Note: Official Documents of the Commission and the Scientific Committee for the Conservation of Antarctic Marine Living Resources are produced in the four official languages of the Commission and Scientific Committee: English, French, Russian and Spanish. Copies of documents in these languages can be obtained from the Secretariat by writing to:

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Commission for the Conservation of
Antarctic Marine Living Resources
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AUSTRALIA

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REPORT OF THE FIFTH MEETING OF THE SCIENTIFIC COMMITTEE

OPENING OF THE MEETING

1.1 The Scientific Committee for the Conservation of Antarctic Marine Living Resources met under the Chairmanship of Dr. D. Sahrhage (Federal Republic of Germany) from 8 to 15 September 1986 at the Wrest Point Hotel, Hobart, Australia.

1.2 Representatives from the following Members attended the meeting: Argentina, Australia, Belgium, Brazil, Chile, European Economic Community, France, German Democratic Republic, Federal Republic of Germany, India, Japan, Republic of Korea, New Zealand, Norway, Poland, South Africa, Union of Soviet Socialist Republics, United Kingdom and United States of America.

1.3 At the invitation of the Scientific Committee, representatives from the Food and Agriculture Organisation of the United Nations (FAO), the Intergovernmental Oceanographic Commission (IOC), the International Union for Conservation of Nature and Natural Resources (IUCN), International Whaling Commission (IWC), the Scientific Committee on Antarctic Research (SCAR), and the Scientific Committee on Oceanic Research (SCOR) attended the meeting as observers. Representatives from the acceding states of Spain, Sweden and Uruguay also participated as observers by invitation.

1.4 The Chairman welcomed delegates, and extended a special welcome to the three new members of the Scientific Committee: Brazil, India and Republic of Korea. Observers were also welcomed and encouraged to participate, as appropriate, in discussions of agenda items 4 through 8.

1.5 A list of participants is at Annex 1. A list of documents considered during the session is at Annex 2.

1.6 Responsibility for the preparation of the Scientific Committee's report was assigned to the following rapporteurs: Dr J. Beddington (UK) (fish resources), Dr I. Everson (UK) (krill resources), Mr D. Miller (South Africa) (ecosystem monitoring and management), Drs G. Chittleborough and K. Kerry (Australia) (data collection and handling), and Dr J. Bengtson (USA) (all other agenda items).

ADOPTION OF THE AGENDA

2.1 The Chairman noted that since the preparation and distribution of the provisional agenda, some additional issues associated with the Commission had arisen which also required the attention of the Scientific Committee.

2.2 It was agreed that in anticipation of related requests expected from the Commission, two additional topics would be addressed under agenda item 14: a) a review of exemptions from conservation measures for scientific research, and b) the proposal to the Commission that the Scientific Committee provide advice on the likely effects on harvested species and non-target species of alternative conservation and harvesting strategies, using the various conservation measures open en to the Commission.

2.3 It was agreed that a request for funds from the BIOMASS Executive would be considered under agenda item 8.

2.4 The provisional agenda, with the additions noted above, was adopted (Annex 3).

REPORT BY THE CHAIRMAN

3.1 The Chairman noted that Members had been active since the last session, with four intersessional meetings taking place. He thanked the conveners, rapporteurs, participants, and the Secretariat for contributing to the success of these meetings.

3.2 The Working Group on Ecosystem Monitoring, chaired by Dr K. Kerry (Australia), met in Hamburg, FRG, from 2–7 July 1986. A report from that meeting was distributed as SC-CAMLR-V/3, and is attached as Annex 6.

3.3 A Workshop on Antarctic Fish Age Determination, chaired by Dr T. Lubimova (USSR), was held in Moscow, USSR, from 14–18 July 1986. The Convener presented a verbal report from that meeting; it is anticipated that a final report will be available soon.

3.4 The Ad Hoc Working Group on Fish Stock Assessment, chaired by Dr R. Hennemuth (USA), was held in Hobart, Australia, from 1–5 September 1986. A report from that meeting was distributed as SC-CAMLR-V/4, and is attached as Annex 4.

3.5 An informal group on Long-Term Program of Work for the Scientific Committee, chaired by Dr K. Sherman (USA), was held in Hobart on 7 September 1986. A report from that meeting was circulated as SC-CAMLR-V/6, and is attached as Annex 9.

3.6 Preparations for a Krill CPUE Simulation Study, coordinated by Dr J. Beddington (UK) had made some progress.

3.7 Preparations for the CCAMLR/IOC Scientific Seminar on Antarctic Ocean Variability and Its Influence on Marine Living Resources, Particularly Krill, to be held in June 1987, are proceeding well (SC-CAMLR-V/BG/16).

3.8 The Chairman noted that a Plan of Action to guide the Secretariat during the intersessional period was drafted, as agreed, at the conclusion of the last meeting by the Chairman, Vice-Chairmen, the Executive Secretary, and Conveners of working groups. This plan proved to be quite useful in coordinating Secretariat activities, and all tasks outlined were completed.

3.9 The Chairman felt that preparing a Plan of Action for the Secretariat annually will prove very useful. However, he noted that changes in venue and dates of planned meetings had caused some difficulty in the past year. Therefore, firmer agreements for intersessional plans should be made during the Scientific Committee meeting to allow Members and the Secretariat to make appropriate plans to participate.

3.10 Reports of Members, reflecting fisheries and scientific activities undertaken during the past year, had not been received from all Members as required. Only 5 Members (European Economic Community, German Democratic Republic, Federal Republic of Germany, Japan and South Africa) submitted their reports in time to meet the deadline of 30 days prior to the Scientific Committee meeting. An additional 11 Members submitted their reports after the deadline or at the start of the meeting. No reports had been received yet from 2 Members.

3.11 In noting that late reports put a heavy, last-minute work load on the Secretariat, the Chairman encouraged all Members to meet the agreed deadlines for submission of documents.

3.12 India submitted a report of activities from 1981–1985 which includes the period during which India participated in the Scientific Committee as an observer. The Chairman

stated that it would be helpful if observers from acceding states would also provide a report of their activities. A report from Spain was received.

3.13 The submission of current STATLANT data is adequate, but the historical data is still incomplete. Detailed historical fisheries data would be valuable, as well as future catch and effort data that provide more detail than those available in STATLANT submissions.

3.14 In closing his report, the Chairman called the Scientific Committee's attention to its important responsibility of providing sound advice to the Commission. He reminded Members of the great scientific and political importance of maintaining high standards in their work and of formulating advice to the Commission to ensure the effective conservation and proper management of the ecosystem and its living resources. Through these actions, the Scientific Committee would promote the credibility of the Convention and of the Antarctic Treaty system as a whole.

FISH RESOURCES

Fish Stock Assessment

4.1 Dr R. Hennemuth presented the report (SC-CAMLR-V/4) of the Ad Hoc Working Group on Fish Stock Assessment, which is attached as Annex 4. The group had met in Hobart from 1 to 5 September under Dr Hennemuth's Chairmanship.

4.2 The Committee noted that considerable progress had been made and thanked the members of the group, the Convener and the Rapporteur (Dr J. Gulland) for their hard work.

4.3 Information required for stock assessment has been available to the group from the current fisheries on most stocks of major importance. There are still, however, some significant shortcomings: these include gaps in the historical data series, lack of detailed catch and effort statistics, non-standard reporting of some length and age data, and the lack of any information other than total catches for some stocks, e.g. *Notothenia guntheri (Patagonotothen brevicauda guntheri)* and *Dissostichus eleginoides*. These gaps seriously inhibit the production of complete and accurate assessments.

4.4 A discussion of the Working Group's conclusions on the status of the stocks was deferred until a discussion of the agenda item 'Advice to the Commission' (paragraphs 4.38–4.65).

4.5 The Working Group had made a number of recommendations concerning future assessments of fish stocks; these concerned routine submission of data, the preparation of assessments, the co-ordination of surveys and the form of the advice on stock assessment matters.

4.6 The Working Group had made the suggestion that in future a different approach to the process of fish stock assessment should be considered. They suggested that initial routine assessments should be prepared by the Secretariat, that these be reviewed and further developed by an expert group which would then distribute a report to the Scientific Committee members for consideration at the next meeting. The Working Group indicated that it did not envisage that a further meeting of the Working Group would be necessary in the immediate future.

4.7 The Scientific Committee, after some extensive discussion of the matter, agreed to the following procedure. Following a specification of priority stocks for future assessment, routine analysis will be prepared by the Secretariat. The new Convener of the Ad Hoc Working Group, Dr Kock, in consultation with the Chairman of the Scientific Committee and the Secretariat, will decide by 31 July 1987 whether there are sufficient data available to make a meeting of the Group desirable. If it is decided to hold a meeting, it will take place in Hobart just prior to the Scientific Committee meeting.

4.8 The Working Group had recommended that there was a need to co-ordinate fish stock surveys and mesh selectivity experiments in the Convention Area. Dr Sherman (USA) was asked to consult with Members on their plans for surveys and mesh selectivity experiments in the 1986/87 season. The results of this consultation are given in Annex 5.

4.9 It was agreed that it would be desirable to continue co-ordination of surveys and experiments both for the 1986/87 season and for the 1987/88 season. It was agreed that Dr Sherman be asked to consult with Members and to convene a meeting to ensure that both the methods used and the timing and location of the surveys were appropriate to the requirements of fish stock assessment.

4.10 The Working Group had also drawn attention to some problems encountered in framing management advice based on stock assessment work. Such advice should focus on matters relevant to the Convention e.g. degree of depletion, level of replacement yield or the degree to which recruitment had been affected by fishing. These matters cannot always be determined with certainty and the group had suggested that the Scientific Committee might discuss the possibility of introducing some relatively easily measurable criteria for bringing

into effect different management measures. For example, these might include closure of a fishery when stock was estimated to be depleted to a specified level, or re-opening of a directed fishery when survey results indicated a recovery. The Scientific Committee noted that such ideas were relevant in the broader context of the Scientific Committee's work and deferred discussion until the Commission had considered the Australian delegation's paper (CCAMLR-V/11).

Further Data Requirements

4.11 The only formal requirement at present for submission of data is that STATLANT A and B forms should be submitted to the Secretariat by 30 September following the fishing season. The Working Group had recommended that the Scientific Committee consider further possible requirements for the routine submission of data. It was agreed that such data should be separated into biological data and data concerning catch and effort. Two small groups were set up to develop proposals under the convenership of Dr Kock (FRG) [Biological Data] and Dr Shimadzu (Japan) [Catch and Effort Data].

Biological Data

4.12 Biological data including length frequency distributions, age and length data of the commercial catch and the population are also required for stock assessment. These data are normally obtained by sampling the commercial catch and during research vessel cruises. Although such biological data are normally reported in the scientific literature there is often a delay, due to publication time, before they are available. It is therefore recommended that such data as determined in paragraph 4.13 be submitted each year on the same fine spatial and temporal scales as the catch and effort data. Such data should be submitted by September 30 each year.

4.13 To overcome the problems of data not always being reported in accordance with agreed standards (SC-CAMLR-IV/3, p. 79, paragraph 9; SC-CAMLR-V/4, p. 2, paragraph 4), and to ensure that data were in a form suitable for fish stock assessment, the group on biological data recommended that data be reported in accordance with the methods described in BIOMASS Handbook No.13. These are:

Length – total length to the nearest cm below

Weight – total fresh weight (in g)

Maturity Stage – according to the five-point scale in the 1977 review by Everson (FAO/GLO/SO/77/1)

Age – referring to 1 July as birthday (BIOMASS Handbook No. 8). Method used for ageing to be stated.

4.14 The Scientific Committee agreed that representative length compositions be identified as coming from commercial or exploratory or research vessel catches and be recorded in 1 cm intervals only (Report of the Ad Hoc Working Group on Fish Stock Assessment 1985, p. 80, paragraph 9). If possible, historical data should be reported in the same way.

4.15 In addition to these data it was suggested that the following be supplied: length-weight relationships that are used in national laboratories to convert length into weight; weight (length) at age; and maturity at age.

4.16 The Scientific Committee recommended that

- the Commission initiate routine annual reporting of these data using the procedures outlined above.

Catch and Effort Data

4.17 It was agreed by the Scientific Committee that Members provide catch data by species and sub-area from the preceding season to the Fish Stock Assessment Working Group or Scientific Committee meetings.

4.18 Data should be recorded on formats already in use since 1985 (formats of Northeast Fisheries Center, Woods Hole Laboratory) and be sent to the Secretariat at least 6 weeks in advance of the next Working Group meeting. It is recommended, however, that the new Data Manager of CCAMLR (in close collaboration with the Convener of the Working Group on Fish Stock Assessment) revise these formats as soon as possible, based on the needs of the CCAMLR data-base and on experience already available in national laboratories and existing fishing conventions. A report on possible revisions should be submitted to the next meeting

of the Scientific Committee. Furthermore, it is recommended that the new Data Manager arrange for the transfer of data to the Secretariat data-base by magnetic tapes.

4.19 The group on Catch and Effort Data reported, and the Committee confirmed, that at the Fourth Meeting of the Commission a decision was made regarding the collection and reporting of data from finfish populations (CCAMLR-IV, paragraph 45). The decision specified a detailed list of data to be collected and confirmed that three kinds of data would continue to be submitted: (i) annual updates of the inventory of commercial fishery data, (ii) STATLANT reports for the preceding seasons including separate reporting of effort data for finfish and krill operations, and (iii) to the greatest extent possible, summaries of catch and effort data on a fine scale, specifically on a spatial scale of 0.5° latitude by 1° longitude and a temporal scale of 10 days.

4.20 It was recognised that there is a shortage of fine-scale catch and effort data from commercial fishery operations. Most of the fish stock assessment analyses to date have tended to concentrate on Virtual Population Analysis as a technique to determine stock trends. Much of the pertinent information for such analyses has been derived from research vessel data. This situation is likely to continue for several years until sufficient annual data, particularly on commercial catch and effort, have been accumulated. It was decided in 1985 that such data will be collected and archived. In the meantime, it is important to ensure that catch and effort data (as listed in paragraph 4.19 (iii)) are collected by all fishing nations. National scientists and the Fish Stock Assessment Working Group should be encouraged to broaden their analyses of Antarctic fish stocks for assessment purposes to the greatest extent practicable.

4.21 Although requirements for the collection of catch and effort data have been elaborated, the form and detail in which they are to be reported to the Scientific Committee for use by its Working Groups has not been determined.

4.22 The Scientific Committee recommended, therefore, that to facilitate the detailed analysis of catch and effort:

- the Commission initiate routine annual reporting of the data on finfish in the detail listed below:

(1) nationality of fishing vessel
(2) characteristic of operation; commercial/research
(3) year, month and ten-day period

(4) location/code of 0.5° latitude x 1° longitude
(5) total catch
(6) catch by species
(7) number of hauls
(8) hours fished.

4.23 The deadline for submission of such fine scale catch and effort data from commercial finfish fisheries should be September 30 each year. Formats for the submissions will be prepared and distributed by the Secretariat.

4.24 Dr Slosarczyk (Poland), Dr Lubimova (USSR) and Dr Ranke (GDR) indicated that their countries would have difficulty with reporting data on the scale specified in point (4) of paragraph 4.22.

4.25 In addition to the routine data reporting requirements discussed above (paragraphs 4.13–4.15), the Scientific Committee discussed what data should be sought as a priority during the next year. The Working Group had identified a number of stocks which had been exploited but for which no data were available (SC-CAMLR-V/4, Table 4), and others where data were insufficient for stock assessments to be made. The Scientific Committee agreed that additional data should be submitted in the next year for the following stocks:

Species	Area
Notothenia guntheri	48.3
Notothenia squamifrons	48.3 and 58.4.4

It also noted the need for data on *Dissostichus eleginoides* in all areas.

4.26 Dr Barrera-Oro (Argentina) requested that data on the species *Micromesistius australis* should be submitted.

Fish Age Determination

4.27 Dr T. Lubimova described the progress made by the Age Determination Workshop held in Moscow (14–19 July, 1986). The report of the Workshop had not yet been completed

but the Rapporteur, Mr Martin White, was in correspondence with members and the report was expected to be finalised soon. The Scientific Committee expressed its thanks to Dr Lubimova, the Convener of the Workshop, and to the Rapporteur and the participants for their hard work.

4.28 The Workshop had concentrated on the main fish target species of the fisheries in the Convention Area and on *Pleuragramma antarcticum* which is an ecologically important species. Earlier workshops held under the auspices of the BIOMASS program were used as a starting point for the discussions. Material was considered from a wide variety of different structures which were used for comparative age-determination.

4.29 Although the Workshop was not able to reconcile all the problems involved in age determination, considerable progress was made. In summary, the results obtained were as follows:

Species	Material	Comments
Notothenia rossii	Scales	General agreement on ageing up to ages 8–10 but not beyond
Notothenia gibberifrons	Scales/Otoliths	General agreement on ageing up to age 7 but not beyond
Champsocephalus gunnari	Otoliths/Vertebrae	Very subjective with no general agreement
Pleuragramma antarcticum	Otoliths/Bones	Ageing may be possible but insufficient experience is available at this time in dealing with this species

4.30 Further work on these problems, including validation of ageing, will be facilitated by an exchange of material, to be coordinated by Dr Kock (FRG). Dr Kock will synthesise the results received and present a report initially to members taking part in the exchange. The Scientific Committee welcomed this initiative.

4.31 Dr Barrera-Oro (Argentina) referred again to the species *Micromesistius australis* which at irregular intervals migrates into the Scotia Sea area. Because there were discrepancies in the ageing of this species between scientists from different countries, he requested that material from this species be included in the exchange scheme.

Mesh Selectivity

4.32 Dr W. Slosarczyk (Poland) referred to experiments conducted by Polish scientists in the 1978/79 season (SC-CAMLR-V/BG/14). These experiments had been discussed at length by the Working Group (SC-CAMLR-V/4, paragraphs 62–64). Consistent results between different mesh sizes had been obtained for *C. gunnari* and *N. gibberifrons*. These results, however, were obtained with netting material not currently used in the commercial fishery.

4.33 Dr Slosarczyk and Dr Everson were asked to draft guidelines for mesh selectivity experiments. Their report was not received in time for discussion at the meeting. The main conclusions are included in Appendix 1 of Annex 5.

4.34 The clear need for more information on mesh selectivity had been identified at previous meetings of the Scientific Committee. The future plans for selectivity experiments are to be co-ordinated by Dr Sherman (USA) (paragraphs 4.8–4.9).

4.35 Dr T. Lubimova (USSR) drew the Scientific Committee's attention to a document prepared by colleagues in the USSR on the methodology of mesh selection experiments (SC-CAMLR-V/BG/41). It was agreed that a translation of this document would be made available to the Scientific Committee.

Mesh Size Measurement Specifications

4.36 At its last meeting, the Scientific Committee had noted the need for a clear specification of the method to be used for mesh measurement when mesh size regulations were in force.

4.37 It was agreed that it was desirable to have regulations similar to those in force in other fisheries organisations. The Scientific Committee recommended that the Commission incorporate the text of SC-CAMLR-V/8 in its mesh size regulations.

Advice to the Commission

Sub-Area 58.5 (Kerguelen Waters)

4.38 Annual landings of the main commercial fish species from area 58.5 in recent years have been as follows (in metric tonnes):

	1980	1981	1982	1983	1984	1985	1986
N. rossii	1,742	7,924	9,812	1,829	744	1,707	802
N. squamifrons	11,308	6,239	4,038	1,832	3,792	7,394	2,464
C. gunnari	1,631	1,122	16,083	25,852	7,127	8,253	17,137
D. eleginoides	138	40	121	128	145	6,677	459

4.39 The Working Group had reported that management measures applied by the French authorities, including the additional protection afforded to *N. rossii* last season, had halted the decline in the stocks. There is some evidence of a slight recovery in 1986 of the most depleted stock, that of *N. rossii*.

4.40 The Scientific Committee recommended that current Conservation Measures applied by the French Authorities should continue in this area and that the resolutions adopted by CCAMLR should remain.

Sub-Area 58.4.4

4.41 The Working Group had drawn attention to catches in area 58.4.4 amounting to some 10,000 tonnes since 1979, primarily of *N. squamifrons*. No data were available, and accordingly no assessments could be made of these stocks. The Scientific Committee calls the attention of the Commission to the need for data on these stocks so that proper assessments can be made.

Sub-Area 58.4.2

4.42 The Scientific Committee noted that a catch of nearly 1,000 tonnes of *Pleuragramma antarcticum* was taken in area 58.4 (sub-division unknown) in the 1984/85 season, with lesser catches taken in previous seasons. In view of the long coastline included in this area and the relevance of catches of this species to the proposed Prydz Bay study area for

ecosystem monitoring, the Committee recommended that more detailed catch statistics and biological data be supplied for this species in all sub-areas of area 58.4.

Sub-Area 48.3 (South Georgia)

4.43 Annual landings of the main commercial fish species from area 48.3 in recent years have been as follow s (in metric tonnes):

	1980	1981	1982	1983	1984	1985	1986
N. rossii	24,897	1,651	1,100	866	3,022	1,891	70
C. gunnari	7,592	29,384	46,311	128,194	79,997	14,148	11,107
N. gibberifrons	8,143	7,971	2,605	0	3,304	2,081	1,679
N. guntheri	7,381	36,758	31,351	5,029	10,586	11,923	16,002

For further data see Table 3 of Report of Ad Hoc Working Group on Fish Stock Assessment, SC-CAMLR-IV/4.

4.44 At its fourth meeting, the advice provided by the Scientific Committee was that both directed and incidental catches from the depleted *N. rossii* stock should be kept to as near to zero as possible until there was evidence from experimental surveys that the stock is increasing (SC-CAMLR-IV, paragraph 4.68) and that a total prohibition on fishing in this area was the only way to ensure no catch of *N. rossii* (SC-CAMLR-IV, paragraph 4.70).

4.45 The Ad Hoc Working Group on Fish Stock Assessment had reported (SC-CAMLR-V/4 para 74) that:

(a) The stock of *N. rossii* was confirmed to be severely depleted.

(b) The stocks of *C. gunnari* and *N. gibberifrons* were currently well below their initial level and the combined replacement yield of these species plus those of *Chaenocephalus aceratus* and *Pseudochaenichthys georgianus* is small no more than a few thousand tonnes.

4.46 In the light of these results, the Scientific Committee recommended that the Commission take steps to ensure recovery of the fish stocks from their present status. In this regard it recommended as follows:

4.47 • the current Conservation Measures for *N. rossii* should be maintained and that the resolution applying to the by-catch for this species in this area should be adopted as a Conservation Measure.

The Scientific Committee noted that the Fish Stock Assessment Working Group has estimated that the stock of *N. rossii* could be expected to increase in the absence of catches at a rate of approximately 30% per year. This projection implies that, in the absence of fishing, an improvement in the stock of *N. rossii* should be measurable from a series of several annual trawl surveys, along the lines of those conducted in 1984/85 (SC-CAMLR-IV/3).

4.48 • the current Conservation Measure involving the prohibition of fishing within 12 miles of the coast and current mesh regulations should remain.

4.49 In the case of *C. gunnari* and *N. gibberifrons*, the Scientific Committee recommended:

- the Commission consider the following possible management options which offer different degrees of protection and hence potential recovery rates for these stocks:

(1) A closure of the fishery in the area 48.3 to all fishing for a period of one year or more.

This option should ensure the greatest protection to the stocks which were estimated by the Working Group to be well below the level of their maximum net productivity.

(2) Prohibit a directed fishery on these stocks and keep the by-catch of these species as low as possible.

This option should ensure rapid recovery of the stocks which were estimated by the Working Group to be well below the level of their maximum net productivity.

(3) Specify that catch levels for these species be small and compatible with a recovery of the stocks. In this context it was suggested that catches of these species, together with catches of *C. aceratus* and *P. georgianus*, should be less than the estimated replacement yield of a few thousand tonnes.

This option should avoid further depletion of the stocks while permitting the fishery to continue.

A specific suggestion was that catch levels should be no more than had occurred in the 1985/86 season. This suggestion if adopted, would have the least effect on the fishery while limiting the risk of further depletion of the stocks.

4.50 In the case of *C. gunnari* a further option was identified, namely that the Commission considers:

- imposing no restrictions on catch levels, but relies on the current Conservation Measures and resolutions (including mesh regulations) to ensure conservation of the stock.

This option would allow a fishery to continue on *C. gunnari* while permitting an escapement of a proportion of sexually mature fish. Analysis of preliminary selection experiments had indicated that the mean length at first capture was close to the optimal, given the known growth and mortality parameters.

4.51 The Scientific Committee also discussed the possibilities of a multi-species approach to management measures in this area. However, it was not able to examine specific multi-species management options as sufficient data on all stocks, as well as on the detailed location of the fisheries for different species, were not available.

4.52 A particular problem in this respect concerned the fishery for *N. guntheri* around Shag Rocks. No data were available to assess this stock and hence the effect of different management measures could not be assessed. It was noted that because of the localised nature of this fishery, its continuation should be compatible with a low by-catch of other species.

Sub-Area 48.1 (Peninsula)

4.53 Annual landings of the main commercial fish species from area 48.1 in recent years have been as follows (in metric tonnes):

	1980	1981	1982	1983	1984	1985	1986
N. rossii	18,763	0	0	0	0	0	0
*C. gunnari**	1,087	1,700	0	2,604	0	0	0
N. gibberifrons	765	50	0	0	0	0	0

in 1979: 35,930 t; in earlier years: 0

4.54 The Working Group had reported that knowledge of the state of the stocks in the area is still poor. *N. rossii* is probably well below its initial abundance, and the abundance of *C. gunnari* dropped after heavy fishing in 1978/79. There was no evidence to indicate that *N. gibberifrons* had been significantly affected by fishing.

4.55 There was no fishery in this area during the last season.

4.56 The Scientific Committee recommended that the Commission consider extending to a full Conservation Measure its resolution to Members to avoid a directed fishery for *N. rossii* in this area.

Sub-Area 48.2 (South Orkneys)

4.57 Annual landings of the main commercial fish species from area 48.2 in recent years have been as follows (in metric tonnes):

	1980	1981	1982	1983	1984	1985	1986
N. rossii	1,722	72	0	0	714	58	0
*C. gunnari**	5,231	1,861	557	5,948	4,499	2,361	2,682
N. gibberifrons	1,398	196	589	1	9,160	5,722	341

* 1978: 138,895 and 1979: 21,434 t; earlier years: 0

4.58 The Scientific Committee noted that the Commission had at its last meeting requested Members to refrain from a directed fishery for *N. rossii* in the area. The Scientific Committee recommended that the Commission consider extending this request into a full Conservation Measure.

4.59 The Working Group had reported that the abundance of the main species in the catch, *C. gunnari*, is highly dependent on year class strength and is very much lower than when fishing started in 1977. *N. gibberifrons* is moderately heavily fished.

4.60 In discussion of the Working Group's assessment of the stock of *C. gunnari* two views emerged which have rather different implications for management.

4.61 One view accepted the assessment performed by the Working Group.

4.62 The other view was that except in special oceanographic circumstances which produce stable concentrations of krill (the food of *C. gunnari*), *C. gunnari* do not occur in dense concentrations in the area. These oceanographic conditions might have occurred only during the period of heavy catches in 1977/78 and to a lesser extent in 1978/79. Dr Lubimova (USSR) described the experience of Soviet fisheries including aspects of the distribution of krill. These considerations lead to an alternative to the Working Group's assessment. However, no data were submitted to the Working Group to support this view.

4.63 If the Working Group's assessment is correct, the stock of *C. gunnari* is currently substantially below the level prevailing at the start of the fishery, and well below the level of maximum net productivity. In this case some management action is desirable. Some possible options identified for management were:

(1) Prohibit a directed fishery on this stock and keep the by-catch of this species as low as possible.

This option should ensure the rapid recovery of *C. gunnari*, which was estimated by the Working Group to be well below the level of maximum net productivity.

(2) Specify that catch levels on this species be sufficiently small to avoid further reduction in the stock.

This option should ensure that further declines in the stock are not the result of excessive fishing.

4.64 If the view outlined in 4.62 is correct, the situation is uncertain. For example, there is no evidence to indicate whether the stock is below its level of net maximum productivity or not.

4.65 It was not possible for the Scientific Committee to reach a unanimous view on which of the two possibilities was considered to most closely reflect the true situation.

General Points

4.66 Dr Y. Shimadzu (Japan) commented that the high variability in recruitment of the species *C. gunnari* made its management extremely difficult. He therefore stressed the necessity of research on year class strength.

4.67 In order to reduce the current levels of uncertainty, the Scientific Committee recommended that co-ordinated surveys aimed at providing independent estimates of stock biomass should be encouraged (paragraphs 4.8–4.9).

KRILL RESOURCES

Fishery Status and Trends

5.1 There has been an increase in the annual catches of krill over the past two years. Several nations reported improved success in preparing peeled krill products. A synopsis of national krill landings (in metric tonnes) is given below.

	Split-Year			
	1982/83	1983/84	1984/85	1985/86*
Chile	3 752	1 649	2 598	3 264
GDR	0	0	50	0
Japan	42 282	49 531	38 274	61 846
Republic of Korea	1 959	2 657	0	0
Poland	360	0	0	2 065
USSR	180 290	74 381	150 538	379 270
Total	228 643	128 218	191 460	446 445

* Preliminary figures

5.2 The catch reported by Chile was achieved by one vessel working for 43 days in Statistical Area 48. Next year it is planned that 2 ships will participate in the fishery.

5.3 Dr Shimadzu reported that the increase in the Japanese krill catch was due to an increase in the number of fishing vessels. Greater emphasis is now being placed on the preparation of peeled krill. He provided 3 kg of peeled krill for delegates to sample.

5.4 The Polish catches were part of an experimental study conducted mainly in the Elephant Island area (90 tonnes were taken from near South Georgia). It is intended to continue the study next season.

5.5 The total USSR catch was made up as follows:

Subarea 48.3	141 994	metric tonnes
Subarea 48.2	224 744	" "
Area 88	1 884	" "
Area 58	10 648	" "
	379 270	

The increased USSR catch was due to an increase in fishing effort.

5.6 The total catch for all nations for the 1985/86 season is the highest since the peak value in 1981/82 of 528 201 tonnes.

5.7 As in previous seasons, a substantial proportion of the 1985/86 catch was taken from Statistical Subarea 48.2 (South Orkneys), and it was questioned whether this had had any demonstrable effect on local krill-dependent predators. No information was available from which to draw any direct conclusions. The main fishing area is to the north of the South Orkneys 15–200 miles offshore. No long-term monitoring of krill or its predators has been undertaken in this area. Further discussion was referred to the agenda item dealing with ecosystem monitoring.

Further Data Requirements

5.8 The quality of the catch data being recorded was questioned. It was explained that the standard practice is to estimate total catch based on the amount of krill actually delivered on deck and not to use indirect estimates based on conversion factors applied to the amounts of commercial products.

5.9 Mortality due to krill passing through the meshes of nets is unknown. Research on this question is encouraged.

Biological Aspects Relevant to Stock Assessment

5.10 Discussion centred around the following main subject areas: stock separation, microscale density (swarming versus dispersed krill), near surface distribution, acoustic target strength, age determination and growth.

5.11 Dr Lubimova introduced a paper (SC-CAMLR-V/BG/25) with analyses of samples from around the Antarctic Continent which demonstrated the existence of 4 separate stocks. These are roughly centred in the Weddell Sea, Ross Sea, Prydz Bay and the Lazarev Sea. These stocks have been identified on the basis of water mass circulation. The small amount of mixing that takes place at the northern end of their range prevents separation of these stocks as indicated by biochemical and morphometric studies. They might however be considered as stocks for management purposes.

5.12 Two studies on microscale distribution were described. Dr Sahrhage reported that during early winter (May/June) in the area between east of Elephant Island and Adelaide Island, very few krill swarms were detected by the echosounders although dispersed krill were caught in RMT nets. However, to the northwest and north of Elephant Island, (a known krill fishing area), sizeable swarms were detected in the top 100 metres of the water column, a vertical distribution of swarms similar to that found in the summer. A few krill were also found at greater depths in RMT samples.

5.13 Australian scientists reported that during October they had observed a few krill swarms in the pack ice zone. These patches were characterised by the presence of whale, seal and bird predators. North of the shelf break, *Euphausia superba* predominated, but on the shelf, *E. crystallorophias* was more abundant. Observations by divers indicated that krill were feeding on epontic algae.

5.14 Dr. Lubimova introduced a paper by Dr. Yudanov (SC-CAMLR-V/BG/26) describing theoretical and practical studies aimed at detecting dispersed krill using echosounders. The study indicated that individual krill could be detected down to a depth of 50–60 metres.

5.15 The importance of detecting and quantifying krill near the surface was emphasised. Dr Everson reported on tests using a towed upward-directed transducer which had been used successfully to detect near-surface swarms. He stressed that even under calm conditions, such a system could not theoretically detect krill within one metre of the surface. Quantification is not possible because target strength is dependent on orientation and no information is available on orientation of the krill relative to the transducer beam.

5.16 Several studies investigating target strength were outlined. Dr Lubimova introduced a paper containing details of analysis of a TS experiment during FIBEX. (SC-CAMLR-V/BG/27). Scientists from Japan, Norway, USA and UK reported plans for TS experiments. It is clearly advantageous for all workers in this field to be fully informed of planned programs and results of individual studies. Dr Everson agreed to act as a clearing house for this information and report to the next meeting of the Scientific Committee.

5.17 Growth studies have been undertaken using biochemical techniques as well as population size frequency distributions. Scientists from USA have been working in conjunction with Dr Ettershank (Australia) to further develop and validate the lipofuscin assay technique. Similar studies are being planned by Japan and UK. Dr Beddington reported on analyses of size frequency distribution from 'Discovery Investigations' during the 1931–39 period. These indicated fast growth in summer and zero growth in winter. The estimated growth rates indicate that krill would take about 6 years to get to their maximum size. Studies by USSR scientists on age and length of krill were presented as SC-CAMLR-V/BG/39 and an Australian paper on the moulting interval and growth of juvenile krill (SC-CAMLR-V/BG/36) was also presented.

5.18 Denzil Miller reported that the BIOMASS krill review was now two-thirds complete. The Committee acknowledged the large amount of work Mr Miller had done to provide such a good comprehensive review. They hoped that the project would be completed soon.

5.19 Attention was drawn to a recent FAO publication on krill catching and processing (FAO Tech Rep. 268).

Krill CPUE Simulation Study

5.20 Dr Beddington described the progress made in this study during the year. He had found it very difficult to find suitable, qualified consultants who could undertake the work at short notice. This had meant that it is now necessary to delay the whole study by about 10 months. Since no expenditure has been incurred, it was felt that this delay would have only minor implications for the CCAMLR budget.

5.21 The current intention is to conduct two parallel studies using Dr Butterworth (University of Cape Town) and Prof. Mangel (University of California at Davis) as consultants.

5.22 A document (SC-CAMLR-V/11) was presented to the Scientific Committee on the subject of krill modelling and simulation, indicating the view that meetings between USSR scientists working on this problem and the Convener and other experts working on the Krill Simulation Study should be arranged as soon as practicable.

5.23 One study would involve analysis of the USSR fishery, covering all aspects of the fishery including operation of scouting and commercial vessels. This would involve a visit to USSR by Dr Beddington and/or Dr Everson to ensure that the data that are being provided are suitable for the analyses. This visit would take place in the northern spring, allowing analysis to take place during the northern summer, leading to an interim report in time for the 1987 Scientific Committee meeting.

5.24 The other study would involve examination of the operation of Japanese fishing companies. Dr Shimadzu had kindly arranged a comprehensive itinerary for Dr Butterworth to accomplish this in October 1986. Analysis of both studies would proceed over the northern winter, leading to the preparation of an interim report for the 1987 Scientific Committee meeting.

5.25 The above studies would address the following objectives:

(a) develop a simulation model of a krill population capable of generating a range of spatial patterns of krill distribution and krill population dynamics;

(b) develop a model of fishing with the capacity to simulate a. range of fishing strategies;

(c) combine models (a) and (b) to explore the relationship between various measures of CPUE with changes in simulated krill abundance.

5.26 The remaining objective for the simulation study involved determination of the extent to which CPUE of individual vessels and fleets can be used as an index of abundance over large scale areas of the Southern Ocean. The reason for this is that although CPUE can be used as an estimator of local abundance, it is not clear how far away from the fleet such an index is reliable. This approach requires catch and effort data from the fishery and also independent survey data on krill abundance.

5.27 Recognising that the FIBEX acoustic data set is comprehensive in the south west Atlantic, Dr Everson had prepared a proposal for a workshop meeting which would involve

analysis of that data set in conjunction with catch and effort data from the same area at the same time. The response to this suggestion was reasonably favourable. Criticisms arose, however, due to misunderstandings over the way the objectives had been defined and also due to fundamental disagreements voiced by USSR scientists over the survey design and analysis (SC-CAMLR-V/11). It was agreed that the basic approach was valid even though the period of time elapsed since the FIBEX survey would mean that contemporaneous catch and effort data might be difficult to obtain. SIBEX, a more recent study, stood a better chance of being cross-referenced to concurrent catch and effort data. Various national programs were described that were considered relevant.

5.28 It was agreed that a joint CCAMLR/BIOMASS workshop meeting should be held, hopefully in 1988, to investigate the topic. The Workshop would have the following terms of reference:

(i) The overall objective of the workshop shall be to determine the extent to which CPUE of individual vessels and fleets can be used as an index of abundance over large scale areas of the Southern Ocean.

(ii) To assemble, consolidate and validate data on krill abundance surveys by nets and hydroacoustics. These surveys must be independent of commercial fishing operations.

(iii) To assemble, consolidate and validate environmental data associated with these krill surveys.

(iv) To assemble, consolidate and validate krill catch and effort data in accordance with paragraph 5.9 of SC-CAMLR-IV from fishing operations that are concurrent with the independent surveys.

(v) To analyse the data in accordance with the objective in (i) above and report the conclusions to the Scientific Committee Meeting following the workshop.

5.29 Dr Everson agreed to act as Convener for the Workshop.

5.30 The following timetable was proposed:

		Completion Date
(i)	Convener collates outline information on krill abundance surveys	31 Dec 1986
(ii)	Definition of data formats	31 Dec 1986
(iii)	Convener circulates outline survey information and requests information indicating which surveys can be cross-referenced to concurrent catch and effort data	30 Apr 1987
(iv)	Convener calls for abundance survey and CPUE data	End 1987
(v)	Data checking and validation	Mid 1988
(vi)	Workshop meeting	late 1988

5.31 Concurrent with this proposed timetable is the requirement that analytical procedures be defined. Procedures had been outlined by scientists from USA and USSR (SC-CAMLR-V/11) which might be applicable. Members were requested to inform the Convener of any suitable analytical procedures known to them.

5.32 The Convener agreed to discuss and refine such procedures as might be deemed necessary to ensure the security of the data provided for the analysis. It was recognised that data security was an important consideration that applied both to commercial catch and effort data as well as survey data sets such as those of BIOMASS.

5.33 It was agreed that krill catch and effort data would be supplied in accordance with paragraph 5.9 of SC-CAMLR-IV.

5.34 The Committee welcomed the proposals by Japan and USSR to undertake simultaneous studies of krill abundance and CPUE during the next few seasons.

5.35 Scientists from USSR reported that it is still not current practice for commercial fishing vessels to record detailed catch and effort data in accordance with paragraph 5.9 of SC-CAMLR-IV. The Committee regretted this situation. It was strongly recommended for

the purpose of this Study that the data specified in paragraph 5.9 be collected by commercial vessels operating in survey areas.

Advice to the Commission

5.36 The Scientific Committee had noted a large increase in krill catches from the region just north of the South Orkneys in Statistical Subarea 48.2. Information available to the Committee indicated that this level was likely to be maintained or increased. Some concern was expressed that the current level of fishing (with a catch during the last year of over 200,000 tonnes) might be having a significant effect on local predators. The Scientific Committee therefore recommended that detailed catch data for krill caught in sub-area 48.2 be reported to the Commission. The data should be reported in accordance with paragraph 4.19 (iii) of this Report, by the end of September 1987.

ECOSYSTEM MONITORING AND MANAGEMENT

Working Group for the CCAMLR Ecosystem Monitoring Program

6.1 Dr K. Kerry (Australia), Convener, introduced the Report of the Working Group for the CCAMLR Ecosystem Monitoring Program Meeting held in Hamburg, 2–7 July 1986 (Annex 6). He thanked members of the Group for their participation and Mr D. Miller (South Africa) who had acted as Rapporteur.

6.2 The Working Group reaffirmed the background and rationale of the approach adopted by the Ad Hoc Working Group on Ecosystem Monitoring Meeting held in Seattle (6–11 May 1985) (SC-CAMLR-IV, Annex 7). The two main considerations were:

(i) The need to maintain ecological relationships between harvested and dependent (and related) species within the Convention Area,

and

(ii) The need to establish the important elements of a program to monitor ecosystem changes in the Convention Area.

Both (i) and (ii) were considered to require the extension of the existing baseline data, the possible establishment of new data baselines, and the identification of essential sub-programs for directed research.

6.3 The Working Group further recognised that in order to monitor the resource potential of individual species and detect any harvest-induced effects on key Antarctic marine species, it would be necessary to collect different types of data.

6.4 The Group endorsed the approach used at the Seattle Meeting in selecting the potential indicator species. An additional three species were selected:

Predator species: *Thalassoica antarctica* (Antarctic petrel)
Diomedea melanophoris (Black-browed albatross)

Prey Species: *Euphausia crystallorophias*, in selected areas.

6.5 The Group reaffirmed the most important areas identified at the Seattle Meeting for monitoring predator-prey interactions in the Southern Ocean system. These are:

- the Prydz Bay region (5868°S 55–85°E within CCAMLR Statistical Area 58.4.2) – representative of higher latitude Antarctic predator-prey interactions;

- the Antarctic Peninsula region (60–68°S 54–75°W within CCAMLR Statistical Areas 48.1 and 88); and

- the South Georgia region (53–56°S 35–40°W within CCAMLR Statistical Area 48.3) – representative of lower latitude predator-prey interactions.

The Group also agreed upon a proposed network of sites for monitoring and directed research.

6.6 The various parameters to be monitored that had been selected at the Seattle Meeting (Tables 3-5 in SC-CAMLR-IV, Annex 7) were reviewed. Additions to the list of parameters of potential immediate use were identified as were a number of additional parameters which required directed research. The Group recognised that the interpretation of many monitoring parameters requires quantitative information on the large-scale distributions and smaller scale spatial/temporal relations of predators with respect to their prey. Within this context, various parameters to assess rates of change in prey abundance (in particular, krill) were identified.

Methods to be used for monitoring both predators and prey were discussed. A number of specific environmental variables thought to affect predator-prey species interactions, as well as predator and prey species dynamics separately were identified.

Practical Implementation and Co-ordination of the CCAMLR Ecosystem Monitoring Program

6.7 On the basis of the Working Group's report, the Scientific Committee reiterated the importance of establishing a long-term program to detect and record changes in critical components of the ecosystem as a basis for the conservation of Antarctic marine living resources (SC-CAMLR-IV, paragraph 7.2).

6.8 Following the last session, the Chairman wrote to the IWC Scientific Committee requesting information on the possible means whereby trends of Antarctic whale stocks might be assessed and whether minke whale or other cetaceans might function as useful indicators of krill availability. The IWC Scientific Committee's response indicated that it was conducting a Comprehensive Assessment of whale stocks and that this assessment was expected to be completed by 1990. The response also indicated that there were differing views regarding the possible utility of minke whale as an indicator species.

6.9 The Scientific Committee expressed its thanks to the IWC Scientific Committee and noted that the Comprehensive Assessment should provide updated information on the status of Antarctic whale stocks and could help to assess the possible effects of krill fisheries on whales. The Scientific Committee therefore encouraged the IWC Scientific Committee to complete the Comprehensive Assessment as rapidly as possible.

6.10 It was noted that the Workshop on the Feeding Ecology of Southern Baleen Whales proposed by the IWC Scientific Committee in 1983 would address issues of importance to both the IWC and CCAMLR. The Scientific Committee recommended that further consultations be undertaken to facilitate joint planning and early scheduling of this workshop.

6.11 It was agreed that the Chairman of the Scientific Committee, in consultation with the Convener of the Working Group on Ecosystem Monitoring, would write to the IWC Scientific Committee to:

(a) determine how the Comprehensive Assessment might contribute to evaluating the nature of and possible means for detecting the effects of krill harvest on Antarctic whale stocks,

(b) explore means for analysing available data and information assembled during the Comprehensive Assessment on physiological condition, stomach contents, and feeding behaviour of minke whales in terms of the utility for indicating changes in the krill/whale system, and

(c) identify what further steps might be taken to co-operatively plan and convene a Workshop on the Feeding Ecology of Southern Baleen Whales.

