

APPENDIX II

Arctic Fisheries Working Group

Report of Meeting in Copenhagen, March 6-12, 1961

1. Participants

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2. Terms of Reference

At the Eighth meeting of the Permanent Commission, in London in May 1960, the Liaison Committee of I.C.E.S. was invited..... "to arrange for the Arctic Fisheries Working Group to continue their studies in the light of the investigations by contracting governments, with special reference to the problems of larger minimum mesh sizes in relation to stocks and species of fish in the north-eastern part of the Convention Area other than those dealt with in the 1960 Report of the Working Group". (P.C. 8/126).

3. Scope of this Report

On the basis of data for 1960 submitted by members of the Group, recent developments in the cod and haddock fisheries have been analysed and are reported here. The assessments of the probable effect on these fisheries of increases in mesh size, which were presented in the 1960 report of the Group to the Liaison Committee (27.4.60), have been re-examined in the light of recent data. Since the conclusions of the Group on this question remain substantially unaltered, the remarks given here are supplementary to those of the 1960 Report and are intended to be read in conjunction with that report.

Although there is much less information on species other than cod and haddock, it has been possible to make some appreciation of the probable consequences of increase of mesh size in three other fisheries which are of importance in the north-eastern Arctic, namely redfish, coalfish and plaice.

4. Cod

4.1 Recent trends in the fishery

The total catch of Arctic cod in 1960 was about 640,000 metric tons, which was some 100,000 tons less than in 1959 (figures for Norway are provisional).

In Region I the trawler catch increased by 58,000 tons, but it decreased in Region IIb by 141,000 tons and by 23,000 tons in Region IIIA. The catch per unit effort decreased slightly in all three Regions.

The increase in total catch in Region I was due partly to the concentration in the southern part of the region of four to six year old cod, as a result of the rise in temperature there, and partly to a shift of fishing effort to Region I from Region IIb. A considerable part of the catches in Region I consisted of fish in their fifth year of life, i.e. the 1956 year-class, and these were sufficiently abundant to lead to some stabilization of the catch per unit effort at about the level of 1958 and 1959.

The total mortality rate of fish above six years of age in Region I between 1959 and 1960 appeared to be rather higher than would have been expected, even allowing for the increased fishing in 1960. This could have been accounted for, however, by a shift of fishing towards the eastern part of the area where the younger fish are more abundant, and perhaps by a tendency for vessels to concentrate more on haddock than is usual. In general, the conclusions reached by the Group at its previous meetings, namely that the total mortality rate of cod above six years of age is in the region of 65% per year, of which the greater part, perhaps three-quarters to four-fifths, is due to fishing, remain unaltered.

4.2 Assessments of the effect of mesh increase

The basis on which the assessments given in the 1960 Report of the Group were made have been re-examined in some detail. No modification of the selectivity values adopted previously was required, but it was thought necessary to make further allowance for some uncertainty which exists concerning the true numbers of small fish which have been taken in the trawl catches in recent years, and of the reliability with which the ratio of fishing to total mortality can be established. Assessments have also been calculated on the basis of a slightly different period of years, namely 1952-60 instead of 1950-59, which it is thought give a better appreciation of the effect of an increase of mesh size at present levels of fishing intensity. The conclusions from these revised assessments may be summarised as follows:-

- (a) Estimates of the immediate loss of landings to the trawl fleets are virtually the same as those quoted in para. 7 of the 1960 Report. Immediate losses would vary very much from one fleet to another, depending on the size composition of fish caught and on discarding

practice. For an increase of mesh from 110 mm to 120 mm, the immediate loss of landings (by weight) would range from zero to about 5% with an average of about 4% for the trawl fleets as a whole. For an increase of mesh from 110 mm to 130 mm the immediate loss of landings would range from zero to 11%, with an average of 8%. In interpreting these results, attention is drawn to the remarks contained in paras. 7(b), (c) and (d) of the 1960 Report.

