APPENDIX I

REPORT OF THE SUBGROUP ON MONITORING METHODS

(Bergen, Norway, 8 to 10 August 1996)

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INTRODUCTION

The Subgroup on Monitoring Methods held its meeting from 8 to 10 August 1996 in Bergen, Norway, immediately before the meeting of WG-EMM. The meeting was convened by Dr K. Kerry (Australia).

2. The agenda of the meeting comprised all the tasks referred to the subgroup by WG-EMM in 1995 (SC-CAMLR-XIV, Annex 4, paragraphs 5.19, 5.24, 5.26, 5.27, 5.29 to 5.32, 5.39, 5.41, 5.42, 5.44, 5.48, 5.51 and 5.53). The agenda adopted by the subgroup, the list of participants and the list of papers considered at the meeting are appended to this report as Attachments A, B and C respectively.

3. Dr E. Sabourenkov (Secretariat) was rapporteur. Additional sections were prepared by Drs D. Miller (South Africa) and W. Trivelpiece (USA).

REVIEW OF NEW METHODS AND TECHNIQUES

4. Drafts of several new methods (WG-EMM-Methods-96/4 to 96/7, 96/13 and 96/14) as well as sampling techniques were developed during the intersessional period and submitted for examination by the subgroup. These drafts were also submitted to SCAR for consideration by SCAR-BBS (WG-EMM-Methods-96/12). The subgroup noted with thanks the comments of SCAR-BBS. It was noted that the SCAR-BBS received the drafts late in July and had not had sufficient time to circulate them among its members. However, the Subcommittee's comments were taken into account, as appropriate, throughout the subgroup's discussions. Matters raised in the report of the intersessional meeting of WG-EMM's Subgroup on Statistics (Appendix H) and excerpts from the report of the meeting of SCAR-GSS (SC-CAMLR-XV/BG/10) were also taken into consideration by the subgroup.

5. It was agreed that when only minor amendments and editorial changes were required to draft standard methods, these drafts would be revised accordingly and recommended for publication in *CEMP Standard Methods*. In cases where drafts required an extensive revision, the subgroup identified those points which needed to be taken into account in the revision as well as scientists whose assistance would be required for revision(s) during the forthcoming intersessional period.

6. In its review of methods, the subgroup considered the development of procedures to examine the suitability of monitoring methods to meet CEMP objectives. Where appropriate these deliberations are incorporated into the relevant sections of this report. However, the subgroup was unable to establish a framework for a comprehensive review of existing methods and reiterated WG-EMM's call to develop this framework as a matter of urgency (SC-CAMLR-XIV, Annex 4, paragraph 4.42).

7. The comments and recommendations of the subgroup in respect of standard methods and techniques given in this report should be read in conjunction with original papers tabled at the meeting.

New Standard Methods

Attachment of Instruments

8. A technique for attaching external instruments, including TDRs and satellite tracking devices, to penguins and Antarctic fur seals was prepared by Dr I. Boyd (UK) at the request of WG-CEMP. It was agreed that this technique (WG-EMM-Methods-96/5) was practical, comprehensive and, with minor amendments, including those suggested by SCAR-BBS, should now be included as an appendix to the *CEMP Standard Methods*.

9. The subgroup recalled that a Workshop on Researcher-Seabird Interactions had been held in 1993 in Minnesota, USA, and noted that much useful information was contained in the subsequent report. Similarly, it was noted that the work of Dr R. Bannasch (1995) provided important information. Both reports contained theoretical and practical information to be considered when attaching instruments to birds and seals.

10. It was noted that the wrapping of instruments in electrical tape before they were glued onto an animal allowed subsequent removal with minimal damage to fur, hair or feathers. Where larger instruments are used, or where longer deployments (a month or more) are required, it may be necessary to glue unwrapped instruments directly onto an animal. The instruments are then removed by carefully cutting the feathers or pelage close to the instruments. Instruments not recovered in this way will fall off during moult. It was noted that some Members have carried out over 100 platform transmitter terminal (PTT) deployments of Adélie penguins using this method without any demonstrable adverse effects on the survival of the birds.

11. The subgroup noted that some of the fast-setting epoxy glues (e.g. Loctite 401) are exothermic when setting and that the structural strength of the feathers and thus their ability to hold the instrument may be compromised if too much heat is generated. Care should be exercised, therefore, to delay the attachment of the instrument to the feathers by a few seconds to allow some of the initial heat to dissipate.

12. The subgroup reiterated the requirement that instruments attached to penguins should be neutrally buoyant and that their total weight in air should be less that 5% of the bird's weight.

13. The subgroup noted that many scientists are tracking flighted birds, including CEMP-designated species. However, the techniques used for attaching instruments to flighted birds are different to those used on penguins and include the use of harnesses. The subgroup recommended that scientists with experience in attaching instruments to flying birds be asked to provide details of methods they have used and to develop recommendations for a CEMP standard method.

