

FISH RESOURCES

Fish Stock Assessment - Report of the Working Group

3.1 The Convener of the Working Group on Fish Stock Assessment (WG-FSA), Dr K.-H. Kock (FRG), presented a report of the meeting which had been held in Hobart at the offices of the Secretariat from 25 October to 2 November 1989.

3.2 The Report of the WG-FSA is attached at Annex 6.

3.3 In reviewing the Report, the Scientific Committee thanked the Convener and participants for all their hard work. There were a large number of background papers presented to the WG-FSA and in addition, a number of background papers presented to the Scientific Committee covered matters involved in fish stock assessment. A list of documents is given in Annex 6, Appendix 3.

3.4 The Scientific Committee endorsed the Report of the WG-FSA and in receiving the Report, used its findings as a basis for discussion of the agenda items to be covered under fish resources.

3.5 To avoid unnecessary duplication, where certain sections of the WG-FSA Report were accepted with only minor or no comment, this Report refers to the relevant paragraphs in the Working Group Report. This should be read in conjunction with this Report.

Scientific Research Exemption Provision

3.6 During the meeting of the Working Group the Secretariat had been in correspondence with the USSR. Three research vessels (*Slavgorod*, *Borispol* and *Passat 2*) had started a fishery survey in the South Georgia region (Statistical Area 48.3). It was announced during the meeting that these vessels had been withdrawn.

3.7 Dr Lubimova reported that the vessels had fished for less than one week and that catches were small and mainly of the species *Champscephalus gunnari*. The results will be presented to CCAMLR at its next meeting.

3.8 The Scientific Committee noted the concerns of the WG-FSA, (Annex 6, paragraphs 3 and 4) and recommended that:

- (a) plans for such research cruises should be circulated in advance;
- (b) catches should be reported on a haul-by-haul basis to the Secretariat; and
- (c) research vessel catches should be considered as part of TAC.

3.9 Dr Beddington referred to the plans presented to the WG-FSA for a further joint UK/Polish research cruise to Subarea 48.3 in January 1990. The vessel that would be used was a commercial trawler *Hillcove* as the RV *Profesor Siedlecki* was unavailable. The survey design was randomised and catches were therefore expected to be small (Annex 6, paragraph 3).

Catch and Effort Statistics

Statistical Area 48 (Atlantic Ocean Sector), (Annex 6, paragraphs 5 to 12)

3.10 The concerns of the WG-FSA about reporting catch and effort statistics from the operations of a longline fishery by the USSR for *Dissostichus eleginoides* in Subarea 48.3 were noted by the Scientific Committee.

3.11 The Secretariat at the request of the WG-FSA had prepared in SC-CAMLR-VIII/BG/54, a reporting format for presenting catch and effort statistics for longline fisheries.

3.12 The Scientific Committee recommended that all past and current catch and effort statistics for this fishery should be presented to CCAMLR in the format set out in this document.

3.13 Concern was expressed about the operation of this longline fishery as similar fisheries elsewhere in the world had posed conservation problems which were difficult to detect from catch and effort statistics alone. In addition, there had been significant instances of incidental mortality, particularly of albatrosses and large petrels, in other longline fisheries.

3.14 Dr Lubimova explained that the fishery operated at an average depth of 800 metres and would on occasion, go as far as 1 200 metres. The fishery targeted primarily on older age groups which appeared sporadically close to the continental slope. There was no indication

of any problem of incidental mortality, but noted that SC-CAMLR-VIII/BG/54 involved a procedure for reporting any such incidents.

Statistical Area 58 (Indian Ocean Sector), (Annex 6, paragraphs 13 to 14)
Statistical Area 88 (Pacific Ocean Sector), (Annex 6, paragraph 15)

3.15 The above paragraphs were endorsed without comment.

Age Determination, (Annex 6, paragraphs 17 to 20)

3.16 Lic E. Barrera-Oro (Argentina) emphasised the importance of correct age data and noted how errors in these data would be propagated through other analyses. A workshop was considered as the best way of dealing with such problems and it was agreed that the Scientific Committee should consider holding such a workshop in two to three years time.

Other Biological Information, (Annex 6, paragraphs 21 to 27)

3.17 Some doubts were expressed by Dr Lubimova about the major difference in the length at first spawning of *C. gunnari* between South Orkney and South Georgia reported in SC-CAMLR-VIII/BG/16. These were noted, but could not be resolved.