6.12 In terms of implementing studies on other important predator species, the Committee requested the Convener to communicate with the SCAR Group of Specialists on Seals and the Sub-Committee on Bird Ecology to provide advice on the precise sampling protocols and sample sizes required for the effective monitoring of parameters identified by the WG. This would provide information on the timing of investigations and the minimum time required to establish adequate baseline data sets for future assessments of system changes. The Committee appreciated that much of the necessary information was contained in various handbooks already published under the auspices of BIOMASS (as summarised in SC-CAMLR-V/BG/12) or other SCAR publications (e.g. the book on seal research methodology currently being formulated by the SCAR Group of Specialists on Seals). It also recognised that the newly formed SCAR Group of Specialists on Southern Ocean Ecology could play an important role in the future integration of studies on both predators and prey.

6.13 The Scientific Committee reaffirmed the urgent need to commence the practical implementation of the Ecosystem Monitoring Program. The Committee agreed that the Working Group should meet during the inter-sessional period in Paris (10–16 June 1987), directly after the CCAMLR/IOC Scientific Seminar on Antarctic Ocean Variability and its Influence on Marine Living Resources, Particularly Krill. Important topics to be addressed at this meeting would include:

- data needs, data acquisition and data handling in respect of predator, prey, environmental and fisheries variables;

- standardisation of monitoring methods;

- identification and elaboration of new methods;

- the potential role of remote sensing technology in terms of monitoring important parameters;

- theoretical aspects and pilot studies as related to monitoring needs and methodologies;

- establishing a schedule for various program elements.

6.14 In order to facilitate co-ordination of the program, a summary of Members' Activities (present and planned) was drawn up (see Annex 7). It was agreed that this table would provide a useful basis for discussion at the intersessional meeting of the Working Group.

6.15 With respect to evaluating the potential usefulness of remote sensing technology and telemetry for monitoring needs, the Committee agreed that at least 1 ½ days of the above scheduled inter-sessional meeting should be devoted to a detailed appraisal of currently available techniques as well as pertinent future developments in the field. It was recognised that in general, experience and expertise in the field are currently limited. For this reason the Committee felt that it was important that suitable specialists (up to approximately three in number) should be invited to the meeting to advise the Working Group on the development of appropriate remote sensing equipment to meet monitoring needs.

DATA COLLECTION AND HANDLING

Presentation of Data

7.1 Catch and effort statistics are received on STATLANT 08A and 08B forms. Data received up to and including the 1984/85 season (see SC-CAMLR-V/BG/8) are summarised and presented at Annex 8 in this report.

7.2 It was noted that the flow of data to the Commission was satisfactory to a large degree although there were still gaps in both the recent and historical data and that some catches were still being reported as unidentified.

7.3 It was explained that some gaps in data presented by the USSR reflected the absence in the particular season of research vessels which gather the data. In other instances the data gathered by the fishing companies was no longer available.

7.4 Of particular importance are the data on catches of *N. guntheri* taken in a separate directed fishery in subarea 48.3 (in the vicinity of Shag Rocks) and also finfish catches before 1979 in subarea 58.5. The USSR agreed to provide these data before the next meeting of the Committee.

7.5 It was recognised that some fish catches were not assigned to species because of problems experienced by fishermen in identifying the catch despite the provision of identification charts. It is to be hoped that the new Species Identification Sheets produced in conjunction with FAO will help. It was recommended that fishing countries adopt procedures to include scientific observers on commercial vessels as a means of ensuring *inter alia* correct identifications.

7.6 The temporal and spatial scales on which data should be collected and presented were discussed again. It was noted that in addition to gathering detailed catch and effort data on a spatial scale of 0.5° latitude by 1° longitude and a temporal scale of 10 days, there was a need for recording data on finer scales for analyses that will be required in the future. Two such requirements have been identified and there has been agreement to record data on a finer scale for use in studies on krill (see SC-CAMLR-IV, paragraph 5.9) and finfish (see CCAMLR-IV, paragraph 45).

7.7 Further, based on the report of the Working Group for the CCAMLR Ecosystem Monitoring Program, it was agreed that krill fishery data may be needed on spatial scales that *inter alia* are related to the foraging range of predators. The Committee therefore reiterated the request that data be gathered on as fine scales as possible so that they may be utilised either in such a form or recombined for areas of biological significance.

Presentation of Data by the Secretariat

7.8 The Committee reviewed the presentation of data given in the reports of the Scientific Committee and in SC-CAMLR-V/7 and agreed that some forms of presentation were unnecessary and others somewhat difficult to follow. It was agreed that a new format was required and that this should be prepared by the Secretariat in consultation with the Convener of the Ad Hoc Working Group on Fish Stock Assessment for presentation on a trial basis at the next meeting of the Scientific Committee. The format used for presentation of summarised data in SC-CAMLR-V/4 offered some advantages and could be used for guidance.

7.9 The publication of a Statistical Bulletin was considered. In the past the publication of such a bulletin had been deferred until such time as a complete set of historical data became available (see SC-CAMLR-IV, paragraph 8.4). Although there are still some gaps in the data, the Committee now believes that the point has been reached where such a bulletin should be prepared. It therefore proposes that the bulletin be published and updated annually. To facilitate the update of the bulletin, a loose-leaf format is proposed. FAO codes should be used to refer to countries.

Advice to the Commission

7.10 In general, data collection and handling shows some improvement. There are still problems associated with catches not being identified, and with gaps in the historical data set.

7.11 The Scientific Committee also drew the Commission's attention to the need outlined in paragraph 4.25 for detailed data to be submitted on *N. guntheri* in area 48.3 and *N. squamifrons* in 48.3 and 58.4.4. In addition, the Scientific Committee recommended that catch data for the period prior to 1979 for area 58.5 should be submitted.

7.12 Data on both finfish and krill fisheries should be collected on as fine temporal and spatial scales as possible and in the detail set out for finfish in the Report of the Fourth Meeting of the Commission in paragraph 45. This was seen as important not only for the work of the Ad Hoc Working Group on Fish Stock Assessment and the Krill CPUE Simulation Study but also for the needs of the Ecosystem Monitoring Program.

7.13 A bulletin should be published summarising historical catch and effort data. This bulletin should be updated annually. The formats for presentation of data in the bulletin will be determined by the Convener of the Working Group on Fish Stock Assessment in association with the Secretariat.

7.14 It is recommended that note be taken of paragraph 4.42 of this report in which it is recommended that detailed data on the catches of *Pleuragramma antarcticum* in the whole of area 58.4 be provided at the temporal and spatial scales discussed in paragraph 7.6. It was noted that so far there have only been research vessel catches by the USSR.

CO-OPERATION WITH OTHER ORGANISATIONS

CCAMLR Scientific Committee Observers at Meetings

8.1 The CCAMLR Scientific Committee was represented at the following meetings during the inter-sessional period:

38th Meeting of the International Whaling Commission, Dr J. Beddington;

19th Meeting of SCAR, Dr J.-C. Hureau (SC-CAMLR-V/BG/12);

73rd Meeting of ICES, Dr K. Sherman (CCAMLR-V/16).

8.2 A calendar of future meetings was discussed (CCAMLR-V/BG/3) and it was agreed that the Scientific Committee would be represented at the meetings as indicated below:

74th Statutory Meeting of ICES, Denmark, 9–17 October 1986, Dr K. Sherman;

39th Meeting of the International Whaling Commission, United Kingdom, June 1987, Dr W. de la Mare;

IWC Scientific Committee Meeting on Indian Ocean Sanctuary, Seychelles, February 1987, no representative designated as yet;

Scientific Seminar on Antarctic Ocean Variability and its Influence on Marine Living Resources, Particularly Krill, Paris, 2–6 June 1987, Dr D. Sahrhage;

The IOC Program Group for the Southern Oceans, Paris, 8–13 June 1987, Dr D. Sahrhage;

XVIII General Meeting of SCOR, Australia, 26–28 November 1986, Dr K. Kerry.

CCAMLR/IOC Scientific Seminar on Antarctic Ocean Variability and its Influence on Marine Living Resources, Particularly Krill

8.3 Dr Sahrhage noted that the preparations for this meeting are proceeding well (see SC-CAMLR-V/BG/16). Over 30 abstracts for papers have been received to date, and more

are anticipated prior to the final deadline of November 1986. Complete manuscripts are required by 28 February 1987.

8.4 Springer-Verlag has provisionally agreed to publish the proceedings of the Seminar (up to 350 pages at their expense). It may be desirable to find funds to cover publication of a larger volume. The issue is discussed further under agenda item 11 (budget).

8.5 A one-day meeting of the Steering Group for this Seminar will be held prior to the meeting; other arrangements and preparations for the meeting will be addressed through correspondence.

CCAMLR/FAO Species Identification Sheets

8.6 The Executive Secretary reviewed the status of the joint CCAMLR/FAO project on Species Identification Sheets for the Southern Ocean. The English version of this work (2 volumes) has been completed and is being distributed. The publication has been sent to the Secretariat (1,000 copies), members of CCAMLR (10 copies), and authors of sections (2 copies) from a total of 2,000 copies in the first printing.

8.7 The French version of this work is expected to be ready for distribution in early 1987. The Spanish version is expected to be completed by the end of 1987.

8.8 The Chairman thanked all those who have been involved in this successful collaboration between CCAMLR and FAO. He especially thanked Dr W. Fischer of FAO and Dr J.-C. Hureau for their efforts in producing a high quality product.

8.9 The Executive Secretary advised that the Species Identification Sheets are considered 'occasional papers' under the CCAMLR documents scheme, and are therefore to be made available free of charge. To ensure that the volumes distributed find their way to the scientists most likely to use them, each delegation was asked to provide Dr Hureau with a list indicating the number of volumes requested, and the name of the person to whom volumes should be sent for national distribution.

BIOMASS and the SCAR Group of Specialists
on Southern Ocean Ecology

8.10 The SCAR observer summarised his written report (CCAMLR-V/12). The SCAR Group of Specialists on Southern Ocean Ecosystems and their Living Resources has been disbanded, but the BIOMASS Executive will continue co-ordinating the analysis of FIBEX and SIBEX data. The BIOMASS group feels that it has much to contribute to the goals of CCAMLR, and therefore seeks to work with the Scientific Committee whenever appropriate.

8.11 SCAR has constituted a new Group of Specialists on Southern Ocean Ecology. This group has several goals that are complementary to those of the Scientific Committee. It was noted that CCAMLR is likely to benefit from the insights provided both by directed and basic research activities.

8.12 The Chairman expressed his view that it is highly desirable for the Scientific Committee and SCAR to work closely together, drawing on their mutual strengths.

8.13 The SCAR observer presented a request for financial support to BIOMASS from CCAMLR (see SC-CAMLR-V/BG/7/Rev.1). Several of the workshops to be held by BIOMASS have direct relevance to the Scientific Committee's work, and there was general support for seeing this work proceed. However, the propriety of CCAMLR funding BIOMASS activities was questioned by one Member.

8.14 A brief consultation on behalf of the Chairman was held to poll the Members on the request from SCAR to provide financial support for the BIOMASS workshops. There was general agreement that the topics to be addressed by these Workshops would add to an improved understanding of the structure and function of the Antarctic marine ecosystem. Two of the workshops and part of a third address topics of particular importance to the Scientific Committee: 1) CPUE as an estimate of krill abundance, 2) Fish Ecology, and 3) Krill Physiology and Biochemistry. Of these, the CPUE workshop is of greatest relevance and significance to the issues being addressed by the Scientific Committee. Next in priority is the Fish Ecology Workshop, and third is the age and growth aspects of the Krill Physiology and Biochemistry Workshop. The Scientific Committee agreed that also the Workshop on Krill Acoustics will be of particular interest to CCAMLR.

8.15 In order to support those activities that will directly benefit the work of the Scientific Committee, the Committee considered a suggestion that $A10,000 be made available to the

BIOMASS program. The Committee was divided on the issue with many delegations speaking in favour and one against.

REVIEW OF LONG-TERM PROGRAM OF WORK OF THE SCIENTIFIC COMMITTEE

9.1 Dr K. Sherman (USA) reviewed the draft report of the Informal Group on the Long-Term Program of Work for the Scientific Committee (SC-CAMLR-V/6) (Annex 9). The main areas for which a long-term program were outlined were: (1) advice to the Commission, (2) fishery stock assessments, (3) mammal and bird population assessments, and (4) ecosystem monitoring.

9.2 The Scientific Committee agreed that developing a long-term program of work was an important activity that will assist the Committee in its work. Evaluating and modifying the long-term program is an ongoing process that requires annual updating. It was agreed that this annual review would occur immediately following the Scientific Committee's session, so as to benefit from its discussions.

9.3 It was noted that two papers tabled at this session had particular relevance to formulating and providing advice to the Commission (SC-CAMLR-V/17 and SC-CAMLR-V/BG/13).

9.4 Many fishery assessment activities are being planned for the next several years. These efforts will be more productive if they are coordinated within the Scientific Committee. It was agreed that an *ad hoc* group, chaired by Dr Sherman, would meet immediately after the Scientific Committee session to coordinate plans for fishery assessment cruises.

9.5 In light of the many fish stock assessment tasks outlined, there was a proposal to make the *Ad Hoc* Fish Stock Assessment Working Group into a permanent Working Group. It was agreed that this proposal would be considered further during the intersessional period and at the 1987 session of the Scientific Committee.

9.6 The Scientific Committee recognised the considerable expertise available regarding Antarctic mammal and bird population assessment. Consultations and exchanges of information are encouraged between the Scientific Committee and existing groups of experts (such as the Scientific Committee of the International Whaling Commission, SCAR Group of Specialists on Seals, and SCAR Subcommittee on Bird Biology).

PUBLICATIONS POLICY AND PROCEDURES FOR THE PREPARATION OF MEETING DOCUMENTS

Reports of Members' Activities

10.1 The Executive Secretary presented a report on the reporting of Members' activities in the Convention area (SC-CAMLR-V/7). The Secretariat had developed more specific guidelines to assist Members in preparing their reports in a more standardised format.

10.2 The importance of keeping the reports brief was stressed. Attachments (e.g. lengthy bibliographies) are making the reports unduly long. However, some Members called attention to the value of including current information in attachments to the reports.

10.3 The guidelines shown in SC-CAMLR-V/7 were modified to exclude 5.b. on page 4 (list of documents intended for submission for the consideration of the Scientific Committee). It was also agreed that in future reports, only appendices and attachments that do not exceed 5 pages will be reproduced by the Secretariat.

10.4 The two principal sections for describing activities, as outlined in the guidelines, are (a) fishery activities, and (b) research activities. It was agreed that Members' activities that fall outside these categories (e.g. implementation of Conservation Measures) should be brought directly to the attention of the Commission.

10.5 The Chairman once again encouraged Members to submit their reports on time, as required. During the past year, only 5 reports were submitted in time to meet the established deadline.

10.6 The Scientific Committee agreed that the Reports of Members' Activities were a necessary instrument for the work of both the Commission and the Scientific Committee.

Review of Charge Policy for Publications

10.7 The Executive Secretary reviewed the charge policy for various CCAMLR documents (CCAMLR-V/9). At present, 6 types of documents are published by the Secretariat: (1) basic documents of the Commission, (2) report of the annual meeting of the Commission, (3) report of the meeting of the Scientific Committee, (4) report of Members' activities, (5) selected papers presented to the Scientific Committee, and (6) occasional publications.

10.8 The Standing Committee on Administration and Finance (SCAF) decided that these documents should continue to be available without charge until such time as a change in this policy is considered necessary.

10.9 Because of rising costs associated with publications, SCAF asked the Secretariat to explore measures to reduce the expense of producing publications. Each of the types of publications was discussed within the Scientific Committee to re-evaluate the importance of different documents and to attempt to determine cost-saving measures.

10.10 The Scientific Committee welcomed the continuation of the policy to make documents available free of charge.

10.11 The selected papers is a useful compendium of documents and should be continued. It was felt that the creation of some sort of editorial board would be useful in selecting and perhaps reducing the number of papers published. For an editorial board to be both fair and efficient, it was stressed that criteria used in selecting papers needed to be developed.

10.12 It was agreed that at the end of the session, a group comprised of the Chairman, the Vice-Chairmen, the Conveners of working groups, the Executive Secretary, and the Science Officer would form an ad hoc editorial board. They will report to the next session regarding the selection criteria and actions taken.

Annexes to the Scientific Committee Report

10.13 There was wide support for continuing to include the full reports of working groups as annexes to the Scientific Committee's report. Much of the work that is done by the Scientific Committee is done in these groups, and therefore these reports should be entered into the formal record of the Committee.

10.14 Documents to be submitted to working groups should be sent to the Conveners in advance of the meetings. These papers then become a useful addition to the work of the broader Scientific Committee.

10.15 It was agreed that when working group reports refer to a paper circulated during the meeting, these papers themselves should be considered for publication in the 'Selected Papers' issues.

General Comments

10.16 It was noted that when the Basic Documents are reprinted next, the 'Declaration of the Chairman in 1980' should be included.

10.17 The size format for reports at the present time is not standard. Some Members stated that it would be helpful if all documents were of a uniform size.

10.18 The use of single-spaced instead of double-spaced printing on the Scientific Committee's report could potentially save reproduction and postage costs by reducing the bulk of the documents.

10.19 The use of a large sheet format (e.g., A4) might allow copies of back issues to be photocopied as needed, thereby reducing the need for maintaining large backlogs of extra copies of documents.

BUDGET FOR 1987

11.1 The Scientific Committee developed a proposal for the 1987 budget in accordance with the recommendations made for activities during the forthcoming intersessional period. The proposed budget was endorsed. It is given at Annex 10.

ELECTION OF CHAIRMAN OF SCIENTIFIC COMMITTEE

12.1 Dr W. Slosarczyk (Poland) nominated Dr I. Everson (UK) as Chairman of the Scientific Committee, noting his high scientific qualifications and his considerable experience in Antarctic marine biology. The nomination was seconded by Dr J.-C. Hureau (France), who called attention to Dr Everson's long and respected record as an Antarctic researcher over the past 25 years.

12.2 Dr Inigo Everson (UK) was unanimously elected Chairman of the Scientific Committee for the period from the end of the Fifth Session until the end of the Session of the Committee in 1988, in accordance with Rules 3 and 8 of the Scientific Committee's Rules of Procedure.

12.3 It was noted that scientists of all Member delegations are eligible for election and that a scientist's election as Chairman reflects that he or she has suitable scientific qualifications and experience to facilitate the work of the Scientific Committee.

12.4 It was further stated that the first two Chairmen of the Committee had been from non-fishing Members and that at the next election of the Scientific Committee's Chairman, Members should take account of the desirability of electing a qualified scientist from a fishing Member. In subsequent elections, Members should take account of the desirability of electing qualified scientists so as to achieve a balance from both fishing and non-fishing Members.

12.5 In accepting the office of Chairman, Dr Everson thanked the outgoing Chairman, Dr Sahrhage, for his exceptionally able leadership over the past four years. He stated that he would attempt to follow the example set by Dr Sahrhage, striving to ensure that the Committee produces the best possible scientific advice to the Commission.

NEXT MEETING

13.1 In accordance with discussions held during the 1985 session, hotel bookings have been made in Hobart for the sixth meeting of the Scientific Committee and Commission for the period of 26 October to 6 November 1987.

13.2 Tentative hotel bookings for the seventh meeting have been made in Hobart for the period 24 October to 5 November 1988.

13.3 It was noted that in 1988 there are three meetings planned of interest to Members: (1) Fifth SCAR Symposium on Biology (end of August/early September), (2) SCAR XX (3 weeks in September), and (3) the CCAMLR meetings. It was suggested that moving the CCAMLR meetings forward by at least one week, so that they follow the SCAR meetings, might reduce travel costs for delegates planning to attend several of these sessions.

13.4 The timing and venue of future meetings will be discussed further by the Commission and Secretariat.

OTHER BUSINESS

Declining Populations of Southern Elephant Seals

14.1 The Argentine delegation called attention to the apparent decline in southern elephant seal populations in several areas of the Antarctic over the past several decades. Bearing in mind Article II of the Convention and the possibility that such a decline is possibly related to harvesting of the prey of this species, the Argentine Delegation requested the Scientific Committee to review the current status of southern elephant seal populations.

Marine Mammal and Bird Agenda Item

14.2 In fulfilling the terms of Article II of the Convention, there are two general categories in which marine mammal and bird issues may arise:

(a) Ecosystem monitoring -- which evaluates the dynamic manner in which mammals and birds interact with their prey and physical environment, and

(b) Population assessment -- which considers specific aspects of trends in the populations themselves, especially depleted or declining populations.

14.3 Noting the issue raised concerning depleted stocks of southern elephant seals, the United States delegation proposed that an agenda item entitled 'Marine Mammal and Bird Population Assessment' be included on the agenda of the 1987 meeting of the Scientific Committee. Such an agenda item would provide a mechanism to the Committee for reviewing the status of marine mammal and bird populations, especially to assess the recovery of depleted populations.

14.4 When considering population assessment issues for marine mammal and bird populations, the Scientific Committee should avail itself, through consultations, with the expertise represented in the Scientific Committee of the International Whaling Commission, the SCAR Group of Specialists on Seals, and the SCAR Subcommittee on Bird Biology.

Advice to Commission on Conservation Strategies

14.5 Attention was drawn to the paper submitted to the Commission by the Australian delegation (CCAMLR-V/11). The Committee noted that the paper would be discussed by the Commission and that following discussion, the Commission may ask the Scientific Committee for guidance as to possible alternative approaches to achieving the objectives of the Convention. This request may also seek an indication of the respective advantages and disadvantages of different approaches.

14.6 In this regard, it was noted that the Scientific Committee's long-term program of work (see Annex 9) calls for formulating and providing management advice to the Commission.

Conservation Measures for Fish Stocks

14.7 Attention was drawn to paragraphs 85–88 of the Report of the *Ad Hoc* Working Group on Fish Stock Assessment. The Working Group suggests that the Commission consider introducing 'relatively easily measurable criteria for bringing into effect different management measures.' The examples given are: to close a fishery for one season whenever the abundance of the adult stock was estimated to have fallen below some specified level or to re-open a directed fishery when survey information indicated increased biomass and/or recruitment.

14.8 Where the Commission is considering introducing specific measures, it would be desirable to determine the expected effects of such measures, and compare them with the effects of not taking action.

Exemption of Scientific Research from Conservation Measures

14.9 The Scientific Committee discussed the exemption from Conservation Measures for vessels conducting scientific research. It was pointed out that some types of valuable data (e.g. incoming recruits) could only be obtained by sampling in areas where Conservation Measures were in force (e.g. within 12 miles of South Georgia).

14.10 It was noted that the past scientific contributions made by commercial fishing vessels undertaking special research programs (e.g. F/V *Carina* SC-CAMLR-V/BG/28) have been quite helpful, and that future work could be expected also to make useful contributions.

However, the Committee emphasised that care must be taken to ensure that in those few special cases in which exemptions are granted, ship activities are closely coordinated with other research operations.

14.11 The Scientific Committee requested that, except in special circumstances, notifications to the Commission of exemptions be made well in advance of the planned departure of the ship. Early notification will allow sufficient time to inform Members and increase the efficiency of coordination with other programs. Although it would be desirable to have notice at least 6 months prior to the start of a cruise, flexibility in this timetable is necessary in order to maintain the ability to take advantage of unexpected research opportunities which arise.

Improved Contact Between the Secretariat and Members

14.12 The Chairman expressed the view that the work of the Scientific Committee would be facilitated if it were possible to improve communication between Members and the Secretariat. He noted that the circulation of Committee documents and information did not always reach delegates expeditiously.

14.13 To improve the exchange of information, it was agreed that the list of participants in the report of the Scientific Committee meeting would include complete mailing addresses of all participants.

14.14 It was also agreed that Members would inform the Secretariat of any changes in personnel or addresses for persons in their delegations.

ADOPTION OF THE REPORT OF THE FIFTH MEETING OF THE SCIENTIFIC COMMITTEE

15.1 The Report of the Fifth Meeting of the Scientific Committee was reviewed and adopted.

15.2 In agreeing to adopt the Report in the English language, the Delegations of Argentina, Chile and France reserved the right to request changes to the text when the translations were completed.

CLOSE OF THE MEETING

16.1 Dr K. Sherman of the USA expressed sincere thanks on behalf of the Committee to the outgoing Chairman, drawing attention to the manner in which Dr Sahrhage had led the Committee in its development over the past four years. The Chairman thanked the Members and other participants, in particular the Conveners of Working Groups and Rapporteurs, for their support and co-operation during his two terms in office. He also thanked the Secretariat, including the interpreters and technical staff, and closed the meeting.

ANNEX 1

LIST OF MEETING PARTICIPANTS

LIST OF PARTICIPANTS

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ANNEX 2

LIST OF MEETING DOCUMENTS

LIST OF MEETING DOCUMENTS

SC-CAMLR-V/l:	PROVISIONAL AGENDA FOR THE FIFTH MEETING OF THE SCIENTIFIC COMMITTEE FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES
SC-CAMLR-V/2:	ANNOTATION TO PROVISIONAL AGENDA FOR THE FIFTH MEETING OF THE SCIENTIFIC COMMITTEE (Secretariat)
SC-CAMLR-V/3:	REPORT OF THE WORKING GROUP FOR THE CCAMLR ECOSYSTEM MONITORING PROGRAM, HAMBURG, FEDERAL REPUBLIC OF GERMANY 2-7 JULY 1986
SC-CAMLR-V/4:	REPORT OF THE AD HOC WORKING GROUP ON FISH STOCK ASSESSMENT
SC-CAMLR-V/5:	REPORT OF THE CONSULTATION ON CO-ORDINATION OF FISH STOCK ASSESSMENT SURVEYS
SC-CAMLR-V/6:	REPORT OF THE INFORMAL GROUP ON THE LONG-TERM PROGRAM OF WORK FOR THE SCIENTIFIC COMMITTEE
SC-CAMLR-V/7:	REPORTING OF MEMBERS' ACTIVITIES IN THE CONVENTION AREA (Secretariat)
SC-CAMLR-V/8:	DRAFT REGULATIONS ON MESH-SIZE MEASUREMENT (France)
SC-CAMLR-V/9:	SUMMARY OF REPORT OF THE CCAMLR AD HOC WORKING GROUP ON FISH STOCK ASSESSMENT, SEPTEMBER 1986
SC-CAMLR-V/10:	REPORT OF THE FIFTH MEETING OF THE SCIENTIFIC COMMITTEE (Chairman of the Scientific Committee)
SC-CAMLR-V/11:	PROPOSAL ON MODELLING OF KRILL POPULATION DYNAMICS AND KRILL FISHERY (U.S.S.R.)

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SC-CAMLR-V/BG/I:	REPORT OF MEMBERS' ACTIVITIES IN 1985/86 SOUTH AFRICA

SC-CAMLR-V/BG/2:	REPORT OF MEMBERS' ACTIVITIES IN 1985/86 FEDERAL REPUBLIC OF GERMANY
SC-CAMLR-V/BG/3:	REPORT OF MEMBERS' ACTIVITIES IN 1985/86 JAPAN
SC-CAMLR-V/BG/4:	REPORT OF MEMBERS' ACTIVITIES IN 1985/86 GERMAN DEMOCRATIC REPUBLIC
SC-CAMLR-V/BG/5:	REPORT OF MEMBERS' ACTIVITIES IN 1985/86 AUSTRALIA
SC-CAMLR-V/BG/6:	REPORT OF MEMBERS' ACTIVITIES IN 1985/86 ARGENTINA
SC-CAMLR-V/BG/7:	SCAR ACTIVITIES RELATED TO CCAMLR (SCAR Observer)
SC-CAMLR-V/BG/8:	DRAFT SUMMARY OF CATCH AND EFFORT STATISTICS (Secretariat)
SC-CAMLR-V/BG/9:	REPORT OF MEMBERS' ACTIVITIES IN 1981–1985 INDIA
SC-CAMLR-V/BG/10:	REPORT OF MEMBERS' ACTIVITIES IN 1985/86 UNITED KINGDOM
SC-CAMLR-V/BG/11:	REPORT OF MEMBERS' ACTIVITIES IN 1985/86 UNITED STATES
SC-CAMLR-V/BG/12:	REPORT OF THE NINETEENTH MEETING OF THE SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH (SCAR) (CCAMLR Observer)
SC-CAMLR-V/BG/13:	SOME PRINCIPLES FOR FISHERIES REGULATION FROM AN ECOSYSTEM PERSPECTIVE (Australia)
SC-CAMLR-V/BG/14:	REPORT OF MEMBERS' ACTIVITIES IN 1985/86 POLAND
SC-CAMLR-V/BG/15:	REPORT OF MEMBERS' ACTIVITIES IN 1985/86 FRANCE
SC-CAMLR-V/BG/16:	SCIENTIFIC SEMINAR ON ANTARCTIC OCEAN VARIABILITY AND ITS INFLUENCE ON MARINE LIVING RESOURCES, PARTICULARLY KRILL (Chairman of the Scientific Committee)
SC-CAMLR-V/BG/17:	MODELLING AND DECISION MAKING AS PART OF THE CCAMLR MANAGEMENT REGIME (South Africa)

SC-CAMLR-V/BG/18: REPORT OF MEMBERS' ACTIVITIES IN 1985/86 REPUBLIC OF KOREA

SC-CAMLR-V/BG/19: REPORT OF MEMBERS' ACTIVITIES IN 1985/86 USSR

SC-CAMLR-V/BG/20: REPORT OF MEMBERS' ACTIVITIES IN 1985/86 NORWAY

SC-CAMLR-V/BG/21: REPORT OF MEMBERS' ACTIVITIES IN 1985/86 NEW ZEALAND

SC-CAMLR-V/BG/22: RESERVED

SC-CAMLR-V/BG/23: RESERVED

SC-CAMLR-V/BG/24: CHOOSING DISTANCE BETWEEN ACOUSTIC SURVEY TACKS
(U.S.S.R.)

SC-CAMLR-V/BG/25: DIFFERENTIATION OF INDEPENDENT POPULATIONS OF THE ANTARCTIC KRILL
(U.S.S.R.)

SC-CAMLR-V/BG/26: FINDING AND QUANTITATIVE ESTIMATION OF KRILL CONCENTRATIONS BY HYDROACOUSTIC INSTRUMENTS
(U.S.S.R.)

SC-CAMLR-V/BG/27: DETERMINATION OF ANTARCTIC KRILL ACOUSTIC BACK SCATTERING CROSS SECTION
(U.S.S.R.)

SC-CAMLR-V/BG/28: PRELIMINARY REPORT ON BIOLOGICAL OBSERVATIONS AND EXPLORATORY FISHING DATA COLLECTED IN THE SOUTH GEORGIA AREA DURING THE 1985/86 CRUISE OF MT 'CARINA'
(Poland)

SC-CAMLR-V/BG/29: PRELIMINARY APPRAISAL OF ANTARCTIC FISH SELECTION BY THE 32/36 BOTTOM TRAWL COMBINED WITH VARIOUS CODENDS
(Poland)

SC-CAMLR-V/BG/30: REPORT OF MEMBERS' ACTIVITIES IN 1985/86 CHILE

SC-CAMLR-V/BG/31: AGE AND GROWTH IN LENGTH OF MICROMESISTIUS AUSTRALIS, NORMAN, 1937 (PISCES, GADIDAE), IN THE SOUTHERN ZONE OF THE ARGENTINE SEA
(Argentina)

SC-CAMLR-V/BG/32: MESH SIZE MEASUREMENT
(Secretariat)

SC-CAMLR-V/BG/33: STATEMENT TO THE 1986 MEETING OF THE COMMISSION FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES
(IUCN)

SC-CAMLR-V/BG/34: THE PROTECTION OF THE MARINE ENVIRONMENT BY INTERNATIONAL SYSTEMS OF OBSERVATION AND INSPECTION OF VESSELS
(IUCN)

SC-CAMLR-V/BG/35: GENETIC VARIATIONS AND POPULATION STRUCTURE OF KRILL FROM THE PRYDZ BAY REGION OF ANTARCTIC WATERS
(Australia)

SC-CAMLR-V/BG/36: MOULTING INTERVAL AND GROWTH OF JUVENILE ANTARCTIC KRILL FED DIFFERENT CONCENTRATIONS OF THE DIATOM *PRAEODACTYLUM TRICORNUTUM* IN THE LABORATORY
(Australia)

SC-CAMLR-V/BG/37: GUIDELINES FOR THE PREPARATION OF THE REPORT ON KRILL HYDROACOUSTIC SURVEY
(U.S.S.R.)

SC-CAMLR-V/BG/38: METHODOLOGICAL GUIDELINES ON THE ASSESSMENT OF KRILL TRAWLS CATCHABILITY BY MEANS OF STATISTICAL MODELLING
(U.S.S.R.)

SC-CAMLR-V/BG/39: PROBLEMS OF THE POPULATION AGE STRUCTURE STUDY OF EUPHAUSIA SUPERBA DANA WITH THE EXAMPLE OF ANTARCTIC PENINSULA AREA AND ADJACENT WATERS
(U.S.S.R.)

SC-CAMLR-V/BG/40: INFORMATION ON SPANISH ACTIVITIES 1985/86

SC-CAMLR-V/BG/41: GUIDELINES FOR DATA COLLECTION ON TRAWL SELECTIVITY AND MORTALITY OF FISH ESCAPED THROUGH TRAWL COD-END
(U.S.S.R.)

ANNEX 3

AGENDA FOR THE FIFTH MEETING OF THE SCIENTIFIC COMMITTEE

AGENDA FOR THE FIFTH MEETING
OF THE SCIENTIFIC COMMITTEE

1. Opening of the Meeting

2. Adoption of the Agenda

3. Report by the Chairman

4. Fish Resources

   (i) Fish Stock Assessment
   (ii) Further Data Requirements
   (iii) Fish Age Determination - Review of the Report of the Workshop
   (iv) Mesh Selectivity
   (v) Mesh size measurement specification
   (vi) Advice to the Commission

5. Krill Resources

   (i) Fishery Status and Trends
   (ii) Biological Aspects Relevant to Stock Assessment
   (iii) Interim Report on Simulation Study
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6. Ecosystem Monitoring and Management

   (i) Review of the Report of the Working Group for CCAMLR Ecosystem Monitoring Program
   (ii) Ecosystem Monitoring Program
   (iii) IWC Reply on monitoring of whale stocks
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7. Data Collection and Handling

   (i) Data being collected
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   (iii) Processing of data in Secretariat
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8. Co-operation With Other Organisations

   (i) Reports of CCAMLR representatives at meetings of other international organisations
   (ii) CCAMLR-IOC Scientific Seminar on Antarctic Ocean Variability and its Influence on Marine Living Resources, Particularly Krill
   (iii) CCAMLR/FAO species identification sheet project

9. Review of Long-term Program of Work of the Scientific Committee

10. Publications Policy and Procedures for the Preparation of Meeting Documents

11. Budget for 1987

12. Election of Chairman of Scientific Committee

13. Next Meeting

14. Other Business

15. Adoption of the Report of the Fifth Meeting of the Scientific Committee

16. Close of the Meeting

ANNEX 4

REPORT OF THE AD HOC WORKING GROUP ON FISH STOCK ASSESSMENT

REPORT OF THE AD HOC WORKING GROUP ON FISH STOCK ASSESSMENT

INTRODUCTION

The meeting of the Working Group was held at the CSIRO Marine Laboratories, Battery Point, Hobart, Australia from 1–4 September 1986. Dr R.C. Hennemuth was in the chair. A list of those attending is given in Appendix I. Dr J.A. Gulland was appointed rapporteur. A list of documents presented at the meeting is given in Appendix II.

BASIC DATA

2. At its 1985 meeting, the Group reported considerable improvement in the data reported to the Commission, though there were some shortcomings. The level of reporting of current data is similar to last year, though there are still gaps in the historical data. Summary statistics, as reported on STATLANT A and B forms, were available from all countries for the 1984/85 season. However, the reporting of more detailed information on catch and effort is still falling short of the requirements set out in the annex of the report of the 1984 Meeting of the *Ad Hoc* Working Group. The exception was the fishery around Kerguelen, where very detailed information was collected by the French authorities. A summary of these data was made available to the Working Group (Doc. 3).

3. The collection and reporting of catch and effort data on a fine scale may also become important in connection with ecosystem monitoring. The Working Group for the CCAMLR Ecosystem Monitoring Program has proposed a number of study areas which are smaller than most STATLANT Subareas, though in some cases overlapping two or more subareas. In accordance with the Commission's 'ecosystem' approach to management, it will probably be necessary when detailed ecosystem monitoring is attempted, for catches in these study areas to be reported. Provided that the original data (e.g. from logbooks) are being collected in the agreed detail, this should present no great problem, though it would be important that any precise boundaries specified by the ecosystem group should be consistent with boundaries of the smallest statistical units (i.e. half-degree squares).

4. Length and age data have been reported for most species for those seasons and areas in which significant catches were taken but there are still some important gaps (see

Appendix III). In some cases reporting has not been in accordance with agreed standards, and this is causing problems in analysis (see paragraphs 4.3 to 4.11 of the 1985 Scientific Committee's Report). Problems remain concerning age determination. The Working Group noted that the Age Determination Workshop held in Moscow had discussed the problems, but many remained unsolved. It was hoped that future work (e.g. the exchange of scales and otoliths) would help resolve these. In any case, the Working Group believed that it was important for the problems to be clearly identified. In particular, in order to aid the interpretation of differences in age compositions reported by different countries in their routine data submission to CCAMLR, it would be valuable to have information for each of the major species on the interpretations of the same scale or otolith by different scientists, and the degree to which differences in interpretation increase with the size (and presumed age) of fish.

NEW RESEARCH

5. One working paper presented to the Group (Doc. 2) reported new fish stock assessments. The results of this study, covering the stocks of *N. rossii* and *C. gunnari* at South Georgia, are discussed in a later section. In addition, a number of working papers were presented describing studies relevant to stock assessment. These included surveys around Elephant Island, area 48.1 (Doc. 1), surveys of juvenile *C. gunnari* around South Georgia (Doc. 10), biological observations and exploratory fishing around South Georgia (Doc. 4) and results of mesh selection experiments (Doc. 5).

ASSESSMENTS

General

6. Though significant catches have been taken from the Antarctic for some 15 years, catches from any one stock have, in most cases, been concentrated in one or more periods of no more than two or three years, separated by periods of light and negligible fishing (see Table 1 and Figure 1). For some stocks - the South Georgia stock of *N. rossii* is a good example - this appears to be due to an extreme form of pulse fishing, i.e. the fishing down in one or two seasons of the accumulated stock from several years' natural production. In other cases the pulses may be a natural feature of the stock; catches from some stocks, e.g. of *C. gunnari,* consist now of only one or two year-classes, and if year-class strength is highly

variable, then high catches (and probably also high fishing effort) will be limited to those years in which good year-classes are present.

7. In either situation it is difficult to define 'typical' values of catch, fishing effort or fishing mortality which can be compared with some optimum or target values to provide a basis for management advice under the Convention.

8. The absence of a typical, or expected, value of fishing mortality raises particular problems in the application of virtual population analysis (VPA). This requires the input of a terminal F, i.e. the value of fishing mortality in the last year for which catch-at-age data are available. If there is no clear average value for previous years which can be used as a first approximation, another approach is needed. The most satisfactory in many cases will be an estimate of current biomass (e.g. from research vessel surveys), especially if accompanied by confidence limits (see Doc. 2). While catch and effort statistics and length/age data are important, they often need to be supplemented by other information (e.g. from surveys) if a satisfactory assessment is to be made. This matter is discussed later in relation to future assessment studies.

9. The variability in catches is demonstrated in Table 1 which presents the total catch of all fish species, and a summary of the statistical information given in more detail in SC-CAMLR-V/BG/8. In two areas, more than half the total historical catch has been taken in one season (1977/78 for Statistical Subarea 48.2, South Orkney, and 1978/79 for 48.1, Peninsula). Fishing at South Georgia (48.3) and Kerguelen (58.5) has been more consistent, but in neither area have catches approached those in the initial seasons (1969/70 at South Georgia, and 1971/72 at Kerguelen). It is also apparent from the more detailed data that recent pulses of good catches come increasingly from the shorter-lived species, especially *Champsocephalus gunnari*. At both South Georgia and Kerguelen, catches of this species have declined appreciably from the most recent peak in 1982/83. As a result, the total fish catches in 1984/85 were only some 73,000 tonnes, the lowest annual figure since 1975/76.

South Georgia

Notothenia rossii

10. The 1985 report concluded that this stock had been reduced to a very small proportion of its 1969 abundance, and that recruitment in recent years was also much less than earlier. This was confirmed by new studies. The VPA analysis was repeated using the most recent

age and length data. In this analysis, the terminal F (for the 1984/85 season) was determined using the biomass estimates derived from the surveys reported by Kock (SC-CAMLR-IV/BG/12). The estimated trends in biomass are shown in Figure 2, which indicates that the current biomass is only a few percent of the initial value.

11. Estimates of year-class strengths (derived from the VPA analysis and expressed as numbers of 2 year old fish) are given in Table 2. This shows that recent recruitment has been small. Although recruitment, expressed as a percentage of current stock, has increased, this increase has not been sufficient to balance the decrease in stock size (Doc. 2).

12. Polish survey data during the 1985/86 season indicated some increase in mean length of the samples, and a decrease in the proportion of fish less than 45 cm. There was a decrease in catch per haul compared with previous surveys. However, restrictions were applied which limited the directed fishing on *N. rossii* and also restricted the amount of fishing within 12 miles, so that these changes do not necessarily reflect real changes in the population. There is no indication of any significant improvement in recruitment.

13. In 1985 it was estimated that the current replacement yield*, based on considerations of yield-per-recruit and current recruitment, was less than a thousand tonnes. An alternative approach was examined by Cooke (Doc. 2), based on apparent recruitment as a percentage of current stock numbers. This gave a range of a few thousand tonnes depending on the values used for current stock. The difference between the two approaches derives largely from different implied assumptions about the numbers of fish recruiting to the fishery.

14. Similarly, the expected trends in stock abundance over the next few years in the absence of any fishing depend on the magnitude of recruitment. If recruitment in the immediate future is the same as the average recruitment in previous years, and it is assumed that the 1985/86 catch is the same as in 1984/85, and that catches are zero in 1986/87 and subsequent seasons, the recovery will be as shown in Figure 2. This figure implies a replacement yield of one or two thousand tonnes, which is probably close to the actual values. It is also close to the average level of recent catches.

* Replacement yield is that catch which, if taken during a season, would leave the abundance of the stock at the end of the season at the same level as at the end of the previous season.

N. gibberifrons

15. Based on estimates of mortality derived from average lengths, it was concluded by the 1985 Working Group that this stock was heavily fished, with fishing mortality well in excess of natural mortality. This was confirmed by a VPA analysis, based on Polish length and age data[**], with the terminal F determined from the 1985 survey data reported by Kock (1985). Using a value of natural mortality M = 0.25 (probably an upper limit for a relatively long-lived fish), the average F on 9+ fish from 1976 to 1985 was 0.37, and was much higher in some years (1.35 in 1980/81). This has resulted in a considerable decline in adult biomass, since 1975. Trends in total biomass are less well known, because of difficulties in the VPA in determining the actual abundance of the younger year-classes in the most recent years. The stock trajectory estimated from VPA is shown in Figure 4b.

16. For the same reason, it is difficult to determine the strength of recent year-classes. The most recent year-class for which a reasonably reliable estimate is available is that spawned in 1977 (7 year olds in the 1984/85 season). For this and earlier year-classes, there is no evidence of any significant fall in recruitment, but fishing did not cause any substantial fall in spawning stock until 1978.

17. The replacement yield is almost certainly small, although the precise value will depend on the strengths of the recent year-classes, and these are not well known. The current biomass has been estimated as 15,762 tonnes based on the surveys reported by Kock. Lower catches would allow a recovery of the stock. The expected trend in abundance, if catches were zero from 1986/87 onwards, is indicated in Figure 3.

C. gunnari

18. This species is shorter lived than the *Notothenia* species, and catches in recent years have been based on only one or two year-classes. It was concluded in the 1985 report that this stock was being heavily fished.

19. VPA analysis, based on Polish age/length data and with terminal F set to match the 1984/85 survey data, confirms this conclusion. Fishing mortality has been very high, especially in 1976/77 and in the last couple of seasons.

** The interpretation of scales used in producing these age data differs from those of other scientists. The latter interpretations tend to imply a rather faster growth rate, and use of these interpretations could modify the VPA analysis. A re-examination of the data, and if appropriate, a re-run of the analysis is clearly desirable.