Data Collection Using TDRs

14. A detailed method for the collection of at-sea behaviour data using TDRs had been prepared by Dr Boyd (WG-EMM-Methods-96/5). It was noted that the deployment of these instruments was straightforward and that the method as presented was appropriate and in a form suitable for immediate use. In some instances, and for penguins in particular, where the duration of foraging trips is less than one day, it may be necessary to set the sampling rate for depth intervals at one second. This will use available electronic memory much faster and may require shorter deployment times or instruments (TDRs) with expanded memory. It was agreed that, with this addition, the standard method be adopted.

15. At its 1994 meeting, WG-CEMP began the process of developing indices of predator foraging performance based on at-sea behaviour for inclusion in the monitoring program (SC-CAMLR-XII, Annex 6, paragraphs 4.15 to 4.23). At its first meeting, WG-EMM approved the proposal to hold a workshop on the measurement of at-sea behaviour of krill predators (SC-CAMLR-XIV, Annex 4, paragraphs 5.29 to 5.32).

16. The subgroup strongly supported the proposal for the workshop to examine the methods for analysis and interpretation of TDR data and the development of indices of predator foraging performance and requested WG-EMM to support the holding of such a workshop in the first half of 1997.

Methods for Monitoring Petrels

17. The subgroup considered the proposed methods for dietary studies of the Cape petrel (WG-EMM-Methods-96/4), for monitoring the population size and breeding success of the Antarctic petrel (WG-EMM-Methods-96/14) and describing a lavage technique for sampling diets of Procellariiformes (WG-EMM-Methods-96/6).

Chick Diet – Cape and Antarctic Petrel

18. The subgroup welcomed the draft method developed by Drs N. Coria, G. Soave and D. Montalti (Argentina) for dietary studies of the Cape petrel (WG-EMM-Methods-96/4). It was noted that the method was based largely on Method A8, which had been developed for penguins. Because of similarities between the Cape petrel and the Antarctic petrel, it was agreed that both species could be investigated using the same procedure.

19. It was agreed that the monitoring method should be based on the collection of food from parent birds and not from chick regurgitations. Adults should be caught beside their nest to ensure that they are, in fact, breeding.

20. The question of whether seawater, fresh water or water of intermediate salinity should be used for flushing petrels (and also penguins) was discussed. Although both fresh and seawater have been used, there are insufficient data to determine the relative value or effect of either. It was agreed that until appropriate investigations have been carried out, scientists could use either, but they must note which had been used when reporting the data to CCAMLR. It was emphasised that water used for stomach flushing should be warmed. Where possible, the recovery of birds after flushing should be monitored.

21. Several problems have been encountered in preserving and analysing food items. These problems were generic and concerned samples obtained from all bird species. They were therefore considered along with a more detailed examination of parameter A8 (paragraphs 62, 63 and 66 to 69).

22. The method was revised in light of the above discussions and it was agreed that it is suitable for publication as a CEMP standard method. The revised text is given in WG-EMM-96/53.

Antarctic Petrel

23. Draft methods prepared by Dr F. Mehlum (Norway) and Dr J. van Franeker (Netherlands) for the determination of breeding population size and adult survival rate were presented in WG-EMM-95/86 and WG-EMM-Methods-96/14. The latter paper included the comments received from SCAR-BBS (WG-EMM-Methods-96/12). The subgroup expressed its thanks to the authors for the considerable effort in preparing the documents.

Breeding Population Size

24. It was agreed that the proposed method was appropriate but that further drafting was required to take account of the following points before finalisation as a standard method.

(i) Following courtship, Antarctic petrels undertake a pre-laying exodus and are away from the colony for a few days. The recording of nests and eggs should commence immediately the birds return to lay.

(ii) Colonies of Antarctic petrels vary enormously in size from a few nests to colonies in excess of 100 000. Different methods of counting birds (including photographic surveys) are therefore required.

(iii) The list of 'Mandatory Data' should include only those data which are to be used in the calculation of CEMP indices. All supplementary data recorded during observation should be included in the data recording forms developed for this purpose.

(iv) If observations do not take place at a standard time each day, then they should be made each day at a random time over the 24-hour period, and the time of these observations recorded. Later analysis will show whether any bias is introduced by sampling at a particular time of day.

(v) Consideration should be given to determining the applicability of this method to Cape petrels.

Adult Survival Rate

25. This method was drafted originally to monitor both annual survival and recruitment (WG-EMM-Methods-96/14). The subgroup, however, felt that for large and dense colonies it would be

difficult to determine recruitment because it would be virtually impossible to find all the banded birds and also because birds often do not return to breed in their natal colony. Once adults commence breeding, they apparently return each season to the same nest. It was agreed, therefore, that a new parameter of 'adult annual survival' be adopted and that the text of the method be rewritten accordingly.