Mesh Selection, (Annex 6, paragraphs 28 to 39)

3.18 Dr W. Slosarczyk (Poland) drew attention to some inconsistencies in different parts of the WG-FSA Report where mesh selection was discussed. The Scientific Committee noted this and endorsed the summary conclusions as follows:

Assuming that the actual size of the twine mesh in commercially used codends is on the average 10% greater than the nominal mesh (SC-CAMLR-VII/BG/11), the introduction of the following mesh sizes in the commercial fishery in Statistical Area 48 should be considered:

- (a) Subarea 48.3
 - (i) Fishery targeted at *C. gunnari*
80 mm, to protect immature fish, or

90 mm, to protect first spawners, or
100 mm, to give an age at first capture of 4 years;

- (ii) Fishery targeted at *Patagonotothen brevicauda guntheri*
50 mm, to protect immature fish;
 - (iii) Mixed fishery (not targeted at *C. gunnari* or *P.b. guntheri*)
120 mm extended to include *Notothenia gibberifrons*, *Chaenocephalus aceratus* and *P. georgianus* (in addition to *Notothenia rossii* and *D. eleginoides*, which have had such a mesh regulation since 1984 - Conservation Measure 2/III), to ensure better protection of immature fish;
- (b) Subareas 48.1 and 48.2
110 mm, to ensure protection of first spawners of *C. gunnari* and immature *N. gibberifrons*.

In addition to the above, the provision should be included that chafers will not be used and codends will be diamond shaped mesh made of twine, no thicker than 4.5 mm.

‘Although the Working Group agreed that further work was necessary it was felt that the analyses presented were now at a stage when selection factors could be used as a guide in introducing new mesh sizes.’

3.19 Concern was expressed by Dr Lubimova that there could be substantial mortality of small fish passing through nets which could lessen the benefits to be gained from mesh regulations. Given the morphological peculiarities of the species concerned, before taking decision on new mesh size, studies should be carried out on the survival rate of fish escaped from the trawl.

3.20 Dr O. Østvedt (Norway) noted that this concern had been raised in meetings of ICES, but the decision had been that mesh regulations were still of substantial benefit and should be retained.

Assessments Prepared by Member Countries, (Annex 6, paragraphs 42 to 76)

3.21 A large number of assessments had been prepared for the WG-FSA and discussed at length by them. Given the technical nature of the work and comments, the Scientific Committee felt that it could only note and endorse these discussions.

Statistical Area 48

Subarea 48.3 (South Georgia)

Catches, (Annex 6, paragraphs 77 to 79)

3.22 Table 1, paragraph 77 of the WG-FSA Report (Annex 6) indicated catches of *Myctophidae spp.* increasing from 1 102 tonnes in 1987 to 29 673 tonnes in 1989. Concern was expressed that this was a very large increase in catch levels which had occurred without any stock assessment.

3.23 Dr Lubimova explained that this was an experimental fishery directed at a single species, *Electrona carlsbergi* which had an extended range beyond the Polar Front. Preliminary biomass estimates of the stock were high and the by-catch was limited to squid. This by-catch was at an extremely low level and only single squids were caught. Results of the analyses would be presented to CCAMLR next year.

3.24 Concern was expressed about the definition of an experimental fishery by several delegations and the view was expressed that the large increases in catch should have been preceded by some assessment that could be reviewed by the Scientific Committee.

3.25 The Scientific Committee recommended that in order to avoid confusion concerning the species involved, the Secretariat should ensure that the target species involved was identified in future reporting of catch statistics to the Commission.

Assessments of Individual Stocks

Notothenia rossii in Subarea 48.3, (Annex 6, paragraphs 80 to 84)

3.26 The Scientific Committee endorsed the WG-FSA Report and noted that there were no data presented on the size-at-age composition of the catch of this species. In view of the high degree of depletion of this species such data were essential. The Scientific Committee recommended that length compositions and age compositions from recent catches should be provided to the Working Group.

Management Advice

3.27 The Scientific Committee recommended that in view of the current low level of the stock *N. rossii*, all conservation measures should be kept in force.

Champscephalus gunnari in Subarea 48.3 (Annex 6, paragraphs 85 to 99)

3.28 Dr Beddington pointed out that the comments on the reliability of the biomass estimates for the UK/Polish survey contained in Annex 6, Appendix 6 (paragraph 91) had been submitted by the USSR Delegation after the close of the meeting. The Scientific Committee recommended that this authorship should be reflected in a revision of paragraph 91 of Annex 6, Appendix 6.

Management Advice

3.29 There is a large difference between the assessment of the stock of *C. gunnari* as presented in two separate analyses. WG-FSA-89/27 has a high level of uncertainty as the survey estimate on which it is based could be a substantial over-estimate or under-estimate of the stock, while the WG-FSA could not agree on a way of assessing the reliability of the results presented in WG-FSA-89/22 Rev. 1.

