ANNEX 8

REPORT OF AD HOC WORKING GROUP ON FISH STOCK ASSESSMENT

(6–7 September, 1984)

A. INTRODUCTION

1. The Working Group met under the Chairmanship of Dr R. Hennemuth (USA) on 6 and 7 September, 1984. Dr J.A. Gulland (FAO) was appointed rapporteur. The terms of reference of the group were, briefly,

(a) to identify those fish stocks which appeared to be heavily fished, and for which conservation action might be necessary;

(b) to indicate the options for conservation measures in respect of these stocks.

2. The main working document for the group was the draft review of the fish stocks prepared as part of the BIOMASS programme by Drs K.-H. Kock, G. Duhamel and J.-C. Hureau (SC-CAMLR-III/BG/2). Useful information was also contained in the report on Polish fisheries (SC-CAMLR-III/BG/11), and the analysis presented by the UK (SC-CAMLR-III/5), the comments by Japan (SC-CAMLR-III/6), as well as the data from STATLANT forms and other material in the CCAMLR data base.

B. STOCKS REQUIRING MANAGEMENT ACTION

3. In reviewing the current state of the stocks the working group considered four main types of data in respect of each stock – the total catch; the catch per unit effort (c.p.u.e.) in the commercial fisheries; the total biomass, as estimated from survey data; and the biological data (especially mean weight; mean length and mean age). The summaries of these data for the two major areas (South Georgia and Kerguelen) are given in Appendices I and II to this report.

4. The general pattern of fishing in the region has been for a short period (sometimes only one season) of high catches to be followed by a period of low catches, with a large volume of catches occurring again, if at all, only after a period of some years. Though there are differences between areas, and between species, as set out in the later sections, the overall picture is one of successive fishing down of a number of accumulations of fish, and of a resource that is, as a whole, heavily exploited. The notothenids, especially *N. rossii*, are probably the species that have been most greatly affected by fishing, and the various species of icefish are less seriously depleted.

5. The *ad hoc* group therefore believed that the Scientific Committee should urgently consider the need for management measures for the fin-fish stocks, with a view to the introduction as soon as possible of whatever measures are found to be appropriate. Further studies would undoubtedly change some aspects of the assessments set out below, and would enable the details of the management measures, e.g. the duration of a closed season, the optimum mesh size, or the magnitude of a TAC for a particular stock, to be specified with more precision. Such studies, especially those which took advantage of more detailed statistical information, would, as discussed later, be highly desirable. Some stocks might be shown to be less heavily fished than currently estimated, but it is also possible that others are in fact even more seriously depleted than suggested here.

B.1. South Georgia

Notothenia rossii marmorata

6. The catches of over 400,000 tons of this species reported from the South Atlantic in 1970 almost certainly came from South Georgia, but may have included a small amount of other species. After a small catch in 1971, no catches were reported until 1976. Apart from 1976 and 1980 annual catches since 1971 have been very small, mostly around 1,000 tons or less.

7. Estimates of c.p.u.e. and biomass, which are available since 1978 and 1976 respectively, vary considerably from year to year, but, with reservations due to changes in target species, suggest a downward trend. The biomass in 1976 was probably around 40,000 tons or less. In comparison the biomass at the beginning of the 1970 season must have been, to supply the observed catches, at least 400,000 tons, though it was probably not much more.

8. The average size and age of the fish has decreased steadily since 1970, and the average weight in 1981 was only one quarter of that in 1970. The mean size is now close to that at sexual maturity.

9. In summary, all available evidence is consistent in indicating that this stock is very severely affected by fishing, and that the present biomass is less than 10% of the initial biomass when the fishery started.

Notothenia gibberifrons

10. This species does not appear to support a directed fishery, and annual catches have tended to be smaller but less variable than for other species. Since the first reported catches in 1976, the reported total has varied between 2,500 tons and 10,000 tons, with no obvious trend. There is an indication of a downward trend in c.p.u.e., but this is inconclusive because of a change in target species by the Polish vessels concerned.