26. A detailed procedure for the establishment of sampling plots for large colonies was prepared by Dr S.-H. Lorentsen (Norway). This procedure was adopted for inclusion as an appendix to the *CEMP Standard Methods*.

Stomach Lavage for Procellariiformes

27. A paper on the use of stomach lavage techniques to sample diets of Procellariiformes was prepared by Dr R. Veit (USA) (WG-EMM-Methods-96/6) at the request of WG-CEMP. The subgroup welcomed this paper, which gives a useful background for the use of this sampling technique. The paper primarily addressed the sampling of birds caught at sea and did not relate directly to the determination of chick diet. The information contained in the paper was considered in the development of methods for the collection of food samples from petrels (paragraphs 18 to 22).

28. The subgroup noted that for species of birds which are of special conservation concern, stomach lavage would be the most appropriate procedure because it does not involve killing birds.

29. It was emphasised that in sampling stomach contents multiple flushing is necessary unless no food items were obtained in the first flush.

Breeding Chronology – Antarctic and Cape Petrels

30. The subgroup recommended that a method for breeding chronology similar to Method A9 should be developed for petrels.

Effects of Diseases and Pollutants

31. At last year's meeting of WG-EMM, it was noted that the outbreak of disease or presence of pollutants may mask the effects on monitored parameters of food availability or changes in the environment. Therefore, it was agreed that protocols should be developed for the collection and

preservation of samples taken from birds in the field for later pathological and/or toxicological analysis (SC-CAMLR-XIV, Annex 4, paragraphs 5.46 to 5.51).

32. Papers submitted to the subgroup dealt with protocols for collecting samples for both toxicological (WG-EMM-Methods-96/7) and pathological analysis (WG-EMM-Methods-96/13). The latter document was submitted as an extension of WG-EMM-Methods-95/44.

33. The subgroup made some editorial changes to the protocol for collecting samples for toxicological analysis and recommended that the protocol should be published as an annex to *CEMP Standard Methods*. Note was taken that samples could only be analysed in specialised laboratories and that such analyses were very expensive. Contamination of collected samples is possible if the wrong sort of containers are used and so care should be taken to have the correct containers on hand in the field.

34. The subgroup noted that the instructions for the collection of diagnostic samples if and when an outbreak of disease or a parasite infestation is observed in a seabird colony (WG-EMM-95/44) had been available to Members and that comments were to be forwarded to Dr Kerry for inclusion in a revised document (SC-CAMLR-XIV, Annex 4, paragraphs 5.46 to 5.48). No comments were received, so the document was revised by Dr H. Gardner (Australia) in the light of experience gained by a number of veterinarians and other scientists working on the Australian CEMP program. The revised document was tabled as part of WG-EMM-Methods-96/13. The subgroup thanked Dr Gardner for its preparation.

35. The subgroup agreed that the revised instructions provided an excellent approach to the examination of birds for disease and the collection of samples for diagnostic investigations. They could be used immediately if required. The subgroup felt, however, that it did not have sufficient expertise to thoroughly evaluate the content of the protocol and recommended that time be given for examination by other veterinarians. Due to the important nature of the document and the fact that scientists may need to collect specimens in the field this season, it is requested that Members forward comments to the Secretariat before the 1996 meeting of the Scientific Committee. Dr Gardner will then be asked to revise the text, which in turn should be forwarded to those undertaking field programs. Inclusion as an appendix to the *CEMP Standard Methods* would then follow.

36. The subgroup requested that diagrams or colour photographs should be included in the protocol to aid dissection and identification of organs and tissues to be sampled. Dr Kerry agreed to consult with Dr Gardner on the provision of such illustrative material.

37. The recommendation of WG-EMM was reiterated that upon publication of the protocol, scientists conducting field studies should consult with a veterinary pathologist before going into the field, to ensure that, if needed, urgent analysis of samples is possible and any specialised sampling requirements can be accommodated (SC-CAMLR-XIV, Annex 4, paragraph 5.49). It was recommended that scientists make contact with appropriate laboratories before going into the field to ensure analyses can be undertaken if necessary and that collection techniques appropriate to that laboratory are used.

Other Methods

Marking of Birds for Long-term Studies

38. Many of the CEMP parameters require that penguins be permanently marked for identification. Banding has been generally used to do this. There is, however, increasing evidence that flipper bands may be lost or that they may injure individuals of some penguin species (see for example WG-EMM-Methods-96/8). Alternative methods are now being sought. It was noted that a workshop on alternative marking techniques had been held recently in conjunction with the meeting of SCAR-BBS, but unfortunately the report of this workshop was not available to the subgroup.

39. The use of implanted electronic tags is increasing as an alternative to bands. These tags have the advantage of permitting automated identification and monitoring. A study on the use of implanted identification tags in penguins was submitted for consideration at the meeting (WG-EMM-Methods-96/8). The paper had been sent earlier to SCAR-BBS as a contribution to its workshop (see paragraph 38 above).