- (b) Revised estimates of percentage long-term gains to be expected from increases of mesh from 110 mm up to 140 mm have been calculated for the trawl fisheries as a whole, for fisheries with other gears, and for the total fishery for Arctic cod. The range of assessments obtained are summarised in the following table:-

Increase of mesh from 110 mm to:-	Percentage long-term gain of landings to:-		
	Trawl fisheries	Fisheries with other gears	Total fishery
120 mm	3-5	7-8	4-6
130 mm	6-9	15-18	8-12
140 mm	8-12	25-31	12-16

- (c) No allowance is made in these assessments for factors such as a change in fishing tactics of the trawler fleets or an increased fishing power of the gear, both of which might reasonably be expected to happen after an increase in mesh size. Thus, the above assessments are to be compared with those previously given in Table A of the Appendix to the 1960 Report, which were:-

Table A (of 1960 report). Cod: effect of increase of mesh size with no redistribution of fishing

Increase of mesh from 110 mm to:-	Percentage increase in long-term catch to:-		
	Trawl fisheries	Fisheries with other gears	Total fishery
120 mm	4	7	5
130 mm	8	15	10
140 mm	13	25	16
150 mm	14	39	20

Comparison of the two sets of assessments shows that the earlier figures lie for the most part within the range of the later ones.

Although no precise allowance can be made for any change of fishing tactics or increase in fishing power of trawl gear with increase of mesh size, the likelihood is that these would have little effect on the total gain but would increase the share taken by the trawl fisheries compared with that taken by other gears.

- (d) In summary, it may be said that the revised assessments give essentially the same conclusions as the earlier ones. Assessments of the effect of a mesh increase cannot, by the nature of things, be given with exactness; but having made what in the opinion of the Group were the most reasonable assumptions where uncertainty exists, the results leave little doubt that an increase of mesh to at least 130 mm, and probably to still larger sizes, would result in long-term gains both to the trawl fisheries and to those using other gears.

4.3 Conclusions for cod

It appears from the most recent data that the stocks of Arctic cod remain at a low level of abundance under conditions of a high fishing mortality rate. This gives the Working Group cause for anxiety concerning the prospects for the fishery in the immediate future. There are indications, however, that the 1959 and 1960 year-classes, which will begin to enter the fishery in 1963, may be rather better than those of recent years. Introduction of a larger mesh would give greater protection to these fish while still small and so would add to the improvement in the fishery which may be expected from them.

5. Haddock

Having examined the 1960 data for haddock, the Working Group found no reason to alter its conclusion stated in the 1960 Report, namely that the effects of fishing on the stocks in the Arctic have been broadly similar to those on cod. The total mortality rate remains in the region of 50% - 55%, of which the greater part appears to be due to fishing.

The smaller growth potential of Arctic haddock compared with cod means that, other things being equal, the haddock fishery cannot be expected to respond to large increases in mesh size as well as would the cod fishery. Nevertheless, it was concluded in the 1960 report that there would be long-term gains in the total catch of haddock of about 6% for an increase of mesh size to 120 mm, and of about

9% for an increase to 130 mm. Revised assessments, bringing in the 1960 data, have not altered these conclusions so far as total catch is concerned but, as anticipated in para 8(c) of the 1960 report, have shown that its partition between trawls and other gears is difficult to predict with any accuracy. On this point our latest assessments have shown that the conclusion reached in the 1960 report, namely that there would at least be no loss to the trawl fisheries as a whole from increases of mesh to sizes in the region of 125 to 130 mm, still remains valid.

6. Redfish

6.1 State of the stocks

Having reviewed the statistical data on the redfish fisheries in the north-eastern Arctic, provided by the U.S.S.R. and West Germany, the Working Group notes that on certain fishing grounds there has been a marked decline in catch per unit effort in recent years. This decline has been most noticeable on the Kapitova Bank (in the deep water between the Bear Island Bank and the Norwegian coast), but substantial declines have also occurred in the area of the Bear Island Bank proper, at Skolpen Bank and at Finmark. Having in mind that similar decreases have occurred on other redfish grounds in the North Atlantic as fishing has intensified, such as on the Rosengarten and on grounds off the coast of Labrador and Newfoundland, it seems probable that these are caused by fishing. So far, however, the accompanying symptoms of heavy fishing which are found in stocks of other species, such as a decline in average size of fish, are not yet apparent in redfish, although this may be the result of the very slow growth rate of this species. Further investigations are needed before the effect of fishing on redfish can be established conclusively.