11. The strongest evidence of the effect of fishing comes from the substantial and fairly steady decrease in mean length and mean age since 1976. The mean length in the catches is now about the same as the length at maturity, indicating that a proportion of immature fish occur in the catch.

Champsocephalus gunnari

12. There have been two periods of intense directed fishing on this species (the two seasons 1976/77 and 1977/78, and the 1982/83 season) when catches from the Atlantic sector exceeded 100,000 tons annually, though for the first period it is not clear how much came from S. Georgia. Otherwise, catches have been moderate to small. Because of changes in target species, the available c.p.u.e. data, without detailed information on position or target species, tells us little about trends in abundance. Estimates of biomass are comparable with some of the annual catches, indicating a high fishing mortality.

13. This fish appears to mature at a relatively early age. After the initial period when older fish, (4 years old and upwards and 35–45 cm in length) were common, catches have been dominated by 3-year-old, 25–30 cm fish so that variability in annual caches reflects variability in recruitment. This change in age composition confirms the impact of heavy fishing, but does not necessarily indicate 'over-fishing' in a biological sense. However, the reliance on what seems to be a single age-group, makes the fishing vulnerable to any change in recruitment patterns.

Dissostichus eleginoides

14. Reported catches have been small. There appears to be no directed fishery, and some fish may be included in reported catches of other species. It is difficult to assess the state of this species because the catches are primarily of juveniles and there is little or no fishing on

adults, and also because its occurrence in the South Georgia area is highly variable from year to year. Estimates of c.p.u.e. and biomass of the exploited segment of the stock indicate a downward trend, but the drop in biomass exceeds the reported catch which indicates the change may not be a simple direct result of fishing.

Pseudochaenichthys georgianus

15. Reported catches of this species have been small, around 1,000 tons per year since 1977 except for a peak catch of 9,000 tons. Estimates of biomass show no clear trend, and modal estimates of around 30,000 tons could suggest only a small fishing mortality.

16. In contrast the c.p.u.e. data do suggest a significant decline. The extent of the estimated decline depends on the method of analysis used, but the more detailed analysis based on monthly c.p.u.e. indicate that the stock in 1983 was only a small fraction of that in 1977.

B.2. Other South Atlantic Grounds

17. Assessment of the stocks in other parts of the south Atlantic is made difficult by the absence of sub-area breakdown in the available statistics for any catches before 1977 and for one of the major fishing countries before 1980. About 38,000 tons of *Champsocephalus gunnari* were taken by Poland in sub-area 48.2 (South Orkney) in the 1977/78 season, and it is possible that a large proportion of the catches of over 100,000 tons reported by the Soviet Union as caught in area 48 in each of the 1976/77 and 1977/78 seasons came from this sub-area. In subsequent years, no large catches of fish have been reported from any of the Atlantic sub-areas other than 48.3 (S. Georgia). The greatest single season catch of one species was some 19,000 tons of *Notothenia rossii* in area 48.1 (A. Peninsula) probably, according to the BIOMASS group, from off Elephant Island) in 1979/80. No catches have been reported from this stock in subsequent years.

18. The available c.p.u.e. and biological data are very limited. More data are needed in order to make an assessment of the state of the stocks.

B.3. Kerguelen

Notothenia rossii

19. After moderate catches in 1969/70, peak catches of nearly 150,000 tons were taken in 1970/71. Later catches have fluctuated between less than 2,000 tons, and 35,000 tons in 1976/77.

20. Since 1980 there has been a substantial fall in c.p.u.e. and in mean length, and there has been a reduction in the total spawning area since 1981.

21. The status of this stock is probably very similar to that of the same species round S. Georgia. The initial catches around 1970 greatly reduced an accumulation of old fish, and the catches since 1977 have exceeded the replacement capacity of the reduced stock.

