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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REPORT OF THE FOURTH 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 2 to 9 September, 1985 at the Wrest Point Hotel, Hobart.

1.2 Representatives from the following members attended the meeting: Argentina, Australia, Belgium, Chile, European Economic Community, Federal Republic of Germany, France, German Democratic Republic, Japan, 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 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 Brazil, India, the Republic of Korea and Spain also participated as observers by invitation. Dr J. Gulland participated as a specialist invited by CCAMLR.

1.4 The Chairman welcomed delegates and observers, and encouraged the observers to participate, as appropriate, in discussions of agenda items 4 to 9 and item 12.

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. Gulland (fish stock assessment and squid resources), Dr I. Everson (UK) (krill resources), Mr D. Miller (South Africa) (ecosystem monitoring and management), Dr G. Chittleborough and Dr K. Kerry (Australia) (data collection and handling), and Dr J. Bengtson (USA) (all other agenda items). Dr E. Sabourenkov (CCAMLR Secretariat) coordinated the integration of these components into the complete report of the Scientific Committee.

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* The first part of the number relates to the appropriate item of the agenda.

ADOPTION OF THE AGENDA

2.1 There was a discussion of some proposals to modify the wording of agenda item 7. It was agreed that the title of this agenda item would remain unchanged, as Ecosystem Monitoring and Management.

2.2 The provisional agenda was adopted (Annex 3).

REPORT BY THE CHAIRMAN

3.1 The Chairman noted that decisions of the Scientific Committee at the last meeting had resulted in an active intersessional period. He thanked the Secretariat, and conveners, rapporteurs, and members of working groups and workshops for their valuable work.

3.2 The *Ad Hoc* Working Group on Ecosystem Monitoring, chaired by Dr K. Kerry (Australia), met at the National Marine Mammal Laboratory, National Marine Fisheries Service, Seattle, USA on 6 to 11 May, 1985.

3.3 A workshop on Krill Catch-Per-Unit Effort (CPUE), chaired by Dr W. Ranke (GDR) and Dr I. Everson (UK), met in Hobart on 21, 22 and 29 August, 1985.

3.4 The *Ad Hoc* Working Group on Fish Stock Assessment chaired by Dr R. Hennemuth (USA), met in Hobart on 23 to 28 and 30 August, 1985.

3.5 The Chairman noted that staff of the Secretariat had visited the fishing nations Chile, France, GDR, Japan, Poland and the USSR, during the inter-sessional period to evaluate data collection and handling procedures. The Secretariat identified some major problems regarding data submission that require the Scientific Committee's further attention.

3.6 Reports of members, reflecting fisheries and scientific activities undertaken during the past year, had not been received from all members as required. Some members submitted their reports well in advance of the meeting, allowing time for translation and distribution early in the meeting. Others submitted reports during the Working Group meetings immediately preceeding the Scientific Committee meeting and some members submitted their reports during the Scientific Committee meeting itself. Because of the heavy translation load, the reports submitted immediately prior to and during the meeting could not be translated during the meeting and had to be distributed in the original language only. The Chairman

further noted that reports from three members regarding activities in 1984 had still not been received. The representative from the EEC made a verbal report that no scientific or fisheries activities had been undertaken during the past year.

3.7 It was noted that the importance of submitting reports of members on time, as well as report content, style and uniformity would be discussed in further detail under agenda item 11.

3.8 The Chairman informed the Committee that during the inter-sessional period he had been in contact with the Secretariat of CCAMLR, the conveners of Working Groups and representatives of FAD, BIOMASS and IOC concerning various aspects of the Committee's work.

3.9 The Chairman recalled that the first conservation measures of the Convention came into force in April, 1985. He noted that the international community was watching the Scientific Committee critically for further positive steps towards conservation in support of the Convention by providing sound advice to the Commission.

FISH STOCK ASSESSMENT

4.1 The Report of the *Ad Hoc* Working Group on Fish Stock Assessment (Annex 4) which had met in Hobart from 23–30 August, 1985 was presented by the Chairman, Dr R. Hennemuth, who also had prepared Chairman's comments on the main conclusions of the Working Group (Annex 5). The Committee noted that considerable progress had been made in several aspects of the Working Group's tasks and thanked the members of the group, together with the Chairman and Rapporteur (Dr J. Gulland) for their hard work.

4.2 The Committee also had available to it the recently published BIOMASS study 'Biology and Status of Exploited Antarctic Fish Stocks' (BIOMASS Scientific Series No. 6). It congratulated the three authors concerned on their work, and thanked SCAR and the SCAR Observer (Mr N. Bonner) for arranging for this report to be available in Hobart so soon after publication.

AVAILABILITY OF DATA

4.3 The Working Group had available to it a considerable addition to the previously available data, especially relating to length and age composition of catches around South Georgia. This enabled it to make significant advance on the preliminary analyses presented at the 1984 Commission Meeting. However, there were still a number of major problems in the supply of data.

4.4 One specific question concerned the representativeness of the information on age and length composition collected from the Soviet research vessels. It was noted in the report of the Secretariat visit to the USSR (SC-CAMLR-IV/5, paragraph 30) that because identical fishing gears were used and areas fished were similar, the samples taken on board research vessels were thought to be representative of commercial catches. However, the Working Group had noticed, in the case of *Champsocephalus gunnari*, the inconsistency between the sizes reported in the research vessel catches (with many fish less than 30 cm) and the fact that the Soviet commercial fleet had been observing a 30 cm size limit with an allowance of only 15% (by weight) of smaller specimens. The Working Group had therefore concluded (Annex 4, paragraph 25) that the research vessel samples were not representative of the commercial catches, and that in the absence of reliable catch-at-age data it was impracticable to attempt a Virtual Population Analysis (VPA).

4.5 It was explained that the research vessel activities were spread over the whole area of the continental shelf, whereas the commercial catches were concentrated in the most favourable places for fishing. In the case of *C. gunnari* there were large differences in the sizes of fish occurring in different areas, which could explain the difference between research vessel and commercial catches. While samples with the wide geographical spread of the research vessel data were valuable for some purposes, for other purposes, e.g. VPA, it was essential to have reliable information on the actual size composition of the removals of the stock.

4.6 Most of the participants pointed out that where there might be differences between the sizes of fish caught by commercial and research vessels, arrangements should be made to sample directly the catches of the commercial vessels. It also noted that because of the differences in sizes between areas, it was essential, for reliable interpretation of the data, to know where different samples had been taken. It was also stressed that all biological data should in future be reported by fine geographical break-down, preferrably by one degree by half degree squares, or finer. It noted that a break-down of this type was already in use when

reporting Kerguelen data. In that area there did not seem to be a problem about the representativeness of the research vessel data.

4.7 The Committee endorsed the recommendation of the Working Group that in future all reporting of length frequencies should be by one centimetre groupings, measurements being carried out according to BIOMASS standards. In reporting biological data, the source of the data (commercial or research vessel etc.) and mesh size used should be clearly specified.

4.8 The Working Group had examined a number of discrepancies in the statistical data reported to the Commission, regarding reporting by split years, and the allocation to sub-areas. It recommended that the revised figures contained in paragraphs 4 and 5 of the Working Group report should be incorporated in the Commission's data base.

4.9 The Committee also noted that very few detailed catch and effort data had been available to the Working Group in respect of the South Georgia fishery. In particular, only data from Poland were available for area break-down smaller than the sub-areas of the STATLANT form. In contrast, detailed data including break-downs by one degree by half degree squares were available for the fishery at Kerguelen from 1979 onwards. Absence of detailed data has severely limited the types of analysis that could be used in studying the fish stocks. For the South Georgia stocks, analyses had to be restricted almost entirely to the examination of age and length data, whereas at Kerguelen, it had been possible to examine the detailed distribution of catches in space and time, and the year to year trends in abundance as indicated by detailed CPUE data. This had made it possible to determine more precisely the state of the Kerguelen stocks and the magnitude of the potential yield of these stocks. It was also difficult or impossible, in the absence of detailed area break-down of catch data, to determine for the South Georgia stocks the possible effectiveness of management measures such as partially closed areas or closed seasons. The Committee therefore reaffirmed the view expressed in its 1984 report (SC-CAMLR-III, paragraph 7.51) taking account of the remarks of some delegations incorporated therein, that for stock assessment work it was essential to have detailed catch and effort data, along the lines set out in Appendix 6 of Annex 6, and Appendix III of Annex 8 of the 1984 report.

4.10 The Committee noted that few new data had become available for the fish stocks in other parts of the Atlantic sector (Peninsula area, South Orkneys, South Shetlands), and that therefore the Working Group had not attempted any new analysis for that area. It noted that biological data were available from FRG and Japan and had also been reported during the meeting by the GDR, and that some interpretations of the available data, including biomass estimates, were included in the BIOMASS study (BIOMASS Scientific Series No.6).

4.11 The Committee also noted that at the time of the Working Group meeting, the statistics for the 1983/84 season ending in June 1984, were incomplete and the data from the USSR were absent. This seriously inhibited the ability of the Working Group, and the Committee, to give comprehensive and up-to-date advice on the status of the stocks.

STOCK ASSESSMENT RESULTS

South Georgia

Notothenia rossii

4.12 The 1984 report of the Scientific Committee (SC-CAMLR-III, paragraph 7.11) concluded that 'this stock is very severely affected by fishing'. All the further information discussed during the present meeting confirmed that conclusion. Not only was the stock depleted by the very large catches between 1969 and 1971, but the relatively small catches taken since then have been sufficient to cause further declines. Though the strengths of the year-classes currently in the fishery are not precisely known, they are certainly small, and even small catches will be sufficient to prevent a recovery. The information on yield-per-recruit and current year-class strength, as well as on the effects of recent catches suggest that the current replacement yield is less than a thousand tons. In contrast, if the spawning stock could be rebuilt to provide recruitment of say 10 million fish (i.e. rather less than the recruitment in the 1960s), and the fishing mortality and age at first capture adjusted to provide a yield of around 1000 gm per recruit, this would correspond to a sustainable annual yield of around 10,000 tons.

Champsocephalus gunnari

4.13 While it appears that this stock is heavily fished, there is no indication that recruitment has, up to the present, been affected. Though the information on year-class strength is not as good as for Kerguelen, it does suggest that, as in the case at Kerguelen, recruitment at South Georgia is variable. This variability is in part the cause of the high variability in annual catches, and this effect is increased by the degree to which recent catches are dominated by a single year-class. This, as noted last year, makes the fishery vulnerable to years of low recruitment, a possibility which has to be recognised if the high level of mortality continues.

4.14 For both species, the yield-per-recruit calculations indicated that increases would be obtained by increasing the age at first capture or reducing fishing mortality. Substantial reductions in fishing mortality, even to less than about 20% of current levels, would not much decrease yield-per-recruit and would increase spawning stock.

Notothenia gibberifrons

4.15 There has been a clear upward trend in total mortality as estimated from mean lengths from about 0.1 in 1975/76, to 0.3 or more after 1981. This seems almost certainly due to the increased catches; catches were negligible before 1975. The data suggest the current values of F and M are around 0.2 and 0.1 respectively. It seems probable that fishing mortality (as an average over the last years) is well in excess of natural mortality. This high rate of fishing may be detrimental to the stock in the long run. It was noted that this species is taken primarily as a by-catch.

4.16 It was noted that figures of CPUE given for this species in Table 2 of the Working Group's report (Annex 4) showed a continuous decline from 1978 to 1984. However, Mr Slosarczyk (Poland) pointed out that this was not a homogeneous series. The 1978–1980 data were based on bottom trawl, and 1982 and 1984 on mid-water trawl. Even though there were still downward trends within each sub-series, this observation cast doubt on the validity of the overall trend as a true measure of the change in stock size. However, it did emphasise the importance of reporting catch and effort data in as much detail as possible.

Dissostichus eleginoides

4.17 The Working Group had listed this species in its 1984 report among the species requiring management action, but had not considered it during its 1985 meeting. This fish appears to have a sporadic distribution, being mainly caught in deep waters. Total catches have been small, and are composed mainly of juveniles.

Other Species

4.18 In its 1984 report (SC-CAMLR-III, paragraph 7.12) the Committee had expressed some concern over the stocks of *Pseudochaenichthys georgianus* around South Georgia. The data are too sparse to show any clear trends for *P. georgianus*. The same situation applies

also to *Chaenocephalus aceratus*. Reported catches of both species were low except in 1977/78 when 13,000 tons of *P. georgianus* were reported. Some of the actual catch for these species may be part of the large reported catches of unidentified species.

4.19 The available data are felt still to be insufficient for a clear assessment.

Kerguelen

Notothenia rossii

4.20 The decline of this stock has continued and there is some evidence that recruitment has been adversely affected. The annual average catches of around 5000 tons since 1980 have been greater than the recruitment rate.

Champsocephalus gunnari

4.21 Length and age analysis of this relatively short-lived species show that there are large variations in year-class strength. A good cohort was born in 1979, and supported good catches in the 1981/82 and 1982/83 seasons, but has now become scarce. Information from the 1984/85 season suggests that the 1982 cohort is also good. The relatively high total mortality suggests that fishing mortality is significant, but there is no evidence that this is affecting recruitment.

Notothenia squamifrons

4.22 Recent catches have been considerably smaller than the peak catches of 26,500 and 51,000 tons taken in the 1970/71 and 1971/72 seasons. However, there is no evidence to determine whether there has been a decline in stock size, or whether the decrease in catch is due more to a decrease in fishing effort on a species which is less attractive commercially than *N. rossii*.

4.23 It was noted that there were few data available on the fishery prior to 1979. Such data, particularly series of age and length data would need to be made available for making a long-term study of the fishery, and thus obtaining improved estimates of sustainable yield.

Other Areas in the South Atlantic

4.24 Because few data had been reported to the Commission, the Working Group did not attempt to assess the stocks in other parts of the South Atlantic region. Total catches from the Peninsula region and around the South Orkneys (sub-areas 48.1–48.2) up to 1982/83 season (with incomplete reports for the 1983/84 season) were about 80,000 tons and about 200,000 tons respectively. These figures include estimates of the quantities from these sub-areas for which the sub-area of capture was not identified in the original reports. These include peak catches of 18,800 tons of *N. rossii* from the Peninsula sub-area in 1979/80, and about 150,000 tons of *C. gunnari* from the South Orkneys sub-area in 1977/78. Catches of 12,300 tons of unidentified species were reported by the Soviet Union from the South Orkney region in 1981/82, but otherwise recent catches have been small. Reported catches in 1983/84 from sub-area 48.2 were in the order of 12,000 tons (mostly *N. gibberifrons*). No catches were reported from 48.1 in that season.

4.25 It was not possible to make assessments of these stocks with the available data, but it was pointed out that at both South Georgia and Kerguelen one or two seasons of relatively high catches had been sufficient to deplete severely the *N. rossii* stocks.

BY-CATCHES IN THE KRILL FISHERY

4.26 The Committee noted that quantities of small fish had on occasion been taken in krill trawls on the shelf areas, and that this might potentially cause a management problem.

4.27 Both at South Georgia and in the Prydz Bay region by-catches of small fish are scarce or absent in deep waters, but tend to increase as the shelf is crossed and on parts of the shelf, e.g. near the Clark Rocks south-east of South Georgia three trawl hauls by an FRG research vessel contained a significant number of small fish. There are some indications in various published papers that late postlarval and juvenile fish (age groups 0 and 1) feeding on sub-adult krill, are found in the areas where krill concentrations are exploited by the fishery. The work during FIBEX and SIBEX confirmed in part these indications, but at the same time suggested some possible solutions to the problem.

4.28 In commercial krill fishing incidental catches of small fish can interfere with processing the catch. Locations of high by-catch are therefore avoided, and the incidence of such catches in the commercial fisheries is therefore very small especially in the off-shore, deep-water operations such as the Japanese.

4.29 The Committee believed, therefore, that by-catches in the krill fishery were not, at the present, a management problem. Fish seem to be most common over the shelf areas, and in rather dispersed patches of immature krill. The avoidance by the krill fishery of shallow onshore waters and dispersed patches of immature krill should, under current conditions, give protection to postlarval and juvenile fish. However, it believed that the matter should be kept under review. Further research should be encouraged, and the results of new and existing studies, including the results of the SIBEX work, should be reported to the Committee.

ADVICE TO THE COMMISSION

General comments on mesh regulations

4.30 There were no direct observations on selectivity for Antarctic fish available to the *Ad Hoc* Working Group, which was therefore unable to specify what precise mesh size would correspond to desired sizes of first capture, or minimum fish sizes.

4.31 In the Convention area, comparisons of catches by research vessels using small meshes with those of the commercial fleets have shown that for *C. gunnari* the larger size meshes in commercial nets do release the smallest size-class of fish (ca. 15 cm). For the other species including *N. rossii* a comparison of the data sets shows no such difference, with very small fish being absent even from the small mesh catches. This suggests that the small fish are absent from the commercial fishing grounds and that all sizes of fish offshore can be retained in the mesh sizes now in use.

4.32 The Committee noted that when mesh regulations are in force, there should be clear specifications of how the mesh sizes should be measured. This matter has been considered in detail by several other International Fishery Commissions. The experience of these bodies, and their member states, should be drawn upon in determining appropriate specifications for CCAMLR. A form of words currently used at Kerguelen, which might provide a basis for such specification, is given in the Working Group report (paragraph 44).

Status of the stocks

South Georgia

Notothenia rossii

4.33 This stock is severely depleted and the only hope for significant catches in the future is to rebuild the spawning stock. There should certainly be no directed fishery, but since any incidental catches would cause further declines in the stock, measures should also be taken to keep incidental catches to a minimum. Because the juveniles, up to about 4 or 5 years of age, are distributed in the coastal areas, protection of these fish is achieved by the closure of the coastal zone. However, all sizes of adult fish offshore can be retained by the mesh sizes now in use, and there will be little benefit from moderate changes in mesh size.

Champsocephalus gunnari

4.34 The stock appears to be heavily fished, even though there is no indication that recruitment has been affected as yet. Gains in terms of yield-per-recruit would be expected from any measures that increased the age of recruitment (e.g. mesh size), or reduced the fishing mortality (e.g. limits on annual catches, or on the number of vessels operating). Measures of the latter type, by increasing the number of year-classes contributing effectively to the fishery, would reduce the year-to-year variability and the vulnerability of the fishery to declines in recruitment.

Notothenia gibberifrons

4.35 The present fishing mortality, though due only to by-catch, appears to be high. It would seem desirable to keep the amount of by-catch to as low a level as practicable.

4.36 The Chairman of the Working Group, Dr Hennemuth, noted that in accordance with the terms of the Convention, especially Article II, the Committee had a responsibility to recommend that conservation measures be taken to restore depleted stocks, such as those of *N. rossii*, though it was a matter for the Commission upon advice by the Scientific Committee to decide on the specific management measures that would best achieve this conservation objective. The problems arose in identifying those measures that would be most effective. Because of the existence of by-catches, individual species catch limits on other species would

not, with certainty, provide adequate protection. Mesh regulations would have little impact on *N. rossii* catches. The closure of parts of the whole area, or for part of the season might in principle provide protection. Unfortunately, the detailed information on catches by small areas was not available to determine whether partially closed areas or seasons, if any, would provide adequate protection to the *N. rossii* stocks. In these circumstances it would seem that a total closure was the only measure that would definitely ensure the conservation of *N. rossii*, and that the Commission should be advised accordingly.

4.37 Dr Beddington (UK) drew attention to a proposal made by Dr Robertson (NZ) at the 1984 session that the South Georgia area (48.3) should be closed to all commercial trawling (SC-CAMLR-III, paragraph 7.34 of the report), and proposed, in the view of the undoubtedly very serious state of the *N. rossii* stock, and the absence of adequate data to determine the effectiveness of other measures, that there should be an indefinite closure of the South Georgia region until enough data had been received by the Commission to estimate safe levels of yield.

4.38 Dr Robertson (NZ), noting his 1984 proposal, stated he fully supported the UK proposal for closing the South Georgia region to all fishing.

4.39 Dr Sherman (USA) emphasised that the Working Group report underlined the serious state of the stocks, and the need to take a conservative approach. He also supported the proposal.

4.40 Mr D. Miller (South Africa) said, given the current unsatisfactory flow of information from the commercial fishery and the apparent depleted state of the important commercial fish species indicated by the data that were available, he supported the resolution to close the South Georgia area (48.3) to commercial fisheries activities for the period of at least one year. In the event of further data becoming available, this closure should be reviewed at the earliest possible opportunity and the best possible scientific evaluation made of the state of the important commercial fish stocks.

4.41 In also supporting the proposal, Dr Kock (FRG) noted the severe decline in recruitment to *N. rossii*, and the requirement under Article II to act to ensure stable recruitment.

4.42 Prof. Hureau (France) also supported the proposal, and noted that in view of the similar decline of *N. rossii* at Kerguelen (58.5) it might be necessary to take similar action in that area.

4.43 Dr Lubimova (USSR) reminded the Committee of the serious conservation measure of closing the 12-mile zone around South Georgia which had entered into force in April 1985. This closed area comprises some 30% of the shelf area adjacent to the island. Such a measure provides full protection for the immature component of the *N. rossii* population. The Soviet fleet has not conducted directed fishing on the spawning component of the population in recent years. In view of this, there is no practical or scientific justification for the closure of the whole South Georgia area. She proposed the continuation of the existing conservation measures adopted by the Commission, including the prohibition of directed trawl fishing for *N. rossii*.

4.44 Dr Shimadzu (Japan) said he also had problems with the proposal. He believed that if there were deficiencies in the supply of data, the proper course would be to postpone decisions to encourage data submission, and discuss the matter further next year when better data should be available. If no additional data were available at the next Commission session, he believed the proposal would then merit very serious consideration.

4.45 Dr Marschoff (Argentina) remarked that fishing fleets never caught the last fish from a stock in a directed operation. Extinction is realised either by a species being unable to re-assert its position in the ecosystem, or being caught as a by-catch. This risk is clear in the case of *Notothenia gibberifrons*, and enough data are available to demonstrate the need for protection. The Argentinian delegation therefore proposed the closure of the South Georgia area to fishing, and recalled its position expressed at the third session concerning conservation measures related to area 48.3 which would have a broader scope than those adopted at that session.

4.46 Dr Ranke (GDR) stated he preferred the species by species approach. He noted that the Commission had introduced a number of measures, including a 12-mile limit, at its 1984 session, and the effects of these measures had not yet been determined. He believed it would be premature to introduce further measures, especially general and somewhat indiscriminate measures, until the effects of existing measures had been fully assessed.

4.47 Dr Chittleborough (Australia) said he had sympathy with the species by species approach, and agreed that with adequate data this should lead to better management. However, he noted the severe decline in recruitment, and believed that effective action was needed to maintain the balance in the ecosystem. He therefore supported the proposal to close the South Georgia area (48.3).

4.48 Mr Slosarczyk (Poland) questioned the necessity of taking such a drastic measure as proposed by the UK. At present the main catches in the area were of *C. gunnari*. For catches of this species taken by Poland with pelagic trawls, the by-catch of other species was very small. For *C. gunnari* the most appropriate measure would be mesh regulation.

4.49 Dr Østvedt (Norway) noted that in other areas experience had shown that the only effective method for restoring severely depleted stocks had been a complete closure for a period. He therefore supported the proposal by the UK. Dr Duhamel (EEC) also supported the proposal.

4.50 In summary, the Committee strongly urged the Commission to take action to conserve and protect the depleted stocks of *N. rossii*, but could not agree on additional management measures necessary to ensure the conservation of the species. It also drew the Commission's attention to benefits in terms of increased yield per recruit that would result from reductions of fishing mortality on *C. gunnari* and *N. gibberifrons*.

Kerguelen

4.51 Since 1979 a number of controls have been progressively established by the French authorities. These are set out in the report of the 1984 meeting of the Scientific Committee (SC-CAMLR-III, paragraph 7.22). However, the Working Group had noted that the present controls seem to have been applied too late to prevent the large initial decline in the stocks, and that there has been a further decline in the stock of *N. rossii* in recent years. The Committee believed that consideration should be given to some strengthening of these controls. It believed that it might also be useful to analyse age and length data for *C. gunnari* to show whether, to improve the yield-per-recruit, it might be desirable to reduce the amount of fishing, or increase the size of first capture.

4.52 In the light of the declining stock of *N. rossii* the Committee believed that further measures were needed, and accordingly recommended that there should be a prohibition of directed fishing for *N. rossii* in the Kerguelen area (58.5), until such time as there was clear evidence that the stocks had recovered, and could sustain significant directed fishing. It noted that the detailed catch and effort statistics showed that the fisheries in this region were largely mono-specific, and that the by-catch of *N. rossii* in fisheries for other species would be very small. A ban on *N. rossii* would therefore involve a reduction of the overall catch limits imposed by France to allow for the elimination of *N. rossii* from the total. It was also

proposed, recognising an existing regulatory measure of France, to prohibit all fishing activities in area 58.6 (Crozet Is. area).

4.53 During the adoption of the final report of the Committee the Soviet delegation reserved its position in respect of the Committee's recommendations for the Kerguelen area (58.5) pending additional scientific information to be made available on the status of the stocks in the area.

4.54 The Committee noted that joint scientific research between France and USSR was planned.

Other Sub-areas in the Atlantic Sector

4.55 No detailed assessments have been made for these sub-areas. Catches have been significant in both 48.1 (Peninsula) and 48.2 (South Orkney) in some past seasons, although current catches are not high. Experience of other sub-areas has shown that Antarctic stocks are sensitive to exploitation, and the stocks of *N. rossii* can be depleted by a single season's heavy fishing. Some concern was therefore expressed that *N. rossii*, and possibly other species, might already be depleted. Concern was also expressed about the possible impact on these stocks of additional uncontrolled fishing effort in these sub-areas by vessels diverted from South Georgia or Kerguelen as a result of management actions in those areas.

4.56 Some delegations were taking account of the experience of uncontrolled fishing in other areas, and of the need to keep fishing effort in balance with the productive capacity of the resource. Dr Tomo (Argentina) expressed his point of view that there is already sufficient scientific evidence to show the desirability of some kind of control on excessive fishing, even if there are insufficient data to specify precisely the optimum control.

4.57 Four possible actions were considered

(a) a complete closure of all further commercial fishing in sub-areas 48.1 and 48.2 until the data from the fishery in previous years had been analysed to determine safe catch limits;

(b) a closure of directed fishing for *N. rossii* in sub-areas 48.1 and 48.2;

(c) a precautionary limit, perhaps of 10,000 tons (i.e. around the level of some recent years), on the total annual catches in each of these two sub-areas;

(d) closure of the area within 12 miles of the coasts in sub-areas 48.1 and 48.2 to commercial fishing.

4.58 In much of the region considered, the continental shelf is very narrow, in many places less than 12 miles. A closure of a 12-mile zone might therefore have similar effects as a complete closure.

4.59 Some members believed a closure pending submission and analysis of data from past fisheries, was the only course that avoided all further risks to the stock, and that there were insufficient data to show whether other measures would be effective. Other members objected to the proposed measures and believed that the scientific evidence available at the present time was insufficient to justify such a drastic measure.

4.60 A number of delegates indicated their view that the closure of directed fishing for *N. rossii* would be the measure that focussed most specifically on what appeared to be the special needs of this species. However, because of the possible occurrence of by-catches it might not, by itself, be sufficient to ensure conservation of *N. rossii*. It also failed to offer protection to other species that might be affected by uncontrolled fishing.

4.61 Dr Robertson (NZ) suggested that precautionary catch limits should be set for all other Antarctic areas to prevent heavy exploitation before research could establish safe harvesting levels. In several areas outside the Antarctic, management authorities have found the setting of precautionary quotas or catch limits a useful way of controlling excess fishing effort pending detailed stock assessments. Some delegates also noted that this approach could have advantages in the Convention area, not only in sub-areas 48.1 and 48.2, but also in other areas where no fishing has so far been done. There was, however, no agreement on what, under present circumstances, would be appropriate precautionary limits in the south Atlantic sub-areas.

4.62 In subsequent discussion it was emphasised that for purposes of regulation it was desirable to specify clearly what area was concerned. In some statements the South Georgia region was taken as being identical with statistical sub-area 48.3 - and similarly for the Kerguelen (58.5), Peninsula (48.1) and South Orkney (48.2) regions. However, it was noted that these sub-areas often covered ocean areas that were much wider than the actual distribution of the fish. Some delegates expressed the view that a narrower definition, for example the waters shallower than 1000 m, might therefore be more desirable. Dr Marschoff (Argentina) felt that the area contained within 24 miles from land would be suitable. It was

felt that a final decision on this matter should be taken by the Commission, taking into account legal questions of enforcement and other non-scientific matters.

4.63 The Soviet delegation pointed out that conclusions and proposals contained in the paragraphs 4.55-–4.62 are not based on specific data. No data relating to 48.1 and 48.2 areas have been analysed by the Working Group or by the Committee and therefore the proposed conservation measures are not justified at all and not acceptable to the Soviet delegation. The delegation proposed to reconsider this matter after appropriate data have been supplied to the Scientific Committee and analysed.

Future activities

4.64 An urgent need was to make assessments of the resources in the Peninsula and South Orkney sub-areas. This work lay within the existing terms of reference of the *Ad Hoc* Working Group on Fish Stock Assessment. The Committee therefore recommended that this Working Group should meet under the convenership of Dr R. Hennemuth (USA), if possible during the inter-sessional period, to give particular attention to the stocks in sub-areas 48.1 and 48.2. It was most important that the group should have available to it full information concerning past fishing activities in those sub-areas, including length and age-composition data, and detailed catch and effort statistics. The details of the requirements are set out in last year's report (SC-CAMLR-III, Appendix III to Annex 8).

4.65 Experience of the recent Working Group meeting had shown the value of some routine processing of data in advance of the actual session (see Annex 4, paragraph 54). The Committee therefore believed that data should be reported well in advance of the meeting, and given some preliminary analysis by the Secretariat under the guidance of the Chairman of the Working Group. The actual date of the meeting should be chosen, after consultation with those concerned with providing data, so as to ensure adequate preparation. It also noted that the meeting would be unproductive, and should not be held if adequate data were not made available.

4.66 The Committee endorsed the suggestions by the Working Party for further research to improve assessments and management advice. The requirements for improved data recording and reporting have already been noted. Research is also needed on mesh selectivity for all Antarctic species, and countries were urged to conduct such experiments during the next year if possible. Surveys of juvenile fish, especially of *N. rossii* in the inshore waters of South Georgia in order to monitor changes in recruitment, would also be valuable. It was noted that

the reference in the Working Group report (Annex 4, paragraph 22) to previous surveys of juvenile *N. rossii* by Soviet scientists was due to a misunderstanding. Such surveys had in fact taken place in respect of other species.

4.67 The need for direct consultations among those concerned with age-determinations from scales or otoliths was emphasised. The Committee expressed the hope that arrangements could be made to achieve such consultations, and that if at all possible they should include Soviet scientists, who had been absent from the previous BIOMASS age-determination workshop. The Committee proposed to hold this Workshop in Moscow or Riga (USSR). Dr Lubimova was invited to arrange for the organisation of this Workshop.

SUMMARY OF ADVICE TO THE COMMISSION

South Georgia

4.68 The *N. rossii* stock at South Georgia (48.3) is severely depleted hence incidental as well as directed catch should be reduced to as near zero as possible until such time as there is evidence from experimental fishing surveys that the stock is recovering.

4.69 The catch of *N. rossii* in the South Georgia area (48.3) could be reduced, but would not be eliminated, by continuing or expanding the existing conservation measures regulating fisheries activities in the area.

4.70 Because of uncertainties concerning the nature and selectivity of fisheries and the possible segregation of age classes in this area, a total prohibition on fishing in the South Georgia area (48.3) is the only way to assure no catch of *N. rossii*.

4.71 Gains in terms of yield-per-recruit of *C. gunnari* would be expected from any measures that increased the age of recruitment (e.g., mesh size), or reduced the fishing mortality (e.g., limits on annual catches, or on the number of vessels operating).

4.72 The present fishing mortality of *N. gibberifrons*, though due only to by-catch, appears to be high. It would seem desirable to keep the amount of by-catch to as low a level as practicable.

Kerguelen

4.73 The *N. rossii* stock at Kerguelen is declining; hence, further catch in the area 58.5 should be reduced to as near zero as possible until such time as there is evidence from experimental fishing surveys that the stock is recovering.

4.74 Because the distribution of *N. rossii* at Kerguelen (58.5) is relatively well known, the catch of this species can effectively be eliminated by a prohibition on directed fisheries.

Other Sub-Areas

4.75 Available data are insufficient to estimate sustainable yields or to determine whether any fish stocks have been depleted in areas outside the South Georgia and Kerguelen areas. Restrictions on fisheries in the South Georgia and Kerguelen areas could result in increased fishing effort in these other areas.

4.76 To prevent overexploitation it would be desirable to establish measures limiting fisheries activities in such areas until such time as data are sufficient to estimate fishery productivity in these areas.

Future activities

4.77 With regard to paragraph 4.76, there is an urgent need to make assessments of the finfish resources in the vicinity of the Antarctic Peninsula and the South Orkney Islands. The Working Group on Fish Stock Assessment should meet during the intersessional period to give particular attention to the finfish stocks in these sub-areas.

4.78 To accomplish this task, it is essential that the working group have full information concerning past fishing activities in these sub-areas, including length and age composition data, and detailed catch and effort statistics.

4.79 The Commission should take such steps as may be necessary to ensure that these data are provided to the Secretariat (Working Group) no later than 60 days prior to the meeting.

4.80 Further research on mesh selectivity and other topics is needed to improve assessments and management advice. Countries are urged to conduct such research during the next year if possible.

4.81 The need for direct consultations among those concerned with age determinations from scales or otoliths was emphasised. It was proposed to hold this Workshop in Moscow or Riga (USSR). Dr Lubimova (USSR) was invited to arrange for the organisation of this Workshop.

KRILL RESOURCES

CPUE as an estimator of krill abundance

5.1 Dr W. Ranke (GDR), Convener, introduced the report of the 'Workshop on Krill CPUE' (Annex 6). Due to unforeseen circumstances, he had been unable to be present for the first part of the meeting and thanked Dr I. Everson (UK) for chairing the meeting for that period. He also thanked Mr D. Miller (South Africa) for preparing a comprehensive account of the meeting.

5.2 The Working Group had considered how CPUE data had been used in other fisheries and had looked for parallels in krill fisheries.

5.3 The Japanese krill fishery appears to have characteristics, at least during the peak of the fishing season, such that catch per unit fishing time can be used as an index of local density. Whilst valid for the immediate vicinity of the fishing vessel or fleet, or possibly larger areas, such an index might be difficult to apply to larger areas without additional information such as search-time or inter-krill-concentration distance.

5.4 The Soviet fisheries strategy is different from that of the Japanese and whilst local abundance might be estimated in the same way, the different operational procedures would require different analytical procedures to provide abundance estimates for larger areas.

5.5 A range of relationships between CPUE and overall krill density is possible. In order to explore this range, and in particular, to identify the type of effort data which will reflect properly the relationship between CPUE and abundance, the Working Group had recommended that an exploratory simulation study would be required for which the following broad terms of reference were proposed:

(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;

(d) in addition, examine how catch and effort data may be combined with independent survey data, based on hydroacoustic methods or research trawls, in order to obtain an index of abundance applicable to larger areas.

5.6 It was agreed that the BIOMASS acoustic data sets might provide valuable information on krill swarm spatial distribution. Tentative plans for BIOMASS workshops on this subject were therefore welcomed.

5.7 The Scientific Committee fully accepted the need for such a simulation study and recommended the following procedure for its implementation:

(i) to entrust Dr J. Beddington (UK) with an overall responsibility for the project;

(ii) to employ, at CCAMLR expense, consultant(s) with professional experience in modelling and complex statistical analyses required for this study;

(iii) initially, Dr Beddington would correspond with nominated experts from Japan, USSR and other fishing states, as well as other members interested in taking part;

(iv) members involved in this study should ensure that the requisite data are made available to the Workshop referred to in item (vi) below and are encouraged to undertake relevant studies within their national research programs;

(v) it is proposed that Dr Beddington would organise visits to both USSR, Japan and if necessary other fishing states to work with the experts to be nominated by the countries so as to assist them in tasks defined in paragraph 5.5;

(vi) that a final workshop, under the convenership of Dr Beddington would be held for a period of about 2 weeks at Hobart or another suitable location;

(vii) the budgetary implications of this program are that participation by members should be at national expense. The cost for the consultant(s) and other services would be borne by the Commission;

(viii) an interim report should be presented to the next meeting of the Scientific Committee in 1986 and a final report at the 1987 meeting;

(ix) the reports would require review and technical discussion at the Scientific Committee, leading to the formulation of specific data requirements for estimating krill abundance by CPUE or by the survey methods.

5.8 Some confusion arose as to the appropriate list of basic data to be collected. As a basis for discussion, the Krill CPUE Workshop had used a list agreed at the Woods Hole Meeting (SC-CAMLR-III, Annex 6) as opposed to the revised version in SC-CAMLR-III, Appendix 6. It was agreed that the former list, revised by the Workshop in the light of its specific requirements, should be used. The variables are listed below in paragraph 5.9 (i–iv).

5.9 In order to allow experts to undertake theoretical studies concerning methods of applying search time and CPUE data to the estimation of krill abundance over large areas, krill fishing countries are requested to make available samples of data listed below (e.g. covering the operations of one fleet for two seasons). At the same time it was taken into account, that the Soviet data could presently be provided only from research vessels.

(i) <u>Description of Vessel</u>
- name of ship
- type of vessel
- registration number and port of registration
- ship nationality
- gross registered tonnage
- length overall (m)
- maximum shaft power (kW at ... rev/min or horse power)

(ii) <u>Description of Gear</u>
- trawl type (according to FAO nomenclature)
- code number for trawl type

- mouth opening or length of bottom rope and length of upper rope (m)
- effective area of mouth
- mesh size at codend (mm stretched)
- liner mesh size (mm)
- underwater acoustic equipment, echosounders (types and frequencies), sonar (types and frequencies), netsonde (yes/no)

(iii) Tow Information

- date
- position at start of fishing (in degrees and minutes)
- time at start of fishing (in hour and minutes GMT; if local time, indicate the variation from GMT)
- time at end of fishing (before hauling)
- fishing depth (m) (only if midwater trawl)
- direction of trawling (if the track changed during trawling, give the direction of the longest part of the track)
- towing speed (knots) - comment on gear performance

(iv) Catch Records for Each Tow

- estimated total catch (kg)
- approximate species composition (percent of total)
- weight (kg) of krill
- average size of krill (mm) or commercial size categories (e.g. S,M,L).