40. The subgroup agreed that for some applications the use of implanted tags makes monitoring easier and helps avoid the multiple handling of birds. Currently, tags are implanted in Adélie penguins under the skin of the neck and care should be taken not to implant into muscle tissue. Introduction of bacteria during tag implantations has the potential to lead to chronic localised infections and the development of recurrent acute infections or disseminated foci of persistent infection, following detachment, of bacteria from the initial site and dispersion via the bloodstream. Detailed information is contained in WG-EMM-Methods-96/8.

41. It was also noted that implanted tags may migrate away from the original injection site. The subgroup recommended that studies be conducted as soon as possible on the prevalence of tag

migration. The use of X-ray examination for such studies is preferable to killing the bird for dissection.

42. The subgroup recommended that since the use of implanted tags is increasing in CEMP monitoring studies, protocols for their use should be developed and published in *CEMP Standard Methods*. Dr Kerry agreed to draft these methods in conjunction with Dr J. Clarke (Australia).

Crabeater Seals

43. The subgroup reviewed an extract from the report of the August 1996 meeting of SCAR-GSS (SC-CAMLR-XV/BG/10) presented by Dr T. Øritsland (Norway) on behalf of SCAR-GSS. It was noted that SC-CAMLR had requested the assistance of SCAR-GSS in the drafting of standard methods for the monitoring of crabeater seals.

44. SCAR-GSS had advised that its APIS program should provide much new information on circumpolar population numbers and that standard methods for surveying crabeater seals should become available in 1997. Further, ancillary information on the ecology of crabeater seals is also likely to arise from APIS fieldwork. The subgroup noted that SC-CAMLR had supported the development of APIS (SC-CAMLR-XIII, paragraphs 9.2 to 9.9).

45. The subgroup drew WG-EMM's attention to the advice of SCAR-GSS that, given the difficulties of working in the pack-ice and the general paucity of knowledge on crabeater seals, it is too soon to determine which, if any, data are relevant for CEMP purposes. SCAR-GSS also advised that the development of appropriate monitoring methods and indices for crabeater seals is only likely to be possible when APIS is completed in 2000.

46. The subgroup, therefore, recommended that members with experience in working on crabeater seals should continue towards developing monitoring indices for this species. Furthermore, WG-EMM should encourage the maintenance of close contact with, and support for, APIS in the interests of developing monitoring methods and indices for crabeater seals.

REVIEW OF EXISTING METHODS AND TECHNIQUES

47. The subgroup discussed the existing standard methods and suggested the following changes, additions and/or comments.

Method A1 – Adult Weight on Arrival at Breeding Colony

48. There were no suggested changes to this method.

49. The subgroup noted that very few scientists were able to be in the field in time to observe the first arrival of birds at the breeding colony. Last year, a possible new method was suggested which may help to assess the variability in early-season breeding condition among Adélie penguins (SC-CAMLR-XIV, Annex 4, paragraph 5.16). This method involves comparing interannual variability in weights of adults and first eggs at peak egg laying, using nests with two adults present but at the stage at which only the first egg had been laid.

50. Dr Trivelpiece reported that this method looks promising, although additional years of data are needed before a judgment can be made. There were significant differences between years in the weights of male and female Adélie penguins and in the weights of the eggs. However, not all of these years also had data on the length of time between arrival and egg laying, making it impossible to determine whether these differences reflected differences in actual arrival condition or in the length of the courtship fasting period. This study is continuing and results will be presented when available.

Method A2 – Duration of First Incubation Shift

51. The subgroup suggested the following changes to the data collection and analysis methods of this parameter:

Data Collection: General Procedure

1. Select 100 pairs prior to the beginning of the egg-laying period. Note: these can be the same birds as used to determine breeding success by Procedure B.

2. Band or mark (with dye) both pair members, capturing (marking) them close to egg laying to minimise the possibility of the birds deserting.

3. Check nests daily, note dates of relief. When both birds are present at the nest during a nest check, each receives a half-day credit for that day.

4. Continue monitoring nests daily until the chicks hatch and both members of the pair are seen, indicating they are both still alive.

Analytical Methods

1. For analysis purposes, use only pairs which laid two eggs and successfully hatched both chicks (note: this will minimise differences in age/experience among the sample nests between years).

2. For each nest, day 0 equals the date of clutch completion.

3. Calculate the duration of the first incubation shift for males and females.

4. Calculate total number of days spent by males and females on the nest throughout the incubation period.

5. Determine the total number of reliefs at the nest during the incubation period.

6. Note the dates and causes of nest failures.

Interpretation of Results

Add paragraph 2:
Analysis of incubation shift durations within and among sites indicates that incubation shifts at specific sites are fairly constant year-to-year while significant differences exist between different sites (Trivelpiece, ms in prep.). Adélie penguins may be returning to areas of known productivity during their first long incubation shifts (WG–EMM-96/58), hence the fairly consistent, year-to-year, duration of shifts at each site. Differences between sites may reflect differences in travel time needed to reach productive areas in the early spring from different breeding locations.

