

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, preferably 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.

Champscephalus 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.

Champscephalus 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.

Champscephalus 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.