20. The trends in biomass, as estimated from VPA, are shown in Figure 5a. This shows large fluctuations, with a decline until 1978, and then a strong peak in 1982/83 due largely to the strong 1980 year-class, followed by a further sharp decline. Current biomass is very much less than in 1975.

21. Recruitment is highly variable, and therefore it is very difficult to determine whether fishing is having any effect on recruitment.

22. Future trends in abundance, and the values of current replacement yields depend critically on current recruitment and recruitment over the next few years. There is little reliable information on these. However, the stock appeared to recover from a low level of abundance in 1978 under fishing mortalities slightly less than 0.3. The chances of an average or better year-class occurring would probably be increased if catches were kept at a low level (i.e. F less than 0.3) until a good year-class enters the fishery.

23. The Working Group noted that the USSR reports on length composition to the Secretariat included records of substantial quantities of juvenile fish (age-class 1, approximately 17 cm), presumably taken with a small-meshed net. It was explained that these records, which had been reported as coming from commercial catches, actually came from exploratory fishing, and not from the commercial fishery. While recognising the value of exploratory fishing data, the Working Group emphasised the importance of also having data from the commercial fishery, so that accurate knowledge could be obtained of the sizes of all fish being removed from the stock.

Other Species

24. Table 3 sets out the total reported catch, by species, from South Georgia in recent years. This shows that in addition to the large catches of the three species for which assessments are now available, significant catches of *N. guentheri*, and smaller but non-negligible catches of several other species have been reported. In addition, significant quantities of unclassified species continue to be reported, especially by the Soviet Union. The Working Group repeated its concern expressed in last year's report, that every effort should be made to identify fully the species in the catch.

25. *N. guentheri* is a small species, caught only by the Soviet Union in the Shag Rocks area. No information has been provided that could enable the Working Group to attempt an assessment of this stock. In view of the volume of the catches (cumulative catches of over

115,000 tonnes) the Working Group stressed that information should be provided about this stock as a matter of urgency.

26. Length composition data are available for recent commercial (Poland) and research vessel (FRG) catches for *Chaenocephalus aceratus* and *Pseudochaenichthys georgianus*. These indicate little change in size between 1983/84 and 1985/86, with the catches of *P. georgianus* being almost entirely of adults. Since the catch of 13,000 tonnes of *P. georgianus* in the 1977/78 seasons, catches of both species have been at around 1,000 tonnes annually.

Peninsula Subarea (48.1)

Introduction

27. Large-scale harvesting of finfish in the Peninsula region started in 1978/79 and was reported for the two successive seasons and for 1982/83. The main fishing grounds were off Deception Island, off the north coast of King George Island, northeast of Joinville and particularly northwest and west of Elephant Island. Peak catches of 52,000 tonnes were taken in the first season. In the subsequent years, yields dropped substantially: 22,389 tonnes in 1979/80, 5,980 tonnes in 1980/81 and 2,604 tonnes in 1982/83 (Anonymous, 1985). The main target species were *Champsocephalus gunnari* (35,900 tonnes), and *Chaenodraco wilsoni* (10,130 tonnes, exclusively taken off Joinville) in 1978/79 and *Notothenia rossii* (18,763 tonnes) in 1979/80.

28. Research activities were recorded from the area since 1975/76, i.e. before the onset of commercial fishing. By reviewing existing data on length and age compositions and biomass estimates (mostly from research vessel catches and exploratory fishing activities) an attempt is made to assess the effect fishing might have had on the stocks.

29. Analysis is restricted to the commercially most important species *Notothenia rossii*, *N. gibberifrons* and *Champsocephalus gunnari*.

Notothenia rossii

30. Data recently submitted to CCAMLR and those already available in scientific literature give evidence that *N. rossii* in the Peninsula region may form three distinct groups during its life cycle:

(a) juveniles living in the fjords and close to the coast in their first 3–5 years (Argentinean data from Potters Cove, Linkowski and Zukowski, 1980: Admiralty Bay)

(b) females (mostly juveniles) and males (juveniles and fish in their first year of sexual maturity) which are about to recruit to the spawning stock (5–7 years old, mostly belonging to age class 6, by-catches in Polish commercial fisheries in 1978/79, FRG research vessel catches in 1980/81 and 1983/84 to 1985/86) (Kock 1982, 1986) (see Figure 6c).

(c) the spawning stock consisting of some fish from about age class 5 onwards, age class 8 being the first fully recruited age class (Federal Republic of Germany research vessel catches Freytag, 1980; Kock, Duhamel and Hureau, 1985, Figure 19, and Soviet commercial catches in 1979/80) (see Figure 6a and b).

31. This separation into different groups, according to age and maturity, makes it difficult to obtain any estimate of overall abundance and complicates attempts at assessment.

32. The spawning stock (or at least part of it) was found during research trawling in a rather restricted area northwest of Elephant Island in 200–450 m depth. Length and age composition from the catches in 1976/77 and 1977/78 differed little from each other (Freytag, 1980; Kock, Duhamel and Hureau, 1985).

33. Length and age composition of the commercial catches in 1979/80 (see Figures 6a and b) indicates that the same concentration was exploited during the commercial fishery. Attempts to locate the spawning stock after the large-scale fishing in 1979/80 failed. The concentrations located in the research vessel surveys in March 1981, February 1985 and May/June 1986 consisted predominantly of fish of age classes 6 and 7, i.e. the individuals which were about to recruit to the spawning stock.

34. The catch of 18,762 tonnes in 1979/80, which was probably of mature fish exceeded the estimate made of the biomass before exploitation of 9,000 – 15,500 tonnes (Kock, Duhamel and Hureau 1985, Table 51). In view of the difficulties in locating concentrations of spawning fish in later seasons, this suggests that the 1979/80 fishery removed most of the mature fish. In the absence of any reported catch in subsequent years, and the limited supply of survey and other non-fishing data, it is impossible to make any quantitative statement about the current state of the stock, though it is probably well below its initial abundance.

Champsocephalus gunnari

35. Data are available from 1977/78 onwards. Research vessel catches from the Elephant Island area in 1977/78 consisted entirely of individuals of 28–38 cm (age classes 3 to 5 according to USSR age determinations). According to the length compositions, these concentrations were exploited commercially by the Soviet fleet and partly by the Polish fleet. The fish were then 30–40 cm long and belonged to age classes 4–6 (see figures 7a and 7b and Kock, Duhamel and Hureau, 1985, Figures 27, 28). A much smaller part of the catches originated from King George Island and consisted of individuals of 35–47 cm. These were mostly taken by Polish and GDR vessels (Kock et al Figure 28). The same concentrations were exploited by Soviet and Polish vessels in 1979/80.

36. Length and age compositions from Soviet exploratory fishing since 1980/81 demonstrated a high year to year variability in the composition of the catches (see Figures 7a and 7b) without any significant trend. The similarity of length compositions of FRG research vessel catches in 1980/81, 1983/84 and 1984/85 taken off Elephant Island with those reported from Soviet exploratory fishing in the Peninsula Subarea indicate that the latter were also taken around Elephant Island.

37. Elephant Island is the most important fishing ground in the Peninsula Subarea.

38. The catches in 1978/79 were in the order of the (rough) biomass estimate for the whole Peninsula Subarea in 1977/78 (Kock, Duhamel and Hureau, 1985, Table 51). Most of the biomass was formed by 2 or 3 very abundant year-classes which were fished out in 1978/79 and 1979/80. Year-classes of that strength have not been observed since.

39. Stock biomass dropped substantially in the Elephant Island area as a result of the heavy fishing in 1978/79. No significant change is, however, apparent from the length and age compositions over the successive 6–7 years, i.e. in contrast to South Georgia, fishes more than 32 cm obviously still form a significant part of the population. Even when no fishing took place, year to year changes in the length and age compositions indicate a high natural variability which makes it even more difficult to detect any changes brought about by fishing.

Notothenia gibberifrons

40. Catches of about 4,000 tonnes (mostly taken in 1978/79) were less than 10% of the biomass estimated for the whole Peninsula Subarea (Kock, Duhamel and Hureau, 1985,

Table 51). Even if the catches were taken entirely around Elephant Island, they were only 20% of the estimated biomass there. A significant proportion of the catches, however, were obviously juveniles (USSR data submitted to CCAMLR for 1978/79). Neither the length compositions of catches from FRG research vessels, nor the length and age compositions from Soviet exploratory fishing vessels (see Figure 8) give evidence that the stock is significantly affected by fishing.

Other Species

41. Of the other species represented in the statistics, *Chaenocephalus aceratus* and *Chionodraco rastrospinosus* do not seem to have been substantially affected by the fishery. It is not possible to make any statement about *Chionodraco wilsoni*.

South Orkney Subarea (48.2)

Introduction

42. Commercial fishing in this subarea apparently began in the 1977/78 season, when 140,000 tonnes were taken (nearly all *C. gunnari*). Subsequent catches were much smaller, though unlike in the Peninsula area, some catches were taken in each season. Cumulative catches since 1978 are just under 100,000 tonnes i.e. less than in 1977/78. *C. gunnari* continues to be important, but in recent years significant catches of *N. gibberifrons* have also been taken.

Champsocephalus gunnari

43. Age and length data supplied by the USSR indicate that the year-class strength in this stock, as in other stocks of the same species, is highly variable. The very high catches in 1977/78 came from a couple of very good year-classes (those of 1974 and 1975) which, despite the high catches, continued to form the bulk of the stock even in 1980/81, when they were 5 and 7 year olds. In 1980, young fish (less than 4 years old) were virtually absent from the catch. A better year-class entered the fishery in 1983.

44. The USSR age-data was used to construct a VPA, using the FRG survey data to give a terminal F. The estimated trend in biomass is shown in Figure 5b. This indicates a sharp

decline from the peak biomass in 1978, with some recovery in 1983, but then a further decline to a very low level in 1985. Because of the variable year-classes, it is not clear to what extent the abundance in 1978 was typical of the unexploited abundance. The abundance in 1985 may have been under-estimated. However, the decline in biomass evident in Figure 5b is so great that it is clear that the stock has been reduced by fishing.

45. As has been shown for *C. gunnari* in other areas, future trends depend greatly on the strength of year-classes present in the fishery over the next four years. Current catches are largely of relatively old fish, which suggests that the most recently recruited year-classes are weak. In that case, the stock may decline in the immediate future, even in the absence of fishing.

N. gibberifrons

46. Total cumulative reported catches of this species are only about 20,000 tonnes, taken mostly in the 1979, 1984 and 1985 seasons. Sufficient age data are available from the USSR to make a VPA analysis using the survey data for 1984/85 provided by the FRG, to estimate terminal F. The results, in terms of the estimated abundance, are given in Figure 4a. This does not show any marked trend, the estimated abundance actually being highest in 1984. The results depend on the values of M and terminal F. The analysis suggests that fishing mortality in some years was quite high (0.6 – 0.8), indicating that the stock is probably at least moderately heavily fished.

47. Only 1 tonne of this species was reported caught in 1982/83; this was the only year with a large catch of unidentified species (12,349 tonnes) in this area. The reported catch of *Champsocephalus* in 1983/84 was 5,948 tonnes, which is comparable with the following year's catch. If the unidentified fish were primarily *N. gibberifrons*, this could substantially affect the VPA assessments for this stock. A revised VPA was carried out incorporating this catch. This analysis yields higher estimates of stock size in previous years (see broken line in Figure 5a). This revised VPA gives similar quantitative conclusions regarding fishing mortality.

Kerguelen Subarea (58. 5)

48. The data base available for assessing the stocks at Kerguelen is somewhat different from that in other areas, with the result that somewhat different methods have been used.

Prior to 1978, few data were available and this lack of long term series and detailed data from the earlier part of the fishery has made it difficult to apply VPA and similar methods. Since 1979 and the imposition of controls by France, very detailed catch and effort data have been available.

49. Examination of the detailed data, broken down into 9 subareas around the island, has shown that within any one subarea and during any particular season, catches tend to be predominantly of one species. Thus, using the detailed data, it is possible to follow trends in abundance of individual species from the c.p.u.e. However, the usefulness of c.p.u.e. will vary from species to species, depending for example on the degree of aggregation.

Notothenia rossii

50. It was noted in last year's report that, this stock was very greatly depleted by very high catches at the beginning of the fishery, and that with catches continuing at a level of a few thousand tonnes, was probably continuing to decline. A closure has applied to the spawning grounds (on the southeast continental shelf during winter) since 1983. This restriction has reduced the total catch, but has also broken the most representative series of c.p.u.e. data.. A less satisfactory series of c.p.u.e. values is available for the fishery in the summer, in which *N. rossii* is caught incidentally. This gives the following values.

Year	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
Catch (tonnes)	1299	1981	462	584	488	788
cpue (t/hr)	1.38	0.80	0.39	1.05	0.81	2.41

51. The higher figure in the most recent years may indicate some recovery, but a more accurate measure of recovery would be from annual experimental fishing on the spawning grounds. It would also be useful to use trammel nets in coastal waters to monitor changes in the abundance of juveniles.

Notothenia squamifrons

52. This species is found mostly during summer in the subareas to the south and southeast of the island. The c.p.u.e. in these areas, together with the total catches from Kerguelen, were as follows:

Season	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
Total catch (tonnes)	11,308	6,287	4,031	1,815	3,794	7,408	2,464
cpue (t/hr)	3.67	3.11	1.68	1.51	3.68	3.30	2.48

53. The variation in c.p.u.e. is not large, and does not suggest that there have been major trends in abundance during this period.

54. There has been some decrease in the mean length of fish from 34.8 cm in 1979/80 to 32.0 cm in 1985/86; and this is now less than the mean length at first maturity. Age composition data also suggest an increase in total mortality, from 0.38 in 1981 to 0.77 in 1986.

55. Current catches are very much less than those taken in 1970/71 and 1971/72, when a total of 77,000 tonnes were caught. Though no quantitative assessment has been made, the available information suggests that the stock has been considerably depleted from its initial (1970) level, and is now being exploited at an approximately sustainable level, but without recovery. Further studies are clearly needed. The series of data since 1979 may now be sufficient to warrant a VPA approach.

Champsocephalus gunnari

56. This is now the main species in the Kerguelen fishery. There are two distinct fishing areas, around the island itself and on the Skiff Bank. These are probably two distinct stocks.

57. Detailed length data have been collected since 1980 and these show that the fishery has in most years been based on a single cohort (occasionally two). The growth of each cohort can be easily followed in the length composition data, with modal lengths in June of successive years being 9, 18, 26, 29 and 33 cm. Around the island, there have been dominant cohorts in 1979 and 1982. On the Skiff Bank the dominant cohorts have been in 1977 and 1980.

58. Because the catches in any one year are largely of a single cohort, and there is a gap between cohorts, it is possible to estimate the change in numbers of each major cohort (expressed as catch per unit effort) by dividing the total catch per unit effort in weight, by the mean weight of individuals in the cohort.

Season	Catch (tonnes)	Effort (hours)	Cohort	Length (cm)	Mean Weight (g)	Mean cpue (wt)	cpue (number)	Apparent Survival (%)
Shelf								
1981/82	15024	2488	1979	26	96	6.04	6.29	
1982/83	25847	4208	1979	29	189	6.14	4.42	70
1983/84	6241	5708	1979	33	216	1.09	0.50	11
1984/85	8041	1293	1982	26	96	6.22	6.47	
1985/86	17054	2871	1982	29	139	5.94	4.27	66
Skiff Bank								
1980/81	991	618	1977	28	123	1.60	1.30	
1981/82	1024	635	1977	32	194	1.61	0.83	64
1983/84	805	886	1980	28	123	1.10	0.88	
1984/85	250	224	1980	32	194	0.90	0.46	52

59. These figures suggest that while total mortality must be high (as evidenced by the lack of old fish) recruitment may be only partial in the first year (26 cm group on the Shelf, 28 cm on the Skiff Bank). The abundance in any one season is clearly dependent on the strength of the cohort (or cohorts) present; so far there is no evidence that these strengths are influenced by fishing.

60. Because of the lack of data from the early years of the fishery, it is difficult to make definite statements about the relation of current biomass to the average pre-exploitation biomass. This lack of early data, and the variability in recruitment, makes it difficult to estimate the level of sustainable or replacement yields.

Other Areas

61. The Working Group noted that some 10,000 tonnes of fish (mainly *Notothenia squamifrons*) had been taken from Subarea 58.4.4 (probably Ob and Lena sea-mounts) since 1979. Apart from total catch, no information has been reported to the Commission from which it might be possible to make an assessment of these stocks.

MANAGEMENT

Mesh Selection

62. The Polish delegate presented information on some mesh selection experiments carried out by the R.V. *Professor Siedlecki*. Most of the work was done with two cod-ends of mesh-sizes approximately 60 and 100 mm, made of a tape material. This type of netting is

not generally used now, so the selectivity results may not exactly apply to the commercial fleet. Based on a subjective judgement of the flexibility of the two netting materials, it is believed that if there is a difference, the selectivity of the commercial fleet gear might be somewhat greater, though the difference is not likely to be large.

63. For some species, the selection factors of the two nets differed considerably, and it was not possible to reach a clear conclusion about selection. However, for two of the more important species (*C. gunnari*, and *N. gibberifrons*), there was fair agreement between the data sets. These are summarised below.

	60 mm (mean 61.2) 50% point SF		100 mm (mean 101.6) 50% point SF	
Mackerel icefish (*Champsocephalus gunnari*)	22.2	3.63	33.5	3.30
Bumphead Notothenia (*N. gibberifrons*)	21.1	3.45	35.7	3.51

Using the mean selection factors (3.46 and 3.48) and applying these to the legal minimum sizes of 80 mm and 120 mm of *C. gunnari* and *N. gibberifrons* respectively gives the following predicted 50% selection lengths:

C. gunnari	80 mm – 27.7 cm	120 mm – 41.5 cm
N. gibberifrons	80 mm – 27.8 cm	120 mm – 41.8 cm

64. For *C. gunnari*, the 50% selection length corresponding to the 80 mm mesh is greater than the mean length at maturity. The corresponding age is about 3.5 years. The yield-per-recruit calculations given in paragraph 28 of the 1985 Report show that this might be close to the optimum age at first capture, depending on the current level of fishing mortality.

65. When mesh selection studies are made, or mesh regulations introduced, it is important that the measurements are made in a standard manner. A document was prepared by the Secretariat (Doc. 12), setting out the procedures used by some other bodies. The Working Group did not have time to consider the details of that document but endorsed the Scientific Committee's view that standardisation was needed (see paragraph 4.32 of the 1985 Committee Report).

Closed Areas and Incidental Catches

66. As noted in last year's report, the effectiveness of closed areas in reducing fishing mortality as a whole, or on some section of the stock (e.g. juveniles) depends on the degree to which the group of fish to be protected inhabits clearly identifiable areas. For example, juvenile *N. rossii* are found mainly in the coastal zone. In line with these and other findings, the Commission has recommended certain actions, including the prohibition of directed fishing for *N. rossii*, and of fishing within 12 miles of South Georgia. It is too early to see what effect these measures are having.

67. As far as other species are concerned, the detailed catch and effort data for the post-1979 fishing at Kerguelen show that the major catches of most species are concentrated in a limited number of months and a few locations. A large degree of protection for any given species can therefore be achieved through the closure of the appropriate subareas and months. Such a closure is already in place for *N. rossii* at Kerguelen.

68. For other areas, the STATLANT B data are the most detailed catch/effort data reported to the Commission.

69. The STATLANT B data for the South West Atlantic frequently show a mixed species catch and thus indicate that the fishing effort may not be directed towards individual species. The patterns of fishing were discussed in conjunction with the Statlant B data.

70. Most fishing in recent years has been directed towards *Champsocephalus gunnari*. In many months of most seasons this species dominates in the catches, often accounting for over 90% of the total. Fishing vessels move to areas where *Champsocephalus gunnari* is expected to be found, and if found the fleet commences fishing on it. If, however, this species is not found in quantity but other commercial species are present in reasonable quantity, then the majority of vessels fish whilst scouting vessels move off in search of the target species. The occurrence of fishable concentrations of *Champsocephalus gunnari* varies seasonally and in quantity. With the present state of knowledge, the distribution of the target species cannot always be predicted. This accounts for the highly variable catch composition. Under favourable conditions over 90% of the catch is *Champsocephalus gunnari* although often this species only makes up 50% of the total, probably because directed fishing on *Champsocephalus gunnari* did not take place throughout the reporting period.

71. Fishing for *Champsocephalus gunnari* is undertaken using pelagic as well as bottom trawls. Pelagic trawls are often fished close to or even on the bottom. *Champsocephalus*

gunnari is known to migrate inshore to the fjords of South Georgia during April and May to spawn and large catches have been reported for those months (Table 5).

72. On a few occasions in the recent past, the fishery has been directed towards other species. When catches of *Notothenia guentheri* are present, it can safely be assumed to have been the target species, as it is rarely found in association with the other commercial species. During the 1978/79 and 1979/80 seasons, Polish vessels in the vicinity of Joinville Island (Subarea 48.1) were fishing for *Chaenodraco wilsoni*.

73. With the limited information on area of capture contained in the STATLANT B forms, this is probably as far as this review can be carried. With more detailed area breakdown, it might be seen that the situation in the South Atlantic is similar to that at Kerguelen, with considerable separation between the fisheries directed at different species.

Status of Stocks

South Georgia

74. In the 1985 Report, it was noted that the *N. rossii* stock was severely depleted, and that the stocks of *C. gunnari* and *N. gibberifrons* were also heavily fished. The more recent analysis reported on here confirms these conclusions. The stocks of *C. gunnari* and *N. gibberifrons* have been depleted well below their initial level, and the combined replacement yield of these species plus those of *C. aceratus* and *P. georgianus* is small - no more than a few thousand tonnes. Catches of *N. guentheri* are taken as a separate directed fishery around Shag Rocks, and there is no information on which to base an assessment of this stock.

Peninsula

75. The knowledge of the state of the stocks in this subarea is poor. Of the main species in the catch, the stock of *N. rossii* is probably well below its initial abundance, and that of *C. gunnari* dropped after heavy fishing in 1978/79, but there is little evidence that *N. gibberifrons* has been significantly affected by fishing.

South Orkney

76. The abundance of the main species in the catch, *C. gunnari*, is highly dependent on year-class strength. Current abundance is very much lower than that when fishing started in 1977. The other species, *N. gibberifrons* is moderately heavily fished.

Kerguelen

77. The management measures applied by the French authorities, including the additional protection given to the spawning stock of *N. rossii*, appear to have halted the decline in stocks that was occurring prior to 1979. There is some evidence of an increase in recovery of the most depleted stock, that of *N. rossii*, in 1986.

FUTURE ASSESSMENT WORK

78. Appendix III indicates the information relevant to stock assessment that is currently available for major stocks, and shows the annual catches from those stocks. Where there has been a significant fishery, much of the basic assessment information (i.e. catch, age and length data), has now been provided. There are still some gaps. For example, with the exception of Kerguelen, there is very little catch per unit effort data on a sufficiently fine scale to be of use for assessment purposes, and there are some stocks, e.g. *N. guentheri* and *D. eleginoides* for which very little data of any kind are available. The Working Group stressed the importance of filling these gaps. At the same time it recognised that filling gaps in historical data sets and adding data from one or two more fishing seasons was unlikely to lead to major improvements in the assessments that are already available, including those presented in this report.

79. There are a number of other stocks, some of which have supported catches, for which no data are so far available. These are listed in Table 4. Obviously no assessments can be done for these stocks.

80. The Working Group believed that it was timely to review the procedures being used to make assessments of the stocks, and to make proposals for how this work should be carried out in the future. In doing this, the Group recognised that what work was done had to be linked to the requirements of the Commission for advice on management, and the ways in which that advice would be provided in the future. It also recognised that within the

framework of the Commission, three stages could be distinguished – reporting of data by the countries to the Secretariat, routine processing of these data by the Secretariat, and the actual preparation of the assessment studies.

81. The Working Group noted that although a number of proposals have been made regarding submission of data (notably in the report of the Woods Hole meeting of the *Ad Hoc* Working Group on Data Collection and Handling) the only formal requirement on data submissions, including timing of reports, is that STATLANT A and B forms should be submitted to the Secretariat by 30 September following the fishing season. It believed that more formal commitments for the supply of other routine information should be made and that the Scientific Committee should set out in some detail the nature of these requirements, including standard methods for recording and reporting data. Such standards have already been set out elsewhere (e.g. for biological data in various BIOMASS documents) and standards for length reporting have been adopted by the Scientific Committee (see paragraph 4.7 of the 1985 Report). The Working Group recommended that the Scientific Committee consider recommending to the Commission formal requirements for routine submission of these data.

82. The Working Group noted that some of the difficulties experienced by the Commission in relation to data handling were now almost solved. It should therefore be possible for the Secretariat to assemble and circulate in advance the available data, in a standard format, along with the results of routine analyses requested by the Scientific Committee or by Working Groups. However, the production of full stock assessments including the integration of results from different types of data and analyses is likely to require expertise not immediately available within the Secretariat. At the same time, this type of work is not efficiently carried out by a large group, such as the present Working Group. Indeed it is unlikely that there would be a need for this group to meet again in the immediate future. A better arrangement might be for a small group (of perhaps three or four experts) to meet at some convenient place and time (not necessarily in Hobart), to prepare a report which could serve as the basis for the discussions of the Scientific Committee on stock assessment matters, including assessments of the current status of each major stock. The timing of such a meeting might be chosen late enough to assure a full reporting of data, but early enough to allow the report to be circulated to the members of the Scientific Committee in sufficient time for them to be able to digest it before the Committee's meeting.

83. The most useful data are likely to be survey results. These are particularly useful if they provide estimates of absolute numbers or biomass, but surveys giving relative numbers, e.g. indices of year-class strength from surveys of 0+ fish, are also of potential value. The

latter surveys need to be repeated at regular intervals using standard methods, if their potential is to be realised.

84. Surveys are expensive, and therefore need to be carefully planned if they are to provide the most information at the lowest cost. In particular, priorities and proposals for coordination need to be set by the Scientific Committee, taking account of the demands for advice by the Commission, and the degree to which individual stocks are depleted, moderately fished, or still unexploited.

85. The advice on stock assessment developed by the Scientific Committee should clearly focus on matters relevant to the Convention such as the ratios of current abundance to initial, unexploited, abundance; the current level of replacement or sustainable yield, or the degree to which recruitment has been affected by fishing.

86. Unfortunately, these matters cannot always be determined with certainty. For example, after there has been a clear decline in recruitment, there may still be doubt as to the role of fishing in causing this decline. The Working Group therefore believes that the Commission might wish to consider introducing some relatively easily measurable criteria for bringing into effect different management measures. For example, it might be decided to close a fishery for one season whenever the abundance of the adult stock was estimated to have fallen below some specified level and or to re-open a directed fishery when survey information indicated increased biomass and/or recruitment. The group suggests that this matter be discussed in more detail in the Scientific Committee.

87. Where the Commission is considering introducing specific measures, e.g. an increase in mesh size, or the closure for some specific period of a particular fishery, it would be desirable to determine the expected effects of such measures, and compare them with the effects of not acting. Bearing in mind the uncertainties of many assessments, such comparison might be made under different assumptions concerning the present state of the stocks, so that it can be seen to what extent the advantages of one or other management action is dependent on the precise state of the stocks. If such a procedure is to be followed, and the necessary calculations made, it would be essential for the Commission to give an early indication of the kind of measures it might wish to consider.

88. In any case, the priorities for future assessment work need to be matched to the requirements by the Commission for management advice. Thus, the more detailed the proposed measures, and the more detailed the advice needed, the more detailed should be the analysis performed and the greater will be the need for comprehensive reporting of data.

89. The Working Group noted that the analyses conducted at this meeting (e.g. VPA's) have been useful for an initial reconstruction of the stock trajectories up to the present time. However, additional information will be essential for developing on-going management advice for the Commission.

Table 1: Catches of fish in Convention Area, by year and subarea, 1970 – 1986 (in tonnes)

Year	Statistical Area 48					Statistical Area 58					Statistical Area 88	
	Sub Area					Sub Area					Sub Area	
	48.1	48.2	48.3	Unspecified	Total	58.4	58.5	58.6	Unspecified	Total	Unspecified	Total
1970	–		399704		399704		–	–	–	–	–	–
1971	–	–	113713	–	113713	–	–	–	99091	99091	–	–
1972	–	–	3351	–	3351	–	–	–	219552	219552	–	–
1973	–	–	2995	–	2995	–	–	–	32685	32685	–	–
1974	–	–	747	–	747	–	–	–	50034	50034	–	–
1975	–	–	4053	–	4053	–	–	–	68805	68805	–	–
1976	–	–	28732	–	28732	–	–	–	29233	29233	–	–
1977	–	–	124611	–	124611	–	–	–	10866	10866	–	–
1978	–	140311	37626	26185	204122	–	–	–	151503	151503	23	23
1979	52195	29105	24705	16257	122262	–	–	–	2629	2629	200	200
1980	26151	14808	56664	–	97623	4679	14827	–	–	19506	–	–
1981	6106	5086	91557	–	102749	3534	15348	–	–	18882	2100	2100
1982	–	3674	89036	–	92710	1519	30061	–	–	31580	105	105
1983	2620	18412	146482	–	167514	332	29658	18	–	30008	–	–
1984	–	15762	104742	–	120504	254	12436	–	–	12690	131	131
1985	–	8866	38517	–	47383	1325	24040		–	25365	–	–

Table 2: Estimates of recruitment (thousands of fish at age 2) for two notothenid stocks.

Year class	*N. rossii* S. Georgia		*N. gibberifrons* S. Orkney	
1959	10077	(11 years old in 1970)		
1960	15670	(10 years old in 1970)		
1961	19853	(9 years old in 1970)		
1962	21671	(8 years old in 1970)		
1963	20097	(7 years old in 1970)		
1964	20306	(6 years old in 1970)		
1965	16223	(5 years old in 1970)		
1966	10685	(4 years old in 1970)		
1967	5603	(3 years old in 1970)	167.2	(12 years old in 1979)
1968	3870	(2 years old in 1970)	398.8	(11 years old in 1979)
1969	4526	(2 years old in 1971)	816.9	(10 years old in 1979)
1970	6410	(2 years old in 1972)	1748.0	(9 years old in 1979)
1971	8094	(2 years old in 1973)	3091.3	(8 years old in 1979)
1972	8357	(2 years old in 1974)	4763.7	(7 years old in 1979)
1973	8568	(2 years old in 1975)	10513.0	(6 years old in 1979)
1974	8424	(2 years old in 1976)	19958.7	(5 years old in 1979)
1975	8221	(2 years old in 1977)	28083.5	(4 years old in 1979)
1976	7074	(2 years old in 1978)	38137.9	(3 years old in 1979)
1977	6272	(2 years old in 1979)	45940.7	(2 years old in 1979)
1978	6587	(2 years old in 1980)	39807.9	(2 years old in 1980)
1979	5797	(2 years old in 1981)	52217.0	(2 years old in 1981)
1980	3302	(2 years old in 1982)	47166.1	(2 years old in 1982)
1981	1474	(2 years old in 1983)	77123.6	(2 years old in 1983)
1982	inadequate data		74066.1	(2 years old in 1984)

Table 3: Catches, by species, from South Georgia (subarea 48.3) (tonnes)

YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Pisces n.e.i.	–	1454	27	–	493	1407	190	13840	270	331	5166	7313	4849	11753	4227	3775
Nototheniidae n.e.i.	–	–	–	–	–	–	–	–	129	2407	486	210	51	–	40	365
Notothenia gibberifrons	–	–	–	–	–	–	4999	3727	11758	2540	8143	7971	2605	–	3304	2081
Notothenia guentheri	–	–	–	–	–	–	–	–	–	15011	7381	36758	31351	5029	10586	11923
Notothenia rossii	399704	101558	2738	–	–	–	10753	8365	2192	2137	24897	1651	1100	866	3022	1891
Notothenia squamifrons	–	–	35	765	–	1900	500	2937	–	–	272	544	812	–	–	1289
Dissostichus eleginoides	–	–	–	–	–	–	–	441	635	70	255	239	324	116	109	285
Channichthyidae n.e.i.	–	–	–	–	–	–	–	–	–	–	–	4554	–	–	–	54
Chaenocephalus aceratus	–	–	–	–	–	–	–	293	2066	464	1084	1272	676	–	161	1042
Champsocephalus gunnari	–	10701	551	1830	254	746	12290	93400	7557	641	7592	29384	46311	128194	79997	14148
Pseudochaenichthys georgianus	–	–	–	–	–	–	–	1608	13015	1104	665	1661	956	–	888	1097
Myctophidae	–	–	–	–	–	–	–	–	–	–	505	–	–	524	2401	523
Rajiformes	–	–	–	–	–	–	–	–	4	–	218	120	1	–	7	28

Table 4: Cumulative catches, by subarea, of species or species groups) for which no assessment data have been provided.

Species	TOTAL CATCH (tonnes)						
	SOUTH ATLANTIC OCEAN			INDIAN OCEAN			PACIFIC OCEAN
	Subarea			Subarea			Subarea
	48.1	48.2	48.3	58.4.2	58.4.4	Unspecified	88
Notothenia rossii					538		
Notothenia squamifrons	36	239	9054		8406		
Dissostichus eleginoides	102	254	2474		168		
Pleuragramma antarcticum		110		1245			1628
Nototheniidae n.e.i.	21	1494	3688				
Champsocephalus gunnari				293*			15**
Channicthyidae n.e.i.	26	1911	4608				
Myctophidae	48	350	3953				129
Rajiformes	1	10	378				
Pisces n.e.i.	4876	20163	55095			993	202

* Probably *Chaenodraco wilsonii*

** Unlikely to be this species

Table 5: Monthly reported catches of *Champsocephalus gunnari* using midwater otter trawls (OTM) and bottom trawls (OTB) in the South Georgia region during the 1982/83 season.

	Month							
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
(OTM)	6551	15029	20752	10346	16741	6162	6191	3393
(OTB)			9235	2130	8234	12085	8998	51
TOTAL	6551	15029	29987	12476	24975	18247	15189	3444

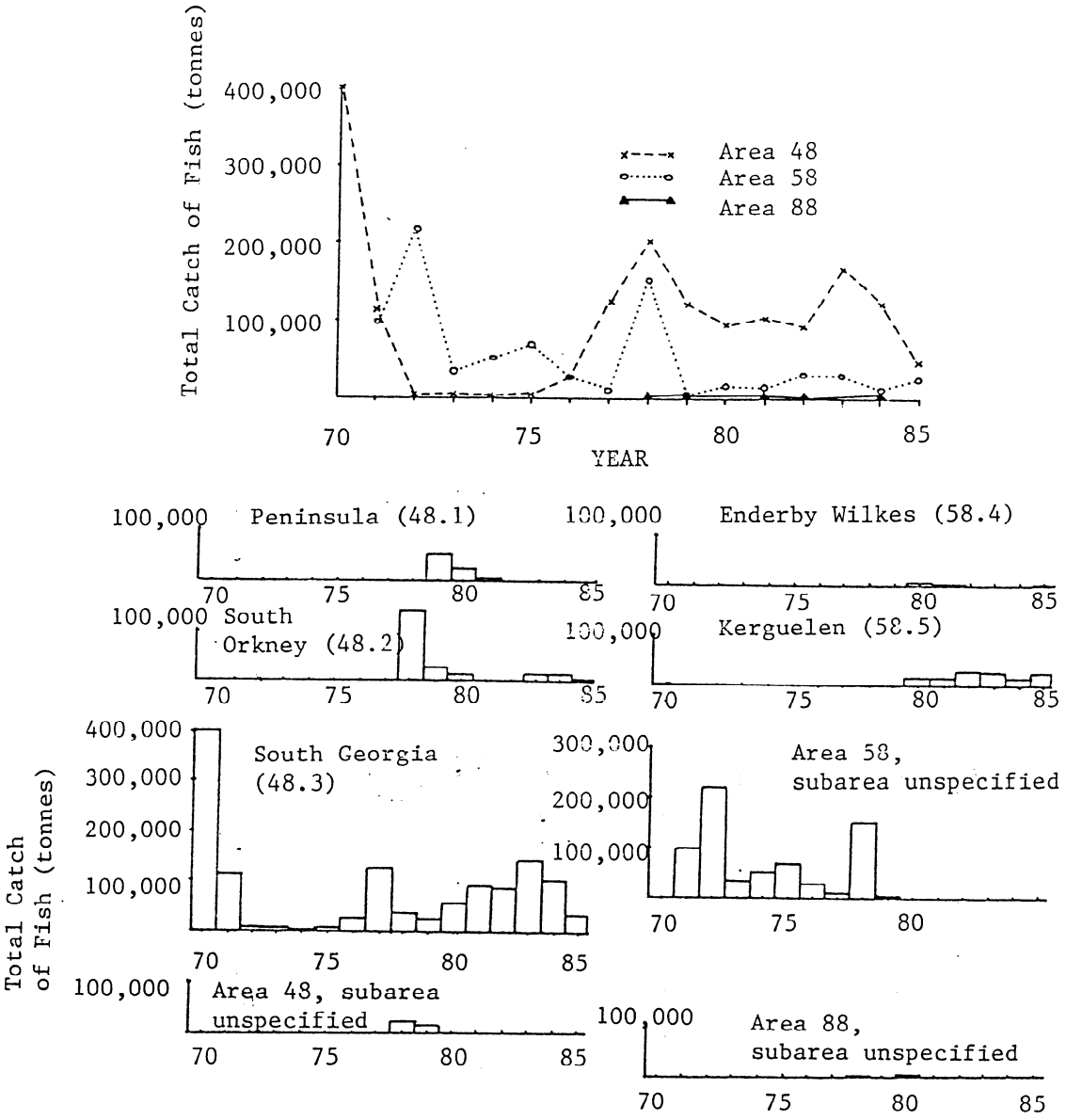

Figure 1: Annual total catches of all fin-fish species combined from each subarea of the Antarctic.

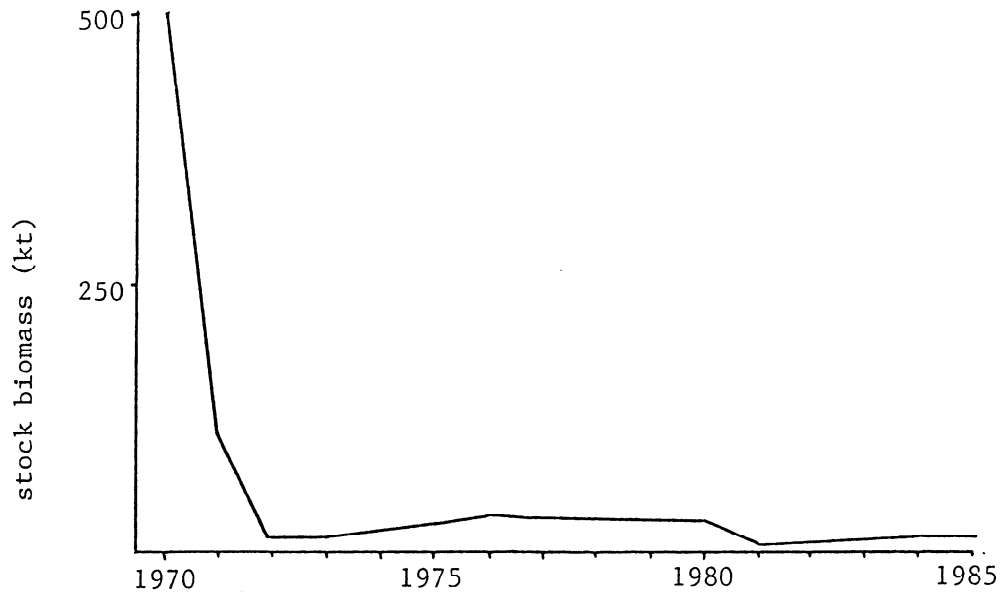

Figure 2: Estimated trends, from VPA, of biomass of *Notothenia rossii* at South Georgia.

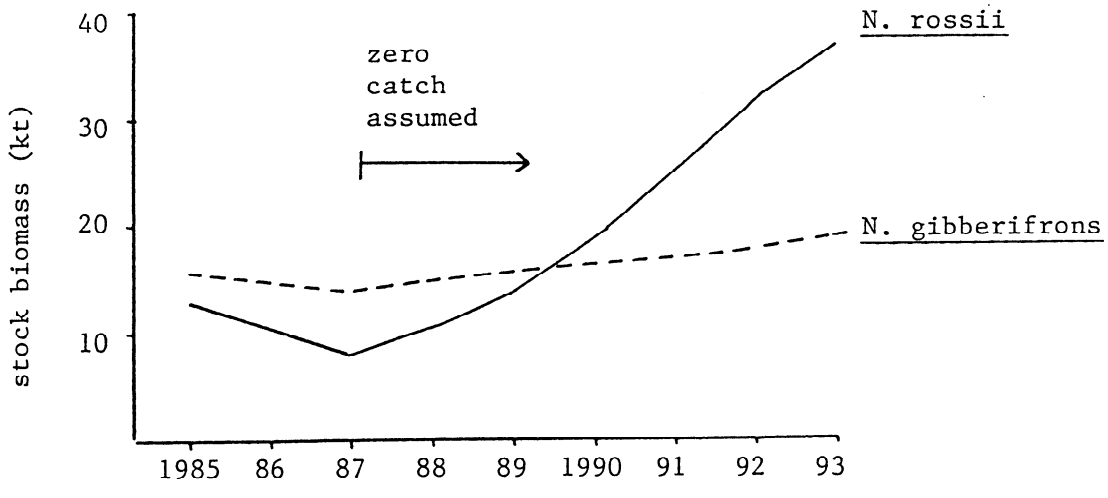

Figure 3: Estimated expected stock projections for *N. rossii* and *N. gibberifrons* in Area 48.3 assuming (i) catch in 85/86 same as 84/85 (ii) zero catch 86/87 onwards (iii) recruitment equal to average value of previous years.

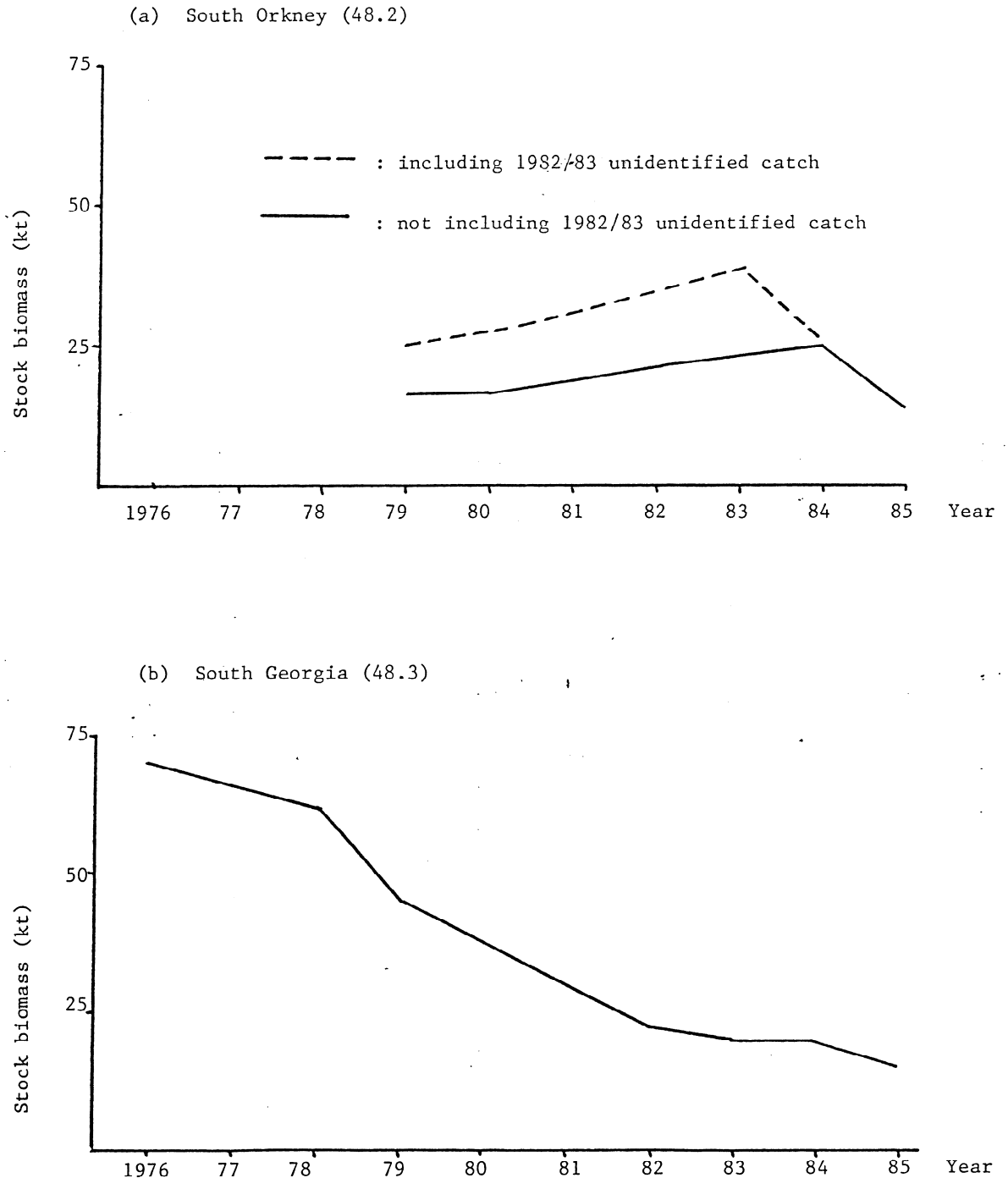

Figure 4: Estimated trends, from VPA, of biomass of *Notothenia gibberifrons*.