5.10 Because of the specific purpose of the Krill CPUE Workshop, no advice concerning regulatory measures was provided to the Commission.

5.11 The attention of the Commission is drawn to certain ongoing data requirements and in particular to the need:

(a) to continue with the collection of catch and effort data in accordance with current national practice;

(b) to make every effort to collect data listed in paragraph 5.9 as a matter of routine;

(c) to collect data from fisheries research vessels integrated with catch data from fishing fleets wherever possible.

5.12 For the purposes of the simulation study vessels would remain anonymous and precise locations would not be identified.

5.13 In adopting the report the Scientific Committee noted the provisions for supply of environmental data as listed in SC-CAMLR-III, Appendix 6 and recommended that where possible these be collected.

5.14 The Scientific Committee indicated that it expected the proposed scientific work on this problem should ensure the Scientific Committee would be able to give the Commission guidance on the regular submission of krill catch and effort data in the future.

Other methods of krill abundance estimation

5.15 The Scientific Committee had received from the SCAR Group of Specialists on the Southern Ocean Ecosystems and their Living Resources an advance copy of the report on the Post-FIBEX Acoustic Workshop, held in Frankfurt in September 1984. The report highlighted several important points which were taken note of and discussed.

a) Statistical analysis had been refined so as to take full advantage of the survey design.

b) Only those data collected in accordance with the survey design had been used in the analysis.

c) Detailed examination by national groups of their data with respect to calibration constants had meant that many Mean Volume Backscattering Strength (MVBS) values had had to be revised.

d) A revised target strength/size relationship was provided.

5.16 The net effect of all these changes was that the estimated biomass of krill within the FIBEX area was now only one eleventh of the initially estimated value. Furthermore, the value is very much less than would be expected by comparison with information on krill consumption by predators, estimated krill production based on conversion ratios from primary production, and the current fishery. Because of this disparity, it was considered vital to reappraise all these estimates.

5.17 The Committee was pleased to note that an independent project aimed at studying all aspects of target strength is currently being planned.

5.18 The FIBEX study did not estimate dispersed krill or those present near the surface. Certain national programs are addressing these problems.

5.19 The Scientific Committee recognised that greater refinement was necessary with the indirect estimates of krill abundance, particularly with respect to providing variances associated with the various estimators.

5.20 The report of the Post-FIBEX Acoustic Workshop was seen as being a valuable contribution to the study of krill because it had provided comprehensive analytical procedures, highlighted deficiencies in the methodology and provided a stimulus to further research. The Committee felt that BIOMASS should be commended for initiating and sponsoring the project.

Current information on krill abundance

5.21 The reported low abundance of krill in the Atlantic sector during the 1983/84 season was discussed (see paragraphs 8.6 – 8.9 of SC-CAMLR-III). Examination of the data indicated that the cause was natural variability in water circulation causing a low abundance in some areas such as South Georgia. Further investigations during the 1984/85 season showed that there was low krill abundance around Elephant Island and the northern part of Bransfield Strait while dense concentrations were observed in the southeast of the Bransfield Strait* and off Joinville Island.

5.22 In the Prydz Bay region, krill had been concentrated to the south in contrast to FIBEX observations, when krill were distributed over the whole region.

5.23 Short-term variation in krill abundance was seen as being a key factor in understanding ecosystem interactions involving krill. The Scientific Committee looked forward to the results and conclusions of the SIBEX studies.

* Known in Argentina as Mar de la Flota

Fishery status and trends

5.24 Statistics on the overall krill landings in the Convention Area in recent years show a steep decline from about 528,000 tons (1981/82) to about 229,000 tons (1982/83) and only about 128,000 tons (1983/84).

5.25 The USSR landings in 1983/84 was 74,000 tons. This is lower than in previous seasons, due to technological problems with processing and this is expected to continue for the next two years.

5.26 The Japanese landings in 1983/84 was 49,531 tons, which in 1984/85 was reduced to 39,000 tons as a result of a reduction in the number of fishing boats operating. This was due mainly to increased market competition from *Euphausia pacifica* which are caught around Japan.

5.27 A synopsis of national krill catches is given below (in metric tons):

Fishing Country	Split Year	
	1982/83	1983/84
CHILE	3752	1649
JAPAN	42282	49531
REPUBLIC OF KOREA	1959	2657
POLAND	360	0
USSR	180290	74381
TOTAL	228643	128218

BIOMASS review on krill

5.28 The Scientific Committee was informed that the BIOMASS review on krill had still not been completed. Some rewriting will now be necessary in the light of conclusions of the post-FIBEX Acoustic Workshop, whilst other sections still need to be written. Mr D. Miller was currently co-ordinating the work. The Chairman of the Scientific Committee received a request from the Convener of the SCAR Group of Specialists on the Southern Ocean Ecosystems and Their Living Resources to enter into contractual arrangements with CCAMLR for obtaining additional funds for the publication of this resources review.

Priority topics for next meeting

5.29 Several topics of krill research were highlighted for discussion at the next meeting of the Scientific Committee. Members were asked to consider these and provide background papers wherever possible.

5.30 The following subjects were identified as being of particular importance:

a) Age Determination and Growth
b) Stock Separation
c) Target Strength
d) Estimation of abundance of near surface and dispersed krill.

SQUID RESOURCES, THEIR STATUS AND ROLE IN THE ANTARCTIC ECOSYSTEM

6.1 The Committee discussed this item on the basis of a background document prepared by the Secretariat (SC-CAMLR-IV/6) and a review of the results of Soviet investigations on pelagic squids (SC-CAMLR-IV/BG/18). It also had available to it the Antarctic cephalopod section of the general review of Antarctic marine fauna presented by Dr J. Bengtson at the 1984 session (SC-CAMLR-IV/BG/5). The Chairman noted that useful information was also contained in BIOMASS Report 33, BIOMASS Handbook 21 and the Draft FAO Species Identification Sheets. The Committee welcomed the extensive and detailed information contained in the Soviet document, but regretted that because the document was circulated to the Committee while the item was being discussed, it was not possible to give it full consideration.

6.2 Dr Tomo (Argentina) referred to FAO Species Catalogue (Vol. 3) and stated that in the waters to the north of the Convention area there are commercial fisheries on various species of squids. Some of these are already intense.

6.3 In the Convention area there is at present no commercial fishery for cephalopods. Because of differences in species composition and squid distribution north and south of the Convergence, it was believed that it was unlikely that any significant commercial fishing would develop in the Convention area in the near future. There had been some confusion concerning statistical returns from previous years, including a report of a few hundred tons by Japan in 1978. The Japanese delegation promised to examine this and clarify their statistics in advance of the next session.

6.4 Many of the mammals and birds in the Antarctic eat squid. For several of these, squids form the most frequent item of diet and therefore may play an important role in the Antarctic ecosystem. (It was noted that owing to an error in the source document, the original version of SC-CAMLR-IV/6 gave an incorrect picture of the importance of squid in the diet of fishes).

6.5 The Committee believed that further research into squid and squid ecology should be strongly encouraged. It noted that this matter had been examined in detail by the BIOMASS *Ad Hoc* Group on Squid Ecology. The list of research priorities established by this group is given in SC-CAMLR-IV/6 (paragraph 7), and its list of recommendations is given in Attachment II to that document. The Committee welcomed these proposals and recommendations, and agreed that they provided a set of useful guidelines for future squid research. In particular, the Committee hoped that the countries concerned would be able to take action to ensure the early working-up of data on cephalopods from the DISCOVERY and ELTANIN expeditions.

ECOSYSTEM MONITORING AND MANAGEMENT

AD HOC WORKING GROUP ON ECOSYSTEM MONITORING

7.1 Dr K. Kerry (Australia), Convener, introduced the report of the *Ad Hoc* Working Group on Ecosystem Monitoring (Annex 7).

7.2 The Working Group had defined the objective of ecosystem monitoring in relation to Antarctic marine living resources as:

> 'To detect and record significant changes in critical components of the ecosystem, to serve as the basis for the conservation of Antarctic Marine Living Resources. The monitoring system should be designed to distinguish between changes due to the harvesting of commercial species and changes due to environmental variability, both physical and biological.'

7.3 Within the defined objective, the *Ad Hoc* Working Group considered that ecosystem monitoring with respect to Antarctic marine living resources could be seen to be comprised of two facets:

(a) the monitoring of parameters of selected indicator species (those likely to have quantifiably significant changes in monitored parameters) of seals, seabirds and whales;

(b) the monitoring of harvested species (krill, fish and squid) and other species reflecting change, as an aid to understanding the nature and cause of any observed change.

7.4 Six Antarctic pinniped, seabird and cetacean species were identified as the most potentially useful indicators of changes in food availability. These species were chosen by the *Ad Hoc* Working Group in terms of a series of selection criteria taking into account such factors as the selected species relationship with critical prey components, importance in the Antarctic marine ecosystem and availability of baseline data. The species chosen were:

- Crabeater seal
- Adelie penguin
- Chinstrap penguin
- Macaroni penguin
- Antarctic fur seal
- Minke whale.

7.5 Of the Antarctic krill, fish and squid species evaluated for inclusion in ecosystem monitoring programs - *Euphausia superba*, *Pleuragramma antarcticum* and early life stages of fish were considered to be of most immediate and direct relevance with respect to the predators identified.

7.6 The minke whale was discussed as a potential indicator of the effects of krill harvest, but the Working Group, noting the current decision of the International Whaling Commission (IWC) to impose a pause in commercial whaling, did not afford it a high priority within the framework set by the Group. Cognizance was taken of the Group's recommendation that the Scientific Committee of CCAMLR consult with the IWC to determine whether and how minke whales or other cetaceans might function as indicators of krill availability as well as the general status of the Antarctic marine ecosystem. The Group also recommended that the Scientific Committee should consult with the IWC on the current status of Antarctic whale populations and the means by which trends might be monitored in the future. It was agreed that a series of questions should therefore be formulated along these lines by the Chairman of the Scientific Committee and that they be conveyed to the Scientific Committee of the IWC.

7.7 Parameters to be monitored within each species group were suggested taking into account trophic level, behaviour, longevity, sensitivity to perturbation (both natural and unnatural) and measurability.

7.8 Temporal and spatial resolution was considered of fundamental importance in the collection and interpretation of monitoring data. The Working Group therefore defined the scales of important variables relating to predators, prey, the environment and interactions among such variables.

7.9 Using a variety of criteria (e.g. influence of specific predators or predator groups, presence of species conducive to monitoring, presence or absence of fishing operations) the Working Group evaluated the suitability of potential areas and sites for ecosystem monitoring programs. High priority was placed on the initiation of integrated ecosystem monitoring programs in selected areas. These programs would combine directed research and monitoring of the selected predators and prey species in open water, pack-ice areas and onshore. Such programs would also include simultaneous investigation of local predator-prey dynamics. The Working Group recommended the following priority areas for integrated studies:

- Prydz Bay
- Bransfield Strait*
- South Georgia.

7.10 Other sites for monitoring purposes included a wide network of sites and areas to complement the integrated research and monitoring efforts proposed for the priority areas identified above, and sites of special interest for directed research.

7.11 The Working Group also outlined an approach for the establishment of an ecosystem monitoring regime which identified additional parameters and a variety of topics for future research (especially on predator-prey dynamics and remote sensing studies by satellites).

IMPLEMENTATION OF AN ANTARCTIC MARINE ECOSYSTEM MONITORING REGIME

7.12 Taking into account the report of the *Ad Hoc* Working Group, the Scientific Committee recognised the importance of a long-term monitoring program in terms of the high variability of krill and any subsequent impact on its important predators. In this regard the

* Known in Argentina as Mar de la Flota

Committee noted the points raised in a document submitted by the USSR (SC-CAMLR-IV/13) relating to the need to focus joint research effort only in two areas: Prydz Bay Area with adjacent waters between 55° and 85° E; and Bellingshausen/ Amundsen Sea Area. Selection of monitoring sites would thus reflect the area of krill dominance as well as its total area of distribution. Remote sensing by satellite would play an important role in directed research of this kind. Results of such research can also be seen to ultimately facilitate the determination of the levels of fisheries exploitation thereby ensuring optimal reproductive success of krill-dependent and related species. The Committee thus recognised the urgent need for pilot studies on predators and prey in terms of monitoring important variables identified by the *Ad Hoc* Working Group. It also considered that directed ecological research on important predator and prey species was an urgent pre-requisite for determining potential indicator variables and essential background information for initiating or interpreting results of monitoring studies.

7.13 Therefore, bearing in mind the general provisions (and specifically Recommendation 4) of the report of the *Ad Hoc* Working Group on Ecosystem Monitoring, and taking into account the concomitant requirements of monitoring important predator species, their prey and the environment, the Scientific Committee recommended the establishment of a 'Working Group for the CCAMLR Ecosystem Monitoring program'.

7.14 Dr K. Kerry (Australia) was unanimously elected Convener of this group. The terms of reference for the Working Group were agreed upon and follow:

1. to plan, recommend, coordinate and ensure the continuity of a multi-nation CCAMLR ecosystem monitoring program within the Convention area;

2. to identify and recommend research including theoretical investigations to facilitate design and evaluation of the recommended ecosystem monitoring program;

3. to develop and recommend methods for the collection and storage and analysis of data including data formats for submission to CCAMLR;

4. to facilitate the analysis of data, their interpretation, and to identify the management implications;

5. to report progress to each meeting of the Scientific Committee with recommendations for further work.

7.15 In order to expedite the operational implementation of an ecosystem monitoring program, the Scientific Committee agreed that an inter-sessional meeting of the Working Group lasting about 6 days should be scheduled for June/July 1986. It was also agreed that the Convener of the Working Group would formulate a detailed agenda in consultation with other members of the Committee during the current meeting session and by correspondence.

7.16 Following the Australian submission to the Third Meeting of the Scientific Committee (SC-CAMLR-III/7) and taking note of the task set for the Working Group on Ecosystem Monitoring, the Australian delegation framed an action plan for an international ecosystem monitoring program specific to the system within the Prydz Bay priority area. This document (SC-CAMLR-IV/10) was seen by the Committee to represent a useful framework upon which the Working Group on Ecosystem Monitoring could structure its deliberations.

SUMMARY OF RECOMMENDATIONS ON ECOSYSTEM MONITORING

7.17 The following recommendations were agreed on by the Scientific Committee:

(1) a Working Group for the CCAMLR Ecosystem Monitoring program be established;

(2) the above Working Group meet during the intersessional period;

(3) a series of questions be sent to the Scientific Committee of the IWC in order to evaluate the means by which trends of depleted populations might be monitored and the potential of whales as agents for ecosystem monitoring purposes might be assessed.

DATA COLLECTION AND HANDLING

DATA BEING COLLECTED

Inventory of commercial fishery data

8.1 The Committee agreed that the summary data given in SC-CAMLR-IV/BG/8 should be updated annually and provided to the Secretariat. While member nations should supply this summary information each year, the original data should be held in each national data base.

Guidelines on collection of fishery data

8.2. Basic data on fishery operations should continue to be recorded, following the guidelines as set out in Appendix 6 of the Report of the Third Meeting of Scientific Committee (SC-CAMLR-III). The committee noted that in the Kerguelen fishery, data were recorded at the level of the position of each individual trawl. However, the USSR representative advised that although attempts have been made to follow the guidelines set out in Appendix 6 since 1982, data could not readily be processed at the level of detail of 1° squares. It was explained that serious attempts were being made to improve this situation currently. As explained to the Secretariat during the recent visit to the USSR (SC-CAMLR-IV/5), efforts are being made to locate logbooks of commercial operations prior to 1982 in the hope of retrieving fishery data for some earlier years. The Scientific Committee underlined the importance of establishing early baselines of fisheries data which are as complete as possible.

Submission of fishery data

8.3 Referring to the preference recorded in the Report of the Third Meeting of the Scientific Committee (SC-CAMLR-III, paragraph 6.29) for catch and effort data to be submitted in a spatial scale of 0.5° latitude by 1° longitude, and a temporal scale of ten days, the Committee discussed this further in the light of the Reports of the Fish Stock Assessment Working Group and the Krill CPUE Workshop held immediately prior to the fourth meeting of Scientific Committee. An alternative summary could be done by sectors and depth, which some members felt might be advantageous.

8.4 The catch and effort data collection and reporting system based on logbooks, such as has been in effect around Kerguelen was also discussed. This system has proved to be workable and enable very complete assessments as outlined in the Fish Stock Assessment Working Group Report.

8.5 The Japanese delegation raised a question on the legal aspect of the submission of logbook data (including retrospective data) and attention was drawn to a reference to the same question in the report of last meeting (SC-CAMLR III, paragraphs 6.27 and 6.28). It was stressed that the collection and analysis of data and presentation of the results may be a sufficient procedure to fulfil the obligations of fishing countries rather than the simple submission of detailed data to fisheries organisations.

8.6 Both schemes of collecting and reporting length (and age) composition of the commercial catch as outlined in last year's Scientific Committee Report were considered to be satisfactory. The Scientific Committee considered that it would be particularly useful for this purpose to have experienced data collectors who move from one fishing vessel to another. It was considered necessary where data can be obtained only from one vessel, as from research vessels, to identify the specific data recorded when this vessel was working alongside the rest of the fishing fleet.

8.7 As reported under Agenda Item 4, the reporting of finfish fishery data was in most cases falling far short of requirements. Despite repeated requests, finfish fishery data either were not supplied, arrived too late, or were inadequate for use in the workshop.

8.8 For krill catch and fishing effort data, the spatial and temporal requirements for routine data submission should be clarified following the simulation exercises proposed under Agenda Item 5. For the present, it was agreed that krill fishing operations be recorded in the format as set out in paragraph 5.9.

DATA BEING TRANSMITTED

8.9 As reported (SC-CAMLR-IV/8), the STATLANT data base is still far from complete. The Scientific Committee requests the Commission to press for the full and proper completion of STATLANT reports for each past season.

8.10 As noted in the previous report (1984), some STATLANT 8B forms give combined effort data for finfish and krill fishing operations. The Scientific Committee requests member

nations to review data supplied on STATLANT 8B forms since 1982 to ensure that effort data are recorded separately for krill and finfish fishing.

8.11 The Committee agreed that for future seasons, the STATLANT reports for the preceding season should be lodged at the very latest by September 30 of that year.

PROCESSING OF DATA

8.12 The processing of data as received by the Secretariat, is described in SC-CAMLR-IV/8.

8.13 The Scientific Committee noted that assessments by working groups would be facilitated by a higher degree of pre-processing of data within the Secretariat. (For example, length frequency distributions of catches converted to age distribution.) Part of the problem is that data do not arrive in time for the necessary checking and entry. Close consultation between the Secretariat and Working Group Conveners is required to ensure that all possible pre-processing of the necessary data is carried out before a working group assembles.

8.14 Noting that in the Report of the 1984 Meeting, the Scientific Committee deferred the publication of the Statistical Bulletin until a complete set of historical data was available, the Committee has to report that these historical data are still incomplete. Those data which are available are attached as Annex 8 to this Report.

ADVICE TO THE COMMISSION

8.15 Member nations agreed to forward to the Secretariat 30 days before the meeting each year, an annual update of the inventory of commercial fishery data (as in SC-CAMLR-IV/BG/8).

8.16 The Scientific Committee underlines the importance of having baseline data (i.e. historic data) in Antarctic fisheries in as complete a form as possible.

8.17 Despite repeated requests, finfish fishery data either have not been supplied, arrived too late, or were inadequate for stock assessment. Attention is drawn to this unsatisfactory position and the Commission is requested to press members for the timely and complete submission of data.

8.18 The Scientific Committee presses member nations for full and proper completion of STATLANT reports for each past season. In particular, effort data for finfish and krill fishing operations should be recorded separately.

8.19 In future, the STATLANT forms for the preceding season should be lodged at the very latest by September 30 of that year.

8.20 The Scientific Committee noted that assessments by working groups would be facilitated by early submission of data to the Secretariat, and close liaison between the Secretariat and the Working Group Conveners to ensure that all possible pre-processing of data is carried out before a Working Group assembles.

8.21 The Scientific Committee requests member nations to forward the historical data required in order to publish the Statistical Bulletin.

COOPERATION WITH OTHER ORGANISATIONS

CCAMLR observers at meetings

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

37th meeting of the International Whaling Commission, Dr J. Beddington (see CCAMLR-IV/14);

18th meeting of SCAR, Dr D. Sahrhage (SC-CAMLR-IV/BG/16);

Joint IUCN/SCAR Symposium on Scientific Requirements for Antarctic Conservation, Dr D. Sahrhage (SC-CAMLR-IV/BG/17) (also see SC-CAMLR-IV/BG/24);

72nd meeting of ICES, Dr K. Sherman (CCAMLR-IV/19).

9.2 It was agreed that Dr Sherman would represent the Scientific Committee at the 73rd Statutory Meeting of ICES in London, October 1985.

9.3 It was agreed that because the 13th Session of CWP in Rome will not take place until 11 to 18 February, 1987, arrangements for the Scientific Committee representation can be made at the next meeting.

9.4 It was agreed that Dr Beddington would represent the Scientific Committee at the 38th Scientific Committee Meeting of the IWC in the United Kingdom in May–June 1986.

9.5 It was agreed that the Scientific Committee would not be represented at the 9th Annual Meeting of ICCAT in Palma de Majorca in November 1985.

9.6 It was agreed that the Scientific Committee would not be represented at the 7th Special Meeting of ICSEAF in Tarragona in November–December 1985.

9.7 It was agreed that a Scientific Committee representative would be designated at a later date to the IUCN Review of the World Conservation Strategy to be held in June 1986.

9.8 It was agreed that a Scientific Committee representative would be designated at a later date to the 19th Meeting of SCAR in the USA in June 1986.

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

9.9 This seminar will be held at UNESCO Headquarters in Paris from 2 to 6 June, 1987 (SC-CAMLR-IV/BG/19). It was noted that three oceanographers will be chosen by IOC to serve on a planning/steering committee for the seminar. It was agreed that an additional three members should be invited from the Scientific Committee of CCAMLR to serve on the steering committee. Some members believed that the selection of these members should be made by the Chairman of the Scientific Committee in consultation with the Executive Secretary and other appropriate persons. Others believed that the Chairman of the Commission should be involved in this selection.

Species identification sheets

9.10 A progress report was given by Prof. J.-C. Hureau on the joint CCAMLR/FAO project on Species Identification Sheets for the Southern Ocean (CCAMLR-IV/12). A preliminary

draft of this document has been completed (in English) and is undergoing further editing. Thanks were expressed to contributors who have helped in drafting and editing.

9.11 Vernacular names for some species are still required in some languages. The Soviet representative offered to provide the editors with vernacular names in Russian for the appropriate species as possible.

9.12 It is anticipated that the English version of this document will be published by the end of 1985. If sufficient additional funds can be obtained, the French and Spanish versions may be published in 1986; otherwise publication will be delayed until 1987. The Russian version may be published in 1987.

9.13 Representatives from Argentina, Chile, and the USSR expressed concerns about the publication delays and funding difficulties associated with the Spanish and Russian versions.

9.14 Members of CCAMLR and those on the FAO mailing list will receive copies of this work free of charge. Additional copies will be sold by FAO to the general public to generate funds for future updates and editions.

9.15 The Chairman thanked Prof. J.-C. Hureau, the other authors and the editor, Dr W. Fischer of FAO, for their efforts on this project.

International Union for the Conservation
of Nature and Natural Resources

9.16 The IUCN observer expressed the continued interest of his organisation with the work of CCAMLR. He also called attention to the report of the Joint SCAR/IUCN Symposium on Scientific Requirements for Antarctic Conservation which had been circulated at the meeting as document SC-CAMLR-IV/BG/24.

Scientific Committee on Antarctic Research
Scientific Committee on Oceanic Research

9.17 The SCAR/SCOR observer called attention to the report of the meeting of the SCAR Group of Specialists on Southern Ocean Ecosystems and their Living Resources

(SC-CAMLR-IV/BG/25). This report deals with the future of the BIOMASS Program, which has great bearing on the work of the CCAMLR Scientific Committee.

Food and Agriculture Organisation

9.18 It was noted that although FAO had attempted to arrange for an observer to be present at the meeting, it was unable to send an observer due to last minute difficulties.

THE ROLE OF SEA-GOING OBSERVERS IN PROMOTING THE OBJECTIVES OF THE COMMISSION

10.1 The United Kingdom delegation introduced a proposal to encourage the placement of scientific observers on commercial fishing vessels (SC-CAMLR-IV/11). Two main goals of this proposal were to: assist the non-fishing nations in gaining familiarity with the technical operations of Antarctic fisheries, and to assist in improving the evaluation of fishery data (e.g., fishing time, searching time, biological samples, etc.).

10.2 Some members suggested that the proposal could be developed into a useful scheme if it could be initially established on a voluntary, bilateral basis. Such bilateral arrangements could possibly begin during the 1985–86 fishing season. Representatives from fishing nations indicated that such arrangements could only begin on a reciprocal basis.

10.3 A clear distinction should be made between scientific observers and inspectors. The scientific observers would not have any role as fisheries inspectors; their role would be solely scientific. It was suggested that the term ‘scientific consultant’ might be a better description of these observers.

10.4 It was noted that the presence of scientific consultants on fishing vessels could contribute greatly to the quality of data coming from commercial and scientific operations.

10.5 To be most valuable, scientific consultants should have scientific training and be familiar with laboratory techniques applicable to fisheries operations.

10.6 The representative of France commented on the value of fishing nations accommodating and encouraging collaboration with scientific consultants from non-fishing nations and assisting in the placement of such consultants on commercial fishing vessels. The

representative of Japan, however, stressed that quality data collection was best achieved when carried out by national scientists, as noted in paragraph 8.6 and indicated that they were giving consideration to the institution of such a system in the Japanese fishery.

10.7 There was some doubt as to how the placement of scientific consultants on vessels may relate to Article XXIV of the Convention. The Scientific Committee agreed that further consideration of this legal matter should be referred to the Commission.

PUBLICATIONS POLICY AND PROCEDURES FOR THE PREPARATION OF MEETING DOCUMENTS

11.1 A review of publication categories and procedures was prepared by the Secretariat (CCAMLR-IV/9).

11.2 It was agreed that the initiation of the Statistical Bulletin will be further delayed until more complete data records are held by the Commission. In the meantime, a Draft Summary of Catch and Effort Statistics will be appended to the Scientific Committee's Report (Annex 8).

11.3 The Chairman thanked Dr G. Stander (South Africa) and the members of the *Ad Hoc* Working Group on Publication Matters for their past efforts. Because the work of this *ad hoc* group has now been completed, the group was disbanded.

Reports of members

11.4 The Chairman described the unsatisfactory aspects of Members' Reports on scientific and fishing activities. It was noted that only 50% of the required reports had been submitted at the start of the meeting, others were submitted late, and still others had not been submitted at all.

11.5 To facilitate the review of members' activities, it would be desirable to have the content, style and length of the reports more uniform. The Secretariat was asked to develop more specific guidelines to assist members in preparing their reports in a more standardised format.

11.6 The Secretariat noted that it would be desirable to keep the length of reports as short as possible, but that reports should address all major activities of members. Keeping the individual reports concise will reduce the volume of material to be translated and duplicated and keep the overall volume of publication of the reports to a manageable size.

11.7 It was agreed that members should ensure that their reports are received by the Secretariat a minimum of 30 days prior to the annual meeting. This deadline is required to allow translation of the reports.

11.8 It was agreed that members' reports should not exceed 5 pages in length. Members are invited to supplement these concise summaries with more detailed working documents describing specific aspects of their national research or fishing activities, including bibliography. These supplements will not be translated and published.

LONG-TERM PROGRAM OF WORK OF THE SCIENTIFIC COMMITTEE

12.1 The United States delegation presented a proposal to develop a long-term program of work to guide the activities of the Scientific Committee.

12.2 The Scientific Committee has the task of providing information and management advice about a complex ecosystem. To accomplish this task, the Committee must oversee the collection, analysis and reporting of a broad spectrum of data which includes fishery statistics, biological attributes and status of target and non-target species, characteristics of the physical environment, and ecological relations among living resources and their environment.

12.3 It was suggested that the Scientific Committee's ability to successfully achieve its goals would be enhanced by outlining a long-term program of work. The establishment of a long-range agenda would permit the orderly and sequential development of the appropriate data bases and analyses required to meet the Commission's responsibilities in establishing policy and conservation measures.

12.4 It was proposed that a timetable would help to define goals and assure that they are completed. It would also permit the Commission and members to make the appropriate scientific and budgetary plans.

12.5 A matrix of proposed activities for the Scientific Committee was prepared on the basis of informal consultations among members (Annex 9). In light of the short time available for consideration of the specific points included in this timetable, it should be considered as tentative, and subject to review and revision.

12.6 In general, the Scientific Committee supports the idea of the development of a long-term program of work to guide its activities.

12.7 There was some discussion of the timing of obtaining sets of fisheries data, and this topic is discussed in further detail under other relevant agenda items.

12.8. It was suggested that monitoring krill distribution and abundance should be incorporated into the matrix under fishery stock assessment.

12.9 It was suggested that in addition to marine mammal and bird assessment, aspects of trends could also be treated in the matrix under ecosystem monitoring.

12.10 Such a plan should be updated regularly, and members were encouraged to further consider the program of work during the inter-sessional period.

12.11 The utility and desirability of joint work among members and other groups such as SCAR/SCOR, the BIOMASS Program, and the IWC should be emphasised.

12.12 It was agreed that this preliminary long-term plan would be used to help prepare for the next Scientific Committee meeting, that the item be further considered at the next meeting, and that a one day meeting held immediately prior to the next session may be desirable.

REVIEW OF SECRETARIAT SERVICES TO THE SCIENTIFIC COMMITTEE

13.1 The United Kingdom delegation reviewed the services of the Secretariat to the Scientific Committee, and proposed steps to facilitate these services.

13.2 It was suggested that as the tasks and priorities of the Scientific Committee change, so do the needs and expectations of Secretariat services change from those as originally outlined (SC-CAMLR-IV/9).

13.3 It was proposed that annually at the conclusion of the Scientific Committee meeting, a small group should review the Committee's report and develop an outline of the work needed from the Secretariat during the inter-sessional period. This group would be comprised of the Chairman, the two Vice-Chairmen, and the Conveners of Working Groups that will be active during the inter-sessional period, and the interested delegations.

13.4 There was general support for undertaking the steps outlined in this proposal on an informal trial basis for one year, to be reviewed at the next session.

13.5 It was agreed that the Chairman would invite a small group as outlined above to meet at the conclusion of the Scientific Committee's meeting to prepare a guide to the Secretariat for the inter-sessional period.

BUDGET FOR 1986

14.1 The Scientific Committee developed a proposal for the budget of 1986 in accordance with the recommendations made for activities during the forthcoming inter-sessional period. The proposed budget was endorsed. It is given at Annex 10.

14.2 The Scientific Committee agreed that in assigning priorities, preference should be given to the active work of the Scientific Committee rather than to arrangements with other organisations.

ELECTION OF VICE-CHAIRMEN

15.1 Prof. J.-C. Hureau (France) and Mr W. Slosarczyk (Poland) were nominated and unanimously elected as Vice-Chairmen of the Scientific Committee. Their terms will be from the end of the 1985 session to the end of the 1987 session.

15.2 The Chairman expressed the appreciation of the Scientific Committee to outgoing Vice-Chairmen Drs W. Ranke (German Democratic Republic) and D. Robertson (New Zealand) for their service over the past years.

NEXT MEETING

16.1 The United Kingdom delegation proposed that the date of the Scientific Committee's annual meeting be changed to May in order to allow more immediate implementation of conservation measures in the following fishing season.

16.2 It was agreed that regardless of the date of the meeting, it would be highly desirable to maintain the current practice of having the Scientific Committee and Commission meet during the same general period at the same location. This arrangement is desirable because of the interactive relationship between the Commission and the Scientific Committee as well as for financial reasons.

16.3 Support for the proposal to move the meeting date to May was split within the Scientific Committee due to potential conflicts with field work, other meetings, and lack of time to analyse recent fishery data.

16.4 The French delegation proposed moving the meeting to late October. Such a date would allow the Scientific Committee to have the benefit of the most recent fishery data available, which are to be submitted by 30 September each year.

16.5 The Scientific Committee recommended to the Commission that it consider changing the dates of the Scientific Committee and Commission meetings to the period of late October-early November.

OTHER BUSINESS

17.1 It was suggested that printing CCAMLR working documents on both sides of the paper would be desirable because it would save paper and reduce the volume of paper that delegates were required to carry home with them. The Secretariat indicated that due to technical limitations of its equipment, printing documents on both sides of the paper would cause a major slowdown in reproducing and distributing documents. Therefore, documents will, for the present and immediate future meeting, have to be printed on one side only.

17.2 The Argentine delegation, calling attention to some errors in the translation of scientific terms from English to Spanish, offered to provide the Secretariat with a technical glossary in Spanish to assist the work of the Secretariat's translators.

17.3 The delegations of Argentina and Chile expressed their dissatisfaction with the unavailability of several working documents in Spanish. Throughout the meeting of the Scientific Committee, the lack of some documents in Spanish, an official working language of CCAMLR, placed limitations on their ability to participate and contribute as fully as would otherwise have been possible.

17.4 The Chairman once again urged delegates to ensure that documents be submitted as soon as possible to facilitate the work of the Scientific Committee. In particular, the early submission of documents would allow time for translation into all CCAMLR working languages.

ADOPTION OF THE REPORT OF THE FOURTH MEETING OF THE SCIENTIFIC COMMITTEE

18.1 The Report of the Fourth Meeting of the Scientific Committee was reviewed and adopted.

CLOSE OF THE MEETING

19.1 The Chairman thanked all members and observers for their cooperation during the session and expressed on behalf of the Scientific Committee thanks to the Rapporteurs, to the Secretariat, and the Interpreters.

