38 Other Members, however, stated that establishing additional measures was inappropriate and unnecessary in the light of present information. Furthermore, Mr I. Nomura (Japan) was critical of the rationale presented in paragraphs 8.36 and 8.37, since Mr Ichii's findings are based on quantitative data, albeit requiring some revision, and the arguments on uncertainties cited above were based only on conjectures of qualitative nature.

8.39 Last year there was agreement that the question of the potential impact of localised catches was one in which it was appropriate and useful to continue to explore the options and consequences of various management strategies.

8.40 In this context the Scientific Committee commended the Data Manager for carrying out the simulation analysis requested last year and described in SC-CAMLR-XI, paragraphs 5.42 and 5.43. Detailed discussion of the results of the simulation exercise are provided in Annex 4, paragraphs 5.34, 5.35 and 5.37 and summarised in Annex 6, paragraph 6.60. It had been agreed that this initial simulation had reproduced, at least in a general way, the magnitude and distribution of the catch (Annex 6, paragraph 6.62).

8.41 The Scientific Committee endorsed the suggestion for refinement of the model (Annex 6, paragraph 6.63) and hoped that further discussions of the implications of the existing and projected analyses would take place at the joint meeting of the WG-Krill and WG-CEMP in 1994.

8.42 As another aspect of this dialogue, Members engaged in krill fishing had been invited at the 1992 Scientific Committee meeting to consider and report on what potential measures or combination of measures would be acceptable for application with Subareas 48.1 and 48.2 in order to address the problem of providing some precautionary protection for land-based krill predators foraging within 100 km of breeding colonies between December and March (SC-CAMLR-XI, paragraph 5.40).

8.43 It was noted that in their response to this question (Annex 6, paragraph 6.66), discussions amongst Japanese fishermen had focussed on whether or not there was a need to impose fishing restrictions on the fishery rather than on exploring options for precautionary measures.

8.44 In light of the preceding discussion, the Scientific Committee agreed unanimously that it would be helpful for scientists from both fishing and non-fishing countries to continue their discussion exploring potential options for measures supporting a precautionary approach to the issue of potential impacts of localised fishery activity. In doing so, the Scientific Committee drew a clear distinction between discussions of the options of types of potential precautionary measures and the need to implement specific measures. It was emphasised that the current discussion should focus on potential options for precautionary measures. The possible need for implementing measures should be considered separately.

8.45 Several Members noted that there were numerous precedents within CCAMLR for the identification and implementation of precautionary measures, including those already in existence for krill. All these have come about through several years of prolonged, intensive discussion between scientists from fishing and non-fishing nations and their enactment had attracted widespread support for CCAMLR from within the Antarctic Treaty System and from other international resource management bodies.



## PREY REQUIREMENTS FOR KRILL PREDATORS

8.46 The Scientific Committee noted the advice of WG-CEMP that data assembled in 1992 on krill consumption by predators were adequate for most estimates of krill consumption by penguins, fur, crabeater and leopard seals. It noted further that Members requiring additional or more detailed information should contact the scientists responsible for the different elements of this compilation (see SC-CAMLR-X, Annex 7, paragraphs 6.8 to 6.24; SC-CAMLR-XI, Annex 7, paragraphs 7.2 to 7.9).

8.47 The approach to understanding functional relationships between krill availability and predator performance, initiated at the Joint Meeting of WG-Krill and WG-CEMP in 1992 (SC-CAMLR-XI, Annex 8), had made substantial progress during the year. The results of the analysis in WG-Krill-93/43 by Drs Butterworth and Thomson (South Africa) based on predator data submitted intersessionally by Drs Bengtson, Boveng (USA), Boyd, Croxall (UK) and Trivelpiece (USA) (Annex 6, paragraphs 7.9 and 7.10) had been extensively discussed by WG-Krill (Annex 4, paragraphs 5.12 to 5.21) and WG-CEMP (Annex 6, paragraphs 7.11 to 7.39).

8.48 There was general agreement that the analysis represented an important step forward and Drs Butterworth and Thomson and the scientists providing the data were thanked for enabling such rapid progress to be made.

8.49 Nevertheless, the initial analysis had identified a number of problems with, and questions relating to, the data submitted for the modelling exercise. In its report, WG-CEMP has responded to most of the queries which had arisen (Annex 6, paragraphs 7.17 to 7.28 and 7.32) but four questions had to be referred back to the originators of the data with a request to respond before 31 December 1993 (Annex 6, paragraph 7.31).

8.50 The Scientific Committee noted the discussion in WG-CEMP concerning the topic of assessment of functional relationships (Annex 6, paragraphs 7.34 to 7.38) and particularly the recommendation that all the analyses described in WG-Krill-93/43 need repeating using the correct data. It endorsed the request of WG-CEMP that Members should undertake these analyses as soon as the remaining data had been circulated. It would be extremely valuable to have some of these analyses available in time for the joint meeting of the two Working Groups next year.

8.51 The Scientific Committee agreed with WG-Krill (Annex 4, paragraph 5.16) that work on a two-way model (accounting also for effects of differing levels of krill consumption by predators) should not be started until the results of the re-analysis of the one-way model had been evaluated.

8.52 In further discussion it was emphasised that the intention was to use the one-way model to study the functional relationship by simulating the effects of different harvest levels on predator performance. The two-way interaction had related objectives but would require the compilation and analysis of significant amounts of new data.

#### LIAISON BETWEEN WORKING GROUPS

8.53 The Scientific Committee noted that numerous topics had arisen in the consideration of the reports of WG-Krill and WG-CEMP where joint discussions were essential to make effective progress. The Scientific Committee recommended that these two Working Groups should hold joint meetings in 1994 and welcomed the offer of South Africa to arrange these. Dr Holt, Vice-Chairman of the Scientific Committee, was asked to form an *ad hoc* group, including the Conveners of these Working Groups, to draw up the terms of reference and work program for the joint meeting.

#### OTHER BUSINESS

8.54 The Scientific Committee noted that most items of Other Business in the report of WG-CEMP were being discussed as part of other agenda items.

#### ADVICE TO THE COMMISSION

8.55 The Scientific Committee recommended that a short newsletter, describing major results and conclusions of WG-CEMP, be prepared and distributed annually following the completion of the Scientific Committee meeting (paragraph 8.3).

8.56 The Scientific Committee recommended that the draft Management Plan for the Protection of Cape Shirreff and San Telmo Islands, South Shetland Islands, be considered for adoption by the Commission (paragraph 8.4).

8.57 Members should be encouraged to maintain national registers of electronic tags and related banding data associated with their seabird research activities (paragraph 8.9).

8.58 The Scientific Committee suggested including funds in the projected 1995 budget for supporting a workshop on at-sea behaviour methodology, pending a formal recommendation from WG-CEMP next year (paragraph 8.7).

8.59 The Scientific Committee recommended that the Secretariat be asked to continue to obtain and process JIC data on sea-ice distribution and that all available historical data should be added to the database (paragraph 8.15).

8.60 Members should be reminded of the importance of submitting their CEMP data in a timely fashion and therefore were strongly encouraged to submit to the CCAMLR Data Centre all available predator data collected in accordance with CEMP Standard Methods (paragraph 8.17).