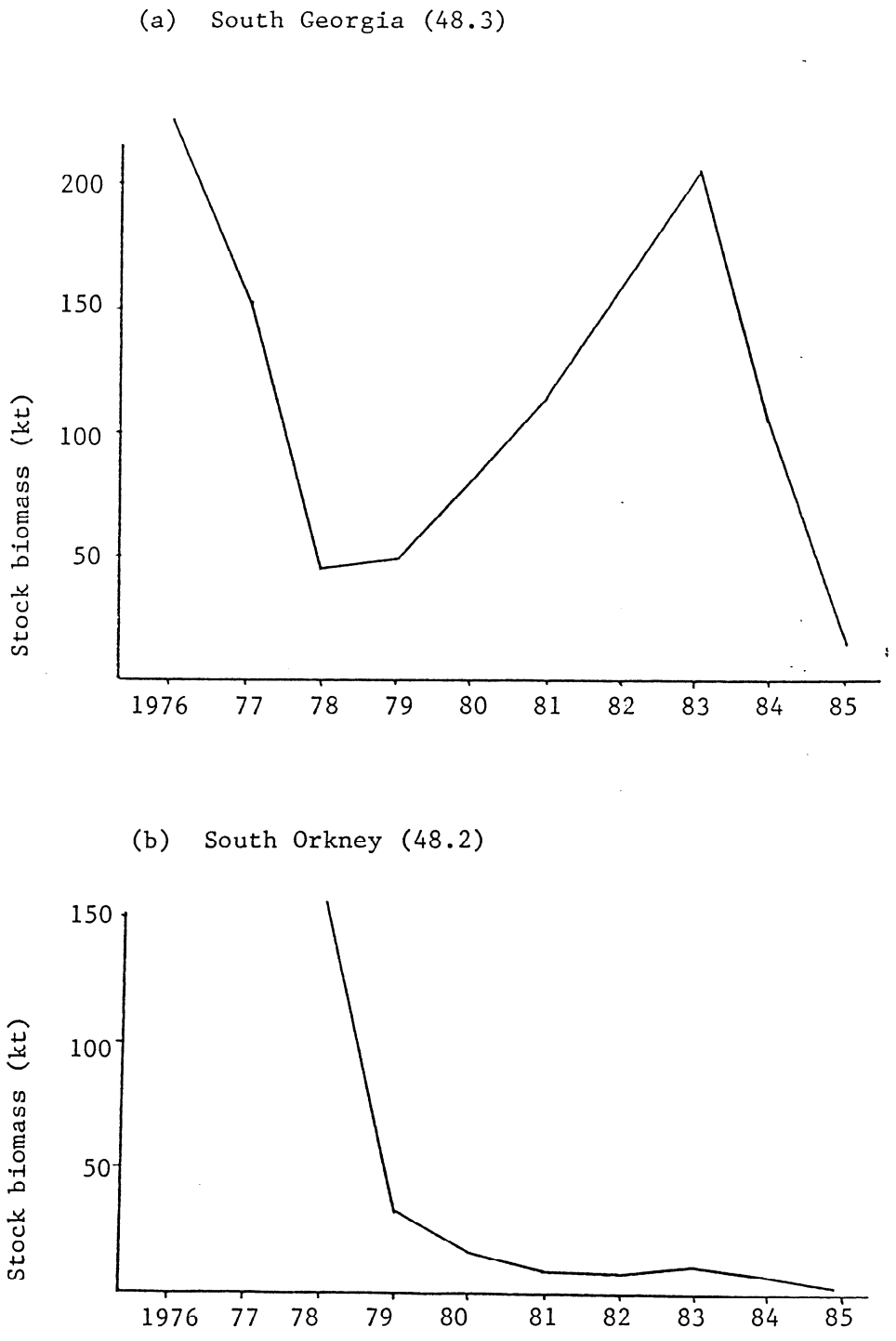

Figure 5: Estimated trends, from VPA, of biomass of *Champsocephalus gunnari*.

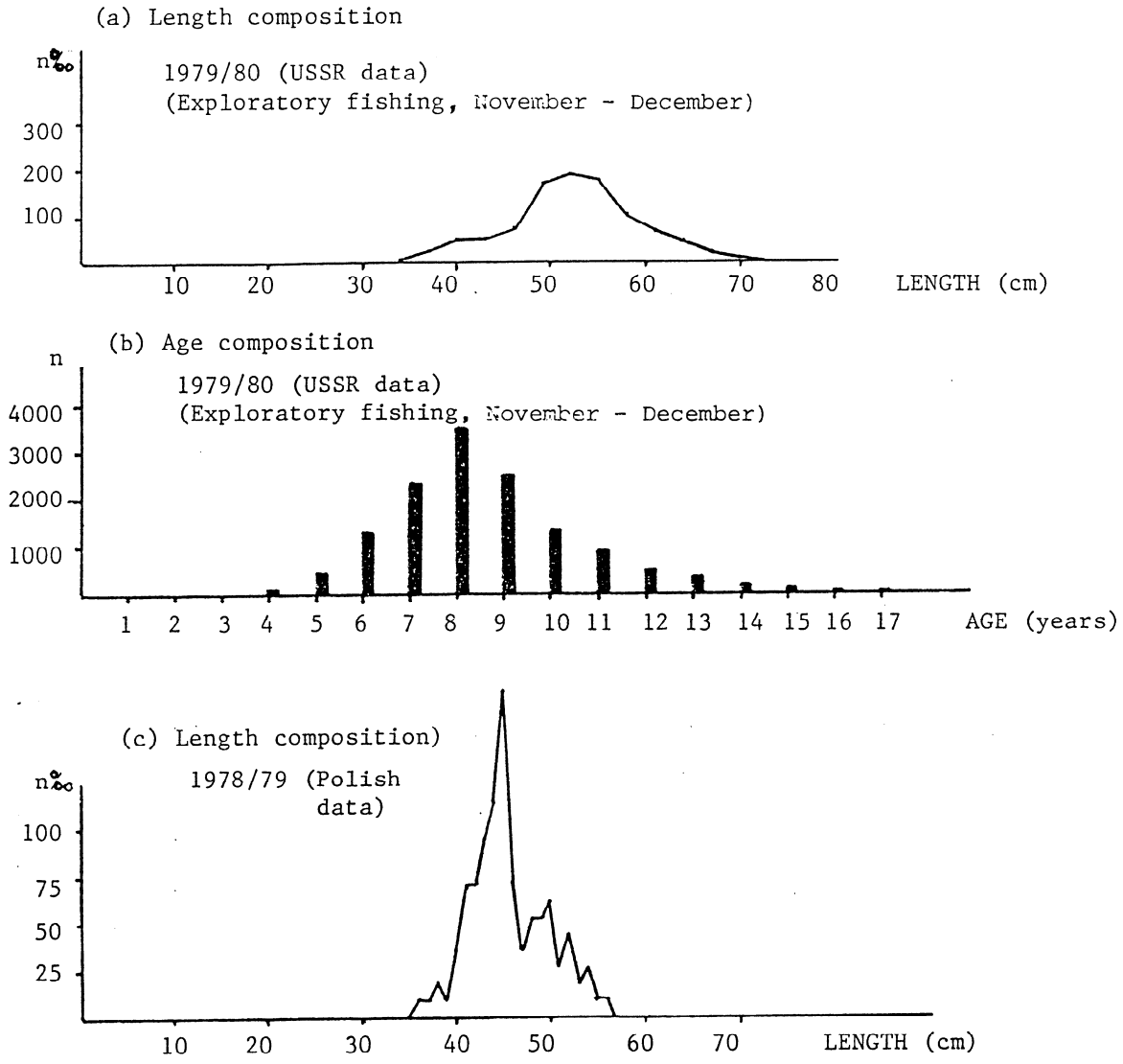

Figure 6: Length and age composition of *Notothenia rossii* in the Peninsula area.

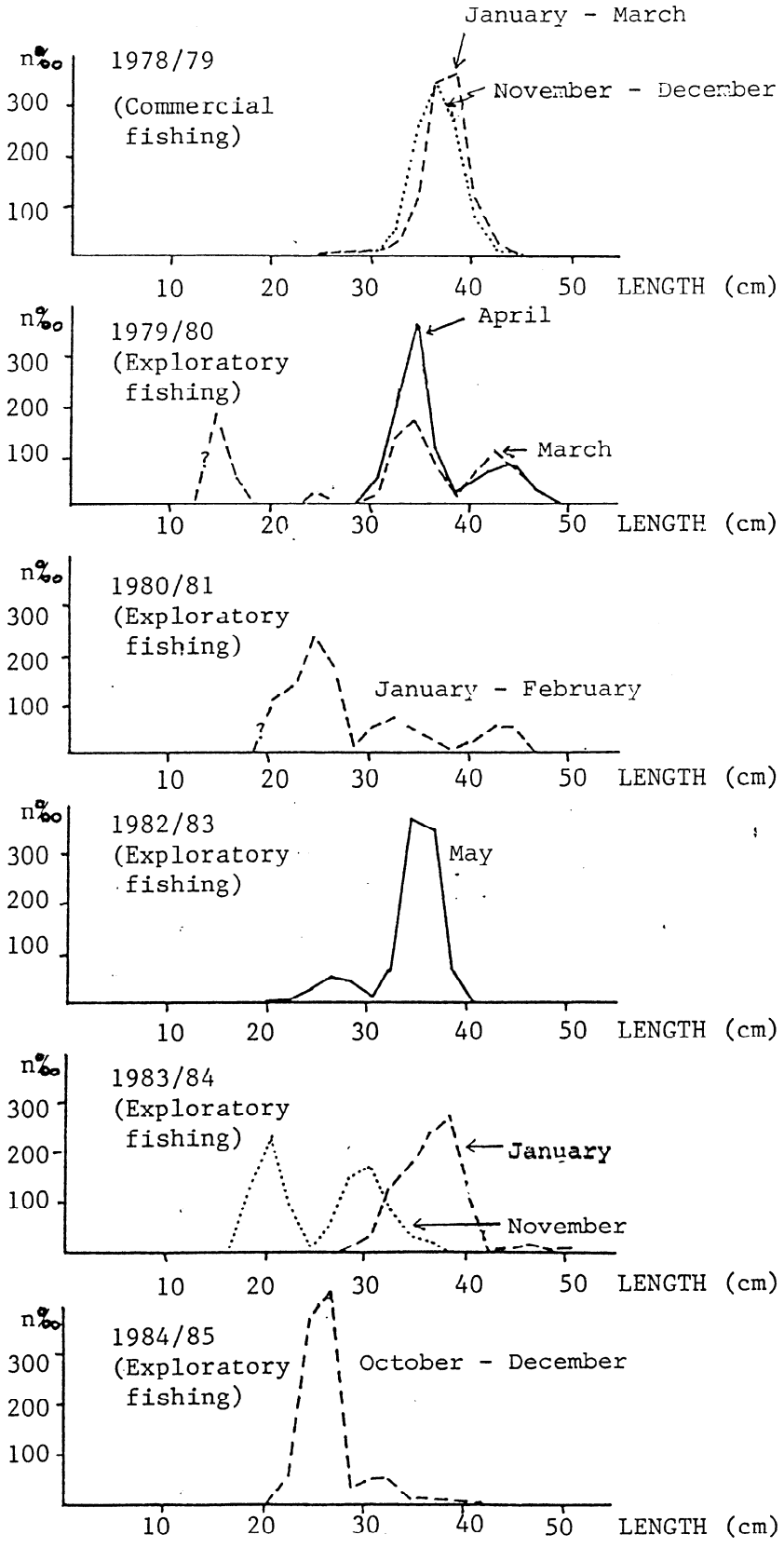

Figure 7a: *Champsocephalus gunnari* length frequency (USSR data) in the Peninsula area.

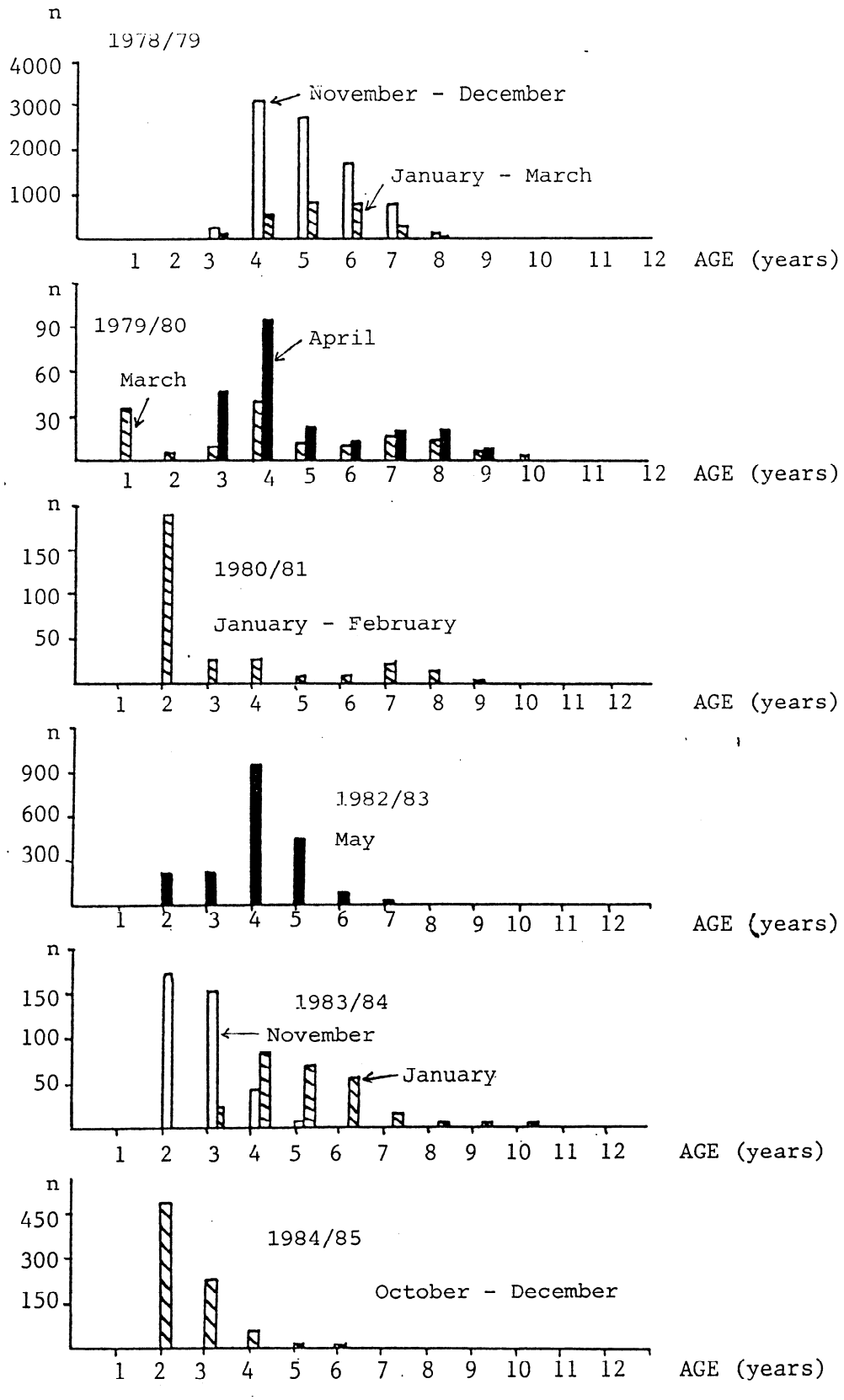

Figure 7b: *Champsocephalus gunnari* age composition (USSR data) in the Peninsula area.

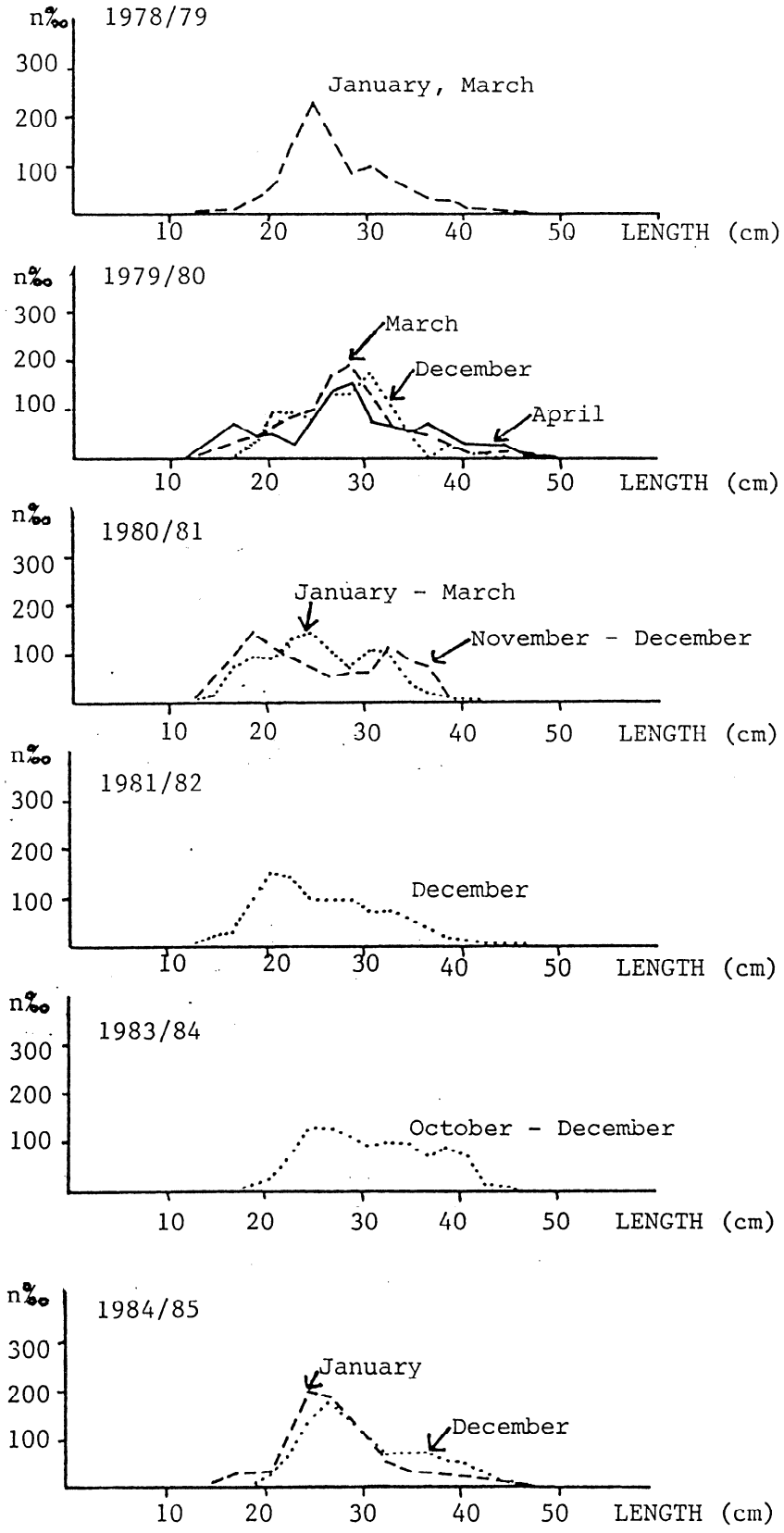

Figure 8: Length composition of *Notothenia gibberifrons* (USSR data) in the Peninsula area.

APPENDIX I

LIST OF PARTICIPANTS OF FISH STOCK ASSESSMENT WORKING GROUP

(1–4 September 1986, Hobart)

AUSTRALIA	Mr W. de la Mare Mr P. Heyward Dr K. Kerry Dr G.P. Kirkwood Dr R. Williams
CHILE	Dr A. Mazzei
EEC	Dr G. Duhamel Dr K.-H. Kock
NEW ZEALAND	Dr D. Robertson
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SOUTH AFRICA	Mr. D. Miller
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UK	Dr J. Beddington Dr I. Everson
USA	Dr R. Hennemuth
IUCN	Dr J. Cooke
INVITED EXPERTS	Dr W. Gabriel Dr J. Gulland
SECRETARIAT	Dr D. Powell Dr E. Sabourenkov

APPENDIX II

LIST OF DOCUMENTS OF FISH STOCK ASSESSMENT WORKING GROUP

(1–4 September 1986, Hobart)

Fish WG/1986/Doc.1	Preliminary Results of a Bottom Trawl Survey Around Elephant Island in May/June 1986 (K.-H. Kock, FRG)
Doc.2	Assessments of the Stocks of *Notothenia rossii marmorata* and *Chamsocephalus gunnari* in the South Georgia Area (J. Cooke, IUCN)
Doc.3	The Kerguelen Database (G. Duhamel, France)
Doc.4	Preliminary Report on Biological Observations and Exploratory Fishing Data Collected in the South Georgia Area During the 1985/1986 Cruise of MT *Carina* (W. Slosarczyk, Poland)
Doc.5	Preliminary Appraisal of Antarctic Fish Selection by the 32/36 Bottom Trawl Combined with Various Codends (W. Slosarczyk, Poland)
Doc.6	Program of Work
Doc.7	Data Availability for Fish Stock Assessment in Subareas 48.1–48.3, 1986
Doc.8	Draft Summary of Recent Published Instantaneous Mortality Rates, Area 48
Doc.9	Results of VPA Runs for Subareas 48.1–48.3

Doc.10 Distribution and Relative Abundance of Juvenile Pike Glassfish (*Champsocephalus gunnari*) from the Trawl Survey Results on the South Georgi Shelf in June–July 1985
(V.A. Boronin, G.P. Zakharov, V.P. Shopov, USSR)

Doc.11 Informal Summary of Results of the Antarctic Fish Age Determination Workshop

Doc.12 Mesh Size Measurement
(Secretariat)

Doc.13 Management and Uncertainty; the Example of South Georgia
(J.A. Gulland)

APPENDIX III

PENINSULA SUBAREA 48.1

Notothenia rossii

YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Catch (tonnes)	0	0	0	–	–	–	0	0	0	470	18,763	0	0	0	0	0	–
Length composition	–	–	–	–	–	–	FRG*	–	FRG*	GDR POL	USSR	FRG*	–	–	ARG	JAP FRG*	ARG
Age composition	–	–	–	–	–	–	FRG	–	FRG	–	–	–	–	–	–	FRG	FRG
Age/length Key	–	–	–	–	–	*	* FRG	–	* FRG	–	USSR	–	–	–	–	FRG	FRG
Length at age	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Weight at age	–	–	–	–	–	–	–	–	–	–	USSR	–	–	–	–	FRG	–
Maturity at age	–	–	–	–	–	–	–	–	–	–	USSR	–	–	–	–	–	–
Mortality	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Partial Recruitment	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Biomass	–	–	–	–	–	–	FRG	–	FRG	–	POL	POL	–	–	ARG	FRG	–

§ CATCH REPORTED BUT NO BIOLOGICAL DATA

* AVAILABLE IN PUBLISHED PAPERS

SOUTH ORKNEY SUBAREA 48.2

Notothenia rossii

YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Catch (tonnes)	0	0	0	–	–	–	0	0	85	237	1722	72	0	0	714	58	–
Length composition	–	–	–	–	–	–	–	–	§	POL	POL	POL	–	–	§	§	–
Age composition	–	–	–	–	–	–	–	–	§	§	§	§	–	–	§	§	–
Age/length Key	–	–	–	–	–	–	–	–	§	§	§	§	–	–	§	§	–
Length at age	–	–	–	–	–	–	–	–	§	§	§	§	–	–	§	§	–
Weight at age	–	–	–	–	–	–	–	–	§	§	§	§	–	–	§	§	–
Maturity at age	–	–	–	–	–	–	–	–	§	§	§	§	–	–	§	§	–
Mortality	–	–	–	–	–	–	–	–	§	§	§	§	–	–	§	§	–
Partial Recruitment	–	–	–	–	–	–	–	–	§	§	§	§	–	–	§	§	–
Biomass	–	–	–	–	–	–	–	–	POL	POL	POL	POL	–	–	§	§	–

SOUTH GEORGIA SUBAREA 48.3

Notothenia rossii

YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Catch (tonnes)	399,704	101,558	2,738	–	–	–	10,753	8,365	2,192	2,137	24,897	1,651	1,100	866	3,022	1,891	–
Length composition	USSR	USSR	USSR	USSR	–	USSR	FRG	USSR GDR POL	FRG USSR GDR POL	POL	GDR	USSR GDR POL	USSR POL	USSR	POL	USSR FRG POL	–
Age composition	§	§	§	–	–	–	FRG*	§	§	§	§	§	§	§	§	§	–
Age/length Key	USSR	USSR	USSR	USSR	–	USSR	§	USSR	USSR	§	§	USSR	USSR	USSR	§	USSR FRG	USSR
Length at age	§	§	§	–	–	–	§	§	§	§	§	§	§	§	§	USSR	USSR
Weight at age	USSR	§	§	–	–	–	§	§	§	§	§	§	§	§	§	USSR FRG	–
Maturity at age	USSR	§	§	–	–	–	§	§	§	§	§	§	§	§	§	USSR	–
Mortality	§	§	§	–	–	–	§	§	§	§	§	§	§	§	§	§	–
Partial Recruitment	§	§	§	–	–	–	§	§	§	§	§	§	§	§	§	§	–
Biomass	§	§	§	–	–	–	§	POL	POL	POL	POL	POL	POL	POL	POL	FRG*	–

PENINSULA SUBAREA 48.1

Notothenia gibberifrons

YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Catch (tonnes)	–	–	–	–	–	–	0	0	0	3,280	765	50	0	0	0	0	–
Length composition	–	–	–	–	–	–	FRG	–	FRG	GDR USSR POL	GDR USSR	JAP USSR FRG	JAP USSR	–	FRG USSR USSR	JAP FRG USSR	ARG
Age composition	–	–	–	–	–	–	–	–	–	§	§	§	§	–	–	–	–
Age/length Key	–	–	–	–	–	–	–	–	–	USSR POL	USSR	USSR	§	–	USSR	USSR	–
Length at age	–	–	–	–	–	–	–	–	–	POL	USSR POL	POL	USSR POL	–	–	USSR	–
Weight at age	–	–	–	–	–	–	–	–	–	§	§	§	§	–	–	USSR	–
Maturity at age	–	–	–	–	–	–	–	–	–	§	§	§	§	–	–	USSR	–
Mortality	–	–	–	–	–	–	–	–	–	§	§	§	§	–	–	–	–
Partial Recruitment	–	–	–	–	–	–	–	–	–	§	§	§	§	–	–	–	–
Biomass	–	–	–	–	–	–	–	–	FRG	POL	POL	§	§	–	–	FRG	ARG

SOUTH ORKNEY SUBAREA 48.2

Notothenia gibberifrons

YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Catch (tonnes)	–	–	–	–	–	–	0	0	75	2,598	1,398	196	589	1	9,160	5,722	–
Length composition	–	–	–	–	–	–	FRG	–	FRG	USSR POL	USSR POL	USSR	USSR	§	USSR	FRG USSR	–
Age composition	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	§	–
Age/length Key	–	–	–	–	–	–	–	–	§	USSR POL	POL	USSR	§	§	USSR	USSR	–
Length at age	–	–	–	–	–	–	–	–	§	POL	POL	POL	§	§	§	USSR	USSR
Weight at age	–	–	–	–	–	–	–	–	§	§	§	§	§	§	USSR	§	–
Maturity at age	–	–	–	–	–	–	–	–	§	§	§	§	§	§	USSR	USSR	–
Mortality	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	§	–
Partial Recruitment	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	§	–
Biomass	–	–	–	–	–	–	–	–	POL	POL	POL	POL	§	§	§	§	–

SOUTH GEORGIA SUBAREA 48.3

Notothenia gibberifrons

YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Catch (tonnes)	–	–	–	–	–	–	4,999	3,727	11,758	2,540	8,143	7,971	2,605	0	3,304	2,081	–
Length composition	–	–	–	–	–	–	POL FRG	POL GDR	POL GDR FRG	POL	GDR	POL GDR	POL	–	§	FRG USSR	USSR
Age composition	–	–	–	–	–	–	POL	POL	POL	POL	§	POL	POL	–	§	§	–
Age/length Key	–	–	–	–	–	–	POL	POL	POL	POL	§	POL	POL	–	§	USSR	USSR
Length at age	–	–	–	–	–	–	§	§	§	§	§	§	USSR	–	§	§	–
Weight at age	–	–	–	–	–	–	§	§	§	§	§	§	USSR	–	§	§	–
Maturity at age	–	–	–	–	–	–	§	§	§	§	§	§	USSR	–	§	§	–
Mortality	–	–	–	–	–	–	§	§	§	§	§	§	§	–	§	§	–
Partial Recruitment	–	–	–	–	–	–	§	§	§	§	§	§	§	–	§	§	–
Biomass	–	–	–	–	–	–	FRG	POL	POL FRG	POL	POL	POL	POL	POL	POL	FRG	

SOUTH GEORGIA SUBAREA 48.3

Notothenia guntheri (THIS SPECIES IS NOT FOUND IN SUBAREAS 48.1 AND 48.2)

YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Catch (tonnes)	–	–	–	–	–	–	–	–	–	15,011	7,381	36,758	31,351	5,029	10,586	11,923	–
Length composition	–	–	–	–	–	–	–	–	–	§	§	§	§	§	§	FRG	–
Age composition	–	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	–
Age/length Key	–	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	–
Length at age	–	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	–
Weight at age	–	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	–
Maturity at age	–	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	–
Mortality	–	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	–
Partial Recruitment	–	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	–
Biomass	–	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	

PENINSULA SUBAREA 48.1

Champsocephalus gunnari

YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Catch (tonnes)	–	0	0	0	0	0	0	0	0	35,930	1,087	1,700	0	2,604	0	0	–
Length composition	–	–	–	–	–	–	FRG	–	FRG	GDR USSR POL	GDR USSR	JAP USSR FRG	JAP	USSR	USSR FRG	FRG JAP USSR	–
Age composition	–	–	–	–	–	–	–	–	–	§	§	§	–	§	–	–	–
Age/length Key	–	–	–	–	–	–	–	–	–	USSR POL	§	USSR	–	USSR	USSR	USSR	–
Length at age	–	–	–	–	–	–	–	–	–	POL	POL	§	–	§	–	–	–
Weight at age	–	–	–	–	–	–	–	–	–	§	USSR	§	–	§	–	–	–
Maturity at age	–	–	–	–	–	–	–	–	–	§	USSR	§	–	§	–	–	–
Mortality	–	–	–	–	–	–	–	–	–	§	§	§	–	§	–	–	–
Partial Recruitment	–	–	–	–	–	–	–	–	–	§	§	§	–	§	–	–	–
Biomass	–	–	–	–	–	–	–	–	POL FRG	POL	§	§	–	§	–	FRG	FRG

SOUTH ORKNEY SUBAREA 48.2

Champsocephalus gunnari

YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Catch (tonnes)	–	0	0	0	0	0	0	0	138,895	21,439	5,231	1,861	557	5,948	4,499	2,361	–
Length composition	–	–	–	–	–	–	FRG	–	USSR POL FRG	USSR POL	USSR POL	USSR	USSR	USSR	USSR	FRG USSR	–
Age composition	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	§	–
Age/length Key	–	–	–	–	–	–	–	–	USSR POL	USSR POL	USSR POL	USSR	USSR	USSR	USSR	USSR	–
Length at age	–	–	–	–	–	–	–	–	§	USSR POL	POL	POL	§	§	§	§	–
Weight at age	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	§	–
Maturity at age	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	USSR	–
Mortality	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	§	–
Partial Recruitment	–	–	–	–	–	–	–	–	§	§	§	§	§	§	§	§	–
Biomass	–	–	–	–	–	–	FRG	–	POL FRG	POL	POL	POL	§	§	§	FRG	–

SOUTH GEORGIA SUBAREA 48.3

Champsocephalus gunnari

YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Catch (tonnes)	–	10,701	551	1,830	254	746	12,290	93,400	7,557	641	7,592	29,384	46,311	128,194	79,997	14,148	–
Length composition	–	§	USSR	USSR	USSR	USSR	USSR POL FRG	USSR POL GDR	USSR POL FRG GDR	USSR POL	USSR GDR	USSR POL	POL	USSR	USSR POL	USSR	USSR FRG
Age composition	–	§	§	§	§	POL	POL	POL	POL	POL	§	POL	POL	§	POL	§	§
Age/length Key	–	§	USSR	USSR	USSR	USSR	USSR POL FRG	USSR POL	USSR POL	USSR POL	USSR	USSR POL	POL	USSR	USSR POL	USSR	USSR
Length at age	–	§	§	§	§	§	§	§	§	§	§	§	§	§	§	USSR	USSR
Weight at age	–	§	§	§	§	§	§	§	USSR	§	§	§	§	§	§	USSR	§
Maturity at age	–	§	§	§	§	§	§	§	USSR	§	§	§	§	§	§	USSR	§
Mortality	–	§	§	§	§	§	FRG*	§	FRG*	§	§	§	§	§	§	§	§
Partial Recruitment	–	§	§	§	§	§	§	§	§	§	§	§	§	§	§	§	§
Biomass	–	§	§	§	§	–	FRG	POL	POL FRG	POL	POL	POL	POL	POL	POL	POL FRG	§

ANNEX 5

REPORT OF THE CONSULTATION ON CO-ORDINATION OF FISH STOCK ASSESSMENT SURVEYS

REPORT OF CONSULTATION ON CO-ORDINATION OF FISH STOCK ASSESSMENT SURVEYS

An informal consultation was held among members of the Scientific Committee to co-ordinate fish stock assessment surveys and to ensure that the methodology, timing and location of the surveys are appropriate to the requirements of fish stock assessments.

2. Fish stock assessment surveys are planned by seven countries in support of the CCAMLR research program. Joint operations will be conducted in the Kerguelen area (58.5) by France and the USSR. In the South Georgia area (48.3), three fish stock assessment surveys will be conducted: one by Spain, another in a joint effort by Poland and the USA, and a third by the German Democratic Republic. In the South Orkney Islands area (48.2), the USSR and Spain will each conduct a survey. A survey will be conducted by Spain in both the South Shetland Islands area (48.1) and the South Sandwich Islands area (48.4). Australia will survey fish stocks in the Prydz Bay area (58.4).

3. All the surveys in the Atlantic sector will be conducted using commercial-sized bottom trawls of 32–36m headline fitted with 80 mm mesh (as measured by CCAMLR Regulation on Mesh Size Measurement). The survey indices of abundance will be based on the 'swept area' method on the Polish/USA and Spanish surveys. Sampling for most surveys will be stratified randomly by depth. The USSR surveys will be conducted on a transect pattern (including hydrology, phytoplankton, and zooplankton investigations) from shoal to deep water across-the-shelf.

4. Mesh selectivity experiments will be conducted in the South Georgia area during the Spanish and joint Polish/USA cruises. These surveys will use different mesh sizes of 80 through 90, 100, and up to 120 mm. A standard method with fine-meshed liners placed on the cod end will be used to retain fish which have escaped through the various mesh sizes. These data will be used to estimate selectivity factors, mean length of fish at 50% selectivity level and to determine the mesh sizes offering optimal escapement for immature fish stages. An introduction to the methodology for conducting mesh selectivity experiments is given in Appendix 1 of this annex and in the document SC-CAMLR-V/BG/41. In addition to the South Georgia surveys described above, Spain will conduct mesh selectivity experiments in the South Shetland and South Orkney Islands areas.

5. Preliminary recruitment-index experiments leading towards a standard strategy for future CCAMLR recruitment surveys will be conducted in the South Georgia area during United Kingdom studies of early life stages of fish, and during joint Polish/USA surveys.

Surveys of juveniles will also be conducted by the German Democratic Republic in this area. In addition, the USSR is currently undertaking a long-term program investigating the distribution and abundance of juvenile fish in various areas of the Antarctic. The details for 1986/87 were not available during the 1986 sessions of the Scientific Committee. The survey strategy for the initial experiment is given in Tables 1–3. It is recognised that further consultations will be required prior to the establishment of standard recruitment index methods based on the results of the preliminary experiments to be conducted by the United Kingdom, Poland and the USA. Results of juvenile icefish (Channichthyidae) distribution and abundance surveys were presented in a document presented for the Fish Stock Assessment Working Group Meeting (Fish WG/1986/Doc.10). The analysis of ichthyoplankton data from SIBEX cruises will proceed during two BIOMASS Workshops to be held in Cambridge in October 1986 and 1987.

6. During the survey operations in 1986/87, collections will be made of ichthyoplankton by Brazil, France, Poland, USSR, United Kingdom and USA.

7. The timing of fish stock assessment surveys will allow for sequential sampling for fish stock assessment purposes in the South Georgia area from November to December (see Table 2). The South Orkney Islands will be surveyed October by Poland and during the first half of January by Spain; the USSR survey in this area will be conducted within the January to March period depending on the extent of the pack ice.

8. The following three tables provide information on fish stock assessment surveys planned in 1986/87:

Table 1. National Fish Survey Activities in Support of the CCAMLR Scientific Program Planned for the 1986/87 Season.

Table 2. Timing of Fish Stock Assessment Surveys to be Undertaken in 1986/87 by Area.

Table 3. Summary of Planned Fish Survey Operations in 1986/87.

9. Survey details for the Spanish and Polish/USA operations for the 1986/87 season are given in Appendices 2 and 3, of Document SC-CAMLR-V/5.

TABLE 1: NATIONAL FISH SURVEY ACTIVITIES IN SUPPORT OF THE CCAMLR SCIENTIFIC PROGRAM PLANNED FOR THE 1986/87 SEASON

Country	Area	Dates	Type of Activity
Argentina*	Bransfield Strait	Jan–Feb	Provision plans for scientific fishing
Australia	Prydz Bay	Feb–Mar	Scientific sampling with small-scale trawls
Belgium	Information not available		
Brazil*	South Shetland Is.	Dec/Mar	Abundance and distribution, ichthyoplankton
Chile*	Gerlache Strait	Summer	Scientific sampling for fish ecology studies
France	Kerguelen	Nov–Apr/Jul–Aug	Joint French/Soviet research on stock assessment; biomass surveys ichthyoplankton; it is unknown at this time whether or not it will be possible to undertake mesh selectivity studies this season
GDR*	South Georgia (maybe S. Orkney I.)	Nov–Dec	Commercial trawling and scientific research
FRG	No activities planned in 1986/87		
India	Indian Ocean Sector	Summer	Provisional plans for scientific sampling in transit to study area
Japan	No activities planned in 1986/87		
Rep. of Korea	No activities planned in 1986/87		
New Zealand	Ross Sea	Summer	Notothenid physiology
Norway	No activities planned in 1986/87		
Poland*	South Georgia Bransfield Strait	Nov–Dec Dec–Jan	Joint Polish/USA stock assessment; abundance and distribution studies; mesh selectivity research; ichthyoplankton surveys

TABLE 1 continued

Country	Area	Dates	Type of Activity
Spain*	S. Georgia, Orkney, Sandwich, Shetland Islands	Nov–Feb	Biomass trawl surveys by species; mesh selectivity studies; 1 research vessel, 1 commercial vessel
South Africa	No activities planned in 1986/87		
USSR*	Kerguelen Other areas	Nov–Apr/Jul–Aug will be available	stock assessment; abundance and distribution studies, ichthyoplankton studies; joint USSR/French research (see above) (information on activities in other areas will be available)
UK*	South Georgia	Dec/Jan	Scientific research on early life stages of fish; distribution and abundance, interactions with principal prey species, vertical distribution.
USA*	South Georgia	Nov–Dec	Joint Polish/USA scientific research (see above)
Uruguay	No activities planned in 1986/87		

* suggest that an *ad hoc* group co-ordinate the effort in relation to trawling locations, methods, and formats for transmitting results and data to the Secretariat.

TABLE 2 : TIMING OF FISH STOCK ASSESSMENT SURVEYS TO BE UNDERTAKEN IN 1986/87

Region	Country	Fish Stock Surveys	Ichthyoplankton Surveys
South Georgia	GDR	Nov–Dec	
	Poland/USA	24 Nov–26 Dec	Dec
	Spain	19 Nov–11 Dec	
	UK		Jan
South Sandwich Islands	Spain	13 Nov–10 Feb	
South Orkney Islands	Poland	Oct	
	GDR	Nov–Dec	
	Spain	23 Dec–8 Jan	
	USSR	Jan–Mar	Jan–Mar
South Shetland Islands	Spain	10–31 Jan	
Prydz Bay	Australia	Feb–Mar	
Kerguelen Islands	France	Nov–Apr/Jul–Aug	Nov–Apr/Jul–Aug
	USSR	Nov–Apr/Jul–Aug	

TABLE 3 : SUMMARY OF PLANNED FISH SURVEY OPERATIONS IN 1986/87

Country:	Argentina	Australia	Belgium	Brazil	Chile	France	GDR	FRG	India	Japan
Ships:	Irizar	Nella Dan	no activities planned		[shore station]	Fiolent		planned	no activities	no activities planned
Ship call sign:		OZKC								
Dates:	Jan/Feb 87	Feb/Mar 87		Dec 86/Mar 87	Jan/Feb	Nov/Apr Jul/Aug	Nov/Dec			
Operating area:	Bransfield Str.	Prydz Bay		Bransfield Str. King George Is	South Bay, Anvers Island	Kerguelen	South Georgia (maybe S.Orkney)			
Dist. offshore:		< 150 n.m.				12–120 n.m.	> 12 n.m.			
On/off shelf:		on shelf		on shelf						
Sampling program:				abundance and distribution	ecology of Nototheniidae	transects with oceanographic and biological stations	commercial and scientific trawls		provisional plans for scientific sampling in transit to operations area	
Sample types:	fish abundance	bottom trawls midwater trawls		ichthyoplankton and mature fish surveys		biomass surveys ichthyoplankton	bottom trawls, midwater trawl			
Gear types:	Otter, bongo, blacke, Isaac-kidd	3m beam trawl small otter trawl IYGPT				bongo net standard trawl				
Transect types:		N-S transects from shelf edge to coast @ 2 degree interval				8 transects perpendicular to the coastline				
Mesh selectivity?:	no	no				no	no			
Larvae/juveniles?:	yes	yes: RMT & IYGPT		yes		yes	yes			
Krill research?:	yes	yes				no	no			
Other aspects:		CTD profiles and phytoplankton								
General comments:	transect details are not yet defined	cruise will not be assessment *per se* because gear is too small, but data are applicable				this work will be undertaken jointly with Soviet scientists				

TABLE 3 continued

Country:	Korea	New Zealand	Norway	Poland	South Africa	Spain	Uruguay	USSR	United Kingdom	USA
Ships:	no activities planned	no activities planned	no activities planned	Siedlecki	no activities planned		no activities planned			Siedlecki
Ship call sign:										
Dates:				Oct/Jan		Nov/Feb		Nov/Apr Jul/Aug	Dec/Jan	Nov/Dec
Operating area:				South Georgia Shag Rocks Bransfield Str.		S. Shetland Orkney, Georgia Sandwich, Shag to 500 m isobat		South Georgia Kerguelen other areas	South Georgia	South Georgia Shag Rocks Bransfield Str.
On/off shelf:				on shelf		on shelf				on shelf
Sampling program:				stock assessment		transects and strat. random bottom trawls		stock assessment	early life stages	stock assessment
Sample types:				abundance and distribution, ichthyoplankton		sex/age comp., biomass, length bottom trawl semi-pelagic trawl		abundance and distribution ichthyoplankton	distr. and abund. interactions with prey, vert. distr.	abund. & distr. ichthyoplankton bottom trawls
Gear types:										
Transect types:										see cruise plan
Mesh selectivity?:				yes		yes		yes		yes
Larvae/juveniles?:				yes		no		yes		yes
Krill research?:				yes		no		yes		yes
Other aspects:						hydrography meteorology biol. samples of catch				
General comments:				Nov/Dec studies are joint with USA		an observer and sampling scheme will also be put on commerc. vessel in same area		Kerguelen studies are joint with France		joint with Poland

APPENDIX 1

METHODS FOR NET SELECTIVITY STUDIES ON FISH

The following methods are based on those described by Dr J. Zaucha (Doc. SC-CAMLR-V/BG/29).