19.2 The Chairman closed the Fourth Meeting of the Scientific Committee.

ANNEX 1

LIST OF MEETING PARTICIPANTS

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Mr S. FREAKLEY
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Representative

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Mr M. VANTROYEN
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GERMANY, FEDERAL REPUBLIC OF

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Alternate Representative:	Dr Karl-Hermann KOCK Research Assistant Institut Für Seefischerei Hamburg

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	Mr Akira NAKAMAE Assistant Director International Division Fisheries Agency Tokyo
	Mr Hideomi NAKAJIMA Fisheries Division of Economic Affairs Bureau Ministry of Foreign Affairs Tokyo
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INVITED EXPERT

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ANNEX 2

LIST OF MEETING DOCUMENTS

SC-CAMLR-IV/1:	PROVISIONAL AGENDA FOR THE FOURTH MEETING OF THE SCIENTIFIC COMMITTEE FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES
SC-CAMLR-IV/2:	ANNOTATION TO PROVISIONAL AGENDA FOR THE FOURTH MEETING OF THE SCIENTIFIC COMMITTEE
SC-CAMLR-IV/3:	REPORT OF THE AD HOC WORKING GROUP ON FISH STOCK ASSESSMENT
SC-CAMLR-IV/4:	REPORT OF AD HOC WORKING GROUP ON THE USE OF KRILL CPUE DATA
SC-CAMLR-IV/5:	REPORT OF SECRETARIAT VISIT TO SEVERAL FISHING NATIONS – MEMBERS OF CCAMLR. MARCH 1985
SC-CAMLR-IV/6:	ANTARCTIC SQUID RESOURCES – NOTES FOR CONSIDERATION UNDER ITEM 6 OF THE SCIENTIFIC COMMITTEE AGENDA
SC-CAMLR-IV/7:	REPORT OF THE MEETING OF THE AD HOC WORKING GROUP ON ECOSYSTEM MONITORING
SC-CAMLR-IV/8:	DATA COLLECTION AND HANDLING
SC-CAMLR-IV/9:	SECRETARIAT STAFF – SERVICES TO THE SCIENTIFIC COMMITTEE
SC-CAMLR/IV/10:	ECOSYSTEM MONITORING: PRYDZ BAY PRIORITY AREA
SC-CAMLR-IV/11	SEA-GOING OBSERVERS
SC-CAMLR-IV/12:	CHAIRMAN'S COMMENTS ON THE REPORT OF THE AD HOC WORKING GROUP ON FISH STOCK ASSESSMENT (SC-CAMLR-IV/3)
SC-CAMLR-IV/13:	COMMENTS ON THE REPORT OF THE AD HOC WORKING GROUP ON ECOSYSTEM MONITORING
SC-CAMLR-IV/14:	DRAFT REPORT OF THE FOURTH MEETING OF THE SCIENTIFIC COMMITTEE
SC-CAMLR-IV/14: FINAL	REPORT OF THE FOURTH MEETING OF THE SCIENTIFIC COMMITTEE
SC-CAMLR-IV/15:	COMMENTS ON THE PUBLICATION OF FAO SPECIES IDENTIFICATION SHEETS FOR FISHERY PURPOSES
SC-CAMLR-IV/BG/1:	REPORT OF MEMBERS' ACTIVITIES IN 1984/85 SOUTH AFRICA
SC-CAMLR-IV/BG/2:	RESEARCH CURRENTLY BEING UNDERTAKEN BY THE REPUBLIC OF SOUTH AFRICA ON 'DEPENDENT AND RELATED SPECIES' WITHIN THE ANTARCTIC MARINE ECOSYSTEM
SC-CAMLR-IV/BG/3:	BIBLIOGRAPHY OF SOUTH AFRICAN RESEARCH WORK UNDERTAKEN IN THE CCAMLR AREA AND IN CLOSELY RELATED GEOGRAPHIC REGIONS

SC-CAMLR-IV/BG/4: REPORT OF JAPANESE ACTIVITIES IN THE CONVENTION AREA IN 1984/85

SC-CAMLR-IV/BG/5: ANTARCTIC CEPHALOPODS

SC-CAMLR-IV/BG/6: UNITED STATES FISHING AND SCIENTIFIC ACTIVITIES IN THE AREA OF THE CONVENTION ON THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES, 1984–1985

SC-CAMLR-IV/BG/7: DRAFT SUMMARY OF CATCH AND EFFORT STATISTICS

SC-CAMLR-IV/BG/8: INVENTORY OF COMMERCIAL FISHERY DATA BEFORE SEPTEMBER, 1983

SC-CAMLR-IV/BG/9: REPORT OF MEMBERS' ACTIVITIES IN 1984/85
AUSTRALIA

SC-CAMLR-IV/BG/10: REPORT OF MEMBERS' ACTIVITIES IN 1984/85
UNITED KINGDOM

SC-CAMLR-IV/BG/11: PRELIMINARY RESULTS OF INVESTIGATIONS OF THE FEDERAL REPUBLIC OF GERMANY ON NOTOTHENIA ROSSII MARMORATA FISCHER 1885 IN JANUARY/FEBRUARY 1985

SC-CAMLR-IV/BG/12: ESTIMATES OF FISH STOCK BIOMASS AROUND SOUTH GEORGIA IN JANUARY/FEBRUARY 1985

SC-CAMLR-IV/BG/13: REPORT OF MEMBERS' ACTIVITIES IN 1984/85
FEDERAL REPUBLIC OF GERMANY

SC-CAMLR-IV/BG/14: REPORT OF MEMBERS' ACTIVITIES IN 1984/85
USSR

SC-CAMLR-IV/BG/15: REPORT OF MEMBERS' ACTIVITIES IN 1984/85
POLAND

SC-CAMLR-IV/BG/16: REPORT ON EIGHTEENTH MEETING OF THE SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH (SCAR)

SC-CAMLR-IV/BG/17: REPORT ON JOINT IUCN/SCAR SYMPOSIUM ON SCIENTIFIC REQUIREMENTS FOR ANTARCTIC CONSERVATION

SC-CAMLR-IV/BG/18: RESULTS OF SOVIET INVESTIGATIONS OF THE DISTRIBUTION AND ECOLOGY OF PELAGIC SQUIDS (OSCOPSIDAE) IN THE SOUTHERN OCEAN

SC-CAMLR-IV/BG/19: SECOND ANNOUNCEMENT
SCIENTIFIC SEMINAR ON ANTARCTIC OCEAN VARIABILITY AND ITS INFLUENCE ON MARINE LIVING RESOURCES, PARTICULARLY KRILL

SC-CAMLR-IV/BG/20: REPORT OF MEMBERS' ACTIVITIES IN 1984/85
ARGENTINA

SC-CAMLR-IV/BG/21: PRELIMINARY ATLAS OF BALAENOPTERID WHALE DISTRIBUTION IN THE SOUTHERN OCEAN BASED ON PELAGIC CATCH DATA

SC-CAMLR-IV/BG/22:	REPORT OF MEMBERS' ACTIVITIES IN 1984/85 FRANCE
SC-CAMLR-IV/BG/23:	REPORT OF MEMBERS' ACTIVITIES IN 1984/85 GERMAN DEMOCRATIC REPUBLIC
SC-CAMLR-IV/BG/24:	NOTE ON JOINT IUCN/SCAR SYMPOSIUM ON SCIENTIFIC REQUIREMENTS FOR ANTARCTIC CONSERVATION
SC-CAMLR-IV/BG/25:	FUTURE OF BIOMASS AND RELATION OF THE GROUP OF SPECIALISTS TO CCAMLR
SC-CAMLR-IV/BG/26:	DRAFT PUBLICATIONS LIST OF BIOMASS HANDBOOKS
SC-CAMLR-IV/BG/27:	REPORT OF MEMBERS' ACTIVITIES IN 1984/1985 NORWAY
SC-CAMLR-IV/BG/28:	STATEMENT TO THE 1985 MEETING OF THE COMMISSION FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES
SC-CAMLR-IV/BG/29:	NOTE ON INTERNATIONAL SYSTEMS OF OBSERVATION AND INSPECTION ON VESSELS
SC-CAMLR-IV/BG/30:	REPORT OF MEMBERS' ACTIVITIES IN 1984/85 CHILE

ANNEX 3

AGENDA FOR THE
FOURTH MEETING OF THE SCIENTIFIC COMMITTEE

1. Opening of the Meeting

2. Adoption of the Agenda

3. Report by the Chairman

4. Fish Stock Assessment
   (i) Review of the Report of the *Ad Hoc* Working Group
   (ii) Further Data Requirements
   (iii) Advice to the Commission

5. Krill Resources
   (i) Review of the Report of the Workshop
   (ii) Further Data Requirements
   (iii) Advice to the Commission

6. Squid Resources, Their Status and Role in the Antarctic Ecosystem

7. Ecosystem Monitoring and Management
   (i) Review of the Report of the *Ad Hoc* Working Group
   (ii) Further Research Requirements
   (iii) Advice to the Commission

8. Data Collection and Handling
   (i) Data Being Collected
   (ii) Data Being Transmitted
   (iii) Processing of Data in Secretariat
   (iv) Further Data Requirements
   (v) Advice to the Commission

9. Cooperation With Other Organisations

10. The Role of Sea-Going Observers in Promoting the Objectives of the Commission

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

12. Long-Term Program of Work of the Scientific Committee

13. Review of Secretariat Services to the Scientific Committee

14. Budget for 1986

15. Election of Vice-Chairmen

16. Next Meeting

17. Other Business

18. Adoption of the Report of the Fourth Meeting of the Scientific Committee

19. 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 from 23–30 August. Dr R.C. Hennemuth (USA) was in the chair. A list of those attending is given in Appendix 1. Dr J.A. Gulland was appointed as rapporteur. A list of documents presented to the meeting is given in Appendix II.

REVIEW OF BASIC DATA

2. The Secretariat reported on the data on catches, effort, length and age composition etc. that had been received from the fishing countries. A summary of what data are now available is given in Appendix III in which the information presented by the Secretariat has been modified in the light of explanations and corrections given by the participants.

3. The group had pleasure in noting that there had been a considerable increase in the volume of data reported to the Commission or provided to the Working Group, especially relating to length and age composition. This had enabled the group to make significant advances on the preliminary analyses presented at the 1984 Commission meeting. However, the reporting of commercial catch and effort statistics was in all cases falling short of the requirements set out in the report of the Woods Hole data meeting and in the annex to the 1984 meeting of the *ad hoc* Working Group. In particular, data was received only from Poland giving an area breakdown smaller than the subareas of the STATLANT B forms. These forms were available from all countries only for 1982/83, and only from Poland and France for other years. In the annex to last year's report the group had noted that, failing complete reports, 'it was essential to have at least some years of fine detail CPUE for comparative purposes'. The absence of these detailed data continues to make it difficult to determine accurately the trends in abundance of several species. The group also noted that for the USSR the catch data for the 1983/84 season had not been received by the Commission at the time of the Working Group meeting.

4. The group noted that there had been some confusion about the statistics of catches of *N. rossii* at South Georgia, due to the change in reporting from calendar year to split

(July–June) year, and the omission of data for the split year 1969/70 from some tabulations (e.g. in the summary catch statistics, SC-CAMLR-IV/BG/7). This was clarified by noting that a comparison between calendar and split year catches allowed the catches in half-year periods to be deduced. This is set out below.

	Period	Original calendar year report (FAO/CAMLR)	Revised (split year report)	Deduced half-year catches	Deduced split-year catches
1969	I–VI	89100			
	VII–XII		Not	89,100	399,704
1970	I–VI	403,100	reported	310,604	
	VII–XII		101,558	92,496	101,558
1971	I–VI			9,062	
	VII–XII	11,800	2,738	2,738	2,738
1972	I–VI	NIL		NIL	
	VII–XII		NIL		

5. For many of the earlier years data have been received only for major areas (e.g. Atlantic) and not for sub-areas (e.g. South Georgia). For analyses it is important to allocate catches at least to sub-areas. Up to 1977 it seems reasonable to assume that all South Atlantic catches were taken from South Georgia (48.3). In the 1977/78 season some Polish catches were reported from other sub-areas. Assuming that the Soviet catches had the same distribution as Poland, the distribution in the 1977/8 and 1978/9 seasons were estimated as follows (for *Champsocephalus gunnari*).

Year	Fishing Nation	48.1 t	48.1 %	48.2 t	48.2 %	48.3 t	48.3 %	Total 48 t
1977/78	Poland	–		38446	94.9	2069	5.1	40515
	USSR	–		96906		5208		102114
1978/79	Poland	7411	62.5	4331	36.5	110	0.9	11852
	USSR	28319		16550		420		45289

The group suggested that the Commission's tabulation should be modified along these lines in order to reduce the amounts included under 'sub-area unknown'.

6. In general, there had been few problems with the species information. However, the group noted that in some recent years there had been significant quantities of unidentified species reported from some sub-areas. It urged the countries concerned to make every effort to reduce these uncertainties.

7. Problems were also met in respect of both age and length data. Examination of age-length keys reported by different countries showed some differences. For example,

recent keys for the 45–47 cm group for *N. rossii* at South Georgia reported by FRG and the USSR were as follows:

Age	3	4	5	6	7
FRG (1985)			23	61	7
USSR (1984)	87	276	188	19	

Differences for *C. gunnari* between USSR and Polish age frequencies were also noted.

8. Though these differences (of rather more than one year) still allowed some clear conclusions to be reached about certain matters, for example changes in mortality rates, it was clearly very important that they should be resolved. This would require direct interchange of experience between those actually engaged in reading scales or otoliths. In the first instance, this might be done by exchange of material, but it is likely that a small workshop-type meeting will be desirable. Since those concerned are unlikely to be attending other CCAMLR meetings, the workshop might be held in some conveniently located institute between Commission sessions.

9. In respect of length, the group noted that some difficulties had arisen because different length groupings, e.g. 3 cm and 5 cm, had been used when reporting data in respect of the same stock. It is preferable that data should be reported by 1-cm groups, since this ensures no loss of information, and should, if the original data is already in a computer, entail little additional work. If broader groupings are used, it is important that all countries report their data (if not in 1-cm groups) by the same groupings. The groupings used in present reports to the Commission are shown in Table 1. This shows that nearly all countries are now reporting by 1-cm groups. The Working Group therefore urged that the other countries should adopt the same system. It noted that Poland could use this system and that USSR would also try to find some solution to the problem. The Working Group also urged strongly that all measurements should be carried out according to the standards recommended by BIOMASS (i.e. total length to the cm below).

10. As noted later (paragraph 25), some problems have been met concerning the source of data (research/survey/commercial vessels) and mesh size. This should always be specified. Also, although samples from any source have value, for some purposes, e.g. VPA, it is important to know the size and age-composition of the commercial catches. Most of the Soviet data referred to survey rather than commercial catches; and the group therefore urged the Soviet delegation to make every effort in the future to collect samples from their commercial vessels.

NEW RESEARCH

11. The group heard presentations from FRG on the results of research vessel surveys in early 1985 (Documents 3 and 4), France, concerning assessments of the stocks around Kerguelen (Document 9), Argentina, concerning growth of *Champsocephalus* near Elephant Island (Document 11) and USSR on the reproduction of several species round South Georgia (Document 5). It also had available to it an English translation of the USSR document SC-CAMLR-III/INF.10 available in Russian at the 1984 meeting. It noted that in addition to information directly relevant to stock assessment, which has been used in the analyses in the following sections of this report, these documents also contained interesting biological results of a more general nature. These aspects were not discussed in detail during the working group meeting. The group noted that the basis of some of the statements made in the 1984 Soviet document, e.g. on natural mortality rates, or optimum fishing patterns, was not clear in the document. This made it difficult to compare and integrate these values with those from other sources. It hoped therefore that more detailed reports would be presented to the Commission at future meetings.

ASSESSMENTS

General

12. Information summarising the information on catches, density and biological characteristics of the major stocks, up-dating the similar information presented in the 1984 report, is given in Table 2. The group noted that the estimates of biomass were based on the assumption that the catches represented the total stock within the path of the trawl (between the wings). For fish living close to the bottom this assumption of full catchability seems satisfactory, but for fish that are sometimes well off the bottom (e.g. *C. gunnari*) this may lead to an under-estimate of the stock.

South Georgia

Notothenia rossii

13. An extensive series of length and age data from the beginning of the fishery in 1970 taken from research vessels which may not be fully representative of the commercial catches

were reported by the USSR. They enabled analyses of mortality rates, recruitment and yield-per-recruit to be made.

Mortality Rates

14. Given an array of age composition data for a series of years, there are a number of ways in which estimates of mortality can be obtained, each of which has some advantages and disadvantages. In the absence of CPUE data, or other annual indices of abundance, which might allow the changes in abundance of a single year-class to be followed through its life in the fishery, the most useful approach is to obtain estimates of mortality from data in a single year, using Heincke's or similar methods.

15. The basic equations are

$$S = \text{survival} = \frac{\text{Total numbers of fish age x + 1 and older}}{\text{Total numbers of fish age x and older}}$$

and Z = total mortality coefficient = $- \log_e S$.

Calculation could be made using x as any fully recruited age, but the most useful estimate will normally be for x = youngest fully recruited age.

16. Other estimates can be obtained from the same data, for example from the slope of the right hand limb of an age-frequency distribution, when plotted on a logarithmic scale – the so-called catch curve. These methods will give estimates which will have different values, but they will all have similar sources of potential error. First, the numbers at age will be affected by selection and recruitment, so that the methods should be applied only for fully recruited ages, and for ages for which there are no changes in selectivity. Second, trends in year-class strength are confounded with mortality rates. Strong year-classes among the younger fish, and especially, for Heincke's method a strong year-class aged x, will cause the mortality rate to be over-estimated. Conversely a declining trend in the year-class strength will tend to produce low estimates of mortality.

17. With these reservations estimates have been made of mortality rates. The results of applying Heincke's method to the USSR and FRG data are shown in Figure 1. As noted elsewhere there are differences in interpretation in making age-determinations, with the FRG

interpretations tending to be older than the Soviet. Thus the age at full recruitment, used in producing the estimates, has been 6 for the Soviet data and 7 for the FRG data.

18. The alternative approach is illustrated in Figure 2, where the catch-curves corresponding to the USSR data in 1970 and 1984, and the FRG data for 1985, are given.

19. Both approaches show a very great increase in apparent mortality rate, since 1970. Despite differences in age-determination the Soviet and FRG data for 1984–1985 are consistent in showing high and approximately constant mortality rate from the age at full recruitment onwards for at least four or five years. At that point (about age 10) the data are too few to estimate age-specific mortality. In contrast, the 1970 data, which reflects conditions before fishing could have had a significant effect on mortality or length frequencies, should provide a measure of natural mortality. These data do not fit a constant mortality rate. Between ages 5 and 10, the numbers at age change little; between 10 and 12 there is a moderate decline, and then a very great decline between 12 and 13. Part of this may be explained by problems of age-determination, or by partial recruitment occurring over a wide range of ages (up to perhaps 9 or 10). However, the data are highly suggestive of a variable natural mortality, low over ages up to 10 or so, and then increasing. The Heincke estimates in Figure 1, which reflect the life-expectancy from 6 onwards are in 1970 and 1971 strongly influenced by the high mortalities after age 10, and therefore tend to over-estimate the mortality among the younger ages. However, under exploited conditions fish over age 10 are very scarce, and for the purposes of assessment it is the mortality rate among the younger ages that is important. A straight line representing an average natural mortality has been fitted by eye in Figure 2. This corresponds to a value of Z (= M) = 0.11. This is lower than other figures (e.g. 0.3 in the Soviet report at the 1984 meeting, SC-CAMLR-III/INF.10). For further calculations, e.g. of yield-per-recruit, values of 0.15 and 0.20 were used. While less subjective methods of fitting a line and obtaining an estimate of M. could be used, it is clear that whatever method is found to be appropriate will provide an estimate that will be lower than 0.3.

VPA and Recruitment Changes

20. In the report (p. 208) of its 1984 meeting, the Working Group had noted that the recruitment of *N. rossii* appeared to have decreased substantially. This was based on a rough comparison of the total contributions to the catches made by the year-classes present in 1970 (about 30–40,000 tons), and those caught in later years (about 5,000 tons). A more precise estimate can now be made, using the estimates of the numbers caught at each age in each year

(Table 3) and a Virtual Population Analysis. The type of analysis is indicated in Document 2 in Appendix II. With reservations concerning the representativeness of some input data (see paragraph 13), the VPA allows estimates to be made of the numbers in the stock at each age and of the fishing mortality on each age in each year. The results are given in Table 4. This shows the very high fishing mortality that occurred in the first years of the fishery, and also the large numbers that were present at each age at that time. The best quantitative estimates of the strengths of different year-classes can be obtained from the VPA tabulations. The numbers present at age 3 (or older ages, as indicated, for fish present in the stock in 1970), in millions, were as follows:

Year-class	Numbers	Y/c	Nos	Y/c	Nos
1958	6.5 (at 12)	1966	10.6 (at 4)	1974	6.5
1959	10.1 (at 11)	1967	5.6	1975	6.6
1960	15.6 (at 10)	1968	3.1	1976	4.6
1961	19.8 (at 9)	1969	3.4	1977	2.0
1962	21.6 (at 8)	1970	5.2	1978	0.7
1963	20.0 (at 7)	1971	6.1	1979	(0.3)
1964	20.3 (at 6)	1972	6.1	1980	(0.04)
1965	16.2 (at 5)	1973	6.8		

As indicated by the brackets, the estimates for the most recent years are sensitive to the values used for terminal F, and are therefore not very reliable. Even ignoring these last two very low values, the tabulation shows, not only that the average recruitment since 1970 is much smaller than that in the 1960s, but also that there has been a further decline in recruitment since 1976. There are some points that are not easily explained by a direct stock-recruitment relation, for example the moderately low year-classes of 1966–1969 for which the adult stock was still at its high, unexploited abundance. Nevertheless, the only prudent conclusion from the available data is that the recruitment is at a low value because of a low adult stock, and that the recruitment will remain at a very low level until the adult stock has been rebuilt.

21. Reports of rod and line fishing at the British Antarctic Survey base at Grytviken show declining catches from the time commercial fishing began. While too much weight should not be given to this evidence, it does confirm the changes in year-class strength estimated by other methods. It also illustrates the potential value of inshore surveys, e.g. with trammel nets, to monitor recruitment.

22. The Soviet delegation reported that Soviet scientists had carried out some surveys of juvenile fish. However, the information was not available at the time of the Working Group meeting, so it was not possible to use them to confirm or reject the conclusions about the trends in recruitment reached here. The Working Group urged that these data should be reported to the Commission as early as possible.

Yield-Per-Recruit

23. Calculations were made of yield-per-recruit, and biomass-per-recruit, using Soviet catch-at-age data, and values of M = 0.2 and M = 0.15. The detailed results are given in Document No. 13. The values of yields (gms/recruit) at age 2 may be summarised as follows:

	M = 0.15 Age at Recruitment					M = 0.20 Age at recruitment		
F	3	4	5	6	7	3	4	5
0.01	125	124	120	112	101	86	85	81
0.05	485	496	495	474	436	342	346	341
0.10	719	765	792	781	735	518	545	556
0.15	817	904	968	979	940	601	657	691
0.20	843	968	1070	1106	1081	633	716	775
0.40	748	948	1165	1291	1325	583	743	887
0.60	593	<u>850</u>	<u>1130</u>	1311	1383	487	<u>691</u>	<u>889</u>
0.80	500	770	1088	1302	1396	432	642	873

The average parameter values during recent years are approximately F = 0.6, with a mean age at first capture of 4 or 5. The corresponding values are underlined in the table above. This shows that purely in terms of yield-per-recruit there would be gains from conservation measures aimed at reducing fishing mortality, or increasing the size of first capture. The reductions in fishing mortality could be very substantial – down to 0.1 or less, i.e. less than one-sixth of the present value before there would be any significant fall in yield-per-recruit. Conservation measures, particularly reductions in fishing effort, could also have the more important effect of increasing spawning stock biomass.

Status of Stocks

24. The previous, 1984, report concluded that 'this stock is very severely affected by fishing'. All the further information discussed during the present meeting confirmed that conclusion. Not only was the stock depleted by the very large catches between 1969 and 1971, but the relatively small catches taken since then have been sufficient to cause further declines. Though the strengths of the year-classes currently in the fishery are not precisely known, they are certainly small, and small catches will be sufficient to prevent a recovery. The information on yield-per-recruit and current year-class strength, as well as on the effects of recent catches suggest that the current replacement yield is less than a thousand tons. In contrast, if the spawning stock could be rebuilt to provide recruitments of say 10 million fish (i.e. rather less than the recruitment in the 1960s), and the fishing mortality and age at first capture adjusted to provide a yield of around 1000 gm per recruit, this would correspond to a sustainable yield of around 10,000 tons.

Champsocephalus gunnari

25. Age and length data for this stock were available from a number of sources, including Polish commercial trawlers, FRG research vessels and Soviet survey vessels. There were considerable differences between these (see Figure 3). The FRG catches taken with a net with a small-meshed liner included large numbers of I-group fish around 15 cm, which were released by the larger mesh sizes used by the other vessels. The group noted that the reported Soviet survey catches included substantial catches of fish less than 30 cm, whereas because of a size limit of 30 cm, few fish of this size were taken in the commercial fishery. The survey data were therefore not fully representative of the commercial catches. This made it difficult to assemble reliable catch-at-age data for the fishery as a whole. The group therefore believed it was impracticable to attempt a VPA analysis at the present time.

26. It was possible to estimate total mortality rates, using the catch-curve method, for some recent data. This gave the following results:

1982/3	Polish data	Z = 1.1
1983/4	Polish data	Z = 2.2
1983	Soviet data	Z = 1.0
1984	Soviet data	Z = 0.6

27. These values are variable, and in the case of Poland possibly overestimates because of the presence of an apparently very strong recruiting year class (see paragraph 16). The difference between the Soviet and Polish figures may also reflect a systematic difference in fishing strategy. The values are all considerably greater than the value of natural mortality M = 0.35 used by the BIOMASS working group. This suggests a relatively high fishing mortality, probably in the range, taking an average over years of high and low fishing effort, of 0.5 – 1.0. This range is similar to the range of f = 0.8 to 0.9 in 1977/78 obtained by the BIOMASS Working Group. This estimate of the likely range of f also receives some confirmation, as already noted in last year's report, from the fact that catches have been high relative to the estimates of biomass from swept area methods.

Yield-Per-Recruit

28. Using the value of M = 0.35, and the USSR weight at age data, calculations were made of the yield-per-recruit. The results are given in Document No. 14 and are summarised below (as yield in grams per recruit at age 2).

Fishing Mortality	Age at First Capture		
	2	3	4
0.01	8	7	6
0.05	31	30	28
0.10	50	49	46
0.15	61	62	59
0.20	68	70	68
0.40	74	82	84
0.60	73	83	88
0.80	71	83	89

29. This shows that for the high levels of fishing mortality probably occurring now, the optimum age at first capture would be around 4. Also, there would be little or no loss in yield-per-recruit from a substantial reduction in fishing mortality. Such a reduction would also provide an increase in the spawning stock biomass.

30. While it appears that this stock is heavily fished, there is no indication that recruitment has, up to the present, been affected. Though the information on year-class strength is not as good as for Kerguelen, it does suggest that, as in the case at Kerguelen, recruitment is variable. This variability is in part the cause of the high variability in annual catches, and this effect is increased by the degree to which recent catches are dominated by a single year-class. This, as noted last year, makes the fishery vulnerable to falls in recruitment, a possibility which has to be recognised if the high level of mortality continues.

Other Species

31. The Working Group was not able to examine in detail the information concerning the other species. Estimates of total mortality Z, were made for *N. gibberifrons*, *C. aceratus* and *P. georgianus*, using the formula

$$Z = \frac{K(L_\infty - \bar{1})}{\bar{1} - 1_c}$$

where $\bar{1}$ is mean length in the catch above the size of recruitment 1_C, and K and L_∞ are the von Bertalanffy coefficients. The results using data from Poland and FRG are given in Figures 4 and 5.

32. In interpreting these figures it has to be noted that the method is not very precise, and often tends to give under-estimates of the true mortality. However, the method should, at the

minimum, be useful in indicating trends in mortality. It should also be noted that the method, like catch-curves, produces an estimate which relates to the average mortality over some period prior to the time of observation. This lag has to be taken into account when attempting to relate mortality estimates to the catches, which are shown in the upper part of Figures 4 and 5.

33. For *N. gibberifrons* Figure 4 shows a clear upward trend, from about 0.1 in 1975/76, to 0.3 or more after 1981. This seems almost certainly due to the increased catches: catches were negligible before 1975. The data suggest the current values of F and M are around 0.2 and 0.1 respectively. In absolute terms these may, because of problems with the method, be too low, but it does seem probable that fishing mortality (as an average over some years) is well in excess of natural mortality. This high rate of fishing may be detrimental to the stock in the long run. It was noted that this species is taken as a by-catch.

34. For the other two species there is no clear trend. Except for 1977/78, when 13,000 tons of *P. georgianus* were taken (which may be reflected in the higher estimates of mortality in 1980/81 and 1981/82), reported catches of both species have been small. Some catch of these species may be part of reported catches of unidentified species.

KERGUELEN

35. Detailed information on the fishery around Kerguelen, with particular reference to *N. rossii*, *N. squamifrons* and *C. gunnari*, was presented by G. Duhamel (Document 9). Since 1979 detailed log-book data had been collected by the fishing vessels, and reported to the French authorities. This has allowed a detailed description of the location of the main fishing trends to be compiled, and catch-per-unit-effort data to be calculated by small areas.

N. rossii

36. The decline noted in the previous report has continued, as reflected by the CPUE in the peak season (in the winter, in the waters off the south-east coast – see Figure 2 of Document 9), and by the adjusted CPUE. The mean age and mean lengths have not changed much since 1980, so it is possible that, as in the South Georgia area, recruitment has been affected by the decline in the adult stock. In any case, it is clear that this stock is heavily exploited, and that even the relatively low catches (an annual average of around 5,000 tons since 1980) have been greater than the depleted stock can withstand.

N. squamifrons

37. This species is mainly found to the south and south-east of the island. The CPUE for these regions shows a fairly regular cycle with peak catch rates in the summer. The data since the 1979/80 season show no clear trend; the 1979/80 value was higher, but the values for the following four seasons have been all about equal.

38. Recent catches have been considerably smaller than the peak catches of 26,500 and 51,000 tons taken in the 1970/71 and 1971/72 seasons. However, there is no evidence to determine whether there has been a decline in stock size, or whether the decrease in catch is due more to a decrease in fishing effort on a species which is less attractive commercially than *N. rossii*.

C. gunnari

39. This relatively short-lived species is caught over much of the shelf, except the north west, including the Skiff Bank. The greatest catches are taken to the east of the island. Length and age analysis show that there are large variations in year-class strength. A good cohort was born in 1979, and supported good catches in the 1981/82 and 1982/83 seasons, but has now become scarce. Information from the 1984/85 season suggests that the 1982 cohort is also good. The relatively high total mortality suggests that fishing mortality may now be significant, but there is no evidence that this is affecting recruitment in any way. There is also at present no explicit analysis of the present situation of the fishery on the curves of yield-per-recruit as a function of mortality or size at first capture.

MANAGEMENT MEASURES

General Considerations: Mesh Regulation

40. In other areas regulations on the minimum size of mesh have proved acceptable methods for increasing the effective size (and age) of first capture. In the Convention area, comparisons of catches by research vessels using small meshes with those of the commercial fleets have shown, as noted above, that for *C. gunnari* the commercial nets do release the smallest size-class of fish (ca. 15 cm). For the other species a comparison of the data sets shows no such difference, with very small fish being absent even from the small-mesh

catches. This suggests that the small fish are absent from the commercial fishing grounds and that all sizes of fish offshore can be retained in the mesh sizes now in use.

41. The earlier analyses did suggest, on the basis of yield-per-recruit analyses, that if the age (and size) at first capture of at least *N. rossii* and *C. gunnari* was increased, then the yield-per-recruit and stock would improve. Because the selective action of a trawl is not exact, and selection occurs over a range of sizes, there cannot be a unique match of mesh size to size of first capture. However, it is usual to choose the mesh size whose 50% selection point (i.e. the length at which 50% of the fish will pass through the meshes) is equal to the desired length at first capture. This mesh size is in turn determined by the relation

50% selection point = selection factor x mesh size.

42. There were no direct observations on selectivity for Antarctic fish available at the meeting. It was therefore not possible to make good estimates of the appropriate mesh size. However, the selection factor (SF) must be closely related to the shape of the fish, and for fish free of spikes and projections the SF is close to the ratio of total length to maximum girth. It was therefore suggested that a first approximation to the SF could, in the absence of direct experiments at sea, be obtained from the physical examination of the fish, and measurements of girth and length. This might give acceptable values for some species, but it was pointed out that other species e.g. some ice fishes spread their gill covers and fins when caught, thus making it difficult to get through the meshes, and reducing the SF below the value that might otherwise be expected.

43. With this reservation, the group felt that some observations on girth and total length could be useful, but it also emphasised strongly the need for direct field observations on selectivity e.g. through the use of small-meshed covers, and urged countries to take advantage of any opportunity to carry out selectivity experiments.

44. The group noted that it is important, when introducing mesh regulations, to have a clear understanding of what is meant by a mesh of a given size. This question has been the subject of lengthy discussions in other Commissions, especially in the north Atlantic, and the experience of those bodies should be drawn upon in establishing CCAMLR rules. In this connection, the Working Party noted that the formulation used by the French authorities in respect of Kerguelen provided a useful starting point. This was as follows

Mesh size

'1. A mesh is of a minimum size when, diagonally stretched along the length of the net, a flat gauge, 2 mm thick and of the appropriate width, will pass easily through the mesh when the net is wet.

2. The mesh size in a net is of the acceptable size when at least 60% of the measurements on a series of 20 consecutive meshes reach the standard set out in paragraph 1. The measurements should be made at least 10 meshes away from the end of the cod-end, parallel to the longitudinal axis of the trawl.'

Closed Areas

45. Protection of any desired group of fish-juveniles, spawners etc. can also be achieved by closing areas for all or part of the year where these fish are abundant. The group therefore reviewed information on such distributions.

46. *Notothenia rossii* is known to spawn during May and June at South Georgia. No information is available on precise spawning locations. Differing opinions were discussed by the Working Group. According to some the spawning grounds are located within the 12-mile limit. Other opinions indicate that spawning occurs in a water depth of 120–350 m, which would suggest that spawning sites could be almost anywhere on the shelf. The same species at Kerguelen spawns in water at about 300 m deep on the shelf break and the same situation may apply at South Georgia. The group recommended that some sampling by research vessels be made to clarify this situation. Juveniles are demersal and inhabit the coastal kelp beds until four or five years old.

47. *Champsocephalus gunnari* spawns during April and May in the fjords and bays following aggregation and migration inshore in the preceding two months.

Management Needs

South Georgia

Notothenia rossii

48. This stock is severely depleted, and the only hope for significant catches in the future is to rebuild the spawning stock. There should certainly be no directed fishery, but since any incidental catches would cause further declines in the stock, measures should also be taken to keep incidental catches to the minimum.

Champsocephalus gunnari

49. The stock appears to be heavily fished, even though there is no indication that recruitment has been affected as yet. Gains in terms of yield-per-recruit would be expected from any measures that increased the age of recruitment (e.g. mesh size), or reduced the fishing mortality (e.g. limits on annual catches, or on the number of vessels operating). Measures of the latter type by increasing the number of year-classes contributing effectively to the fishery, would reduce the year-to-year variability, and the vulnerability of the fishery to declines in recruitment.

Notothenia gibberifrons

50. The present fishing mortality, though due only to by-catch, appears to be high. It would seem desirable to keep the amount of by-catch to as low a level as practicable.

Kerguelen

51. Since 1979 a number of controls have been progressively established by the French authorities. These are set out in the report of the 1984 meeting of the Scientific Committee (paragraph 7.22). These measures seemed to have prevented the occurrence of the serious decline that has occurred for the South Georgia stock of *N. rossii*. However, the present controls seem to have been applied too late to prevent some decline in the stock of *N. rossii* in recent years, and consideration should be given to some strengthening. It might also be useful to analyse age and length data for *C. gunnari* to determine mortality rates, and make

yield-per-recruit calculations. These could show whether, to improve the yield-per-recruit, it might be desirable to reduce the amount of fishing, or increase the size at first capture.

FURTHER ACTIVITIES

52. The group emphasised that the first priority in terms of actions which would facilitate future assessment studies was to improve the amount, detail, quality and timeliness of basic data. Significant improvements were achieved in the reports to the Commission in advance of the present meeting. However, in a number of aspects, particularly regarding the submissions of detailed catch and effort statistics, the present reports by some of the biggest fishing countries fell short of the basic standards set out in existing Commission reports.

53. The group also noted a number of research studies which would be of particular value. These included a clarification of the methods of age determining, and of the present differences in interpretation between countries; mesh selection studies; the monitoring of young (up to 4 years old) *Notothenia rossii* in the inshore waters of South Georgia; and a more precise identification of the spawning grounds of this and other species.

54. The group noted that much of the time during its meeting had been taken up with work of data compilation, and running routine analyses such as VPA. With the benefit of experience, it is clear that the duration of the meeting could be shortened, and more time spent in discussions of matters of substance arising from the analyses, if most of this work could be done in advance of the meeting. The group therefore suggested to the Scientific Committee that, when similar meetings are convened in the future, clear guidance should be given to the Secretariat, so that they can carry out the preliminary analyses. Consideration should also be given to possible modifications of the latest dates of submission of data to the Commission.

ADOPTION OF THE REPORT

55. The Working Group adopted its Report.

CLOSURE OF THE MEETING

56. The Chairman in closing the meeting, thanked the Rapporteur, Dr Gulland, and others of the group who had worked on specific tasks during the meeting. He also expressed the appreciation of the Working Group to the CSIRO Marine Laboratories for making their facilities available.

APPENDIX I

LIST OF PARTICIPANTS OF
FISH STOCK ASSESSMENT WORKING GROUP
(23–28, 30 August, 1985)

ARGENTINA	Dr A. Tomo Dr E. Marschoff
AUSTRALIA	Dr R. Williams Dr K. Kerry Mr W. de la Mare Dr G. Kirkwood Mr P. Heyward
CHILE	Dr A. Mazzei
EEC	Dr G. Duhamel
FRANCE	Dr. J.-C. Hureau
FRG	Dr K.-H. Kock
GDR	Dr W. Ranke
JAPAN	Dr Y. Shimadzu Dr Y. Watanabe
NORWAY	Nr O.J. Østvedt
POLAND	Dr W. Slosarczyk
SOUTH AFRICA	Mr D. Miller
USSR	Dr R. Borodin Mr S. Komogortsev
UK	Dr J. Beddington Dr I. Everson
USA	Dr R. Hennemuth Dr W. Gabriel
IUCN SCAR/SCOR OBSERVER	Dr J. Cooke
INVITED EXPERT	Dr J. Gulland (UK)

SECRETARIAT	Dr D. Powell
	Mr F. Ralston
	Dr E. Sabourenkov

APPENDIX II

FISH STOCK ASSESSMENT WORKING GROUP
23–30 AUGUST, 1985

LIST OF DOCUMENTS

Fish WG/1985/Doc.1	Draft Agenda Fish Stock Assessment Working Group 23–30 August, 1985
Doc.2	Note on Available Data and Programs for Fish Stock Assessment (Submitted by the Secretariat)
Doc.3	Preliminary Results of Investigations of the Federal Republic of Germany on *Notothenia rossii marmorata* Fischer 1885 in January/February 1985 (Karl-Hermann Kock)
Doc.4	Estimates of Fish Stock Biomass around South Georgia in January/February 1985 (Karl-Hermann Kock)
Doc.5	Reproduction Parameters of *Notothenia rossii marmorata*, *Notothenia gibberifrons* and *Champsocephalus gunnari* of South Georgia Island (L.A. Lisovenko)
Doc.6	Summary of Biological and Catch Data
Doc.7	List of Documents
Doc.8	Fish Catch Reports from the Peninsula, South Georgia and Kerguelen Subareas, 1970/71–1983/84
Doc.9	Distribution and Abundance of Fish on the Kerguelen Islands Shelf (G. Duhamel)

Doc.10 USSR Catches, Split-Year 1969/70
(Submitted by the Secretariat)

Doc.11 Age and Length Growth of *Champsocephalus gunnari*, Lonnberg 1905 (Pisces, Chaenichthyidae, in the Area of Elephant Island, West Zone, Antarctica
(Aldo P. Tomo)

Doc.12 List of Participants

Doc.13 Yield Per Recruit Calculations – *N. rossii*, South Georgia

Doc.14 Yield Per Recruit Calculations – *C. gunnari*, South Georgia

APPENDIX III

Data Availability (Update of Document 6)

STATLANT CATCH REPORTS

COUNTRY	SPLIT YEAR	FORM 8A[1]	FORM 8B[2]
USSR	71–78	Area Only	No
	79	Area Only	Catch/Mo/Area Only
	80–82	Yes	No
	83	Yes	Yes (X MSS)
	84	No	No
POL	77–85	Yes	Yes (MSS is MIXED)
GDR	77	Area Only	Despatched but not received before meeting.
	78–81	Yes	Despatched but not received before meeting.
	82–83	No Fishing	No Fishing
	84	Yes	Yes
FRA	80–85	Yes	Yes (EFF Unit is Days Fished)
BGR	78–80	Yes	Yes (X MSS, GEAR)

[1] Species
Split year
Subarea

[2] Species
Month
Gear
Effort (EFF)
Main Species Sought (MSS)
X = Not by

SPECIES/AREA	LENGTH COMPOSITION	AGE COMPOSITION	AGE/LENGTH KEY	LIFE HISTORY PARAMETERS				CPUE
				WEIGHT AT AGE	MATURITY AT AGE	MORTALITY	PARTIAL RECRUIT.	RESEARCH VESSEL
Notothenia rossii /So. Georgia	USSR: 70–73 75 77–78 81–83 85 Exploratory Fishing Mesh=120mm.		USSR: 70–73 75 77–78 81–83 85 W	USSR: 70	USSR: 70			
	GDR: 77 78 80 81							
	FRG: 85 Research Vessel		FRG: 85 Research Vessel	FRG: 85				
	POL: 77–85 (X80,83) [Mesh=60–100mm] Commercial							POL: 77–84 (SC-CAMLR-III/BG/11)
/48.1 Peninsula Subarea	JPN: 85 GDR: 79 FRG: 85		75–76 & 77–78 Available in published papers					
/Kerguelen	FRA: 80–85 Shelf 80–85 Skiff B Commercial							
Champsocephalus gunnari /So. Georgia	USSR: 72–84 X82 Research Vessel		USSR: 72–84 X82 Research Vessel	USSR: 78 Res.Vess.	USSR: 78 Res.Vess.			

