ANNEX 7

REPORT OF THE WORKING GROUP FOR THE CCAMLR ECOSYSTEM MONITORING PROGRAM

(Viña del Mar, Chile, 7 to 12 August, 1992)

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INTRODUCTION

1.1 The Seventh Meeting of the Working Group for the CCAMLR Ecosystem Monitoring Program (WG-CEMP) was held at the Hotel O'Higgins, Viña del Mar, Chile from 7 to 12 August 1992. The meeting was chaired by the Convener, Dr J.L. Bengtson (USA).

1.2 The Convener, on behalf of the Working Group, expressed thanks to the Government of Chile for inviting the Working Group to hold its meeting in Viña del Mar.

1.3 The Convener opened the meeting and welcomed participants. Scientists from nine Member countries, namely, Argentina, Australia, Chile, Italy, Japan, Norway, Russia, UK and USA, attended the meeting.

1.4 It was noted with regret that Brazil, who is actively involved in CEMP-related work and has supplied data to the CCAMLR Data Centre, was not able to send scientists to the meeting. The Convener reported that he had received a letter from the Brazilian Delegation conveying its apologies for not being able to arrange for a Brazilian scientist to participate in the meeting, and stating that it hoped to arrange Brazilian participation at future meetings of WG-CEMP. The Working Group welcomed this information and encouraged Brazil to make the necessary arrangements to include their scientists in the work of WG-CEMP.

1.5 The Working Group expressed concern that scientists from France, Germany, New Zealand and South Africa, all of whom have programs of direct relevance to CEMP, were not present at the meeting despite recent encouragement from the Scientific Committee (SC-CAMLR-X, paragraph 6.59) and Commission (CCAMLR-X, paragraph 4.19). Possible ways of encouraging scientists from these and other countries to actively participate in WG-CEMP were further discussed under "Review of Members' Activities".

ADOPTION OF THE AGENDA

2.1 The Provisional Agenda was introduced and discussed. It was suggested results of CEMP monitoring and reports of other related studies be considered under separate agenda items (Items 5

and 6). It was agreed that any matters arising from the Joint Meeting of the Working Group on Krill (WG-Krill) and WG-CEMP, which had not already been covered by major agenda items should be discussed under "General Matters". Two topics were proposed for consideration under "Other Business", namely, "Access to CEMP Data" and "IUCN Assessment of Marine Protected Areas". With these changes, the revised Agenda was adopted.

2.2 The Agenda is included in this report as Appendix A, the List of Participants as Appendix B, and the List of Documents submitted to the meeting as Appendix C.

2.3 The report was prepared by Drs P. Boveng (USA), J. Croxall (UK), K. Kerry (Australia) and E. Sabourenkov (Secretariat).

REVIEW OF MEMBERS' ACTIVITIES

3.1 During the past season Members were actively involved in monitoring and directed research in support of CEMP. In total, 72 documents were submitted for consideration at the meeting. A summary of Members' research activities are given in Tables 1, 2 and 3.

3.2 In 1991 the Secretariat was asked to propose a new format for Table 2 "Summary of Members' directed programs on assessing the utility of potential predator parameters". It was suggested that the table would be more useful if it summarised the data on each parameter collected and analysed by each Member in each year and if it allowed the inclusion of references to publications describing results of the analyses (SC-CAMLR-X, Annex 7, paragraph 3.3).

3.3 The Secretariat prepared a new format for Table 2 and circulated it to Members in advance of the meeting. A draft table was compiled from information available to the Secretariat and presented at the meeting. Participants made several amendments to the structure of the table, namely including information on future research and references to published results. This new format for Table 2 was adopted by the Working Group.

3.4 It was agreed that the report from the 1992 WG-CEMP meeting would include an updated Table 2 using the old format. The Secretariat was requested to contact Members during the intersessional period seeking information for the table using the newly adopted format, which will be included in the report of the next meeting of WG-CEMP.

3.5 Scientists present at the meeting provided brief reports on their recent and prospective activities as part of CEMP. A summary of Members' reports is attached at Appendix D.

3.6 A written report from New Zealand on their CEMP-related research program for 1992/93 was available to the meeting (WG-CEMP-92/24). Papers from New Zealand's penguin research were also available (WG-CEMP-92/21, 22 and 23).

3.7 It was noted that the research planned by Norway for 1992/93 at Svarthammaren, Dronning Maud Land (WG-CEMP-92/55) on the population dynamics of the Antarctic petrel represents research of direct relevance to the CEMP objectives on a species which is a designated indicator species for CEMP.

3.8 The Working Group agreed that both the New Zealand and Norwegian studies would be valuable contributions to CEMP. These research initiations were welcomed and the participation of scientists from these countries in the work of WG-CEMP was encouraged.

Members' Participation in CEMP

3.9 The Working Group again drew the Scientific Committee's attention to the situation that WG-CEMP did not have the benefit of contributions from several countries with active research programs of direct relevance to CEMP. Scientists from several Member countries, especially Germany, France, New Zealand and South Africa were known to be conducting research with relevance to CEMP, but they did not participate regularly in WG-CEMP meetings or contribute data. As noted above, Brazil has indicated that it hopes to increase its future participation in CEMP.

3.10 The Working Group commented that its analytical efforts would be strengthened considerably by having all Members participate in CEMP. With the aim of increasing participation, the Convener was asked to:

(i) send reports from the past two meetings of WG-CEMP, including the list of documents, and the CEMP brochure directly to scientists known to be involved in research of interest to CEMP; and

(ii) include with the above information a letter soliciting participation in WG-CEMP and contribution of relevant data.

3.11 Members were encouraged to provide to the Convener of WG-CEMP lists of names and addresses of appropriate scientists and researchers to be included in this mailing.

3.12 In regard to the request of the Working Group for material raising the awareness of CEMP and CCAMLR, Dr D. Vergani (Argentina) presented a video tape (described in WG-CEMP-92/43) concerning the biology of Adélie penguins and the principles of CEMP monitoring. The Working Group noted that the video was well produced and that it would be valuable for increasing the awareness of CEMP.

MONITORING PROCEDURES

Predator Monitoring

Sites and Species

4.1 No proposals were received for new additions to the list of designated CEMP species or monitoring sites.

4.2 Proposals were received for according protection, under Conservation Measure 18/IX, to the CEMP sites at Cape Shirreff, Livingston Island (WG-CEMP 92/4) and Magnetic Island, near Vestfold Hills, Princess Elizabeth Land (WG-CEMP-92/5).

4.3 The Working Group welcomed and supported, as a matter of principle, the protection of the CEMP site at Cape Shirreff. It was, however, unclear whether the proposed CEMP management plan was in exact conformance with the management already in effect under the Antarctic Treaty for Cape Shirreff as a Site of Special Scientific Interest (Number 32). The Working Group suggested that the Delegation of Chile revise the proposal during the intersessional period and resubmit it in time for consideration at the next meeting of WG-CEMP.

4.4 The Working Group supported the principle of according protection to the CEMP site at Magnetic Island. Although some questions were raised about some of the wording contained in the proposal, the concerns of the Working Group were of such a nature that it was felt the modifications could be accomplished by the Delegation of Australia in time for that delegation to submit the revised proposal to the 1992 meeting of the Scientific Committee.

4.5 To enhance the efficiency of Working Group operations it was agreed that three *ad hoc* subgroups should be established in order to review the details of future proposals relating to:

(i) designation and protection of monitoring sites and review of management plans;

(ii) practical aspects of standard monitoring methods and proposals for new methods; and

(iii) statistical aspects of monitoring methods.

4.6 The Convener was requested to consult with Members in order to form these *ad hoc* subgroups with the assistance of the Secretariat.

4.7 Each subgroup would be responsible for reviewing relevant submitted documents (including existing Standard Methods where appropriate) and presenting to the Working Group recommendations for appropriate action. Suggestions for future modifications to the Standard Methods will therefore only be considered on the basis of written proposals. These proposals should state the nature of and reason for the proposed change and should include the new text to be inserted in the method if the modification is accepted. Documents relating to the work of each of the subgroups will only be considered at a meeting of WG-CEMP if they are received by the Secretariat for circulation and review no later than three months prior to the start of the WG-CEMP meeting.

Procedures for Calculating Indices and Trends

4.8 At its 1991 meeting, the Working Group agreed (SC-CAMLR-X, Annex 7, paragraphs 4.27 to 4.34) that the Secretariat should compute indices that summarise the results of CEMP monitoring for each Standard Method, site, species, and year for which data have been submitted. The Working Group had also recommended that a document be prepared describing the methods of calculation of the indices, including worked examples and the computer source code used to accomplish the calculations.

4.9 WG-CEMP reviewed the document prepared by the Secretariat summarising these indices (WG-CEMP-92/7), and considered how each index is currently being compiled, as well as algorithms for simple comparisons among the indices and estimation of the statistical power of the methods to discern changes in each indexed parameter. The Data Manager noted that the FORTRAN code for all analysis routines is available from the Secretariat in a form appropriate for PC computers, as are the CEMP data from which the indices are derived. Members active in CEMP monitoring are encouraged to obtain and test the software on their own data sets and to critique the analytical methods.

4.10 It was noted that as calculations of indices are refined, the Working Group will need to establish a more statistically formalised approach to comparisons among sites, colonies, and years. Lic. E. Marschoff (Argentina) and others observed that most of the comparisons should be made in

an analysis of variance (ANOVA) framework in order to produce the correct standard errors and to avoid the statistical significance problems associated with multiple pair-wise comparisons.

4.11 The Working Group requested that Lic. Marschoff and other interested participants use the existing CEMP data to develop examples of ANOVA designs for consideration at the next WG-CEMP meeting. It was felt, however, that the current approach developed by the Secretariat will continue to serve as a useful format for preliminary comparisons that the Working Group has initiated and is likely to continue for the next year or two.

4.12 The Working Group agreed that WG-CEMP-92/7 should receive wider circulation, to ensure that it was available to scientists actually conducting CEMP monitoring. It was agreed that the paper should be included as an appendix to the CEMP Standard Methods for Monitoring Studies and also be published in the CCAMLR Selected Scientific Papers.

Field Research Procedures

4.13 Several papers were tabled (WG-CEMP-92/20, 24, 28, 44, and 47), describing developments in field research techniques of relevance to CEMP.

4.14 Dr S. Focardi (Italy) described a technique (WG-CEMP-92/47) by which cetaceans can be assayed for exposure to certain organochlorine pollutants by analysis of biomarkers using small skin samples collected with biopsy darts.

4.15 Dr Kerry described results of continued development of an automated weighing and data logging system for penguins (WG-CEMP-92/20). Weights of the birds are recorded automatically as they pass over a weighbridge. The system uses small, implantable passive transponder tags to identify individuals and record their arrivals and departures from the colony. The Working Group noted that development of this pioneering technology had progressed for several years and welcomed the announcement that it is now fully functional. It was also noted that other researchers, for example Professor Y. Le Maho of France, have successfully used similar technology for about the past year.

4.16 In response to a previous discussion by WG-CEMP on standardising and comparing procedural details that are difficult to portray in the Standard Methods (SC-CAMLR-IX, Annex 6, paragraph 85), Dr Vergani presented a video tape (described in WG-CEMP 92/44) concerning the Standard Methods for CEMP Monitoring. The Working Group thanked Dr Vergani for his contribution.

4.17 The Convener reported (WG-CEMP-92/28) on progress toward a workshop on methods to monitor the at-sea behaviour of penguins and pinnipeds (SC-CAMLR-X, paragraphs 6.9 to 6.10 and SC-CAMLR-X, Annex 7, paragraphs 4.45 to 4.52). Informal discussions between the Convener and scientists at the 1991 meeting of the Society for Marine Mammalogy suggested that there might be an opportunity to hold such a workshop in association with the next meeting of the Society, to be held in Galveston, Texas, USA, in late 1993. Many of the researchers who would be interested in such a workshop will already be in attendance at that meeting and some of the hosts of that meeting indicated interest in co-sponsoring such a workshop with WG-CEMP.

4.18 There is, however, a workshop planned for September, 1992, by Dr J.W. Testa at University of Alaska, Fairbanks, USA. This workshop will address analysis of data from time-depth recorders (TDRs), one of the topics of interest to CEMP. The Working Group agreed that the results of the Alaska workshop, as well as new results in preparation by the British Antarctic Survey, should be reviewed before proposing a specific time for scheduling a workshop sponsored by WG-CEMP to develop standard methods for monitoring.

Prey Monitoring

4.19 At its last meeting, WG-CEMP discussed the designs suggested by WG-Krill's Subgroup on Survey Design for monitoring prey in support of CEMP predator monitoring (SC-CAMLR-X, Annex 7, paragraphs 4.55 to 4.68). No proposals were received for new procedures or modifications to those discussed last year.

Environmental Monitoring

Land-Based Observations

4.20 The Working Group agreed that no changes were needed to parameters F1, 3 and 4. (Method F2, which pertains to sea-ice data on an ISR scale, is discussed below).

Remote Sensing

4.21 Following a detailed submission by the Secretariat in 1991 on the possibility of acquiring satellite imagery for routine monitoring of sea-ice distribution around CEMP sites, WG-CEMP and SC-CAMLR recommended and endorsed a pilot study to be undertaken by the Secretariat. The aims of the study were (SC-CAMLR-X, paragraph 6.19):

(i) to establish the mechanism for the acquisition of data on sea-ice distribution from satellite imagery;

(ii) to compute relevant parameters from these data, such as distance from the CEMP site to the ice edge, ice cover, etc.; and

(iii) to compute indices from these data for use by CEMP.

4.22 In the original submission by the Secretariat (SC-CAMLR-X/7), two spatial and temporal scales were identified;

Large, long time-scale: on the scale of the subarea, and over the whole year at two-week intervals. The Secretariat was asked to acquire data over an unspecified period in this category.

Small, short time-scale: on a 200 km radius from CEMP sites. The Secretariat was asked to acquire data from two sites (Mawson Coast and South Orkney Islands) over a two-month period, with an image every 5 to 10 days. These two areas were chosen because they are amongst the most problematic areas to obtain images from; the Mawson Coast area is on the limit of signal reception at Casey Station (Australia), and is a mainland site. The South Orkney Island group is in an area of highly variable meteorological and oceanographic conditions, and is also towards the limit of signal reception at Palmer Station (USA).

4.23 The Data Manager reviewed the Secretariat's report on the results of the pilot study (WG-CEMP-92/9). The Working Group thanked the Secretariat for the excellent report on the pilot study. The pilot study revealed that the weekly Joint Ice Centre (JIC) charts for the whole of Antarctica could be readily obtained and digitised weekly for areas of 0.5° latitude and 5° longitude. Percentage ice cover can then be compiled for larger areas and the distance of CEMP sites from the ice edge determined.

4.24 The Advanced Very High Resolution Radiometry (AVHRR) data were more difficult to obtain and images require special equipment and processing. Once obtained, however, the data are superior to the derived JIC data and provide information on a scale of 10 to 30 km. A major problem, however, is in obtaining cloud-free images and it was recommended that the images must be selected at the receiving station. Subsequent specialist interpretation of the charts was required.

4.25 Images obtained from November 1991 to February 1992 by the Australian Bureau of Meteorology were presented for the Mawson region and one undated image from the South Orkneys. Ice fronts derived from the Mawson images were included in WG-CEMP-92/36.

4.26 It was noted that although the data derived from the AVHRR images are superior to the broad-scale data obtained from JIC ice charts it was decided not to proceed with acquiring AVHRR data since it was felt that ice data on a broader scale were all that was needed at present. Furthermore, in view of the problems of obtaining and interpreting AVHRR data and the likely higher costs of the images and their processing, the JIC charts were sufficient at present.