2. Standard techniques using a fine-meshed liner should be used. Due to the rough nature of fishing grounds and consequent danger of damage, the liner should only be attached in the upper part of the codend and reach down to the middle of the codend side walls. The same type of fine-meshed netting insert should be placed inside the bottom part of the codend (Fig.1). In this configuration, fish in the codend can only escape through the meshes of the upper part of the trawl to the fine-meshed liner.

3. Selectivity studies should be conducted under the same conditions as those of commercial operations. The basic net design should be identical to that which is in current commercial use on the fishing grounds. Any additional strengthening to protect the codend must not affect the overall functioning of the net. Double-layer codends, without a chafer, are not recommended for these investigations. The codend ought to be strengthened only by the use of cross ropes, up to 5 of which may be splitting straps, attached to the codend. These should be no less than 1 m apart except for the last four cross ropes which should be not less than 50 cm apart. No more than one tension line should be fastened to the upper side of the codend. All floats should be fastened to the side lacings. Since heavy splitting straps lying on the fine-meshed liner might affect selectivity results, the codend ought to be used with the splitting straps open during trawling. Only after hauling the codend on board to empty the codend and liner should both ends of the straps be shackled together.

4. Analysis should be concentrated on those tows which fulfil the following basic requirements: (1) estimated total catch of the tow should be greater than 500 kg of fish (very large catches should also be excluded), (2) the investigated species should constitute at least 20% of the total weight of the catch.

5. The lengths of fish from representative samples from the codend and codend liner should be measured. The following standard calculations should then be made for each species to obtain the selectivity parameters and ogives for the codend under test with respect to each fish species: (1) mean length of fish for 50% selectivity level, (2) selectivity interval (in cm) between the mean length of fish for selectivity levels of 75 and 25%, (3) selectivity factor $F_x = l_{505} /A$, where: L_{50} = fish length at a 50% selectivity level and A = mean mesh size in the codend.

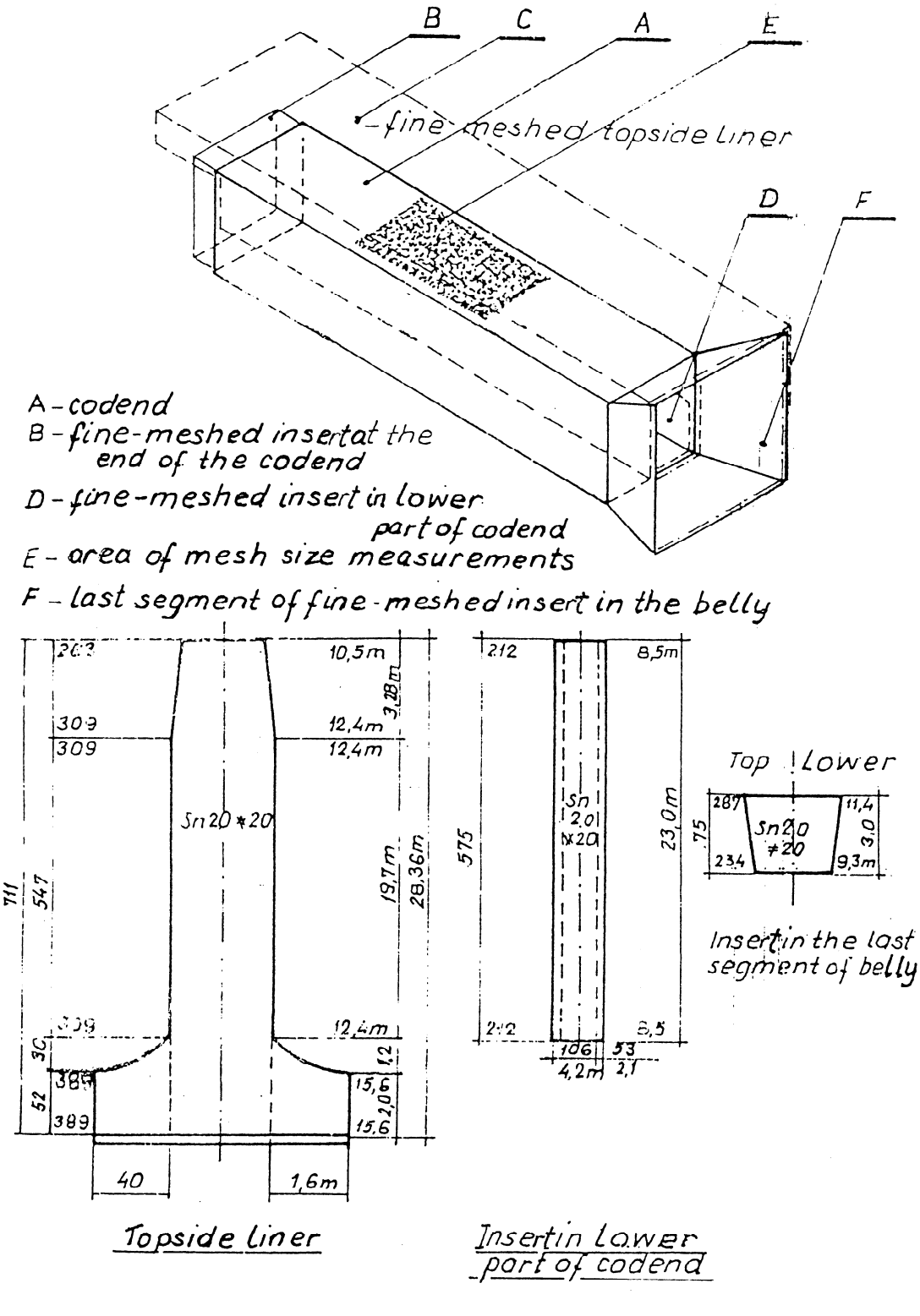

Figure 1: Plan of Tape Codend with Fine-meshed Topside Liner and Fine-meshed Insert in Lower Part of Codend.

ANNEX 6

REPORT OF THE WORKING GROUP FOR THE CCAMLR ECOSYSTEM MONITORING PROGRAM HAMBURG, FEDERAL REPUBLIC OF GERMANY 2–7 JULY, 1986

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2 – 7 JULY, 1986

INTRODUCTION

The Working Group for the CCAMLR Ecosystem Monitoring Program was established at the Fourth Annual Meeting of the Scientific Committee of CCAMLR (SC-CAMLR) in September 1985. Dr K.R. Kerry (Australia) was elected as Convener of the Group. In order to expedite the operational implementation of a program, SC-CAMLR agreed that an intersessional meeting of the Working Group should be held during 1986 and a draft agenda was prepared for circulation.

2. The Scientific Committee accepted an invitation from the Federal Republic of Germany to hold the meeting at the Bundesforschungsanstalt fur Fischerei, Hamburg.

3. The meeting was held from 2 – 7 July, 1986.

4. Participants were welcomed by Dr D. Sahrhage, the Director of Institut für Seefischerei, Hamburg, and Chairman of SC-CAMLR. A list of participants is attached (Appendix 1).

5. The Convener opened the meeting and the agenda (Appendix 2) was adopted.

ORGANISATION OF THE MEETING

6. Mr D. Miller (South Africa) was appointed rapporteur for the Working Group.

7. A list of documents used as working papers and reference material is attached (Appendix 3).

REVIEW OF THE REPORT OF THE AD HOC WORKING GROUP ON ECOSYSTEM MONITORING, SEATTLE, 1985

8. To amplify the record of the Seattle Meeting, an outline was given of the background and rationale for the approach adopted. Two main considerations governed the initial approach: firstly, the requirement to maintain ecological relationships between harvested and dependent (and related) species, within the whole Convention area; secondly, the need to establish elements of a monitoring program as soon as possible. This automatically involved considering the extension of existing baseline data series as well as the creation of new baselines and the identification of necessary programs of directed research. In addition it was recognised that although the requirement covered the whole Southern Ocean system, it would be pointless to propose a comprehensive monitoring and research program for all species and their interactions, and therefore a selective approach would be needed. This would have to identify key predator and 'prey' species and important trophic links (with an emphasis on the practical aspects of monitoring). Thus a compromise program involving intensive local studies and broad coverage studies of harvested and dependent species would be required.

9. In selecting 'prey' species, discussion was focused primarily on how changes in availability would affect predators. The main attention was given to commercially harvested (or harvestable) species. *Euphausia superba* was identified as a priority target species. Discussion of related species identified *Pleuragramma antarcticum*, early life-history stages of fish, and in certain areas *Euphausia crystallorophias*, as potentially suitable indicators of system changes.

10. Predator species were selected primarily with respect to their dependence on *E. superba* (on the basis of quantitative dietary data). Criteria of subsidiary importance were geographical distribution, tractability of the monitoring programs and associated directed research, and the quality of existing baseline information.

11. Sites and areas for monitoring studies were chosen primarily on the basis of the presence of key species, and the existence and nature of current or perspective long-term scientific operations, and secondarily in order to achieve adequate geographical coverage.

Monitoring of Indicator Species

(a) Areas within which monitoring should be conducted

12. The Working Group agreed that the most important areas for the implementation of monitoring of predator-prey interactions in the Southern Ocean system were:

- the Prydz Bay region (58 – 68°S; 55 – 85°E; within CCAMLR Statistical Area 58.4.2) - representative of higher latitude Antarctic predator-prey interactions

- the Antarctic Peninsula region (60 – 68°S; 54 – 75°W; within CCAMLR Statistical Areas 48.1 and 88) representative of predator-prey interactions in dynamic intermediate latitude areas

- the South Georgia region (53 – 56°S, 35 – 40°W; within CCAMLR Statistical Area 48.3) - representative of lower latitude predator-prey interactions.

13. The Group also agreed upon a proposed network of sites for monitoring and directed research (see Table 1). The locations of the major study regions and the sites listed in Table 1 are shown in Figure 1.

(b) Species to be monitored

14. The Working Group endorsed the predator species chosen at the Seattle meeting as being the most useful potential indicators of change in food availability (especially of krill, *Euphausia superba*) in different geographical areas. It also acknowledged the criteria used in making the choice. After further consideration of the criteria and the selected sites for monitoring, the Group agreed to add the Antarctic petrel and the black-browed albatross to the list. The full list of species selected is:

(i) Crabeater seal
(ii) Antarctic fur seal
(iii) Adelie penguin
(iv) Chinstrap penguin
(v) Macaroni penguin
(vi) Minke whale

(vii) Antarctic petrel
(viii) Black-browed albatross.

15. At the Seattle meeting the Working Group had prepared a set of questions for referal to the Scientific Committee of the International Whaling Commission (IWC), concerning the suitability of the minke whale as a potential indicator of the effects of changes in krill availability (Appendix 4 of the report of the Seattle Meeting). The Working Group reviewed the response from the Scientific Committee of the IWC. It expressed its thanks to the IWC Scientific Committee for the work which it had done.

16. The Working Group noted that the IWC Scientific Committee is continuing to address problems associated with the first and third category of questions forwarded by SC-CAMLR concerning the nature and extent of the impact of krill fishing on trends in whale abundance. It was also noted that the Comprehensive Assessment of Whale Stocks being undertaken by the IWC could provide information relevant to these questions. The Comprehensive Assessment is expected to be completed by 1990. Because of its potential importance, the Working Group supported the rapid completion of the Comprehensive Assessment.

17. It was noted by the Working Group however, that the Comprehensive Assessment has as its major objective to improve current estimates of whale stocks. The Working Group therefore requested that high priority also be given to evaluating available data (and data collected during the Comprehensive Assessment) on physiological condition, stomach contents and feeding behaviour of minke whale in terms of their usefulness in indicating changes in the krill/whale system. It recommended that SC-CAMLR correspond with the IWC Scientific Committee in order to explore means by which this might be achieved.

18. The IWC representative drew the attention of the Working Group to preparations being undertaken by the IWC to hold a Workshop on the Feeding Ecology of Southern Baleen Whales. The possibility of CCAMLR jointly sponsoring such a workshop had been raised by the IWC in 1983. The IWC Scientific Committee has initiated steps to prepare an inventory of available data relevant to the above Workshop (to be reviewed at its 1987 meeting). The Working Group agreed that encouragement should be given to these developments. In this context the attention of the Working Group was drawn to national efforts in relation to the analysis and synthesis of available data as outlined in ECO/6 tabled at this meeting.

19. The Group noted that the proposed Feeding Workshop will be useful in evaluating further the potential of the minke whale as an indicator species. It therefore recommended that SC-CAMLR should support the Workshop.

(c) Parameters to be monitored

20. The groundwork established at the Seattle meeting was reviewed. This information is summarised in Tables 3, 4 and 5 of SC-CAMLR-IV/7. Few additions and deletions were suggested. Additions to the list of parameters of potential immediate use (Table 3, SC-CAMLR-IV/7) were body condition in crabeater seal, and three parameters for minke whale (Table 2). Additions to the list of parameters which require directed research in order to assess their potential utility for monitoring programs comprised chick growth rates, fledging success and diet of Antarctic petrel, meal size in penguins, and several minke whale parameters (Table 3).

21. From the parameters listed in Table 2, specific parameters were selected for inclusion in monitoring programs to be established in the Prydz Bay, Antarctic Peninsula, and South Georgia regions (Table 4). Specific sites where land-based work should be carried out - at least at a minimum level - are listed in the footnotes to Table 4; further evaluation of some of these sites is still required.

22. It was especially noted that certain parameters of considerable potential importance for monitoring (e.g. frequency and duration of foraging trips; feeding rates and behaviour) and data critical to the interpretation of monitoring results (e.g. location of feeding areas; diet outside the breeding season), could not be evaluated or acquired without appropriate technological developments and the provision of dedicated shiptime.

23. The Working Group agreed on the sites where complementary monitoring work could be done, and reaffirmed the desirability of conducting work at these sites (SC-CAMLR-IV/7, pp.13–14). The species parameters to be measured at these sites would be the same as those specified in Table 2. The Group also reaffirmed the usefulness of conducting directed research at several sites identified in SC-CAMLR-IV/7, p.14. It noted that work on snow petrel at Cape Hallett (and elsewhere) and on Weddell seal in the Southern Ross and Weddell Seas could provide insight into predator interactions with *Pleuragramma antarcticum*.

24. With regard to monitoring important predator-krill interactions, the Group recommended that: the Scientific Committee request the SCAR Group of Specialists on Seals and the Subcommittee on Bird Biology to provide advice on the precise sampling protocols and sample sizes required for the effective monitoring of the identified parameters, including advice on the timing of investigations and the minimum time required to establish adequate base-lines.

25. Recognising that:

(a) the interpretation of many of the predator monitoring parameters requires quantitative information on diet outside the breeding season of most if not all predator species,

(b) to obtain the information needed for (a) requires dedicated time on research cruises and, for some species, dedicated research cruises *per se*, and

(c) scientific programs are being conducted by member nations within the framework of other international bodies could contribute to the acquisition of data,

the Working Group recommended that SC-CAMLR request SCAR to promote and coordinate, as a matter of urgency, the acquisition of pertinent data through the scientific research programs of member nations. The formation of the SCAR Group of Specialists on Southern Ocean Ecology was seen as an important development in the promotion of such coordinated research activities.

26. Recognising that the development of various devices permitting automated measurement and recording of data, especially involving at-sea distribution and behaviour of predators, was of paramount importance for the implementation of a successful long-term program, the Working Group recommended that the Scientific Committee approve the convening (by the Chairman of the Working Group in consultation with the Chairman of the SCAR Group of Specialists on Seals and the Subcommittee on Bird Biology) of a Workshop at which specialists currently involved in developing appropriate remote sensing equipment could discuss with members of the Working Group the requirements associated with the recommended monitoring programs. The workshop should also attempt to arrange for the preparation of detailed specifications for equipment to meet monitoring needs. The meeting should ideally be convened in conjunction with the next meeting of the Working Group.

27. In addition to data on krill abundance and hydrology, there will be a need to collect the supplementary data listed in Table 4 if some explanation of the expected variability in the various monitoring parameters is to be obtained.

28. It was recognised that there is a fundamental distinction between monitoring parameters for the assessment of important prey species in their own right (e.g. for resource appraisal purposes) and for the use of such parameters to evaluate predator-prey interactions.

It follows that the status of selected prey species and their interactions with other system components would be reflected in both the spatial and temporal variability of the prey species in the areas selected (Prydz Bay region, the Antarctic Peninsula region, and South Georgia regions). It also follows that monitoring interaction effects should provide data sufficient to distinguish between changes resulting from harvesting commercial species (of prey) and changes due to environmental variability, both physical and biological.

29. It was accepted that on a variety of temporal scales, it is necessary to monitor the following four categories of parameters with respect to assessing rates of change in abundance of the prey species selected:

(a) prey population variables over the region
(b) prey population variables associated with important predators
(c) prey population variables associated with prey fishery
(d) advection of prey.

30. A schema outlining the various parameters to be monitored to assess rates of change in krill abundance is given in Figure 2.

31. It was agreed that monitoring changes induced by the immigration and emigration of krill into and out of a particular area (i.e. fluxes across regional boundaries) would be critically important in the assessment of rates of change in krill abundance.

32. It was appreciated that the areal significance of this movement may vary and that some studies have attempted to determine to what extent advection of krill is important. The Group noted that the extensive USSR programs, the planning for SIBEX in the Western Atlantic, the British Antarctic Survey Offshore Biological Programme at South Georgia, and proposals for integrated monitoring of krill taking into account environmental variability in the Prydz Bay region (Krill WG/1985/Docs. 9 and 10), provide useful points of departure for the development of studies of this nature in the near future. Further development of such studies was encouraged. The Group noted that development of various techniques permitting automated recording of abundance and distribution data would greatly assist the monitoring of prey species, and agreed that research in this area should also be encouraged.

33. In relation to krill fisheries activities, the Group recognised two possible effects on krill abundance/distribution in the regions being considered. The first effect would be reflected in demographic parameters of krill actually taken by the fishery. The second would reflect effects of the fishery on the demography of the krill population(s) concerned.

34. Most of the parameters required for *Pleurogramma antarcticum* are the same as for krill (see Figure 2), except that the variables associated with the fishery are not applicable. Some allowance, however, has to be made for estimating the extent of the by-catch of *P. antarcticum* taken during krill fishing operations.

35. Similar allowance has to be made to assess the quantity of early life-history stages of other fish species taken as a by-catch of the krill fishery and to include an analysis of changes in species composition based on collections of early life-history stages. It was noted that work in this area was in progress and had been reported to the Scientific Committee (SC-CAMLR-IV, 4.26–4.29).

(d) Methods of monitoring selected parameters

36. Within the confines of the arguments outlined in the report of the Sub-group on Krill, Fish and Squid tabled in Seattle, various methods and parameters were identified as being useful for monitoring the variables summarised in Figure 2 (see Table 5).

37. The Group recognised that there is considerable overlap between the methods outlined in Table 5 and their use in monitoring changes in krill abundance. Most of the methods are applicable to the two other priority prey species identified, although it was appreciated that knowledge of these is not as great as it is for krill.

38. The Group recognised that assessment of recruitment and natural mortality are important parameters to be considered if adequate assessment of prey species dynamics and trophic relationships are to be made. However, the Group acknowledged the difficulty at present of monitoring these parameters. Directed research in this area was encouraged.

QUANTITATIVE RELATIONSHIPS BETWEEN CHANGES IN PARAMETERS OF SELECTED PREDATOR SPECIES, THEIR PREY AND THE ENVIRONMENT

39. Accepting the objectives of monitoring changes in the Southern Ocean system outlined in Paragraph 11 of the report of the Seattle Meeting, the Working Group acknowledged that effects of environmental variability on species to be monitored (both predator and prey species individually and their interactions) have to be examined critically.

40. In terms of Article II of the Convention on the Conservation of Antarctic Marine Living Resources, monitoring of environmental variables should be so designed as to provide the information necessary to distinguish between changes in the system induced by the harvesting of particular species (especially krill) and changes resulting from environmental variability, both physical and biological.

41. The Working Group identified a number of specific environmental variables thought to affect predator-prey interactions, as well as predator and prey dynamics separately. An attempt was made to define the spatial and temporal scales at which such variables should be monitored for both predators and prey, and the methods that could be used (Table 6). Their short and long-term suitability for monitoring purposes was also assessed.

42. The Working Group noted that certain environmental variables identified in Table 6 are also likely to affect the scope of fisheries activities directly. This in turn would be expected to exert some second-order effect on predator species dependent on the harvested resource, especially krill.

43. The Working Group further considered that in the future it may be both desirable and expedient to consult with appropriate specialist groups having intimate knowledge of the theoretical background of, and methods for, monitoring important environmental variables (e.g. hydrological and meteorological variables), particularly the Program Group for the Southern Oceans of the IOC and Working Group 74 of SCOR.

FRAMEWORK FOR THE DEVELOPMENT OF AN INTERNATIONAL MONITORING PROGRAM

44. The Working Group agreed that a wide variety of data needs would be identified and that these would be dependent on the specific site being considered. Similarly logistic, technological and economic considerations need to be taken into account when formulating the development of an internationally-coordinated monitoring program.

45. The operational requirements of monitoring activities themselves will be dependent on a variety of empirical, iterative and interpretative activities. The Working Group attempted to integrate a range of such activities using directed monitoring of Adelie and chinstrap penguins as examples (Figure 3). It became apparent that the requirements for the institution of an effective monitoring framework to study environmentally/ecologically induced changed in the target penguin species used in Figure 3 could be divided as follows:

- interpretative requirements;
- requirements for technological developments;
- requirements for directed research; and
- the actual parameters to be monitored.

46. For the areas discussed below, the Group recognised that in terms of obtaining adequate assessments of both temporal and spatial variability of the key prey species to be monitored, as much of the area as practicable should be surveyed at various times of the year. In terms of assessing the availability of krill to key predators, monitoring surveys need to cover as much as possible of the total distributional area of the krill population(s) concerned. In addition, it was felt that no matter how precise the estimates of changes in krill abundance might be, such estimates would be of little application to monitoring systematic changes unless results were corroborated by synoptic data on krill predators.

47. Bearing such considerations in mind, the following initial monitoring framework was proposed for the three regions:

Antarctic Peninsula Region

48. This region was defined as: west of 54°W, east of 75°W (or the western ice edge, whichever is further), south to the Antarctic Peninsula and north to latitude 60°S. This represents an area of approximately 9×10^5 km^2.

(a) Land-based monitoring

49. The following land-based monitoring sites for birds, and possibly fur seals, were identified:

(i) Palmer Station
(ii) King George Island (at Admiralty and Maxwell Bays and one site on the north coast)
(iii) Elephant Island.

The species and parameters to be monitored at each site are listed in Table 7. Sampling should be undertaken on a yearly basis.

(b) Ship-based monitoring

(i) Predators

50. Two features of crabeater seal biology were identified as suitable for monitoring. These are:

Condition Index: It was suggested that Condition Index should be measured during October (breeding haul-out) and might also be measured during late summer if the population is accessible. The former would reflect winter feeding conditions, the latter, summer feeding. Measurements of Condition Index during summer require ship-based food surveys within 100 km of the monitoring sites. Sampling should be on a yearly basis.

Demographic Variables: Sampling should be undertaken in the pack-ice zone during the period October–December, wherever suitable concentrations of seals are found. The sampling interval should be in the order of 3 – 5 years.

Detailed protocols will await advice from the SCAR Group of Specialists on Seals.

(ii) Prey

51. Krill abundance and distribution should be monitored over the whole region. Intensive monitoring should be focused within critical period predator foraging ranges of the land-based monitoring sites, particularly at King George Island and Elephant Island.

52. The critical period foraging ranges of Adelie and chinstrap penguins and fur seal were estimated to be within about 100 km radius of their respective breeding sites. It was therefore agreed that within that range, sampling of prey should be highly concentrated and within the critical periods identified in Table 7.

53. Monitoring operations should comprise a standard survey of transects aligned at right angles to the main direction of water movement over the whole region (e.g. as in the extensive programs of the USSR and SIBEX).

54. An alternative approach which was discussed would be to estimate the flux of krill in the region by repeated sampling throughout a particular season of transects situated at the geographical boundaries of the region. Although attractive in that it would allow trends

during the season to be identified, strong reservations were expressed concerning the scientific basis of the approach.

55. No specific requirements for monitoring early life-history stages of fish or *P. antarcticum* could be identified. It is expected that some data will become available incidentally in catches of krill. These data would provide some information for future monitoring directed specifically at these groups.

(iii) Environment

56. Closely spaced stations should be monitored within the critical period foraging ranges of monitored species from the land-based sites. Sampling strategies to be employed should encompass hydrological and meteorological measurements. In particular, the Group considered it was essential that standardised hydrological sections should be taken along the regional boundaries at least once each season.

(iv) Logistics

57. As a first approximation, the following estimates of shiptime per year were made:

(i)	Regional krill survey and environmental monitoring	40 shipdays
(ii)	Intensive (i.e. associated with land-based sites) krill surveys at each site (Dec to Jan)	60 shipdays
(iii)	Seal monitoring	30 shipdays
	Total:	130 shipdays

(c) Data requirements from fisheries activities

58. Detailed catch and effort data will be required on appropriate scales to provide suitable information on the impact of fisheries activities (especially the krill fishery) within

the region. The Group agreed that detailed requirements would be assessed at its next meeting.

(d) Onset of monitoring activities

59. In view of the potential of monitoring as a tool for providing data on which to base management advice, the Working Group agreed that monitoring activities must be implemented as soon as possible. Refinement of particular techniques will occur as an on-going process as results from directed research programs become available.

South Georgia Region

60. This was defined as the region enclosed by latitudes 53 to 56°S and longitudes 35 to 40°W. This represents a total area of approximately 8×10^4 km^2.

(a) Land-based monitoring

61. Bird Island was identified as the primary site for land-based predator monitoring.

62. The species, parameters, and the extent to which they should be monitored, are summarised in Table 7. A foraging range of about 100 km was agreed to be a reasonable estimate for the most important predator species, fur seal and macaroni penguin. The range was considered to be about 250 km for the black-browed albatross.

(b) Ship-based monitoring

(i) Predators

63. No ship-based predator monitoring studies were identified for the region.

(ii) Prey

64. Three sets of survey activities were considered necessary. These are the estimation of the abundance and distribution of krill (a) for the whole region, (b) within the foraging range of the predator species and (c) studies of flux of krill across regional boundaries. In terms of monitoring krill within foraging range of the primary land-based monitoring site chosen (Bird Island), the critical radius was agreed to be about 100 km and the optimal time for the conduct of the surveys was during February.

65. Bearing in mind the depleted state of certain South Georgia fish stocks, effective monitoring of the early life-history stages of fish was considered to be of high priority.

(iii) Environment

66. As noted for the Antarctic Peninsula region (paragraph 56).

(iv) Logistics

67. As a first approximation the following rough estimates of shiptime per year were made:

(i)	Regional krill survey and environmental monitoring	60 shipdays
(ii)	Intensive krill surveys	30 shipdays
	Total:	90 shipdays

(c) Data requirements from fisheries activities

68. As noted for the Antarctic Peninsula region (paragraph 58).

(d) Onset of monitoring activities

69. As noted for the Antarctic Peninsula region (paragraph 59).

Prydz Bay Region

70. This was defined as the region enclosed by 55°E and 85°E, extending from the mainland north to 58°S. This represents an area of approximately 900 x 600 nautical miles (approximately 2 x 10^6 km^2).

(a) Land-based monitoring

71. For Adelie penguins, three monitoring sites are to be selected, including one at Davis, and another possibly at Scullin Monolith. The foraging range is about 100 km from each site.

72. For Antarctic petrel, colonies at Scullen Monolith and the Rauer Islands are being investigated as potential monitoring sites. The foraging range may extend to 300 km.

(b) Ship-based monitoring

(i) Predators

73. As for the Antarctic Peninsula region, two features of crabeater seal biology were identified as suitable for monitoring. Sampling protocols of Condition Index and Demographic Variables are the same as those described in paragraph 50.

(ii) Prey

74. Distribution and abundance of krill need to be monitored over the whole region, with concurrent monitoring of the environment as noted for the Antarctic Peninsula region. Variations in abundance and distribution have to be recorded during the summer period, as well as from year to year. At the regional level, a series of standardised meridional transects (a minimum of 3 for the region) should be followed by intensive surveys in areas of high krill concentration identified during regional surveys. Intensive monitoring of krill abundance and distribution within critical range of land-based predator monitoring sites also needs to be carried out.

75. No specific requirements for monitoring *P. antarcticum* or early life-history stages of fish were formulated.

(iii) Environment

76. As for the South Georgia and the Antarctic Peninsula regions (Paragraph 56).

(iv) Logistics

77. As a first approximation the following estimates of shiptime per year were made:

1. Regional krill surveys and environment

wide-scale	20 shipdays	
intensive	30 shipdays	
2 x summer surveys		100 shipdays

2. Intensive surveys in association with land-based predator monitoring sites

Adelie penguin (3 sites x 10 days)	30 shipdays
Antarctic petrel (2 sites x 10 days)	20 shipdays

3. Crabeater seal monitoring

2 surveys x 15 days	30 shipdays
Total:	180 shipdays

(c) Data requirements from fisheries activities

78. As noted for the Antarctic Peninsula and South Georgia regions (paragraph 58).

(d) Onset of monitoring activities

79. As noted for the Antarctic Peninsula and South Georgia regions (paragraph 59).

PRACTICAL NEEDS FOR THE IMPLEMENTATION OF AN ECOSYSTEM MONITORING PROGRAM

80. The monitoring programs outlined in this report are mainly based upon those species and parameters considered to be most suitable for immediate monitoring. The Working Group emphasised that for a number of species and parameters, as well as for some environmental features, considerable research and development are required before it will be possible to assess whether parameters being considered are the most suitable for monitoring purposes and can in fact be monitored both routinely and practicably. In addition, steps have to be taken to assess whether meaningful data on important system interactions will be obtained.

81. The initial program framework outlined here thus requires selected pilot studies during its initial years in order to determine, as far as possible, the level of sampling precision desired and ultimately the sampling intensity necessary in the future. The Group therefore agreed that in this context directed studies should be carried out on the key elements identified as requiring further research in the Report of the Seattle Meeting.

82. The Working Group noted the overall importance of ensuring standardisation of the methods and procedures to be used in monitoring. In particular, the acquisition and handling of data should be agreed upon at an early stage in the implementation of any future monitoring program framework. Many nations are already carrying out research which is likely to contribute to such a monitoring framework and, as has already been mentioned, there are a lot of baseline data which could be used. Data from these sources will have to be compatible with those collected in the program envisaged in this Report. It was noted that there is an urgent need to reach agreement on the various methodologies to be used so that the implementation of the program can be commenced as soon as practicable.

83. Despite the urgent need for the standardisation of methods to be used, the Working Group acknowledged that there was insufficient time available at the present meeting to discuss this problem adequately. In addition, many of the associated matters of substance are likely to necessitate the input of expert opinion which was unavailable within the Group. The Working Group therefore recommended that practical needs for the timely implementation and phasing of the monitoring program framework discussed at the meeting should be referred to the next meeting of the Group as a major agenda item.

84. Specific topics to be addressed at the next meeting should include:

- data needs, data acquisition and data handling in respect of predator, prey, environment and the fishery;
- standardisation of monitoring methods;
- identification and elaboration of new methods;
- remote sensing;
- theoretical aspects and pilot studies as related to monitoring needs and methodologies;
- scheduling of various program elements.

85. It was noted that various SCAR Groups, especially the Sub-Committee on Bird Biology and the Group of Specialists on Seals, are in a position to provide the necessary expert advice to the Working Group.

86. While noting that the objectives of the monitoring program differ from those of the BIOMASS program, the Group recognised that many of the techniques/methods developed through BIOMASS are directly applicable to the present program. It was agreed that the Working Group should investigate the potential utilisation of these methods, including those for data handling, within the context of the monitoring program.

87. The Working Group noted that having elaborated the framework for a Monitoring Program it was now important to determine the degree to which existing national programs could contribute to such a Monitoring Program and to consider the practical contributions each country might make.

88. In this connection the Group acknowledged the papers tabled as ECO/6, ECO/7, ECO/12, ECO/13. It noted a preliminary announcement inviting cooperation during a forthcoming research cruise of the R.V. *Kaiyo Maru* to the Antarctic Peninsula Region in 1987/88.

89. It was agreed that there would be an advantage in holding the next meeting of the Working Group soon after the CCAMLR/IOC jointly sponsored Scientific Seminar on Ocean

Variability and its Influence on Marine Living Resources Particularly Krill to be held in Paris from 2–6 June 1987. In the meantime it was suggested that some progress might be made by arranging an informal discussion at a suitable time during the forthcoming meeting of SC-CAMLR.

CLOSE OF MEETING

90. The Report was adopted and the meeting concluded at 1700 hours on 7 July 1986.

91. The Convenor thanked the Chairmen of the Sub-Groups and especially the Rapporteur for their efforts, and expressed the Group's appreciation to Dr Sahrhage for hosting the meeting and to the staff of the Institute für Seefischerei for its assistance.

RECOMMENDATIONS TO THE SCIENTIFIC COMMITTEE

1. The Scientific Committee in recognising the importance of the Comprehensive Assessment of Whale Stocks to the Ecosystem Monitoring Program request the IWC to complete the study as a matter of urgency (paragraph 16).

2. The Scientific Committee correspond with the IWC to explore means by which available data relating to parameters associated with the physiological condition and feeding behaviour of minke whales might be analysed (paragraph 17).

3. The Scientific Committee support the IWC proposal for a jointly sponsored Workshop on the Feeding Ecology of Southern Baleen Whales (paragraph 19).

4. The Scientific Committee request the SCAR Group of Specialists on Seals and the Subcommittee on Bird Biology to provide advice on the precise sampling protocols and sample sizes required for the effective monitoring of the identified parameters, including information on the timing of investigations and the minimum time required to establish adequate base-lines (paragraph 24).

5. The Scientific Committee request SCAR to promote and coordinate, as a matter of urgency, the acquisition of data on the diets of predator species outside the breeding season (paragraph 25).

6. The Scientific Committee approve the convening by the Chairman of the Working Group of a Workshop to discuss the development of remote sensing equipment for use in the proposed monitoring program and include the necessary funds in the Scientific Committee budget for 1987 (paragraph 26).

Table 1: Sites selected and suggested for monitoring studies to complement the programs in the three main integrated study regions.

(for the locations of sites see Figure 1)

Species	Sites
Adelie penguin	NW Ross Sea (Cape Hallett and Cape Adare) Pointe Geologie Davis Casey Syowa Shepard Island* Signy Island, South Orkney Islands
Chinstrap penguin	Signy Island, South Orkney Islands South Sandwich Islands* Bouvet Island*
Macaroni penguin	Bouvet Island* Marion Island* Kerguelen Island* Heard Island*
Antarctic fur seal	Bouvet Island*
Crabeater seal	Weddell Sea* Amundsen and Bellingshausen Seas*

Suggested sites

Table 2: Parameters of potential immediate use for monitoring programs (revision of SC-CAMLR-IV/7 Table 3).

Species	Parameters	Sampling Interval*	Time-series required**	Integration time***
Antarctic fur seal	Foraging/attendance cycles	W	Short-medium	D
	Pup growth and weaning weight	Y	Short-medium	M
Crabeater seal	Reproductive rate	P	Long	Y
	Age at sexual maturity	P	Long	Y
	Cohort strength	P	Long	YY
	Body condition	Y	Short-medium	M
Penguins (Adelie, chinstrap, macaroni)	Arrival weight	Y	Medium	MM
	Population size	P	Medium-long	M-Y
	Survival	P	Long	M-Y
	Incubation shift duration	W	Medium-long	D
	Breeding success	Y	Medium-long	M
	Foraging trips	W	Short-medium	D
	Fledging weights	Y	Medium	M
	Adult weight at fledging	Y	Medium	M
	Macaroni weight before moult	Y	Medium	D
Minke whale	Reproductive rate	P	Long	Y
	Age at sexual maturity	P	Long	Y
	Cohort strength	P	Long	YY

* W = within season
Y = year-to-year
P = periodic (3 to 10 years)

** Short = 3 - 5 years
Medium = 5 - 10 years
Long = more than 10 years

*** Integration time = time over which parameter will reflect environmental variability
D = days
M = months
Y = years

Table 3 Directed research programs required to assess the utility of potential monitoring parameters (revision of SC-CAMLR-IV/7 Table 4).

Species	Program	Time-series required**	Integration time***
Antarctic fur seal	Indices of body condition (blood, blubber)	Unknown; prob. medium	MM
	Juvenile tooth size	Medium-long	Y
	Fine structure of teeth	Short-medium	M
Crabeater seal	Collection of material for further analyses of demographic variables	Long	Y
	Instantaneous growth rates	Unknown; prob. Medium	M?
	Juvenile tooth size	Medium-long	Y
	Indices of body condition (blood, blubber)	Unknown; prob. medium	MM
	Feeding areas and behaviour, using satellite technology	Unknown	D-M
Antarctic petrel	Growth rate, fledging success, diet	Short-medium	M
Penguins	Feeding areas, behaviour and frequency, using-satellite technology	Unknown	D-M
	Meal size		
Minke whale	Surveys of abundance using sightings (as by IDCR)	Long	Y
	Diving behaviour	Short-medium	D-M
	Analysis of existing data:		
	- Stomach contents	Short	D-M
	- Blubber thickness	Short-medium	M-Y
	- Density and patchiness	Short-medium	M-Y
	- School size	Short-medium	M-Y

**}
***} - see footnotes to Table 2

Table 4: Recommended minimum effort to detect and monitor possible predator responses to changes in food availability.

Area and Species	Monitoring Parameters	Assessment Requirements	Supplementary Data; Interpretative Requirements
I	II	III	IV
Prydz Bay Region			
Crabeater seal	Body condition (blubber thickness) Age at sexual maturity Age structure and cohort strength Reproductive rates	Develop and validate standard, non-destructive measurement techniques Determine stock discreteness Determine optimal frequency, size and timing of samples	Ice condition; winter and summer distribution; diet; foraging range and behaviour
Adelie penguin	Breeding success[3] Fledging weight Next most desirable: arrival weight; as many other parameters as possible from Table 2	Determine and standardize sampling methods[4]	Ice onditions; summer diet; foraging areas and range Winter distribution; diet; foraging range and foraging behaviour[5]
Antarctic petrel		Determine krill dependence; identify potential monitoring parameters	Snow, depth at wave and ice conditions
Antarctic Peninsula Region			
Crabeater seal	Same as for Prydz Bay region	Collect independent samples from one or more adjacent areas for comparison, and determine stock discreteness	Same as for Prydz Bay region
Adelie penguin[6]	Same as for Prydz Bay region	Same as for Prydz Bay region	Same as for Prydz Bay region
Chinstrp penguin[7]	Same as for Adelie penguin	Same as for Adelie penguin	Same as for Adelie penguin; wave height
Antarctic fur seal	Foraging/attendance cycle Pup growth and weaning weight	Survey to determine if feasible monitoring sites exist	Same as for crabeater seal
South Georgia Region			
Antarctic fur seal	Foraging/attendance cycle Pup growth and weaning weight	Determime optional frequency, size timing of samples	Same as for crabeater seal
Macaroni penguin	Same as for Adelie penguin; adult weight before moult	Seasonal diet; foraging area and behaviour; winter distribution; ice condition	
Black-browed albatross	Reproduction success Duration of foraging trips Population size	Same as for Macaroni penguin	

Table 4 (continued)

Footnotes:

1. The SCAR Group of Specialists on Seals should be asked to consider and provide advice on the optimum sampling protocol.

2. Davis, Mawson and third area yet to be specified.

3. As a minimum, this should be mean number of chicks per pair fledged by successful pairs and proportion of fledged two-chick broods among all fledged broods; otherwise it could be mean number of chicks fledged per breeding pair.

4. The SCAR Subcommittee on Bird Biology should be asked to consider and provide advice on the optimum sampling protocol.

5. Obtaining needed information on winter distribution and movements will probably require development and use of satellite-linked tracking capability.

6. Palmer Station area, King George Is. (at least Admiralty and Maxwell Bays and, if possible, an additional site on the north coast), Elephant Is. and Signy Is.

7. Same sites as for Adelie penguin except Palmer Station area.

Table 5 Methods to be utilised in monitoring rates of changes in abundance in selected prey species. Krill is used as an illustrative example and parameters to be measured should be cross-referenced with the schema illustrated in Figure 2.

Parameters	Scale			Points of Cross Reference With Figure 2
	Macro 100–1000 km	Meso 1–100 km	Micro 1–100 m	
Abundance Absolute Changes in	A N (S) C	A N C	A N P	(ai); (bi); (ci) (bii); (cii); (ciii); (di)
Emigration/Immigration	A N H	A N H		(di)
Aggregation patterns	A N	A N V	A N P	(bii) (cii) (aii)
Demography Sex Size/Age Reproductive/ Development Stage	N B	N B	N B	(aii) (bii) (cii) (dii)

Key :

A - Acoustics
N - Net sampling
(S) - Satellite imagery (future development?)
C - Fisheries catch dependent methods
P - Photography
V - Visual observation of
B - Biochemical/genetic traces
H - Hydrographic measurements

Table 6: Environmental Data Requirements

Feature	Scale		Outline of Proposed Methods	Status	Comments
	Spatial	Temporal			
1. WATER					
1.a. Water Movements	Macro & Meso Within Season	Year to Year	1. Hydrographic grid of stations leading to determination of currents 2. Direct measurement of currents 3. Satellite imagery (position of fronts etc)	M	Affects prey flux in region. Location of frontal systems and water bodies affects prey distribution
1.b. Physical/Chemical Properties	Meso & Micro	Year to Year Within Season	1. Nutrient estimation e.g. Silicate, Phosphate, Nitrate 2. Temperature, Salinity leading density estimation	R	Affects ability of prey to live and survive in the region
1.c. Biological Properties	Meso & Micro	Year to Year Within Season	1. Determination of primary and Secondary production	R	Affects ability of prey to live and survive in the region
2. ICE					
2.a. Sea Ice Movement and Characteristics: Ice Edge Position % Cover Ice Type&Thickness Floe Size Snow Cover	Macro & Meso	Year to Year Within Season	1. Satellite observation 2. Field observation	M	Affects primary production, vulnerability of krill to natural predators and fishing mortality. Accessibility of krill to predators, size of sampling area and ability to sample. Affects vulnerability of krill predators to higher order predators
2.b. Ice Shelf Extent	Meso & Micro	Year to Year	1. Satellite observations 2. Field observations	U	Affects spawning grounds

Table 6 (continued)

Feature	Scale		Outline of Proposed Methods	Status	Comments
	Spatial	Temporal			
3. WEATHER & CLIMATE					
3.a. Wind and/or Wave Height	Meso & Micro	Within Season	1. Field Observations 2. Satellite tracked buoys 3. Satellite observations	M&D	Surface turbulance affects primary production and thus indirectly krill production. Also affects predator energy requirements and commercial fishing success
3.b. Atomspheric Circulation	Macro & Meso	Year to Year	1. Analysis of weather maps	M	Cyclones affect water movement and thus krill distribution
3.c. Air Temperature at Land Stations	Macro & Meso	Year to Year	1. Field observations	M	Mean air temperature gives indication of trends in mesoscale and macroscale environments

Key to Status Indicators: M - Suitable to monitor now
R - Topic currently under research that my ultimately provide a parameter suitable for monitoring
D - New techniques need to be developed to enable research leading to monitoring
V - Relatively unimportant in the context of this Group's studies

Table 7: Sites within regions at which land based monitoring of predators should be undertaken. Important parameters to be monitored (or already monitored) and the critical period when monitoring activities should take place are indicated.