SPECIES/AREA	LENGTH COMPOSITION	AGE COMPOSITION	AGE/LENGTH KEY	LIFE HISTORY PARAMETERS				CPUE
				WEIGHT AT AGE	MATURITY AT AGE	MORTALITY	PARTIAL RECRUIT.	RESEARCH VESSEL
	POL: 76–84 X80,83 Commercial Also Shag Rocks 77,79,81	POL: 75–79 81–82 84 Commercial	POL: 76–84 X80,83 Commercial Also Shag Rocks 77,79,81	POL: Sosinski Paper				POL: 77–84 (SC-CAMLR-III/BG/11) Research & Comm [85Commercial]
	FRG: 85 Research Vessel							
	GDR: 77 78 80							
/48.2 So. Orkney	FRG: 85							
/48.1 Peninsula Subarea	FRG: 85 Research Vessel							
	GDR: 79 80							
	JPN: 81,82,85							
/Kerguelen	FRA: 80–85 Shelf, Skiff B Commercial							
N. squamifrons /Kerguelen	FRA: 80–85 Shelf 81–82 Skiff B.							
Pseudochaenichthys georgianus /So. Georgia	POL: 77–79 81–82 84 Commercial						POL: 77–84 (SC-CAMLR-III/BG/11) Research & Comm	

SPECIES/AREA	LENGTH COMPOSITION	AGE COMPOSITION	AGE/LENGTH KEY	LIFE HISTORY PARAMETERS				CPUE
				WEIGHT AT AGE	MATURITY AT AGE	MORTALITY	PARTIAL RECRUIT.	RESEARCH VESSEL
	FRG: 85 Research Vessel							
	GDR: 77 78							
N. gibberifrons /So. Georgia	POL: 76–82 X80 Commercial Also Shag Rocks 77,79,81	POL: 76–82 X80	POL: 76–82 X80 Commercial Also Shag Rocks 77,79,81					POL: 77–84 (SC-CAMLR-III/BG/11) Research & Comm
	FRG: 85 Research Vessel							
				USSR: 71	USSR: 71			
	GDR: 77 78 80 81							
/48.2 So. Orkney	FRG: 85							
/48.1 Peninsula Subarea	JPN: 81,82,85 Research Vessel							
	GDR: 79 80							
	FRG: 85							
N. guentheri /48.1 Peninsula Subarea	FRG: 85 Research Vessel							
Chaenocephalus aceratus /So. Georgia	POL: 77–85 X80,83 Commercial							POL: 77–84 (SC-CAMLR-III/BG/11) Research & Com

SPECIES/AREA	LENGTH COMPOSITION	AGE COMPOSITION	AGE/LENGTH KEY	LIFE HISTORY PARAMETERS				CPUE
				WEIGHT AT AGE	MATURITY AT AGE	MORTALITY	PARTIAL RECRUIT.	RESEARCH VESSEL
	FRG: 85 Research Vessel							
	GDR: 77 78							
/48.2 So. Orkney /48.1 Kerguelen	FRG: 85							
Dissostichus eleginoides /So. Georgia								POL: 77–84 (SC-CAMLR-III/BG/11) Research & Comm
Other Species /48.1 Peninsula Subarea	JPN: 81,82,85 Not all species all years Research Vessel							

TABLE I: Length groups used for length frequency calculations

(measured length range is in brackets – in cm)

	N. rossii	*N. squam.*	*N. guentheri*	*N. gibberif.*	*Ps. georgianus*	*Ch. aceratus*	*Ch. gunnari*
Argentina							1cm (20–46)
Japan*	1cm (32–59)			1cm (5–44)	1cm (13–52)	1cm (9–55)	1cm (8–41)
France**	1cm (32–87)	1cm (16–53)					1cm (11–38)
Poland	2cm (30–86)			1cm (6–51)	2cm (14–62)	2cm (12–80)	1cm (12–68)
FRG	1cm (34–73)		1cm (9–21)	1cm (4–49)	1cm (5–58)	1cm (8–71)	1cm (3–58)
USSR	2cm (39–71) 3cm (30–84) 5cm (30–85) 6cm (33–81)						2cm (12–60) 4cm (16–56)

* In Japan 1cm length groups are also used for other species: *N. nudifrons*, *N. neglecta*, *N. kempi*, *N. eulepidotus*, *Ch. rastrospinosus*, *Ch. wilsoni*, *P. antarcticum*, *Cryodraco antarcticos* and T. sp.

** In France 1cm length groups are also used for *D. eleginoides* and *Ch. rhinoceratus*

TABLE 2: Summary of Basic Information

Area: SOUTH GEORGIA
Species: NOTOTHENIA ROSSII

			CPUE (t/h)		Biomass (t)		Mean length, weight, age			
	Total Catch (t)	Target Species	Polish Commercial Vessels	Research Vessels	From Commercial Catches	From Research Vessel Catches	$\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$	
70	399704*	N. rossii					68.1 [a]63.6 [a]63.4	3664 3190 3890	9.3	
71	101558*						[a]61.9 [a]60.0 – [a]65.1 [a]64.9	3042 3294 – 3805 3683	–	
72	2738*						[a]60.1 [a]56.4 –	3325 2362 –	–	
73	23**						[a]59.5	59.4 2984	2418	6.8
74	5***							–	–	–
75	10**						[a]54.9 –	2390 –	–	
76	10753*					35682	[b]55.9 56.5 [a]54.9	2408 2077 2250	6.5	

* Where Atlantic catches were not reported by subarea, these were assigned to South Georgia

** Zero catch was reported. These were estimated from USSR length frequency samples for inclusion in VPA

*** Zero catch was reported. Estimated inasmuch as minimum value was required to proceed with VPA

**** Polish catches only

[a] Soviet [b] Polish [c] Split year [d] FRG

Area: SOUTH GEORGIA
Species: NOTOTHENIA ROSSII

			CPUE (t/h)		Biomass (t)		Mean length, weight, age			
	Total Catch (t)	Target Species	Polish Commercial Vessels	Research Vessels	From Commercial Catches	From Research Vessel Catches	$\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$	
77	8365*	C. gunnari in Polish vessels			37928	–	59.1 [a]55.2	2381 2480	–	
78	6311*	Opportunistic in Polish vessels	0.05		5606	9326	[c]54.8 53.5 [a]54.8 [a]54.0	2279 1796 2430 2344	–	Total catch 48: 5143
79	7955*	Opportunistic in Polish vessels	0.44		–	1421	[c]48.9 50.5	1658 1476	–	Total catch 48: 8662
80	24897	Opportunistic in Polish vessels	0.07		–	–	–	–	–	
81	1651	C. gunnari in Polish vessels	0.02		2327		[c]43.0 43.0 [a]51.4	1159 906 1890	5.3	
82	1100	C. gunnari in Polish vessels	0.15		34284		[c]47.8 47.8	1556 1249	–	

* Where Atlantic catches were not reported by subarea, these were assigned to South Georgia

** Zero catch was reported. These were estimated from USSR length frequency samples for inclusion in VPA

*** Zero catch was reported. Estimated inasmuch as minimum value was required to proceed with VPA

**** Polish catches only

[a] Soviet [c] Split year
[b] Polish [d] FRG

Area: SOUTH GEORGIA
Species: NOTOTHENIA ROSSII

			CPUE (t/h)		Biomass (t)		Mean length, weight, age		
	Total Catch (t)	Target Species	Polish Commercial Vessels	Research Vessels	From Commercial Catches	From Research Vessel Catches	$\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$
83	866	–	–		–		[a]53.6	2255 –	–
84	351****	C. gunnari in Polish vessels	0.06		2600		[c]45.9 – [a]51.6	1390 – 1867	–
85						12781	[c]47.1 [d]49.9	1494	

* Where Atlantic catches were not reported by subarea, these were assigned to South Georgia

** Zero catch was reported. These were estimated from USSR length frequency samples for inclusion in VPA

*** Zero catch was reported. Estimated inasmuch as minimum value was required to proceed with VPA

**** Polish catches only

[a] Soviet
[b] Polish
[c] Split year
[d] FRG

Area: SOUTH GEORGIA
Species: NOTOTHENIA GIBBERIFRONS

			CPUE (t/h)		Biomass (t)		Mean length, weight, age			
	Total Catch (t)	Target Species	Polish Commercial Vessels	Research Vessels	From Commercial Catches	From Research Vessel Catches	$\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$	
70										
71										
72										
73										
74										
75										
76	4999*					40094	[c]41.2 (41.2)	952 (802)		
77	3727*	C. gunnari			22339	–	[c]36.9 37.0	602 576		
78	16707*	Opportunistic in Polish vessels	0.53		19989	20100	[c]37.2 34.0	612 443		Total catch 48: -18500t
79	7485*	Opportunistic in Polish vessels	0.47	E		E 5894	[a]31.7 (30)	465 (302)		Total catch 48: 9910t

* Where Atlantic catches were not specified by subarea, these were assigned to South Georgia [c] Split year
( ) Research vessel catches

Area: SOUTH GEORGIA
Species: NOTOTHENIA GIBBERIFRONS

	Total Catch (t)	Target Species	CPUE (t/h) Polish Commercial Vessels	CPUE (t/h) Research Vessels	Biomass (t) From Commercial Catches	Biomass (t) From Research Vessel Catches	Mean length, weight, age $\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$
80	8143	Opportunistic in Polish vessels	0.45		–	–			
81	7429	C. gunnari in Polish vessels	0.30		13693	–	[c]33.0	602	
82	2605	C. gunnari in Polish vessels	0.13		25801	–	[c]31.9 32.0	422 368	
83									
84	531**	C. gunnari in Polish vessels	0.10		17700				
85				E		E	30.3		

** Polish catches only
( ) Research vessel catches
[c] Split year

Area: SOUTH GEORGIA
Species: CHAMPSOCEPHALUS GUNNARI

	Total Catch (t)	Target Species	CPUE (t/h) Polish Commercial Vessels	CPUE (t/h) Research Vessels	Biomass (t) From Commercial Catches	Biomass (t) From Research Vessel Catches	Mean length, weight, age $\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$	
71	10701*									
72	551*									
73	1830*									
74	254*									
75	746*									
76	12290*					141469	35–45			
77	93400*	C. gunnari in Polish vessels			226606	–	35–45			
78	7277**	Opportunistic in Polish vessels	0.11		2372	34713	25–32		$\underset{\sim}{}$ 3	Total catch 48: 154309 #
79	518**	Opportunistic in Polish vessels	0.02		–	1152	25–32		$\underset{\sim}{}$ 3	Total catch 48: 28317

* Where Atlantic catches were not specified by subareas these were assigned to South Georgia
** Soviet Catches form Area 48 were prorated based on the distribution of Polish catches by Atlantic subarea
# Probably mostly taken around South Orkney Islands

Area: SOUTH GEORGIA
Species: CHAMPSOCEPHALUS GUNNARI

			CPUE (t/h)		Biomass (t)		Mean length, weight, age		
	Total Catch (t)	Target Species	Polish Commercial Vessels	Research Vessels	From Commercial Catches	From Research Vessel Catches	$\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$
80	7592	Opportunistic in Polish vessels	0.05		–	–			
81	29322	C. gunnari in Polish vessels	0.62		88414	–	25–30		$\underline{\sim}$ 3
82	46311	C. gunnari in Polish vessels	0.62		46192	–	25–30		$\underline{\sim}$ 3
83	128184	–	–		–	–			
84	8098****	C. gunnari in Polish vessels	1.46		153000***	–			
85	[d]			E		15821	[d]21.3		15821

*** Bottom and pelagic trawl data combined
**** Polish catches data
[d] FRG

Area: SOUTH GEORGIA
Species: DISSOSTICHUS ELEGINOIDES

			CPUE (t/h)		Biomass (t)		Mean length, weight, age			
	Total Catch (t)	Target Species	Polish Commercial Vessels	Research Vessels	From Commercial Catches	From Research Vessel Catches	$\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$	
70										
71										
72										
73										
74										
75										
76						13497	–	–		
77	441*	C. gunnari in Polish vessels			4676		63.3 49.1	2956 1280		South Georgia Shag Rocks
78	1925*	Opportunistic in Polish vessels	0.03		–	7322	–	–		
79	194*	Opportunistic in Polish vessels	0.01		–	646	–	–		

* Where Atlantic catches were not specified by subarea, these were assigned to South Georgia
** Polish catches only

Area: SOUTH GEORGIA
Species: DISSOSTICHUS ELEGINOIDES

			CPUE (t/h)		Biomass (t)		Mean length, weight, age			
	Total Catch (t)	Target Species	Polish Commercial Vessels	Research Vessels	From Commercial Catches	From Research Vessel Catches	$\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$	
80	261	Opportunistic in Polish vessels	0.02		–	–	50.5 39.3	1404 616		South Georgia Shag Rocks
81	322	C. gunnari in Polish vessels	< 0.01		233	–	–	–		
82	354	C. gunnari in Polish vessels	–		–	–	–	–		
83	116		–		–	–	–	–	–	
84	3**	C. gunnari in Polish vessels	0.01		–	–	–	–		
85						8159				

* Where Atlantic catches were not specified by subarea, these were assigned to South Georgia
** Polish catches only

Area: SOUTH GEORGIA
Species: PSEUDOCHAENICHTHYS GEORGIANUS

	Total Catch (t)	Target Species	CPUE (t/h) Polish Commercial Vessels	CPUE (t/h) Research Vessels	Biomass (t) From Commercial Catches	Biomass (t) From Research Vessel Catches	Mean length, weight, age $\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$
70									
71									
72									
73									
74									
75									
76						36401			
77	1608	C. gunnari in Polish vessels		–	23210	–	[c]47.8	1086	
78	13015	Opportunistic in Polish vessels	0.47	–	39703	31057	[c]49.3	1199	
79	1104	Opportunistic in Polish vessels	0.19	E –	–	E 4192	[c]40.9	637	

* Polish catches only

[c] Polish split year (e.g. 76/77)

Area: SOUTH GEORGIA
Species: PSEUDOCHAENICHTHYS GEORGIANUS

			CPUE (t/h)		Biomass (t)		Mean length, weight, age		
	Total Catch (t)	Target Species	Polish Commercial Vessels	Research Vessels	From Commercial Catches	From Research Vessel Catches	$\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$
80	665	Opportunistic in Polish vessels	0.04	–	–	–			
81	1584	C. gunnari in Polish vessels	0.11	–	8717	–	[c]44.7	875	
82	956	C. gunnari in Polish vessels	0.13	–	16940	–	[c]44.6	868	
83	–	–	–	–					
84	888*	C. gunnari in Polish vessels	0.16	–	70500	–	[c]47.3	1049	
85				E		8134	43.0		

* Polish catches only

[c] Split year

Area: 58.5
Species: N. ROSSII ROSSII

	Total Catch (t)	Target Species	CPUE (t/h) Commercial Vessels	Biomass (t) From Commercial Catches	Biomass (t) From Research Vessel Catches	Mean length, weight, age $\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$
70	(20300)							
71	(149700)							
72	(37400)							
73	(2500)							
74	6150	C. gunnari N. rossii N. squamifrons						
75	6667	C. gunnari N. rossii N. squamifrons						
76	1859	C. gunnari N. rossii N. squamifrons						
77	6318	C. gunnari N. rossii N. squamifrons						
78	17239	C. gunnari N. rossii N. squamifrons						
79	No fishing							

Area: 58.5
Species: N. ROSSII ROSSII

	Total Catch (t)	Target Species	CPUE (t/h)	Biomass (t)		Mean length, weight, age			¢		™	
			Commercial Vessels	From Commercial Catches	From Research Vessel Catches	$\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$	Lcm	Wg	Lcm	Wg
80	1721	C. gunnari	8.35	–	–	55.3		$\underline{\sim}$ 7				
81	7991	C. gunnari N. rossii N. squamifrons	5.38	–	–	52.7		$\underline{\sim}$ 6.5	50.0	1615	54.7	2092
82	9881	C. gunnari N. rossii N. squamifrons	1.60	–	–	50.8		$\underline{\sim}$ 6	49.0	1524	51.3	1722
83	1881	C. gunnari N. rossii N. squamifrons	1.65	–	–	53.9		$\underline{\sim}$ 6.5	49.7	1588	54.7	2092
84	749	C. gunnari N. rossii N. squamifrons	0.38	–	–	(54.4)		$\underline{\sim}$ 7	51.1	1720	55.3	2162

Area: 58.5
Species: C. GUNNARI

	Total Catch (t)	Target Species	CPUE (t/h) Commercial Vessels	Biomass (t) From Commercial Catches	Biomass (t) From Research Vessel Catches	Mean length, weight, age $\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$
70	(500)							
71	(49900)							
72	(15700)							
73	(7200)							
74	26714	C. gunnari N. rossii N. squamifrons	–	–	–			
75	30043	C. gunnari N. rossii N. squamifrons	–	–	–	24.1 (Skiff Bank) 32.3 (Others)		3 4
76	8841	C. gunnari N. rossii N. squamifrons	–	–	–			
77	26947	C. gunnari N. rossii N. squamifrons	–	–	–			
78	42668	C. gunnari N. rossii N. squamifrons	–	–	–	27.4 (Skiff Bank) 32.0 (Others)		3 4
79	No fishing							

Area: 58.5
Species: C. GUNNARI

	Total Catch (t)	Target Species	CPUE (t/h) Commercial Vessels	Biomass (t) From Commercial Catches	Biomass (t) From Research Vessel Catches	Mean length, weight, age $\bar{l}$ (cm)	$\bar{w}$ (g)	$\bar{t}$	
80*	1368	C. gunnari							
*	1169*	N. rossii	1.81 (Shelf S.W.)			26.4	96	3	
	1*	N. squamifrons	0.01 (Skiff Bank)			–		–	Non representative
81*	1052	C. gunnari							
*	61*	N. rossii	0.42 (Shelf N.E.)			35.3	246	5	
	992*	N. squamifrons	1.60 (Skiff Bank)			28.5	123	3	
82*	15990	C. gunnari							
*	6928*	N. rossii	4.01 (Shelf N.E.)			23.5	66	2	
	1025*	N. squamifrons	1.61 (Skiff Bank)			32.6	190	4	
83*	25927	C. gunnari							
*	21004*	N. rossii	6.63 (Shelf N.E.)			27.8	114	3	
	4*	N. squamifrons	0.03 (Skiff Bank)			(22.5)	57	2	
84*	(7139)	C. gunnari							
*	6155*	N. rossii	0.98 (Shelf N.E.)			32.6	190	4	
	898*	N. squamifrons	1.12 (Skiff Bank)			27.7	112	3	
85*	5456*		6.18 (Shelf N.E.)			24.8	79	2	
*	223		0.89 (Skiff Bank)			31.3	167	4	

* Nb. Tons analysed for CPUE and mean length

** A total amount of 1 Ton has been caught on the Skiff Bank during 1980
992 " 1981
1025 " 1982
4 " 1983
898 " 1984
223 " 1985

TABLE 3: Numbers Caught at Each Age, *N. rossii*. Estimates based on length frequency, age length and mean weight data provided by U.S.S.R.

70	0.	0.	1233020.	5445839.	10686174.	14898992.	14487986.	16029261.	14487986.	11919194.	6678859.	5445839.	1335772.
71	0.	104133.	911162.	2134724.	2863653.	3071919.	2837620.	3202085.	3150019.	3097952.	2056624.	2134724.	494631.
72	0.	3346.	32625.	70269.	92856.	107077.	101222.	112933.	105404.	92856.	56885.	49356.	12548.
73	0.	26.	524.	1396.	1571.	1213.	977.	829.	707.	619.	401.	384.	87.
74	0.	4.	111.	362.	452.	312.	227.	149.	119.	105.	65.	65.	14.
75	0.	4.	222.	854.	1146.	736.	485.	234.	159.	146.	88.	92.	21.
76	0.	4436.	195186.	798490.	1184426.	891647.	621048.	283907.	168570.	124209.	70977.	70977.	13308.
77	0.	6804.	122464.	530679.	884465.	772206.	561295.	244929.	132670.	71438.	37420.	34018.	6804.
78	0.	15771.	199765.	465242.	586153.	509927.	391645.	215536.	126167.	65712.	31542.	18399.	2628.
79	0.	13999.	276483.	703456.	853946.	650959.	479470.	248484.	143491.	69996.	34998.	17499.	3500.
80	0.	34821.	951768.	2623167.	3064230.	2066034.	1462473.	696416.	394636.	174104.	92855.	34821.	5803.
81	0.	818.	69542.	204534.	232351.	138265.	93268.	40089.	22908.	7363.	4909.	1636.	0.
82	0.	0.	51799.	160053.	177513.	93704.	59365.	22116.	12222.	2328.	2328.	0.	0.
83	0.	0.	13441.	79111.	121355.	83720.	53765.	19202.	8449.	3456.	1536.	384.	0.

TABLE 4: V.P.A. for *N. rossii* (based on catch at age data, Table 3)

Notothenia rossii, South Georgia

	YEAR													
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
	FISHING MORTALITY													
2	0.000	0.027	0.001	0.000	0.000	0.000	0.001	0.001	0.003	0.006	0.042	0.003	0.000	0.300
3	0.278	0.387	0.011	0.000	0.000	0.000	0.032	0.021	0.034	0.068	0.748	0.111	0.218	0.400
4	0.812	1.109	0.046	0.001	0.000	0.000	0.171	0.114	0.103	0.161	1.615	0.348	0.398	0.600
5	1.247	1.584	0.116	0.001	0.000	0.000	0.347	0.290	0.178	0.278	2.296	0.585	0.579	0.600
6	1.560	1.977	0.199	0.002	0.000	0.000	0.427	0.401	0.271	0.306	2.497	0.701	0.498	0.600
7	1.499	2.030	0.297	0.002	0.000	0.001	0.561	0.526	0.365	0.440	2.919	0.989	0.760	0.600
8	1.590	2.593	0.400	0.003	0.000	0.001	0.529	0.451	0.394	0.417	2.947	0.923	0.676	0.600
9	1.540	2.584	0.715	0.004	0.001	0.001	0.661	0.507	0.444	0.498	3.343	1.349	0.834	0.600
10	1.700	2.837	0.605	0.008	0.001	0.001	0.808	0.664	0.510	0.475	2.619	1.026	0.446	0.600
11	1.261	2.674	0.466	0.004	0.001	0.001	0.762	0.614	0.708	0.566	3.023	0.600	1.169	0.600
12	2.203	3.282	0.525	0.005	0.001	0.002	1.141	1.093	0.711	1.182	2.312	0.572	0.000	0.600
13	0.000	2.236	0.213	0.001	0.000	0.000	0.353	0.291	0.210	0.278	2.312	0.000	0.000	0.000
MEAN F	1.485	2.236	0.213	0.001	0.000	0.000	0.353	0.291	0.210	0.278	2.312	0.572	0.521	0.600
REC AGE	4+	4+	4+	4+	4+	4+	4+	4+	4+	4+	4+	4+	4+	4+

Table 4, continued

AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
							STOCK SIZE								
2	220.7	4259.7	6366.9	2868.9	441.4	441.4	7896.5	7989.9	5639.7	2424.6	928.9	355.8	44.1	0.0	0.0
3	5571.1	3114.8	3394.2	5256.2	6123.8	6123.8	6830.2	6518.2	6580.1	4605.6	1970.1	729.2	290.9	44.7	0.0
4	10664.1	3452.6	1732.4	2751.2	4438.1	5235.2	5586.5	5416.9	5227.0	5208.0	3521.3	763.7	534.3	191.6	24.5
5	16215.6	3876.7	932.8	1355.0	2267.1	3418.0	4428.2	3854.7	3956.7	3860.3	3630.3	573.3	441.6	293.8	86.1
6	20301.9	3815.4	651.4	680.0	1110.6	1888.9	2808.8	2561.8	2360.8	2711.6	2392.7	299.2	261.5	202.7	132.0
7	20094.8	3492.8	432.7	436.9	556.7	922.9	1581.7	1499.8	1404.5	1474.3	1635.0	161.3	121.5	130.2	91.1
8	21662.8	3674.0	375.6	263.3	357.5	461.2	756.4	739.2	725.3	798.3	777.1	72.3	49.1	46.5	58.5
9	19852.5	3617.2	225.0	206.2	215.3	297.4	380.3	365.1	385.6	400.4	430.7	33.4	23.5	20.5	20.9
10	15664.1	3483.4	223.4	90.1	168.0	177.1	244.0	160.7	180.0	202.6	199.3	12.5	7.1	8.4	9.2
11	10074.5	2342.7	167.1	99.9	73.2	136.8	145.1	89.0	67.8	88.5	103.1	11.9	3.7	3.7	3.8
12	6530.7	2336.6	132.3	85.8	81.5	60.1	113.0	55.5	39.4	27.3	41.2	4.1	0.0	0.9	1.7
13	0.0	590.5	71.8	64.1	69.9	67.1	49.0	29.6	15.2	15.9	6.9	0.0	0.0	0.0	0.4
TOT NOS	146852.7	38056.4	14705.4	14157.6	15903.1	19229.8	30819.7	29280.3	26582.3	21817.4	15636.5	3016.5	1777.3	942.9	428.1
WGHTUNAD	489899.0	108578.3	13324.8	13113.6	17786.4	24124.9	33419.7	30141.8	28932.8	29232.2	26417.7	3522.3	2518.6	1825.5	1140.5
SPWN NOS	135473.2	29648.0	5156.3	6378.4	9275.1	12156.1	15452.5	14199.0	13856.1	13767.5	11550.6	1801.6	1285.4	798.1	399.0
WGHTUNAD	478253.3	104861.4	10957.0	10401.7	14541.7	20326.1	28018.5	25012.1	24134.1	25326.6	23801.7	2950.9	2184.9	1671.2	1091.5

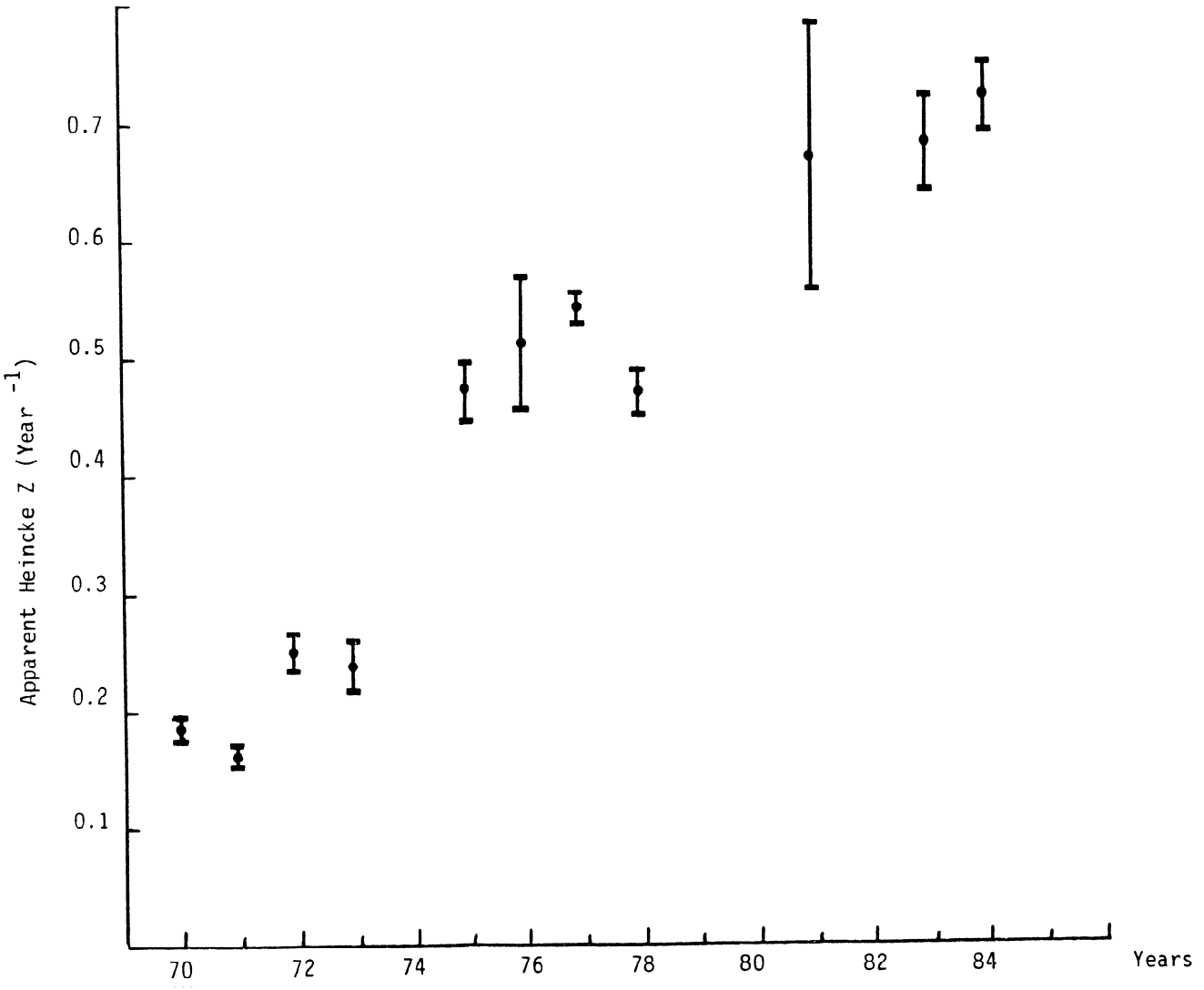
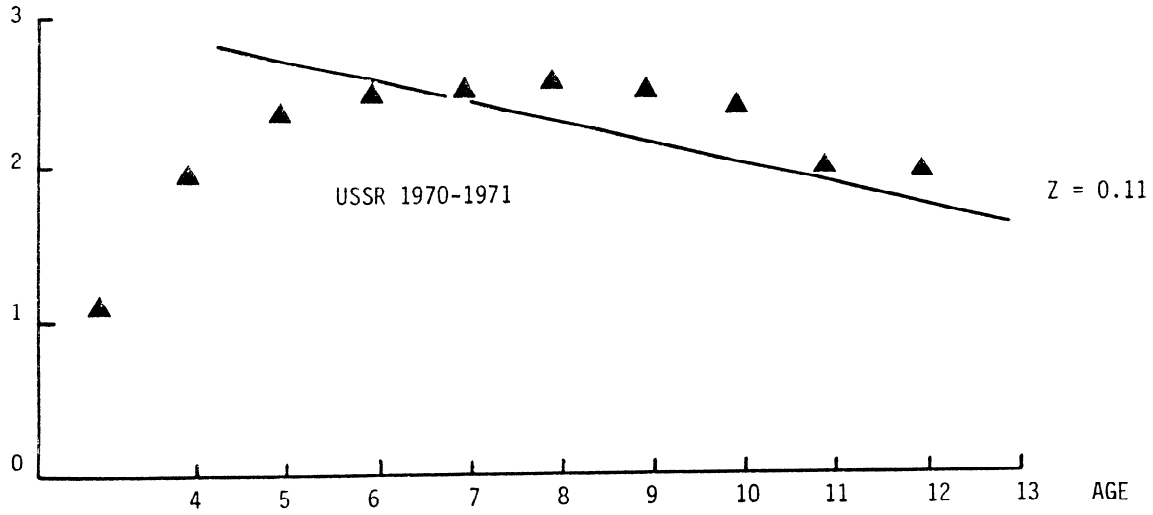


Figure 1: Estimates of total mortality in *N. rossii* for subdivision 48.3 using Heincke method
Error bars - ± Standard error
Age at full recruitment = 6 years



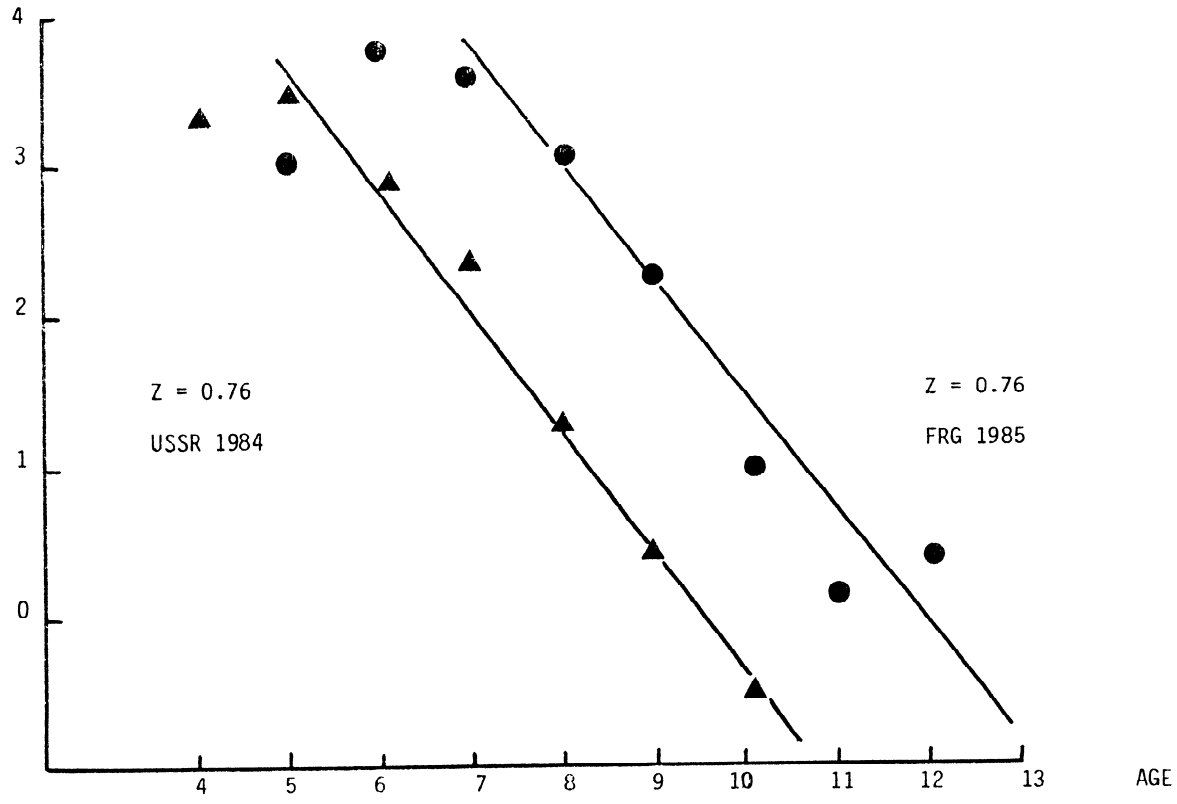


Figure 2: Catch Curves for *N. rossii* for S. Georgia, based on 1970–1971 USSR data, 1984 USSR data and 1985 FRG data.

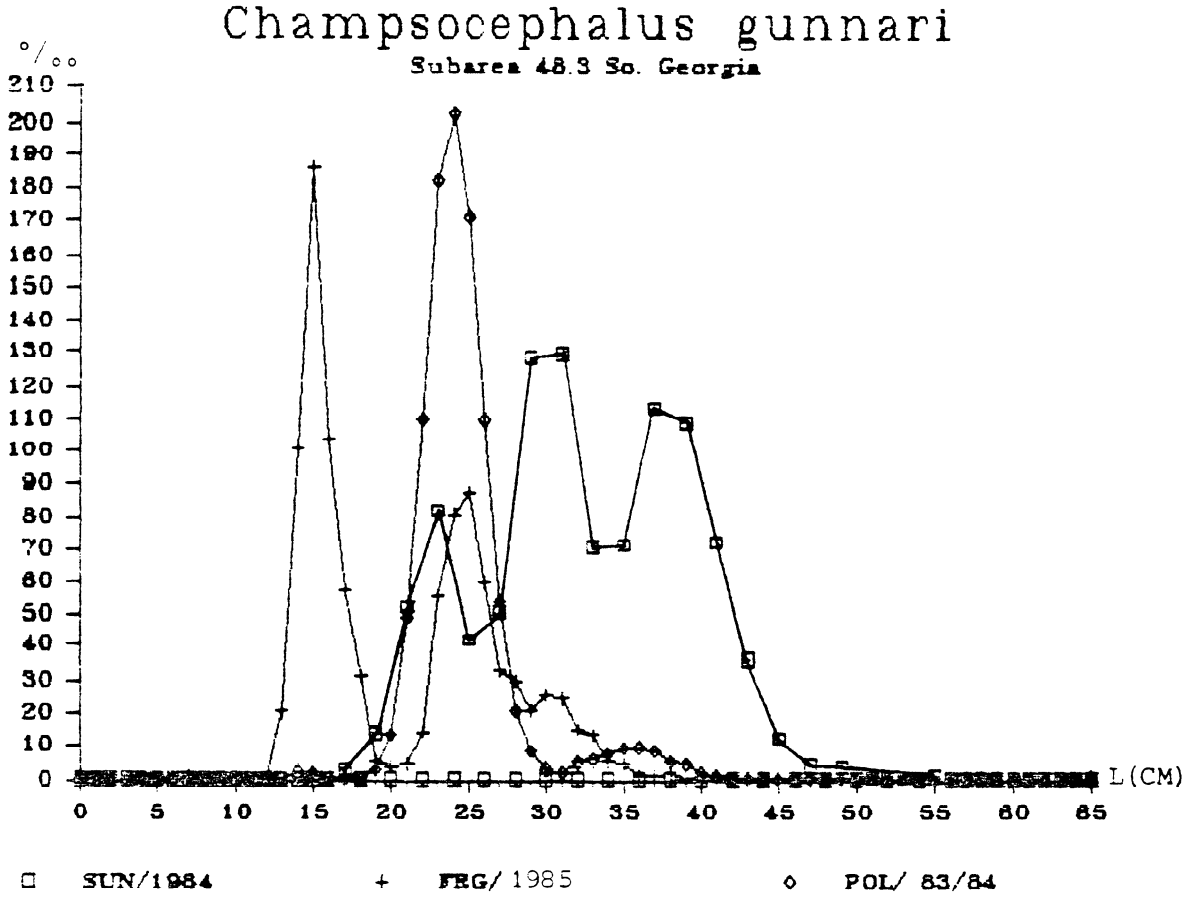


Figure 3: Length composition of *C. gunnari* at S. Georgia showing the effect of selectivity.