4.27 It was noted that JIC data were derived from satellite images together with data from ground stations, aircraft, ships and other sources. The data, when further subjected to processing, can provide an indication of the ice conditions prevailing on a scale of 100s of km. The Working Group accepted these limitations and believed analysis of the JIC data might provide useful information for interpretation of trends in predator and prey on an ISR basis.

4.28 As a first step, the Working Group recommended that the Secretariat be asked to obtain relevant JIC ice data and ice edge position data for the three ISRs and Subareas 48.1, 48.2 and 48.3. These data should be entered into the CCAMLR Database according to Method F2.

4.29 The Secretariat was asked to prepare an estimate for the Scientific Committee's consideration of the resources that would be necessary to undertake this task.

4.30 The Working Group requested that the Secretariat analyse the relevant sea-ice data to calculate the following indices on a twice-monthly basis:

(i) maximum extent of ice cover by 5° intervals of longitude within each subarea; and
(ii) percentage ice cover (proportional ice cover by subarea).

4.31 The following additional indices should be calculated for the CEMP sites at Bird Island, Signy Island, Laurie Island, Seal Island, Cape Shirreff, Ardley Island, Stranger Point, Hope Bay and Anvers Island:

(i) date on which the ice edge advances northward past each site;
(ii) date on which the ice edge retreats southwards past each site;
(iii) total time (weeks) that sea-ice is within 100 km of each site;
(iv) distance from each site to the edge of consolidated sea-ice each week during the breeding season (September to April).

4.32 The data requested will allow WG-CEMP to relate data on predator indices (population size and breeding success), the presence of krill and the krill fishery to ice conditions (Standard Method F2). This attempt at comparing trends in environmental conditions to the status of predators and prey will be a useful guide to future research.

4.33 If possible, it would be desirable for data collection to begin at the start of the 1992/93 season (September 1992). Retrospective data from September 1985 to the present are also requested to compare data on predator performance, the presence of krill and the location of fishing. It was noted that 1986/87 and 1987/88 were years of extensive and heavy ice cover in the vicinity of the Antarctic Peninsula and so a comparison with other years would be valuable. It was also considered useful to conduct similar analyses of sea-ice data from prior years, particularly during the years when surveys from the BIOMASS program were being conducted. It was agreed that priority should be given to data collection from current and future years, and that past years should be added as time permitted.

Formats for Publishing Future Editions of the Standard Methods

4.34 At its 1991 meeting, WG-CEMP discussed the need for establishing a cost-effective mechanism for publishing future editions of the *Standard Methods for Monitoring Studies*. The Secretariat had been asked to evaluate various options for publishing Standard Methods in a format that would allow inclusion of new methods, revisions of established methods, and occasional addenda (SC-CAMLR-X, Annex 7, paragraph 4.5).

4.35 The Data Manager introduced the Secretariat's report suggesting a change in the Standard Methods publication format (WG-CEMP-92/10). A loose-leaf ring-binder system was suggested as offering the most efficient format for future editions. This format would allow circulating and replacing only the revised and/or new portions of the methods rather than having to publish the entire contents of the Standard Methods each time a change was made.

4.36 The Working Group agreed that the format recommended by the Secretariat should be used when publishing future editions of the Standard Methods. The format offers flexibility in updating the Standard Methods as they are revised and supplemented. Moreover, it is expected that this format will result in future cost savings, even though the immediate costs of initiating a ring-binder system are anticipated to be higher than continuing with the old format.

4.37 The Secretariat was asked to make appropriate arrangements for implementing the new format for the next edition of the *Standard Methods for Monitoring Studies*. It is hoped that the new edition might be available for distribution in November 1992, so that it could be used by field personnel during the 1992/93 austral summer field season.

REVIEW OF MONITORING RESULTS

Predator Data

Status of Data Submissions

5.1 A table showing the methods, sites, species, and years for which CEMP predator monitoring data have been submitted to the Secretariat was presented in WG-CEMP-92/13. A list of all CEMP colony and site codes currently in use was also provided. The Data Manager noted that some data were submitted too late to include in the table.

Report on Indices and Trends

5.2 This summary was presented in two parts, one containing results from monitoring of penguin species (WG-CEMP-92/8) and one pertaining to flighted seabirds and Antarctic fur seals (WG-CEMP-92/12). The first part contains a set of "instructions for users", to aid in understanding the results and in making comparisons. In both parts, tables were provided under each method showing the index value computed for each site, species, and year. Matrices were also presented, which represented the pair-wise absolute differences between the index values and the levels of statistical significance of pair-wise tests for differences.

5.3 The Working Group noted that it had been very helpful, for the purpose of detecting possible computational and reporting problems, to have the indices presented in tabular form; Members that have submitted data were encouraged to scrutinise very closely the results based on their data.

5.4 It was noted, however, that the tables would grow rapidly as more data were added; therefore graphical summaries to supplement the tables should be included as feasible by the Data Manager.

Standard Methods for Penguins

Method A1 - Mean Weight at Arrival

5.5 Although differences among many of the index values for this parameter were statistically significant, the Working Group found it difficult to ascribe ecological meaning to the differences considering the experience at the monitoring sites and the results presented below for other methods. It was noted that the data submitted thus far have not included information to allow weighted averaging of the data to account for possible day-to-day variations in arrival date over the period of data collection. This may explain some of the significant differences, though it was further noted that sample sizes recommended in the Standard Methods may actually be higher than is necessary to detect differences of the magnitude that would be considered ecologically meaningful.

Method A2 - Duration of Incubation Shift

5.6 Although few data have as yet been submitted for this parameter, several members noted that the durations of the second incubation shifts of Adélie penguins at Béchervaise Island were substantially longer than those (not part of CEMP data) at other sites. This might be explained by the rather large distances over which the Béchervaise penguins are foraging (see WG-CEMP-92/36).

Method A3 - Breeding Population Size

5.7 The breeding populations of three penguin species at the Signy Island were much smaller in 1991 than in the previous and subsequent years. It was noted that 1991 was a year of heavy sea-ice in that area, and that other predator parameters (discussed below) indicated poor conditions in that year for penguins and seals in the Elephant Island area and at South Georgia.

5.8 Several participants noted that data collected under Method A3 constitute some of the most basic information about the status of penguin colonies and that many studies initiated outside CEMP may have collected this type of data by methods corresponding to the Standard Methods. However, the list of sites for which such data have been submitted to CEMP is not as long as might be expected. Some of these data have been presented to the Working Group in working papers (e.g., WG-CEMP-92/6, 45 and 54). The Working Group noted that this type of data is much more useful to CEMP if submitted to the CCAMLR Data Centre using CEMP data submission formats and reiterated its request to Members to submit results to CEMP from studies that had collected data using methods comparable to the Standard Methods.

Method A4 - Age-Specific Recruitment and Survival

5.9 WG-CEMP has not yet specified data submission formats or requested that data be submitted for this method. It was acknowledged, however, that relevant data are being obtained at several sites using this Standard Method. The Working Group encouraged Members to prepare progress reports on their activities with Method A4.

Method A5 - Duration of Foraging Trips

5.10 Data from this method yield separate indices for the brood period and the creche period. Some of the reported index values for the brood period were thought to be in error (foraging trips were unrealistically short) and it was left to the originators of the data and the Data Manager to determine the nature of the problem.

5.11 The Working Group noted the striking variability in foraging trip duration of Adélie penguins at Palmer Station during the creche period in the three years from 1990 to 1992. Some members commented on the possible relationship between the variance in trip duration and the degree of patchiness in the prey availability.

Method A6 - Breeding Success

5.12 The Data Manager reminded those submitting data that Procedure C of this method requires a count of nests with eggs on the date when 95% of nests have eggs. Some of the submitted data did not include this count and therefore the indices could not be computed for those sites and years. In addition, some index values were felt to be in error; those values will be checked and corrected by the data originators in consultation with the Data Manager.

5.13 Dr Croxall noted that in 1991 there were decreases in breeding population sizes and a catastrophic failure of breeding success across all krill-eating seabird species at South Georgia.

Method A7 - Chick Weight at Fledging

5.14 As with parameter A6, this parameter exhibited a decline in the index at South Georgia during 1991.

Method A8 - Chick Diet

5.15 This method is designed to detect gross changes in the species composition of food delivered to penguin chicks. The Working Group suggested that the table of indices for this method should show the percentages of fish and *Euphausia crystallorophias* in addition to the values for krill and total crustaceans already presented.

5.16 The data collected thus far contain some interesting contrasts between the penguins studied in the Prydz Bay ISR and those in the Antarctic Peninsula ISR. For example, the proportions of krill and total crustaceans are much lower in the food delivered to chicks in Prydz Bay and the total weights of stomach contents tend to be lower as well.

Standard Methods for Flying Seabirds

Methods B1 and B2 - Black-Browed Albatross Breeding Population Size and Success

5.17 Because only one year of data from one site has been submitted thus far, no interpretation of the data was possible.

Standard Methods for Fur Seals

Methods C1 and C2 - Duration of Foraging Trips by Females and Pup Growth Rate

5.18 During the 1991 season at both South Georgia and Seal Island, female fur seals made trips of longer than average duration. Dr Croxall noted that researchers at South Georgia have verified that there is a negative correlation between annual estimates of foraging trip duration and of pup growth, as would be expected from other documented relationships between these parameters and prey availability.

Prey Data

5.19 The Convener, in introducing this item recalled that WG-CEMP had requested the following data to enable it to undertake its annual assessments and to formulate advice based upon an integrated perspective of predator, prey and environmental data (SC-CAMLR-X, Annex 7, paragraph 5.6):

(i) summaries of fine-scale krill catch data and an analysis of the distribution of catches relative to predator colonies;

(ii) the most recent estimates of krill biomass (or relative biomass) in each ISR and other subareas or meso-scale survey areas as estimates become available; and

(iii) results of specific fine-scale surveys near CEMP sites or surveys to determine aspects of distribution movements or behaviour, as they become available.

Fine-Scale Krill Catch Data

5.20 Fine-scale catch data in Statistical Area 48 as reported to CCAMLR for 1990/91 were summarised by the Secretariat (WG-Krill-92/13). It was noted that fishing began at South Georgia in July, shifted to the South Orkney Islands and next to the South Shetland Islands, and then returned to the South Georgia region again during the winter of 1991. Although some fishing around South Georgia was reported in November/December, there was virtually none between October 1990 and April 1991 during the critical breeding period for land-based krill predators.

5.21 The location of the krill catch in Subarea 48.1 was similar to the pattern of previous years (WG-Krill-92/18 and 19). Virtually all of the catches in Subarea 48.1 occurred within approximately 100 km of the north coast of the South Shetland Islands. Near the Seal Island CEMP site, fishing occurred from the end of November 1990 to January 1991 and from mid-March to mid-April 1991.

5.22 In Subarea 48.2, the fishery in 1991 mostly operated within 100 km of land. The locations of these catches were similar to those in 1987 and 1988, but it was noted that in 1989 and 1990, krill fishing occurred much further offshore than in the other years.

5.23 The Working Group welcomed the paper illustrating fine-scale positions of Russian krill fishing vessels in Subarea 48.1 during the season 1988/89 (WG-CEMP-92/30). Data on catch-per-day and catch-per-hour were also presented.

5.24 WG-CEMP commended Dr V. Sushin (Russia) and his co-authors for producing this valuable contribution, and agreed that it would be most helpful to receive reports of similar analyses from subsequent seasons. Dr K. Shust (Russia) indicated that he believed such data were available and that he hoped it would be possible to table such papers at future meetings of WG-CEMP.

5.25 Chile also presented a paper, WG-Krill-92/21, showing graphically the distribution of hauls and the CPUE data in the vicinity of Livingston and Elephant Islands for the 1991/92 fishing season. CPUE data for the period from 1987 to 1992 showed medium values in 1987, low values in 1989 and 1990 and comparatively high ones in 1988, 1991 and 1992.

5.26 The Working Group expressed their thanks to Chile and Russia for their excellent and timely papers describing fine-scale aspects of the krill fishery. Both datasets viewed in conjunction with the hydroacoustic data available from scientific surveys for the same region provided excellent comparisons of krill distribution and relative changes in abundance which will help in interpreting changes in predator performance in the region.

5.27 In recognising the value of haul-by-haul data, the Working Group recalled that Japan and Korea had previously indicated that they are unable to report haul-by-haul data as a result of legislation in their countries (SC-CAMLR-X, paragraph 3.90).

5.28 Dr M. Naganobu (Japan) noted that, in his opinion, for the purposes of scientific study and resource management, the most detailed data possible are often desired. However, to respect commercial confidentiality, he felt that international organisations generally do not request such detailed haul-by-haul information.

5.29 The Working Group again emphasised that obtaining such data would represent a valuable source of information on krill distribution and relative abundance. It noted that although haul-by-haul data may not be available from the Japanese fishery, it might be possible to request reports of combined krill catches on a scale smaller than currently required. For example, it would be useful to have the catch levels for combined hauls reported at a scale of approximately 10 x 10 n miles. The Working Group recommended that the Scientific Committee request whether domestic legislation would preclude Japan from reporting combined krill catches on a very fine-scale (e.g., 10 x 10 n miles) in areas within the CEMP ISRs.

Pleuragramma antarcticum

5.30 The Secretariat circulated a compilation of fine-scale catch data for *Pleuragramma antarcticum* in Division 58.4.2 for the years 1978 to 1989. Catches occurred between 31°E to 76°E south of 65°30'S. Total catches ranged from 30.6 tonnes (1980) to 984 tonnes (1985). The catch of 67 tonnes in 1988 was taken within the apparent foraging range of Adélie penguins at the Béchervaise Island CEMP site during the third quarter of the reporting period.

Estimates of Krill Biomass in ISRs

5.31 In response to WG-CEMP's request for broad-scale biomass estimates for krill in the ISRs, WG-Krill had provided estimates of krill biomass from hydroacoustic surveys. These data were derived from surveys conducted in limited areas within the ISRs (SC-CAMLR-XI/4, paragraph 5.53 and Table 4). Although many surveys have been undertaken, WG-Krill considered that estimates based upon recalculated data from the FIBEX surveys of 1980/81 provided the best synoptic estimates for the ISRs as a whole for South Georgia and the Antarctic Peninsula. The 1992 Australian survey was accepted as providing the best estimate for the Prydz Bay region. The discrepancy between data obtained in 1981 from *Walther Herwig* and other surveys for the Antarctic Peninsula were noted (SC-CAMLR-XI/4, paragraph 4.57). It was emphasised that the biomass estimates from WG-Krill were only applicable to the area covered by the surveys and should not be extrapolated to cover the total area of the ISRs.

5.32 The Working Group thanked WG-Krill for these estimates. WG-CEMP requested that WG-Krill update these estimates, as possible, to cover the entire area of the ISRs, and to incorporate new data as they become available.

Fine-Scale Surveys Specifically in the Vicinity of CEMP Sites

5.33 Dr R. Holt (USA) presented WG-CEMP-92/16 which described research undertaken by the US AMLR Program during the 1991/92 field season. He noted this was the fourth year of an ongoing program which carried out *inter alia* hydroacoustic surveys around the Seal Island CEMP site (near Elephant Island). These hydroacoustic surveys were conducted within a 60 x 130 n mile rectangle according to the standard method (SC-CAMLR-X, Annex 4, Appendix D, Attachment 4) supplemented with MOCNESS zooplankton sampling and CTD/rosette hydrocasts.

5.34 The hydroacoustic surveys were conducted between 19 January and 6 February 1992 and repeated from 25 February to 11 March. Krill biomass decreased from 2.2 million tonnes to 1.1 million tonnes during this period (WG-CEMP-92/15). This was in marked contrast to the results from surveys conducted in 1990 and 1991 when krill abundance increased from mid-January to mid-March. The reason for the decrease is not known. No fishing took place in the region during this time.