Champsocephalus gunnari

22. Catches have fluctuated considerably with peak catches of 25,000 to 50,000 tons annual occurring at intervals of approximately 5 years, without any very marked downward trend.

23. Good indices of c.p.u.e. are available from log-book data from 1980 onwards, but show no clear trend, though the figure for 1983/84 is reported to be low.

24. Size and age composition data are available from 1975. These show that the fishery is based on small (ca.30cm), and young (3–4 year old fish). There is, however, no downward trend in the average size or age.

25. There is probably less reason for serious concern about the status of this stock than for any other Antarctic fish stock from which significant catches have been taken.

C. IMPROVED STOCK ASSESSMENT

26. While the material reviewed above shows that fishing is having a great effect on virtually all harvested fish stocks, and provides *prima facie* evidence that management is needed – urgently in the case of *Notothenia rossii* – the present analysis is not sufficient to

specify a detailed management programme which would maintain stocks at, or restore them to, some optimum condition, and ensure sustained harvesting within the guidelines set by the Convention. Several lines of further study seem desirable, including the following:

(i) Analysis of detailed catch and effort data

The figures of c.p.u.e. considered here may fail to give a reliable measure of the true changes in abundance because of changes in target species, and area and time of fishing; also some measures of fishing effort, e.g. days fishing, may not reflect true fishing mortality because of loss of time to handle the catch or bad weather, or improvements in gear. These factors need to be taken into account through a more full examination of the original data in as detailed a form as possible.

(ii) Simulation modelling of age and length composition

Given information on the population parameters (growth, use of recruitments, mortality) of each stock, it should be possible to determine the expected changes, from the unexploited condition, in biomass, mean length, mean age etc corresponding to different levels of fishing, e.g. $F_{0.1}$, F_{max} etc., and compare these with the observed changes. Preliminary examination of the use of the method during the meeting confirmed that this was likely to be a valuable approach. Calculations based on parameters for three species round South Georgia, given in Annex III, using ages of first capture appropriate to the fishery before 1980 were in general agreement with the conclusions from other data that these stocks were heavily fished. However, further studies along these lines, to compare more closely the expected and observed trends in c.p.u.e., age-composition, and to narrow the range of possible parameters, would help to produce more quantitative assessment. In particular, they could be useful in determining the relation of the current fishing mortality to that which would be desirable according to various policy criteria.

(iii) Recruitment changes

Apart from changes in total mortality and hence in mean age, biomass per recruit etc., superficial analysis suggests there have been significant changes in recruitment in some stocks. At Kerguelen recruitment of *Champsocephalus gunnari* may have

increased, possibly in response to reduced predation. On the other hand at S. Georgia, and possibly also at Kerguelen, recruitment of *Notothenia rossii*, appears to have decreased substantially. If the large catches at South Georgia came from perhaps 10–15 year-classes, each year-class would have I produced on an average, 30-40,000 tons, whereas recent year-classes, as judged by the decline in stock arising from catches averaging less than 5,000 tons annually, are producing little more than 10% of this figure.

27. It is highly desirable, especially in relation to Article II 3(a) of the Convention, to get better estimates of the trends in recruitment (e.g. from cohort analysis or VPA), and especially to consider whether the decline in recruitment of *N. rossii* (if shown to be real) is caused by a depletion of the spawning stock.

28. To carry out these additional analyses, the group felt it would be useful to have a special mid-term meeting. If this were held it would be important, especially in relation to item (i), that detailed catch and effort statistics were available to the meeting. Availability of additional biological data, especially from countries for which data were not available to the BIOMASS group, was also important. A small group was asked to specify the form of the detailed data that should be provided for the proposed meeting. The suggestions of this group are set out in Appendix III.