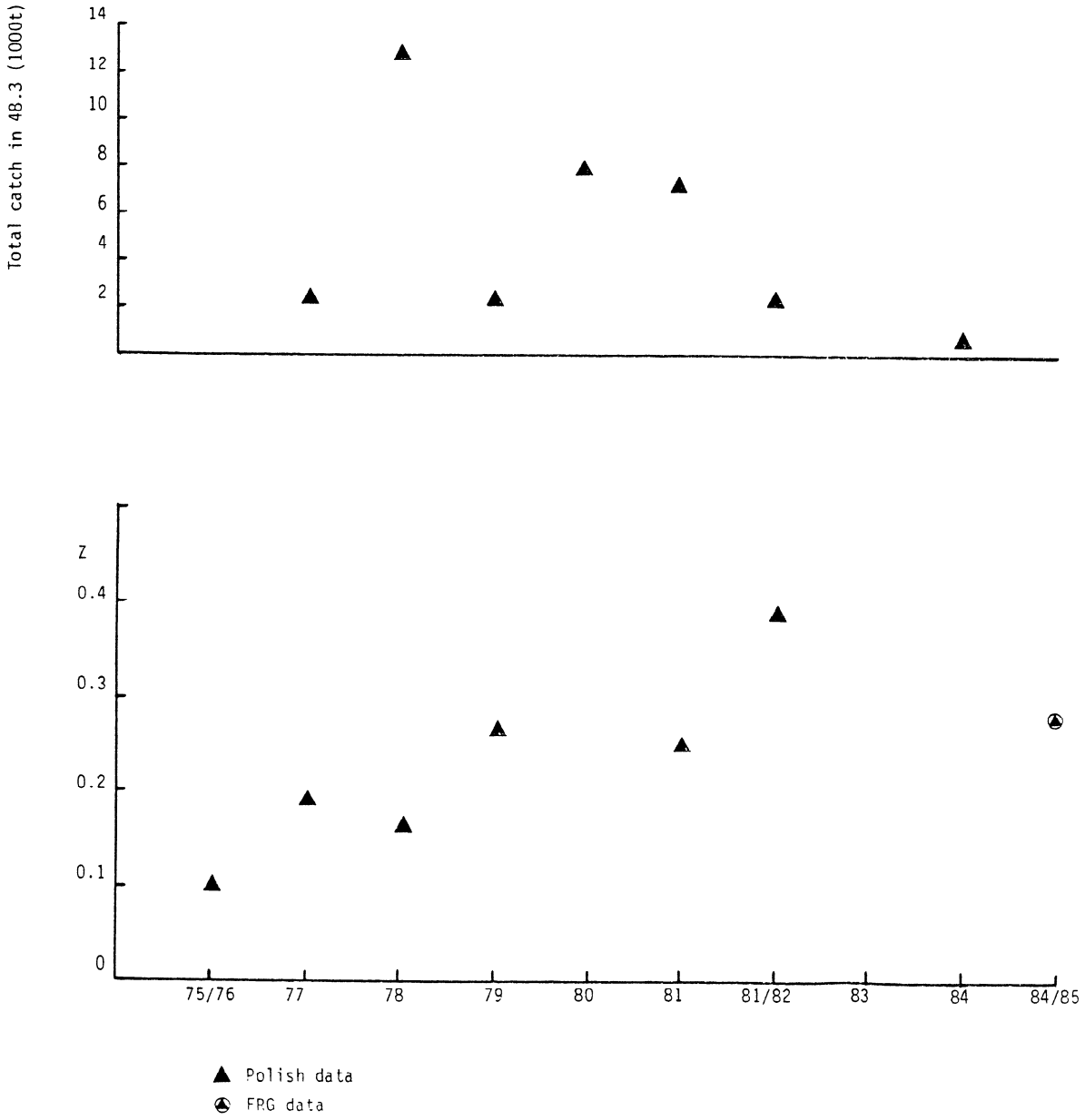


Figure 4: Estimates of total mortality for *N. gibberifrons*, based on average length.

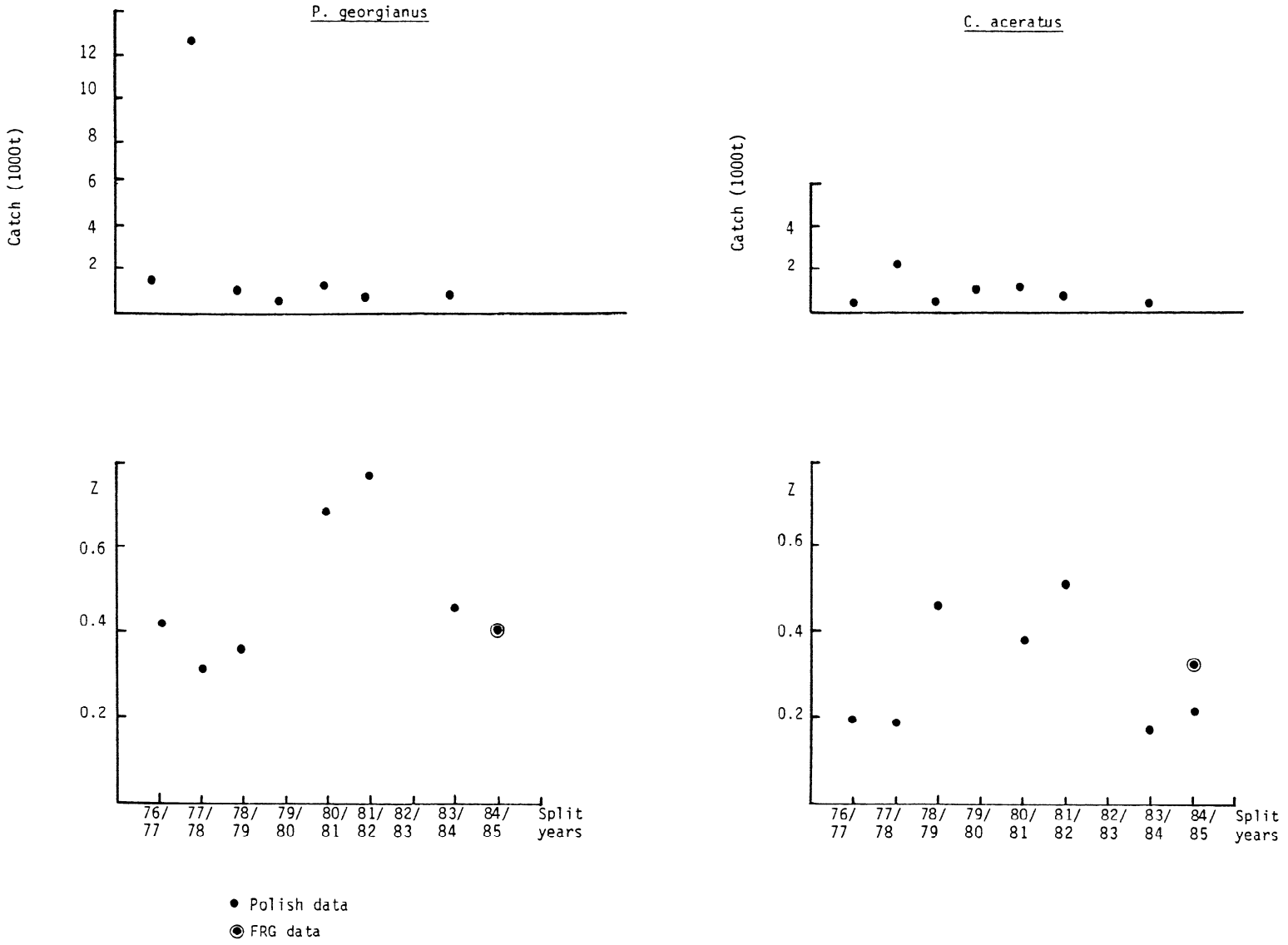


Figure 5: Estimates of total mortality for *P. georgianus* and *C. aceratus* based on average length.

ANNEX 5

CHAIRMAN'S COMMENTS ON THE RESULTS OF THE FISH STOCK ASSESSMENT WORKING GROUP MEETING

REPORT OF THE AD HOC WORKING GROUP ON FISH STOCK ASSESSMENT

CHAIRMAN'S SUMMARY

ASSESSMENTS

1. The new length and age data which was made available for the group by several countries permitted an improved assessment of the effects of fishing on *N. rossii* and *C. gunnari* stocks at South Georgia. An assessment of *N. rossii* and *N. squamifrons* at Kerguelen was presented by France. Data were not available to assess any stocks in the South Atlantic peninsula subarea.

South Georgia

N. rossii

2. The previous, 1984, report concluded that 'this stock is very severely affected by fishing'. All the further information discussed during the present meeting confirmed that conclusion. Not only was the stock depleted by the very large catches between 1969 and 1971, but the relatively small catches taken since then have been sufficient to cause further decline. Though the strengths of the year-classes currently in the fishery are not precisely known, they are certainly small, and small catches will be sufficient to prevent a recovery. The information on yield-per-recruit and current year-class strength, as well as on the effects of recent catches suggest that the current replacement yield is less than a thousand tons. In contrast, if the spawning stock could be rebuilt to provide recruitment of say 10 million fish (i.e. rather less than the recruitment in the 1960s), and the fishing mortality and age at first capture adjusted to provide a yield of around 1000 gm per recruit, this would correspond to a sustainable annual yield of around 10,000 tons.

C. gunnari

3. While it appears that this stock is heavily fished, there is no indication that recruitment has, up to the present, been affected. Though the information on year-class strength is not as

good as for Kerguelen, it does suggest that, as in the case at Kerguelen, recruitment is variable. This variability is in part the cause of the high variability in annual catches, and this effect is increased by the degree to which recent catches are dominated by a single year-class. This, as noted last year, makes the fishery vulnerable to years of low recruitment, a possibility which has to be recognised if the high level of mortality continues.

4. For both species, the yield per recruit calculations indicated that increases would be obtained by increasing the age at first capture or reducing fishing mortality. Substantial reductions in fishing mortality, even to less than about 20% of current levels, would not much decrease yield-per-recruit and would increase spawning stock.

N. gibberifrons

5. There has been a clear upward trend in total mortality from about 0.1 in 1975/76, to 0.3 or more after 1981. This seems almost certainly due to the increased catches; catches were negligible before 1975. The data suggest the current values of F and M are around 0.2 and 0.1 respectively. It does seem probable that fishing mortality (as an average over the last years) is well in excess of natural mortality. This high rate of fishing may be detrimental to the stock in the long run. It was noted that this species is taken primarily as a by-catch.

6. The data are too sparse to show any clear trends for *C. aceratus* and *P. georgianus*, for which, reported catches were low except in 1977/78 when 13,000 tons of georgianus were reported. Some of the actual catch for these species may be part of the large reported catches of unidentified species.

Kerguelen

7. The detailed fisheries log-book data which have been collected since 1979 have permitted a detailed description of the fishery and trends in population size.

N. rossii

8. The decline of this stock has continued and there is some evidence that recruitment has been adversely affected. The annual average catches of around 5000 tons since 1980 have been greater than the recruitment rate.

C. gunnari

9. Length and age analysis of this relatively short-lived species show that there are large variations in year-class strength. A good cohort was born in 1979, and supported good catches in the 1981/82 and 1982/83 seasons, but has now become scarce. Information from the 1984/85 season suggests that the 1982 cohort is also good. The relatively high total mortality suggests that fishing mortality is significant, but there is no evidence that this is affecting recruitment.

N. squamifrons

10. Recent catches have been considerably smaller than the peak catches of 26,500 and 51,000 tons taken in the 1970/71 and 1971/72 seasons. However, there is no evidence to determine whether there has been a decline in stock size, or whether the decrease in catch is due more to a decrease in fishing effort on a species which is less attractive commercially than *N. rossii*.

MANAGEMENT ADVICE

Mesh Regulations

11. There were no direct observations on selectivity for Antarctic fish available at the meeting.

12. In the Convention area, comparisons of catches by research vessels using small meshes with those of the commercial fleets have shown, that for *C. gunnari* the larger size meshes in commercial nets do release the smallest size-class of fish (ca. 15 cm). For the other species including *N. rossii* a comparison of the data sets shows no such difference, with very small fish being absent even from the small mesh catches. This suggests that the small fish are absent from the commercial fishing grounds and that all sizes of fish offshore can be retained in the mesh sizes now in use.

13. The earlier analyses did suggest, on the basis of yield-per-recruit analyses, that if the age (and size) at first capture of at least *N. rossii* and *C. gunnari* was increased, then the yield-per-recruit and stock would improve. Because the selective action of a trawl is not exact, and selection occurs over a range of sizes, and because data was lacking there could

not be determined a unique match of mesh size to size of first capture. However, it is usual to choose the mesh size whose 50% selection point (i.e. the length at which 50% of the fish will pass through meshes) is equal to the desired length at first capture.

14. The group noted that it is important, when introducing mesh regulations, to have a clear understanding of what is meant by a mesh of a given size; e.g. how the mesh is to be measured. This question has been the subject of lengthy discussions in other Commissions, especially in the north Atlantic, and the experience of those bodies should be drawn upon in establishing CCAMLR rules if mesh regulations are to be introduced.

CLOSED AREAS

15. There was no new information provided on the distribution in time and space for fish around South Georgia. For *N. rossii* juveniles apparently occupy coastal areas until about 4 or 5 years of age. *C. gunnari* spawns inshore in April and May following offshore aggregation and migration inshore.

16. Experience at Kerguelen has indicated that closed areas for all or part of the fishing season can provide protection for juveniles and spawners.

MANAGEMENT NEEDS

South Georgia

N. rossii

17. This stock is severely depleted, and the only hope for significant catches in the future is to rebuild the spawning stock. There should certainly be no directed fishery, but since any incidental catches would cause further declines in the stock, measures should also be taken to keep incidental catches to a minimum.

C. gunnari

18. The stock appears to be heavily fished, even though there is no indication that recruitment has been affected as yet. Gains in terms of yield-per-recruit would be expected from any measures that increased the age of recruitment (e.g. mesh size), or reduced the fishing mortality (e.g. limits on annual catches, or on the number of vessels operating). Measures of the latter type by increasing the number of year-classes contributing effectively to the fishery, would reduce the year-to-year variability, and the vulnerability of the fishery to declines in recruitment.

N. gibberifrons

19. The present fishing mortality, though due only to by-catch, appears to be high. It would seem desirable to keep the amount of by-catch to as low a level as practicable.

Kerguelen

20. Since 1979 a number of controls have been progressively established by the French authorities. These are set out in the report of the 1984 meeting of the Scientific Committee (paragraph 7.22). However, the present controls seem to have been applied too late to prevent further decline in the stock of *N. rossii* in recent years, and consideration should be given to some strengthening. It might also be useful to analyse age and length data for *C. gunnari* to show whether, to improve the yield-per-recruit, it might be desirable to reduce the amount of fishing, or increase the size of first capture.

INFORMATION NEEDS

21. Although there was new data provided this year, the available information is still insufficient for firm assessments. The reporting of commercial catch and effort was in all cases falling short of the requirements stated last year. Only Poland provided catches giving a geographical breakdown smaller than subareas. Statlant 8B forms were available at the time of the working group only for 1982/83 from all countries, and only from Poland and France for other years.

22. The group did estimate split year catches of *N. rossii* for USSR for 1969/70 to 1971/72; and subareas of area 48 for *C. gunnari*. The group recommended that the Commission's tabulations be modified accordingly.

23. The group also urged that countries make every effort to classify the significant quantities of fish reported as unidentified.

24. The group recommended reporting of length frequencies by one centimeter groupings, measurements being carried out according to BIOMASS standards.

25. More detailed reports of biological information giving the basis of the analysis and results are required and should be provided to the Commission at future meetings.

26. Information on time and fine scale area of both fish and fishing distributions around South Georgia is required.

27. Information on mesh selectivity is required for all species, and countries are urged to conduct such experiments during the next year if possible.

28. Surveys of juvenile fish are needed to provide indices of recruitment. Any past data would be particularly valuable.

29. Differences in ageing between countries were noted for *N. rossii* and *C. gunnari*. It is important that they should be resolved, and the group recommend direct interchanges of materials, and also a workshop to be held in some conveniently located institute. Those actively engaged in age reading should be involved.

30. The group noted that much of the time during its meeting had been taken up with work of data compilation, and running routine analyses such as VPA. With the benefit of experience, it is clear that the duration of the meeting could be shortened, and more time spent in discussions of matters of substance arising from the analyses, if most of this work could be done in advance of the meeting. The group therefore suggested to the Scientific Committee that, when similar meetings are convened in the future, clear guidance should be given to the Secretariat, so that they can carry out the preliminary analyses. Consideration should also be given to possible modifications of the latest dates of submission of data to the Commission.

ANNEX 6

REPORT OF THE *AD HOC* WORKSHOP ON KRILL CPUE

INTRODUCTION

1. The Working Group met on 21, 22 and 29 August 1985. Dr W. Ranke (GDR) had been appointed Convenor of the group. In his absence Dr I. Everson (UK) chaired the meeting for the first two days and Mr D. Miller (South Africa) acted as rapporteur.

2. Having briefly reviewed the background to the meeting, the Chairman proposed an agenda (see Appendix I) which was subsequently adopted by the meeting (see Appendix II for list of participants).

3. A number of documents were available to the meeting and these are listed in Appendix III.

REVIEW OF PURPOSE OF THE MEETING

4. The purpose of the meeting was reviewed. The aims of the group were, briefly:

   (a) To identify the measures of fishing effort that are suitable for the monitoring of krill abundance by the catch-per-unit-effort (CPUE) method, and the methods of analysing effort data in order to produce indices of abundance.

   (b) To describe research projects that will improve the quality of krill abundance estimates by the CPUE method.

USE OF CPUE DATA

Basic Description of CPUE Theory

5. Dr J. Gulland (CCAMLR invited expert) briefly described the underlying theory behind the use of the CPUE method for the estimation of commercial fish abundance. He identified three types of fisheries operations and highlighted differences in the characteristics of CPUE data so collected.

6. The three fisheries types identified were demersal trawl fishery, whaling and purse seine fishing. These differ in the relative importance given when computing or collecting

data on fishing effort to the time spent actually fishing, and the time spent searching. Bottom trawl fisheries are characterised by more or less continuous fishing whilst whaling involves a high proportion of searching relative to catching time. Purse seining involves a combination of the two strategies.

7. The group recognised that the assumption of random distribution of krill fishing activities was not necessarily a pre-requisite of the fishery although it simplified the basic principles of CPUE application. It follows that an inverse linear relationship cannot be assumed between krill abundance and fishing effort for a wide distributional area and for essentially localised fishing activity. The krill fishery is therefore likely to reflect a combination of operations varying between searching and continuous fishing in areas of good catches as in a demersal fishery.

Fishing Effort and the Krill Fishery

Description of fishing strategies

8. Japanese and Soviet methods of krill exploitation differ. Dr Y. Shimadzu briefly summarised the Japanese fishing operation as set out in Documents 4–6 and Document 9. He highlighted differences in single catcher boat and in mother-ship type operations, indicating associated variations in the catch-per-haul data. The Japanese fishing operation also depends on the type of krill targeted and this in turn directly affects fishing time. When large krill are being fished, haultime is reduced to improve the quality of the catch. The Japanese krill fishery appears similar at least during the peak fishing season to a demersal trawl operation, for which catch-per-unit-fishing time is quite readily used as an index of density. For this operation fishing appears to be more or less continuous, with little or no between-haul searching. The length of haul is adjusted to the catch rate, so that catch per haul would not reflect changes in density. The catch per hour or per minute would not be so affected. The group therefore recognised that in the Japanese fishery catch-per-unit-fishing time would appear to provide a useful index of local density in the immediate vicinity (i.e. of the order of perhaps 1–5 km around the vessel's track although judging by the daily operational area of catcher boats in mothership type operations, this area may be much larger – possibly as much as 50 km). Difficulties occur when attempting to expand to provide abundance indices for larger areas in the absence of search-time or inter-krill-concentration distance.

9. The Soviet fisheries strategy is very different from that of the Japanese. As described in Documents 7 and 8, it relies on advice from fisheries research vessels to locate fishing

vessels in areas of high krill abundance. At present, problems with processing the catch set the level of fishing effort and little data is available from actual fishing operations. The group appreciated that research vessel survey data would be likely to provide fisheries independent estimates of krill abundance.

Measures of Abundance for Large Areas

10. While the catch-per-unit-fishing time in operations such as the Japanese mid-season fishery do provide information on krill density over an area much larger than the path swept by the net (perhaps dimensions of 1–-5 km upwards – Item 8 and Document 4) (or possibly areas of 1° latitude by 5° longitude in those areas where fishing has been distributed over such an area); problems still exist in using catch/effort data to provide measures of abundance over larger areas such as 'fishing' areas or areas occupied by a biological stock. The key questions are found in the ratio of the overall density to local density in the selected areas, or, what is nearly but not quite the same thing, the proportion that high density areas (sufficiently high to support a fishery) occupy of the total distributional area of the stock. The second question is best answered when information on the searching carried out by the fishing fleets is available and from which the average distance between high-density patches may be deduced. On this point, the tactics of the Soviet and Japanese fleets are different, and data from the two types of operation may require different methods of analysis in order to produce useful indices of abundance.

11. In other cases (e.g. whaling) theoretical studies, including simulation modelling, have proved valuable in determining the best methods of approach. The group therefore strongly recommended that a consultant, be appointed, or some other suitable arrangement be made, to study methods of applying search time and CPUE data to the estimation of krill abundance over larger areas.

12. A range of relationships between CPUE and overall krill density are possible. In order to explore this range, and in particular, to identify the type of effort data which will give the strongest relationship between CPUE and abundance, a simulation study will be required. The following broad terms of reference are proposed:

(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;

(d) In addition, examine how catch and effort data may be combined with independent survey data, based on hydroacoustic methods or research trawls, in order to obtain an index of abundance applicable to larger areas.

13. The aim of the study is exploratory, and hence, both parts of the model should be able to simulate a wide range of possible behaviours. Data from the BIOMASS programme would assist in the development of a spatial model for krill. Changes in the character of krill aggregations with local krill density may give an indication of some possible models for variation in aggregation behaviour with krill stock abundance. In addition, there are several statistical methods which might be applied depending on the nature of the observations being made. In general, the objective would be to derive the appropriate probability density functions describing the frequency, size and type of krill aggregates using the so called 'kernel' method or other appropriate statistical procedures. Comparison of the probability density functions for different times and different areas might be indicative of changes in the krill population. As the 'kernel' method is a relatively new statistical technique, some participants felt that there are likely to be problems in applying the technique to the krill fishery. The group drew notice to the forthcoming ICES meeting in London in October, 1985 when the method will be discussed in some more detail.

14. Data provided to the Working Group by Japanese scientists (along the lines proposed in Appendix IV) should provide sufficient data for input into a model for one class of fishery in which fishing is carried out more or less independently by each vessel. However, further information, both qualitative and quantitative, is required for the USSR fisheries, particularly with respect to the role of fisheries research vessels in directing the fishing fleet to krill concentrations and the time budgets of a range of fishing vessels.

15. A budget to cover appropriate work should be made available to initiate the simulation study. It is likely that the money involved would be around the cost of one year's consultancy time. A preliminary report will be required at the 1986 meeting of SC-CAMLR with a final report being submitted to the 1987 meeting.

Data Requirements and Proposals for Data Submission

16. The group reviewed the type of data required to implement CPUE analyses to determine krill abundance. It recognised that such analyses are most effective in a very small area and only provide very local estimates of krill abundance.

17. Three types of catch and effort data to be collected by fishing operations in order to obtain a measure of krill density or abundance have been discussed on a number of occasions. The group reviewed the data list compiled by the Woods Hole meeting of the CCAMLR *ad hoc* Working Group on Data Collection and Handling. It agreed that only minor modifications were necessary, principally concerning data of interest for other purposes and not essential for providing density or abundance indices. The revised list is given in Appendix IV.

18. The group noted that volumes of data were likely to be large for some countries' operations and that questions had been raised whether difficulties of interpretation, and therefore the potentially reduced value of the data justified the effort and expense of compiling large data sets. Examination of detailed Japanese data resolved some, but not all, of the doubts expressed concerning the value of detailed data.

19. The group further believed that many of the remaining doubts about whether or not varying details of data concerning fishing operations listed in Appendix IV and time-budget information were useful, would be resolved by specific analyses proposed in Paragraph 12. It is therefore essential that countries possessing such data should make a representative sample (e.g. covering the operation of one fleet for two seasons) available. At the same time the meeting believed that all countries should make every effort to collect data listed in Appendix IV as a matter of routine.

20. In terms of abundance estimation, the group appreciated the important role that independent fisheries research vessels may play. Wherever possible, data collected by fisheries research vessels should be integrated with catch data from fishing fleets. Such data are especially important in terms of the Soviet fishery where both research vessel and fishery data are collected routinely. The group requested that Soviet data of this nature be made available.

21. Furthermore, the group appreciated the valuable contribution made by the BIOMASS acoustic surveys to the collection of distributional and abundance information on krill over a wide geographic area. It <u>strongly recommended</u> that further analysis of this data be

encouraged, particularly in terms of the spatial distribution of krill swarms and their probability of occurrence.

22. The group considered that catch and effort data should continue to be collected in accordance with current national practice. Specific proposals on the reporting format should only be made in the light of the results from the proposed simulation exercise (Item 12).

Fishing Power

23. Changes in fishing power – a larger net, more powerful trawler, changed net design (e.g. as discussed in Document 4) – will affect the catch-per-unit of fishing time on a given density of krill. It is therefore essential to have good records of factors that may affect fishing power (see Appendix IV, Part I). Research into the relation between these parameters and fishing power is encouraged.

Calibration and Verification of CPUE Methods

24. The group agreed that in the future some attempt will have to be made to calibrate the effort-effectiveness of fishing power. In addition, independent verification of the assumed linear relationship between krill abundance as indexed by CPUE and actual abundance requires empirical analysis. Co-operative programmes between research and fishing vessels were once again encouraged.

Krill Behaviour With Respect to CPUE

25. It was agreed that CPUE may change as a result of variability in the catchability of krill caused by behaviour.

26. At present few substantial data are available for determination of cause-effect relationships in krill swarm formation. Few data are available concerning the effects of swarming, seasonal behaviour and diurnal variation on the catchability of krill in terms of fishing operations.

27. The group strongly recommended that research vessel investigations of krill behaviour and catchability be encouraged.

OTHER APPROACHES TO MONITORING KRILL ABUNDANCE

28. The group recognised a number of fisheries independent methods for monitoring krill abundance.

29. Hydroacoustics was seen as the most effective method for direct estimation of krill abundance and distribution. The group took cognisance of some of the problems inherent in the hydroacoustic method and outlined by the BIOMASS Krill Acoustics Working Party. Problems outlined included inadequate krill acoustic target strength information, inadequate insonification of surface waters, dispersal effects and a mismatching between krill consumption by predators and acoustic standing stock estimates. The costs of acoustic surveys would also be a serious consideration for their implementation over an extended area.

30. The group recognised the potential importance of monitoring krill abundance over smaller areas than 'stock' or 'fishing' areas, particularly when studying the interaction between krill predators (especially those with restricted foraging ranges – e.g. penguins); krill; and krill fishing. For these purposes the catch-per-unit-fishing time might already be a reasonably satisfactory index of local krill density.

FOLLOW-UP TO WORKSHOP

31. A preliminary report on simulation modelling of krill fishing operations (Items 11, 12 and 15) will be required for the Fifth Meeting of SC-CAMLR. The group recognised that the availability of suitable data will be essential for the successful implementation of the simulation modelling exercise. The group appreciated the efforts of the Japanese delegation in supplying such data to the present meeting. It also took note that the USSR may be unable to submit detailed data from commercial krill fishing operations.

APPENDIX I

KRILL CPUE WORKSHOP
AGENDA

1. Review of Purpose of the Meeting

2. Use of CPUE Data

   (a) Basic Theory

   (b) Fishing Effort and the Krill Fishery

   - Description of fishing strategy and breakdown into activities
   - Measures of abundance for large areas
   - Data requirements and proposals for data submission
   - Fishing power
   - Calibration and verification of CPUE methods against several independent methods.

   (c) Krill Behaviour With Respect to CPUE

3. Other Approaches to Monitoring Krill Abundance

4. Follow-up to the Workshop

5. Adoption of the Report

APPENDIX II

LIST OF PARTICIPANTS OF
KRILL CATCH PER UNIT OF EFFORT WORKSHOP
(21–22, 29 AUGUST, 1985)

ARGENTINA	Dr A. Tomo
	Dr E. Marschoff
AUSTRALIA	Dr K. Kerry
	Mr W. de la Mare
	Mr P. Heyward
	Dr G. Kirkwood
CHILE	Dr A. Mazzei
FRG	Dr K.-H. Kock
GDR	Dr W. Ranke
JAPAN	Dr Y. Shimadzu
	Dr Y. Watanabe
NORWAY	Dr O. Østvedt
POLAND	Dr W. Slosarczyk
SOUTH AFRICA	Dr D. Miller
USSR	Dr R. Borodin
	Mr S. Komogortsev
UK	Dr I. Everson
	Dr J. Beddington
USA	Dr K. Sherman
	Dr R. Hennemuth

IUCN SPONSORED EXPERT	Dr J. Cooke
INVITED EXPERT	Dr J. Gulland (UK)
SECRETARIAT	Dr D. Powell
	Mr F. Ralston
	Dr E. Sabourenkov

APPENDIX III

WORKSHOP ON KRILL CPUE ANALYSES

Hobart, 21–22, 29 August 1985

List of Documents

Krill WG/1985/Doc.1	Workshop on Krill CPUE Annotated Agenda
Doc.2	Krill – Catch Per Unit Effort (J.A. Gulland)
Doc.3	A Note on Relating Krill CPUE Measures to Abundance Trends (Douglas S. Butterworth and Denzil G.M. Miller)
Doc.4	Some Considerations on the Usefulness of CPUE Data from Japanese Krill Fishery in the Antarctic (Yasuhiko Shimadzu and Taro Ichii)
Doc.5	An Updated Information of the Japanese Krill Fishery in the Antarctic (Yasuhiko Shimadzu)
Doc.6	Some Aspects of Repeated Operation on the Same Patch in Japanese Krill Fishery (Taro Ichii)
Doc.7	Agenda
Doc.8	List of Documents
Doc.9	Proposals on the Standardisation of Complex Studies Aimed to the Elaboration of the System of the Biological and Oceanographical Monitoring of the Antarctic Waters (basing on examples of the observation of the XXII expedition of the R/V 'Academic Knipovich' at the section going along 67°E. Commonwealth Bay, March 1984) (R.R. Makarov and V.V. Maslennikov, 1985, USSR National Section, CCAMLR)

Doc.10 Technique of Modelling Quantitative Distribution of Krill Basing on the Oceanographical, Biological and Hydroacoustic data of surveys on the Computer
(R.R. Makarov, et. al, 1985, USSR National Section, CCAMLR)

Doc.11 List of Participants

Doc.12 A Note on the Characteristics of Japanese Operation
(Yasuhiko Shimadzu)

Doc.13 Data Tape Listing (Japanese commercial krill fishing operations)

Other Papers

Report on Post-Fibex Acoustic Workshop, Frankfurt, Federal Republic of Germany, September 1984. (Submitted by SCAR)

The Influence of Schooling Behaviour on CPUE as an Index of Abundance in Rep. Int. Whal. Commn (Special Issue 2), 1980. K. Radway Allen.

Estimating Catchability Coefficients from Catch and Effort Data in Rep. Int. Whal. Commn 33, 1983. J.G. Cooke.

A Rationale for Modifying Effort by Catch, using the Sperm Whale of the North Pacific as an Example in Rep. Int. Whal. Commn (Special Issue 2), 1980. Charles W. Fowler.

Population Assessment of the Antarctic Minke Whale in Rep. Int. Whal. Commn 29, 1979. Seiji Ohsumi.

Basis of Fishing Effort for Minke Whaling in the Antarctic in Rep. Int. Whal. Commn 30, 1980. Yasuhiko Shimadzu.

Bias of the CPUE Using Search Time as Effort Measure in Rep. Int. Whal. Commn 32, 1982. Samuel Zahl.

Correcting the Bias of the CPUE due to a Varying Whale Density in Rep. Int. Whal. Commn 33, 1983. Samuel Zahl.

Adjustments to the CPUE for Antarctic Minke Whaling in Rep. Int. Whal. Commn 34, 1984. Samuel Zahl.

Summary Report of Krill (*Euphausia superba*) Fishing Ground Exploitation in the Antarctic Ocean (1981/1982). National Fisheries Research and Development Agency, Busan, Republic of Korea.

Formation of Antarctic Krill Concentrations in Relation to Hydrodynamic Process and Social Behaviour. Z. Witek, A. Grelowski and J. Kalinowski, ICES, C.M. 1982/L: 59.

Forms of Antarctic Krill Aggregations. J. Kalinowski and Z. Witek, ICES, C.M. 1982/L: 60.

APPENDIX IV

PROPOSALS FOR BASIC DATA COLLECTION

The following list was drawn directly from that detailed on Page 193 of the Report of the Third Meeting of SC-CAMLR.

1. Fishing Power

(a) Description of Vessel

- name of ship
- registration number and port of registration
- ship nationality
- gross register tonnage
- length overall (m)
- maximum shaft power (kW at ... rev/min) or horse power

(b) Description of Gear

- trawl type (according to FAO nomenclature)
- code number for trawl type
- mouth opening or length of bottom rope and length of upper rope (m)
- effective area of mouth (m^2)
- mesh size at mouth (mm stretched)
- mesh size at codend (mm stretched)
- liner mesh size
- underwater acoustic equipment echosounders (types and frequencies), sonar (types and frequencies), netsonde (yes/no).

2. Fishing Information

(a) Tow Information

- date
- position at start of fishing (in degrees and minutes)
- time at start of fishing (in hour and minutes GMT; if local time, indicate the variations from GMT)
- time at end of fishing (before hauling)
- bottom depth (m)
- fishing depth (only if midwater trawl)
- direction of trawling (if the track changed during trawling, give the direction of the longest part of the track)
- towing speed
- comment on gear performance

(b) Catch Records for Each Tow

- estimated total catch (kg)
- approximate species composition (percent of total)
- weight (kg) of krill
- average size of krill (mm) or commercial size categories (e.g. S, M, L).

ANNEX 7

REPORT OF THE *AD HOC* WORKING GROUP ON ECOSYSTEM MONITORING

REPORT OF THE *AD HOC* WORKING GROUP ON ECOSYSTEM MONITORING SEATTLE, WASHINGTON USA 6–11 May 1985

The Ad Hoc Working Group On Ecosystem Monitoring was established at the 1984 meeting of the Scientific Committee of CCAMLR. As a result of the Group's work during that meeting the Scientific Committee decided that an intersessional meeting of the Working Group be held during 1985 and a draft agenda was prepared (Appendix I).

2. The Scientific Committee accepted an invitation from the National Marine Fisheries Service (NMFS) of the United States to hold the meeting at the National Marine Mammal Laboratory of the NMFS in Seattle.

3. Tie meeting was held from 6 to 11 May 1985.

4. Participants were welcomed by the Director, Northwest and Alaska Fisheries Center, Dr. William Aron, and the Director of the National Marine Mammal Laboratory, Dr. Howard Braham. A list of participants is included as Appendix II.

5. The Convenor, Dr. Knowles Kerry (Australia), opened the meeting and the agenda was adopted. Dr. Kerry explained that while there had been a proposal to revise the draft agenda since the meeting of the Scientific Committee in September 1984, after consultation with members of the Scientific Committee it had been decided to retain the original draft agenda.

ORGANISATION OF THE MEETING

6. Dr. John Bengtson (USA) and Dr. Darry Powell (CCAMLR Secretariat) were appointed rapporteurs for the Working Group.

7. The Group agreed to work through the first four agenda items in Plenary and to form one sub-group to consider and report on items 5, 6 and 7 in relation to krill, fish and squid as prey and another to consider and report on items 5, 6 and 7 in relation to seals, seabirds and whales as predators.

8. The Chairman of the Sub-group on Krill, Fish and Squid was Dr. Inigo Everson (UK) and Drs. Denzil Miller (South Africa) and Eugene Sabourenkov (CCAMLR) acted as rapporteurs. The Chairman of the Sub-group on Seals, Seabirds and Whales was Dr. Robert Hofman (USA) and Drs. John Bengtson (USA) and Darry Powell (CCAMLR) were rapporteurs. The reports of the Sub-groups were presented in SC-CAMLR-IV/7. Several documents were used as a reference for discussions and some papers were tabled at the meeting. A list of documents is in Appendix III.

9. The Chairman invited Dr. D. Siniff, the Co-Convenor of the SCAR Group of Specialists on Seals, and Dr. W.R. Siegfried, the Chairman of the BIOMASS Working Party on Bird Ecology, to present summaries of the responses of their respective groups to the questions posed by the CCAMLR Scientific Committee on the use of Antarctic Seals and birds as indicator species. (See SC-CAMLR-IV/7, Annex VI).

10. The Secretariat was asked to thank the Scar Group of Specialists on Seals and the BIOMASS Working Party on Bird Ecology for their valuable submissions.

OBJECTIVES OF ECOSYSTEM MONITORING

11. The objective of ecosystem monitoring in relation to the Antarctic Marine Living Resources was defined by the group as follows:

- to detect and record significant changes in critical components of the ecosystem, to serve as a basis for the Conservation of Antarctic Marine Living Resources. The monitoring system should he designed to distinguish between changes due to the harvesting of commercial species and changes due to environmental variability, both physical and biological.

12. Bearing in mind the intent of Article II of the Convention for the Conservation of Antarctic Marine Living Resources, it was recognised that it is important to identify and evaluate selected organisms as potential agents for monitoring changes in the structure and functioning of Southern Ocean ecosystems at various spatial scales.

13. The critical consumer species were deemed to be seals, seabirds and whales, and the selection of species (indicator species) for monitoring was restricted to those which may show quantifiably significant changes in the parameters monitored as a result of the decreased availability of prey.

14. Discussions on prey were focussed primarily on the evaluation of how the availability of prey species ray affect certain predators.