5.35 It was noted that several measures of reproductive success of chinstrap penguins at the Seal Island CEMP site varied in correspondence with the estimates of krill biomass, being moderately high in 1990, very low in 1991 and very high in 1992.

5.36 The Working Group welcomed the report on the AMLR Program prey surveys near the Seal Island CEMP site. Such prey surveys conducted within the foraging range of land-based predators during this critical breeding season greatly assisted the understanding of the dynamics of krill, its predators and the marine ecosystem as a whole.

Environmental Data

5.37 Having considered the Secretariat's report of the pilot study on the methods regarding the acquisition of sea-ice data (WG-CEMP-92/9) (paragraphs 4.21 to 4.33) the Working Group noted that there were no further data for review at the present meeting.

ECOSYSTEM ASSESSMENT

6.1 At their 1990 meetings, the Commission (CCAMLR-IX, paragraph 4.34), Scientific Committee (SC-CAMLR-IX, paragraphs 5.4, 5.39 and 8.6), and WG-CEMP (SC-CAMLR-IX, Annex 6, paragraphs 41 to 43) agreed that WG-CEMP should determine annually the magnitude, direction and significance of trends in each of the predator parameters being monitored; evaluate annually these data by species, sites and regions; consider conclusions in light of relevant information (e.g., prey and environment); and formulate appropriate advice to the Scientific Committee.

6.2 It was agreed that this annual assessment procedure should include a review of background information available to the Working Group in submitted papers, in addition to consideration of CEMP monitoring results, fishery data, prey surveys and environment data.

Review of Background Information

6.3 The Working Group noted that the many papers submitted for its meeting contain valuable information on the status of predator, prey and the environment. A selection of these papers was reviewed by participants under the general sub-headings "Predator Studies", "Prey Studies", or "Environment Studies".

Predator Studies

Population Trends

6.4 Information on breeding populations of Adélie penguins and elephant seals at Stranger Point, King George Island was analysed (WG-CEMP-92/6). Penguin populations declined in 1982/83 and again in 1987. A relationship between reduced breeding success of Adélie penguins and declines of female elephant seals was observed. The declines were thought to be related to environmental changes.

6.5 Adélie penguin populations in the Ross Sea area had increased in the 1980s. In contrast, penguin populations in the species in the Antarctic Peninsula area were stable or declining (WG-CEMP-92/21, 22 and 23). Adélie penguins in these areas mostly rely on different prey species (*P. antarcticum* in the Ross Sea and krill in the Peninsula area). The observed trend of increasing seawater temperature in the Ross Sea may be associated with better survival and recruitment of *P. antarcticum* and thus a better food supply for penguins.

6.6 A comparison of the population abundance of Adélie penguins at Hope Bay was made using 1991 data (WG-CEMP 92/45) and unpublished data from British Antarctic Survey (Croxall, pers. comm.). Breeding success of Adélie penguins was compared in zones of high human impact and those without such impact. No difference was observed in breeding success of penguins in the different zones. However, an increase of populations was observed in both zones but in different proportions. These differences appeared to be related to different rates of recruitment between these zones.

6.7 Two censuses of fur seals were conducted at Cape Shirreff, Livingston Island during the 1991/92 season (WG-CEMP-92/53). The total number of fur seals in December 1991 was 5 861 with 2 033 pups and in January 1992 it was 7 826 animals with 2 926 pups. These data were compared with counts in 1990/91 giving 4 750 animals with 2 000 pups. Dr A. Aguayo (Chile) noted that counts from the 1965/66 and 1972/73 seasons included both Cape Shirreff and Telmo Islands, but

were reported simply as counts for Cape Shirreff (Aguayo and Torres, 1967[1]; Aguayo, 1978[2]). Later counts have been reported separately. Therefore, previous interpretations of fur seal abundance and population growth rate at these sites may need clarification (Aguayo and Torres, in press[3]).

6.8 The effect of human disturbance on bird populations at Ardley Island was investigated (WG-CEMP-92/54). At present, it is not possible to distinguish among population changes due to human impact, environmental and/or fisheries effects.

Predator-Prey Interactions

6.9 WG-CEMP-92/38 provides the first detailed data on the depth, duration, frequency and timing of diving behaviour for macaroni penguins at the chick-rearing period at South Georgia. Modal dive-depths ranged from 5 m (night) to 20 to 35 m (day) with maxima of 11 m and 115 m, respectively. This indicates clearly the depth strata within which availability of krill is of relevance to this species. WG-CEMP-92/37 compares gentoo penguin diving pattern and performances in winter with similar data for the chick-rearing period (WG-CEMP-91/18). The major seasonal differences relate to frequency of foraging trips and mass of prey in stomachs rather than to changes in diving patterns. Various indices of foraging "effort" do not necessarily show simple, or direct relationships to foraging trip duration. Both studies derived from collaboration between UK and Japanese scientists.

6.10 The foraging ranges of six female and four male Adélie penguins breeding at Béchervaise Island near Mawson Station (Mac. Robertson Land) were determined by satellite tracking using the ARGOS system (November 1991 to January 1992) (WG-Krill-92/36). Birds were tracked during incubation and chick feeding periods. During the incubation period, birds made foraging trips to the continental shelf break approximately 110 km distant at its closest point. Birds feeding chicks continued to make some journeys of one to two days to the area of the Continental Shelf break. However, once fast-ice disappeared in mid-January, most foraging trips were less than 24 hours long and occurred within 12 km of the colony. There is potential therefore for overlap between the foraging range of Adélie penguins breeding along the Mac. Robertson Land and any future harvest

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1 AGUAYO, A. and D. TORRES. 1967. Observaciones sobre mamiferos marinos durante la Vigésina Expedición Antártica Chilena. Primer censo de pinípedos en las islas Shetland del Sur. *Rev. Biol. Mar., Valparaíso 13*(1): 1-57.

2 AGUAYO, A. 1978. The present status of the Antarctic fur seal, *Arctocephalus gazella*, at South Shetland Islands. *Polar Record (Field Work) 19*(119): 167-176.

3 AGUAYO, A. and D. TORRES. In press. Observaciones sobre el crecimiento poblacional de *Arctocephalus gazella* en Cabo Shirreff, isla Livingston, Antártica. *Ser. Cient. INACH 43*.

of krill in the region. The foraging range of the birds feeding chicks at Béchervaise Island may at times considerably exceed the 15 to 50 km determined for breeding penguins in the South Shetland and South Orkney Islands.

6.11 WG-CEMP-92/42 reviews past and present information on the nature and causes of population changes in Antarctic and sub-Antarctic seabirds, seals, and whales, particularly for the point of predicting effect of future environmental changes.

Predator Reproduction/Demography

6.12 WG-CEMP-92/39 reports the 1990/91 survey of breeding populations of fur seals at South Georgia; the total population is still increasing, albeit at a lower rate (<10%) than in the 1960 to 1975 period. WG-CEMP-92/40 shows that the duration of the perinatal period of fur seals is related to arrival and pupping date and that younger females tend to arrive later. In 1990/91, all females were in poorer condition, gave birth to smaller pups and had shorter perinatal periods. WG-CEMP-92/41 explains these latter relationships in more detail. Not only were foraging trips and pup growth indices significantly longer and lower, respectively, in 1990/91 but pup production and birth dates in 1991/92 were also reduced and delayed.

6.13 Factors affecting the breeding success of Adélie penguins in the Antarctic Peninsula area were investigated (WG-CEMP-92/46). The major cause was thought to be environmental effects.

Prey Studies

Krill Distribution/Abundance

6.14 Paper WG-CEMP-92/31 by Dr R. Makarov (Russia) presents a historical overview of krill biomass assessments and fishery data in the Atlantic Ocean Sector and adjacent waters of the Antarctic. The overview showed that commercial krill concentrations are found not only in well known areas in Subareas 48.1, 48.2 and 48.3 but also further to the east. The Bouvet Island area as well as coastal waters of the Weddell and Lasarev Seas are examples of such areas. Krill concentrations are also found in the coastal and open sea waters of the Scotia Sea.

6.15 Krill movement rates are evaluated in paper WG-CEMP-92/32 by Dr V. Popkov (Russia) taking into account published information as well as results of Russian surveys conducted in the Scotia Sea. It was found that in the north of Subarea 48.3, residence time of krill varied from 35 to

150 days in different years. These results imply two to three turnovers of krill biomass during the year in this area.

6.16 Paper WG-CEMP-92/35 analyses krill movement rates and water flow data obtained during a survey in a small area (8 x 6 n miles) in the southeast of Subarea 48.3. A high variability in krill patch distribution and biomass was found in the survey. Patches of krill were found at different depths ranging from 0-50 m to 5-150 m.

6.17 Papers WG-CEMP-92/33 and 34 complement each other. Results of these papers are based on a survey carried out by RV *Dimitry Stefanov* in the area to the north of South Orkney Islands (Subarea 48.2) in April 1992. The size of the survey area was 30 x 30 n miles. Data on water flow velocities and krill movement rates are reported.

6.18 Diurnal changes in such demographic characteristics of krill as size composition and sex ratio are described in the paper WG-Krill-92/9 for the area to the west of Coronation Island (Subarea 48.2). It was found that depending on the time of day and depth of sampling, krill have a different size composition and sex ratio.

6.19 Hydroacoustic surveys were conducted in the Prydz Bay Region (WG-Krill-92/23) in 1985, 1991 and 1992 for approximately the same area. Estimates of abundance for a standardised area of 350 000 km^2 were 7, 5 and 2 million tonnes in 1985, 1991 and 1992, respectively.

Krill Characteristics

6.20 A comprehensive review of available information on length/weight relationships for krill is given in WG-Krill-92/15. This information is of particular importance for diet studies of krill predators.

6.21 Length frequencies of krill collected from 1988 through 1992 around Elephant Island were investigated using cluster analyses to detect possible between-station differences in stock composition (WG-Krill-92/12). During the first four years, two distinct groups were identified; in the last year three groups were present. Length frequency distributions varied substantially between groups and among years. Information on strong and poor year classes of krill in the Antarctic Peninsula and Elephant Island region for the past 17 years were also summarised.

6.22 Acoustic and net sampling surveys for krill were conducted in the krill fishing area north of the South Shetland Islands from 18 January to 3 February 1991 (WG-Krill-92/26). Distinct offshore-inshore variability in abundance and maturity of krill were observed.

6.23 Shipboard tracking studies of penguins and female fur seals at Seal Island were conducted in early January 1991 to identify and evaluate their foraging areas (WG-Krill-92/27). Penguin foraging areas were found in inshore regions, where krill frequently occurred but not in high density. In contrast, fur seal foraging areas were found in offshore regions, where krill occurred only occasionally but tended to form large aggregations. These results were derived from a collaborative study by Japanese and US scientists.

6.24 Biological data for krill were collected from samples taken from 50 out of a total of 419 trawls taken by FV *Kirishima* during the 1990/91 fishing season (WG-Krill-92/33). The fishing grounds were located north of Livingston and King George Islands and north of Elephant Island. The sex composition of krill the first area was 65.1% females, 34.4% males and 1.4% juveniles. The sex composition for the second area was 47.1% females, 40.0% males and 12.9% juveniles. Males were more abundant in night catches, while females were more abundant in day catches. Catches in tonnes/mile and tonnes/hour were higher during daytime than during twilight and night time in both fishing areas.

Environment Studies

Oceanographic Characteristics

6.25 The RV *Kaiyo Maru* surveyed waters around the South Shetland Islands during the 1990/91 austral summer (WG-Krill-92/24). Two oceanic processes were found to be characteristic in this area. The first was the steady topographic upwelling of the Warm Deep Water and the second was the wind-driven coastal upwelling.

6.26 Information was reported on the hydrographic flux in the Statistical Area 48 (WG-Krill-92/25). Surface geostrophic flow was calculated from oceanographic data recorded since 1925. Geostrophic velocity and volume transport through five transects were calculated using data collected aboard RV *Kaiyo Maru* during the last nine years.

Assessment of Predator, Prey, Environmental, and Fishery Data

6.27 At its 1991 meeting, WG-CEMP reviewed the first sets of data submitted to the Secretariat under the CEMP monitoring protocol but noted that there were insufficient data and calculated indices to begin the assessment process described above. With the inclusion of data submitted prior to the 1992 meeting (1992 monitoring results and additional historical data) and the availability of

calculated CEMP indices, there were sufficient results to begin considering trends and patterns among CEMP sites, species and years at the present meeting.

6.28 As a first approach to synthesising the CEMP predator data, fishery catch data, prey survey data and environmental data, the Working Group assembled Table 4. Summaries of the data were evaluated to indicate whether the data suggested low, average or high krill abundance and availability to predators. It was emphasised that the krill catch data were included for the purpose of providing an indication of the relative abundance of krill in certain years and areas, and not for the purpose of attempting to detect the potential effects of the fishery on predators or prey.

6.29 The summaries for Subarea 48.1 (Table 4.1 to 4.5) showed clearly that 1991 was a year of poor availability of krill. The breeding success and breeding population size of penguins were low at Seal Island, King George Island, and Anvers Island. Fur seal feeding trips and weight of pups on 1 January also indicated poor conditions at Seal Island in that year.

6.30 Data on Adélie and chinstrap population changes and breeding success in Subarea 48.2 (Table 4.6) dearly identify 1991 as a poor year (although the high survival of chinstrap chicks suggests a late season improvement in food availability). Similarly, 1989 and 1992 can be characterised as good years.

6.31 In Subarea 48.3, predator data indicated poor availability of prey in 1991 and relatively good availability in 1989 and 1992 (Tables 4.7 and 4.8). Late-season growth of fur seal pups in 1991 at South Georgia indicated that prey availability had improved, a finding consistent with fur seal data from Seal Island in Subarea 48.1.

6.32 It was noted that poor years for black-browed albatross in 1988 and 1992 at South Georgia were thought to be primarily due to the presence of heavy snow in the breeding colonies and not to a lack of prey availability; this emphasises the need to record local environmental conditions when monitoring predators. The Working Group agreed that columns for snow and ice within predator colonies should be added to the environment portions of Table 4.

6.33 The Working Group observed that 1991 appeared to be a year of poor krill availability to predators across all three subareas of Statistical Area 48. These effects were most easily recognised in the data from predator breeding success and population size. It was noted that the krill catch data, in some cases, do not show any apparent pattern consistent with predator and prey survey data. For example, in Subarea 48.1, the krill catch was not anomalous in 1991, but research surveys found low krill biomass in January and February.

6.34 Several factors that could make the krill catch data unreliable for indicating, even in a very general way, the availability of krill to predators were identified: (i) only a portion of the total catch is sometimes obtained in the same season in which the predator parameters are monitored; (ii) economic fluctuations affect fishery effort; and (iii) in Subareas 48.1 and 48.2 the fishery moves between several areas among which the concentrations of krill may not be well correlated.

6.35 The Working Group also noted that it would be helpful to have additional information indicating the relative availability of krill to the fishery in each year for the several subareas. This information might include additional or different measures of effort as well as subjective assessments from experts with experience in the fishery (e.g., reports containing the general impressions of fishing captains on whether it was a relatively good or bad fishing season).

6.36 The Working Group noted that this first effort in bringing together the predator, prey, environmental, and fishery data was of necessity a coarse treatment of the data, with a focus mainly on the presence and directions of changes. Future efforts should include consideration of the magnitudes and significance of changes.

Potential Impact of Localised Krill Catches

6.37 Last year WG-CEMP, in considering the fine-scale data on distribution of krill catches, noted the extensive temporal and spatial overlap between krill harvesting and foraging by land-based predators, especially in Subarea 48.1. It agreed that this demonstrated the potential for significant competition between the fishery and krill-dependent predators.