3.30 The large differences between the two analyses for the final year pose serious problems in presenting management advice to the Commission. The TACs at different target F levels that have been derived from the two assessments are given in Table 3.1. They differ substantially.

Table 3.1: TAC levels (tonnes) for *C. gunnari*, Subarea 48.3, calculated from assessments presented in WG-FSA-89/27 and WG-FSA-89/22 Rev. 1 ($M = 0.35$).

	Assessment presented in WG-FSA-89/27	Assessment presented in WG-FSA-89/22 Rev. 1
$F_{0.1} = 0.313$	6 545	22 235
$F_{\max} = 0.645$	11 961	40 273

3.31 In essence, if the trawl survey and the analysis based on it is correct, a TAC based on the CPUE tuned VPA will lead to a substantial depletion of the stock. If the analysis based on the CPUE tuned VPA is correct and a TAC is set on the basis of the trawl survey results, the stock will increase substantially.

3.32 A number of delegations expressed the view that given both the uncertainties and the wide differences between the estimates, any compromise position, e.g. the setting of a TAC based on the average value of the two assessments, would present problems similar to those posed in paragraph 3.31. The reason is that if the status of the stock based on the trawl survey is close to the correct one, a TAC based on an averaging of the assessments will lead to a substantial depletion of the stock. If the status of the stock based on WG-FSA-89/22 Rev. 1 is close to the correct one, the stock will increase substantially.

3.33 Dr Lubimova expressed the view that the advice given in paragraphs 3.30 and 3.31 was sufficient advice to the Commission.

Notothenia gibberifrons in Subarea 48.3,
(Annex 6, paragraphs 101 to 103)

3.34 The analysis performed in the WG-FSA had identified a strong relationship between stock and recruitment which implied that any further reduction in the stock would lead to yet lower recruitment.

3.35 Lic Barrera-Oro reiterated concern expressed in previous meetings by Argentine delegates, about the take of *N. gibberifrons* as by-catch in the directed fishery for *C. gunnari*. Even with the lowest of the TACs presented at the WG-FSA for *C. gunnari* (6 545 tonnes) the by-catch of *N. gibberifrons* will reach a level higher than the limit set by the Working Group (300 tonnes). The proportion of *N. gibberifrons* taken as by-catch in the *C. gunnari* fishery fluctuated between 4 and 10% in previous years. This view was shared by a number of other delegations.

Management Advice

3.36 The WG-FSA had reported that because of the current stock size and the evidence for a stock recruitment relationship, it is inappropriate to recommend catches at the level of $F_{0.1}$. Catches should be kept to a minimum to increase the stock size as much as possible. The Working Group recommended that there should be no directed fishery for *N. gibberifrons* and by-catch should be restricted to not more than 300 tonnes.

This was endorsed by the Scientific Committee with the reservation made by some delegations (see paragraph 3.33) that 300 tonnes may be too large.

Pseudochaenichthys georgianus in Subarea 48.3
Chaenocephalus aceratus in Subarea 48.3
(Annex 6, paragraphs 104 to 106 and 107 to 108 respectively)

3.37 The Scientific Committee endorsed the WG-FSA's review of these stocks without comment.

Management Advice

3.38 In view of the 'by-catch' problem associated with the catch of these species, its likely detrimental effects on other species with a low stock size (e.g. *N. gibberifrons*) and an apparent stock-recruitment relationship in the case of *C. aceratus*, the Scientific Committee recommended that no directed catches of these species be taken and by-catches be reduced to a minimum to allow the recovery of these stocks.

Notothenia squamifrons in Subarea 48.3
(Annex 6, paragraphs 110–113)

3.39 Concern was expressed that this species is relatively long lived, has a low potential yield and that no estimates of mortality or recruitment were available.

Management Advice

3.40 The WG-FSA had been unable to recommend a TAC because the status of the stock was unknown. The Scientific Committee noted this.

3.41 Some delegations expressed the view that in the absence of information on which to calculate a TAC or even estimate potential yield, two options should be presented. One option was for the Commission to recommend a cessation of any directed fishery. If this option was taken, the stock would be expected to increase. The second option was to permit a directed fishery at some level. In this situation, it would not be possible to predict the effect on the stock.

Dissostichus eleginoides in Subarea 48.3 (Annex 6, paragraphs 115 to 119)

3.42 Concern was expressed that catch levels have increased by a factor of four in the last two years and that the WG-FSA had been unable to assess the status of the stock. It was noted that the longline fishery was exploiting older age classes, and the productivity of this species is probably low, although the fecundity is high.