Site	Species	Parameter to be Monitored	Critical Period	Areal Priority for Prey Monitoring
I	II	III	IV	V
		Antarctic Peninsular Region		
Palmer Station	Adelie penguin	Breeding success Fledging weight	Nov-Jan Jan	3
Admiralty and Maxwell Bays	Adelie penguin	Breeding success Fledging weight	Oct-Jan Jan	1
	Chinstrap penguin	Breeding success Fledging weight	Nov-Feb Feb	
King George Is.	Adelie penguin (North coast)	Breeding success Fledging weight	Oct-Jan Jan	1
	Chinstrap penguin (precise site to be selected)	Breeding success Fledging weight	Nov-Feb Feb	
	Fur seal	Foraging/Attendance cycle Pup growth/Weaning weight	Jan-March March	
Elephant Is.	Adelie penguin	Breeding success Fledging weight	Oct-Jan Jan	2
	Chinstrap penguin (site to be selected)		Nov-Feb Feb	
		South Georgia Region		
Bird Is.	Fur seal	Foraging/Attendance cycle	Dec-March (Dec-Jan)	1
		Pup Growth/Weaning weight	Jan-March (March)	
	Macaroni penguin	Breeding success Fledging weight	Dec-Feb Feb	1
	Black-browed albatross	Breeding success Foraging trip duration Population size	Oct-April Jan-April Oct	1
		Prydz Bay Region		
Davis and 2 others	Adelie penguin	Breeding success Fledging weight	Oct-Jan Jan.	1 (at Davis)
	Antarctic petrel	Breeding success Fledging weight	Oct-Jan Jan	(1 or 2)

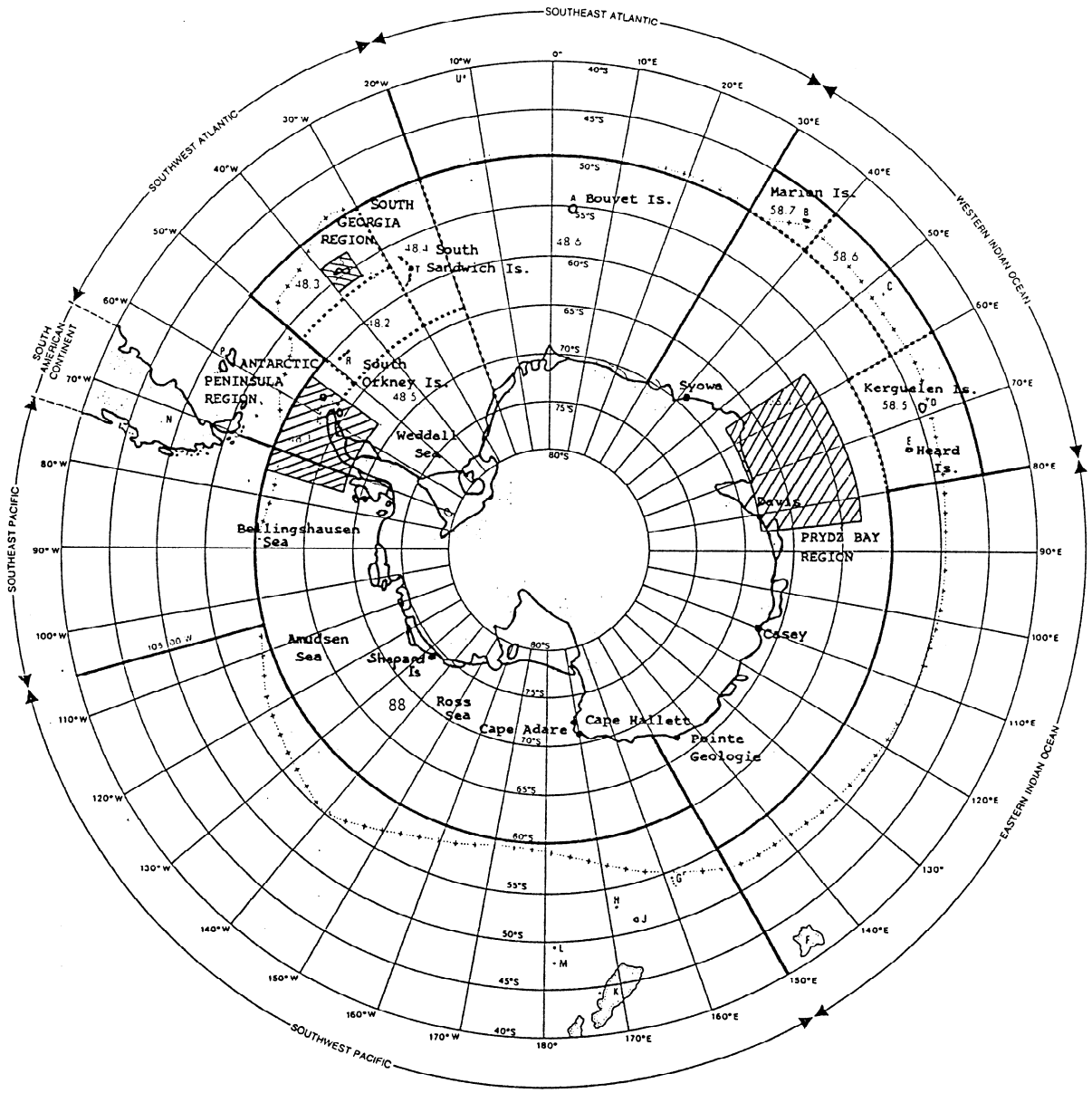

Figure 1: Location of the major study regions and the sites listen in Table 1.

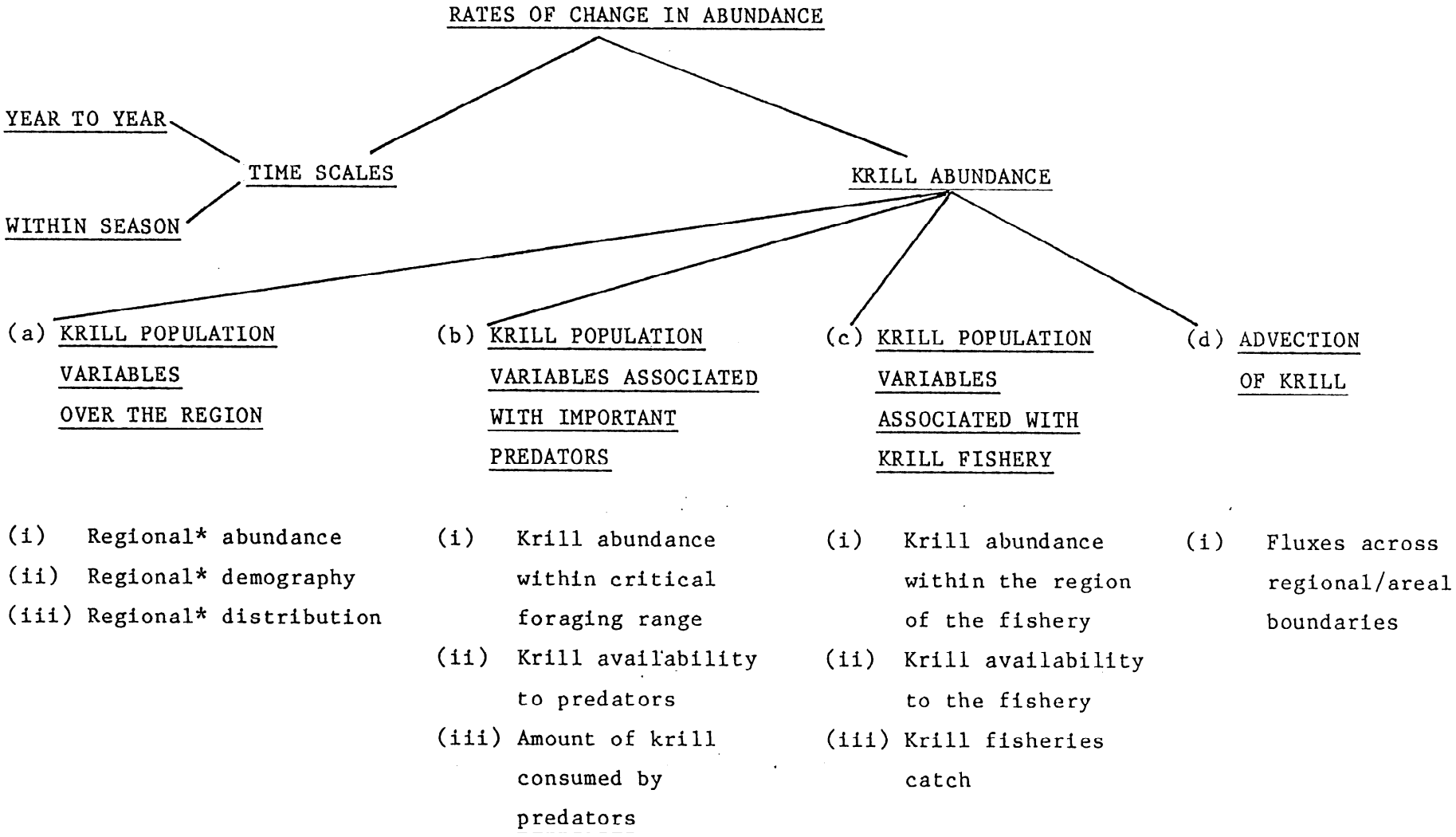

Figure 2: Schematic representation of parameters to be monitored with respect to assessing rates of change in abundance of selected prey species. Krill is used as an illustrative example.

* 'Regional' refers to the areas identified for monitoring in paragraph 12.

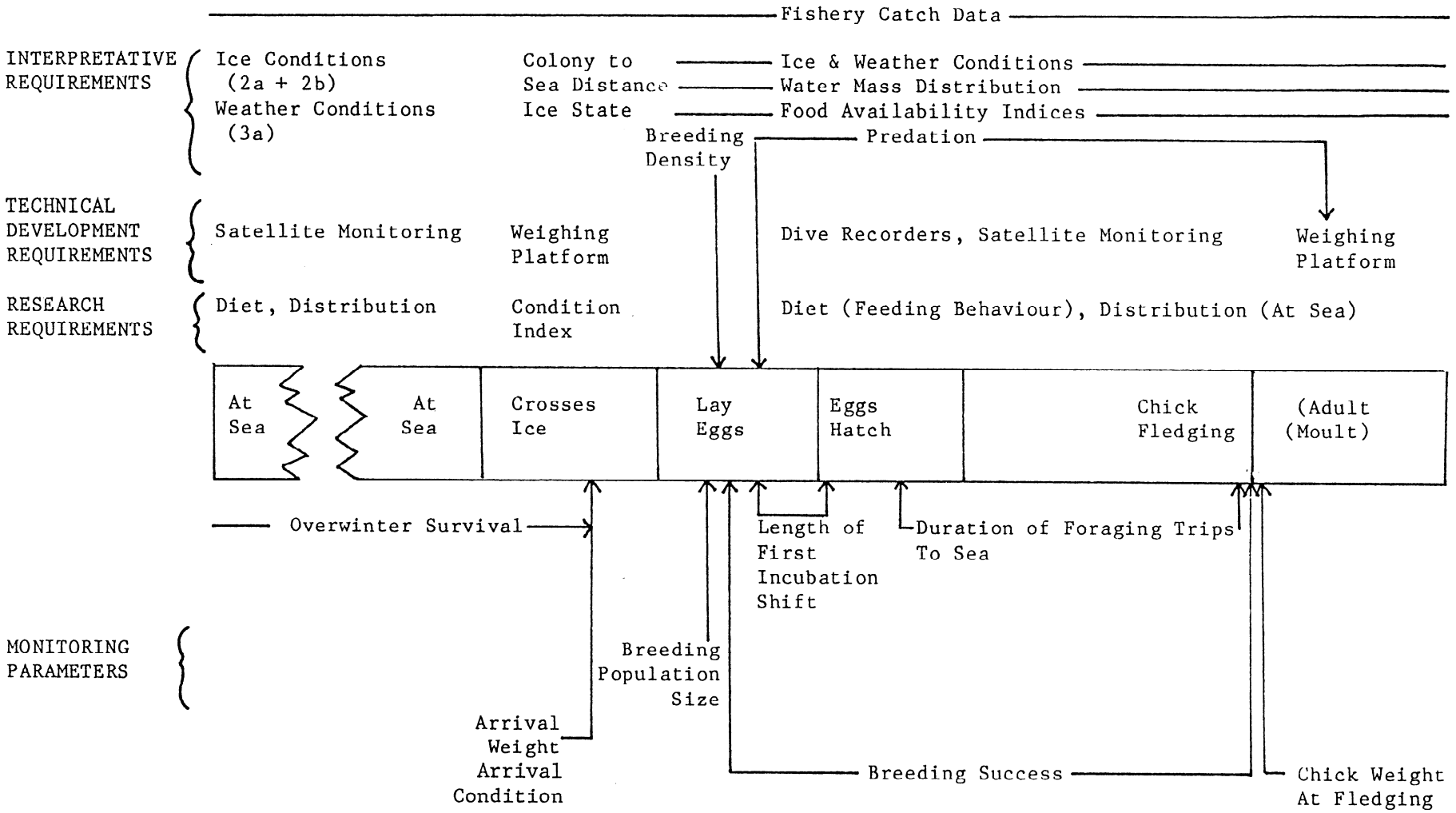

Figure 3: Operational requirements of a monitoring program for Adelie and chinstrap penguins.

APPENDIX 1
CCAMLR/86/ECO/9

WORKING GROUP FOR THE CCAMLR ECOSYSTEM MONITORING PROGRAM

(FRG, Hamburg, 2–7 July, 1986)

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APPENDIX 2
CCAMLR/86/ECO/8

WORKING GROUP FOR THE CCAMLR ECOSYSTEM MONITORING PROGRAM
(FRG, Hamburg, 2–7 July, 1986)

AGENDA

1. Opening remarks

2. Adoption of Agenda

3. Monitoring of Indicator Species

   - parameters to be monitored
   - establishment of baselines
   - theoretical studies

4. Monitoring of Prey Species

   - parameters to be monitored and their variability
   - establishment of baselines
   - theoretical studies

5. Quantitative Relationships between Changes in Parameters of Indicator Species, Their Prey and the Physical Environment

   - theoretical aspects with regard to predator-prey linkage status
   - case history studies with regard to predator-prey relationships
   - other

6. Priority Areas Within Which Monitoring Should Be Conducted

7. Review of Current National Programs in Relation to Monitoring

8. Review of CCAMLR Ecosystem Monitoring Needs

9. Framework of the Development of an International Monitoring Program: Contributions Your Country May Make

10. Practical Needs for the Implementation of an Ecosystem Monitoring Program

- data
- standardisation of methods
- remote sensing
- theoretical studies
- other (requirements for the obligatory collection of data)

11. Implementation and Coordination of Ecosystem Monitoring and Associated Research Activities.

12. Adoption of the Report

APPENDIX 3
SC-CAMLR/86/ECO/10

WORKING GROUP FOR THE CCAMLR ECOSYSTEM MONITORING PROGRAM
(FRG, Hamburg, 2-7 July, 1986)

LIST OF DOCUMENTS

1.	Draft Agenda	SC-CAMLR/86/ECO/1
2.	Members' Comments on Draft Agenda	SC-CAMLR/86/ECO/2
3.	Adopted Agenda	SC-CAMLR/86/ECO/8
4.	List of Participants	SC-CAMLR/86/ECO/9
5.	List of Documents	SC-CAMLR/86/ECO/10
6.	Report of the Fourth Meeting of the Scientific Committee (Item 7: Ecosystem Monitoring and Management)	SC-CAMLR/86/ECO/3
7.	Response of the IWC Scientific Committee to the Questions of the CCAMLR Scientific Committee on Ecosystem Monitoring	SC-CAMLR/86/ECO/4
8.	Krill Sampling and the CCAMLR Ecosystem Monitoring Program (D. Miller, SA)	SC-CAMLR/86/ECO/5
9.	A Preliminary Program of Japanese Activities on Ecosystem Monitoring (Y. Shimadzu, T. Hoshiai, Japan)	SC-CAMLR/86/ECO/6
10.	The Soviet Proposals on the Program of the Ecosystem Monitoring of the Commonwealth Sea and Prydz Bay. (T. Lubimova, USSR)	SC-CAMLR/86/ECO/7
11.	Members' Research Activities in 1984/1985 and 1985/1986 Seasons Related to Ecosystem Monitoring	SC-CAMLR/86/ECO/11

12.	International CCAMLR Applied Research and Monitoring Program. Prydz Bay Priority Area (Australian contribution to the First Five Year Program)	SC-CAMLR/86/ECO/12
13.	Directed Research. Antarctic Marine Living Resources (AMLR). A Program Development Plan (USA)	SC-CAMLR/86/13
14.	Establishment of a Group of Specialists on Southern Ocean Ecology (Annex 3 to the XIX SCAR Report)	SC-CAMLR/86/14
15.	CCAMLR Ecosystem Monitoring Early Life Stages of Fish (Comments on the Agenda Item 5 of the 1986 Meeting). W. Slosarczyk (Poland)	SC-CAMLR/86/15

RELATED PAPERS

1.	Report of the Meeting of the *Ad Hoc* Working Group on Ecosystem Monitoring	SC-CAMLR-IV/7
2.	Comments on the Report of the *Ad Hoc* Working Group on Ecosystem Monitoring (Submitted by the Delegation of the USSR)	SC-CAMLR-IV/13
3.	Report of the Subcommittee on Bird Ecology (SCAR Working Group on Biology) (USA, San Diego, 9–10 June, 1986)	
4.	Report of the Meeting of the SCAR Group of Specialists on Seals SCAR XIX, San Diego, California, USA, 11–13 June, 1986	

5. Attempts at a Quantificative Estimate by Trawl Sampling of Distribution and Juvenile Notothenioids (Pisces, Perciformes) in Relation to Environmental Conditions in the Antarctic Peninsula Region during SIBEX 1983–84
(Mem. Nat. Inst. Polar. Res., Spec. issue, 40, 299–315, 1986).

ANNEX 7

SUMMARY OF MEMBERS' RESEARCH ACTIVITIES RELATED TO ECOSYSTEM MONITORING

SUMMARY OF MEMBERS' RESEARCH ACTIVITIES RELATED TO ECOSYSTEM MONITORING

CONTENTS

Tables 1 – 4 set out programs in progress or envisaged for monitoring or directed research to assess the utility of potential monitoring parameters. The categories under which the different national responses are given are those identified as the most important at the Meeting of the Working Group for the CCAMLR Ecosystem Monitoring Program (Annex 6). The categories are given at Annex 6, Table 2 (predators), Table 6 (environment), Figure 2 (prey) and Table 3 (research programs on predators). Future monitoring and research studies on prey and on the environment were similar to those identified in Table 1 and so have not been reproduced in Tables 2 – 4.

Table 5 provides information on the dates and areas of operation for research cruises and shore based activities.

Table 1: Monitoring Programs for the Current Season (1986/87)

Species and Parameters*	Arg	Aust	Brazil	Chile	France	FRG	GDR	Japan	Korea	NZ	Poland	S.Afr	USSR	UK	USA
1. Predators															
Antarctic fur seal															
Foraging/attendance cycles	–	–	–	–	–	–	–	–	–	–	–	–	–	–	AP
Pup growth and weaning weight	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Crabeater seal															
Reproductive rate	–	–	–	–	–	–	–	–	–	–	–	–	–	–	AP
Age at sexual maturity	–	–	–	–	–	–	–	–	–	–	–	–	–	–	AP
Cohort strength	–	–	–	–	–	–	–	–	–	–	–	–	–	–	AP
Body condition	–	–	–	–	–	–	–	–	–	–	–	–	–	–	AP
Penguins**															
Arrival weight	–	–	–	AP(a)	X(a)	–	–	–	–	X(a)	–	X(m)	–	–	–
Population size	–	PB(a)	–	AP(a)	X(a)	–	–	X(a)	–	X(a)	–	X(m)	–	–	–
Survival	–	PB(a)	–	–	–	–	–	–	–	X(a)	–	X(m)	–	–	–
Incubation shift duration	–	–	–	–	X(a)	–	–	–	–	X(a)	–	X(m)	–	–	–
Brooding success	–	PB(a)	–	–	X(a)	–	–	–	–	X(a)	–	X(m)	–	–	AP(a,c)
Foraging trips	–	–	–	AP(a)	–	–	–	–	–	X(a)	–	X(m)	–	–	AP(a)
Fledging weights	–	PB(a)	–	–	X(a)	–	–	–	–	X(a)	–	X(m)	–	–	AP(a,c)
Adult weight at fledging	–	–	–	–	X(a)	–	–	–	–	X(a)	–	X(m)	–	–	AP(a,c)
Macaroni weight before moult	–	–	–	–	–	–	–	–	–	–	–	X(m)	–	–	–
Minke whale															
Reproductive rate	–	–	–	–	–	–	–		–	–	–	–	–	–	–
Age at sexual maturity	–	–	–	–	–	–	–		–	–	–	–	–	–	–
Cohort strength	–	–	–	–	–	–	–		–	–	–	–	–	–	–
2. Prey															
Krill															
- Population variables	–	–	AP	AP	–	–	–	–	SG	–	?	X	AP,PB,X	–	AP
- Relation to predators	–	PB	–	AP	–	–	–	–	SG	–	AP	X	–	–	AP
- Association with fishery	–	–	–	–	–	–	–	–	SG	–	?	–	–	–	–
- Advection	–	–	–	AP	–	–	–	–	SG	–	?	X(m)	–	–	AP
Early Life History Stages of Fish	–	PB	AP	–	X	–	SG	–	–	–	SG,AP	–	PB,X	SG	AP,SG
Pleuragramma antarcticum	–	PB	–	–	–	–	–	–	–	–	SG,AP	–	PB,X	–	–

Table 1 (continued)

Species and Parameters*	Arg	Aust	Brazil	Chile	France	FRG	GDR	Japan	Korea	NZ	Poland	S.Afr	USSR	UK	USA
3. Environment															
Water															
Movement	–	PB	AP	AP	–	–	–	X	SG	SG	–	AP	AP,PB,X	–	AP
Physical/ chemical properties	–	PB	AP	AP	X	–	–	X	SG	–	AP	X	–	SG	AP
Primary production	–	PB	AP	AP	–	–	–	X	SG	–	AP	X	–	–	AP
Secondary production	–	–	–	–	–	–	P	X	SG	P	AP	X	–	–	AP
Ice***															
Sea ice edge	–	PB(F,S)	–	AP	–	–	–	–	–	–	–	X	AP,X	–	–
Percent cover	–	PB(F,S)	–	AP	–	–	–	–	–	–	–	X	–	–	–
Floe size	–	PB(F)	–	AP	–	–	–	–	–	–	–	X	–	–	–
Snow cover	–	PB(F)	–	–	–	–	–	–	–	–	–	–	–	–	–

* Areas
AP -- Antarctic Peninsula
PB -- Prydz Bay
SG -- South Georgia
X -- Other Area

** Penguin Species
a -- Adelie
c -- Chinstrap
m -- Macaroni

*** Method of Observation:
S -- Satellite
F -- Field

Analysis of existing data

Table 2: Monitoring Programs Proposed for Future Seasons

Species and Parameters*	Arg	Aust	Brazil	Chile	France	FRG	DDR	Japan	Korea	NZ	Poland	S.Afr	USSR	UK	USA
Predators															
Antarctic fur seal															
Foraging/attendance cycles	–	–	–	AP	–	–	–	–	–	–	–	–	–	SG	–
Pup growth and weaning weight	–	–	–	AP	–	–	–	–	–	–	–	–	–	SG	–
Crabeater seal															
Reproductive rate	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Age at sexual maturity	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cohort strength	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Body condition	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Penguin**															
Arrival weight	X(a)	–	AP(a)	AP(a,c)	X(a)	–	–	–	–	–	–	–	–	SG(m)	–
Population size	X(a)	PB(a)	AP(a)	AP(a,c)	X(a)	–	–	–	–	X(a)	–	–	–	SG(m)	–
Survival	X(a)	PB(a)	–	AP(a,c)	–	–	–	–	–	X(a)	–	–	–	–	–
Incubation shift duration	–	–	–	–	X(a)	–	–	–	–	X(a)	–	–	–	?	–
Brooding success	X(a)	PB(a)	–	–	X(a)	–	–	–	–	X(a)	–	–	–	SG(m)	–
Foraging trips	–	–	AP(a)	–	–	–	–	–	–	X(a)	–	–	–	?	–
Fledging weights	–	PB(a)	–	AP(a,c)	X(a)	–	–	–	–	X(a)	–	–	–	SG(m)	–
Adult weight at fledging	–	–	–	–	X(a)	–	–	–	–	X(a)	–	–	–	SG(m)	–
Macaroni weight before moult	–	–	–	–	–	–	–	–	–	–	–	–	–	SG(m)	–
Minke whale															
Reproductive rate	–	–	–	–	–	–	–	PB,X	–	–	–	–	–	–	–
Age at sexual maturity	–	–	–	–	–	–	–	PB,X	–	–	–	–	–	–	–
Cohort strength	–	–	–	–	–	–	–	PB,X	–	–	–	–	–	–	–

* Areas:
- AP -- Antarctic Peninsula
- PB -- Prydz Bay
- SG -- South Georgia
- X -- Other Area

** Penguin Species:
- a -- Adelie
- c -- Chinstrap
- m -- Macaroni

Analysis of existing data

Table 3: Research Program for the Current Season (1986/87)

Species and Parameters*	Arg	Aust	Brazil	Chile	France	FRG	GDR	Japan	Korea	NZ	Poland	S.Afr	USSR	UK	USA
Predators															
Antarctic fur seal															
Indices of body condition	–	–	–	AP										SG	
Juvenile tooth size	–	–	–	AP	–	–	–	–	–	–	–	–	–	?	–
Fine structure of teeth	–	–	–	–	–	–	–	–	–	–	–	–	–	?	AP
Crabeater seal															
Collection of material for further analysis of demographic variables	–	–	–	–	–	–	–	–	–	–	–	–	–	–	AP
Instantaneous growth rates	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Juvenile tooth size	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Indices of body condition	–	–	–	–	–	–	–	–	–	–	–	–	–	–	AP
Feeding areas and behaviour using satellite technology	–	–	–	–	–	–	–	–	–	–	–	–	–	–	AP
Antarctic petrel															
Growth rate	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fledging success	–	?	AP	–	–	–	–	–	–	–	–	–	–	–	–
Diet	–	PB	AP	–	–	–	–	–	–	–	–	–	–	–	–
Penguins**															
Feeding areas (using satellite technology)	–	–	–	–	–	–	–	–	–	–	–	X(m)	–	–	–
Behaviour (" " ")	–	–	–	–	–	–	–	–	–	–	–	X(m)	–	–	–
Frequency (" " ")	–	–	–	AP(a)	–	–	–	–	–	–	–	X(m)	–	–	–
Meal size	–	PB(a)	AP	AP(a,c)	X(a)	–	–	–	X(a)	–	–	X(m)	–	SG	AP
Minke whale															
Surveys of abundance using sightings (as by IDCR)	–	–	–	–	–	–	–	X[1]	–	–	–	–	–	–	–
Diving behaviour	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Analysis of existing data															
- Stomach contents	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
- Blubber thickness	–	–	–	–	–	–	–	PB	–	–	–	–	–	–	–
- Density and patchiness	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
- School size	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

* Areas: AP -- Antarctic Peninsula; PB -- Prydz Bay; SG -- South Georgia; X -- Other Area

** Penguin Species: a -- Adelie; c -- Chinstrap; m -- Macaroni

[1] IDCR (International Decade of Cetacean Research) Cruise Area II (0 – 60 W), 3 vessels from Japan

Table 4: Research Programs Proposed for Future Seasons

Species and Parameters*	Arg	Aust	Brazil	Chile	France	FRG	GDR	Japan	Korea	NZ	Poland	S.Afr	USSR	UK	USA
Predators															
Antarctic fur seal															
Indices of body condition	–	–	–	AP										SG	
Juvenile tooth size	–	–	–	AP	–	–	–	–	–	–	–	–	–	?	–
Fine structure of teeth	–	–	–	–	–	–	–	–	–	–	–	–	–	?	–
Crabeater seal															
Collection of material for further analysis of demographic variables	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Instantaneous growth rates	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Juvenile tooth size	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Indices of body condition	–	PB	–	–	–	–	–	–	–	–	–	–	–	–	–
Feeding areas and behaviour using satellite technology	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Antarctic petrel															
Growth rate	–	PB	–	–	–	–	–	–	–	–	–	–	–	–	–
Fledging success	–	PB	AP	–	–	–	–	–	–	–	–	–	–	–	–
Diet	–	PB	–	–	–	–	–	–	–	–	–	X	–	–	–
Penguins**															
Feeding areas (using satellite technology)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Behaviour (" " ")	–	PB	–	–	–	–	–	–	–	–	–	–	–	–	–
Frequency (" " ")	–	PB	–	–	–	–	–	–	–	–	–	–	–	–	–
Meal size	–	PB	AP	AP(a,c)	X(a)	–	–	–	–	X(a)	–	–	–	–	SG
Minke whale															
Surveys of abundance using sightings (as by IDCR)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Diving behaviour	–	–	–	–	–	–	–	PB,X	–	–	–	X	–	–	–
Analysis of existing data															
- Stomach contents	–	–	–	–	–	–	–	PB,X	–	–	–	–	–	–	–
- Blubber thickness	–	–	–	–	–	–	–	PB,X	–	–	–	–	–	–	–
- Density and patchiness	–	–	–	–	–	–	–	PB,X	–	–	–	–	–	–	–
- School size	–	–	–	–	–	–	–	PB,X	–	–	–	–	–	–	–

* Areas: AP -- Antarctic Peninsula
PB -- Prydz Bay
SG -- South Georgia
X -- Other Area

** Penguin Species: a -- Adelie
c -- Chinstrap
m -- Macaroni

Table 5: Dates and Areas of Operation for Research Cruises and Shore-based Activities

Member	Ship/Station/Region	Proposed Time	Species/Notes
Argentina	Jubany Station, Orcadas Station	Oct–Feb 87/88	Adelie penguin
Australia	M/V *Nella Dan*	Jan–Feb 87	Fish, krill, hydrology
		Oct–Nov 87	Crabeater seal
	Davis Station	Oct–March 87	Adelie penguin
	Scullen Monolith	Dec–Jan 86/87	Antarctic petrel
Brazil	R/V *Barao de Teffe*	Dec–March 86/87	
	Comandante Ferraz		Adelie penguin
	Elephant, Nelson, King George Islands		
Chile	King George Island	On-going	Adelie penguin
EEC	No programs		
France	Dumont D'urville, Kerguelen	On-going	Adelie penguin, Macaroni penguin
FRG	R/V *Polar Stern*	Oct–Dec 87	Krill, hydrology
Japan	Syowa Station, 3 vessels	Oct–Dec 86	Adelie penguin, IDCR cruise 0°–60°W
New Zealand	Ross Sea region	Oct–Dec, on-going	Adelie penguin
Poland/USA	R/V *Prof. Siedlecki*	Dec 86	Early life history stages of fish (ANI, SSI, NOG*) distribution, abundance, growth rate and diet
South Africa	Marion Island	On-going	Macaroni penguin
	Western Lazarev Sea	1987/88	Krill, fish, predators
UK	HMS *John Biscoe*	Jan 87	Early life history stages of fish (ANI, SSI, NOG*) distribution, abundance, growth rate and diet
USA	R/V *Polar Duke*	Nov 86	Crabeater seal
	USCGC *Glacier*	Dec–Jan 86/87	Antarctic fur seal, Crabeater seal
USA/Poland	R/V *Prof. Siedlecki*	Jan–Feb 87	Antarctic fur seal, Chinstrap penguin
USA	Elephant Island	Dec–Feb 86/87	Antarctic fur seal
	James Ross Island	Jan 87	Crabeater seal
	Palmer Station	Dec–Jan 86/87	Adelie penguin
	Admiralty Bay	Dec–Feb 86/87	Adelie penguin, Chinstrap penguin
	South Shetland Islands	Dec–Feb 86/87	Antarctic fur seal

* FAO Species Codes: ANI - *Champsocephalus gunnari*, SSI - *Chaenocephalus aceratus*, NOG - *Notothenia gibberifrons*

ANNEX 8

SUMMARY OF FISHERY STATISTICS

DESCRIPTION OF SUMMARY

The CCAMLR database on fishery statistics is based on STATLANT 08A and 08B type data. These consist of reported catches and corresponding effort for the marine species as submitted by fishing nations for all commercial operations conducted in the Southern Ocean, i.e. major fishing areas 48, 58, and 88 since the 1969/70 fishing season. Gaps for the early years remain in data acquired by the Secretariat. The situation on the availability of data used in this summary is described in Table 1. These data have been taken from the Commission's STATLANT 8A database version 14, and STATLANT 8B database version 16.

UNITS OF MEASURE

2. Catch figures presented refer to nominal catches or live weight equivalents of landings (i.e. landings on a whole or fresh weight basis). In some instances these may have been established using yield rates (conversion factors) applied to landings. Nominal catches are measured in metric tonnes.

SPLIT-YEARS

3. Catches have been accumulated on the basis of twelve month long reporting periods referred to as split-years. The Antarctic split-year begins on July 1 and ends on June 30.

FISHING AREAS, SUBAREAS AND DIVISIONS

4. During the 1984 meeting of the CCAMLR Scientific Committee, new subareas and finer divisions of an existing subarea were recommended for the reporting of 1984/85 fishing activities. These have been communicated to FAO and adopted. The boundaries for all Antarctic areas, subareas and divisions are shown in Chart 1.

NATIONAL CODES

5. FAO codes are used for the identification of fishing countries in Tables 6 – 10. These are listed in Table 3.

CONTENTS

Table 9 STATLANT Catch Report – Pacific Antarctic. (Lists all commercial catch by species, split-year, and country for the Pacific Antarctic. Subtotals have been tabulated for each species, for each split-year, for each subarea.)

Table 10 STATLANT Catch Report – Divisions of Enderby-Wilkes Subarea (58.4). (Lists all commercial catch by species, split-year, and country for the four divisions of the Enderby-Wilkes subarea. Subtotals have been tabulated for each species, for each split-year, for each division.)

Table 1: Current position on availability of STATLANT data.

STAT8A14	Sources of CCAMLR's STATLANT 08A Data																
	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86
Bulgaria									08A	08A	08A	–	–	–	–	–	–
Chile	–	–	–	–	–	–	08A	08A	–	–	–	–	–	08A	08A	08A	08A
France	–	–	–	–	–	–	–	–	–	–	08A	08A	08A	08A	08A	08A	08A
GDR	–	–	–	–	–	–	–	***	08A	08A	08A	08A	–	–	–	08A	08A
Japan	–	–	–	08A	08A	08A	08A	08A	08A	08A	08A	08A	08A	08A	08A	08A	n/r
Korea	–	–	–	–	–	–	–	–	–	08A	–	–	08A	08A	***	–	–
Poland	–	–	–	–	–	–	–	08A	08A	08A	08A	08A	08A	08A	08A	08A	08A
USSR	***	***	***	***	***	***	***	***	***	08A	08A	08A	08A	08A	08A	08A	08A
	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86

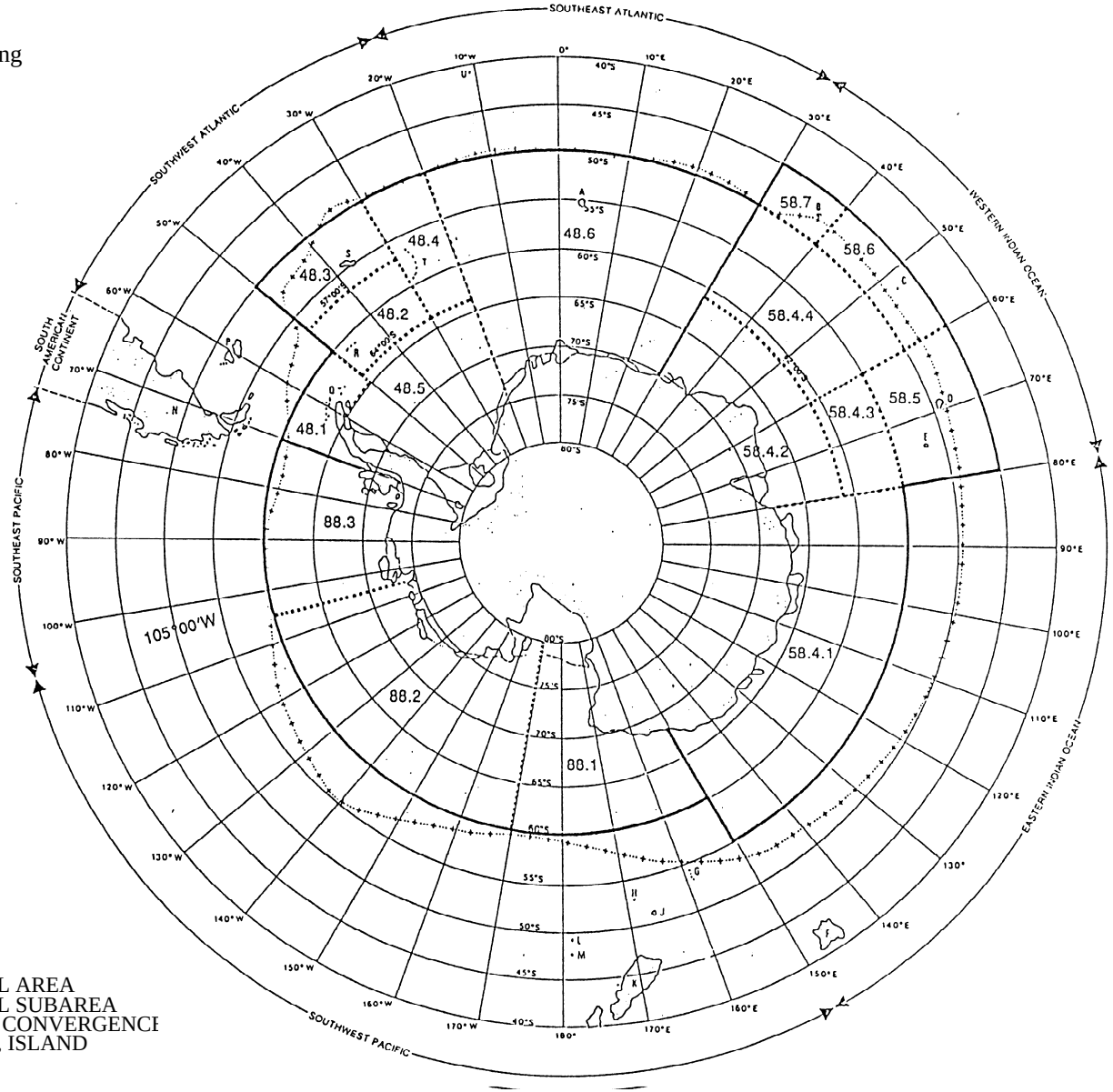
08A : STATLANT 08A forms have been acquired by the CCAMLR Secretariat for these years.
– : No commercial operations were conducted during these years (zero catch).
n/r : Not yet received
*** : Data for these years are based on ad hoc reports, or FAO's Yearbooks of Fishery Statistics.

STAT8B16	Sources of CCAMLR's STATLANT 08B Data																
	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86
Bulgaria									08B	08B	08B	–	–	–	–	–	–
Chile	–	–	–	–	–	–	08B	08B	–	–	–	–	–	08B	08B	08B	08B
France	–	–	–	–	–	–	–	–	–	–	08B	08B	08B	08B	08B	08B	08B
GDR	–	–	–	–	–	–	–	n/r	08B	n/r	08B	08B	–	–	–	08B	08B
Japan	–	–	–	08B	08B	08B	08B	08B	08B	08B	08B	08B	08B	08B	08B	08B	n/r
Korea	–	–	–	–	–	–	–	–	–	08B	–	–	08B	08B	n/r	–	–
Poland	–	–	–	–	–	–	–	08B	08B	08B	08B	08B	08B	08B	08B	08B	08B
USSR	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r	08B	n/r	n/r	n/r	08B	08B	08B	08B
	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86

08B : STATLANT 08B forms have been acquired by the CCAMLR Secretariat for these years.
– : No commercial operations were conducted during these years (zero effort).
n/r : Not yet received, derived as possible from available 08A data.