6.38 The Scientific Committee unanimously endorsed these conclusions, noting that a situation whereby a substantial krill fishery consistently operates within the foraging range of krill-dependent predators at a critical time of year (when the predators have dependent offspring), had long been identified as a most serious concern and one where close and urgent attention needs to be given to appropriate management action (SC-CAMLR-X, paragraph 6.29).

6.39 The Secretariat had continued the assessment of catch distribution with respect to predator colonies, incorporating the 1991 fine-scale data (WG-Krill-92/13) in WG-Krill-92/18. The overall picture for Subarea 48.1 was still remarkably consistent in all four years (1988 to 1991) for which data are available, with 96 to 98% of the krill catch from December to March in the subarea being taken within the critical period-distance[1] for foraging activity of breeding penguins and fur seals. For

[1] December to March within 100 km of predator colonies.

Subarea 48.2, the 1991 data showed 81% of the catch taken within the critical period-distance, similar to 1987 (83%) and 1988 (96%) and very different from 1989 (5%) and 1990 (17%).

6.40 Within the critical period-distance krill catches continued to be a significant fraction of the estimated krill requirement of breeding penguins; for 1991 the catch was 12% and 31% of the combined take of krill by the fishery and by penguins in Subareas 48.1 and 48.2, respectively.

6.41 The Secretariat was thanked for undertaking this valuable analysis and asked to continue to provide this documentation to WG-CEMP on an annual basis.

6.42 Dr Shust noted that in most years the location of the fishery within Subarea 48.1 changes during the season, which will tend to reduce the level of impact in any one part of the subarea. To assess the nature and significance of this the Secretariat was asked in the future (and also retrospectively if possible) to analyse the fine-scale data for the Elephant Island area separately from the rest of Subarea 48.1 and to consider if there were other parts of the subarea which could realistically be subdivided (e.g., Livingston and King George Islands).

6.43 Dr Shust also noted that some penguin colonies used in the calculation of krill consumption by predators were from the southern coast of the South Shetland Islands, whereas the fishery was virtually confined to the waters off the northern coast. It was explained, however, that not only were the fishing grounds (at least as deduced from the maps of the fine-scale data) within the theoretical foraging ranges of penguins from these colonies but that the colonies along the northern coast account for about 90% of the penguin biomass in the subarea.

6.44 There was agreement that the 1991 data strongly reinforced last year's findings in respect of the localised distribution of fishing effort. WG-CEMP reiterated the importance of enhanced research activity in Subareas 48.1 and 48.2, especially:

(i) urgent research into krill biomass, productivity and fluxes;

(ii) improving estimates of the prey requirements of land-based predators; and

(iii) enhancing the CEMP activities, especially expanded monitoring operations in Subarea 48.2 and, as a high priority, conducting monitoring at one or more additional sites on the north coast of the main South Shetland Island group.

6.45 The Working Group recalled last year's statement by the Scientific Committee noting the urgency of examining precautionary management measures to address the overlap of the fishery and krill-dependent predators in the critical period-distance zone (SC-CAMLR-X, paragraph 6.30).

6.46 Dr Naganobu, however, stated that he believed there was no urgency to consider the impact of the krill fishery on predators. He felt that both WG-Krill and WG-CEMP were too concerned about this matter and that considering possible precautionary catch limits for krill based on predator-fishery interactions was premature. The reasons for this opinion were that:

(i) the krill fishery is still small and none of the countries fishing at present has expressed an intention to expand its fishery in the near future;

(ii) there is no evidence that krill fishing has had an adverse influence on predators and that more scientific information (e.g., as described in paragraph 6.44 above) should be collected before management measures are considered; and

(iii) a realistic estimate of the krill requirements of predators has not yet been provided.

6.47 In addition he felt that it was sufficient to consider only penguins for calculations of predator demand when considering overlap between the fishery and predator foraging ranges. This is because the foraging range of fur seals extends beyond the fishing grounds and thus overlap between the fishery and this predator is much less.

6.48 Other members were very concerned at this statement which seems to run contrary to the spirit of the Convention, the content of Article II of the Convention and the expressed policy of both the Scientific Committee and Commission.

6.49 It was felt entirely proper for WG-Krill and WG-CEMP to give serious and urgent consideration to the circumstances whereby substantial krill catches are taken annually from within a very restricted area at a time of year when krill-eating predators, trying to rear offspring, are restricted to the same area. Indeed it would be difficult to imagine a situation of greater potential concern to WG-CEMP.

6.50 It is true that there is no evidence that krill fishing has had an adverse influence on predators. Equally, there is no evidence that there has <u>not</u> been an adverse effect. Indeed it is difficult to see how the situation described above can fail to have <u>some</u> adverse impact on krill-dependent predators. Many of the research initiatives within WG-Krill and WG-CEMP are designed to try to quantify the nature and magnitude of any such effects. However, there is no prospect of cause-

effect relationships being established without many years of detailed study of krill abundance, availability and movements and of predator abundance, distribution and energetics. In the meantime it is essential to consider appropriate precautionary management measures, including, but not confined to, catch limits.

6.51 Dr Bengtson cleared up an apparent misapprehension concerning fur seal foraging ranges, noting that the available data in Subarea 48.1 indicated that nearly all foraging by breeding female fur seals takes place within 100 to 110 km of their breeding site.

6.52 Some members noted that the existing interim estimates of krill requirements of penguins and fur seals at this time are entirely realistic as minimum values of krill requirements of dependent species in the critical period-distance zone and are also the best data currently available.

6.53 Last year the Scientific Committee had agreed unanimously to examine precautionary management procedures relating explicitly to the overlap between the krill fishery and dependent predators. To facilitate this, discussions had been initiated with Members conducting krill fishing in Subareas 48.1 and 48.2, initially by posing questions relevant to the characteristics of the fishery and the consequent implications of various options for potential future conservation measures (SC-CAMLR-X, paragraph 6.36).

6.54 Members involved in the krill fishery had provided much useful information concerning the operations of their fishery, leading to extensive and valuable discussion at WG-Krill (SC-CAMLR-XI/4, paragraphs 5.1 to 5.35).

6.55 It was re-emphasised that the object of developing precautionary measures in this context is to try to identify management measures to afford adequate protection for krill-dependent predators in specific areas at critical times of year without this protection causing unnecessary or unacceptable restrictions for the krill fishery.

6.56 WG-CEMP recommended that the Scientific Committee consider defining zones within Subareas 48.1 and 48.2 for specific areas where there was a consistent pattern of commercial fishing within the critical period-distance of the foraging activities of land-breeding penguins and fur seals. A precautionary approach to management could be accomplished by applying management measures, or a mixture of measures, in such zones. WG-CEMP noted that WG-Krill had listed and elaborated options for management measures to control fishing in specific areas (SC-CAMLR-XI/4, paragraphs 5.46 to 5.51).

6.57 WG-CEMP also recommended that the Scientific Committee invite Members currently engaged in fishing for krill to consider and report on what potential measures, or combinations of measures, would be acceptable to them for application within Subareas 48.1 and 48.2 in order to address the specific problem of providing some precautionary protection for land-based krill predators foraging within 100 km of breeding colonies between December to March inclusive.

ESTIMATES OF PREY REQUIREMENTS FOR KRILL PREDATORS

7.1 This topic is being addressed by WG-CEMP in relation to:

(i) assessing significance (in terms of ecological and management implications) of overlap (geographical and temporal at a variety of scales) between the krill fishery and krill-dependent predators;

(ii) contributing to management objectives under Article II of the Convention (SC-CAMLR-X, Annex 7, paragraph 6.1).

Review of Progress

7.2 The Working Group considered first the progress made on initiatives developed last year to address the first set of objectives (SC-CAMLR-X, Annex 7, paragraph 6.8 to 6.24).

Synthesis of Fur Seal and Penguin Data

7.3 For the South Georgia ISR the latest data synthesis (and presentation of published results) remain those published in SC-CAMLR-VIII/BG/12 and BG/15, updated as described in WG-CEMP-90/31[1]. WG-CEMP-92/50 summarises all relevant published data for Antarctic fur seals, including the mass-specific energy costs of a range of breeding season activities. It also summarises current research which will significantly improve understanding of activity-specific energy budgets.

7.4 For the Antarctic Peninsula ISR WG-CEMP-92/17 reviews available data on penguin population size, breeding timetable, diet and body mass. WG-CEMP-92/18 similarly reviews data on metabolic rates, foraging ranges and assimilation efficiencies of penguins. These are a most valuable

[1] In: *Selected Scientific Papers, 1990 (SC-CAMLR-SSP/7)*: 489-520.

compendium of information and provide an excellent basis for use in ISR-wide prey consumption models. Members with relevant additional data are asked to make them available as soon as possible. WG-CEMP-92/19 synthesises available data for Antarctic fur seals in this ISR, which, together with appropriate data from the studies summarised in WG-CEMP-92/50, provide a good basis for assessing prey consumption of the breeding population of Antarctic fur seals in this region.

7.5 WG-CEMP-92/49 presents a review of data on breeding population size, diet and energy budgets of predators in the Prydz Bay ISR. Although this review is by no means fully comprehensive, it is a starting point for further efforts and provides useful information for inclusion as input parameters in modelling studies of prey requirements of krill predators.

7.6 The magnitude of these data compilation tasks have precluded any attempt to provide WG-CEMP, or the Scientific Committee, with interim estimates of predators' prey requirements based on these new data (SC-CAMLR-X, Annex 7, paragraph 6.21).

7.7 In any case, in the light of the recent discussions between WG-Krill and WG-CEMP and the plans for alternative priority activities developed there, it was agreed that developing interim estimates is now of less immediate urgency.

Synthesis of Crabeater and Leopard Seal Data

7.8 The results of the study investigating the feasibility of constructing energy and prey consumption budgets for crabeater seals were tabled as WG-CEMP-92/25. In the time available it had not been possible to make any similar compilations for leopard seals, for which relevant data are very sparse in most areas. The Working Group noted that the crabeater seal document was not only a valuable compilation but also represented a pioneering attempt to construct an energy budget for an Antarctic ice-breeding seal. It would be most valuable to incorporate these data into ISR prey consumption models in addition to the data for penguins and fur seals.

7.9 Dr D. Torres (Chile) reported that Chile had data from an aerial survey of seals around the South Shetland Islands in November 1980 which might be relevant to the above synthesis (Torres *et al.*, 1981[1]).

[1] TORRES, D., J. YAÑEZ, M. GAJARDO and M. SALLABERRY. 1981. Registros aéreos de mamíferos marinos y aves antárticas en las islas Shetland del Sur. *Bol. Antart. Chileno 1*(2): 6-10.

Advice of IWC Concerning Whales

7.10 Correspondence with the Scientific Committee of the International Whaling Commission regarding the availability of data for estimating energy requirements of baleen whales was reported in WG-CEMP-92/27. It was agreed that the Convener should thank Dr Hammond for this response and request that CCAMLR be informed when abundance estimates for minke whales (from IDCR sightings cruises) and data from the Japanese scientific catch on diet and energy requirements become available.

Data on Seabirds Other than Penguins

7.11 There had been little progress intersessionally on this topic, except for that reported in WG-CEMP-92/49 for Prydz Bay. Dr W. Trivelpiece (USA) noted that extensive data for King George Island were available in the review by Jablonski (1986)[2]. It was noted that Dr W. Fraser (USA) was reviewing the status and distribution of the Southern giant petrel throughout the Antarctic (i.e., including the Antarctic Peninsula ISR) as part of an ongoing initiative coordinated by the SCAR Bird Biology Subcommittee. Members with relevant data were asked to send them to Dr Croxall who would ensure that CCAMLR received a copy of the resulting synthesis from SCAR.

Future Progress

7.12 WG-CEMP decided that given its existing priorities for future work (which were recently modified according to recommendations from the Joint Meeting of WG-Krill and WG-CEMP) it was not advisable at present to schedule a major collaborative workshop to review in detail krill consumption by predators in the ISRs. Members were encouraged to provide WG-CEMP with updated estimates of krill consumption for ISRs or parts thereof. They were also asked to continue to accumulate relevant data to improve the basis for the models in preparation for a full-scale workshop to be scheduled at some later date.

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[2] JABLONSKI, B. 1986. Distribution, abundance and biomass of a summer community of birds in the region of the Admiralty Bay (King George Island, South Shetland Islands, Antarctica) in 1978/79. *Polish Polar Research 7*(3): 217-260.

Estimates of Krill Escapement

7.13 Last year, WG-CEMP noted that the prospects of estimating desired levels of krill escapement on the basis of estimates of krill consumption by all natural predators (e.g. whales, seals, birds, fish, squid) were remote. As described above, WG-CEMP's recent efforts in this regard had been focused on developing estimates of the amount of krill required by selected species of marine mammals and birds.

7.14 In discussion of this item at the Joint Meeting of WG-Krill and WG-CEMP, in addition to clarifying definitions of escapement, the focus of attention was shifted from krill requirements of predators to the need to consider critical levels of predator performance in relation to escapement of krill from the fishery (SC-CAMLR-XI/5, paragraph 1).

7.15 Consequently an initial approach to improve understanding of possible functional relationships between krill availability and predator performance was developed (SC-CAMLR-XI/5, paragraph 2 and Appendix 1).

7.16 The Working Group endorsed this approach. It noted that, in respect of the predator element, the initial modelling exercise required the selection of two or three predator species and the provision of three types of data.

7.17 Based on the criteria outlined in the Appendix to the Joint Report, WG-CEMP agreed that the most appropriate species to select were Adélie penguin, crabeater seal and black-browed albatross.

7.18 The tasks of coordinating the provision of data on (i) average annual survival rate of adults; (ii) average age at first breeding; and (iii) the proportion of good, poor and bad years, from the perspective of predator performance, were allocated as follows:

Adélie penguin:	Dr W.Z. Trivelpiece
Crabeater seal:	Dr J.L. Bengtson
Black-browed albatross:	Dr J.P. Croxall.

7.19 The specified data should be submitted to the Convener as soon as possible.

Liaison with WG-FSA

7.20 There was a suggestion that the Working Group on Fish Stock Assessment (WG-FSA) work on krill predation by fish might be incorporated into WG-CEMP estimates of prey requirements (SC-CAMLR-X, paragraphs 6.55 to 6.56). WG-CEMP noted that WF-FSA should be made aware that because of shifting priorities, no specific proposals had yet been made for scheduling a CEMP workshop on prey requirements.

7.21 WG-CEMP had also been asked by the Scientific Committee to consult with WG-FSA to provide data and advice that would assist WG-FSA in interpreting changes in abundance and distribution of fish stocks (SC-CAMLR-X, paragraph 6.57). WG-CEMP suggested that WG-FSA consider Table 4 in this report.

GENERAL MATTERS

Approaches to Integrated Analyses of Predator/Prey/Environmental Data

8.1 Dr Torres summarised a study he is undertaking at Cape Shirreff (WG-CEMP-92/48) of the application of a geographical information system (GIS) which allows comparison of data on distribution of bird and seal colonies with data on terrain, insolation, and other environmental variables.

8.2 At its 1991 meeting the Scientific Committee had noted the existence of the Antarctic Digital Database Project. The Data Manager had been requested to contact the manager of the Project to discuss existing and potential developments of mutual interest (SC-CAMLR-X, paragraph 6.52). Although no reply to this enquiry had been received by the Secretariat, Dr Croxall informed the meeting that currently the database contained only outline and land-based topography, and that the next development would almost certainly include the addition of bathymetric data. Other hydrographic data, of potential interest to CCAMLR, would be unlikely to be added at this stage, but was expected to be included in future stages of the project.

8.3 The Convener noted that WG-CEMP had discussed under Agenda Item 6 (Ecosystem Assessment) several issues that are directly related to the topic of integrated analyses of predator, prey and environmental data.