Management Advice

3.43 The WG-FSA had suggested a method for assessing the possible sustainable yield. Even in the absence of information on the stock size it is possible to calculate the yield for different levels of the unexploited stock size (using, for example, the Gulland formula, yield equals half the product of mortality and unexploited biomass). Natural mortality is estimated to be 0.06 (Kock, Duhamel and Hureau, 1985).

Biomass	Sustainable Yield
8 000 tonnes	240 tonnes
40 000 tonnes	1 200 tonnes

As the figure of 40 000 tonnes is some five times the stock estimate obtained by the FRG survey in 1984/85, this could be considered as a reasonable upper limit until further data become available. The Scientific Committee endorsed this as a useful basis for setting a TAC. However, the wide discrepancy between the TAC set on the basis of the survey

estimate and that based on the assumption that biomass was five times the survey estimate presented in the report, was felt to be so wide as to serve only as broad guidelines for a TAC.

Patagonotothen brevicauda guntheri Subarea 48.3
(Annex 6, paragraphs 121 to 127)

3.44 The Scientific Committee endorsed the WG-FSA's analyses without comment.

Management Advice

3.45 The Scientific Committee endorsed the view of the WG-FSA that 'uncertainty in the value of natural mortality and the lack of any time series showing trends in biomass levels prevent accurate assessment of the current stock size. In the absence of reliable estimates of natural mortality to evaluate the alternative analyses and in the absence of information on current stock size, catch levels should not be based on VPA results, using $F_{0.1}$ calculations and assumptions about recruitment. The current status of this stock is unknown.'

General Management Advice

3.46 Following its review of the status of the fish stocks in Subarea 48.3, the Scientific Committee discussed the general situation. The Commission has been setting conservation measures for individual stocks over the last few years.

3.47 The view of the USSR Delegation was that this stock by stock approach was adequate to ensure conservation of the fish resources.

3.48 All other delegations present felt that an alternative option involving a closure of the fishery for a short period of at least one year, pending a new assessment, should be presented to the Commission for consideration. The status of all stocks in the area was either unknown due to the lack of data, uncertain due to wide differences in the results of different analyses or depleted and in need of protection. In the case of depleted stocks which had suffered recruitment failure, it was not clear that by-catches would be sufficiently small to ensure recovery. Accordingly, the efficiency of a stock by stock approach was currently low.

3.49 The Convener of WG-FSA was asked to draft a note outlining data and analyses and surveys which would be required to improve the knowledge of the stocks.

3.50 The benefits that might be expected from a short closure would be an increase in heavily depleted stocks and a build up of other stocks to higher levels of productivity.

Subarea 48.2 (South Orkney Islands), (Annex 6, paragraphs 128 to 135)

3.51 The Scientific Committee noted with concern that insufficient data were available for the WG-FSA to complete any assessments. Two stocks are currently exploited, *C. gunnari* and *N. gibberifrons*.

Management Advice

3.52 The management advice of the WG-FSA was that, 'due to the lack of data the Working Group was unable to recommend a TAC for either species. In case, however, the recruitment failure in *C. gunnari* is real, the stock should be protected until evidence to the contrary is available.' This was noted.

In the discussion on this advice, two views were presented. The one that in absence of assessments, some precautionary TAC should be considered. The other, that due to the sporadic nature of the occurrence of *C. gunnari* and *N. gibberifrons* in the area, no catch limit was required.

Subarea 48.1 (Antarctic Peninsula), (Annex 6, paragraphs 135 to 140)

3.53 The Scientific Committee made similar comments on the WG-FSA Report as in paragraph 3.51 for the South Orkney area.

Management Advice

3.54 Due to the lack of data the Working Group had been unable to recommend a TAC for either species. In the discussion on this advice, two views were presented. The one that in absence of assessments, some precautionary TAC should be considered. The other, that due

to the sporadic nature of the occurrence of *C. gunnari* and *N. gibberifrons* in the area, no catch limit was required.

Statistical Area 58, (Annex 6, paragraphs 141 to 143)

Subarea 58.4, (Annex 6, paragraphs 144 to 146)

Division 58.4.4 (Ob and Lena Banks), (Annex 6, paragraphs 147 to 150)

3.55 The Scientific Committee endorsed the Report of the WG-FSA without comment on the above matters.

3.56 Dr Lubimova reported that attempts would be made to present historical data for the Ob and Lena Banks separately.

Subarea 58.5

Division 58.5.1 (Kerguelen Island), (Annex 6, paragraphs 151 to 180)

Champscephalus gunnari in Division 58.5.1

3.57 The Scientific Committee noted that analysis by the WG-FSA had identified certain problems in the stratification of the joint USSR/France survey in 1988. These problems and their solutions are dealt with in paragraph 158 of the Working Group's Report.