15. Thus ecosystem monitoring was considered to consist of two facets:

(a) the monitoring of parameters of indicator species (of seals, seabirds and whales)

(b) the monitoring of harvested species (krill, fish and squid) and other species capable of reflecting change, as an aid to understanding the nature and cause of any observed change.

COMPONENTS OF AN ECOSYSTEM MONITORING PROGRAM

16. The components needed for the development of an ecosystem monitoring program were considered by the Sub-group on Krill, Fish, and Squid and the Sub-group on Seabirds, Pinnipeds, and Cetaceans. The following section briefly reviews the highlights of their discussions.

Species

17. The major criteria used to select predator species thought to be best suited for ecosystem monitoring were:

- specialist predators on the critical prey components identified;
- wide geographic distribution;
- importance in the ecosystem;
- feasibility of study (ease to approach, handle, observe);
- knowledge of general biology;
- availability of baseline data at one or more sites.

18. Of all the Antarctic pinniped, seabird, and cetaceans, the following species were identified as those most likely to be useful as indicators of changes in food availability:

- Crabeater seal
- Antarctic fur seal
- Adelie penguin

- Chinstrap penguin
- Macaroni penguin
- Minke whale

19. Of the Antarctic krill, fish, and squid species that were evaluated for inclusion in ecosystem monitoring programs, the following were considered to be of most immediate and direct relevance with respect to the predators identified:

- *Euphausia superba*
- *Pleuragramma antarctic*
- Early life stages of fish

20. The Minke whale as a potential indicator of the effects of krill harvests was discussed. However within the framework set by the group at this time, it was not given high priority compared with other species identified for monitoring. The Group recommends that the Scientific Committee of CCAMLR consult with the International Whaling Commission to determine whether and how Minke whales or other cetaceans might function as indicators of krill availability as well as the general status of the Antarctic marine ecosystem.

Parameters

21. The parameters within each species group were selected taking into account trophic level, behavior, longevity, sensitivity, and measurability.

22. For food and associated species, the major parameters are the distribution, abundance and availability of the important prey species. The methods available for assessing these are direct sampling using hydroacoustics, a variety of nets or by utilising data from commercial fisheries.

23. Data relating to prey species required for integrated prey/predator monitoring programs would be obtained principally from regular standardised research cruises, but commercial catch and effort data and biological sampling of commercial catches would also be important. Analyses of catch/effort data and age/length structure would be important in contributing to estimations of prey stock abundance. The Group noted that the CCAMLR Workshop on the Use of Catch Per Unit Effort in Krill Stock Assessments and the meeting of the Ad Hoc Working Group on Fish Stock Assessment, both to be held in August 1985, have been asked to consider *inter alia* the question of spatial and temporal scales for the collection

of commercial fisheries data. In this connection the Group agreed that for the purposes of ecosystem monitoring, it would be desirable to have commercial fisheries data collected on as fine a scale as practicable, preferably by the location of each haul.

24. Four broad categories of parameters for predator species were identified for their potential to respond to environmental changes:

- Reproduction
- Growth and condition
- Feeding ecology and behavior
- Abundance and distribution

Within each of these categories, variables were selected for sensitivity to environmental changes in the short or long-term, and on local and regional scales. The feasibility of measuring variables and detecting changes were also considered. On this basis, a list of parameters was drawn up. Some of these are already in use, whereas others having potential require further development (see Tables 3 and 4 in the subsequent sections of the Report).

Spatial and Temporal Scales

25. Temporal and spatial scales were considered of fundamental importance in the collection and interpretation of monitoring data. It is thus imperative that these features be taken into account during the design and planning of ecosystem monitoring programs.

26. In particular, it was considered important to define these scales for variables relating to predators, prey, the environment, and interactions among these variables. Such scales are particularly important in the investigation of cause and effect relationships in monitoring programs. The scales need not be the same for all the components within a particular monitoring program.

27. The temporal scale is crucial both in terms of the longevity of phenomena, the lag time for some changes to occur and be detected, and the time needed to detect trends in these changes. Natural phenomena and responses to these events range in scale from the short-term (days) through the medium-term (months) to the long-term (years).

28. For the purposes of monitoring within the Antarctic marine ecosystem, the most relevant spatial scales are considered to range from local (10's of km) to regional (1000's of km). In addition the micro-scale distribution (metres) of prey species will be important in determining their availability to predators.

29. For integrated studies of both predators and prey, collection of simultaneous data is essential. Depending on the variables and interactions being monitored, simultaneous studies may include elements with short, medium, and long-term variation as well as local and regional scales. Local evaluations of short-tern phenomena as well as regional assessments of medium to long-term phenomena would both constitute simultaneous measurements.

Areas and Sites

30. The Group considered and evaluated the suitability of potential areas and sites for ecosystem monitoring programs. Potential locales were considered on the basis of their utility in monitoring critical prey and predator components of the ecosystem. The following criteria guided the evaluation of various sites:

- The need for a geographical coverage of the Convention area;
- Presence of critical components of the ecosystem;
- Influence of specific predators or predator groups;
- Proximity to concentrations of selected prey;
- Presence of species capable of being monitored;
- Presence or absence of fishing operations in the vicinity;
- Logistics;
- Availability of baseline data;
- The presence of discrete regions or ecotypes in terms of physical /biological attributes.

31. In addition, it was deemed essential to conduct monitoring activities in open ocean, pack ice, and land-based habitats. It was also emphasised that in order to incorporate important elements of various temporal and spatial scales (i.e., local, regional, long and short lag times) into monitoring schemes, it was highly desirable to monitor several species of predators and prey rather than single species.

32. A total of 13 areas and sites were identified as having promise for monitoring programs and their relative merits were summarised. (Table 1 and Figure 1). Each locale can be placed in one of three categories:

TABLE 1: SITES CONSIDERED FOR ECOSYSTEM MONITORING

Area	Presence Species		Baseline		Fishery on prey (since 1975)	Discrete-ness	Logistics	
	Prey	Predators	Prey	Predators			Land	Ships
Prydz Bay* 55–85°E	Krill Pleuragramma	Adelie Crabeater Minke	K + P +	A + CR – M ++	Krill	Yes	Davis Mawson	R.V. F.V.
Capes Hallett-Adare	Krill Pleuragramma	Adelie Crabeater Minke	K (+) P +	A + CR (+) M +	Krill-Boundary	?	Hallett	R.V. S.V.
Bransfield Strait (Palmer, Elephant, S. Shetland Is.)	Krill Pleuragramma	Adelie Chinstrap Furseal Crabeater Minke	K +++ P –	A +++ C ++ F (+) CR +++ M +	Krill Demersal fish	No	Many	R.V. F.V. S.V.
South Georgia Is.		Macaroni Fur seal	K +++	MC +++ F +++	Krill Demersal	No	Bird Is.	R.V. F.V.
Bouvet Is. (South to continent)		Macaroni Chinstrap Fur seal Crabeater Minke	K +	MC (+) C (+) F (+) CR (+) M ?	No	?	SANAE Neumayer	R.V. S.V.
S. Sandwich Is.		Chinstrap (Adelie) Crabeater	No	No	No	No	No	No
S. Orkney Is.	Krill Pleuragramma	Adelie Crabeater Minke	K + P –	C ++ A ++ CR +	Krill Demersal fish	No	Signy Orcadas	R.V. F.V. S.V.
Wilkes Land 100–145°E	Krill Pleuragramma	Adelie Crabeater Minke	K + P –	A + CR – M +	Krill	?	Dumont D'Urville Casey	R.V. F.V. S.V.
Syowa	Krill Pleuragramma	Adelie Crabeater Minke	K + P ?	A + CR + M (+)	Krill	?	Syowa Molodezh-naya	R.V. F.V. S.V.
Southern Ross Sea	Pleuragramma	Adelie Crabeater Minke	P +	A +++ CR (+) M +	No	South of 75°S Yes	Many	Many
Sea Area west of Ant. Penins. (Palmer to Peter I Is.)	Krill Pleuragramma	Adelie Crabeater Minke	K + P (+)	A (+) CR ++ M +	Krill	No	Faraday Rothera San. Martin	R.V. F.V.
Southern* Weddell Sea (South of 70°S)	Krill Pleuragramma	Crabeater Minke	K + P +	CR (+) M +	No	Yes	Neumayer Belgrano Dryzhnaya Halley	R.V. S.V.
Amundsen-* Bellingshausen Seas	Krill Pleuragramma	Crabeater Adelie Minke	K – P –	CR + A + M +	Krill	?	No	F.V.

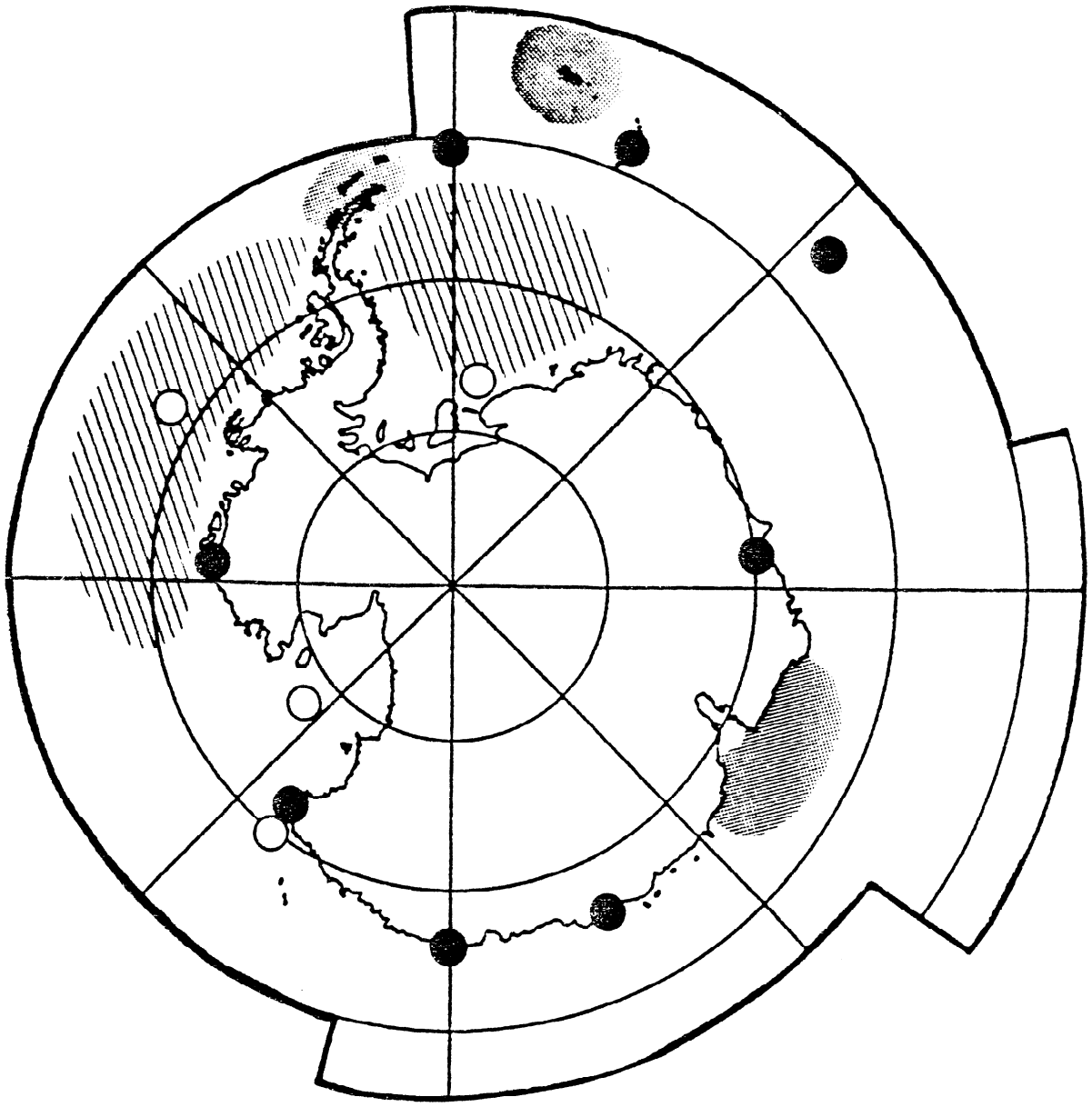
Abbreviations:

A – Adelie penguin
MC – Macaroni penguin
C – Chinstrap penguin
F – Fur seal
CR – Crabeater seal
M – Minke whale
K – Krill
P – Pleuragramma antarcticum
RV – Research Vessels
FV – Fisheries vessels
SV – Support vessels

Rates of baseline existence:
–, (+), +, ++, +++
lowest highest

* Priority Pack-ice Area

Figure 1: Sites and approximate areas suggested for Antarctic ecosystem monitoring programs. Locations were defined by the three categories listed below.



Categories of monitoring sites and areas:

1. Integrated study areas:
2. Network of sites and areas-
   - Land-based sites:
   - Pack ice areas:
3. Sites of special interest for directed research:

(a) Integrated study areas

33. A high priority is placed on the initiation of integrated ecosystem monitoring programs focussed in selected areas. Such programs would combine directed research and monitoring studies of predators and prey in open water, pack ice areas, and onshore. These programs would include simultaneous work on local predator–prey dynamics.

34. The areas recommended as a first priority are:

- Prydz Bay
- Bransfield Strait
- South Georgia

35. An integrated study area recommended as a second priority is the zone comprised of Bouvet Island south to the Antarctic continent.

(b) Network of sites and areas

36. To complement the intensive research and monitoring efforts proposed for the integrated study sites, it is recommended that selected land-based sites and pack ice areas be chosen to form a monitoring network. Activities at network locales would focus principally on predators, but some understanding of local food availability would also be desirable. The sites would provide comparative data for sites inside integrated study areas. The following sites and locales are recommended:

Land-based

- Cape Hallett/Adare
- Bouvet Island
- South Sandwich Islands
- South Orkney Islands
- Wilkes Land (Casey, Dumont D'Urville)
- Syowa Station
- Cape Shepard (Amundsen Sea)

Pack ice:

- Weddell Sea
- Bellingshausen/Amundsen Seas

(c) Sites of special interest for directed research

37. There are several sites that are particularly well-suited to addressing specific research questions relating to ecosystem monitoring. Investigating these questions will provide data important to understanding the dynamics of predator prey interactions observed in the integrated study areas and network sites. The following sites are recommended as desirable locations for the initiation of directed ecological research in support of ecosystem monitoring:

- Cape Hallett/Cape Adare: This site is located adjacent to the Ross Sea, near the boundary between shelf areas and the adjacent pelagic system. Monitoring penguins at this boundary zone could provide insights into prey switching;

- Southern Ross Sea: This high latitude site may provide insight into interactions between *Pleuragramma* and *E. crystallorophias* and local predators such as Adelie penguins, crabeater seals, and possibly minke whales;

- Southern Weddell Sea: This is a particularly important area for crabeater seals, including its interactions with both *E. superba* and *E. crystallorophias*. This would be a useful area to investigate the stock segregation of crabeater seals. Important aspects of predator/prey interactions with *Pleuragramma* could be studied here. (The sea area to the west of the Antarctic Peninsula is of interest for similar reasons, but was accorded lower priority);

- Bellingshausen/Amundsen Seas: The best survey data for crabeater seals are available from this area. It is an important site for dedicated ship surveys for crabeater seal censuses, collections, and studies of stock segregation.

General considerations

38. It was noted there was a need to evaluate the effects of physical and biological factors on the abundance and distribution of both predator and prey species. Table 2 lists major

hydrographic features which should be investigated in relation to temporal and spatial scale effects on the availability of prey to predators in selected monitoring areas. In this respect the need for information on seasonal ice cover and the formation of polynyas was stressed.

TABLE 2: Hydrographic features to be investigated in relation to temporal and spatial-scale-effects on availability of prey to regional predator populations (after Deacon 1936).

Monitoring Area	Macroscale feature (1000's km)	Mesoscale feature (100's km)	Microscale feature (10 km)
Prydz Bay	East Wind and West Wind Drifts	Gyre	ice-edge frontal circulation
Cape Adare/Hallett	East Wind Drift	Ross Sea gyre	ice-edge frontal circulation
Bransfield Strait	–	Weddell-Scotia confluence Flow through high energy system	variable eddies
South Georgia	–	Weddell-Scotia confluence system	variable eddies
Bouvet Island	West Wind Drift	Flow through system	unknown
South Sandwich Islands	–	Weddell-Scotia confluence Flow through system	unknown
South Orkney Islands	Weddell Sea Drift	Weddell Sea Gyre	ice-edge frontal circulation
Wilkes Land	East Wind Drift	Flow through system	ice-edge frontal circulation
Syowa	East Wind Drift	Flow through system	ice-edge frontal circulation
Southern Ross	East Wind Drift	Ross Sea Gyre	ice-edge frontal circulation
Sea Area West of the Antarctic Peninsula	East Wind Drift	Flow through system	ice-edge frontal circulation
Southern Weddell Sea south of 70°	Weddell drift	Weddell gyre	ice-edge partial circulation
Amundsen-Bellingshausen	East Wind Drift	Flow through system	ice-edge partial circulation

39. The group noted in this connection the joint IOC/CCAMLR sponsored 'Scientific Seminar on Antarctic Ocean Variability and its Influence on Marine Living Resources, Particularly Krill' to be held in January-February, 1986 in Paris.

40. The need to define areas offering some form of experimental control was discussed. It was agreed that studies at a variety of locales, each with different characteristics in respect to resources, harvesting, etc., would be the best means of evaluation and that it was impracticable to set up control sites for the recommended monitoring locales at this time.

ESTABLISHMENT OF AN ECOSYSTEM MONITORING PROGRAM

41. In recommending the establishment of an ecosystem monitoring program, the approach adopted was:

- to consider those attributes of predators most suitable for the immediate development of field program and those requiring directed research aimed at this evaluation,

- to consider the kind of information on predator-prey interactions most relevant to establishing correlations between changes in predator parameters and those in prey availability; and for distinguishing between natural variations in prey availability and those induced by harvesting.

42. It was agreed that a variety of specialised research programs on both predators and prey, especially including multi-disciplinary, integrated operations in certain key areas be undertaken. The acquisition of data on the distribution and abundance of predators and prey, by means of both systematic surveys, and, in respect to prey, by means of suitably detailed reporting of harvest catches, should proceed.

43. Species and parameters of species which could form the basis of monitoring programs were identified and set out in Table 3. Theoretically, elements of this program could be implemented but effective implementation on an adequate scale requires development and deployment of automatic recording devices.

44. A second group of parameters (Table 4), again with the focus on predators, was considered to have potential for monitoring purposes, but requires additional research to assess whether this potential can be achieved.

45. Further topics of directed research (Table 5) are required to interpret changes in monitored parameters and to provide increased understanding of important processes operating in the ecosystem.

Table 3: Evaluation of parameters of potential utility for monitoring program starting now.

Species	Parameters	Feasibility at present	Time-series required**	Integration time***
Antarctic fur seal	Foraging/attendance cycles	++*	Short–medium	D
	Pup growth and weaning weight	+++	Short–medium	M
Crabeater seal	Reproductive rates	++	Long	Y
	Age at sexual maturity	+++	Long	Y
	Cohort strength	+	Long	YY
Penguins (Adelie, chinstrap macaroni)	Arrival weight	+*	Medium	MM
	Population size	++	Medium–long	M–Y
	Survival & fecundity	+	Long	M–Y
	Incubation shift duration	+*	Medium–long	D
	Meal size	–	Medium	D
	Breeding success	+++	Medium–long	M
	Foraging trips	+*	Short–medium	D
	Fledging weights	+*	Medium	M
	Adult weight at fledging	+*	Medium	M
	Macaroni weight before moult	+*	Medium	D

* Significantly enhanced by development and/or deployment of automatic recording equipment.
** Short = 3-5 years
Medium = 5-10 years
Long = more than 10 years
*** D = days (real time over which the parameter is measured)
M = months
Y = years

Table 4: Programs of directed research of importance for obtaining data on and evaluation of parameters of potential monitoring significance.

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 behaviour, using satellite technology	Unknown	D-M
Penguins	Feeding behaviour and frequency	Unknown	D-M
Minke whales	Surveys of abundance using sightings (as by IDCR)	Long	Y

** - see footnotes to Table 3.
***

Table 5: Programs of directed research on predators providing data Of fundamental importance for initiating or interpreting the results of monitoring studies.

Species	Program	Location/comments
Antarctic fur seal	Survey of potential new sites for monitoring studies	S. Sandwich, S. Orkney, S. Shetland Is., Antarctic Peninsula
	Monitoring population trends by counting of pup production	S. Georgia and other sites selection following above
	Location of summer and winter foraging areas using satellite technology	S. Georgia and other sites when selected
Crabeater	Quantitative studies of diet	All areas, especially selected integrated study areas
	Determination of stock separation using satellite technology and biochemical techniques	All residual pack-ice areas
	Repeat surveys to estimate abundance and assess population trends	Amundsen-Bellingshausen high priority followed by the other two selected areas
	Foraging areas and movements using satellite technology	Develop at selected sites, then expand
Penguins	Development of automatic weighing devices	Develop at selected sites, then all sites if practical
	Foraging areas and movements using satellite technology	as above

46. Parameters to be considered for the assessment of the biological/demographic status of prey species in relation to their availability to predators require information on distribution, abundance, aggregation and causative associations between prey production and their utilisation by predators. In particular, the group draws attention to the importance of evaluating whether regional concentrations of krill constitute separate management stocks.

47. It was further agreed that consideration should be given to the application of fishing pressure in selected areas as perturbation experiments giving insight into the responses of key components of the ecosystem to predetermined pressures on the food resources.

48. Monitoring the status of depleted stocks of whales, which were themselves the subject of a harvest, is another facet of importance to CCAMLR since Article II of the Convention specifies that exploitation of krill or other food species should not impede the restoration of depleted stocks.

49. The Group noted that monitoring of long-term trends in population sizes of each whale stock is an important element in the monitoring of the Antarctic marine ecosystem. It therefore recommended that the Scientific Committee consult with the International Whaling

Commission on the present status of Antarctic whale populations and the means by which trends might be monitored in the future.

50. Satellite sensing is being investigated for a wide range of purposes, some already operational (e.g., sea ice cover), others highly desirable (e.g., foraging movements of seals and penguins in both summer and winter), while some are merely suggestions at this stage (e.g., as a possible means of monitoring the distribution of fishing effort). The group recommends that satellite sensing techniques be developed and applied wherever possible.

51. The establishment of monitoring programs would require the use of a computerised data base system for data storage, retrieval and processing. This in turn will require a suite of processing algorithms to be developed.

RECOMMENDATIONS

The Ad Hoc Working Group on Ecosystem Monitoring recommended that:

1. A long-term ecological monitoring program should be initiated in the priority areas as identified in paragraphs 33–37.

2. Pilot studies on predators and their prey commence as soon as possible to monitor the variables identified in Table 3.

3. Directed ecological research on predators and their prey be initiated as soon as possible to determine potential indicator variables and essential background information for species and parameters as identified in Tables 4 and 5.

4. The CCAMLR Scientific Committee establish a group charged with the design, planning, implementation (including data collection and evaluation), and coordination of an ecosystem monitoring program as recommended above, taking into account the concommittant requirements for monitoring prey and environmental factors.

5. To assist the group described in Recommendation 4, members of CCAMLR conducting research in the Convention area be requested to submit to the Secretariat inventories of relevant past and present programs and relevant data concerning the species and parameters at the priority monitoring sites and areas listed in this report.

6. The Scientific Committee of CCAMLR consult with the international Whaling Commission on the current status of Antarctic whale populations and the means by which trends might be monitored in the future.

7. That a high priority be given to further evaluation whether regional concentrations of krill constitute separate stocks for management purposes.

CLOSING OF THE MEETING

1. The report was adopted and the meeting was closed at 1700 hours on Saturday, 11 May.

2. The Convenor thanked the Rapporteurs of all Groups and the Chairmen of the Sub-groups for their work. He particularly thanked Dr. J. Bengtson for the organisation of the meeting and the Director of the National Marine Mammal Laboratory and his staff for hosting the meeting.

APPENDIX I

AGENDA

1. Introduction by Convenor, and proposed procedures for conducting the meeting.

2. Approval of Agenda.

3. Review the objectives of ecosystem monitoring.

4. Review the responses to the CCAMLR Scientific Committee of the SCAR Group of Specialists on Seals and the BIOMASS Working Party on Bird Ecology.

5. Review the life history characteristics and parameters of dependent and related species likely to be useful to ecosystem monitoring studies.

6. Identify dependent and related species which have greatest potential to function as indicators of the possible effects of krill harvesting.

7. Consider the types of studies necessary to establish baseline data and to evaluate natural variation in biological and environmental variables.

8. Describe sampling and data collection procedures required to detect effects of fisheries activities on components of the ecosystem.

9. Consider experiments to be undertaken in collaboration with fisheries activities.

10. Evaluate potential sites and areas for ecosystem monitoring programs.

11. Formulate and recommend specific actions for planning and implementing multinational ecosystem monitoring programs.

12. Other items.

13. Adoption of report.

APPENDIX II

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APPENDIX III

BACKGROUND DOCUMENTS

The following list contains documents which provided background information for the meeting.

(a) Documents submitted to SC-CAMLR

Report of SC-CAMLR-II. Questions to the BIOMASS Working Party on Bird Ecology and the SCAR Group of Specialists on Seals with respect to the potential role of birds and seals as indicators of change in the Antarctic marine ecosystem.

SC-CAMLR-III/7. Ecosystem management: Proposal for undertaking a coordinated fishing and research experiment at selected sites around Antarctica.

SC-CAMLR-III/BG/4. Ecosystem monitoring and management: Summary of papers presented at the third meeting of the Scientific Committee.

SC-CAMLR-III/BG/5. Monitoring indicators of possible changes in the Antarctic marine ecosystem.

SC-CAMLR -III /BG/7. Marine mammal fishery interactions: Modelling and the Southern Ocean.

SC-CAMLR-III/BG/9. Summary of the responses of the BIOMASS Working Party on Bird Ecology and SCAR Group of Specialists on Seals on the questions of SC-CAMLR on indicator species.

(b) BIOMASS SCAR Reports

BIOMASS Report Series Numbers 8, 16, 18 and 21 provide background for Reports Numbers 34 and 35 and are included here for the sake of completeness.

BIOMASS REPT SER No. 8. Antarctic bird biology. Pretoria 1979.

BIOMASS REPT SER No. 16. Data, statistics and resource evaluation. Cambridge 1980.

BIOMASS REPT SER No. 18. Antarctic bird biology - II. Queenstown 1980.

BIOMASS REPT SER No. 21. Meeting of the BIOMASS Working Party on Bird Ecology. Hamburg 1981.

BIOMASS REPT SER. No. 34. Meeting of the Biomass Working Party on Bird Ecology. Wilderness 1983.
The relevant information is contained in SC-CAMLR-III/BG/9.

BIOMASS REPT SER. No. 35. Meeting of the SCAR Group of Specialists on Seals. Pretoria 1983.
The relevant information is contained in SC-CAMLR-III/BG/9.

SCAR - Conservation Areas in the Antarctic (March 1985).
Edited by W.N. Bonner and R.I. Lewis Smith, c/o Scott Polar Research Institute, Lensfield Road, Cambridge, UK.

Background documents presented at the meeting

Antarctic research activities of the Federal Research Board of Fisheries in Hamburg (FRG).

Bengtson, J.L. (1984) Review of Antarctic marine fauna. Final report prepared for the U.S. Marine Mammal Commission. (USA).

Current research by Ecology Division, DSIR, New Zealand, on the biology of Adelie penguins in the Ross Sea, Antarctica. (New Zealand)

Miller, D.G. (1985). A conceptual framework for the institution of a monitoring regime in the Antarctic marine ecosystem. (South Africa).

Hubold, G. German marine biological investigations in the Southern Weddell Sea. (FRG).

Hoshiai T., Sweda T., Tanimura A. (1984). Adelie penguin census in the 1981–82 and 1982–83 breeding seasons near Syowa Station, Antarctica. In 'Memoirs of National Institute of Polar Research, Special Issue N32, Proceedings of the Sixth Symposium on Polar Biology.' (Japan).

Slosarczyk W. (1983). Juvenile *Trematomus bernacchii* and *Pagothenia brachysoma* (Pisces, Nototheaiidae) within krill concentrations off Balleny Island (Antarctic). Polish Polar Research, V. 4, N1–4.

Slosarczyk W. (1983). Preliminary estimation of abundance of juvenile *Nototheniidae* and *Channiththyidae* within krill swarms east of South Georgia. Acta Ichthyologica et Piscatoria. V-XIII, Fasc. 1.

Slosarczyk W., Rembriszewski J.M. (1982). The occurrence of *Nototheniidei* (Pisces) within krill concentrations in the region of the Bransfield Strait and the southern Drake Passage. Polish Polar Research. V. 3, N3–4.

Summary of responses to Convenor's letter of 21 December 1984 on the objectives and arrangement of the meting (prepared by Secretariat).

ANNEX 8

DRAFT SUMMARY OF CATCH AND EFFORT STATISTICS

DESCRIPTION OF SUMMARY

1. The Summary 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 remain in data acquired by the Secretariat. The situation on the availability of data used in this summary is described in Table 11. These data have been taken from the Commission's STATLANT 8A database version 10, and STATLANT 8B database version 12.

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 tons.

3. Fishing effort is measured in number of days fished. These include all days (24 hour periods, reckoned from midnight to midnight) in which any fishing took place. Where searching is a substantial part of a fishing operation, days in which searching but no fishing took place should have been included in the days fished tabulation.

Split-years

4. 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

5. 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

6. Codes are used for the identification of fishing nations in Tables 6 – 10. These are defined in Table 12.

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7. Table 1 Commercial Catch Totals, listed for all species reported caught for each split-year. 205

8. Table 2 Commercial Catch Totals, listed for each fishing nation for each split-year. 206

9. Table 3 Commercial Catch and Effort Totals, where krill was the main species sought according to information contained in STATLANT reports, listed for each fishing nation for each split-year. 207

10. Table 4 Commercial Catch and Effort Totals, where species other than krill were the main species sought according to information contained in STATLANT reports, listed for each fishing nation for each split-year. 208

11. Table 5 Commercial Catch and Effort Totals, where the main species sought was not identified in STATLANT reports, listed for each fishing nation for each split-year. 209

12. Table 6 Lists all commercial catch by species, split-year, and country for the entire Convention Area and its three major fishing areas. Subtotals have been tabulated for each species, for each split-year, for each major fishing area. 210

13. Table 7 Lists all commercial catch by species, split-year, and country for the Atlantic Antarctic and its six subareas. Subtotals have been tabulated for each species, for each split-year, for each subarea. 224

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14.	Table 8	Lists all commercial catch by species, split-year, and country for the Indian Ocean Antarctic and its four subareas. Subtotals have been tabulated for each species, for each split-year, for each subarea.	236
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21.		Names of Antarctic major fishing areas, subareas, and divisions.	263

TABLE 1: COMMERCIAL CATCH TOTALS, ALL SPECIES (METRIC TONS)

	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	TOTALS
Pisces Nei		2133	8222	3444	2252	1982	738	13851	14261	7051	6457	14709	7401	24139	6229	71	112940
Nototheniidae									179	2505	1853	210	51		40	365	5203
Notothenia gibberifrons							4999	3727	16782	13363	10306	8135	3194	1	12464	1785	74756
Notothenia guentheri										15011	7381	36758	31351	5029	10586		106116
Notothenia rossii	399704	165194	107326	20361	20906	10248	16814	8462	52551	8662	47124	9864	11149	2695	4530	1315	886905
Notothenia squamifrons		24545	52947	3133	19977	12098	12700	3245	34016	1587	15950	9786	5635	1931	3995	1	201546
Dissostichus eleginoides								441	2218	334	455	378	558	265	255	152	5056
Pleuragramma antarcticum									255			1517	140	339			2251
Trematomus spp.												583					583
Channichtyidae nei										269	1668	4554				54	6545
Chaenocephalus aceratus								293	2277	4018	1440	1272	676		161	1042	11179
Chaenodraco wilsoni										10130	956						11086
Champsocephalus gunnari		20932	54408	8342	7646	48530	22714	103850	219345	58111	15555	33729	62966	162598	91623	1113	911462
Channichthys rhinoceratus									82		8	2	0	0			92
Chionodraco rastrospinosus										1949	233						2182
Pseudochaenichthys georgianus								1608	13674	2100	3122	1661	956		888	1097	25106

TABLE 1: COMMERCIAL CATCH TOTALS, ALL SPECIES (METRIC TONS)
(continued)

	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	TOTALS
Micromesistius australis											36						36
Myctophidae											586		317	524	2530		3957
Rajiformes									8	1	224	120	1	1	24	48	427
Euphausia superba				59	19785	44029	5635	91516	132349	333128	477023	448132	528201	228643	128218	50	2436768
Loliginidae										2							2

TABLE 2: COMMERCIAL CATCH TOTALS, ALL NATIONS (METRIC TONS)

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
Bulgaria, Catch:									2088	3408	1225					
Chile, Catch:							276	92						3752	1649	
GDR, Catch:								790	10313	4961	9970	8279				624
France, Catch:											283	1921	6158	2102	1071	760
Japan, Catch:				59	646	2677	4750	12802	25219	36961	36275	27698	35116	42282	49531	
Korea, Catch:										511			1429	1959	2657	
Poland, Catch:								17054	64016	37486	15961	17656	8324	373	10079	5709
USSR, Catch:	399704	212804	222903	35280	69920	114210	58574	196255	386361	374894	526663	515856	601569	375697	196556	
TOTAL CATCH:	399704	212804	222903	35339	70566	116887	63600	226993	487997	458221	590377	571410	652596	426165	261543	7093

TABLE 3: COMMERCIAL CATCH AND EFFORT TOTALS FOR ALL NATIONS WHERE KRILL WAS THE MAIN SPECIES SOUGHT (METRIC TONS AND DAYS FISHED)

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
Bulgaria,	Catch:																
	Effort:																
Chile,	Catch:							276	92						3752	1649	
	Effort:							38	27						57	34	
GDR,	Catch:																50
	Effort:																5
France,	Catch:											6					
	Effort:											5					
Japan,	Catch:				59	646	2677	4750	12802	25219	36961	36275	27698	35116	42282	49531	
	Effort:				33	70	147	155	298	1061	1397	1041	762	870	782	814	
Korea,	Catch:										511			1429	1959		
	Effort:										17			36	56		
Poland,	Catch:														360		
	Effort:														17		
USSR,	Catch:																
	Effort:																

TABLE 4: COMMERCIAL CATCH AND EFFORT TOTALS FOR ALL NATIONS WHERE SPECIES OTHER THAN KRILL WERE THE MAIN SPECIES SOUGHT (METRIC TONS AND DAYS FISHED)

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
Bulgaria,	Catch:											2088					
	Effort:											80					
Chile,	Catch:																
	Effort:																
GDR,	Catch:																
	Effort:																
France,	Catch:											277	1921	6158	2102	1071	760
	Effort:											24	98	200	95	44	25
Japan,	Catch:																
	Effort:																
Korea,	Catch:																
	Effort:																
Poland,	Catch:										37486		17656	8324	13	10079	5709
	Effort:										1992		1018	460	2	458	431
USSR,	Catch:																
	Effort:																

TABLE 5: COMMERCIAL CATCH AND EFFORT TOTALS FOR ALL NATIONS WHERE THE MAIN SPECIES SOUGHT WAS NOT IDENTIFIED (METRIC TONS AND DAYS FISHED)

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
Bulgaria,	Catch:									2088	3408						
	Effort:									80	120						
Chile,	Catch:																
	Effort:																
GDR,	Catch:								790	10313	4961	9970	8279				574
	Effort:								*n/r	n/r	n/r	n/r	n/r				44
France,	Catch;																
	Effort:																
Japan,	Catch:																
	Effort:																
Korea,	Catch:															2657	
	Effort:															n/r	
Poland,	Catch:								17054	64016		15961					
	Effort:								527	2631		1489					
USSR,	Catch:	399704	212804	222903	35280	69920	114210	58574	196255	386361	374894	526663	515856	601569	375697	196556	
	Effort:	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r	7619	4902	

* ‘n/r’ indicates ‘not yet received’

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	306	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 FISHING AREAS (continued)

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
	annual subtotals			71	0	0	71
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
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
		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

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

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	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	4949	0	0	4949
	81	SUN	775	0	0	775
annual subtotals			8135	0	0	8135
	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 slit-totals			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
annual subtotals			1785	0	0	1785
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
	84	SUN	10586	0	0	10586
annual subtotals			10586	0	0	10586
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

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

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	72	SUN	2738	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
	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

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

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	84	FRA	0	109	0	109
	84	FOL	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
annual subtotals			1313	2	0	1315
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
	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

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

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	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
annual subtotals			0	1	0	1
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
	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	FRA	0	19	0	19
	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
annual subtotals			88	64	0	152

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

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
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
Trematomus spp. Antarctic Cods						
	81	SUN	0	0	583	583
annual subtotals			0	0	583	583
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
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

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

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	81	POL	1272	0	0	1272
annual subtotals			1272	0	0	1272
	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
Chaenodraco wilsoni Wilson's Icefish						
	79	DDR	2028	0	0	2028
	79	POL	8102	0	0	8102
annual subtotals			10130	0	0	10130
	80	POL	956	0	0	956
annual subtotals			956	0	0	956
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	3185	0	0	3195
	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

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

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	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	FRA	0	603	0	603
	81	POL	9166	0	0	9166
	81	SUN	23441	519	0	23960
annual subtotals			32607	1122	0	33729
	82	FRA	0	1087	0	1087
	82	POL	4446	0	0	4446
	82	SUN	42422	14996	15	57433
annual subtotals			46868	16083	15	62966
	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
annual subtotals			424	689	0	1113
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

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

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	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	233	0	0	233
annual subtotals			233	0	0	233
Pseudochaenichthys georgianus South Georgia Icefish						
	77	POL	1608	0	0	1608
annual subtotals			1608	0	0	1608
	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	1661	0	0	1661
annual subtotals			1661	0	0	1661
	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
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

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

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	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
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
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

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

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	ATLANTIC FISHING AREA	INDIAN OCEAN FISHING AREA	PACIFIC FISHING AREA	TOTAL ALL AREAS
	75	JPN	0	2677	0	2677
	75	SUN	41352	0	0	41352
annual subtotals			41352	2677	0	44029
	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