C. MANAGEMENT

29. The group noted that management and conservation measures have already been applied in some Antarctic fisheries. For the Soviet fisheries a regulation setting minimum mesh sizes of 120 mm for *N. rossii* and *D. eleginoides* and 80 mm for smaller species, and corresponding minimum fish sizes for each species and sector, have been in force since 1980 (SC-CAMLR-III/INF.13). Soviet vessels also have refrained from fishing within 12 miles of South Georgia, from the beginning of the fishery, but this does not seem to have been fully effective in halting the decline in the stocks.

30. Round Kerguelen the French authorities have set a number of controls. A minimum mesh size of 70 mm has been set since 1980. From 1984 the regulations will include TAC for *N. rossii* and *C. gunnari*, and closed seasons during the spawning seasons of the two species.

31. The group welcomed these initiatives, and noted that a general application of these measures should have some beneficial effect. Consideration of further measures was desirable.

32. Mesh size. The advantages and disadvantages of this approach are well known in respect of other areas, and this experience seems directly transferable to the Antarctic, except that the shape of some species means that entanglements of small fish by their gill-covers can reduce the effectiveness of larger meshes. A properly enforced mesh regulation, with the mesh size appropriately chosen for the stock concerned, can allow small fish to grow, and can alleviate the effects of 'growth over fishing'. However, the amount of fishing is not controlled, and by itself mesh regulation is unlikely to be fully effective in restoring depleted stocks. While the group did not have the time or information to calculate optimum mesh sizes for each stock, it believed that the mesh sizes currently in force in the Soviet fishery would be useful first approximations. Because of the occurrence of both adults and juveniles of *N. gibberifrons* on the fishing grounds, mesh regulation is likely to be particularly useful for this species.

33. Minimum fish sizes. The effectiveness of this measure taken by itself depends on whether the fishermen can avoid catching small fish, and whether, if caught, they can be returned to the sea alive. The group had no information on these points. At a minimum, size limits matched to the selection size of a minimum legal mesh size assists in the enforcement of the latter measure.

34. Closure of nursery areas.. Similar remarks apply as for mesh regulation. Closure of areas in which small fish predominate can, like mesh regulation, be helpful in alleviating growth overfishing, but at best offers only a partial solution to the problem of re-building depleted stocks. The absence of Soviet fishing within 12 miles of South Georgia should have given protection to juvenile *N. rossii*. This measure should be continued and applied to all fishing fleets.

35. Closure of spawning areas. Since the abundance of the spawning stock is affected by any fishing, whether at the time of spawning or some months earlier, the main significance of these closures is to reduce the overall amount of fishing, especially when the stock is most concentrated. The effectiveness of this measure in rebuilding a depleted stock depends on the size of the catches that are taken outside the closed season, either in a directed fishery or as a by-catch when fishing for other species. For seriously depleted stocks it may be necessary to consider a lengthy closure. At the present time we do not have sufficient information to define the spawning areas. A research vessel survey in the spawning season (May) should be

very useful for this. The history of the fishery for *N. rossii* after the large catches in 1970 suggests a closure of some years might be needed.

36. Catch quotas. When there is sufficient knowledge about the abundance and the surplus production of stock, catch quotas or TACs can ensure, given adequate enforcement, that removals from a stock match its productivity and that fishing mortality is kept at the desired level. At present the group did not have sufficient information to be able to suggest specific figures of TAC corresponding to the surplus production, or optimum fishing mortality, for any individual stock. However, it was pointed out that in the case of severely depleted stocks, the immediate need was for low and conservative figures, which would assure, with a fair degree of confidence, that the stock would start to rebuild. Such a TAC would be revised, probably upwards, as more information became available and the stocks recover. In the case of *Notothenia rossii* at South Georgia, the current information suggests that a precautionary TAC to serve such a purpose would have to be even smaller than catches in recent years.

37. For small TACs the by-catches in fisheries directed at other species can raise problems. If significantly large they can nullify the whole effect of the control measure. Measures to limit by-catch are in force in several fisheries in the northern hemisphere, with varying success. In considering measures to protect *N. rossii* or other severely depleted species the Commission would need to consider carefully methods to limit by-catch to the lowest level possible. In this connection the group noted that recent statistics included some 15% of unidentified species, and urged that proper identification should be made when reporting statistics.