Review of Opportunities for Collaborative Studies

8.4 The Working Group noted that past collaborative studies have succeeded in providing much valuable information for CEMP. Opportunities for such collaboration in the future should continue to be encouraged. It was noted that several areas of common interest for future collaborative work had been identified throughout the Working Group's discussions.

8.5 Dr Naganobu advised the Working Group that Japan plans to conduct research surveys during the 1994/95 austral summer and that there may be opportunities for collaborative studies associated with those surveys.

Matters Arising from the Joint Meeting of WG-Krill and WG-CEMP

8.6 A document prepared by the Conveners of WG-Krill and WG-CEMP and the Chairman of the Scientific Committee summarised the discussions and conclusions from the Joint Meeting of WG-Krill and WG-CEMP (SC-CAMLR-XI/5). Several items in that paper contained requests for information or action by WG-CEMP. The Working Group reviewed these requests to ensure that the relevant points had been addressed by WG-CEMP.

8.7 In paragraph 5 of SC-CAMLR-XI/5, WG-CEMP was requested to consider the use of estimated predator demands in calculating the allocation of precautionary catch limits. The Working Group agreed that it is presently not feasible to estimate krill demand by all krill predators (i.e., cetaceans, pinnipeds, birds, fish, squid) for all geographic portions of Statistical Area 48 and that the assumptions required to use proportions derived from land-based predators alone (without pelagic predators) would be scientifically unsound. The Working Group therefore agreed that using estimates of predator demands to allocate catch limits within subareas is presently not advised.

8.8 Paragraph 9 of SC-CAMLR-XI/5 calls for development of models to evaluate the statistical performance and cost-effectiveness of possible experimental harvesting regimes designed to distinguish between natural variation in predator performance and effects due to fishing. The Working Group noted that the sequence of events in such development should be initiated by proposals for the model framework (especially spatial and temporal scales) from proponents of such models within WG-Krill.

8.9 Paragraph 10 of SC-CAMLR-XI/5 addressed feedback mechanisms for management advice. CEMP is planning to attempt to define criteria and mechanisms for specifying how changes in indices derived from predator parameters being monitored could be used in the formulation of management

procedures and advice. It was emphasised that an essential element of this process is the development of models and simulations investigating the performance of various criteria using the current and historical data sets in the CEMP database.

8.10 The Working Group noted that it had considered, in paragraphs 6.39 to 6.57 of this report, the issues addressed in paragraph 11 of SC-CAMLR-XI/5 pertaining to selection of precautionary management options in areas of localised krill catches.

OTHER BUSINESS

Access to CEMP Data

9.1 Dr Croxall noted that the present policy on access to CCAMLR data (SC-CAMLR-VIII, paragraphs 13.1 to 13.7) could pose a difficult problem for owners of the data if a scientist uses CEMP data for a paper tabled at a CCAMLR meeting and later wishes to publish the results. Problems could arise if there is a disagreement regarding whether or not, or under what circumstances, the paper should be published. This situation could be particularly acute when historical data from long-term studies are involved. Several researchers are presently considering submitting such historical datasets which would greatly expand the CCAMLR Database. Similarly, as the time series of CEMP data currently being collected grow, these will become increasingly valuable sources of data for analysis of subsequent publications.

9.2 Consequently, Dr Croxall proposed a change to the existing rules governing access to CEMP data. Recognising the potentially broad ramifications of any policy change regarding data access, it was agreed that this topic should be given careful consideration. CCAMLR's policy on data access and use is of fundamental importance in both ensuring that relevant data needed for CCAMLR's work are freely available, and that the owners/originators of the data are protected from inappropriate uses of their data.

9.3 The Working Group recommended that the Scientific Committee consider its policies on data access and use as a matter of priority.

IUCN Assessment of Marine Protected Areas

9.4 The Convener informed the Working Group of an initiative on global marine areas being undertaken by the World Conservation Union (IUCN) (WG-CEMP-92/29). The Commission on National Parks and Protected Areas (CNPPA) of the IUCN is conducting a project to assess the

World's marine protected areas and to identify priority areas for conserving global marine biodiversity. This project is being undertaken at the request of the World Bank Environment Department. It is expected that the project's report will offer guidance to the Global Environment Facility (GEF) in assigning priorities for providing grants and financial assistance. The GEF is a three-year pilot program (started in 1990) administered jointly by the World Bank, the United Nations Environmental Program, and the United Nations Development Program.

9.5 The CNPPA project on marine protected areas and the GEF's objective of supporting wise management of marine ecosystems may offer an opportunity to CEMP. If funds are to be made available from the World Bank to help support conservation of global marine biodiversity, providing some type of financial support to CEMP might be an effective way for the GEF to accomplish a part of its objectives.

9.6 The Convener was requested to obtain additional information on these programs and report back to WG-CEMP next year. The objectives of this request are to determine:

(i) whether these programs' goals correspond to those of CCAMLR and the work of WG-CEMP;

(ii) the prospects and circumstances under which funding may be made available for this initiative by the World Bank; and

(iii) whether or not WG-CEMP should consider recommending to the CCAMLR Scientific Committee that a proposal be developed requesting that the World Bank provide funds in support of CEMP.

FUTURE WORK

10.1 The Working Group reviewed progress made, work discussed and tasks identified at the meeting. The principal tasks in the coming year are as follows:

(i) the Convener was asked to solicit contributions from Members not currently contributing to the work of the Working Group (paragraph 3.10);

(ii) the Convener and Secretariat are asked to organise the formation of the three *ad hoc* subgroups (paragraphs 4.5 and 4.6);

(iii) Members are encouraged to test the software for calculating indices (paragraph 4.9);

(iv) Members are encouraged to develop examples of ANOVA analyses of the CEMP data (paragraph 4.11);

(v) the report of the Alaska Workshop on at-sea monitoring of marine mammals should be reviewed before identifying a specific CCAMLR meeting (paragraph 4.17);

(vi) the Secretariat is requested to obtain relevant satellite data (paragraph 4.28) and analyse them as appropriate (paragraphs 4.30 and 4.31);

(vii) the Secretariat is requested to make appropriate arrangements for implementing a new publication format for the next edition of the *Standard Methods for Monitoring Studies* (paragraph 4.37);

(viii) progress reports on activities concerning Method A4 should be prepared (paragraph 5.9);

(ix) the Working Group requests WG-Krill to update krill biomass estimates for the ISRs as available (paragraph 5.32);

(x) the Secretariat will continue analyses of overlap of fishing and predator foraging (paragraph 6.41);

(xi) encourage research activity on the localised distribution of fishing effort (paragraph 6.44);

(xii) Members with additional data on fur seal, penguin and other seabird consumption are asked to make these available as soon as possible (paragraph 7.4 and 7.11). The workshop on krill consumption by predators should be considered for scheduling at a later date (paragraph 7.12);

(xiii) data of survival rate, age at first breeding and proportion of good and bad years for calibration of the integrated modelling exercise identified by the joint workshop should be coordinated and reported as set out in paragraph 7.18 and 7.19; and

(xiv) the Convener was requested to obtain more information on the IUCN initiative on global marine areas (paragraph 9.6).

10.2 To accomplish the tasks identified above, to undertake its annual assessments, and to provide timely advice to the Scientific Committee, it was agreed that extensive discussions, based on intersessional preparatory work, will be needed. Such discussions cannot be effective without a meeting of the Working Group.

10.3 Accordingly, the Working Group recommended that it hold a meeting during the 1993 intersessional period.

Summary of Recommendations to the Scientific Committee

10.4 The Working Group made the following recommendations to the Scientific Committee:

(i) the Secretariat is requested to prepare an estimate for the collection of sea-ice data for the Scientific Committee (paragraph 4.29);

(ii) the Scientific Committee is asked to request whether domestic legislation would preclude Japan from reporting combined krill catches on a very fine-scale basis (paragraph 5.29);

(iii) the Scientific Committee consider defining zones within Subareas 48.1 and 48.2 for areas where there is a consistent pattern of overlap between predators and fishing activity (paragraph 6.56);

(iv) the Scientific Committee invite Members currently engaged in fishing to consider what potential management measures could be acceptable for application within Subareas 48.1 and 48.2 (paragraph 6.57); and

(v) the Scientific Committee consider its policies on data access (paragraph 9.3).

CLOSE OF THE MEETING

11.1 The Report of the Meeting was adopted.

11.2 The Convener thanked participants, rapporteurs, subgroups, the Secretariat and the Chilean Ministry of Foreign Affairs for their work and assistance during the meeting. He noted that the

quality and relevance of the numerous working and background papers prepared during the intersessional period by participants contributed significantly to the meeting's excellent progress.

11.3 Special thanks were extended to the Secretariat for their contributions in support of WG-CEMP during the past year. In particular, the Working Group's activities in calculating and evaluating CEMP indices were advanced in large part because of the efforts of the Secretariat's superb staff.

11.4 The Working Group extended its gratitude to the Government of Chile, the Instituto Antártico Chileno and the University of Chile for hosting and assisting with the meeting in Viña del Mar. By arranging a pleasant venue with efficient facilities, they had enabled the Working Group to engage in a very productive meeting.

Table 1: Summary of Members' CEMP activities on monitoring approved predator parameters.

Parameter		Species[1]	Country	Site Name/ Integrated Study Region/ Network Site	Year Started[2]	Data Submitted[2]	Being Prepared[2]
Penguins							
A1	Weight on arrival at breeding colonies	A	Australia	Magnetic Is Prydz Bay	1984		1990-91
		A	Australia	Béchervaise Is		1992	
		A	Argentina	Stranger Point/ King George Is	1988	1988-90	1991
		A	Argentina	Laurie Is S. Orkney Is	1988	1988-90	1991
			Argentina	Esperanza St.	1991	1991	
		A	Germany	Ardley Is/ S. Shetlands	1991		
		M	UK	Bird Is/ South Georgia	1990	1990-92	
A2	Length of the first incubation shift	A	Australia	Magnetic Is Prydz Bay	1984		1989-91
		A	Australia	Béchervaise Is/ Mawson	1991	1991-92	
		A	Argentina	Stranger Point King George Is	1988		1990-91
			Argentina	Esperanza St.	1991		1991
		A	Germany	Ardley Is/ S. Shetlands	1991		
A3	Annual trends in breeding population size	A	Australia	Magnetic Is Prydz Bay	1984		1990-91
		A	Australia	Béchervaise Is		1992	
		A	Argentina	Stranger Point/ King George Is	1988		1990-91
				Esperanza St.	1991		1991
		M,C	Brazil	Elephant Is S. Shetlands	1986	1992	
		A,C	Chile	Ardley Is S. Shetlands	1982		1989-92
		A	Japan	Syowa Station/ Network site	1970		1989-91

Table 1 (continued)

Parameter		Species[1]	Country	Site Name/ Integrated Study Region/ Network Site	Year Started[2]	Data Submitted[2]	Being Prepared[2]
A3 continued		M,G	UK	Bird Is/ South Georgia	1976	1990-92	
		A,C,G	UK	Signy Is/ Network site	1979	1990-92	
		A	USA	Anvers Is	1992	1992	
		A	Germany	Ardley Is/ S. Shetlands	1991		
A4	Demography	C	Chile	Ardley Is S. Shetlands	1982		1989-92
		M,C	Brazil	Elephant Is S. Shetlands	1986	1989-92	1989-92[3]
		M,C	USA	Seal Is S. Shetlands	1988		1990-92[3]
		A	USA	Anvers Is Palmer Station	1988		1989-91[3]
A5	Duration of foraging trips	A	Australia	Magnetic Is Prydz Bay	1984		1990-91
		C	USA	Seal Is S. Shetlands	1988	1988-92	
		A	USA	Anvers Is Palmer Station	1990	1990-92	
		M	USA	Seal Is		1990	
A6	Breeding success	A	Australia	Magnetic Is Prydz Bay	1984		1989-91
		A	Australia	Béchervaise Is		1992	
		A	Argentina	Stranger Point/ King George Is	1988		1990-91
				Laurie Is/ Esperanza St.	1991		1991
		M,C	Brazil	Elephant Is S. Shetlands	1986	1990-92	
		C	Chile	Ardley Is S. Shetlands	1982		1989-92
		M,G	UK	Bird Is/ South Georgia	1976	1990-92	
		A,C,G	UK	Signy Is/ Network site	1979	1990-92	

Table 1 (continued)

Parameter		Species[1]	Country	Site Name/ Integrated Study Region/ Network Site	Year Started[2]	Data Submitted[2]	Being Prepared[2]
A6 continued		M,C	USA	Seal Is S. Shetlands	1988	1988-92	
		A	USA	Anvers Is Palmer Station	1988	1990-92	
		A	Germany	Ardley Is	1991		
A7	Fledging weight	A	Australia	Magnetic Is Prydz Bay	1984		1990-91
		A	Australia	Béchervaise Is		1992	
		M	Brazil	Elephant Is S. Shetlands	1986	1992	
		C	Brazil	Elephant Is S. Shetlands	1986	1990-92	
		M,G	UK	Bird Is/ South Georgia	1989	1990-92	
		C	USA	Seal Is S. Shetland Is	1988	1988-92	
		A	USA	Anvers Is Palmer Station	1988	1990-92	
		M	USA	Seal Is		1990	
		A	Germany	Ardley Is	1991		
A8	Chick diet	A	Australia	Magnetic Is Prydz Bay	1984		1990-91
		A	Australia	Béchervaise Is Mawson	1991	1991-92	
		M,C	Brazil	Elephant Is S. Shetlands	1986	1992	
		C	Chile	Ardley Is S. Shetland Is	1982		1989-90
		M	UK	Bird Is/ South Georgia	1986	1990-92	
		G	UK	Bird Is/ South Georgia	1986	1990-92	
		C	USA	Seal Is S. Shetlands	1988	1988-91	1992
		A	USA	Anvers Is Palmer Station	1988	1990-92	
		A	Germany	Ardley Is	1991		

Table 1 (continued)

Parameter		Species[1]	Country	Site Name/ Integrated Study Region/ Network Site	Year Started[2]	Data Submitted[2]	Being Prepared[2]
A9	Breeding chronology	A	Australia	Magnetic Is Prydz Bay	1984		1990-91
		A	Australia	Béchervaise Is/ Mawson	1991		1991
		C,M	USA	Seal Is S. Shetland Is	1988	1988-90	
		A	USA	Anvers Is	1988	1990-92	
Flying birds							
B1	Breeding population size	B	UK	Bird Is/ South Georgia	1977	1992	1990-92
B2	Breeding success	B	UK	Bird Is/ South Georgia	1977	1992	1990-92
B3	Age-specific annual survival and recruitment	B	UK	Bird Is/ South Georgia	1977	1990-91	
Seals							
C1	Cow foraging/ attendance cycles	F	Chile	Cape Shirreff	1988	1988	
		F	UK	Bird Is/ South Georgia	1979	1990-92	
		F	USA	Seal Is S. Shetland Is	1988	1988-92	
C2	Pup Growth	F	Chile	Cape Shirreff/ Ant. Peninsula	1985	1984-85 1990-92	
		F	UK	Bird Is/ South Georgia	1973 1978	1990-92	
		F	USA	Seal Is S. Shetland Is/	1988	1988-92	

[1] A - Adélie penguin, M - Macaroni penguin, C - Chinstrap penguin, B - Black-browed albatross, F - Fur seal

[2] All years referred to are split-years

[3] At present these data are not requested for submission to the CCAMLR Data Centre

Table 2: Summary of Members' directed programs on assessing the utility of potential predator parameters.