Method A5 – Duration of Foraging Trips

52. Highly Desirable Data

Add paragraph 2:
The number of chicks a pair is feeding should be recorded as it may influence the foraging behaviour (and diet) of the adults.

Interpretation of Results

Add paragraph 3:

Interannual differences in foraging trip durations from sites adjacent to broad-shelf regions may reflect differences in krill distribution, not availability or biomass *per se*. For example, long trips by Adélie penguins at Anvers Island occur in conjunction with the dominance of large size classes in the krill population, short foraging trips correlate with the dominance of juvenile krill. Large krill are distributed at the shelf break where spawning occurs, small krill are found inshore. For sites such as Anvers Island where the shelf break is 120+ km distant, large interannual variability in foraging durations reflects differences in krill distribution and the distances Adélie penguins must travel to obtain food.

Additional Comments on Method A5

53. At the 1995 meeting of WG-EMM, evidence was presented that male and female Adélie penguins showed differences in foraging behaviour (SC-CAMLR-XIV, Annex 4, paragraph 5.17). These differences, as determined for Béchervaise Island and Edmonson Point, are set out in WG-EMM-Methods-96/11. Based on the above considerations, the subgroup agreed that it was essential that the foraging trip durations be recorded and analysed separately for males and females. Further, because Adélie penguins alternate variously short and long trips, it may be necessary to examine the foraging behaviour of individual birds; scientists undertaking CEMP studies should report the sequential foraging trips of individual birds. With this in mind, the subgroup noted the suggestions of the Secretariat contained in WG-EMM-Stats-95/6.

54. The subgroup noted that, in addition to radio frequency telemetry, there are now a number of methods available for determining foraging trip duration, including Automated Penguin Monitoring Systems, as used by Australia, and satellite tracking. It would be preferable to include descriptions of such automated means as an appendix to the *CEMP Standard Methods* and update them regularly.

Method A6 – Breeding Success

55. Last year, WG-EMM suggested that Procedure C does not reflect breeding success but rather fledging success (chicks fledged per chick hatched) (SC-CAMLR-XIV, Annex 4, paragraph 5.20). In fact, Procedure C explicitly does include hatching, fledging and overall breeding success.

56. The subgroup noted that Procedure A was considerably less rigorous (and therefore potentially less useful) than Procedures B and C. It was therefore recommended that for new studies it should be mandatory to use either Procedure B or Procedure C. Editorial changes to the standard method should be made as necessary. This would be undertaken by the Secretariat prior to the forthcoming meeting of the Scientific Committee.

Method A7 – Chick Weight at Fledging

57. The subgroup suggested that the comments in Procedure A, paragraph 2, relating to banded birds would be more appropriate if included in a separate procedure. Therefore, the last sentence of paragraph 2 in the standard method should be deleted.

An outline of an additional procedure relating to obtaining chick weight at fledging for banded birds was proposed:

General Procedure – Procedure C:

Procedure C involves weighing chicks that are banded as part of ongoing demographic studies (Method A4).

1. Capture banded chicks which are on the beach and about to fledge. Weigh each chick (to nearest 10 to 50 g) and record its band number.

2. Make regular (1 to 2 times daily) visits to all beaches throughout the fledging period, continuing to capture and weigh banded chicks.

3. Attempt to capture 200 to 300 individuals per year.

Comments

Procedure C will provide a chronology of fledging dates each year and will allow later examination of the relationship between chick fledging weights and survival. See also comments in paragraph 69.

Method A8 – Chick Diet

58. The subgroup considered the SCAR proposal that General Procedure A of Method A8 should be redrafted as suggested in WG-EMM-Methods-96/12. In considering this proposal, the subgroup decided that the stomach flushing procedure represents a sample collection technique and as such it should be published as an appendix to the *CEMP Standard Methods*. The proposed text of the stomach flushing procedure was compared with the existing procedure contained in Appendix 7 in the *CEMP Standard Methods*. It was found that the SCAR and CEMP versions were very similar, and it was recommended that Appendix 7 be retained in its present form.

59. As a precautionary measure, it was recommended that the tube used for flushing the stomach should not be inserted deep into the stomach and generally should be stopped when it reaches the bird's oesophagus.

60. The subgroup suggested that if the procedure of taking the diet sample resulted in the bird's death, the bird should be retained for post mortem analysis. An example of the value of this was shown by the post mortem investigation of a little penguin (*Eudyptula minor*) described in WG-EMM-Methods-96/10.

61. It was noted that eyeball measurements could provide good estimates of the length of euphausiids and that some regression equations for this had already been published (e.g. Nemoto et al., 1984).

62. The subgroup recommended that diet samples comprising krill which may require long storage times should be first fixed in formalin (4–10%, 12 h) prior to being preserved in 70% alcohol.