38. While optimal management of an area in which several species are taken requires separate limits for each species when all species are heavily exploited, a combined TAC for all species in an area can be a valuable measure. An overall TAC for all fin-fish species would probably require less detailed information than separate TACs for each species. However, some members felt that the estimation of even approximate TACs was not within the terms of reference of the Working Group. It was agreed that further studies are needed if TACs are to be specified more accurately.

APPENDIX 1

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	403100	N. rossii					68.1	3664	9.3	
71	11800						–	–	–	
72							–	–	–	
73							59.4	2418	6.8	
74							–	–	–	
75							–	–	–	
76	11400					35682	56.5	2077	6.5	
77	8320	C. gunnari in Polish vessels			37928	–	59.1	2381	–	
78	992*	Opportunistic in Polish vessels	0.05		5606	9326	53.5	1796	–	Total catch 48: 5143
79	2114*	Opportunistic in Polish vessels	0.44		–	1421	50.5	1476	–	Total catch 48: 8662
80	24897	Opportunistic in Polish vessels	0.07		–	–	–	–	–	

* Data exclude U.S.S.R. which did not provide data by subareas
** Polish catches only

Area : SOUTH GEORGIA
Species : NOTOTHENIA ROSSII

	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)	$\bar{t}$
81	233	C. gunnari in Polish vessels	0.02		2327		43.0	906	5.3
82	1100	C. gunnari in Polish vessels	0.15		34284		47.8	1249	–
83	866	–	–		–			–	–
84	351**	C. gunnari in Polish vessels	0.06		2600			–	–

* Data exclude U.S.S.R. which did not provide data by subareas
** Polish catches only

Area : SOUTH GEORGIA
Species : CHAMPSOCEPHALUS GUNNARI

70	5800								
71	5200								
72	2100								
73									
74	1000								

* Data exclude U.S.S.R. which did not provide data by subarea
** Probably mostly taken around South Orkney Islands
# Probably taken off South Georgia
*** Bottom and pelagic trawl data combined
**** Polish catches data

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)	$\bar{t}$	
75										
76	22400					141469	35–45			
77	109603#	C. gunnari in Polish vessels			226606	–	35–45			
78	4779*	Opportunistic in Polish vessels	0.11		2372	34713	25–32		$\underset{\sim}{}$3	Total catch 48: 154309**
79	5361*	Opportunistic in Polish vessels	0.02		–	1152	25–32		$\underset{\sim}{}$3	Total catch 48: 28317
80	7592	Opportunistic in Polish vessels	0.05		–	–				
81	29322	C. gunnari in Polish vessels	0.62		88414	–	25–30		$\underset{\sim}{}$3	
82	46311	C. gunnari in Polish vessels	0.62		46192	–	25–30		$\underset{\sim}{}$3	
83	128184	–	–		–	–				
84	8098****	C. gunnari in Polish vessels	1.46		153000***	–				

* Data exclude U.S.S.R. which did not provide data by subarea

** Probably mostly taken around South Orkney Islands

\# Probably taken off South Georgia

*** Bottom and pelagic trawl data combined

**** Polish catches data

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	5100					40094	(41.2)	(802)		
77	3070	C. gunnari in Polish vessels			22339	–	37.0	576		
78	9775*	Opportunistic in Polish vessels	0.53		19989	20100	34.0	443		Total catch 48: ~18500t
79	2540*	Opportunistic in Polish vessels	0.47			5894	(30)	(302)		Total catch 48: 9910t
80	8143	Opportunistic in Polish vessels	0.45		–	–				