Parameter	Areas[a] from which data are available for analysis/ evaluation	Members' Research Activity					
		Undertaken 1990/91		Undertaken 1991/92		Proposed for 1992/93	
		Analysis of existing data	Acquisition of new data	Analysis of existing data	Acquisition of new data	Analysis of existing data	Acquisition of new data
-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-
Penguins[b]							
- Incubation shift (M)	2,4,5,11,14	S.Africa (14,M)	S.Africa (14,M)				
- Weight prior to moult (M)	2,15,14,4,5?	S.Africa (14,M)	S.Africa (14,M)				
- At-sea diving behaviour and activity patterns (A,C,M)	2,4,6	Australia (6,A) USA (2,C,M) Germany (11,A, G)	UK (4,G) USA (2,C,M) Germany (11,A, G)	Australia (6,A) UK (4,G) USA (2,C,M) Germany (11,A, G)	Australia (6,A) UK (4,G) USA (2,C,M) Germany (11,A, C,G)	Australia (6,A) UK (4,G) USA (2,C,M)	Australia (6,A) UK (4,M,G) USA (2,C,M)
- Weight recovery during incubation (A,C,M)	4,6	Australia (6,A)					
- Survival (A,C,M)	1,2,6,11	USA (2,C;11,A)	UK (4,M,G) USA (2,C;11,A)	USA (2,C)	UK (4,M,G) USA (2,C)	USA (2,C)	UK (4,M,G) USA (2,C)
- Chick growth rate	2,11	UK (4,G) Spain (2,C)	UK (4,G)	USA (2,C)	UK (4,G) USA (2,C)	USA (2,C)	UK (4,M,G) USA (2,C)
- Bioenergetics	2,4	Spain (2,C) USA (2,C,M; 11,A)	UK (4,G) USA (2,C,M)	USA (2,C,M)	UK (4,G) USA (2,C,M)	UK (4,G) USA (2,C,M)	UK (4,G)
- Reproductive strategies (C)	2	Spain (2,C)					

Table 2 (continued)

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-
Flighted seabirds							
Black-browed albatross							
- Breeding population size	4,9?,15		UK (4)	UK (4)	UK (4)	UK (4)	UK (4)
- Breeding success	4,9?,15		UK (4)	UK (4)	UK (4)	UK (4)	UK (4)
- Duration of foraging trips	4			UK (4)	UK (4)	UK (4)	UK (4)
- Activity budget at sea	4		UK (4)		UK (4)	UK (4)	UK (4)
- Prey characteristics (diet)	4				UK (4)		UK (4)
Antarctic/Cape petrel							
- Breeding success	2,3,6,8,11,16		UK (3)	USA (2)	USA (2)	Norway (16)	UK (3)
- Chick weight at fledging	2,6,8,11			USA (2)	USA (2)		
- Prey characteristics (diet)	2,6,8,11						
Fur seals							
- Population size	3	Arg (3)	Arg (3)	Arg (3)	Arg (3)	Arg (3)	Arg (3)
- Population structure and demography	2,3	Chile (2) Arg (3)	Chile (2) Arg (3)	Chile (2) Arg (3)	Chile (2) Arg (3)	Chile (2) Arg (3)	Chile (2) Arg (3)
- Reproductive success	4,2		UK (4) USA (2)	UK (4)	UK (4) USA (2)	UK (4)	UK (4) USA (2)
- Prey characteristics (diet)	4,2	USA (2)	UK (4) USA (2)	USA (2)	USA (2)	USA (2)	USA (2)

Table 2 (continued)

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-
Fur seals (continued)							
- At-sea diving behaviour and activity pattern	2,4	UK (4) USA (2)	UK (4) USA (2)	UK (4) USA (2)	UK (4) USA (2)	UK (4) USA (2)	UK (4) USA (2)
- Bioenergetics				UK (4)	UK (4)	UK (4)	UK (4)
- Indices of physiological condition	11				UK (4)		
- Fine structure of teeth	4		UK (4)		UK (4)		UK (4)
Crabeater seal							
- Reproductive rates	2,3,8,10-12	USA (11,12) Sweden (11,12)		USA (11,12) Sweden (11,12)		USA (11,12)	
- Age at sexual maturity	2,3,8,10-12	USA (11,12) Sweden (11,12)		USA (11,12) Sweden (11,12)		USA (11,12)	
- Cohort strength	2,3,8,10-12	USA (11,12)		USA (11,12)		USA (11,12)	
- Indices of physiological condition	11,12			USA (11,12)		USA (11,12)	
- Prey characteristics (diet)	11,12	USA (11)		USA (11,12)			
- At-sea diving behaviour and activity pattern	11,12	USA (11,12)		USA (11,12)		USA (11,12)	
- Satellite telemetry		USA (11,12)		USA (11,12) Sweden (11,12)		USA (11,12)	

Table 2 (continued)

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-
Minke whales							
- Reproductive rate	13,1	Japan	Japan	Japan	Japan	Japan	Japan
- Age of sexual maturity	13,1	Japan	Japan	Japan	Japan	Japan	Japan
- Cohort strength	13,1	Japan	Japan	Japan	Japan	Japan	Japan
- Analyses of existing data:							
- stomach contents	13,1	Japan	Japan	Japan	Japan	Japan	Japan
- blubber thickness	13,1	Japan	Japan	Japan	Japan	Japan	Japan
- density/patchiness	13,1	Japan	Japan	Japan	Japan	Japan	Japan
- school size	13,1	Japan	Japan	Japan	Japan	Japan	Japan
- Feeding activity patterns	13,1	Japan	Japan	Japan	Japan	Japan	Japan

(a) Areas:

1. Ross Sea
2. South Shetland Is
3. S. Orkney Is
4. S. Georgia Is
5. Macquarie Island
6. Davis Station
7. Syowa Station
8. Dumont d'Urville Sea
9. Crozet Island
10. Balleny Is
11. Antarctic Peninsula
12. Weddell Sea
13. Mainly from the Indian Ocean (IWC Areas III and IV)
14. Marion Is
15. Kerguelen Is
16. Queen Maud Land

(b) Penguin species: A - Adélie, C - Chinstrap, M - Macaroni/Royal, G - Gentoo

(c) Petrel species: CP - Cape petrel, AP - Antarctic petrel

Table 3: Summary of Members' directed research on predator parameters required to provide essential background information needed to interpret changes in monitored predator parameters.

Research Topic	Countries Proposing Directed Research	
	Programs Currently Underway	Programs Proposed to Commence (season of initiation)
PENGUINS		
- Foraging areas	Chile, Japan, USA, South Africa, Australia	Japan, Australia (1992/93)
- Energy requirements	USA, UK, Germany	Japan, Australia (1992/93)
- Seasonal movements	South Africa	Japan, Australia (1992/93)
- Relationships between monitored parameters and physical environment (e.g., distribution and structure of sea-ice and frontal systems)	Chile, Australia, UK/USSR, USA, South Africa (frontal systems)	Japan, Australia (1992/93)
FUR SEALS		
- Local abundance/population structure	Argentina, Chile, UK, USA	Brazil
- Energy requirements/life history	UK, USA	
- Foraging areas	Chile, USA, UK, Japan (1990/91, with USA)	
- Relationships between monitored parameters and physical environment (e.g., distribution and structure of sea-ice and frontal systems)	Chile (partial), USA, UK/USSR	
CRABEATER SEALS		
- Foraging areas	USA, Sweden	
- Energy requirements/life history	USA, Sweden	
- Stock discreteness/seasonal movements	USA, Sweden	
- Relationships between monitored parameters and physical environment (e.g., distribution and structure of sea-ice and frontal systems)	USA	
- Abundance/population structure		USA (1992/93)

Table 4: Assessment of predator and prey studies, 1988 to 1992. Predator parameters were obtained from WG-CEMP-92/8 and 92/12 unless otherwise referenced in the tables. Catches within 100 km radius of sites were obtained from fine-scale data, and for the subarea from the *Statistical Bulletin Vol. 4*, over the whole year. CPUE data (tonnes-per-hour fishing) was obtained from Statlant B data for the subarea over the whole year. Data are given qualitative rankings High, Medium, Low, Very Low (H, M, L, VL). The symbols +, 0, - indicate temporal changes in parameters. Foraging duration is expressed as relative length of foraging trips to sea (S = short, M = medium, L = long).

4.1 Site: Anvers Is, Subarea 48.1

Year	Adélie		Krill				Environment		
	Breeding Population Size/Change	Breeding Success	Catch 100 km radius	Subarea	CPUE	Biomass	Snow	Sea-Ice	Ocean
1988		-	VL[1]	M	H				
1989		-	VL	H	M				
1990		M	VL	L	L				
1991		L	0	M	M				
1992	(First census)	H		?	?				

[1] Catches in 100 km radius are very low, < 50 tonnes per year

4.2 Site: Cape Shirreff, Livingston Is, Subarea 48.1

Year	Antarctic Fur Seal[1]		Chinstrap[2]		Krill				Environment		
	Breeding Population Size/Change	Breeding Success	Breeding Population Size/Change	Breeding Success	Catch		CPUE	Biomass	Snow	Sea-Ice	Ocean
					100 km radius	Subarea					
1988	L	M			H	M	H				
1989					H	H	M				
1990					L	L	L				
1991	M +	H	?		M	M	M				
1992	H +	H	0		?	?	?			+Brash	

[1] WG-CEMP-92/53 [2] *Boletin Antártico Chileno, Vol. 11*(1): 12-14.

4.3 Site: Admiralty Bay, King George Is, Subarea 48.1[1]

Year	Gentoo		Adélie		Chinstrap		Krill				Environment		
	Breeding Population Size/Change	Breeding Success	Breeding Population Size/Change	Breeding Success	Breeding Population Size/Change	Breeding Success	Catch		CPUE	Biomass	Snow	Sea-Ice	Ocean
							100 km radius	Subarea					
1988	M -	M	H +	M	L -	M	H	M	H				
1989	M +	H	H +	H	M +	H	H	H	M				
1990	M -	M	M -	M	M -	L	M	L	L				
1991	L --	M	L --	L	L --	L	M	M	M				
1992	H ++	H	L +	H	M +	H			?				

(This summary table was constructed without benefit of reviewing the actual data and may contain source errors)

4.4 Site: Ardley Island and Stranger Point combined, King George Island, Subarea 48.1. Esperanza data used for 1991 for Stranger Point.

Year	Adélie[1] - Ardley		Chinstrap[2] - Ardley		Adélie[3] - Stranger		Krill				Environment		
	Breeding Population Size/Change	Breeding Success	Breeding Population Size/Change	Breeding Success	Breeding Population Size/Change	Breeding Success	Catch		CPUE[4]	Biomass	Snow	Sea-Ice	Ocean
							100 km radius	Subarea					
1988	H	H	M	M	L -	H	H	M	H				
1989	H	M	M	H	L -	H	H	H	M				
1990	M	L	H	L	M -	M	M	L	L				
1991	L	M	L	M	M -	L	M	M	M				
1992	M	?	L	M	+	?	?	?	?				

[1] WG-Krill-92/21; WG-CEMP-92/54
[2] WG-CEMP-92/54
[3] WG-CEMP-92/6; WG-CEMP-92/45
[4] from submissions

Note: Esperanza data for 1991; Stranger Point not available.

4.5 Site: Seal Island, Elephant Island, Subarea 48.1

Year	Chinstrap[1]				Antarctic Fur Seal[2]				Krill				Environment		
	Breeding Population Size/Change	Breeding Success	Fledging Weight	Foraging Duration	Pups Born Number/ Change	Foraging Duration	Pup Growth Rate	Weight at Age	Catch		CPUE	Biomass E/M/L[3]	Snow	Sea-Ice	Ocean
									100 km radius	Subarea					
1988	M ?	M	H	S	M +	M	M	H	L	M	H	/L/			
1989	L -	L	H	M	VL -	?	H	L	H	H	M	/L/			
1990	H +	H	M	L	M +	M	L	L	L	L	L	/M/H			
1991	M -	L	L	S	L -	L	H	L	M	M	M	/L/L			
1992	H +	M	M	M	M +	M	M	H	?	?	?	/H/M			

[1] Data are from the CCAMLR Data Centre and documents WG-CEMP-90/21, 91/11, 91/33 and 92/17
[2] Data are from the CCAMLR Data Centre and documents WG-CEMP-89/21, 90/34, 90/41, 91/11 and 92/17
[3] E/M/L = early, middle or late season; krill surveys (WG-CEMP-92/15)

4.6 Site: Signy Is, South Orkneys, Subarea 48.2

Year	Adélie		Chinstrap		Gentoo		Krill				Environment		
	Breeding Population Size/Change	Breeding Success	Breeding Population Size/Change	Breeding Success	Breeding Population Size/Change	Breeding Success	Catch		CPUE	Biomass	Snow	Sea-Ice[1]	Ocean
							100 km radius	Subarea					
1988	H +	M	L -	H	H ++	H	L	L	M			H	
1989	H 0	L-M	L 0	H	H +	H	VL	L	M			H	
1990	H-M -	L-M	M +	L	H +	L	H	H	L			L	
1991	L ---	M	L -	H	H -	M	H	H	M			M	
1992	L +	H	L-M +	H	M -	H	?	M	?			H	

[1] Murphy, *et al.* In: *Antarctic Ocean and Variability*, D. Sahrhage (Ed.): 120-130.

4.7 Site: Bird Island, South Georgia, Subarea 48.3

Year	Gentoo				Macaroni				Black-browed Albatross[1]			Krill[3]					Environment		
	Breeding Population Size/Change	Breeding Success	Krill in Diet	Meal Size	Breeding Population	Breeding Success	Krill in Diet	Meal Size	Breeding Population Size/Change	Breeding Success	Growth Rate	Catch				CPUE	Biomass	Snow[2]	Sea-Ice	Ocean
												100 km radius		Subarea						
												S	W	S	W	S W				
1988	M -	M	?	?	M -	L	?	?	L - - -	VL	?	L	M	M	H	L M	M	H		
1989	H ++	M	H	H	M +	H	M	H	M ++	M	H	L	M	H	M	H M		M		
1990	H -	L-M	M	H	M -	H	M	H	M 0	M	L	L	L	M	M	M M		M		
1991	L - -	VL	L	L	L -	H	L	L	L-M -	VL	M	VL		L		L	L	M		
1992	M +	H	H	M	M +	M	H	H	L ?	M	H						H	H		

[1] P.A. Prince, unpublished data

[2] Black-browed albatross only

[3] Catch and CPUE are given for the summer season (S: October to March) in the split-year, and winter (April to September) of the following season.