Chart 1:

Boundaries of the Statistical Reporting Areas in the Southern Ocean



LEGEND:
- STATISTICAL AREA
- STATISTICAL SUBAREA
- ANTARCTIC CONVERGENCE
- CONTINENT, ISLAND

LEGEND
- A Bouvet Island
- B Prince Edward and Marion Islands
- C Crozet Islands
- D Kerguelen Islands
- E Macdonald and Heard Islands
- F Tasmania
- G Macquarie Islands
- H Campbell Island
- J Auckland Islands
- K South Island
- L Antipodes Islands
- M Bounty Islands
- N South America
- P Falkland Islands (Malvinas)
- Q South Shetland Islands
- R South Orkney Islands
- S South Georgia
- T South Sandwich Islands
- U Gough Island

Table 2: Statistical reporting areas, subareas and divisions in the CCAMLR Convention Area

AREA/SUBAREA/DIVISION		NAME
Area	48	Atlantic Antarctic
Subarea	48.1	Peninsular Subarea
Subarea	48.2	South Orkney Subarea
Subarea	48.3	South Georgia Subarea
Subarea	48.4	South Sandwich Subarea
Subarea	48.5	Weddell Subarea
Subarea	48.6	Bouvet Subarea
Area	58	Indian Ocean Antarctic
Subarea	58.4	Enderby-Wilkes Subarea
Division	58.4.1	Enderby-Wilkes Division One
Division	58.4.2	Enderby-Wilkes Division Two
Division	58.4.3	Enderby-Wilkes Division Three
Division	58.4.4	Enderby-Wilkes Division Four
Subarea	58.5	Kerguelen Subarea
Subarea	58.6	Crozet Subarea
Subarea	58.7	Marion-Edward Subarea
Area	88	Pacific Antarctic
Subarea	88.1	Eastern Ross Sea Subarea
Subarea	88.2	Western Ross Sea Subarea
Subarea	88.3	Amundsen Sea Subarea

Table 3: Country Identification Codes (CID)

CID	FULL COUNTRY NAME
BGR	Bulgaria
CHL	Chile
FRA	France
DDR	German Democratic Republic
DEU	Germany, Federal Republic of
JPN	Japan
KOR	Korea
POL	Poland
SUN	Union of Soviet Socialist Republics

Table 4: COMMERCIAL CATCH TOTALS BY SPECIES (METRIC TONNES)

	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86
Pisces Nei		2133	8222	3444	2252	1982	738	13581	14261	7051	6457	14709	7401	24139	6229	4315	456
Nototheniidae									179	2505	1853	210	51		40	365	67
Notothenia gibberifrons							4999	3727	16782	13363	10306	8217	3194	1	12464	7803	2019
Notothenia guentheri										15011	7381	36758	31351	5029	10586	11923	16002
Notothenia rossii	399704	165194	107326	20361	20906	10248	16814	8462	52551	8662	47124	9864	11149	2695	4530	3690	871
Notothenia squamifrons		24545	52947	3133	19977	12098	12700	3245	34016	1587	15950	9786	5635	1931	3995	8904	2566
Dissostichus eleginoides								441	2218	334	455	378	558	265	255	6979	1031
Pleuragramma antarcticum									255			1517	140	339		966	692
Trematomus spp.												583					
Channichthyidae nei										269	1668	4554				54	976
Chaenocephalus aceratus								293	2277	4018	1440	1302	676		161	1042	504
Chaenodraco wilsoni										10130	4320						
Champsocephalus gunnari		20932	54408	8342	7646	48530	22714	103850	219345	58111	15555	34067	62966	162598	91623	25041	31683
Channichthys rhinoceratus									82		8	2	0	0			
Chionodraco rastrospinosus										1949	581						
Pseudochaenichthys georgianus								1608	13674	2100	3122	1694	956		888	1097	156
Micromesistius australis											36						
Myctophidae											586		317	524	2530	523	1187
Rajiformes									8	1	224	120	1	1	24	48	20
Euphausia superba				59	19785	44029	5635	91516	132349	333128	477023	448132	528201	228643	128218	191460	446455*
Loliginidae										2							

* Preliminary figure

Table 5: COMMERCIAL CATCH TOTALS (ALL SPECIES), BY COUNTRY (METRIC TONNES)

Country	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86
Bulgaria, Catch:									2088	3408	1225						
Chile, Catch:							276	92						3752	1649	2598	3264
GDR, Catch:								790	10313	4961	9970	8279				624	1295
France, Catch:											283	1921	6158	2102	1071	760	1114
Japan, Catch:				59	646	2677	4750	12802	25219	36961	36275	27698	35116	42282	49531	38274	61846*
Korea, Catch:										511			1429	1959	2657		
Poland, Catch:								17054	64016	37486	19673	18139	8324	373	10079	5709	5992
USSR, Catch:	399704	212804	222903	35280	69920	114210	58574	196255	386361	374894	526663	515856	601569	375697	196556	216245	431161
TOTAL CATCH:	399704	212804	222903	35339	70566	116887	63600	226993	487997	458221	594089	571893	652596	426165	261543	264210	504672

* Preliminary figure

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC FISHING AREAS

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
Pisces nei						
Marine Fishes nei						
	71	SUN	1454	679	0	2133
annual subtotals			1454	679	0	2133
	72	SUN	27	8195	0	8222
annual subtotals			27	8195	0	8222
	73	SUN	0	3444	0	3444
annual subtotals			0	3444	0	3444
	74	SUN	493	1759	0	2252
annual subtotals			493	1759	0	2252
	75	SUN	1407	575	0	1982
annual subtotals			1407	575	0	1982
	76	SUN	190	548	0	738
annual subtotals			190	548	0	738
	77	POL	116	0	0	116
	77	SUN	13724	11	0	13735
annual subtotals			13840	11	0	13851
	78	BGR	168	0	0	168
	78	DDR	22	0	0	22
	78	POL	308	0	2	310
	78	SUN	13500	261	0	13761
annual subtotals			13998	261	2	14261
	79	BGR	321	0	0	321
	79	DDR	89	0	0	89
	79	POL	133	0	0	133
	79	SUN	5090	1218	200	6508
annual subtotals			5633	1218	200	7051
	80	BGR	360	0	0	360
	80	POL	428	0	0	428
	80	SUN	5430	239	0	5669
annual subtotals			6218	239	0	6457
	81	POL	230	0	0	230
	81	SUN	14083	396	0	14479
annual subtotals			14313	396	0	14709
	82	POL	124	0	0	124
	82	SUN	6906	371	0	7277
annual subtotals			7030	371	0	7401
	83	SUN	24118	21	0	24139
annual subtotals			24118	21	0	24139
	84	SUN	5616	611	2	6229
annual subtotals			5616	611	2	6229

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME		SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
		85	POL	71	0	0	71
		85	SUN	4226	18	0	4244
	annual subtotals			4297	18	0	4315
		86	POL	144	0	0	144
		86	SUN	312	0	0	312
	annual subtotals			456	0	0	456
Nototheniidae Notothenids nei							
		78	DDR	20	0	0	20
		78	POL	159	0	0	159
	annual subtotals			179	0	0	179
		79	BGR	2464	0	0	2464
		79	DDR	21	0	0	21
		79	POL	20	0	0	20
	annual subtotals			2505	0	0	2505
		80	BGR	616	0	0	616
		80	DDR	1237	0	0	1237
	annual subtotals			1853	0	0	1853
		81	DDR	210	0.	0	210
	annual subtotals			210	0	0	210
		82	POL	51	0	0	51
	annual subtotals			51	0	0	51
		84	POL	40	0	0	40
	annual subtotals			40	0	0	40
		85	DDR	223	0	0	223
		85	POL	142	0	0	142
	annual subtotals			365	0	0	365
		86	DDR	27	0	0	27
		86	POL	40	0	0	40
	annual subtotals			67	0	0	67
Notothenia gibberifrons Bumphead Notothenia							
		76	SUN	4999	0	0	4999
	annual subtotals			4999	0	0	4999
		77	DDR	370	0	0	370
		77	POL	2527	0	0	2527
		77	SUN	830	0	0	830
	annual subtotals			3727	0	0	3727
		78	BGR	43	0	0	43
		78	DDR	1951	0	0	1951
		78	POL	9839	0	0	9839
		78	SUN	4949	0	0	4949
	annual subtotals			16782	0	0	16782

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	79	BGR	50	0	0	50
	79	DDR	1556	0	0	1556
	79	POL	6812	0	0	6812
	79	SUN	4945	0	0	4945
annual subtotals			13363	0	0	13363
	80	BGR	34	0	0	34
	80	DDR	917	0	0	917
	80	POL	8359	0	0	8359
	80	SUN	996	0	0	996
annual subtotals			10306	0	0	10306
	81	DDR	2411	0	0	2411
	81	POL	5031	0	0	5031
	81	SUN	775	0	0	775
annual subtotals			8217	0	0	8217
	82	POL	970	0	0	970
	82	SUN	2224	0	0	2224
annual subtotals			3194	0	0	3194
	83	SUN	1	0	0	1
annual subtotals			1	0	0	1
	84	POL	531	0	0	531
	84	SUN	11933	0	0	11933
annual subtotals			12464	0	0	12464
	85	DDR	202	0	0	202
	85	POL	1583	0	0	1583
	85	SUN	6018	0	0	6018
annual subtotals			7803	0	0	7803
	86	DDR	293	0	0	293
	86	POL	463	0	0	463
	86	SUN	1263	0	0	1263
annual subtotals			2019	0	0	2019
Notothenia guentheri Guenther's Notothenia						
	79	SUN	15011	0	0	15011
annual subtotals			15011	0	0	15011
	80	SUN	7381	0	0	7381
annual subtotals			7381	0	0	7381
	81	SUN	36758	0	0	36758
annual subtotals			36758	0	0	36758
	82	SUN	31351	0	0	31351
annual subtotals			31351	0	0	31351
	83	SUN	5029	0	0	5029
annual subtotals			5029	0	0	5029

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	84	SUN	10586	0	0	10586
annual subtotals			10586	0	0	10586
	85	SUN	11923	0	0	11923
annual subtotals			11923	0	0	11923
	86	SUN	16002	0	0	16002
annual subtotals			16002	0	0	16002
Notothenia rossii						
Marbled Notothenia						
	70	SUN	399704	0	0	399704
annual subtotals			399704	0	0	399704
	71	SUN	101558	63636	0	165194
annual subtotals			101558	63636	0	165194
	72	SUN	2736	104588	0	107326
annual subtotals			2738	104588	0	107326
	73	SUN	0	20361	0	20361
annual subtotals			0	20361	0	20361
	74	SUN	0	20906	0	20906
annual subtotals			0	20906	0	20906
	75	SUN	0	10248	0	10248
annual subtotals			0	10248	0	10248
	76	SUN	10753	6061	0	16814
annual subtotals			10753	6061	0	16814
	77	DDR	420	0	0	420
	77	POL	2224	0	0	2224
	77	SUN	5721	97	0	5818
annual subtotals			8365	97	0	8462
	78	BGR	27	0	0	27
	78	DDR	1232	0	0	1232
	78	POL	1018	0	0	1018
	78	SUN	4119	46155	0	50274
annual subtotals			6396	46155	0	52551
	79	BGR	33	0	0	33
	79	DDR	163	0	0	163
	79	POL	2648	0	0	2648
	79	SUN	5818	0	0	5818
annual subtotals			8662	0	0	8662
	80	DDR	130	0	0	130
	80	FRA	0	19	0	19
	80	POL	1193	1	0	1194
	80	SUN	44059	1722	0	45781
annual subtotals			45382	1742	0	47124

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	81	DDR	1058	0	0	1058
	81	FRA	0	1275	0	1275
	81	POL	233	0	0	233
	81	SUN	432	6866	0	7298
annual subtotals			1723	8141	0	9864
	82	FRA	0	5032	0	5032
	82	POL	1100	0	0	1100
	82	SUN	0	5017	0	5017
annual subtotals			1100	10049	0	11149
	83	FRA	0	450	0	450
	83	SUN	866	1379	0	2245
annual subtotals			866	1829	0	2695
	84	FRA	0	109	0	109
	84	POL	351	0	0	351
	84	SUN	3385	685	0	4070
annual subtotals			3736	794	0	4530
	85	DDR	32	0	0	32
	85	FRA	0	2	0	2
	85	POL	1281	0	0	1281
	85	SUN	636	1739	0	2375
annual subtotals			1949	1741	0	3690
	86	DDR	2	0	0	2
	86	FRA	0	8	0	8
	86	POL	68	0	0	68
	86	SUN	0	793	0	793
annual subtotals			70	801	0	871
Notothenia squamifrons Scaled Notothenia						
	71	SUN	0	24545	0	24545
annual subtotals			0	24545	0	24545
	72	SUN	35	52912	0	52947
annual subtotals			35	52912	0	52947
	73	SUN	765	2368	0	3133
annual subtotals			765	2368	0	3133
	74	SUN	0	19977	0	19977
annual subtotals			0	19977	0	19977
	75	SUN	1900	10198	0	12098
annual subtotals			1900	10198	0	12098
	76	SUN	500	12200	0	12700
annual subtotals			500	12200	0	12700
	77	SUN	2937	308	0	3245
annual subtotals			2937	308	0	3245

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	78	POL	9	98	0	107
	78	SUN	2327	31582	0	33909
annual subtotals			2336	31680	0	34016
	79	SUN	280	1307	0	1587
annual subtotals			280	1307	0	1587
	80	FRA	0	36	0	36
	80	POL	0	362	0	362
	80	SUN	272	15280	0	15552
annual subtotals			272	15678	0	15950
	81	FRA	0	23	0	23
	81	SUN	621	9142	0	9763
annual subtotals			621	9165	0	9786
	82	FRA	0	15	0	15
	82	SUN	812	4808	0	5620
annual subtotals			812	4823	0	5635
	83	FRA	0	15	0	15
	83	SUN	4	1912	0	1916
annual subtotals			4	1927	0	1931
	84	FRA	0	2	0	2
	84	SUN	0	3993	0	3993
annual subtotals			0	3995	0	3995
	85	FRA	0	1	0	1
	85	SUN	1483	7420	0	8903
annual subtotals			1483	7421	0	8904
	86	FRA	0	2	0	2
	86	SUN	41	2523	0	2564
annual subtotals			41	2525	0	2566
Dissostichus eleginoides Patagonian Toothfish						
	77	POL	135	0	0	135
	77	SUN	306	0	0	306
annual subtotals			441	0	0	441
	78	POL	730	2	0	732
	78	SUN	1290	196	0	1486
annual subtotals			2020	198	0	2218
	79	POL	207	0	0	207
	79	SUN	124	3	0	127
annual subtotals			331	3	0	334
	80	FRA	0	6	0	6
	80	POL	257	7	0	264
	80	SUN	4	181	0	185
annual subtotals			261	194	0	455

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	81	FRA	0	18	0	18
	81	POL	71	0	0	71
	81	SUN	251	38	0	289
annual subtotals			322	56	0	378
	82	FRA	0	24	0	24
	82	SUN	354	180	0	534
annual subtotals			354	204	0	558
	83	FRA	0	71	0	71
	83	SUN	116	78	0	194
annual subtotals			116	149	0	265
	84	POL	3	0	0	3
	84	SUN	106	127	0	233
annual subtotals			109	146	0	255
	85	FRA	0	64	0	64
	85	POL	88	0	0	88
	85	SUN	206	6621	0	6827
annual subtotals			294	6685	0	6979
	86	FRA	0	9	0	9
	86	POL	29	0	0	29
	86	SUN	535	458	0	993
annual subtotals			564	467	0	1031
Pleuragramma antarcticum Antarctic Sidestripe						
	78	POL	0	0	21	21
	78	SUN	0	234	0	234
annual subtotals			0	234	21	255
	81	SUN	0	0	1517	1517
annual subtotals			0	0	1517	1517
	82	SUN	0	50	90	140
annual subtotals			0	50	90	140
	83	SUN	110	229	0	339
annual subtotals			110	229	0	339
	85	SUN	0	966	0	966
annual subtotals			0	966	0	966
	86	SUN	0	692	0	692
annual subtotals			0	692	0	692
Trematomus spp. Antarctic Cods						
	81	SUN	0	0	583	583
annual subtotals			0	0	583	583

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
Channichthyidae nei Icefishes nei						
	79	DDR	269	0	0	269
annual subtotals			269	0	0	269
	80	DDR	1668	0	0	1668
annual subtotals			1668	0	0	1668
	81	DDR	4554	0	0	4554
annual subtotals			4554	0	0	4554
	85	DDR	54	0	0	54
annual subtotals			54	0	0	54
	86	DDR	973	0	0	973
annual subtotals			973	0	0	973
Chaenocephalus aceratus Scotia Sea Icefish						
	77	POL	293	0	0	293
annual subtotals			293	0	0	293
	78	BGR	175	0	0	175
	78	DDR	15	0	0	15
	78	POL	2087	0	0	2087
annual subtotals			2277	0	0	2277
	79	BGR	49	0	0	49
	79	DDR	4	0	0	4
	79	POL	3965	0	0	3965
annual subtotals			4018	0	0	4018
	80	BGR	22	0	0	22
	80	POL	1418	0	0	1418
annual subtotals			1440	0	0	1440
	81	POL	1302	0	0	1302
annual subtotals			1302	0	0	1302
	82	POL	676	0	0	676
annual subtotals			676	0	0	676
	84	POL	161	0	0	161
annual subtotals			161	0	0	161
	85	POL	1042	0	0	1042
annual subtotals			1042	0	0	1042
	86	POL	504	0	0	504
annual subtotals			504	0	0	504
Chaenodraco wilsoni Wilson’s Icefish						
	79	DDR	2028	0	0	2028
annual subtotals			10130	0	0	10130

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	80	POL	4320	0	0	4320
annual subtotals			4320	0	0	4320
Champsocephalus gunnari Antarctic Icefish						
	71	SUN	10701	10231	0	20932
annual subtotals			10701	10231	0	20932
	72	SUN	551	53857	0	54408
annual subtotals			551	53857	0	54408
	73	SUN	1830	6512	0	8342
annual subtotals			1830	6512	0	8342
	74	SUN	254	7392	0	7646
annual subtotals			254	7392	0	7646
	75	SUN	746	47784	0	48530
annual subtotals			746	47784	0	48530
	76	SUN	12290	10424	0	22714
annual subtotals			12290	10424	0	22714
	77	POL	3165	0	0	3185
	77	SUN	90215	10450	0	100665
annual subtotals			93400	10450	0	103850
	78	BGR	1054	0	0	1054
	78	DDR	2769	0	0	2769
	78	POL	40515	250	0	40765
	78	SUN	102114	72643	0	174757
annual subtotals			146452	72893	0	219345
	79	BGR	295	0	0	295
	79	DDR	574	0	0	574
	79	POL	11852	0	0	11852
	79	SUN	45289	101	0	45390
annual subtotals			58010	101	0	58111
	80	BGR	129	0	0	129
	80	DDR	3646	0	0	3646
	80	FRA	0	212	0	212
	80	POL	1562	9	0	1571
	80	SUN	8573	1424	0	9997
annual subtotals			13910	1645	0	15555
	81	POL	9504	0	0	9504
	81	SUN	23441	519	0	23960
annual subtotals			32945	1122	0	34067
	82	FRA	0	1087	0	1087
	82	POL	4446	0	0	4446
	82	SUN	42422	14996	15	57433
annual subtotals			46868	16083	15	62966

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	83	FRA	0	1565	0	1565
	83	POL	13	0	0	13
	83	SUN	136733	24287	0	161020
annual subtotals			136746	25852	0	162598
	84	FRA	0	924	0	924
	84	POL	8098	0	0	8098
	84	SUN	76398	6203	0	82601
annual subtotals			84496	7127	0	91623
	85	DDR	35	0	0	35
	85	FRA	0	689	0	689
	85	POL	389	0	0	389
	85	SUN	16085	7843	0	23928
annual subtotals			16509	8532	0	25041
	86	FRA	0	1092	0	1092
	86	POL	2506	0	0	2506
	86	SUN	11283	16802	0	28085
annual subtotals			13789	17894	0	31683
Channichthys rhinoceratus Longsnouted Icefish						
	78	POL	0	82	0	82
annual subtotals			0	82	0	82
	80	FRA	0	4	0	4
	80	POL	0	4	0	4
annual subtotals			0	8	0	8
	81	FRA	0	2	0	2
annual subtotals			0	2	0	2
	82	FRA	0	0	0	0
annual subtotals			0	0	0	0
	83	FRA	0	0	0	0
annual subtotals			0	0	0	0
Chionodraco rastrospinosus Kathleen's Icefish						
	79	POL	1949	0	0	1949
annual subtotals			1949	0	0	1949
	80	POL	581	0	0	581
annual subtotals			581	0	0	581
Pseudochaenichthys georgianus South Georgia Icefish						
	77	POL	1608	0	0	1608
annual subtotals			1608	0	0	1608

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	78	BGR	527	0	0	527
	78	DDR	4288	0	0	4288
	78	POL	8859	0	0	8859
annual subtotals			13674	0	0	13674
	79	BGR	150	0	0	150
	79	DDR	152	0	0	152
	79	POL	1798	0	0	1798
annual subtotals			2100	0	0	2100
	80	BGR	64	0	0	64
	80	DDR	2330	0	0	2330
	80	POL	728	0	0	728
annual subtotals			3122	0	0	3122
	81	POL	1694	0	0	1694
annual subtotals			1694	0	0	1694
	82	POL	956	0	0	956
annual subtotals			956	0	0	956
	84	POL	888	0	0	888
annual subtotals			888	0	0	888
	85	POL	1097	0	0	1097
annual subtotals			1097	0	0	1097
	86	POL	156	0	0	156
annual subtotals			156	0	0	156
Micromesistius australis Southern Blue Whiting						
	80	DDR	36	0	0	36
annual subtotals			36	0	0	36
Myctophidae Lantern Fishes						
	80	SUN	586	0	0	586
annual subtotals			586	0	0	586
	82	SUN	317	0	0	317
annual subtotals			317	0	0	317
	83	SUN	524	0	0	524
annual subtotals			524	0	0	524
	84	SUN	2401	0	129	2530
annual subtotals			2401	0	129	2530
	85	SUN	523	0	0	523
annual subtotals			523	0	0	523
	86	SUN	1187	0	0	1187
annual subtotals			1187	0	0	1187

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
Rajiformes						
Skates and Rays nei						
	78	DDR	8	0	0	8
annual subtotals			8	0	0	8
	79	DDR	1	0	0	1
annual subtotals			1	0	0	1
	80	DDR	6	0	0	6
	80	FRA	0	0	0	0
	80	POL	218	0	0	218
annual subtotals			224	0	0	224
	81	DDR	46	0	0	46
	81	FRA	0	0	0	0
	81	POL	74	0	0	74
annual subtotals			120	0	0	120
	82	FRA	0	0	0	0
	82	POL	1	0	0	1
annual subtotals			1	0	0	1
	83	FRA	0	1	0	1
annual subtotals			0	1	0	1
	84	FRA	0	17	0	17
	84	POL	7	0	0	7
annual subtotals			7	17	0	24
	85	DDR	28	0	0	28
	85	FRA	0	4	0	4
	85	POL	16	0	0	16
annual subtotals			44	4	0	48
	86	Fra	0	3	0	3
	86	POL	16	0	0	16
	86	POL	1	0	0	1
annual subtotals			17	3	0	20
Euphausia superba						
Antarctic Krill						
	73	JPN	59	0	0	59
annual subtotals			59	0	0	59
	74	JPN	200	446	0	646
	74	SUN	19139	0	0	19139
annual subtotals			19339	446	0	19785
	75	JPN	0	2677	0	2677
	75	SUN	41352	0	0	41352
annual subtotals			41352	2677	0	44029

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	76	CHL	276	0	0	276
	76	JPN	0	4750	0	4750
	76	SUN	609	0	0	609
annual subtotals			885	4750	0	5635
	77	CHL	92	0	0	92
	77	JPN	0	12801	1	12802
	77	POL	6966	0	0	6966
	77	SUN	68301	0	3355	71656
annual subtotals			75359	12801	3356	91516
	78	BGR	94	0	0	94
	78	DDR	8	0	0	8
	78	JPN	0	24701	518	25219
	78	POL	1	0	36	37
	78	SUN	78837	28154	0	106991
annual subtotals			78940	52855	554	132349
	79	BGR	46	0	0	46
	79	DDR	102	0	0	102
	79	JPN	0	34699	2262	36961
	79	KOR	0	511	0	511
	79	SUN	266386	28522	600	295508
annual subtotals			266534	63732	2862	333128
	80	FRA	0	6	0	6
	80	JPN	0	33094	3181	36275
	80	POL	226	0	0	226
	80	SUN	356752	83764	0	440516
annual subtotals			356978	116864	3181	477023
	81	JPN	3751	22793	1154	27698
	81	SUN	285117	132237	3080	420434
annual subtotals			288868	155030	4234	448132
	82	JPN	5404	27168	2544	35116
	82	KOR	0	1429	0	1429
	82	SUN	368182	119381	4093	491656
annual subtotals			373586	147978	6637	528201
	83	CHL	3752	0	0	3752
	83	JPN	5498	32066	4718	42282
	83	KOR	0	1959	0	1959
	83	POL	360	0	0	360
	83	SUN	128751	45620	5919	180290
annual subtotals			138361	79645	10637	228643
	84	CHL	1649	0	0	1649
	84	JPN	40710	8195	626	49531
	84	KOR	0	2657	0	2657
	84	SUN	62321	12045	15	74381
annual subtotals			104680	22897	641	128218

TABLE 6: ANTARCTIC STATLANT CATCH REPORT — ATLANTIC/INDIAN OCEAN/ AND PACIFIC (continued) FISHING AREAS

SPECIES NAME		SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
		85	CHL	2598	0	0	2598
		85	DDR	50	0	0	50
		85	JPN	31304	2249	4721	38274
		85	SUN	146855	3683	0	150538
	annual subtotals			180807	5932	4721	191460
		86	CHL	3264	0	0	3264
		86	POL	2065	0	0	2065
		86	SUN	366738	10648	1884	379270
	annual subtotals			372067	10648	1884	384599
Loliginidae Squids nei							
		79	DDR	2	0	0	2
	annual subtotals			2	0	0	2

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
Pisces nei										
Marine Fishes nei										
	71	SUN	0	0	1454	0	0	0	0	1454
annual subtotals			0	0	1454	0	0	0	0	1454
	72	SUN	0	0	27	0	0	0	0	27
annual subtotals			0	0	27	0	0	0	0	27
	74	SUN	0	0	493	0	0	0	0	493
annual subtotals			0	0	493	0	0	0	0	493
	75	SUN	0	0	1407	0	0	0	0	1407
annual subtotals			0	0	1407	0	0	0	0	1407
	76	SUN	0	0	190	0	0	0	0	190
annual subtotals			0	0	190	0	0	0	0	190
	77	POL	0	0	116	0	0	0	0	116
	77	SUN	0	0	13724	0	0	0	0	13724
annual subtotals			0	0	13840	0	0	0	0	13840
	78	BGR	0	74	94	0	0	0	0	168
	78	DDR	0	0	22	0	0	0	0	22
	78	POL	0	154	154	0	0	0	0	308
	78	SUN	0	0	0	0	0	0	13500	13500
annual subtotals			0	228	270	0	0	0	13500	13998
	79	BGR	3	27	291	0	0	0	0	321
	79	DDR	61	20	8	0	0	0	0	89
	79	POL	15	86	32	0	0	0	0	133
	79	SUN	0	0	0	0	0	0	5090	5090
annual subtotals			79	133	331	0	0	0	5090	5633

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME		SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
		80	BGR	44	160	156	0	0	0	0	360
		80	POL	64	30	334	0	0	0	0	428
		80	SUN	443	311	4676	0	0	0	0	5430
	annual subtotals			551	501	5166	0	0	0	0	6218
		81	POL	0	0	230	0	0	0	0	230
		81	SUN	4230	2770	7083	0	0	0	0	14083
	annual subtotals			4230	2770	7313	0	0	0	0	14313
		82	POL	0	0	124	0	0	0	0	124
		82	SUN	0	2181	4725	0	0	0	0	6906
	annual subtotals			0	2181	4849	0	0	0	0	7030
		83	SUN	16	12349	11753	0	0	0	0	24118
	annual subtotals			16	12349	11753	0	0	0	0	24118
		84	SUN	0	1389	4227	0	0	0	0	5616
	annual subtotals			0	1389	4227	0	0	0	0	5616
		85	POL	0	0	71	0	0	0	0	71
		85	SUN	0	522	3704	0	0	0	0	4226
	annual subtotals			0	522	3775	0	0	0	0	4297
		86	POL	0	0	144	0	0	0	0	144
		86	SUN	0	100	212	0	0	0	0	312
	annual subtotals			0	100	356	0	0	0	0	456
Nototheniidae Notothenids nei											
		78	DDR	0	0	20	0	0	0	0	20
		78	POL	0	50	109	0	0	0	0	159
	annual subtotals			0	50	129	0	0	0	0	179

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	79	BGR	0	77	2387	0	0	0	0	2464
	79	DDR	21	0	0	0	0	0	0	21
	79	POL	0	0	20	0	0	0	0	20
annual subtotals			21	77	2407	0	0	0	0	2505
	80	BGR	0	130	486	0	0	0	0	616
	80	DDR	0	1237	0	0	0	0	0	1237
annual subtotals			0	1367	486	0	0	0	0	1853
	81	DDR	0	0	210	0	0	0	0	210
annual subtotals			0	0	210	0	0	0	0	210
	82	POL	0	0	51	0	0	0	0	51
annual subtotals			0	0	51	0	0	0	0	51
	84	POL	0	0	40	0	0	0	0	40
annual subtotals			0	0	40	0	0	0	0	40
	85	DDR	0	0	223	0	0	0	0	223
	85	POL	0	0	142	0	0	0	0	142
annual subtotals			0	0	365	0	0	0	0	365
	86	DDR	0	0	27	0	0	0	0	27
	86	POL	0	0	40	0	0	0	0	40
annual subtotals			0	0	67	0	0	0	0	67
Notothenia gibberifrons Bumphead Notothenia										
	76	SUN	0	0	4999	0	0	0	0	4999
annual subtotals			0	0	4999	0	0	0	0	4999

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	77	DDR	0	0	370	0	0	0	0	370
	77	POL	0	0	2527	0	0	0	0	2527
	77	SUN	0	0	830	0	0	0	0	830
annual subtotals			0	0	3727	0	0	0	0	3727
	78	BGR	0	6	37	0	0	0	0	43
	78	DDR	0	5	1946	0	0	0	0	1951
	78	POL	0	64	9775	0	0	0	0	9839
	78	SUN	0	0	0	0	0	0	4949	4949
annual subtotals			0	75	11758	0	0	0	4949	16782
	79	BGR	1	37	12	0	0	0	0	50
	79	DDR	843	439	274	0	0	0	0	1556
	79	POL	2436	2122	2254	0	0	0	0	6812
	79	SUN	0	0	0	0	0	0	4945	4945
annual subtotals			3280	2598	2540	0	0	0	4945	13363
	80	BGR	23	11	0	0	0	0	0	34
	80	DDR	0	917	0	0	0	0	0	917
	80	POL	665	420	7274	0	0	0	0	8359
	80	SUN	77	50	869	0	0	0	0	996
annual subtotals			765	1398	8143	0	0	0	0	10306
	81	DDR	0	0	2411	0	0	0	0	2411
	81	POL	0	82	4949	0	0	0	0	5031
	81	SUN	50	114	611	0	0	0	0	775
annual subtotals			50	196	7971	0	0	0	0	8217
	82	POL	0	0	970	0	0	0	0	970
	82	SUN	0	589	1635	0	0	0	0	2224
annual subtotals			0	589	2605	0	0	0	0	3194
	83	SUN	0	1	0	0	0	0	0	1
annual subtotals			0	1	0	0	0	0	0	1

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	84	POL	0	0	531	0	0	0	0	531
	84	SUN	0	9160	2773	0	0	0	0	11933
annual subtotals			0	9160	3304	0	0	0	0	12464
	85	DDR	0	0	202	0	0	0	0	202
	85	POL	0	0	1583	0	0	0	0	1583
	85	SUN	0	5722	296	0	0	0	0	6018
annual subtotals			0	5722	2081	0	0	0	0	7803
	86	DDR	0	0	293	0	0	0	0	293
	86	POL	0	0	463	0	0	0	0	463
	86	SUN	0	341	922	0	0	0	0	1263
annual subtotals			0	341	1678	0	0	0	0	2019
Notothenia guentheri Guenther's Notothenia										
	79	SUN	0	0	15011	0	0	0	0	15011
annual subtotals			0	0	15011	0	0	0	0	15011
	80	SUN	0	0	7381	0	0	0	0	7381
annual subtotals			0	0	7381	0	0	0	0	7381
	81	SUN	0	0	36758	0	0	0	0	36758
annual subtotals			0	0	36758	0	0	0	0	36758
	82	SUN	0	0	31351	0	0	0	0	31351
annual subtotals			0	0	31351	0	0	0	0	31351
	83	SUN	0	0	5029	0	0	0	0	5029
annual subtotals			0	0	5029	0	0	0	0	5029
	84	SUN	0	0	10586	0	0	0	0	10586
annual subtotals			0	0	10586	0	0	0	0	10586

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	85	SUN	0	0	11923	0	0	0	0	11923
annual subtotals			0	0	11923	0	0	0	0	11923
	86	SUN	0	0	16002	0	0	0	0	16002
annual subtotals			0	0	16002	0	0	0	0	16002
Notothenia rossii Marbled Notothenia										
	70	SUN	0	0	399704	0	0	0	0	399704
annual subtotals			0	0	399704	0	0	0	0	399704
	71	SUN	0	0	101558	0	0	0	0	101558
annual subtotals			0	0	101558	0	0	0	0	101558
	72	SUN	0	0	2738	0	0	0	0	2738
annual subtotals			0	0	2738	0	0	0	0	2738
	76	SUN	0	0	10753	0	0	0	0	10753
annual subtotals			0	0	10753	0	0	0	0	10753
	77	DDR	0	0	420	0	0	0	0	420
	77	POL	0	0	2224	0	0	0	0	2224
	77	SUN	0	0	5721	0	0	0	0	5721
annual subtotals			0	0	8365	0	0	0	0	8365
	78	BGR	0	4	23	0	0	0	0	27
	78	DDR	0	55	1177	0	0	0	0	1232
	78	POL	0	26	992	0	0	0	0	1018
	78	SUN	0	0	0	0	0	0	4119	4119
annual subtotals			0	85	2192	0	0	0	4119	6396

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	79	BGR	1	24	8	0	0	0	0	33
	79	DDR	135	13	15	0	0	0	0	163
	79	POL	334	200	2114	0	0	0	0	2648
annual subtotals			470	237	2137	0	0	0	5818	8662
	80	DDR	0	130	0	0	0	0	0	130
	80	POL	48	36	1109	0	0	0	0	1193
	80	SUN	18715	1556	23788	0	0	0	0	44059
annual subtotals			18763	1722	24897	0	0	0	0	45382
	81	DDR	0	0	1058	0	0	0	0	1058
	81	POL	0	0	233	0	0	0	0	233
	81	SUN	0	72	360	0	0	0	0	432
annual subtotals			0	72	1651	0	0	0	0	1723
	82	POL	0	0	1100	0	0	0	0	1100
annual subtotals			0	0	1100	0	0	0	0	1100
	83	SUN	0	0	866	0	0	0	0	866
annual subtotals			0	0	866	0	0	0	0	866
	84	POL	0	0	351	0	0	0	0	351
	84	SUN	0	714	2671	0	0	0	0	3385
annual subtotals			0	714	3022	0	0	0	0	3736
	85	DDR	0	0	32	0	0	0	0	32
	85	POL	0	0	1281	0	0	0	0	1281
	85	SUN	0	58	578	0	0	0	0	636
annual subtotals			0	58	1891	0	0	0	0	1949
	86	DDR	0	0	2	0	0	0	0	2
	86	POL	0	0	68	0	0	0	0	68
annual subtotals			0	0	70	0	0	0	0	70

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
Notothenia squamifrons Scaled Notothenia										
	72	SUN	0	0	35	0	0	0	0	35
annual subtotals			0	0	35	0	0	0	0	35
	73	SUN	0	0	765	0	0	0	0	765
annual subtotals			0	0	765	0	0	0	0	765
	75	SUN	0	0	1900	0	0	0	0	1900
annual subtotals			0	0	1900	0	0	0	0	1900
	76	SUN	0	0	500	0	0	0	0	500
annual subtotals			0	0	500	0	0	0	0	500
	77	SUN	0	0	2937	0	0	0	0	2937
annual subtotals			0	0	2937	0	0	0	0	2937
	78	POL	0	9	0	0	0	0	0	9
annual subtotals			0	9	0	0	0	0	2327	2336
	79	SUN	0	0	0	0	0	0	280	280
annual subtotals			0	0	0	0	0	0	280	280
	80	SUN	0	0	272	0	0	0	0	272
annual subtotals			0	0	272	0	0	0	0	272
	81	SUN	36	41	544	0	0	0	0	621
annual subtotals			36	41	544	0	0	0	0	621
	82	SUN	0	0	812	/0	0	0	0	812
annual subtotals			0	0	812	0	0	0	0	812

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	83	SUN	0	4	0	0	0	0	0	4
annual subtotals			0	4	0	0	0	0	0	4
	85	SUN	0	194	1289	0	0	0	0	1483
annual subtotals			0	194	1289	0	0	0	0	1483
	86	SUN	0	0	41	0	0	0	0	41
annual subtotals			0	0	41	0	0	0	0	41
Dissostichus eleginoides Patagonian Toothfish										
	77	POL	0	0	135	0	0	0	0	135
	77	SUN	0	0	306	0	0	0	0	306
annual subtotals			0	0	441	0	0	0	0	441
	78	POL	0	95	635	0	0	0	0	730
	78	SUN	0	0	0	0	0	0	1290	1290
annual subtotals			0	95	635	0	0	0	1290	2020
	79	POL	100	37	70	0	0	0	0	207
	79	SUN	0	0	0	0	0	0	124	124
annual subtotals			100	37	70	0	0	0	124	331
	80	POL	2	0	255	0	0	0	0	257
	80	SUN	0	4	0	0	0	0	0	4
annual subtotals			2	4	255	0	0	0	0	261
	81	POL	0	0	71	0	0	0	0	71
	81	SUN	0	83	168	0	0	0	0	251
annual subtotals			0	83	239	0	0	0	0	322
	82	SUN	0	30	324	0	0	0	0	354
annual subtotals			0	30	324	0	0	0	0	354

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	83	SUN	0	0	116	0	0	0	0	116
annual subtotals			0	0	116	0	0	0	0	116
	84	POL	0	0	3	0	0	0	0	3
	84	SUN	0	0	106	0	0	0	0	106
annual subtotals			0	0	109	0	0	0	0	109
	85	POL	0	0	88	0	0	0	0	88
	85	SUN	0	9	197	0	0	0	0	206
annual subtotals			0	9	285	0	0	0	0	294
	86	POL	0	0	29	0	0	0	0	29
	86	SUN	0	0	535	0	0	0	0	535
annual subtotals			0	0	564	0	0	0	0	564
Pleuragramma antarcticum Antarctic Sidestripe										
	83	SUN	0	110	0	0	0	0	0	110
annual subtotals			0	110	0	0	0	0	0	110
Channichthyidae nei Icefishes nei										
	79	DDR	26	243	0	0	0	0	0	269
annual subtotals			26	243	0	0	0	0	0	269
	80	DDR	0	1668	0	0	0	0	0	1668
annual subtotals			0	1668	0	0	0	0	0	1668
	81	DDR	0	0	4554	0	0	0	0	4554
annual subtotals			0	0	4554	0	0	0	0	4554
	85	DDR	0	0	54	0	0	0	0	54
annual subtotals			0	0	54	0	0	0	0	54

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	86	DDR	0	0	973	0	0	0	0	973
annual subtotals			0	0	973	0	0	0	0	973
Chaenocephalus aceratus Scotia Sea Icefish										
	77	POL	0	0	293	0	0	0	0	293
annual subtotals			0	0	293	0	0	0	0	293
	78	BGR	0	157	18	0	0	0	0	175
	78	DDR	0	0	15	0	0	0	0	15
	78	POL	0	54	2033	0	0	0	0	2087
annual subtotals			0	211	2066	0	0	0	0	2277
	79	BGR	2	29	18	0	0	0	0	49
	79	DDR	0	0	4	0	0	0	0	4
annual subtotals			1393	2161	464	0	0	0	0	4018
	80	BGR	0	22	0	0	0	0	0	22
	80	POL	153	181	1084	0	0	0	0	1418
annual subtotals			153	203	1064	0	0	0	0	1440
	81	POL	0	30	1272	0	0	0	0	1302
annual subtotals			0	30	1272	0	0	0	0	1302
	82	POL	0	0	676	0	0	0	0	676
annual subtotals			0	0	676	0	0	0	0	676
	84	POL	0	0	161	0	0	0	0	161
annual subtotals			0	0	161	0	0	0	0	161
	85	POL	0	0	1042	0	0	0	0	1042
annual subtotals			0	0	1042	0	0	0	0	1042

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	86	POL	0	0	504	0	0	0	0	504
annual subtotals			0	0	504	0	0	0	0	504
Chaenodraco wilsoni Wilson's Icefish										
	79	DDR	2028	0	0	0	0	0	0	2028
	79	POL	8102	0	0	0	0	0	0	8102
annual subtotals			10130	0	0	0	0	0	0	10130
	80	POL	4320	0	0	0	0	0	0	4320
annual subtotals			4320	0	0	0	0	0	0	4320
Champsocephalus gunnari Antarctic Icefish										
	71	SUN	0	0	10701	0	0	0	0	10701
annual subtotals			0	0	10701	0	0	0	0	10701
	72	SUN	0	0	551	0	0	0	0	551
annual subtotals			0	0	551	0	0	0	0	551
	73	SUN	0	0	1830	0	0	0	0	1830
annual subtotals			0	0	1830	0	0	0	0	1830
	74	SUN	0	0	254	0	0	0	0	254
annual subtotals			0	0	254	0	0	0	0	254
	75	SUN	0	0	746	0	0	0	0	746
annual subtotals			0	0	746	0	0	0	0	746
	76	SUN	0	0	12290	0	0	0	0	12290
annual subtotals			0	0	12290	0	0	0	0	12290

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	77	POL	0	0	3185	0	0	0	0	3185
	77	SUN	0	0	90215	0	0	0	0	90215
annual subtotals			0	0	93400	0	0	0	0	93400
	78	BGR	0	947	107	0	0	0	0	1054
	78	DDR	0	2603	166	0	0	0	0	2769
	78	POL	0	38446	2069	0	0	0	0	40515
	78	SUN	0	96899	5215	0	0	0	0	102114
annual subtotals			0	138895	7557	0	0	0	0	146452
	79	BGR	12	172	111	0	0	0	0	295
	79	DDR	188	386	0	0	0	0	0	574
	79	POL	7411	4331	110	0	0	0	0	11852
	79	SUN	28319	16550	420	0	0	0	0	45289
annual subtotals			35930	21439	641	0	0	0	0	58010
	80	BGR	0	129	0	0	0	0	0	129
	80	DDR	0	3646	0	0	0	0	0	3646
	80	POL	370	439	753	0	0	0	0	1562
	80	SUN	717	1017	6839	0	0	0	0	8573
annual subtotals			1087	5231	7592	0	0	0	0	13910
	81	POL	0	338	9166	0	0	0	0	9504
	81	SUN	1700	1523	20218	0	0	0	0	23441
annual subtotals			1700	1861	29384	0	0	0	0	32945
	82	POL	0	0	4446	0	0	0	0	4446
	82	SUN	0	557	41865	0	0	0	0	42422
annual subtotals			0	557	46311	0	0	0	0	46868
	83	POL	0	0	13	0	0	0	0	13
	83	SUN	2604	5948	128181	0	0	0	0	136733
annual subtotals			2604	5948	128194	0	0	0	0	136746

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	84	POL	0	0	8098	0	0	0	0	8098
	84	SUN	0	4499	71899	0	0	0	0	76398
annual subtotals			0	4499	79997	0	0	0	0	84496
	85	DDR	0	0	35	0	0	0	0	35
	85	POL	0	0	389	0	0	0	0	389
	85	SUN	0	2361	13724	0	0	0	0	16085
annual subtotals			0	2361	14148	0	0	0	0	16509
	86	POL	0	0	2506	0	0	0	0	2506
	86	SUN	0	2682	8601	0	0	0	0	11283
annual subtotals			0	2682	11107	0	0	0	0	13789
Kathleen's Icefish										
	79	POL	370	1579	0	0	0	0	0	1949
annual subtotals			370	1579	0	0	0	0	0	1949
	80	POL	390	191	0	0	0	0	0	581
annual subtotals			390	191	0	0	0	0	0	581
Pseudochaenichthys georgianus South Georgia Icefish										
	77	POL	0	0	1608	0	0	0	0	1608
annual subtotals			0	0	1608	0	0	0	0	1608
	78	BGR	0	474	53	0	0	0	0	527
	78	DDR	0	16	4272	0	0	0	0	4288
	78	POL	0	169	8690	0	0	0	0	8859
annual subtotals			0	659	13015	0	0	0	0	13674
	79	BGR	6	87	57	0	0	0	0	150
	79	DDR	0	0	152	0	0	0	0	152
	79	POL	391	512	895	0	0	0	0	1798
annual subtotals			397	599	1104	0	0	0	0	2100

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	80	BGR	43	21	0	0	0	0	0	64
	80	DDR	0	2330	0	0	0	0	0	2330
	80	POL	29	34	665	0	0	0	0	728
annual subtotals			72	2385	665	0	0	0	0	3122
	81	POL	0	33	1661	0	0	0	0	1694
annual subtotals			0	33	1661	0	0	0	0	1694
	82	POL	0	0	956	0	0	0	0	956
annual subtotals			0	0	956	0	0	0	0	956
	84	POL	0	0	888	0	0	0	0	888
annual subtotals			0	0	888	0	0	0	0	888
	85	POL	0	0	1097	0	0	0	0	1097
annual subtotals			0	0	1097	0	0	0	0	1097
	86	POL	0	0	156	0	0	0	0	156
annual subtotals			0	0	156	0	0	0	0	156
Micromesistius australis Southern Blue Whiting										
	80	DDR	0	36	0	0	0	0	0	36
annual subtotals			0	36	0	0	0	0	0	36
Lantern Fishes										
	80	SUN	48	33	505	0	0	0	0	586
annual subtotals			48	33	505	0	0	0	0	586
	82	SUN	0	317	0	0	0	0	0	317
annual subtotals			0	317	0	0	0	0	0	317

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	83	SUN	0	0	524	0	0	0	0	524
annual subtotals			0	0	524	0	0	0	0	524
	84	SUN	0	0	2401	0	0	0	0	2401
annual subtotals			0	0	2401	0	0	0	0	2401
	85	SUN	0	0	523	0	0	0	0	523
annual subtotals			0	0	523	0	0	0	0	523
	86	SUN	0	0	1187	0	0	0	0	1187
annual subtotals			0	0	1187	0	0	0	0	1187
Rajiformes										
Skates and Rays nei										
	78	DDR	0	4	4	0	0	0	0	8
annual subtotals			0	4	4	0	0	0	0	8
	79	DDR	1	0	0	0	0	0	0	1
annual subtotals			1	0	0	0	0	0	0	1
	80	DDR	0	6	0	0	0	0	0	6
	80	POL	0	0	218	0	0	0	0	218
annual subtotals			0	6	218	0	0	0	0	224
	81	DDR	0	0	46	0	0	0	0	46
	81	POL	0	0	74	0	0	0	0	74
annual subtotals			0	0	120	0	0	0	0	120
	82	POL	0	0	1	0	0	0	0	1
annual subtotals			0	0	1	0	0	0	0	1
	84	POL	0	0	7	0	0	0	0	7
annual subtotals			0	0	7	0	0	0	0	7

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME		SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
		85	DDR	0	0	28	0	0	0	0	28
		85	POL	0	0	16	0	0	0	0	16
	annual subtotals			0	0	44	0	0	0	0	44
		86	POL	0	0	16	0	0	0	0	16
		86	POL	0	0	1	0	0	0	0	1
	annual subtotals			0	0	17	0	0	0	0	17
Euphausia superba Antarctic Krill											
		73	JPN	0	0	0	19	0	40	0	59
	annual subtotals			0	0	0	19	0	40	0	59
		74	JPN	0	0	0	0	0	200	0	200
		74	SUN	0	0	0	0	0	0	19139	19139
	annual subtotals			0	0	0	0	0	200	19139	19339
		75	SUN	0	0	0	0	0	0	41352	41352
	annual subtotals			0	0	0	0	0	0	41352	41352
		76	CHL	276	0	0	0	0	0	0	276
		76	SUN	0	0	0	0	0	0	609	609
	annual subtotals			276	0	0	0	0	0	609	885
		77	CHL	92	0	0	0	0	0	0	92
		77	POL	0	0	6966	0	0	0	0	6966
		77	SUN	0	0	0	0	0	0	68301	68301
	annual subtotals			92	0	6966	0	0	0	68301	75359
		78	BGR	0	0	94	0	0	0	0	94
		78	DDR	0	2	6	0	0	0	0	8
		78	POL	0	0	1	0	0	0	0	1
		78	SUN	0	0	0	0	0	0	78837	78837
	annual subtotals			0	2	101	0	0	0	78837	78940