63. WG-EMM had requested the Subgroup on Statistics to consider how data on empty stomachs should be incorporated into the calculation of indices (SC-CAMLR-XIV, Annex 4). WG-EMM noted that it was essential to determine if birds found with empty stomachs were breeders and suggested that the easiest way to report this information would be as a single figure on form A8 for the number of empty stomachs (Appendix H, paragraphs 21 and 22). The subgroup also recommended that whether or not birds with empty stomachs were found, the total number of birds sampled with food in their stomachs should still be five for each five-day period as required by General Procedure A.

64. The subgroup recommended that the following additional data should be recorded as part of Method A8 (chick diet):

(i) the sex of the sampled birds (see *CEMP Standard Methods*, Appendix 2); and

(ii) the number of chicks of each bird at the time of sampling.

The latter data could be obtained by either capturing the bird at its nest site instead of on the beach or by marking the bird following sampling and following it to the nest.

65. The subgroup noted the comments of the Scientific Committee (SC-CAMLR-XIV, Annex 4, paragraph 5.25) concerning the differences between the first and subsequent vomits (noted in WG-EMM-95/32). The subgroup recommended separating the fresh food fraction of the stomach content from the more digested fraction during collection by switching trays while lavaging the bird. This would make the subsequent analysis of the stomach content easier.

66. Differences in foraging patterns of males and females had recently been documented for Adélie penguins at Edmonson Point and Béchervaise Island (WG-EMM-Methods-96/11). It was recommended that diet samples collected in accordance with Method A8 should also be separately analysed by sex.

67. The subgroup recommended that comments relating to possible bias for species with individuals whose foraging trips may or may not include overnight periods at sea (WG-EMM-96/49 and 96/55) be added to the 'Problems to be Considered' section of the standard method.

68. The need to develop a standardised procedure for Method A8 which would enable a quantitative evaluation of the stomach content was discussed. Several approaches were considered, including evaluation: of the sample wet weight versus displacement volume, methods of removing excess water from the sample, and using a standard volume of water for each sample. The subgroup felt that the best way of dealing with the issue would be to convene a special workshop with participation of experts in sampling zooplankton.

Method A9 – Breeding Chronology

69. The proposed procedure for selecting a sample of nests (see also Method A6, Procedure B, 1) appears to be too restrictive. The procedure should be made more flexible to allow for differences in site conditions and colony size while maintaining the required sample size. The subgroup called for the preparation of modified text for consideration at the next meeting of WG-EMM.

Methods B1, B2 and B3 – Flying Birds

70. No expertise on the subject was available among the subgroup members present, therefore no comments were made with regard to these methods.

Method C1 – Duration of Cow Foraging/Attendance Cycles

71. The recommendation of the Subgroup on Statistics that the method should be amended to allow for reporting failures of animals with transmitters to complete their first six post-natal trips was adopted (Appendix H, paragraph 29).

Method C2 – Pup Growth

72. The subgroup felt that observations carried out in accordance with Procedure A might also be also used to collect information on mortality of pups, i.e. information on the survival of marked pups. However, it was noted that at many sites this would be very difficult, if not impossible, to achieve.

73. The comment of the Subgroup on Statistics that there might be a bias in Procedure B indices because it is impossible to identify pups weighed early in the season which will not survive to weaning, has raised an important point, also relevant to Method A7 (see Williams and Croxall, 1990). This might be also pertinent for penguin chicks (Method A7) and the matter should be investigated.

MONITORING OF ENVIRONMENTAL PARAMETERS

74. Standard methods for the monitoring of environmental parameters were adopted by WG-CEMP in 1990 (SC-CAMLR-IX, Annex 4, paragraph 120). Since these methods have not been developed to the same degree of detail as the predator methods, they are currently appended to the *CEMP Standard Methods*.

75. The above methods are preliminary and submission of the relevant data to CCAMLR is not yet required. The methods are allocated codes in accordance with the proposed CCAMLR nomenclature for CEMP standard methods and include:

F1 Sea-ice cover as viewed from the colony

F2 Sea-ice within the study region

F3 Local weather

F4 Snow cover in the colony.

76. The subgroup noted the comments by the Subgroup on Statistics dealing with the monitoring of environmental parameters influencing harvested species (Appendix H, paragraphs 47 to 50) and dependent species (Appendix H, paragraphs 51 and 52). In particular, the subgroup noted that significant environmental events (i.e. those which fall outside a continuous monitoring regime) are encountered and that these may directly affect monitored parameters. The subgroup agreed that these should be noted and reported to CCAMLR on the predator reporting forms. Accordingly, all forms should be amended to include an entry for 'unusual environmental conditions'.

77. The subgroup noted that the identification and recording of environmental parameters for monitoring purposes requires further development as a matter of priority. Such development needs to be encouraged through a series of workshops to identify essential parameters and to develop decision rules which may be used to select 'critical' parameters which exert demonstrable influences on monitored indices.