4.8 Site: Bird Island, South Georgia, Subarea 48.3

Year	Antarctic Fur Seal[1]								Krill						Environment		
	Breeding Population Size/Change		Birth Mass	Perinatal	Foraging Trip	Growth Rate		Wean Mass	Breeding Success	Catch				CPUE		Biomass	Snow	Sea-Ice	Ocean
						Overall	Late			100 km radius		Subarea							
										S	W	S	W	S	W				
1988	H	0	H	M	S	H	H	M	M	L	M	M	H	L	M	M			
1989	H	-	H	M	M	H	M	H	M	L	M	H	M	H	M				
1990	H	+	H	M	M	M	L	M	H	L	L	M	M	M	M				
1991	L	--	L	S	L	L	H	L	L	VL		L		L		L			
1992	M	+	M	M	M	H	H	M	M							H			

[1] All data from Lunn and Boyd, in press (WG-CEMP-92/41)

4.9 Site: Béchervaise Island, Mawson, Division 58.4.2

Year	Adélie		Krill			Environment		
	Breeding Population Size/Change	Breeding Success	Catch	CPUE	Biomass[1]	Snow	Sea-Ice	Ocean
1991	Start year				M		Start Year	
1992	0	Start year	0	0	L		0	

[1] WG-Krill-92/23

APPENDIX A

AGENDA

Working Group for the CCAMLR Ecosystem Monitoring Program
(Viña del Mar, Chile, 7 to 12 August 1992)

1. Opening of the Meeting

2. Adoption of the Agenda

3. Review of Members' Activities
   - (i) Monitoring
   - (ii) Directed Research
   - (iii) Plans for Future Work

4. Monitoring Procedures
   - (i) Predator Monitoring
     - (a) Sites and Species
     - (b) Proposals for New Procedures
     - (c) Procedures for Calculating Indices and Trends
     - (d) Field Research Procedures
   - (ii) Prey Monitoring
   - (iii) Environmental Monitoring
     - (a) Land-Based Observations
     - (b) Remote Sensing

5. Review of Monitoring Results
   - (i) Predator Data
     - (a) Status of Data Submissions
     - (b) Report on Indices and Trends
   - (ii) Prey Data
     - (a) Review of WG-Krill Report
     - (b) Fine-Scale Catch Data
     - (c) Members' Fine-Scale Surveys

(iii) Environmental Data
    (a) Sea-Ice Patterns
    (b) Other Environmental Events or Trends

6. Ecosystem Assessment
    (i) Review of Background Information
        (a) Predator Studies
        (b) Prey Studies
        (c) Environmental Studies
    (ii) Potential Impact of Localised Krill Catches
    (iii) Formulation of Advice and Recommendations to the Scientific Committee

7. Estimates of Prey Requirements for Krill Predators
    (i) Review of Progress
        (a) Synthesis of Fur Seal and Penguin Data
        (b) Synthesis of Crabeater and Leopard Seal Data
        (c) Advice of IWC Concerning Whales
        (d) Data on Seabirds other than Penguins
    (ii) Interim Results and Report to the Scientific Committee
    (iii) Plans for Proposed Workshop
    (iv) Estimates of Krill Escapement

8. General Matters
    (i) Approaches to Integrated Analyses of Predator/Prey/Environmental Data
    (ii) Review of Opportunities for Collaborative CEMP Studies
    (iii) Matters Arising from the Joint Meeting of WG-Krill and WG-CEMP

9. Other Business
    (i) Access to CEMP Data
    (ii) IUCN Assessment of Marine Protected Areas

10. Summary of Recommendations and Advice

11. Adoption of the Report

12. Close of the Meeting.

APPENDIX B

LIST OF PARTICIPANTS

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(Viña del Mar, Chile, 7 to 12 August 1992)

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APPENDIX C

LIST OF DOCUMENTS

Working Group for the CCAMLR Ecosystem Monitoring Program
(Viña del Mar, Chile, 7 to 12 August 1992)

WG-CEMP-92/1	PROVISIONAL AGENDA
WG-CEMP-92/2	LIST OF PARTICIPANTS
WG-CEMP-92/3	LIST OF DOCUMENTS
WG-CEMP-92/4	CCAMLR ECOSYSTEM MONITORING PROGRAM DRAFT MANAGEMENT PLAN FOR CAPE SHIRREFF CEMP LAND-BASED SITE Delegation of Chile
WG-CEMP-92/5	CCAMLR ECOSYSTEM MONITORING PROGRAM DRAFT MANAGEMENT PLAN FOR MAGNETIC ISLAND CEMP LAND-BASED SITE Delegation of Australia
WG-CEMP-92/6	ELEPHANT SEAL AND PENGUIN POPULATION STUDIES: TOOLS TO UNDERSTAND ECOLOGICAL CHANGES AND/OR FISHERIES EFFECT D.F. Vergani, Z.B. Stanganelli, A.R. Carlini and G.E. Soave (Argentina)
WG-CEMP-92/7	CEMP INDICES: THEIR CALCULATION AND COMPARISON BY THE SECRETARIAT Data Manager
WG-CEMP-92/8 Rev. 1	CEMP INDICES AND TRENDS 1992 PART 1: PENGUIN PARAMETERS Secretariat
WG-CEMP-92/9	MONITORING SEA ICE DISTRIBUTION: REPORT OF THE SECRETARIAT PROJECT ON ACQUISITION OF SATELLITE IMAGERY Secretariat
WG-CEMP-92/10	SUGGESTION FOR CHANGE IN FORMAT OF CEMP STANDARD METHODS PUBLICATION Secretariat
WG-CEMP-92/11	CAN WE USE DISCRIMINANT FUNCTION ANALYSIS TO SEX PENGUINS PRIOR TO CALCULATING AN INDEX OF A MORPHOMETRIC PARAMETER? D.J. Agnew (Secretariat)

WG-CEMP-92/12	CEMP INDICES AND TRENDS 1992 PART 2: FLYING BIRDS AND SEALS Secretariat
WG-CEMP-92/13	CEMP DATA AVAILABILITY Secretariat
WG-CEMP-92/14	Withdrawn
WG-CEMP-92/15	DISTRIBUTION AND ABUNDANCE OF KRILL IN THE VICINITY OF ELEPHANT ISLAND IN THE 1992 AUSTRAL SUMMER Roger P. Hewitt and David A. Demer (USA)
WG-CEMP-92/16	AMLR 1991/92 FIELD SEASON REPORT; OBJECTIVES, ACCOMPLISHMENTS AND TENTATIVE CONCLUSIONS Delegation of the USA
WG-CEMP-92/17	ANTARCTIC PENINSULA INTEGRATED STUDY REGION PENGUIN BIOENERGETIC MODEL INPUT PARAMETERS Delegation of the USA
WG-CEMP-92/18	METABOLIC RATES, FORAGING RANGES AND ASSIMILATION EFFICIENCIES OF PENGUINS: A REVIEW Delegation of the USA
WG-CEMP-92/19	SYNTHESIS AND EVALUATION OF DATA FOR ESTIMATING PREY REQUIREMENTS OF ANTARCTIC FUR SEALS IN THE ANTARCTIC PENINSULA INTEGRATED STUDY REGION Delegation of the USA
WG-CEMP-92/20	AN AUTOMATED WEIGHING AND RECORDING SYSTEM AS AN AID FOR THE STUDY OF THE FORAGING ECOLOGY OF ADELIE PENGUINS (*PYGOSCELIS ADELIAE)* Knowles Kerry, Judith Clarke and Grant Else (Australia)
WG-CEMP-92/21	AN INTERPRETATION OF THE GROWTH OF THE ADELIE PENGUIN ROOKERY AT CAPE ROYDS, 1955-1990 N. Blackburn (Denmark) R.H. Taylor and P.R. Wilson (New Zealand)
WG-CEMP-92/22	RECENT INCREASE AND SOUTHERN EXPANSION OF ADELIE PENGUIN POPULATIONS IN THE ROSS SEA, ANTARCTICA, RELATED TO CLIMATIC WARMING R.H. Taylor and P.R. Wilson (New Zealand)
WG-CEMP-92/23	STATUS AND TRENDS OF ADELIE PENGUIN POPULATIONS IN THE ROSS SEA REGION R.H. Taylor, P.R. Wilson and B.W. Thomas (New Zealand)

WG-CEMP-92/24 NEW ZEALAND ANTARCTIC RESEARCH PROGRAMME
SCIENTIFIC PROPOSAL FOR THE AERIAL SURVEY OF ADELIE PENGUIN ROOKERIES, 1992/93
P.R. Wilson (New Zealand)

WG-CEMP-92/25 PRELIMINARY ASSESSMENT OF THE DATA AVAILABLE FOR ESTIMATING THE KRILL REQUIREMENTS OF CRABEATER SEALS
J.L. Bengtson (USA), T.J. Härkonen (Sweden) and P. Boveng (USA)

WG-CEMP-92/26 HOMOGENEITY OF ADELIE PENGUINS AS KRILL SAMPLERS
E. Marschoff, B.González (Argentina)

WG-CEMP-92/27 ADVICE FROM THE IWC SCIENTIFIC COMMITTEE CONCERING ESTIMATION OF PREY REQUIRMENTS OF BALEEN WHALES IN THE CEMP INTEGRATED STUDY REGIONS
(Convener, WG-CEMP)

WG-CEMP-92/28 PROGRESS IN PREPARING FOR A WORKSHOP ON METHODS TO STUDY THE AT-SEA BEHAVIOUR OF MARINE MAMMALS AND BIRDS
(Convener, WG-CEMP)

WG-CEMP-92/29 POTENTIAL RELEVANCE OF THE GLOBAL ENVIRONMENTAL FACILITY AND A SYSTEM OF MARINE PROTECTED AREAS TO THE CCAMLR ECOSYSTEM MONITORING PROGRAM
(Convener, WG-CEMP)

WG-CEMP-92/30 ON THE PROBLEM OF SOVIET KRILL FISHERY ALLOCATION AND INTENSITY IN THE AREA OF ELEPHANT ISLAND IN THE SEASON OF 1988-1989
V.A. Sushin, A.S. Myskov (Russian Federation)

WG-CEMP-92/31 GEOGRAPHIC ASPECTS OF *EUPHAUSIA SUPERBA* RESOURCES EXPLOITATION
R.R. Makarov (Russian Federation)

WG-CEMP-92/32 INVESTIGATIONS OF INTENSITY OF KRILL DRIFT NEAR SOUTH GEORGIA ISLAND
V.V. Popkov (Russian Federation)

WG-CEMP-92/33 PRELIMINARY RESULTS OF RV *DMITRIY STEFANOV* RESEARCHES IN THE ANTARCTIC AREA OF THE ATLANTIC OCEAN IN APRIL 1992
L.G. Maklygin, V.N. Shnar, A.V. Remeslo, A.P. Malyshko, I.A. Trunov, I.A. Barabanov, V.P. Shopov (Russian Federation) and A.G. Shepelev (Ukraine)

WG-CEMP-92/34 PRELIMINARY RESULTS OF THE EXPERIMENTS ON THE KRILL TRANSPORT STUDY IN THE SOUTH ORKNEY AREA (APRIL 1992)
L.G. Maklygin, V.N. Shnar, A.P. Malyshko (Russian Federation) and A.G. Shepelev (Ukraine)

WG-CEMP-92/35 KRILL BIOMASS AND DISTRIBUTION VARIABILITY IN SUBAREA 48.3 IN JUNE 1991
S.M. Kasatkina, E.I. Timokhin, P.P. Fedulov and K.E. Shulgovskiy (Russian Federation)

WG-CEMP-92/36 THE FORAGING RANGE OF ADELIE PENGUINS AT BECHERVAISE ISLAND, MAC. ROBERTSON LAND, ANTARCTICA, AND ITS OVERLAP WITH THE KRILL FISHERY
K.R. Kerry, J.R. Clarke and G.D. Else (Australia)

WG-CEMP-92/37 DIVING PATTERN AND PERFORMANCE IN NONBREEDING GENTOO PENGUINS (*PYGOSCELIS PAPUA*) DURING WINTER
Tony D. Williams (UK), Akiko Kato (Japan), John P. Croxall (UK), Yasu Naito (Japan), Dirk R. Briggs, Steven Rodwell and Tim R. Barton (UK)

WG-CEMP-92/38 DIVING PATTERN PERFORMACE IN THE MACARONI PENGUIN *EUDYPTES CHRYSOLOPHUS*
J.P. Croxall, D.R. Briggs (UK), A. Kato, Y. Naito, Y. Watanuki (Japan) and T.D. Williams (UK)

WG-CEMP-92/39 PUP PRODUCTION AND DISTRIBUTION OF BREEDING ANTARCTIC FUR SEALS (*ARCTOCEPHALUS GAZELLA*) AT SOUTH GEORGIA
I.L. Boyd (UK)

WG-CEMP-92/40 EFFECTS OF MATERNAL AGE AND CONDITION ON PARTURITION AND THE PERINATAL PERIOD OF ANTARCTIC FUR SEALS
N.J. Lunn and I.L. Boyd (UK)

WG-CEMP-92/41 INFLUENCE OF MATERNAL CHARACTERISTICS AND ENVIRONMENTAL VARIATION ON REPRODUCTION IN ANTARCTIC FUR SEALS
N.J. Lunn and I.L. Boyd (UK)

WG-CEMP-92/42 SOUTHERN OCEAN ENVIRONMENTAL CHANGES: EFFECTS ON SEABIRD, SEAL AND WHALE POPULATION
J.P. Coxall (UK)

WG-CEMP-92/43 LOS PINGUINOS Y EL HOMBRE (THE PENGUINS AND THE MAN)
J.C. Ricca, M.A. Porretti and D.F. Vergani (Argentina)
Abstract only in English

WG-CEMP-92/44 STANDARD METHODS OF CEMP IN VIDEO
J.C. Ricca, M.A. Porretti and D.F. Vergani (Argentina)
Abstract only in English

WG-CEMP-92/45 CHANGES IN ADELIE PENGUIN POPULATION BETWEEN 1963-1992 BREEDING SEASONS AT HOPE BAY
A. Carlini, D.F. Vergani and M.A. Gasco (Argentina)

WG-CEMP-92/46 WHAT IS THE KEY FACTOR IN BREEDING SUCCESS OF ADELIE PENGUINS AT ANTARCTIC PENINSULA AREA
Z.B. Stanganelli and D.F. Vergani (Argentina)

WG-CEMP-92/47 THE HAZARD ASSESSMENT OF CETACEANS BY THE USE OF A NON DESTRUCTIVE BIOMARKER IN SKIN BIOPSY
M. Cristina Fossi, Letizia Marsili, Claudio Leonzio and Silvano Focardi (Italy)

WG-CEMP-92/48 ESPECIFIDAD DE HABITATS PARA *ARCTOCEPHALUS GAZELLA* (LOBO FINO ANTARTICO) Y *PYGOSCELIS* (PINGÜINOS) EN CABO SHIRREFF
Leonardo Lavanderos, Hernán Torres E., y Juan Capella A. (Chile)
Available in Spanish only

WG-CEMP-92/49 NOTES ON THE STATUS OF KRILL PREDATORS IN PRYDZ BAY INTEGRATED STUDY REGION 58.4.2
J.R. Clarke (Australia)

WG-CEMP-92/50 ESTIMATION OF PREY REQUIREMENTS FOR KRILL PREDATORS
J.P. Croxall (UK)

WG-CEMP-92/51 EVALUACION Y PROPOSICION DE ESTUDIOS SOBRE BIOENERGETICA ANTARTICA CHILE
Carlos Guillermo Guerra Correa (Chile)
Available in Spanish only

WG-CEMP-92/52 SINTESIS DE LOS ESTUDIOS SOBRE IMPACTO AMBIENTAL EN CABO SHIRREFF, ISLA LIVINGSTON, ANTARTICA
Daniel Torres N. (Chile)
Available in Spanish only

WG-CEMP-92/53 DISTRIBUCION DE *ARCTOCEPHALUS GAZELLA* EN CABO SHIRREFF, ISLA LIVINGSTON, ANTARTICA, DURANTE DICIEMBRE DE 1991 Y ENERO DE 1992
Anelio Aguayo Lobo and Daniel Torres Navaro (Chile)
Available in Spanish only

WG-CEMP-92/54 REPORT ON BIRD STUDIES ON ARDLEY ISLAND, SOUTH SHETLAND ARCHIPELAGO
Michael Sallaberry A. and José Valenica (Chile)

WG-CEMP-92/55 THE POPULATION ECOLOGY OF SEABIRDS AT SVARTHAMAREN, DRONNING MAUD LAND: CAUSES AND CONSEQUENCES OF VARIATION IN REPRODUCTIVE SUCCESS OF TWO LONG-LIVED SEABIRDS SPECIES (ANTARCTIC PETREL AND SOUTH POLAR SKUA) AT SVARTHAMAREN. AN EXPERIMENTAL APPROACH
A project proposal for the Norwegian Antarctic Expedition 1992/93
Trondheim, December 1991