Management Advice

3.58 The WG-FSA had reported, 'because the stock in the last decade has consisted of only one cohort every three years it should be managed with caution until further information can be collected which could determine whether high post-spawning or similar natural mortality might explain the exhaustion of the cohorts. It would be prudent to assume, on the basis of the CPUE data, that the current cohort in the fishery is of comparable strength to the preceding strong cohorts of 1979 and 1982. Thus, the biomass of the 1985 cohort during the 1989 season could have been of the order of 23 to 45 thousand tonnes, and thus

substantially affected by the catch of 23 thousand tonnes. A low level of fishing mortality should help to resolve the question whether high natural mortality is the cause of cohort exhaustion. If substantial survival proves possible in fish of the current age, it will have the desirable effect of increasing the number of year classes in the fishery and could lead to cohorts recruiting to the fishery more frequently than the current three year interval. Accordingly, the catch level in 1990 could be no higher than occurred on the preceding cohorts at age four, that is, in the range of 0 to 6 000 tonnes.’

The Scientific Committee noted that the final sentence was ambiguous. It was agreed that what was meant was that catches similar in size to recent catches from recent cohorts aged four, should not be exceeded in the next season.

Dissostichus eleginoides in Division 58.5.1
(Annex 6, paragraphs 160 to 166)

3.59 The Scientific Committee endorsed the WG-FSA Report without comment.

Management Advice

3.60 *D. eleginoides* is a long-lived species with probable low productivity albeit high fecundity (see paragraph 3.42). An assessment of the stock is urgently required to estimate the level of catch to stabilise the stock. Adding the cumulative catch to the survey estimate gives a rough estimate for the unexploited biomass of 38 000 tonnes. Applying the Gulland rule to this estimate gives a TAC of 1 100 tonnes.

Notothenia rossii in Division 58.5.1, (Annex 6, paragraphs 167 to 170)

3.61 The Scientific Committee endorsed the WG-FSA Report without comment.

Management Advice

3.62 Conservation Measures (no directed fishery) will be continued into the beginning of the 1990’s for the adult stock. Trends in the abundance of juvenile part of the stock need to continue to be monitored. Biomass surveys will be required to establish that the stock has made a substantial recovery prior to any resumption of exploitation.

Notothenia squamifrons in Division 58.5.1
(Annex 6, paragraphs 171 to 180)

3.63 The Scientific Committee endorsed the WG-FSA Report without comment.

Management Advice

3.64 A lack of information on recruitment patterns makes it difficult to provide objective predictions of future trends in the stock. However, given observed exploitation trends and the present status of the stock, protection of the *N. squamifrons* stock in Division 58.5.1 will be facilitated by closure of the directed fishery for this species. Similarly, recovery of this already depleted stock will be facilitated. Since only about 15% of the current total stock biomass is comprised of adults and that fishing on other species in this area will continue, the setting of acceptable by-catch levels appears necessary. As the current quota levels authorised by France in that area have not been attained, it is recommended that future by-catch levels should be substantially lower than current level.

Division 58.5.2 (Heard Island), (Annex 6, paragraphs 181 to 182)

3.65 The WG-FSA Report was endorsed subject to a note that there had been no commercial fishery at any time in this area.

General Advice to the Commission, (Annex 6, paragraphs 183 to 206)

3.66 The WG-FSA had provided answers to the Commission's questions outlined in CCAMLR-VII, paragraphs 114 to 116.

3.67 The Scientific Committee endorsed the advice given to the Commission with two exceptions:

- with reference to paragraph 193, Mr E. Balguerias (EEC) indicated that protection of *C. gunnari* at age 1 and 2 was assured using a semipelagic trawl. This was based on results of a comparison of catches made by Spanish and US/Polish surveys in 1986/87; and

- with reference to paragraph 204, Dr Lubimova pointed out that measures to minimise and assess the level of larval or young fish caught during krill fishing were in place for the last four years.

Data Requirements	Annex 6, paragraphs 207 to 212
Data Analysis	Annex 6, paragraphs 213 to 215
New Trends in Assessment Work	Annex 6, paragraphs 216 to 217
Organisation of Next Meeting	Annex 6, paragraphs 218 to 220

3.68 These matters were endorsed by the Scientific Committee without comment.

Other Business

3.69 It was agreed by the Scientific Committee that provision should be made in the budget for a visit by the Data Manager to consult with the Chairman of the Scientific Committee and the Convener of WG-FSA.