* Data exclude U.S.S.R. which did not provide data by subareas

** Polish catches only

( ) 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)	$\bar{t}$
81	7648	C. gunnari in Polish vessels	0.30		13693	–			
82	3756	C. gunnari in Polish vessels	0.13		25801	–	32.0	368	
83									
84	531**	C. gunnari in Polish vessels	0.10		17700				

* Data exclude U.S.S.R. which did not provide data by subareas
** Polish catches only
( )Research vessel catches

Area : SOUTH GEORGIA
Species : DISSOSTICHUS ELEGINOIDES

70									
71									
72									
73									
74									

* 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)	$\bar{t}$	
75										
76						13497	–	–		
77	1656	C. gunnari in Polish vessels			4676	–	63.3 49.1	2956 1280		South Georgia Shag Rocks
78	922	Opportunistic in Polish vessels	0.03		–	7322	–	–		
79	331	Opportunistic in Polish vessels	0.01		–	646	–	–		
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		–	–	–	–		

* Polish catches only

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)	$\bar{t}$
70									
71									
72									
73									
74									
75									
76						36401			
77	1608	C. gunnari in Polish vessels		–	23210	–			
78	8759	Opportunistic in Polish vessels	0.47	–	39703	31057			
79	1104	Opportunistic in Polish vessels	0.19	–	–	4192			
80	665	Opportunistic in Polish vessels	0.04	–	–	–			
81	1584	C. gunnari in Polish vessels	0.11	–	8717	–			

* Polish catches only

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)	$\bar{t}$
82	956	C. gunnari in Polish vessels	0.13	–	16940	–			
83	–	–	–	–					
84	888*	C. gunnari in Polish vessels	0.16	–	70500	–			

* Polish catches only

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) 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	1721	C. gunnari	7.7	–	–	–	55	7
81	7991	C. gunnari N. rossii N. squamifrons	3.8	–	–	–	52	6.5
82	9881	C. gunnari N. rossii N. squamifrons	4.0	–	–	–	49	6
83	1881	C. gunnari N. rossii N. squamifrons	2.2	–	–	–	50	6
84	749	C. gunnari N. rossii N. squamifrons	1	–	–	–	–	

Area: 58.5
Species: C. GUNNARI

70	(500)							
71	(49900)							
72	(15700)							
73	(7200)							
74	26714	C. gunnari N. rossii N. squamifrons	–	–	–			

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)	$\bar{t}$
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							
80	1368	C. gunnari N. rossii N. squamifrons	(1.4) (Others)			26.5 (Others)		3
81	1052	C. gunnari N. rossii N. squamifrons	1.2 (Skiff Bank)			28.1 (Skiff Bank)		
82	15990	C. gunnari N. rossii N. squamifrons	1.5 (Skiff Bank) (4.4) (Others)			31.6 (Skiff Bank) 24.9 (Others)		4 3
83	25927	C. gunnari N. rossii N. squamifrons	$\underset{\sim}{}$ 8.0 (Others)			29.0 (Others)		3
84	(7139)	C. gunnari N. rossii N. squamifrons	2.3 (Skiff Bank) $\underset{\sim}{}$ 2 (Others)			28.0 (Skiff Bank) 33.0 (Others)		3 4

APPENDIX III

DATA NEEDS FOR A MID-TERM MEETING

Stocks of Interest

Particular attention should be paid to the stocks (especially *N. rossii*) around South Georgia, but the mid-term meeting should also consider other Atlantic sub-areas, and the stocks around Kerguelen.

Analyses to be Carried Out

The types of analysis that the meeting expects to carry out will determine what types of data needed to be supplied, and how these data need to be processed. To enable the working group to progress successfully it is very important that the greatest amount possible of data processing is carried out in advance of the meeting, so that the participants can concentrate on the interpretation of the results. To this end, this note sets out some of the requirements for preliminary processing, as well as the data needs *per se*.