OTHER BUSINESS

78. The subgroup noted the discussions of the Subgroup on Statistics on the CPD index. This index is currently calculated as the krill catch within 100 km of predator colonies during the period December to March and is intended to indicate the degree of spatial overlap between the foraging area of the birds and the fishery. The subgroup agreed that this was a useful index, but noted that in some instances Adélie penguins regularly forage farther afield. The foraging range of the Adélie penguin varies with the stage in the breeding cycle and the sex of the bird. There is also increasing evidence to suggest that birds regularly travel to specific areas to forage and in any event to the edge of the continental shelf. With this in mind, the subgroup endorsed the recommendations of the Subgroup on Statistics (Appendix H, paragraphs 38 to 40).

79. The subgroup noted that the book *CEMP Standard Methods* would be improved by the addition of an introductory section which described the development of CEMP, its objectives and structure and explained the choice of monitored species and parameters. Such an introduction would be of particular value to scientists who are planning to commence field programs and to field staff.

80. Electronic submission (on disc, e-mail or other internet systems) is now being encouraged by the Secretariat, provided that the data conform to the structure of the CCAMLR databases. Members wishing to submit data electronically should contact the Secretariat to obtain a description of the format in which their data should be submitted.

SUMMARY ADVICE TO WG-EMM

81. (i) Drafts of standard methods recommended for inclusion in *CEMP Standard Methods* (paragraphs 8, 14, 22, 26, 33 and 34) and those which have been prepared but require further revision (paragraphs 24 and 25) are presented in WG-EMM-96/53.

(ii) The following new methods were recommended for development:

(a) breeding chronology of Antarctic and Cape petrels (paragraph 30);
(b) attachment of instruments to flying birds (paragraph 13); and
(c) marking of birds for long-term studies (paragraph 42).

(iii) Several amendments were proposed for existing standard methods (paragraphs 48 to 77).

(iv) An investigation should be carried out on the effect on birds of fresh- and sea-water used for stomach flushing (paragraph 20).

(v) The workshop on the analysis of TDR data and the development of indices of predator foraging performance should be held in the first half of 1997 (paragraph 16).

(vi) Close contact with and support of APIS should be continued in the interests of developing monitoring methods and indices for crabeater seals (paragraph 46).

(vii) A special workshop should be convened to develop a standardised procedure for a quantitative evaluation of the stomach content used for dietary studies (paragraph 68).

CLOSE OF THE MEETING

82. The report was adopted. In closing the meeting the Convener thanked the Institute of Marine Research in Bergen and Dr Øritsland for hosting the meeting. He also thanked all participants.

REFERENCES

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Nemoto, T., M. Okiyama and M. Takahashi. 1984. Squid in food chains of the Antarctic marine ecosystem. *Memoirs of the National Institute of Polar Research*, Tokyo, Special Issue 32: 89–92.

Williams, T.D. and J.P. Croxall. 1990. Is chick fledging weight a good index of food availability in seabird populations? *Oikos*, 59: 414–416.

ATTACHMENT A

AGENDA

Subgroup on Monitoring Methods
(Bergen, Norway, 8 to 10 August 1996)

1. Introduction

2. Review of New Methods
   (i) Attachment of Instruments
   (ii) Petrels
   (iii) Diseases and Pollutants
   (iv) Other Methods

3. Amendments to Old Methods

4. Comprehensive Review of Methods

5. Advice to WG-EMM and Future Work

6. Close of Meeting.

ATTACHMENT B

LIST OF PARTICIPANTS

Subgroup on Monitoring Methods
(Bergen, Norway, 8 to 10 August 1996)

CORSOLINI, Simonetta (Ms)	Dipartimento di Biologia Ambientale Universita di Siena Via delle Cerchia 3 53100 Siena Italy
KERRY, Knowles (Dr)	Convener, Subgroup on Monitoring Methods Australian Antarctic Division Channel Highway Kingston Tas. 7050 Australia knowle_ker@antdiv.gov.au
LORENTSEN, Svein-Håkon (Dr)	Norwegian Institute of Nature Research Tungasletta 2 N-7005 Trondheim Norway svein-hakon.lorentsen@nina.nina.no
MILLER, Denzil (Dr)	Sea Fisheries Research Institute Private Bag X2 Roggebaai 8012 South Africa dmiller@sfri.sfri.ac.za
NAGANOBU, Mikio (Dr)	National Research Institute of Far Seas Fisheries Orido 5-7-1, Shimizu Shizuoka 424 Japan naganobu@enyo.affrc.go.jp
ØRITSLAND, Torger (Dr)	Marine Mammals Division Institute of Marine Research PO Box 1870 Nordnes N-5024 Bergen Norway

TORRES, Daniel (Prof.)
Instituto Antártico Chileno
Luis Thayer Ojeda 814, Correo 9
Santiago
Chile
inach@reuna.cl