OTHER DOCUMENTS

WG-KRILL/CEMP-92/4	CCAMLR ECOSYSTEM MONITORING AND A FEEDBACK MANAGEMENT PROCEDURE FOR KRILL A. Constable (Australia)
WG-KRILL-92/9	DIURNAL CHANGES OF SOME BIOLOGICAL CHARACTERISTICS OF *EUPHAUSIA SUPERBA* DANA IN SWARMS (WESTWARD OF THE SOUTH ORKNEY ISLANDS, 24 MARCH TO 18 JUNE 1990 - BASED ON DATA REPORTED BY BIOLOGIST-OBSERVER) A.V. Vagin, R.R. Makarov and L.L. Menshenina (Russia)
WG-KRILL-92/12	VARIABILITY OF KRILL STOCK COMPOSITION AND DISTRIBUTION IN THE VICINITY OF ELEPHANT ISLAND DURING AMLR INVESTIGATIONS 1988-1992 V. Loeb (USA) and V. Siegel (Germany)
WG-KRILL-92/13	FINE-SCALE CATCHES OF KRILL IN AREA 48 REPORTED TO CCAMLR 1990 TO 1991 Secretariat
WG-KRILL-92/15	REVIEW OF LENGTH-WEIGHT RELATIONSHIPS FOR ANTARCTIC KRILL V. Siegel (Germany)
WG-KRILL-92/16	ALTERNATIVE METHODS FOR DETERMINING SUBAREA OR LOCAL AREA CATCH LIMITS FOR KRILL IN STATISTICAL AREA 48 G. Watters and R.P. Hewitt (USA)
WG-KRILL-92/18	KRILL CATCH DISTRIBUTION IN RELATION TO PREDATOR COLONIES, 1987-1991 Secretariat
WG-KRILL-92/19	DISTRIBUTION OF KRILL (*EUPHAUSIA SUPERBA* DANA) CATCHES IN THE SOUTH SHETLANDS AND SOUTH ORKNEYS D.J. Agnew (Secretariat)
WG-KRILL-92/21	CHILEAN KRILL FISHING OPERATIONS 1992: ANSWERING SC-CAMLR-X, PARAGRAPH 6.36 Victor H. Marín, Darío Rivas and Antonio Palma (Chile)
WG-KRILL-92/23	ESTIMATION OF THE BIOMASS OF KRILL IN PRYDZ BAY DURING JANUARY/FEBRUARY 1991 AND FEBRUARY/MARCH 1992 USING ECHO INTEGRATION I. Higginbottom and T. Pauly (Australia)

WG-KRILL-92/24 CHARACTERSITICS OF OCEANIC STRUCTURE IN THE WATERS AROUND THE SOUTH SHETLAD ISLANDS OF THE ANTARCTIC OCEAN BETWEEN DECEMBER 1990 AND FEBRUARY 1991: OUTSTANDING COASTAL UPWELLING?
M. Naganobu, T. Katayama, T. Ichii, H. Ishii and K. Nasu (Japan)

WG-KRILL-92/25 HYDROGRAPHIC FLUX IN THE WHOLE OF STATISTICAL AREA 48 IN THE ANTARCTIC OCEAN
M. Naganobu (Japan)

WG-KRILL-92/26 ABUNDANCE, SIZE AND MATURITY OF KRILL (*EUPHAUSIA SUPERBA*) IN THE KRILL FISHING GROUND OF SUBAREA 48.1 DURING 1990/91 AUSTRAL SUMMER
T. Ichii, H. Ishii and M. Naganobu (Japan)

WG-KRILL-92/27 DIFFERENCES IN DISTRIBUTION AND POPULATION STRUCTURE OF KRILL (*EUPHAUSIA SUPERBA*) BETWEEN PENGUIN AND FUR SEAL FORAGING AREAS NEAR SEAL ISLAND
T. Ichii, H. Ishii (Japan), J.L. Bengtson, P. Boveng, J.K. Jansen (USA) and M. Naganobu (Japan)

WG-KRILL-92/33 KRILL POPULATION BIOLOGY DURING THE 1991 CHILEAN ANTARCTIC KRILL FISHERY
Armando Mujica R., Enzo Acuña S. and Alberto Rivera O. (Chile)

SC-CAMLR-XI/4 REPORT OF THE FOURTH MEETING OF THE WORKING GROUP ON KRILL
(Punta Arenas, Chile, 27 July to 3 August, 1992)

SC-CAMLR-XI/5 JOINT MEETING OF THE WORKING GROUP ON KRILL AND THE WORKING GROUP FOR THE CCAMLR ECOSYSTEM MONITORING PROGRAM
(Viña del Mar, Chile, 5 and 6 August, 1992)
(Convener's and Rapporteurs' Summary)

APPENDIX D

REPORTS OF MEMBERS' ACTIVITIES WITH REGARD TO CEMP

This appendix contains descriptions of Members' activities in relation to CEMP that were submitted to this meeting by participants (Argentina, Australia, Chile, Italy, Japan, Norway, Russia, UK and USA).

2. In 1991/92 Argentina continued to conduct monitoring of several parameters of predators using CEMP Standard Methods at King George Island (Stranger Point), Laurie Island (Mossman Peninsula) and Antarctic Peninsula (Esperanza Station). Studies were primarily focused on Adélie penguins. A video film "Penguins and Man" has been prepared on basic aspects of the Adélie penguin biology and CEMP studies by the scientists of Argentina (WG-CEMP-92/43 and 44).

3. Results of environmental effects on predator parameters measured are presented in WG-CEMP-92/6, 45 and 46. Paper WG-CEMP-92/6 describes the comparison between population trends of elephant seals, breeding success of Adélie penguins and CPUE krill fisheries in Subarea 48.1. The relationship between breeding success of Adélie penguins and the trend of female elephant seals has been found.

4. Australia has two major programs that concern CEMP. The first, the "Prydz Bay Adélie penguin/prey stock interaction program", investigates the predator-prey interaction in the Adélie penguin population of Magnetic Island, Princess Elizabeth Land, and its food sources in Prydz Bay. The following parameters are being studied: A1, A2, A3, A5, A6, A7 and A8. In addition nest-specific survival, chick growth rates, energy budgets, diving behaviour and foraging location are being investigated. Data for some parameters have been collected at the site since 1980/81 and the data are expected to be made available to CEMP at the completion of the current research project (1992/93).

5. The second Australian project is the deployment at Béchervaise Island near Mawson Station of an automated system for weighing and recording tagged birds within breeding colonies. The system is being used to monitor Adélie penguins, in accordance with CEMP Standard Methods.

6. The program has the following elements: operation of the existing automated monitoring system; development of methods for determining sex of birds of all ages but particularly chicks; evaluation of the performance of the birds when carrying various accoutrement associated with the program including flipper bands, electronic tags glued to feathers, radio or satellite tracking devices

etc.; evaluation of the results obtained by the automated system by comparison with similar data gathered by manual means as described in the CEMP Standard Methods; studies on the food and foraging area by satellite tracking of the birds in the monitored colony; evaluation of new tagging systems including implanted tags for ease of operation, for least trauma to the birds and least effect on the monitored parameter; and installation of the full monitoring system at a number of additional sites along the coast.

7. In the 1991/92 season Chile had carried out the following scientific programs at the Cape Shirreff site:

(i) census and population structure of the Antarctic fur seal population including tagging of seals;

(ii) reproductive performance and mother-pup interaction in the Antarctic fur seal population;

(iii) census of penguins and flying birds during breeding season; and

(iv) collection of cartographic and environmental data.

In addition, a census of populations of the Southern elephant seal and the Weddell seal was conducted.

8. The Instituto Antártico Chileno has installed on the east side of Cape Shirreff a fibreglass module as a modern facility for scientists conducting CEMP studies.

9. On Ardley Island, studies of seabird populations were carried out in 1991/92 and will be continue in 1992/93. Observations of birds during the early nesting period were conducted in October 1991 and will be repeated in October 1992. Banding of penguins and storm petrels was also continued. These studies had been done by scientists of the Facultad de Ciencias, Universidad de Chile, with the support of the Instituto Antártico Chileno.

10. In cooperation with the United States AMLR Program, scientists from the Instituto Antártico Chileno took part in the census of Antarctic fur seal colonies on the South Shetland Islands. The Chilean research vessel, *Capitán Luis Alcázar* was used for this purpose.

11. Studies by Italy of interest to CEMP in 1991/92 were directed primarily at genetic variability of zooplankton community in the Straits of Magellan and the Ross Sea. Some studies were also

focused on pelagic species, in particular, on *Euphausia superba* in the Ross Sea by using hydroacoustic methods.

12. Italy also continued to use 'biomarkers' for assessing different aspects of human impacts on the Antarctic ecosystem. These studies are aimed at developing non-destructive methods of studying higher vertebrate animals, particularly birds and marine mammals.

13. Japan continues to monitor the annual trends in breeding population size of Adélie penguins near Syowa Station. Studies on Adélie penguins will be conducted in the Indian Ocean Sector in cooperation with Australia in 1992/93.

14. Japan continues to investigate the biology and population size of minke whales through selective catching in Southern Ocean. Studies of krill ecology in relation to hydrological parameters as well as survey design will also continue. Japan intends to continue cooperative work on CEMP monitoring.

15. For the time being Norway has no ongoing program directly related to CEMP. There are, however, proposals for a study of population ecology of seabirds (Antarctic petrel and south polar skua) at Svarthammaren Dronning Maud Land as part of the Norwegian Antarctic Expedition 1992/93. Also, a visit to Bouvet Island will possibly be included in the expedition with a program of direct relevance to CEMP.

16. The Russian Federation did not conduct in 1991/92 any research on parameters of predators in accordance with CEMP Standard Methods. Instead, scientific effort of the Russian scientists was concentrated on studies of prey species, namely krill. Scientists from the Ukraine took part in some of these studies. Two scientific observers conducted observations on board krill fishing vessels in Statistical Area 48.

17. An acoustic survey of krill distribution together with trawl selectivity was carried out in the area to the north of the South Orkney Islands (Subarea 48.2). Krill trawl sampling was also conducted in South Georgia and Shag Rocks waters (Subarea 48.3).

18. Krill movement rates and residential time were studied in a survey which took place in Statistical Area 48 and adjacent waters. Results of these studies were submitted for consideration by WG-CEMP in the following papers: WG-CEMP-92/30, 31, 32, 33, 34 and 35.

19. Plans for the next season include, in particular, an acoustic/trawl survey in Statistical Area 48.

20. The United Kingdom land-based research in support of CEMP is conducted at Signy Island, South Orkney Islands, and Bird Island, South Georgia. At Signy Island, parameters A3 and A6 are monitored for Adélie, chinstrap and gentoo penguins, and breeding success continues to be monitored for Cape (and snow) petrels. At Bird Island, parameters currently monitored are A1, A3, A6, A7, A8 (macaroni penguin), A3, A6, A7, A8 (gentoo penguin), B1 to B3 (black-browed albatross), C1 and C2 (Antarctic fur seal). In addition, comprehensive demographic programs are conducted annually on grey-headed and wandering albatrosses and Antarctic fur seal. Some standardised demographic data are obtained annually for gentoo and macaroni penguins.

21. A three-year program of directed research, involving use of implanted recorders to measure heart-rate (and other parameters) in free-ranging gentoo penguins, black-browed albatrosses and Antarctic fur seals, to estimate activity-specific energy budgets both on land and at sea, was started in 1990/91. At-sea activity budgets and foraging trip durations of albatrosses were derived from data on foraging patterns (using satellite transmitters) and chick growth rates during a pilot study in 1991/92 for a three-year program starting in 1992/93. The research cruise planned to investigate predator-krill interactions in detail has been postponed to 1993/94.

22. Of papers tabled last year, WG-CEMP-91/18, (*J. Zool.* (1992) 227:211-230), WG-CEMP-91/19 (*Acta XX Cong. Int. Orn.* (1991): 1393-1401, WG-CEMP-91/20 (*Condor* (1992) 94: 636-645), WG-CEMP-91/21 (*Can. J. Zool.* (1990) 68: 2209-2213), WG-CEMP-91/22 (*J. Mammal.* (1991) 72: 202-206) and WG-CEMP-91/24 (*J. Anim. Ecol.* (1991) 60: 577-592) have all been published. Paper WG-CEMP-91/23 is still in press in *Can. J. Zool.*. Papers tabled this year relate to the completion of current work on diving pattern and performance in gentoo and macaroni penguins (WG-CEMP-92/37: *Auk*, in press; WG-CEMP-92/38: *J. Zool.*, in press), to the recent survey of the distribution and abundance of Antarctic fur seals at South Georgia (WG-CEMP-92/39; *Antarct. Sci*. in press), to the effect of maternal age on birth date and perinatal period in Antarctic fur seals (WG-CEMP-92/40; *J. Zool.*, in press) to the relative influences of maternal and environmental characteristics on fur seal pup size and growth (WG-CEMP-92/41; *Symp. Zool. Soc. Lond.*, in press) and to an overview of environmental change in relation to seabird, seal and whale populations (WG-CEMP-92/42; *Phil. Trans. Roy. Soc. Lond.*, in press).

23. Although there has been no UK research aimed directly at CEMP prey monitoring, a fish stock assessment survey around South Georgia in January 1992 provided some observations that give an indication of the status of krill in this area. Acoustic survey tracks between the randomly located fishing stations over the South Georgia shelf indicated that krill were widespread over much of the area. The standing stock of krill appeared to be substantially higher than at the same time in 1991.

24. Analysis of the stomach contents of the mackerel icefish, *Champsocephalus gunnari*, indicated that a larger proportion of the fish were feeding on krill than in 1991. The proportion of fish stomachs that contained krill was similar to that observed on previous surveys, prior to 1991, when krill had been plentiful. A further analysis of these results will be presented to the 1992 meeting of the Working Group on Fish Stock Assessment (WG-FSA).

25. United States CEMP related activities in 1991/92 consisted of three components:

(i) land-based predator studies at Seal Island, near Elephant Island and at Palmer Station, Anvers Island;

(ii) repeated surveys of hydrographic conditions, phytoplankton production, and krill abundance and distribution in the waters surrounding Elephant Island; and

(iii) census of Antarctic fur seal colonies of the South Shetland Islands.

26. At Seal Island, directed research and monitoring activities were conducted on fur seals, chinstrap penguins, and macaroni penguins. The following parameters were monitored; A5, A6a and c, A7, A8, A9, C1, and C2. In addition, directed research was completed on automated weighing of nesting penguins to determine food load delivered to chicks.

27. At Palmer Station, parameters A3, A5, A6a,b and c, A7, A8, and A9 were monitored for Adélie penguins. This was conducted in conjunction with the National Science Foundation's long-term ecological research project.

28. Two 30-day cruises were conducted aboard the NOAA Ship *Surveyor* from mid-January to mid-March, 1992. Chlorophyll-*a* concentrations, primary production rates, organic carbon concentrations, phytoplankton species compositions, nutrient concentrations, and solar irradiance were measured and mapped around Elephant Island. In addition, the distribution and abundance of krill were measured using sampling nets and acoustic instrumentation.

29. Census of fur seals were conducted at Elephant, King George and Livingston Islands on 19 January 1992 and 21 to 25 February 1992. The objectives were to count seals at known rookery sites and to identify newly-established and previously unknown colonies. Counts were made by investigators walking along the periphery of the colonies. A total of eight colonies had been previously identified and were counted during this census. Two additional sites, where evidence of fur seal breeding had been reported earlier, were also surveyed.

30. Anticipated field work in 1992/93 will include penguin and fur seal monitoring and directed research at Seal Island and penguin monitoring at Palmer Station. Shipboard surveys of hydrographic conditions, phytoplankton production, krill distribution and abundance, krill demography will be conducted around Elephant Island.