TABLE 6: (continued) 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
		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
		85	DDR	50	0	0	50
	annual subtotals			50	0	0	50
Loliginidae Squids nei							
		79	DDR	2	0	0	
	annual subtotals			2	0	0	2
	GRAND TOTALS:		FISH	1587047	777824	2559	2367430
			KRILL	1744991	659675	32102	2436768
			TOTAL	3332038	1437499	34661	4804198

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC

SPECIES NAME		SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	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 SANDWCH	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
	annual subtotals			0	0	71	0	0	0	0	71
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
		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

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	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
Notothenia gibberifrons Bumphead Notothenia										
	76	SUN	0	0	4999	0	0	0	0	4999
annual subtotals			0	0	4999	0	0	0	0	4999
	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

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	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	0	4407	542	0	0	0	4949
	81	SUN	50	114	611	0	0	0	0	775
annual subtotals			50	114	7429	542	0	0	0	8135
	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
	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
annual subtotals			0	0	1785	0	0	0	0	1785

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
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	7391
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
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

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	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
	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
	79	SUN	0	0	0	0	0	0	5818	5818
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

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	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
annual subtotals			0	0	1313	0	0	0	0	1313
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
	78	SUN	0	0	0	0	0	0	2327	2327
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

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	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
	83	SUN	0	4	0	0	0	0	0	4
annual subtotals			0	4	0	0	0	0	0	4
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	68	3	0	0	0	71
	81	SUN	0	83	168	0	0	0	0	251
annual subtotals			0	83	236	3	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 SANDWCH	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
annual subtotals			0	0	88	0	0	0	0	86
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
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

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	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
	79	POL	1391	2132	442	0	0	0	0	3965
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	1084	0	0	0	0	1440
	81	POL	0	0	1189	83	0	0	0	1272
annual subtotals			0	0	1189	83	0	0	0	1272
	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
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

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	80	POL	956	0	0	0	0	0	0	956
annual subtotals			956	0	0	0	0	0	0	956
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
	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	138902	7550	0	0	0	0	146452

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	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	0	9104	62	0	0	0	9166
	81	SUN	1700	1523	20218	0	0	0	0	23441
annual subtotals			1700	1523	29322	62	0	0	0	32607
	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
	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
annual subtotals			0	0	424	0	0	0	0	424

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
Chionodraco rastrospinosus 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	42	191	0	0	0	0	0	233
annual subtotals			42	191	0	0	0	0	0	233
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
	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	0	1584	77	0	0	0	1661
annual subtotals			0	0	1584	77	0	0	0	1661
	82	POL	0	0	956	0	0	0	0	956
annual subtotals			0	0	956	0	0	0	0	956

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	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
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
Myctophidae 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
	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
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

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME		SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
		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
		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
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

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	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
	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

TABLE 7: STATLANT CATCH REPORT ATLANTIC ANTARCTIC
(continued)

SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	PENINS SUBAREA	SOUTH ORKNEY	SOUTH GEORGIA	SOUTH SANDWCH	WEDDELL SUBAREA	BOUVET SUBAREA	UNKNOWN SUBAREA	TOTAL AREA
	84	CHL	1649	0	0	0	0	0	0	1649
	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	DDR	0	0	50	0	0	0	0	50
annual subtotals			0	0	50	0	0	0	0	50
Loliginidae Squids nei										
	79	DDR	2	0	0	0	0	0	0	2
annual subtotals			2	0	0	0	0	0	0	2
GRAND TOTALS:		FISH	83274	226617	1233947	767	0	0	42442	1587047
		KRILL	244348	681737	343061	29	0	1192	474624	1744991
		TOTAL	327622	908354	1577008	796	0	1192	517066	3332038

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
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
		78	SUN	0	0	0	0	46155	46155
	annual subtotals			0	0	0	0	46155	46155

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	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
	annual subtotals			0	2	0	0	0	2
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

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
	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
	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

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	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
	annual subtotals			0	1	0	0	0	1
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	196
		79	SUN	0	0	0	0	3	3
	annual subtotals			0	0	0	0	3	3
		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	0	180
	annual subtotals			83	121	0	0	0	204

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	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
	annual subtotals			0	64	0	0	0	64
Pleuragramma antarcticum Antarctic Sidestripe									
		78	SUN	0	0	0	0	234	234
	annual subtotals			0	0	0	0	234	234
		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
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

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
	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
	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

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	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
	annual subtotals			0	689	0	0	0	689
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

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
Euphausia superba Antarctic Krill									
		74	JPN	446	0	0	0	0	446
	annual subtotals			446	0	0	0	0	446
		75	JPN	2677	0	0	0	0	2677
	annual subtotals			2677	0	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

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	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
	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
GRAND TOTALS:		FISH	10318	103091	17	0	664398	777824
		KRILL	602999	0	0	0	56676	659675
		TOTAL	613317	103091	17	0	721074	1437499

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								
		76	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
GRAND TOTALS:		FISH	0	0	0	2559	2559
		KRILL	12555	47	2402	17098	32102
		TOTAL	12555	47	2402	19657	34661

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
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
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

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	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
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
		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
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

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

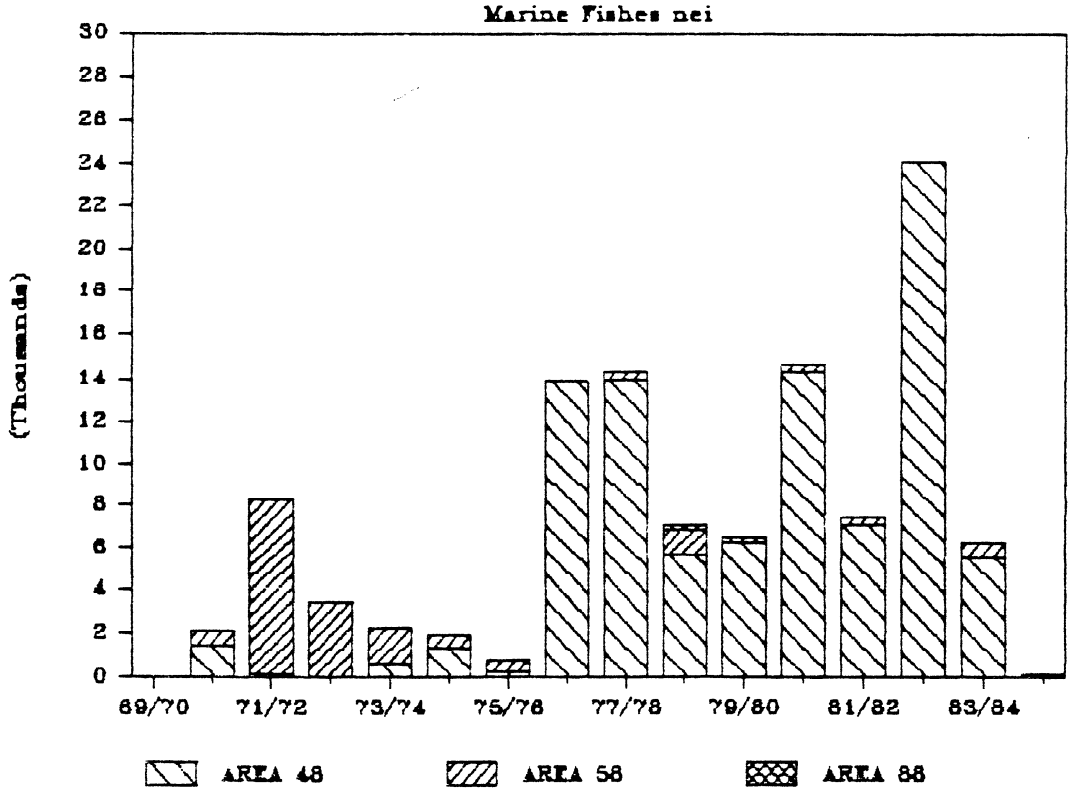
SPECIES NAME		SPLIT YEAR ENDING	FISHING NATION	DIVISION 58.4.1	DIVISION 58.4.2	DIVISION 58.4.3	DIVISION 58.4.4	DIVISION UNKNOWN	ENDERBY-WILKES TOTAL
Champsocephalus gunnari Antarctic Icefish									
		80	SUN	0	0	0	0	14	14
	annual subtotals			0	0	0	0	14	14
Euphausia superba Antarctic Krill									
		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
		81	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)

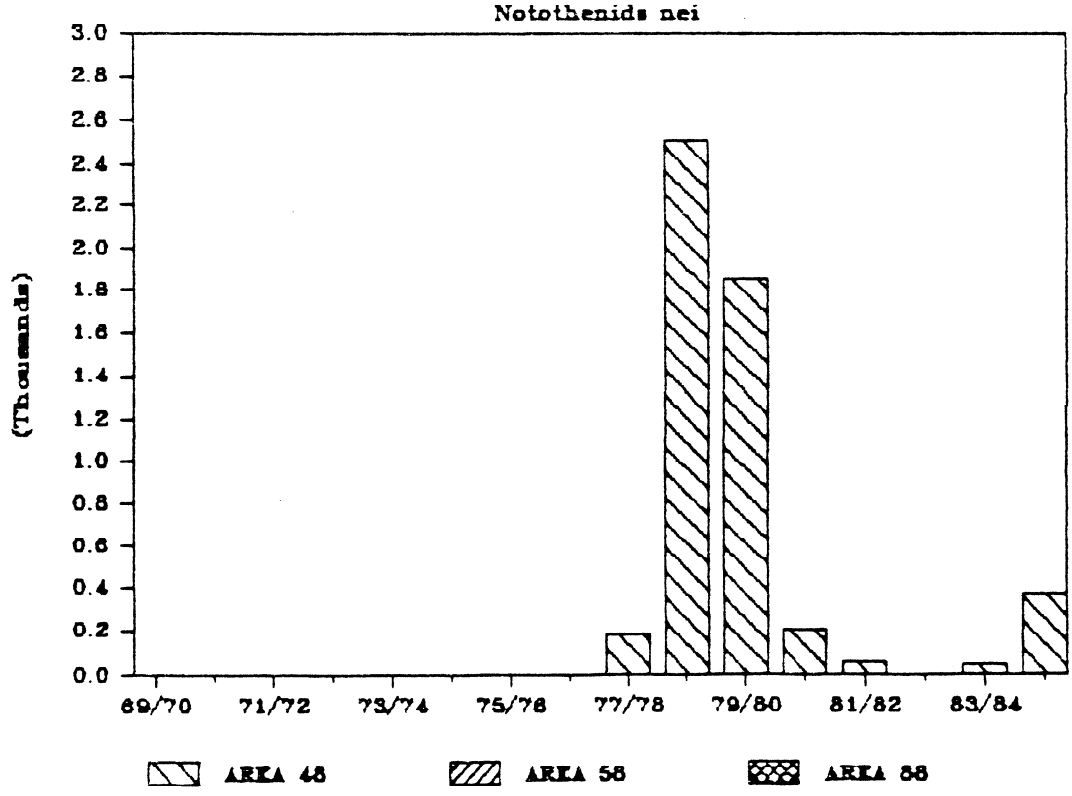
SPECIES NAME	SPLIT YEAR ENDING	FISHING NATION	DIVISION 58.4.1	DIVISION 58.4.2	DIVISION 58.4.3	DIVISION 58.4.4	DIVISION UNKNOWN	ENDERBY-WILKES TOTAL
	82	JPN	22409	4759	0	0	0	27168
	82	KOR	0	0	0	0	1429	1429
	82	SUN	0	0	0	0	119381	119381
annual subtotals			22409	4759	0	0	120810	147978
	83	JPN	27816	4250	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
GRAND TOTALS:		FISH	0	0	0	0	10318	10318
		KRILL	134060	67907	41	1382	399609	602999
		TOTAL	134060	67907	41	1382	409927	613317

HISTOGRAMS FOR ALL COMMERCIAL CATCH BY SPECIES, SPLIT-YEAR, AND MAJOR FISHING AREAS

PISCES nei

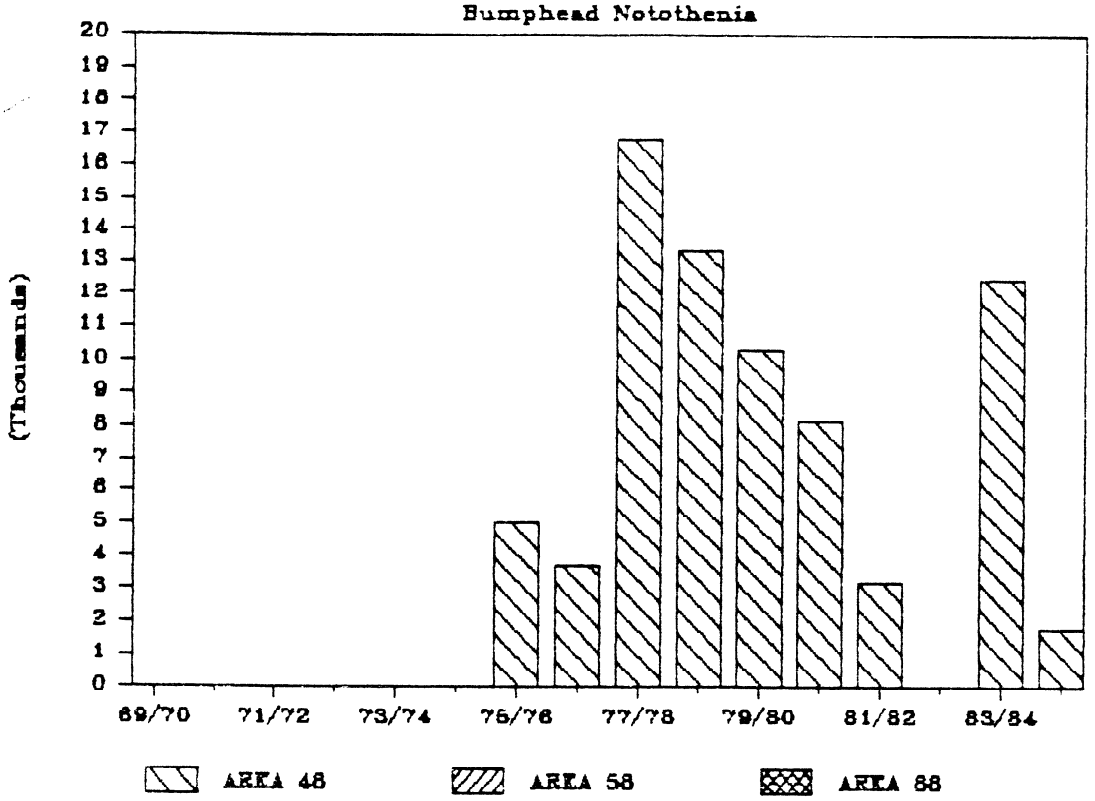


NOTOTHENIIDAE nei



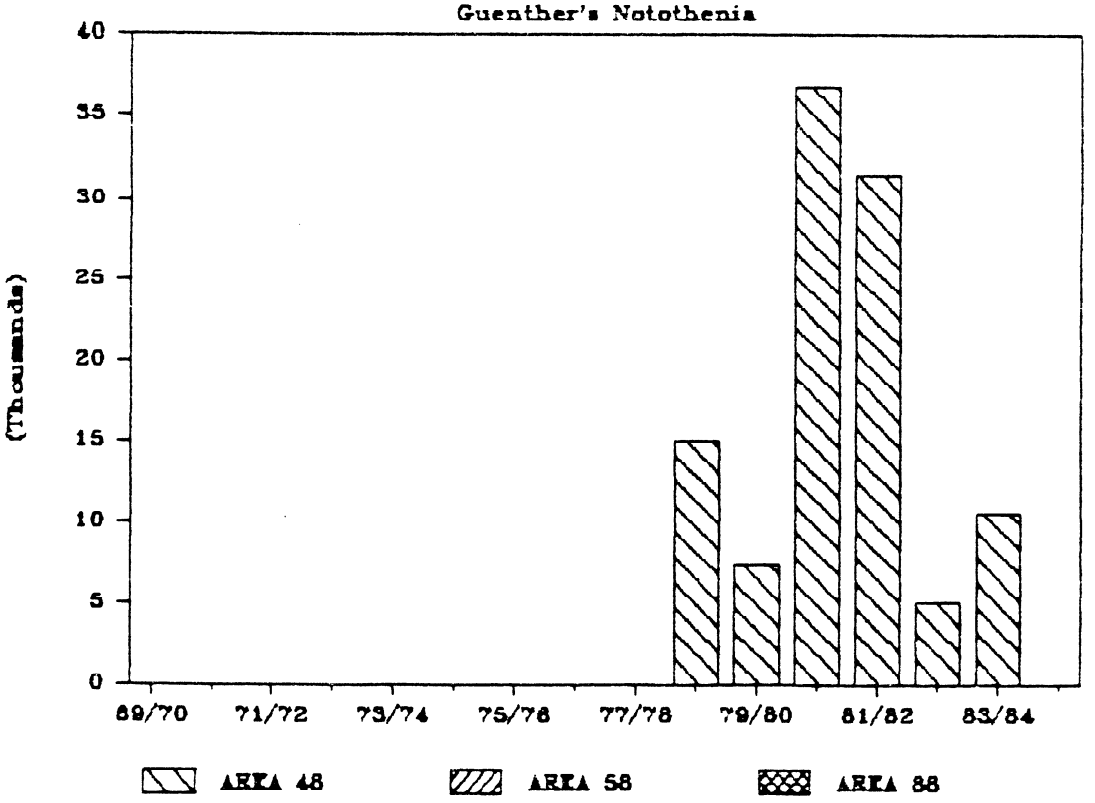
NOTOTHENIA GIBBERIFRONS

Bumphead Notothenia



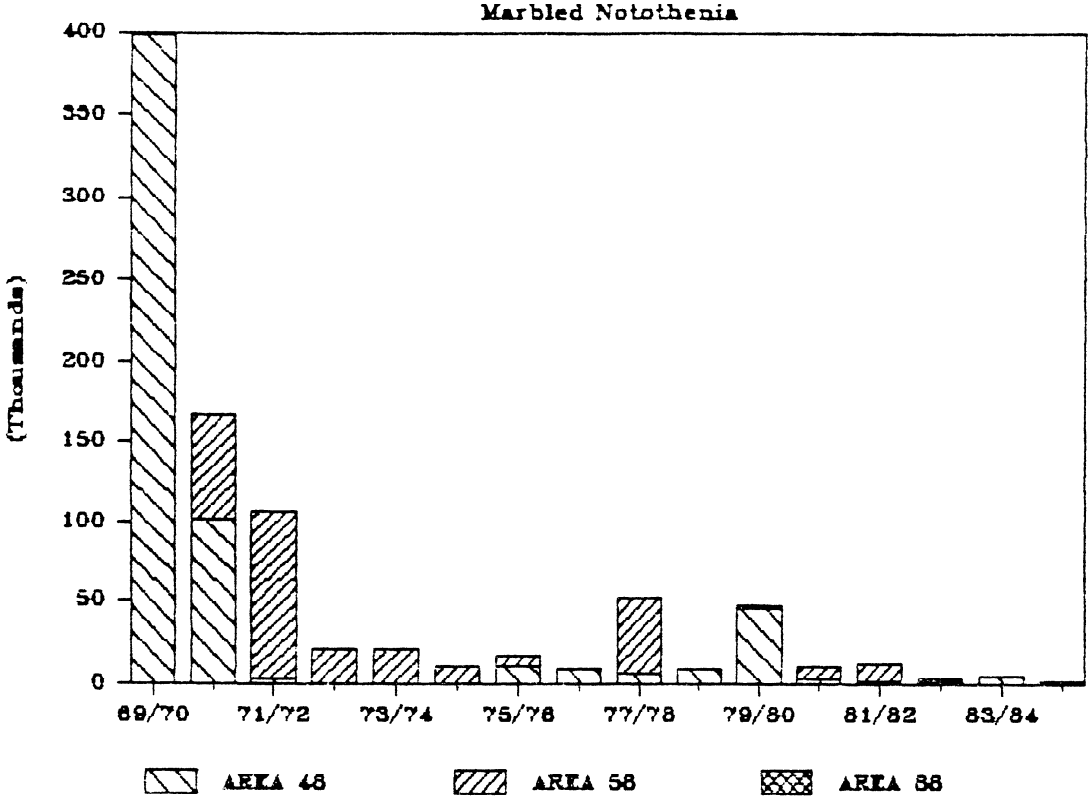
NOTOTHENIA GUENTHERI

Guenther's Notothenia



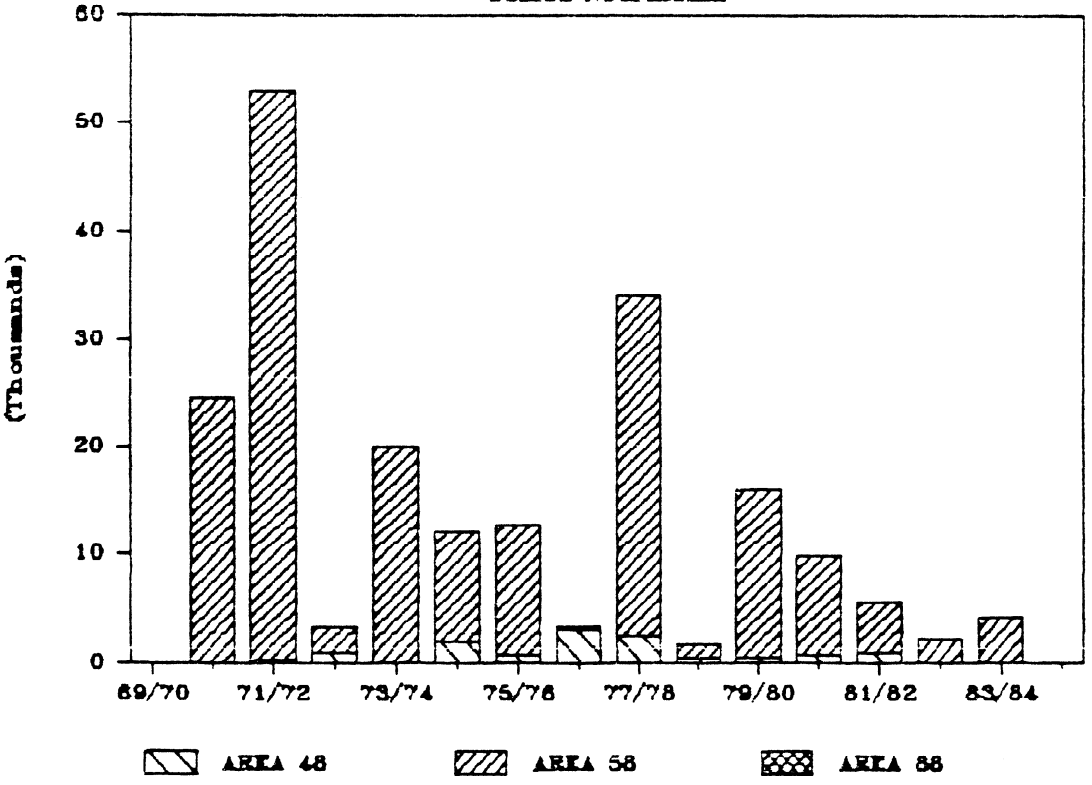
NOTOTHENIA ROSSII

Marbled Notothenia



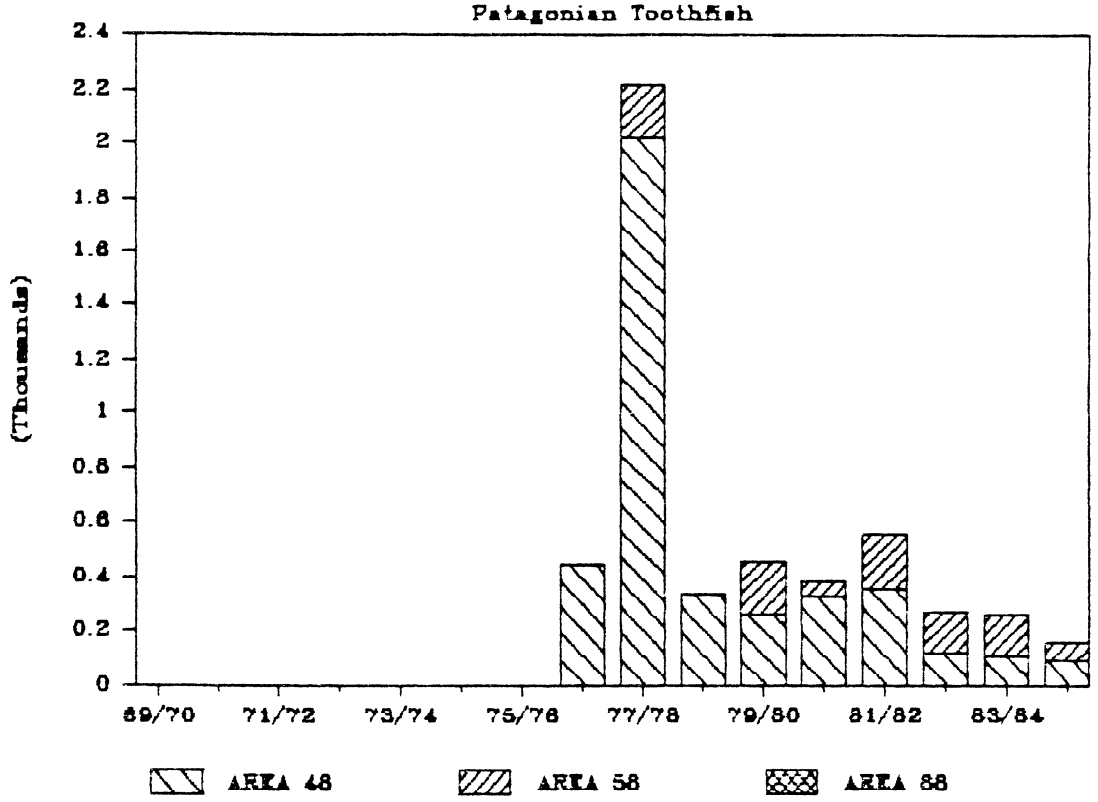
NOTOTHENIA SQUAMIFRONS

Scaled Notothenia



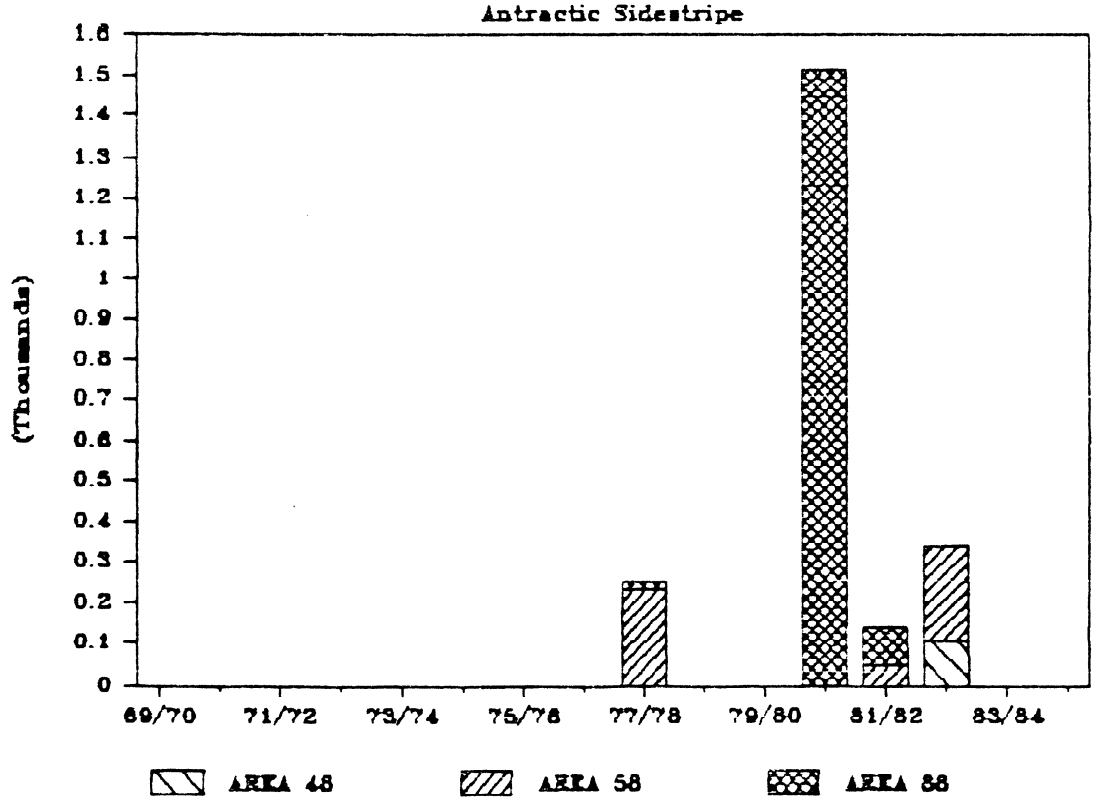
DISSOSTICHUS ELEGINOIDES

Patagonian Toothfish

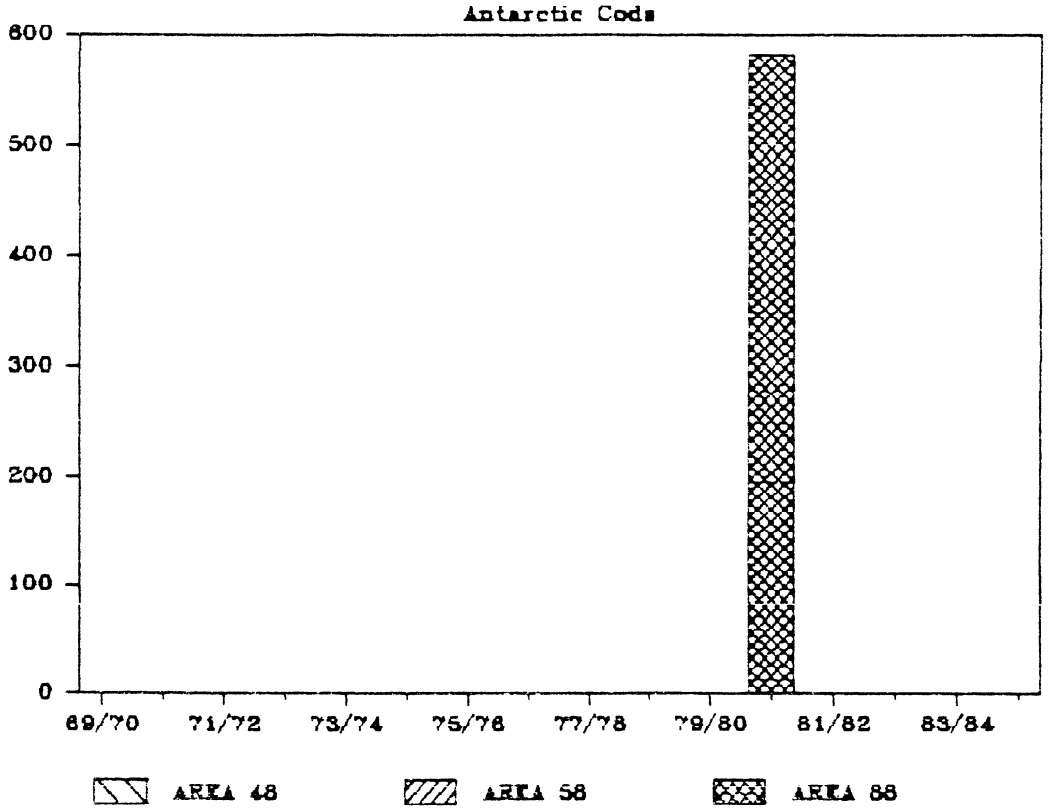


PLEURAGRAMMA ANTARCTICUM

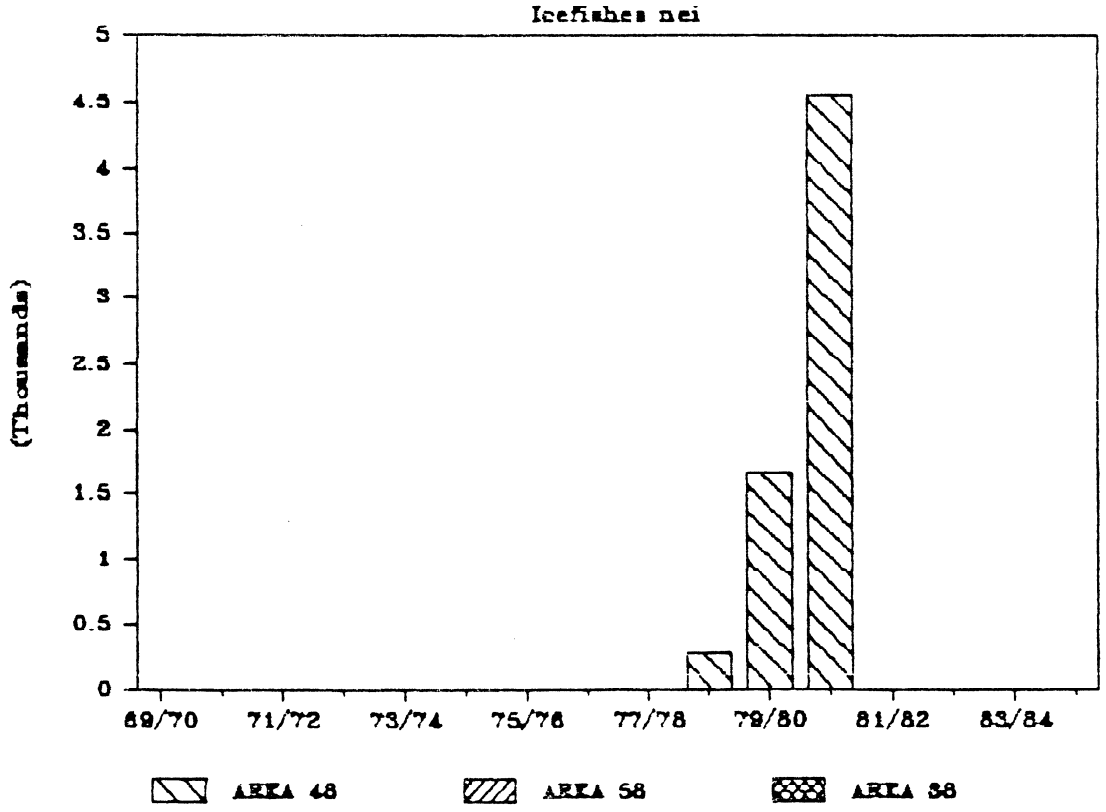
Antractic Sidestripe



TREMATOMUS SPP.