TRIVELPIECE, Wayne (Dr)
Department of Biology
Montana State University
310 Lewis Hall
Bozeman, Mt. 59717
USA
ubiwt@msu.oscs.montana.edu

SECRETARIAT:
Eugene SABOURENKOV (Science Officer)
Genevieve NAYLOR (Secretary)
CCAMLR
23 Old Wharf
Hobart Tasmania 7000
Australia
ccamlr@ccamlr.org

ATTACHMENT C

LIST OF DOCUMENTS

Subgroup on Monitoring Methods
(Bergen, Norway, 8 to 10 August 1996)

WG-EMM-Methods-96/1	PROVISIONAL AGENDA FOR THE 1996 MEETING OF THE WG-EMM SUBGROUP ON METHODS
WG-EMM-Methods-96/2	LIST OF PARTICIPANTS
WG-EMM-Methods-96/3	LIST OF DOCUMENTS
WG-EMM-Methods-96/4	A METHODOLOGICAL PROPOSAL TO DIET STUDIES OF THE CAPE PETREL, *DAPTION CAPENSE* N.R. Coria, G.E. Soave and D. Montalti (Argentina)
WG-EMM-Methods-96/5	DRAFT STANDARD METHODS FOR ATTACHMENT OF INSTRUMENTS AND THE COLLECTION OF DATA ABOUT AT-SEA BEHAVIOUR I.L. Boyd (UK)
WG-EMM-Methods-96/6	USING STOMACH LAVAGE TO SAMPLE DIETS OF PROCELLARIIFORMES R. Veit (USA)
WG-EMM-Methods-96/7 Rev. 1	PROTOCOLS FOR COLLECTING SAMPLES FOR TOXICOLOGICAL ANALYSIS S. Focardi, S. Corsolini and E. Franchi (Italy)
WG-EMM-Methods-96/8	IMPLANTED IDENTIFICATION TAGS IN PENGUINS: IMPLANTATION METHODS, TAG RELIABILITY AND LONG-TERM EFFECTS (DRAFT VERSION) J. Clarke and K. Kerry (Australia)
WG-EMM-Methods-96/9	CCAMLR STANDARD METHOD A8: PROCEDURE A J. Clarke (Australia)
WG-EMM-Methods-96/10	POST MORTEM REPORT ON A LITTLE PENGUIN J. Clarke (Australia)
WG-EMM-Methods-96/11	GENDER DIFFERENCES IN ADELIE PENGUIN FORAGING TRIPS (CCAMLR STANDARD METHOD A5: DURATION OF FORAGING TRIPS) J. Clarke and K. Kerry (Australia)

WG-EMM-Methods-96/12	CEMP MONITORING METHODS: REPORT FROM THE SCAR BIRD BIOLOGY SUBCOMMITTEE TO THE CCAMLR WORKING GROUP ON ECOSYSTEM MONITORING AND MANAGEMENT (WG-EMM) SUBGROUP ON MONITORING METHODS SCAR Bird Biology Subcommittee
WG-EMM-Methods-96/13	PROTOCOLS FOR TAKING SAMPLES FOR PATHOLOGICAL ANALYSIS IN THE EVENT OF DISEASE BEING SUSPECTED AMONG MONITORING SPECIES K. Kerry (Australia)
WG-EMM-Methods-96/14	DRAFT STANDARD METHODS FOR FULMARINE PETRELS: A) ANTARCTIC PETREL *THALASSOICA ANTARCTICA* F. Mehlum (Norway) and J.A. van Franeker (Netherlands)

OTHER DOCUMENTS

WG-EMM-95/44	PROTOCOLS FOR TAKING SAMPLES FOR PATHOLOGICAL ANALYSIS IN THE EVENT OF DISEASE BEING SUSPECTED AMONG MONITORED SPECIES K.R. Kerry, J. Clarke, D. Opendorf (Australia) and J. Cooper (South Africa)
WG-EMM-95/46	DRAFT: DIFFERENCES IN THE FORAGING STRATEGIES OF MALE AND FEMALE ADELIE PENGUINS J. Clarke and K. Kerry (Australia) and E. Franchi (Italy)
WG-EMM-95/86	DRAFT STANDARD METHODS FOR FULMARINE PETRELS: A) ANTARCTIC PETREL F. Mehlum (Norway) and J. A. van Franeker (The Netherlands)
WG-EMM-STATS-96/5	DATA REQUIREMENTS FOR METHOD A5 D.J. Agnew (Secretariat)
WG-EMM-96/6	REPORT OF THE MEETING OF THE SUBGROUP ON STATISTICS (Cambridge, UK, 7 to 9 May 1996) (Attached to WG-EMM report as Appendix H)
SC-CAMLR-XV/BG/10	EXCERPTS FROM THE REPORT OF THE MEETING OF THE SCAR GROUP OF SPECIALISTS ON SEALS (CAMBRIDGE, UK, 1–2 AUGUST 1996)