The main lines of analysis considered were:

(a) Use of c.p.u.e. data to estimate trends in biomass or abundance;

(b) Virtual Population Analysis (VPA) or cohort analysis, to estimate annual values of fishing mortality, and of population numbers or biomass;

(C) Age-structured analysis, to study patterns of yield per recruit etc.;

(d) Swept-area analyses, to estimate total biomass;

(e) Distributional studies, to consider possible locations/timing of closed areas/seasons to protect juveniles or spawning concentrations.

C.P.U.E. Analysis

Because of changes in area or season fished, or in target species, the ratio of total catch to total effort does not reflect correctly changes in biomass. The working group would need to compare series of c.p.u.e. values in different years for the same small area and time division in each year, in order to have a meaningful index of biomass. Figures for different area/time strata could then be combined, e.g. by analysis of variance techniques, to produce a best index of abundance for each year.

To do this the time/area division should be as small as possible. The Woods Hole meeting (SC-CAMLR-III/9, para 66) proposed a maximum spatial grid of 0.5° latitude by 1° longitude. This should be used, but if it proves impracticable to extract all the data in time for the mid-term meeting, the STATLANT B divisions (by month, by sub-area, by main species sought) was the minimum acceptable. It was essential to have at least some years of fine detail c.p.u.e. for comparative purposes. In any case the data should be submitted for the whole period of the fishery.

For the Kerguelen fishery the French authorities have complete log-book data for all countries since 1980, which might be made available to the working group.

Noting that there might be questions of confidentiality, it was suggested that the Commission should write formally to French authorities asking them to make these data available to the working group.

VPA Analysis

Two stages are involved: the production of a set of estimates of the total numbers of fish of each age caught each year, and VPA proper, – the analysis of this set of data to produce estimates of annual values of F and population numbers. The first of these at least should be completed in advance of the meeting of the working group.

Since complete catch-at-age data is not available for all species in all years for all countries, some interpolation and combination of data will be necessary. This will require some subjective judgement, for which the Commission's Data Manager will require advice from members of the working group.

The basic data requirements are for each year, and each species and sub-area, total catch in numbers if available, total catch in each length group (or percentage length composition), and age-length-keys, or other information (e.g. growth curves) to facilitate the conversion from length to age. In principle these data could be presented already summarised by years, but for other purposes, it would be desirable to separate the data by months.

Age-structured Analysis

The basic needs are simple – essentially current estimates of growth parameters, ages or sizes at recruitment, and at maturity, mortality rates etc. These might be best presented as estimates from publications, or from studies in press or in progress. The working group should have available to it computers and programs to enable yield per recruit, mean length, or other calculation to be made quickly and easily.

Swept Area Analysis

The results of research vessel surveys should be presented giving (a) sufficient information on the gear, vessel, towing speed etc. to enable the area swept per hour to be estimated, and (b) catch per hour of each species by depth zone, and area. The tabulations of the areas of bottom within each depth zone made by I. Everson should be made available to the group.

Distribution Studies

These may not require much analysis or data processing as such, but if the working group is to give serious consideration to the location or timing of possible closed areas or closed seasons, it must have available to it detailed information on the location of nursery or spawning areas. This could be presented in the form of charts or maps, or as length or age composition data with fine area and time breakdown.

Operational Matters

Time and place of mid-term meeting: In order to keep travel costs within reasonable bounds, and to ensure that the extraction and processing of data is completed before the meeting, there are two practicable possibilities: (a) in Europe (possibly ICES headquarters,

Copenhagen) in July-August; (b) in Hobart immediately before the next Commission meeting. If the meeting is not held in Hobart, it should be ensured that fully adequate computing facilities are available. Attendance of experts from all member countries was desirable.

Because substantial work will be involved in computing the national data, transmitting it to CCAMLR, and as necessary processing it, the Data Manager should visit the main countries concerned, by early in 1985, to check on progress, clarify precisely what data is required, and to determine the best way of submitting the data (on written forms, computer tapes etc.), bearing in mind the computer facilities available nationally and in CCAMLR.