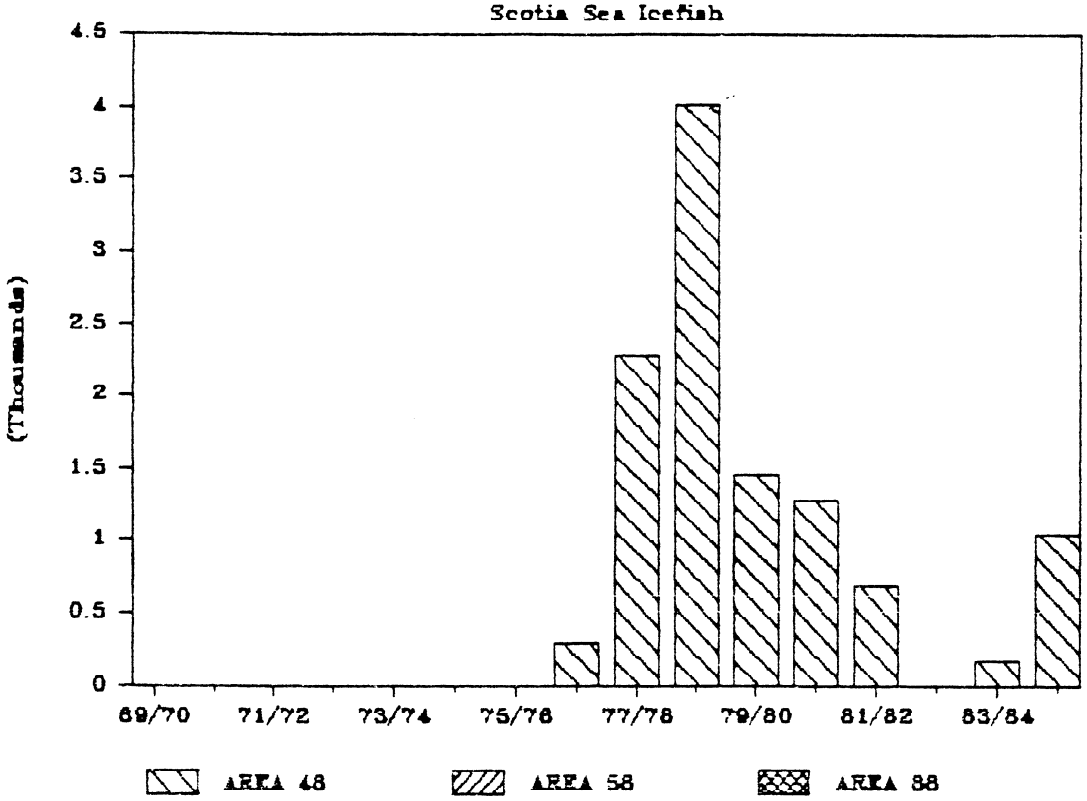


CHANNICHTHYIDAE nei



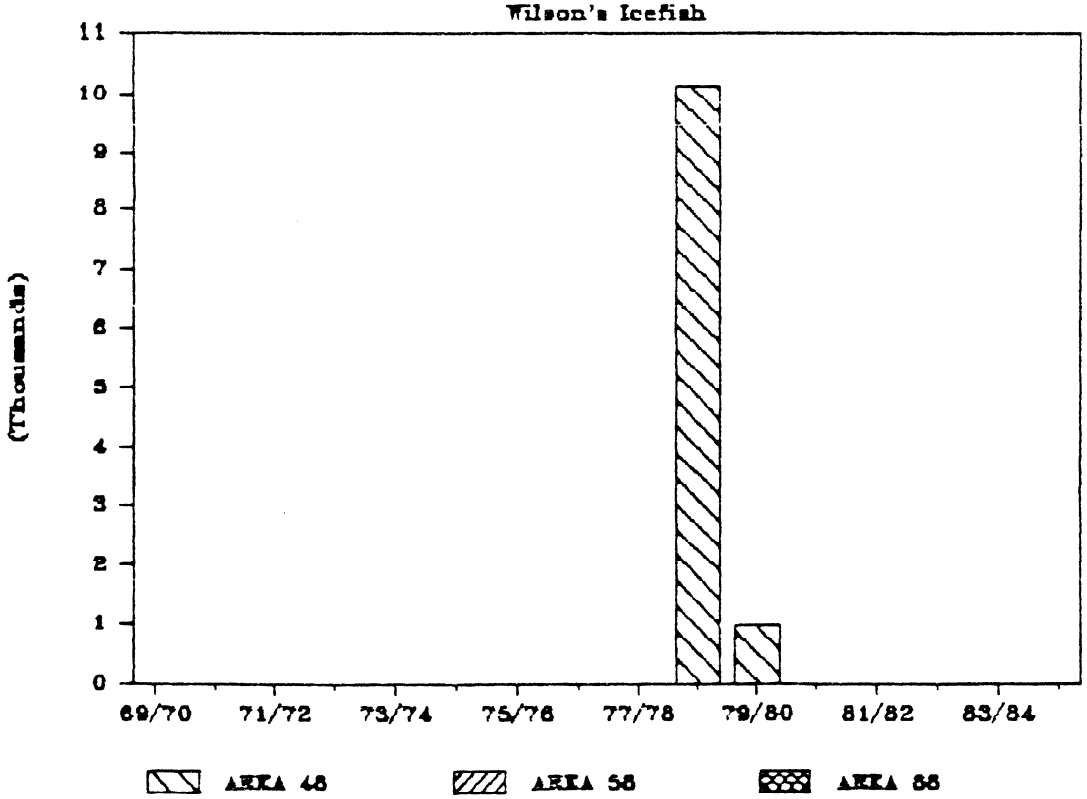
CHAENOCEPHALUS ACERATUS

Scotia Sea Icefish



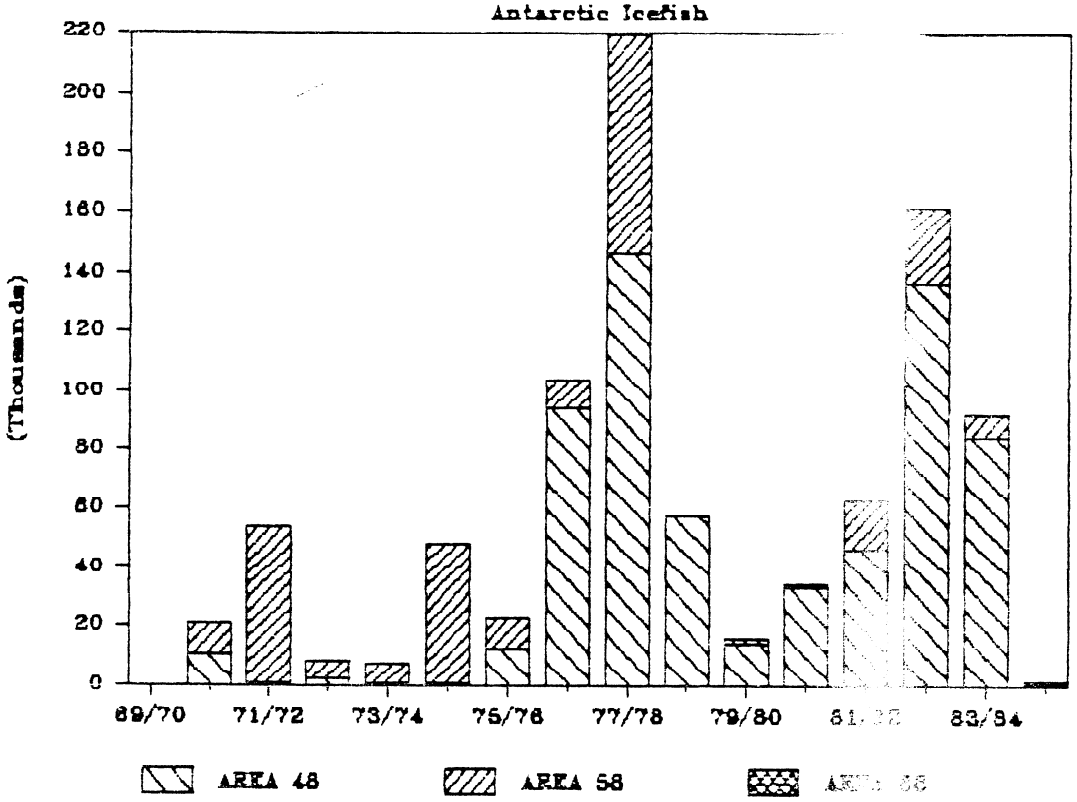
CHAENODRACO WILSONI

Wilson's Icefish



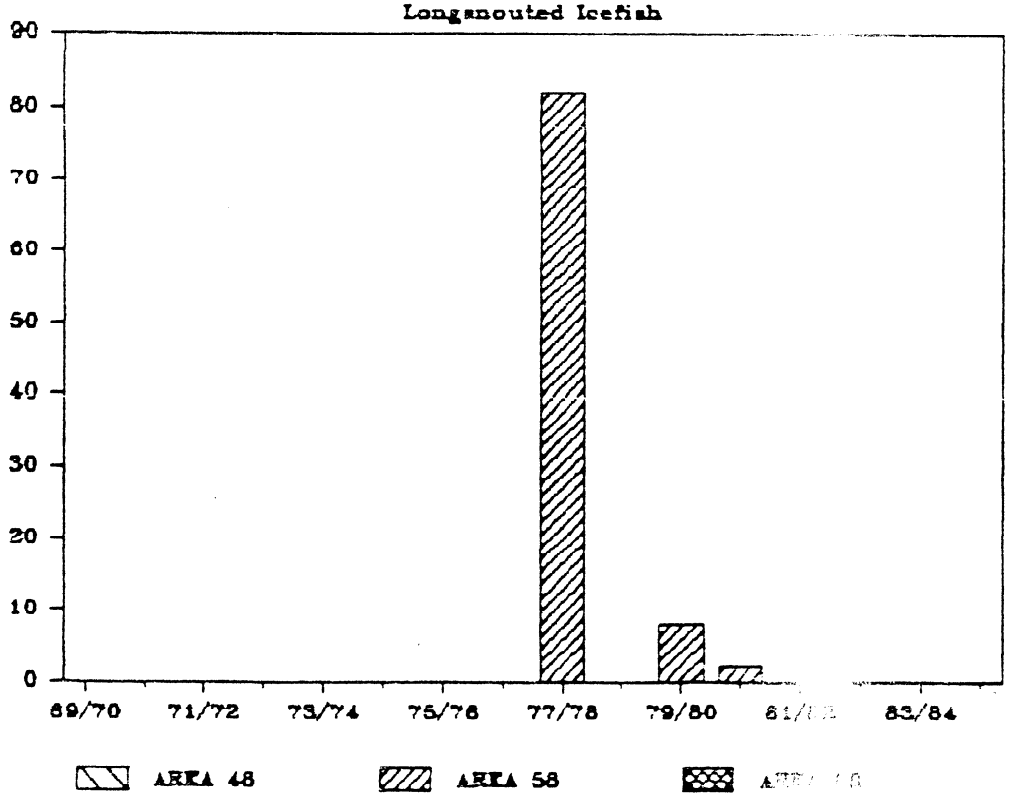
CHAMPSOCEPHALUS GUNNARI

Antarctic Icefish

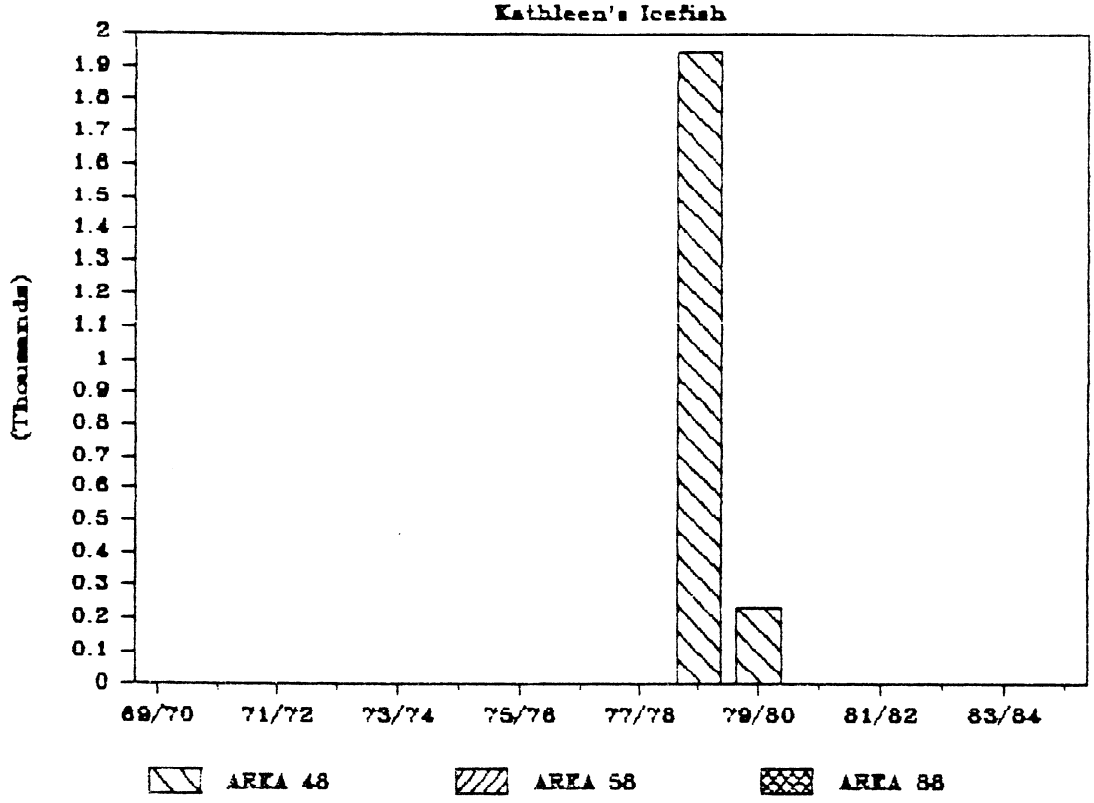


CHANNICHTHYS RHINOCERATUS

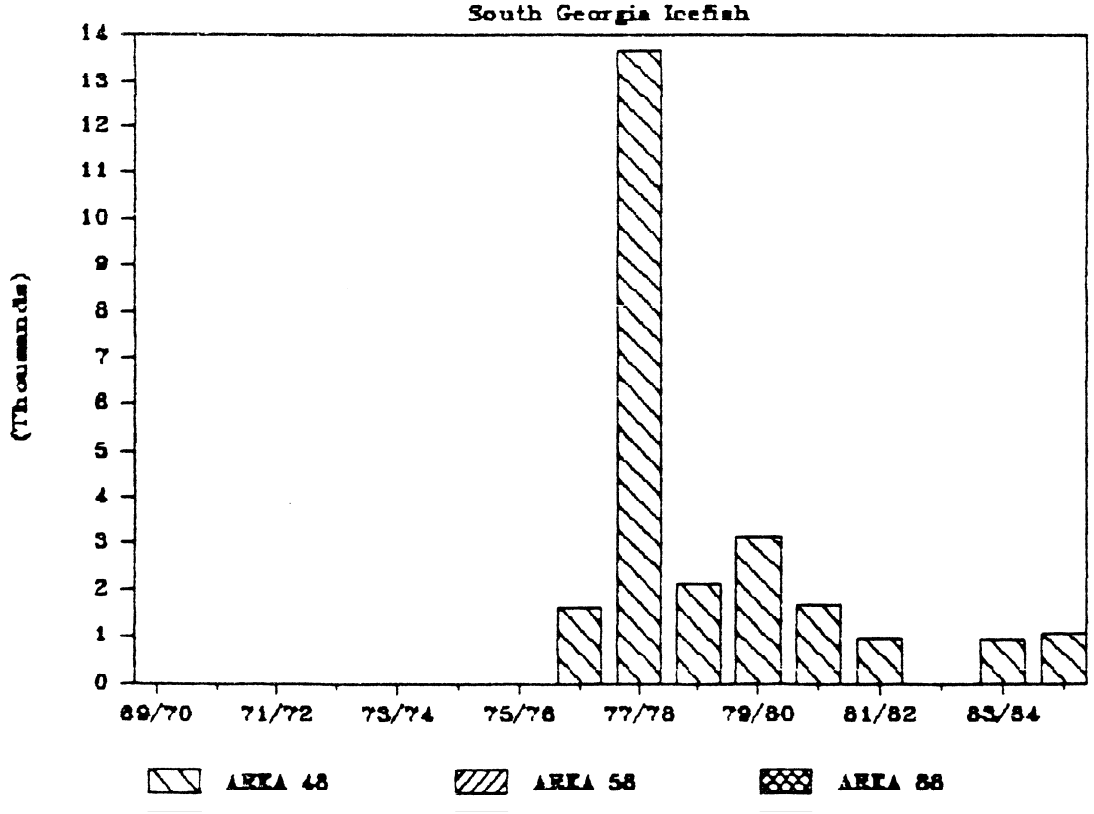
Longsnouted Icefish



CHIONODRACO RASTROSPINOSUS

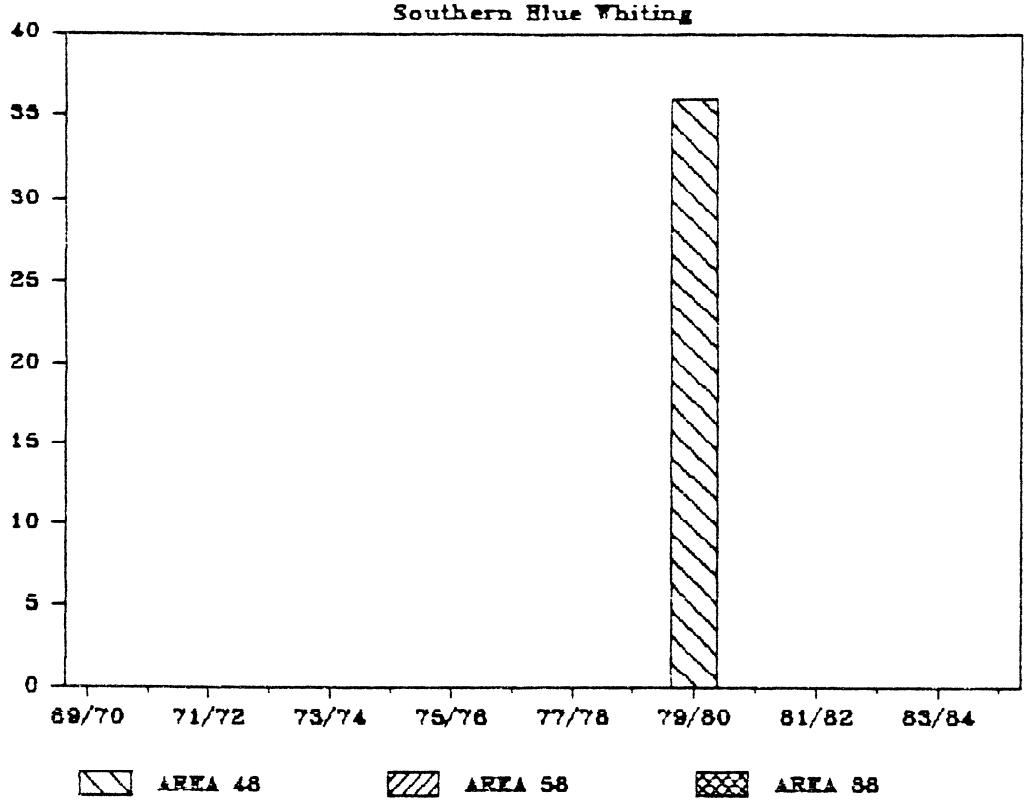


PSEUDOCHAENICHTHYS GEORGIANUS



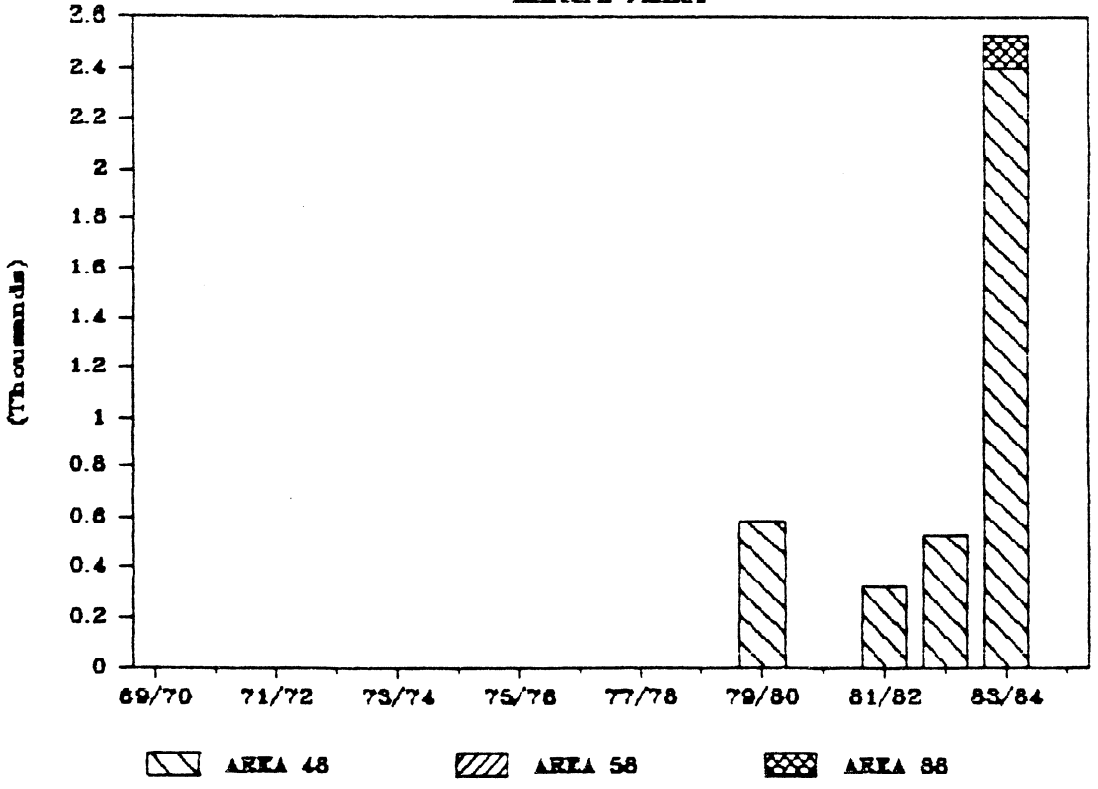
MICROMESISTIUS AUSTRALIS

Southern Blue Whiting



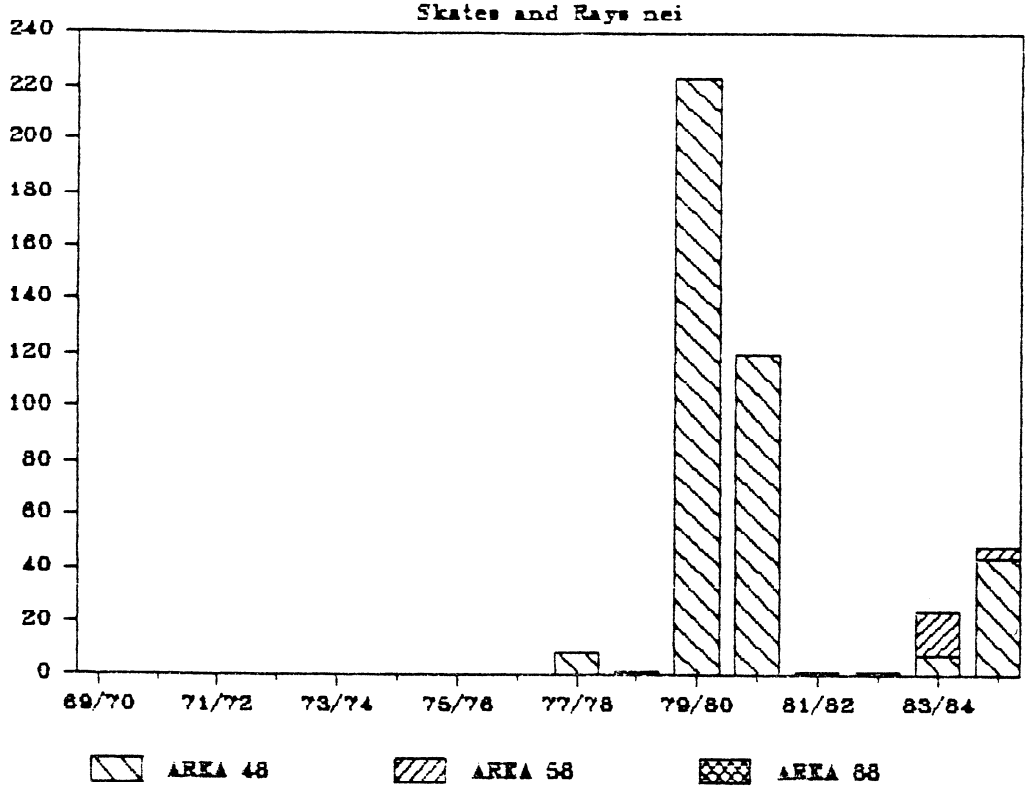
MYCTOPHIDAE

Lantern Fishes



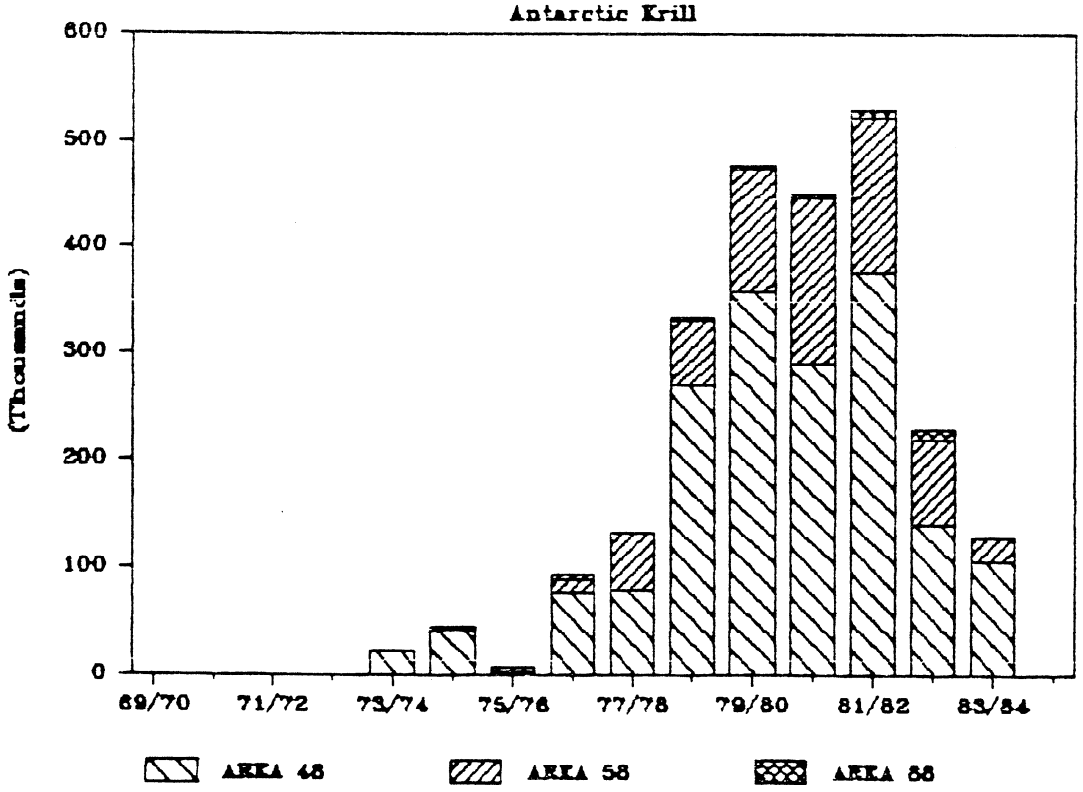
RAJIFORMES

Skates and Rays nei

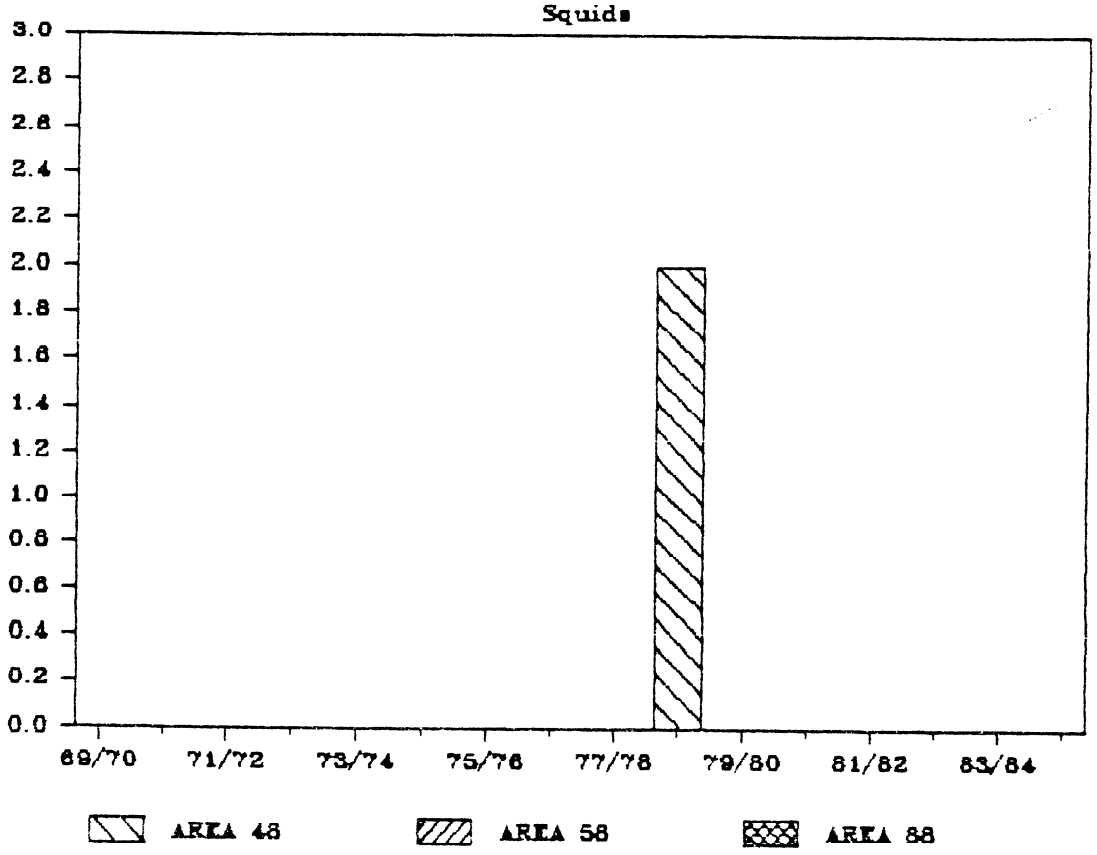


EUPHAUSIA SUPERBA

Antarctic Krill



LOLIGINIDAE



STAT8A10	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
Bulgaria									08A	08A	08A	–	–			
Chile	–	–	–	–	–	–	08A	08A	–	–	–	–	–	08A	08A	n/r
France	–	–	–	–	–	–	–	–	–	–	08A	08A	08A	08A	08A	08A
GDR	–	–	–	–	–	–	–	***	08A	08A	08A	08A	–	–	–	08A
Japan	–	–	–	08A	08A	08A	08A	08A	08A	08A	08A	08A	08A	08A	08A	n/r
Korea	–	–	–	–	–	–	–	–	–	08A	–	–	08A	08A	***	n/r
Poland	–	–	–	–	–	–	–	08A	08A	08A	08A	08A	08A	08A	08A	08A
USSR	***	***	***	***	***	***	***	***	***	08A	08A	08A	08A	08A	08A	n/r
	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

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.

STAT8B12	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
Bulgaria									08B	08B	08B	–	–			
Chile	–	–	–	–	–	–	08B	08B	–	–	–	–	–	08B	08B	n/r
France	–	–	–	–	–	–	–	–	–	–	08B	08B	08B	08B	08B	08B
GDR	–	–	–	–	–	–	–	n/r	n/r	n/r	n/r	n/r	–	–	–	08B
Japan	–	–	–	08B	08B	08B	08B	08B	08B	08B	08B	08B	08B	08B	08B	n/r
Korea	–	–	–	–	–	–	–	–	–	08B	–	–	08B	08B	n/r	n/r
Poland	–	–	–	–	–	–	–	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	n/r
	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

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.

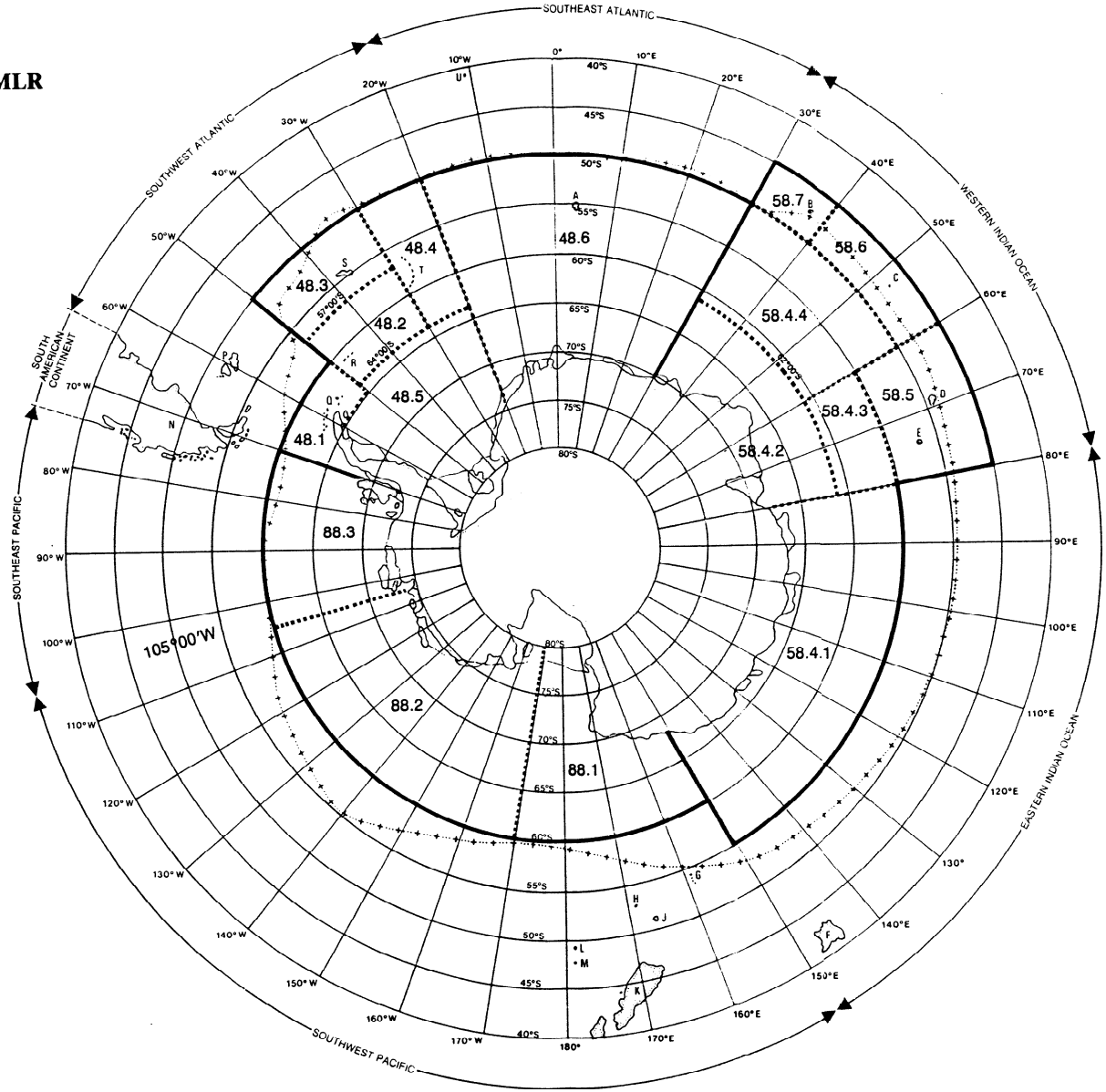
Table 12

NATIONAL IDENTIFICATION CODES

CID	FULL COUNTRY NAME
ARG	Argentina
AUS	Australia
BGR	Bulgaria
CHL	Chile
FRA	France
DDR	German Democratic Republic
DEU	Germany Federal Republic of
JPN	Japan
KOR	Korea Republic of
NZL	New Zealand
NOR	Norway
POL	Poland
ZAF	South Africa
SUN	Union of Soviet Socialist Republics
GBR	United Kingdom of Great Britain and Northern Ireland
USA	United States of America

CCAMLR

Boundaries of the Statistical Reporting Areas in the Southern Ocean



LEGEND

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

Chart 1

LEGEND

- A Bouvet Island
- B Prince Edward and Marion Islands
- C Crozet Islands
- D Kerguelen Islands
- E McDonald 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

NAMES OF ANTARCTIC MAJOR FISHING AREAS, SUBAREAS, AND DIVISIONS

AREA/SUBAREA/DIVISION		NAME
Area	48	Atlantic Antarctic
Subarea	48.1	Peninsula 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

ANNEX 9

LONG-TERM TENTATIVE PLAN OF THE ACTIVITIES OF THE SCIENTIFIC COMMITTEE

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			

* See SC-CAMLR-IV/10 for an example of a specific detailed long-term plan

ANNEX 10

SCIENTIFIC COMMITTEE BUDGET FOR 1986

(Approved by the Commission)

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. In particular, the costs of invited experts and consultants have been assessed provisionally at the United Nations D1 Level. It is expected that, in general, this level of remuneration will be well above that decided in a particular case.

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 inter-sessional meeting of this Working Group under the convenership of Dr R. Hennemuth (USA) for one week at either Hobart or another venue.

3. The budget would need to allow for computing, stationery and administrative expenses, translations and publications of the report, and costs of the participation of one invited specialist.

4. Costs have been estimated as follows:

Invited Expert	10,000
Computing	2,000
Publication and translation of report	79400
Stationery/Administration	1,000
Total Cost	$A20,400

Working Group for Ecosystem Monitoring Program

5. The Scientific Committee agreed to form this Working Group under the convenership of Dr K. Kerry (Australia). Its objectives and terms of reference are detailed in the Committee's report.

6. The Scientific Committee recommended that an inter-sessional meeting of the Group be held for about 6 days in some appropriate place. The budgetary implications are for administrative costs, translations and publication of the report.

7. Costs have been estimated as follows:

Stationery/Administration	3,000
Publication and translation of report	7,400
Total Cost	$A10,400

Workshop on Krill Simulation Study

8. The Scientific Committee agreed that Dr J. Beddington (UK) should organise a simulation study with a model of a krill population and related fishing. The objectives and procedures are detailed in the Committee's report.

9. The Scientific Committee recommended that upon the completion of related studies by research groups in Japan and USSR a final Workshop should be held for 2 weeks in Hobart or another suitable location.

10. The budgetary implications in this simulation study would be for consultant services, travel, administrative expenses, computing and translation and publication of the report.

11. Costs have been estimated as follows:

	1986	1987
Consultant services (4 man-months)	12,500	12,500
Travel Dr Beddington to USSR and Japan (2 trips)	6,800	-
Stationery/Administration	1,500	1,500
Computing	2,000	4,000
Publication and translation of report	7,400	
Total Costs	$A22,800	$A25,400

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

12. Following an earlier decision that CCAMLR will co-sponsor this Seminar with the Inter-governmental Oceanographic Commission (IOC), the Seminar is now scheduled to be held at UNESCO Headquarters in Paris from 2–6 June, 1987.

13. As a result of the postponement of the Seminar, no funds will be required during 1985. Costs for the translation, printing and world-wide distribution of the Announcement of the Seminar, prepared by Dr Sahrhage, are being covered by IOC.

14. For 1986 only the following expenses will be required from the budget of the Commission:

Travel expenses and per them for 2 invited experts to prepare background papers	$A3,000

The preparatory meeting will be held in Hamburg.

15. A sum of the same order of magnitude for the same purpose for another 2 experts is expected from IOC funds.

Antarctic Fish Age Determination Workshop

16. The Scientific Committee recommended that such a Workshop should be held during the inter-sessional period for 5 days. Since research workers from the USSR had not participated in earlier workshops in this field organised under BIOMASS, it was proposed to hold this Workshop in Moscow or Riga and that Dr Lubimova should be invited to arrange for the organisation of this Workshop.

17. While participation in the Workshop by CCAMLR members will be at their own expense, the budgetary implications for the Commission are for stationery and administrative costs and for the translation and publication of the final report.

18. Costs have been estimated as follows:

Stationery/Administration	3,000
Publication and translation of report	7,400
Total Cost	$A10,40

Species Identification Sheets

19. 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
	$A461,000

20. An interim report on the expenditure for this project by both CCAMLR and FAO is contained in a progress report received from FAO (CCAMLR-IV/12).

21. The interim report specifies that a further amount of US$20,000 ($A28,500) will be required to ensure the printing of the French and Spanish-language versions in 1986.

Krill Resources Review (BIOMASS)

22. The Chairman of the Scientific Committee received a request from the Convener of the Group of Specialists on the Southern Ocean Ecosystems and Their Living Resources to enter into contractual arrangements with CCAMLR for obtaining additional funds for the publication of the krill resources review (see 5.25), invited earlier from the BIOMASS program. The Scientific Committee considered a payment of the same amount as provided previously for the fish resources review appropriate:

100 copies of 200 pages at $40 each $A4,000.

Scientific Committee Budget

	1986	1987
	$A	$A
Working Group on Fish Stock Assessment	20,400	
Working Group on Ecosystem Monitoring	10,400	
Krill Simulation Study	22,800	25,400
CCAMLR/IOC Scientific Seminar	3,000	
Antarctic Fish Age Determination Workshop	10,400	
Species Identification Sheets		
- committed	12,000	
- further request	14,000	14,500
Krill Resources Review (BIOMASS)	4,000	
Total	$A97,000	