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	79	BGR	0	18	28	0	0	0	0	46
	79	DDR	0	0	102	0	0	0	0	102
	79	SUN	0	0	0	0	0	0	266386	266386
annual subtotals			0	18	130	0	0	0	266386	266534
	80	POL	0	226	0	0	0	0	0	226
	80	SUN	49439	173539	133774	0	0	0	0	356752
annual subtotals			49439	173765	133774	0	0	0	0	356978
	81	JPN	3751	0	0	0	0	0	0	3751
	81	SUN	89108	60540	135252	0	0	217	0	285117
annual subtotals			92859	60540	135252	0	0	217	0	288868
	82	JPN	4978	426	0	0	0	0	0	5404
	82	SUN	64045	257269	46868	0	0	0	0	368182
annual subtotals			69023	257695	46868	0	0	0	0	373586
	83	CHL	396	3356	0	0	0	0	0	3752
	83	JPN	96	5392	0	10	0	0	0	5498
	83	POL	0	360	0	0	0	0	0	360
	83	SUN	39	116497	11480	0	0	735	0	128751
annual subtotals			531	125605	11480	10	0	735	0	138361
	84	JPN	30479	10231	0	0	0	0	0	40710
	84	SUN	0	53881	8440	0	0	0	0	62321
annual subtotals			32128	64112	8440	0	0	0	0	104680
	85	CHL	2598	0	0	0	0	0	0	2598
	85	DDR	0	0	50	0	0	0	0	50
	85	JPN	8994	22310	0	0	0	0	0	31304
	85	SUN	0	101520	45335	0	0	0	0	146855
annual subtotals			11592	123830	45385	0	0	0	0	180807

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWICH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	86	CHL	3264	0	0	0	0	0	0	3264
	86	POL	1975	0	90	0	0	0	0	2065
	86	SUN	0	224744	141994	0	0	0	0	366738
annual subtotals			5239	224744	142084	0	0	0	0	372067
Loliginidae Squids nei										
	79	DDR	2	0	0	0	0	0	0	2
annual subtotals			2	0	0	0	0	0	0	2

TABLE 8: STATLANT CATCH REPORT INDIAN OCEAN ANTARCTIC

SPECIES NAME		SPLIT YEAR ENDING	FISHING NATION	ENDERBY –WILKES	KERGUEL SUBAREA	CROZET SUBAREA	MARION– EDWARD	UNKNOWN SUBAREA	TOTAL AREA
Pisces nei									
Marine Fishes nei									
		71	SUN	0	0	0	0	679	679
	annual subtotals			0	0	0	0	679	679
		72	SUN	0	0	0	0	8195	8195
	annual subtotals			0	0	0	0	8195	8195
		73	SUN	0	0	0	0	3444	3444
	annual subtotals			0	0	0	0	3444	3444
		74	SUN	0	0	0	0	1759	1759
	annual subtotals			0	0	0	0	1759	1759
		75	SUN	0	0	0	0	575	575
	annual subtotals			0	0	0	0	575	575
		76	SUN	0	0	0	0	548	548
	annual subtotals			0	0	0	0	548	548
		77	SUN	0	0	0	0	11	11
	annual subtotals			0	0	0	0	11	11
		78	SUN	0	0	0	0	261	261
	annual subtotals			0	0	0	0	261	261
		79	SUN	0	0	0	0	1218	1218
	annual subtotals			0	0	0	0	1218	1218
		80	SUN	239	0	0	0	0	239
	annual subtotals			239	0	0	0	0	239
		81	SUN	375	21	0	0	0	396
	annual subtotals			375	21	0	0	0	396

TABLE 8: STATLANT CATCH REPORT INDIAN OCEAN ANTARCTIC
(continued)

SPECIES NAME		SPLIT YEAR ENDING	FISHING NATION	ENDERBY –WILKES	KERGUEL SUBAREA	CROZET SUBAREA	MARION– EDWARD	UNKNOWN SUBAREA	TOTAL AREA
		82	SUN	364	7	0	0	0	371
	annual subtotals			364	7	0	0	0	371
		83	SUN	4	17	0	0	0	21
	annual subtotals			4	17	0	0	0	21
		84	SUN	0	611	0	0	0	611
	annual subtotals			0	611	0	0	0	611
		85	SUN	11	7	0	0	0	18
	annual subtotals			11	7	0	0	0	18
Notothenia rossii Marbled Notothenia									
		71	SUN	0	0	0	0	63636	63636
	annual subtotals			0	0	0	0	63636	63636
		72	SUN	0	0	0	0	104588	104588
	annual subtotals			0	0	0	0	104588	104588
		73	SUN	0	0	0	0	20361	20361
	annual subtotals			0	0	0	0	20361	20361
		74	SUN	0	0	0	0	20906	20906
	annual subtotals			0	0	0	0	20906	20906
		75	SUN	0	0	0	0	10248	10248
	annual subtotals			0	0	0	0	10248	10248
		76	SUN	0	0	0	0	6061	6061
	annual subtotals			0	0	0	0	6061	6061
		77	SUN	0	0	0	0	97	97
	annual subtotals			0	0	0	0	97	97

TABLE 8: STATLANT CATCH REPORT INDIAN OCEAN ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ENDERBY –WILKES	KERGUEL SUBAREA	CROZET SUBAREA	MARION– EDWARD	UNKNOWN SUBAREA	TOTAL AREA
	78	SUN	0	0	0	0	46155	46155
annual subtotals			0	0	0	0	46155	46155
	80	FRA	0	19	0	0	0	19
	80	POL	0	1	0	0	0	1
	80	SUN	0	1722	0	0	0	1722
annual subtotals			0	1742	0	0	0	1742
	81	FRA	0	1275	0	0	0	1275
	81	SUN	217	6649	0	0	0	6866
annual subtotals			217	7924	0	0	0	8141
	82	FRA	0	5032	0	0	0	5032
	82	SUN	237	4780	0	0	0	5017
annual subtotals			237	9812	0	0	0	10049
	83	FRA	0	450	0	0	0	450
	83	SUN	0	1379	0	0	0	1379
annual subtotals			0	1829	0	0	0	1829
	84	FRA	0	109	0	0	0	109
	84	SUN	50	635	0	0	0	685
annual subtotals			50	744	0	0	0	794
	85	FRA	0	2	0	0	0	2
	85	SUN	34	1705	0	0	0	1739
annual subtotals			34	1707	0	0	0	1741
	86	FRA	0	8	0	0	0	8
	86	SUN	0	793	0	0	0	793
annual subtotals			0	801	0	0	0	801

TABLE 8: STATLANT CATCH REPORT INDIAN OCEAN ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ENDERBY –WILKES	KERGUEL SUBAREA	CROZET SUBAREA	MARION– EDWARD	UNKNOWN SUBAREA	TOTAL AREA
Notothenia squamifrons								
Scaled Notothenia								
	71	SUN	0	0	0	0	24545	24545
annual subtotals			0	0	0	0	24545	24545
	72	SUN	0	0	0	0	52912	52912
annual subtotals			0	0	0	0	52912	52912
	73	SUN	0	0	0	0	2368	2368
annual subtotals			0	0	0	0	2368	2368
	74	SUN	0	0	0	0	19977	19977
annual subtotals			0	0	0	0	19977	19977
	75	SUN	0	0	0	0	10198	10198
annual subtotals			0	0	0	0	10198	10198
	76	SUN	0	0	0	0	12200	12200
annual subtotals			0	0	0	0	12200	12200
	77	SUN	0	0	0	0	308	308
annual subtotals			0	0	0	0	308	308
	78	POL	0	0	0	0	98	98
	78	SUN	0	0	0	0	31582	31582
annual subtotals			0	0	0	0	31680	31680
	79	SUN	0	0	0	0	1307	1307
annual subtotals			0	0	0	0	1307	1307
	80	FRA	0	36	0	0	0	36
	80	POL	0	362	0	0	0	362
	80	SUN	4370	10910	0	0	0	15280
annual subtotals			4370	11308	0	0	0	15678

TABLE 8: STATLANT CATCH REPORT INDIAN OCEAN ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ENDERBY –WILKES	KERGUEL SUBAREA	CROZET SUBAREA	MARION– EDWARD	UNKNOWN SUBAREA	TOTAL AREA
	81	FRA	0	23	0	0	0	23
	81	SUN	2926	6216	0	0	0	9142
annual subtotals			2926	6239	0	0	0	9165
	82	FRA	0	15	0	0	0	15
	82	SUN	785	4023	0	0	0	4808
annual subtotals			785	4038	0	0	0	4823
	83	FRA	0	15	0	0	0	15
	83	SUN	95	1817	0	0	0	1912
annual subtotals			95	1832	0	0	0	1927
	84	FRA	0	2	0	0	0	2
	84	SUN	203	3790	0	0	0	3993
annual subtotals			203	3792	0	0	0	3995
	85	FRA	0	1	0	0	0	1
	85	SUN	27	7393	0	0	0	7420
annual subtotals			27	7394	0	0	0	7421
	86	FRA	0	2	0	0	0	2
	86	SUN	61	2462	0	0	0	2523
annual subtotals			61	2464	0	0	0	2525
Dissostichus eleginoides Patagonian Toothfish								
	78	POL	0	0	0	0	2	2
	78	SUN	0	0	0	0	196	196
annual subtotals			0	0	0	0	198	198
	79	SUN	0	0	0	0	3	3
annual subtotals			0	0	0	0	3	3

TABLE 8: STATLANT CATCH REPORT INDIAN OCEAN ANTARCTIC
(continued)

SPECIES NAME		SPLIT YEAR ENDING	FISHING NATION	ENDERBY –WILKES	KERGUEL SUBAREA	CROZET SUBAREA	MARION– EDWARD	UNKNOWN SUBAREA	TOTAL AREA
		80	FRA	0	6	0	0	0	6
		80	POL	0	7	0	0	0	7
		80	SUN	56	125	0	0	0	181
	annual subtotals			56	138	0	0	0	194
		81	FRA	0	18	0	0	0	18
		81	SUN	16	22	0	0	0	38
	annual subtotals			16	40	0	0	0	56
		82	FRA	0	24	0	0	0	24
		82	SUN	83	97		0	0	180
	annual subtotals			83	121	0	0	0	204
		83	FRA	0	54	17	0	0	71
		83	SUN	4	74	0	0	0	78
	annual subtotals			4	128	17	0	0	149
		84	FRA	0	19	0	0	0	19
		84	SUN	1	126	0	0	0	127
	annual subtotals			1	145	0	0	0	146
		85	FRA	0	64	0	0	0	64
		85	SUN	8	6613	0	0	0	6621
	annual subtotals			8	6677	0	0	0	6685
		86	FRA	0	9	0	0	0	9
		86	SUN	8	450	0	0	0	458
	annual subtotals			8	459	0	0	0	467
Antarctic Sidestripe									
		78	SUN	0	0	0	0	234	234
	annual subtotals			0	0	0	0	234	234

TABLE 8: STATLANT CATCH REPORT INDIAN OCEAN ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ENDERBY –WILKES	KERGUEL SUBAREA	CROZET SUBAREA	MARION– EDWARD	UNKNOWN SUBAREA	TOTAL AREA
	82	SUN	50	0	0	0	0	50
annual subtotals			50	0	0	0	0	50
	83	SUN	229	0	0	0	0	229
annual subtotals			229	0	0	0	0	229
	85	SUN	966	0	0	0	0	966
annual subtotals			966	0	0	0	0	966
	86	SUN	692	0	0	0	0	692
annual subtotals			692	0	0	0	0	692
Champsocephalus gunnari Antarctic Icefish								
	71	SUN	0	0	0	0	10231	10231
annual subtotals			0	0	0	0	10231	10231
	72	SUN	0	0	0	0	53857	53857
annual subtotals			0	0	0	0	53857	53857
	73	SUN	0	0	0	0	6512	6512
annual subtotals			0	0	0	0	6512	6512
	74	SUN	0	0	0	0	7392	7392
annual subtotals			0	0	0	0	7392	7392
	75	SUN	0	0	0	0	47784	47784
annual subtotals			0	0	0	0	47784	47784
	76	SUN	0	0	0	0	10424	10424
annual subtotals			0	0	0	0	10424	10424
	77	SUN	0	0	0	0	10450	10450
annual subtotals			0	0	0	0	10450	10450

TABLE 8: STATLANT CATCH REPORT INDIAN OCEAN ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ENDERBY –WILKES	KERGUEL SUBAREA	CROZET SUBAREA	MARION– EDWARD	UNKNOWN SUBAREA	TOTAL AREA
	78	POL	0	0	0	0	250	250
	78	SUN	0	0	0	0	72643	72643
annual subtotals			0	0	0	0	72893	72893
	79	SUN	0	0	0	0	101	101
annual subtotals			0	0	0	0	101	101
	80	FRA	0	212	0	0	0	212
	80	POL	0	9	0	0	0	9
	80	SUN	14	1410	0	0	0	1424
annual subtotals			14	1631	0	0	0	1645
	81	FRA	0	603	0	0	0	603
	81	SUN	0	519	0	0	0	519
annual subtotals			0	1122	0	0	0	1122
	82	FRA	0	1087	0	0	0	1087
	82	SUN	0	14996	0	0	0	14996
annual subtotals			0	16083	0	0	0	16083
	83	FRA	0	1565	0	0	0	1565
	83	SUN	0	24287	0	0	0	24287
annual subtotals			0	25852	0	0	0	25852
	84	FRA	0	924	0	0	0	924
	84	SUN	0	6203	0	0	0	6203
annual subtotals			0	7127	0	0	0	7127
	85	FRA	0	689	0	0	0	689
	85	SUN	279	0	0	0	0	7843
annual subtotals			279	689	0	0	0	8532

TABLE 8: STATLANT CATCH REPORT INDIAN OCEAN ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ENDERBY –WILKES	KERGUEL SUBAREA	CROZET SUBAREA	MARION– EDWARD	UNKNOWN SUBAREA	TOTAL AREA
	86	FRA	0	1092	0	0	0	1092
	86	SUN	757	16045	0	0	0	16802
annual subtotals			757	17137	0	0	0	17894
Channichthys rhinoceratus Longsnouted Icefish								
	78	POL	0	0	0	0	82	82
annual subtotals			0	0	0	0	82	82
	80	FRA	0	4	0	0	0	4
	80	POL	0	4	0	0	0	4
annual subtotals			0	8	0	0	0	8
	81	FRA	0	2	0	0	0	2
annual subtotals			0	2	0	0	0	2
Rajiformes Skates and Rays nei								
	83	FRA	0	1	0	0	0	1
annual subtotals			0	1	0	0	0	1
	84	FRA	0	17	0	0	0	17
annual subtotals			0	17	0	0	0	17
	85	FRA	0	4	0	0	0	4
annual subtotals			0	4	0	0	0	4
annual subtotals			0	3	0	0	0	3
Euphausia superba Antarctic Krill								
	74	JPN	446	0	0	0	0	446
annual subtotals			446	0	0	0	0	446

TABLE 8: STATLANT CATCH REPORT INDIAN OCEAN ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ENDERBY –WILKES	KERGUEL SUBAREA	CROZET SUBAREA	MARION– EDWARD	UNKNOWN SUBAREA	TOTAL AREA
	75	JPN	2677	0	0	0	0	2677
annual subtotals			2677	0		0	0	2677
	76	JPN	4750	0	0	0	0	4750
annual subtotals			4750	0	0	0	0	4750
	77	JPN	12801	0	0	0	0	12801
annual subtotals			12801	0	0	0	0	12801
	78	JPN	24701	0	0	0	0	24701
	78	SUN	0	0	0	0	28154	28154
annual subtotals			24701	0	0	0	28154	52855
	79	JPN	34699	0	0	0	0	34699
	79	KOR	511	0	0	0	0	511
	79	SUN	0	0	0	0	28522	28522
annual subtotals			35210	0	0	0	28522	63732
	80	FRA	6	0	0	0	0	6
	80	JPN	33094	0	0	0	0	33094
	80	SUN	83764	0	0	0	0	83764
annual subtotals			116864	0	0	0	0	116864
	81	JPN	22793	0	0	0	0	22793
	81	SUN	132237	0	0	0	0	132237
annual subtotals			155030	0	0	0	0	155030
	82	JPN	27168	0	0	0	0	27168
	82	KOR	1429	0	0	0	0	1429
	82	SUN	119381	0	0	0	0	119381
annual subtotals			147978	0	0	0	0	147978

TABLE 8: STATLANT CATCH REPORT INDIAN OCEAN ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ENDERBY –WILKES	KERGUEL SUBAREA	CROZET SUBAREA	MARION– EDWARD	UNKNOWN SUBAREA	TOTAL AREA
	83	JPN	32066	0	0	0	0	32066
	83	KOR	1959	0	0	0	0	1959
	83	SUN	45620	0	0	0	0	45620
annual subtotals			79645	0	0	0	0	79645
	84	JPN	8195	0	0	0	0	8195
	84	KOR	2657	0	0	0	0	2657
	84	SUN	12045	0	0	0	0	12045
annual subtotals			22897	0	0	0	0	22897
	85	SUN	3683	0	0	0	0	3683
annual subtotals			5932	0	0	0	0	5932
	86	SUN	10648	0	0	0	0	10648
annual subtotals			10648	0	0	0	0	10648

TABLE 9: STATLANT CATCH REPORT PACIFIC ANTARCTIC

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	EASTERN ROSS SEA	WESTERN ROSS SEA	AMUNDSEN SEA	UNKNOWN SUBAREA	TOTAL AREA
Pisces nei							
Marine Fishes nei							
	78	POL	0	0	0	2	2
annual subtotals			0	0	0	2	2
	79	SUN	0	0	0	200	200
annual subtotals			0	0	0	200	200
	84	SUN	0	0	0	2	2
annual subtotals			0	0	0	2	2
Pleuragramma antarcticum							
Antarctic Sidestripe							
	78	POL	0	0	0	21	21
annual subtotals			0	0	0	21	21
	81	SUN	0	0	0	1517	1517
annual subtotals			0	0	0	1517	1517
	82	SUN	0	0	0	90	90
annual subtotals			0	0	0	90	90
Trematomus spp.							
Antarctic Cods							
	81	SUN	0	0	0	583	583
annual subtotals			0	0	0	583	583
Champsocephalus gunnari							
Antarctic Icefish							
	82	SUN	0	0	0	15	15
annual subtotals			0	0	0	15	15

TABLE 9: STATLANT CATCH REPORT PACIFIC ANTARCTIC
(continued)

SPECIES NAME		SPLIT YEAR ENDING	FISHING NATION	EASTERN ROSS SEA	WESTERN ROSS SEA	AMUNDSEN SEA	UNKNOWN SUBAREA	TOTAL AREA
Myctophidae Lantern Fishes								
		84	SUN	0	0	0	129	129
	annual subtotals			0	0	0	129	129
Euphausia superba Antarctic Krill								
		77	JPN	1	0	0	0	1
		77	SUN	0	0	0	3355	3355
	annual subtotals			1	0	0	3355	3356
		78	JPN	518	0	0	0	518
		78	POL	0	0	0	36	36
	annual subtotals			518	0	0	36	554
		79	JPN	2262	0	0	0	2262
		79	SUN	0	0	0	600	600
	annual subtotals			2262	0	0	600	2862
		80	JPN	1770	47	1364	0	3181
	annual subtotals			1770	47	1364	0	3181
		81	JPN	593	0	561	0	1154
		81	SUN	0	0	0	3080	3080
	annual subtotals			593	0	561	3080	4234
		82	JPN	2544	0	0	0	2544
		82	SUN	0	0	0	4093	4093
	annual subtotals			2544	0	0	4093	6637
		83	JPN	4718	0	0	0	4718
		83	SUN	0	0	0	5919	5919
	annual subtotals			4718	0	0	5919	10637

TABLE 9: STATLANT CATCH REPORT PACIFIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	EASTERN ROSS SEA	WESTERN ROSS SEA	AMUNDSEN SEA	UNKNOWN SUBAREA	TOTAL AREA
	84	JPN	149	0	477	0	626
	84	SUN	0	0	0	15	15
annual subtotals			149	0	477	15	641
	85	JPN	4595	0	126	0	4721
annual subtotals			4595	0	126	0	4721
	86	SUN	0	0	0	0	1884
annual subtotals			0	0	0	0	1884

TABLE 10: STATLANT CATCH REPORT — DIVISIONS OF ENDERBY-WILKES SUBAREA (58.4)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	DIVISION 58.4.1	DIVISION 58.4.2	DIVISION 58.4.3	DIVISION 58.4.4	DIVISION UNKNOWN	ENDERBY – WILKES TOTAL
Pisces nei Marine Fishes nei								
	80	SUN	0	0	0	0	239	239
annual subtotals			0	0	0	0	239	239
	81	SUN	0	0	0	0	375	375
annual subtotals			0	0	0	0	375	375
	82	SUN	0	0	0	0	364	364
annual subtotals			0	0	0	0	364	364
	83	SUN	0	0	0	0	4	4
annual subtotals			0	0	0	0	4	4
	85	SUN	0	0	0	0	11	11
annual subtotals			0	0	0	0	11	11
Notothenia rossii Marbled Notothenia								
	81	SUN	0	0	0	0	217	217
annual subtotals			0	0	0	0	217	217
	82	SUN	0	0	0	0	237	237
annual subtotals			0	0	0	0	237	237
	84	SUN	0	0	0	0	50	50
annual subtotals			0	0	0	0	50	50
	85	SUN	0	0	0	0	34	34
annual subtotals			0	0	0	0	34	34

TABLE 10: STATLANT CATCH REPORT — DIVISIONS OF ENDERBY-WILKES SUBAREA (58.4)
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	DIVISION 58.4.1	DIVISION 58.4.2	DIVISION 58.4.3	DIVISION 58.4.4	DIVISION UNKNOWN	ENDERBY – WILKES TOTAL
Notothenia squamifrons Scaled Notothenia								
	80	SUN	0	0	0	0	4370	4370
annual subtotals			0	0	0	0	4370	4370
	81	SUN	0	0	0	0	2926	2926
annual subtotals			0	0	0	0	2926	2926
	82	SUN	0	0	0	0	785	785
annual subtotals			0	0	0	0	785	785
	83	SUN	0	0	0	0	95	95
annual subtotals			0	0	0	0	95	95
	84	SUN	0	0	0	0	203	203
annual subtotals			0	0	0	0	203	203
	85	SUN	0	0	0	0	27	27
annual subtotals			0	0	0	0	27	27
	86	SUN	0	0	0	0	61	61
annual subtotals			0	0	0	0	61	61
Dissostichus eleginoides Patagonian Toothfish								
	80	SUN	0	0	0	0	56	56
annual subtotals			0	0	0	0	56	56
	81	SUN	0	0	0	0	16	16
annual subtotals			0	0	0	0	16	16
	82	SUN	0	0	0	0	83	83
annual subtotals			0	0	0	0	83	83

TABLE 10: STATLANT CATCH REPORT — DIVISIONS OF ENDERBY-WILKES SUBAREA (58.4)
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	DIVISION 58.4.1	DIVISION 58.4.2	DIVISION 58.4.3	DIVISION 58.4.4	DIVISION UNKNOWN	ENDERBY – WILKES TOTAL
	83	SUN	0	0	0	0	4	4
annual subtotals			0	0	0	0	4	4
	84	SUN	0	0	0	0	1	1
annual subtotals			0	0	0	0	1	1
	85	SUN	0	0	0	0	8	8
annual subtotals			0	0	0	0	8	8
	86	SUN	0	0	0	0	8	8
annual subtotals			0	0	0	0	8	8
Pleuragramma antarcticum Antarctic Sidestripe								
	82	SUN	0	0	0	0	50	50
annual subtotals			0	0	0	0	50	50
	83	SUN	0	0	0	0	229	229
annual subtotals			0	0	0	0	229	229
	85	SUN	0	0	0	0	966	966
annual subtotals			0	0	0	0	966	966
	86	SUN	0	0	0	0	692	692
annual subtotals			0	0	0	0	692	692
Champsocephalus gunnari Antarctic Icefish								
	80	SUN	0	0	0	0	14	14
annual subtotals			0	0	0	0	14	14
	85	SUN	0	0	0	0	279	279
annual subtotals			0	0	0	0	279	279

TABLE 10: STATLANT CATCH REPORT — DIVISIONS OF ENDERBY-WILKES SUBAREA (58.4)
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	DIVISION 58.4.1	DIVISION 58.4.2	DIVISION 58.4.3	DIVISION 58.4.4	DIVISION UNKNOWN	ENDERBY – WILKES TOTAL
	86	SUN	0	0	0	0	757	757
annual subtotals			0	0	0	0	757	757
Euphausia superba Antarctic Krill								
	74	JPN	0	283	0	163	0	446
annual subtotals			0	283	0	163	0	446
	75	JPN	0	2642	0	35	0	2677
annual subtotals			0	2642	0	35	0	2677
	76	JPN	73	4326	0	351	0	4750
annual subtotals			73	4326	0	351	0	4750
	77	JPN	1616	10375	0	810	0	12801
annual subtotals			1616	10375	0	810	0	12801
	78	JPN	12072	12613	16	0	0	24701
annual subtotals			12072	12613	16	0	0	24701
	79	JPN	20571	14128	0	0	0	34699
	79	KOR	0	0	0	0	511	511
annual subtotals			20571	14128	0	0	511	35210
	80	FRA	0	0	0	0	6	6
	80	JPN	22503	10543	25	23	0	33094
	80	SUN	0	0	0	0	83764	83764
annual subtotals			22503	10543	25	23	83770	116864
	81	JPN	18805	3988	0	0	0	22793
	8l	SUN	0	0	0	0	132237	132237
annual subtotals			18805	3988	0	0	132237	155030

TABLE 10: STATLANT CATCH REPORT — DIVISIONS OF ENDERBY-WILKES SUBAREA (58.4)
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	DIVISION 58.4.1	DIVISION 58.4.2	DIVISION 58.4.3	DIVISION 58.4.4	DIVISION UNKNOWN	ENDERBY – WILKES TOTAL
	82	JPN	22409	4759	0	0	0	27168
	82	KOR	0	0	0	0	1429	1429
	82	SUN	0	0	0	0	119381	119381
annual subtotals			22409	4759	0	0	120810	147978
	83	JPN	27816	4250	0	0	0	32066
	83	KOR	0	0	0	0	1959	1959
	83	SUN	0	0	0	0	45620	45620
annual subtotals			27816	4250	0	0	47579	79645
	84	JPN	8195	0	0	0	0	8195
	84	KOR	0	0	0	0	2657	2657
	84	SUN	0	0	0	0	12045	12045
annual subtotals			8195	0	0	0	14702	22897
	85	SUN	0	0	0	0	3683	3683
annual subtotals			2249	0	0	0	3683	5932
	86	SUN	0	0	0	0	10648	10648
annual subtotals			0	0	0	0	10648	10648

ANNEX 9

REPORT OF THE INFORMAL GROUP ON THE LONG-TERM PROGRAM OF WORK FOR THE SCIENTIFIC COMMITTEE

REPORT OF THE INFORMAL GROUP ON THE LONG-TERM PROGRAM OF WORK FOR THE SCIENTIFIC COMMITTEE

INTRODUCTION

During the Fourth Meeting to the Scientific Committee, it was agreed that the Committee's ability to successfully achieve its goals would be enhanced by outlining and annually updating a long-term program of work. This establishment of such a long-term agenda would permit the orderly and sequential development of the appropriate data bases and analyses required to meet obligations specified in the Convention.

2. At its Fourth Meeting, the Scientific Committee developed a provisional matrix including anticipated activities for the next 5 years (Appendix I). In keeping with the agreement that this matrix should be updated regularly, a number of Members met informally just prior to the Fifth Meeting of the Scientific Committee (Appendix 3). The following paragraphs and the updated activity matrix (Appendix 2) reflect these informal discussions.

ADVICE TO THE COMMISSION

3. Purpose: The Scientific Committee has the responsibility to provide the best scientific advice on the status of living resources and the marine ecosystem to the Commission, to ensure the wise conservation and management of resources according to Article II of the Convention.

4. Strategy:

(a) Review results of stock assessment and ecosystem monitoring activities, including research methods and their ability to help achieve priority objectives of the Commission, and report the results of these analyses to the Commission with regard to the status of living resources and the ecosystem.

(b) Establish criteria for conservation measures.

(c) Review the effectiveness of conservation measures.

5. In formulating advice to the Commission, there was general support for using the approach outlined in the paper circulated by D. Miller entitled, 'Modelling and Decision Making as Part of the CCAMLR Management Regime'. In this context, it was also noted that without data on the historical responses of stocks, it will be difficult to use such models to predict possible effects of different management strategies.

6. The Scientific Committee must define in more detail the process by which it formulates advice to the Commission (procedural mechanisms). Furthermore, the Committee needs to annually review the actual steps that can be taken to meet its responsibility to provide advice and management options to the Commission.

7. The activity on the long-term plan dealing with protocols for management advice is an essential component of other work. A clear idea of the objectives for formulating scientific advice to the Commission is necessary for designing research and analysis programs in order to ensure that the data collected and methods used are necessary and sufficient for achieving conservation objectives.

FISHERY STOCK ASSESSMENTS

8. Purpose: To evaluate the status of target species such as krill and finfish in order to provide a background for the development of conservation and management strategies. To collect, analyse, and interpret data both through commercial fishing and scientific research activities.

9. Strategy:

(a) Monitor catch and fishing effort of commercial fishing activity in the Convention area.

(b) Evaluate interannual variation and monitor distribution of krill, fish, and other prey.

(c) Evaluate sampling biases.

(d) Initiate time-series surveys to assess spatial and temporal variability of fish and krill stocks, independent of commercial fishing operations.

MAMMAL AND BIRD POPULATION ASSESSMENTS

10. Purpose: Review and, in consultation with SCAR, IWC, and other expert groups, assess the status and population trends of Antarctic whales, seals, and seabirds, with special attention given to the recovery of depleted or declining stocks.

11. Strategy:

(a) Identify priority data requirements and determine optimal sources of data to asses population status and trends.

(b) Recommend steps to improve the accuracy of stock assessments and to facilitate the recovery of depleted or declining populations.

(c) Co-ordinate and encourage close interactions with groups outside of the Scientific Committee with expertise in Antarctic marine mammals and birds such as the International Whaling Commission, the SCAR Group of Specialists on Seals, and the SCAR Subcommittee on Bird Ecology.

12. The Scientific Committee should take care not to duplicate the efforts of existing expert mammal and bird groups outside of CCAMLR. Instead, the Committee should identify the types of data that it requires, and determine through consultation the extent to which other expert groups can fulfil these needs. The Scientific Committee will then be in a position to decide whether it will undertake selected priority assessments on its own.

ECOSYSTEM MONITORING

13. Purpose: To detect and record significant changes in key components of the ecosystem, to serve as the basis for the conservation of Antarctic marine living resources.

14. Strategy:

(a) Design and implement a system that monitors key predator and prey components of the ecosystem.

(b) Recommend research protocols and methodologies for the monitoring program.

(c) Initiate and/or continue time-series of measurements on selected parameters of krill and its predators.

(d) Co-ordinate the collection, handling, analysis, and interpretation of monitoring data.

APPENDIX I

ACTIVITIES TO BE COMPLETED PRIOR TO THE SCIENTIFIC COMMITTEE'S MEETING HELD DURING THE YEAR INDICATED

AREAS TO BE ADDRESSED BY THE SCIENTIFIC COMMITTEE	1985	1986	1987	1988	1989	1990
ADVICE TO THE COMMISSION	Formulate operational objectives and promulgate scientific advice protocols					
	Review effectiveness of conservation measures —– –>	—– –>	—– –>	—– –>	—– –>	—– –>
FISHERY STOCK ASSESSMENT	Establish data collection and reporting requirements for finfish	Implement routine reporting of commercial fish data and establish CCAMLR data base —– –>	—– –>	—– –>	—– –>	—– –>
		Update stock assessments —– –>	—– –>	—– –>	—– –>	—– –>
		Define spatial distribution and mesh selectivity for management advice				
		Obtain available historic fish data for data base				
		Define recruitment index surveys	Implement recruitment index surveys —– –>	—– –>	—– –>	—– –>
	Evaluate results of krill CPUE workshop	Consider interim report of krill CPUE simulation study	Consider final report of krill CPUE simulation study	Implement routine reporting of commercial krill data and establish CCAMLR data base as necessary —– –>	—– –>	—– –>
			Establish krill fishery data collection and reporting requirements as appropriate	Obtain available historic krill fishery data		
		Encourage directed stock assessment research				
MAMMAL/BIRD ASSESSMENT		Review current status of whale and seal stocks	Evaluate potential methods for monitoring population trends			
ECOSYSTEM MONITORING	Evaluate feasibility and desirability of ecosystem monitoring program	Design and plan ecosystem monitoring program	Begin to establish baselines for priority indicators	Review results of previous years —– –>		Initial 5 year program review
		Define remote sensing archive needs for physical environment data	Establish remote sensing archive	Continue to develop data base —– –>	—– –>	
			Establish historic relational data base			

APPENDIX 2

GENERIC ACTIVITIES FOR CONSIDERATION OF INCLUSION IN THE LONG-TERM PLAN OF THE SCIENTIFIC COMMITTEE

Areas to be addressed by the Scientific Committee	1986	1987	1988	1989	1990
ADVICE TO THE COMMISSION	Formulate immediate and practical objectives —– – – –>	—– – – –>	—– – – –>	—– – – –>	
	Provide best scientific information available on changes in the status of the living resources and the ecosystem —– – – –>	—– – – –>	—– – – –>	—– – – –>	
	Provide management advice —– – – –>	—– – – –>	—– – – –>	—– – – –>	
	Review effectiveness of conservation measures —– – – –>	—– – – –>	—– – – –>	—– – – –>	
FISHERY STOCK ASSESSMENTS					
FINFISH:	Implement routine reporting of commercial fish data and establish CCAMLR data base by establishing formal requirements for reporting age and length data from commercial fisheries —– – – –>	—– – – –>	—– – – –>	—– – – –>	
	Update stock assessments —– – – –>	—– – – –>	—– – – –>	—– – – –>	
	Define spatial distribution of stocks —– – – –>	—– – – –>	—– – – –>	—– – – –>	
	Determine mesh selectivity for management advice				
	Obtain available historic fish data for data base				
	Develop requirements for future data from research vessel fish surveys, means of coordinating program among countries, and specific objectives	Conduct scientific research surveys for stock assessment and mesh selectivity studies —– – – –>	—– – – –>	—– – – –>	
	Define recruitment index surveys	Implement recruitment index surveys	Review results of fish surveys —– – – –>	—– – – –>	
	Determine extent & status of ichthyoplankton collections and establish species list and reference collection	Conduct ichthyoplankton and larval fish surveys	Refine estimates of abundance and evaluate year to year variations and trends —– – – –>	—– – – –>	
		Establish long-term sampling protocol	Refine estimates of recruitment year to year —– – – –>	—– – – –>	

Areas to be addressed by the Scientific Committee	1986	1987	1988	1989	1990
KRILL:	Review status of krill CPUE simulation study	Consider interim report of krill CPUE simulation study	Consider final report of krill CPUE simulation study		
		Initiate stock assessment surveys and baseline studies	Continue stock assessment surveys and baseline studies —– – – –>	—– – – –>	—– – – –>
		Conduct acoustic targetstrength measurements on krill and other prey —– – – –>	—– – – –>	—– – – –>	—– – – –>
		Evaluate statistical bias in year types —– – – –>	—– – – –>	—– – – –>	—– – – –>
			Conduct small-scale studies on krill patch and swarm structure and its effects on population dynamics —– – – –>	—– – – –>	—– – – – –>
			Establish krill fishery data collection and reporting requirements as appropriate		
				Implement routine reporting of commercial krill data & establish CCAMLR data base as necessary —– – – –>	
			Obtain available historic krill fishery data		
			Refine estimates of abundance and evaluate year to year variations and trends —– – – –>	—– – – –>	—– – – – –>
			Evaluate effectiveness of photographic or video methods of size and acoustic target observations		

Areas to be addressed by the Scientific Committee	1986	1987	1988	1989	1990
MAMMAL AND BIRD POPULATION ASSESSMENTS					
WHALES:	Re-analyse historical whaling data for distribution and abundance trends —– –>				
		Evaluate potential utility of sightings data for investigating stock recovery, abundance and distribution —– –>	—– –>	—– –>	—– –>
		Assess feasibility of using photogrammetry and satellite telemetry to assess distribution, movements, and behaviour —– –>			
			Develop experimental protocol for deploying satellite-linked telemetry —– –>		
SEALS:	Refine population estimates for pack ice seals —– –>		—– –>	—– –>	—– –>
	Review the status of population of southern elephant seals, especially in areas where declining —– –>		—– –>	—– –>	—– –>
	Review the status of recovering populations of Antarctic fur seals and initiate surveys where needed	Assess the recovery of Antarctic fur seals at selected sites —– –>	—– –>	—– –>	—– –>
SEABIRDS:	Review the current status of seabird populations —– –>		—– –>	—– –>	—– –>
ECOSYSTEM MONITORING	Design and plan the ecosystem monitoring		Review results of previous years and modify plans as required —– –>		Program review —– –>
	Define remote sensing archive needs for physical environment data	Establish remote sensing archive			
	Evaluate technological needs to achieve predator monitoring goals	Develop appropriate technological instruments to aid monitoring activities —– –>	—– –>	—– –>	—– –>
	Begin to collect data on recommended parameters to form baseline	Establish historic relational data base	Continue to develop and analyse data base —– –>	—– –>	—– –>

APPENDIX 3

INFORMAL GROUP ON THE LONG-TERM PROGRAM OF WORK FOR THE SCIENTIFIC COMMITTEE

7 September 1986, Hobart

LIST OF PARTICIPANTS

J.L. BENGTSON	U.S.A.
P.G. CHITTLEBOROUGH	Australia
M.H. CORTES	Brazil
W. DE LA MARE	Australia
S.N. DWIVEDI	India
P. HEYWARD	Australia
T. HOSHIAI	Japan
J.-C. HUREAU	France
K.R. KERRY	Australia
K.-H. KOCK	European Economic Community
A. MAZZEI	Chile
D. MILLER	South Africa
O.J. ØSTVEDT	Norway
D.L. POWELL	Secretariat
P. QUILTY	Australia
D.A. ROBERTSON	New Zealand
D. SAHRHAGE	Federal Republic of Germany
K. SHERMAN (Chairman)	U.S.A.
Y. SHIMADZU	Japan
W. SLOSARCZYK	Poland
J.G. COOKE	IUCN (Observer)

ANNEX 10

DRAFT SCIENTIFIC COMMITTEE BUDGET FOR 1987

DRAFT SCIENTIFIC COMMITTEE BUDGET FOR 1987

1. The budget figures proposed are upper limits of the potential costs. Actual costs will depend on such factors as venues and availability of support services for working groups. It is emphasised that savings will be made wherever possible.

WORKING GROUP ON FISH STOCK ASSESSMENT

2. The Scientific Committee recommended that, subject to the availability of sufficient data and information on Antarctic fish stocks and related fisheries activities, there should be an intersessional meeting of this Working Group under the convenership of Dr K.-H. Kock (FRG) in Hobart from 20–23 October 1987.

3. The budget would need to allow for computing, stationery and administrative expenses, translation and publication of the report, and the travel and subsistence costs for the participation of one invited specialist, if required, to be financed from the contingency item.

4. Costs have been estimated as follows:

Computing	2,000
Publication and translation of report	7,900
Stationery/Administration	-1,000
Total Cost	$A10,900

WORKING GROUP FOR ECOSYSTEM MONITORING PROGRAM

5. The Scientific Committee recommended that an intersessional meeting of the Group be held from 8 to 13 June 1987 in Paris under the convenership of Dr K. Kerry (Australia).

6. One and a half days of the meeting are to be devoted to a special session to consider the development and use of remote sensing and other advanced technology for ecosystem monitoring. For this special session, the participation of three invited experts is envisaged.

7. The budgetary implications are for administrative costs, translation and publication of the report and costs of participation of three invited experts.

8. Costs have been estimated as follows:

Invited experts – travel and subsistence	8,800
Stationery/Administration	3,000
Publication and translation of report	7,900
Total Cost	$A19,700

KRILL SIMULATION STUDY

9. The Scientific Committee noted that due to the difficulty in finding the required consultants to work on this study, there has been a delay in its execution. There was no expenditure in 1986 on this Study.

10. The Scientific Committee recommended that the last year's budget for year 1986 and 1987 be carried forward to 1987 and 1988. A small allowance for an increase in publication and translation costs has been allowed for 1988.

11. The budgetary implications in this simulation study include consultant services, travel, administrative expenses, computing and translation and publication of the report.

12. Costs have been estimated as follows:

	1987	1988
Consultant services (4 man-months)	12,500	12,500
Travel	6,800	-
Stationery/Administration	1,500	1,500
Computing	2,000	4,000
Publication and translation of report	_____	7,900
Total Cost	$A22,800	$A25,900

CCAMLR/IOC SCIENTIFIC SEMINAR ON ANTARCTIC OCEAN VARIABILITY AND ITS INFLUENCE ON MARINE LIVING RESOURCES, PARTICULARLY KRILL

13. Following an earlier decision that CCAMLR will co-sponsor this Seminar with the Intergovernmental Oceanographic Commission (IOC), the Seminar is scheduled to be held at UNESCO Headquarters in Paris from 2–6 June, 1987 with Dr D. Sahrhage (FRG) as the

Convener.

14. It was noted that the $A3,000 allocated in the 1986 budget for invited experts will not be required. The Scientific Committee recommended that this sum be carried over to 1987 to help pay for the production of a book containing the papers submitted to the Seminar. The book is to be edited by Dr D. Sahrhage (FRG) and published by Springer Verlag within one year of the end of the Seminar.

15. The cost of up to 350 printed pages will be covered by the publisher. Pages in excess of 350 will cost approximately $A50 per page and will have to paid for by CCAMLR/IOC, and possibly other sources.

16. It is foreshadowed that, if required, a further amount not to exceed $A3,000 may be required in 1988.

SPECIES IDENTIFICATION SHEETS

17. At its second meeting, the Commission agreed to contribute to the joint publication of Species Identification Sheets with FAO, the following funds over 3 years:

1984	20,000
1985	14,000
1986	12,000
	$A46,000

18. At its fourth meeting, the Commission agreed to further funding as follows:

1986	14,000
1987	14,500
	$A28,500

19. Thus, the total funding approved over four years was $A74,500.

20. A progress report on the Species Identification Sheets was distributed to the Standing Committee on Administration and Finance by the Secretariat.

CONTRIBUTION TO CCAMLR RELATED ACTIVITIES OF BIOMASS

21. The Scientific Committee realised the important work being done within the BIOMASS Program related to CCAMLR, in particular the Workshops on Fish Ecology, on Krill Acoustics and on Krill Physiology and Biochemistry (as regards age and growth of krill).

22. It was recommended with the objection of Dr Lubimova (USSR) that a sum of $A10,000 be made available to support BIOMASS activities directly related to CCAMLR.

SECRETARIAT TRAVEL – DATA MANAGER AND SCIENCE OFFICER

23. It is essential that the Data Manager, to be recruited, visits the Convener of the Working Group on Fish Stock Assessment, Dr K.-H. Kock (FRG) in Hamburg, the Co-ordinator of the Krill Simulation Study, Dr. J. Beddington, in London and the BIOMASS Data Centre in Cambridge to discuss data collection, submission and evaluation.

24. The Science Officer needs to attend the CCAMLR/IOC Scientific Seminar on Antarctic Ocean Variability and the meeting of the Working Group for Ecosystem Monitoring Program, to be held immediately after the Seminar in June 1987 in Paris.

25. The costs are estimated as follows:

Data Manager	7,200
Science Officer	7,200
	$A14,400

SUMMARY SCIENTIFIC COMMITTEE BUDGET

	1987	1988
	$A	$A
Working Group on Fish Stock Assessment	10,900	
Working Group on Ecosystem Monitoring Program	19,700	
Krill Simulation Study	22,800	25,900
CCAMLR/IOC Scientific Seminar	3,000	3,000
Species Identification Sheets	14,500	
CCAMLR/BIOMASS	10,000	
Secretariat Travel – Data Manager, Science Officer	14,400	
Contingency	6,800	
Total	102,100	

The suggested funding is:

Commission's Budget	63,500
Norwegian Contribution Special Fund	38,600
	$A102,100