6.2 Effect of mesh increase

There is not much information on the selectivity of trawls for redfish, but from selectivity tests at West Greenland (von Brandt, 1960) and in the north-eastern Arctic (Saetersdal, 1960) and also from Canadian data, the selection factor of manila cod-ends for redfish may be taken provisionally as 2.6. The 50% selection length for a mesh of 120 mm would then be about 31 cm, and about 34 cm for a mesh of 130 mm. A range of 6 cm between the 25% and 75% retention points is indicated from the available data. It should be noted, however, that these results are from hauls in which the average quantity of fish caught was probably less than is typical of the commercial fisheries. As there seems to be

a fairly definite tendency for the selection factor of redfish to decrease with increasing catch (von Brandt, idem), the above estimates of selectivity, and hence also the immediate losses quoted below, may be too high.

Bearing this qualification in mind, these selectivity results, together with the information available on the size composition of commercial landings of redfish in recent years, enable provisional assessments to be made of the immediate effect of increases in mesh above 110 mm. For the north-eastern Arctic as a whole, the immediate losses to the trawler fleets are estimated to average about 4% by weight for an increase of mesh to 120 mm, and about 12% for an increase to 130 mm.

The Group are of the opinion that the present state of knowledge of the redfish and its associated fisheries is not sufficient to enable any firm assessment of the long-term effect of mesh increase to be made. It can be calculated, however, that the ratio of fishing to total mortality needed to compensate the above initial losses is about 0.6. This ratio is smaller than that which has been established for Arctic cod and probably for haddock also. If the decline in the redfish fisheries noted above is indeed due to fishing, it implies that the ratio of fishing to total mortality is of at least this magnitude. On this basis, it is therefore reasonable to suppose that in the long-term some, and perhaps all, of these immediate losses would be made up.

7. Coalfish and plaice

Judging by the size-composition of coalfish landed by England and Germany from the north-eastern Arctic, the proportion in them of small fish which would be expected to be released by meshes up to 130 mm is very small indeed. Although it is difficult on present evidence to establish the effect of fishing on the stocks of coalfish, it can be said that the landings would be little affected by increases of mesh size up to at least 130 mm.

The number of plaice which would be released by meshes up to 130 mm is also small. In this case, however, the evidence is that the stock of plaice is fairly heavily fished, and it is probable that such fish as would be released by meshes up to 130 mm would result in a long-term gain.

8. Concluding remarks

In their 1960 report, based on decisions reached at their third meeting, in Moscow, the Group listed a series of recommendations for future investigations into the Arctic fisheries. Because of the importance which it attaches to these

proposals as providing the scientific basis for the rational exploitation of the fisheries, the Group wishes to restate them here, together with some further recommendations arising from their recent meeting:-

- (a) Data are needed as soon as possible from which assessments can be made of the probable effects of increasing the mesh size above 130 mm. In this connection, it is recommended that the countries concerned should pay special attention to problems such as the effect of mesh size on the fishing power of trawls, and the effect of increased speed of trawling on the size composition of catches.
- (b) Special attention should also be given to increasing the precision of assessments of the effect of mesh size on the yield of cod and haddock of the 1959 and 1960 year-classes, which should be a major factor in determining the productivity of the fisheries in the coming decade.
- (c) Investigations on redfish should be continued, in order to clarify the influence of natural factors and of fishing on the abundance of the stocks.
- (d) Further investigations on the selectivity of nets for haddock and redfish are needed, with special reference to materials other than manila and to the effect of quantity of catch. Some information on the selectivity of coalfish is also needed, if mesh sizes above 130 mm are to be considered.
- (e) It is considered that the reporting of commercial statistics of catch and effort in the north-eastern Arctic by smaller sub-divisions of area than the three at present adopted would be a valuable adjunct to future investigations. It is accordingly intended to put forward some proposals in this connection at the next meeting of the Statistical Committee of I.C.E.S.

In the opinion of the Working Group there is a constant need for scientific consultations on the problem of the stock abundance of demersal fish in the north-eastern Arctic. For this purpose it is suggested that the Arctic Working Group should continue its work within the framework of the Gadoid Fish Committee, and be given the opportunity to meet as may be necessary. The systematic work of the Group in the future will make it possible to determine the degree of reliability and the correctness of its general conclusions. Such

an analysis is essential not only for the rationalization of the fishery in this region of the Atlantic, but in order to establish the applicability to other regions of this method of assessment of stock abundance and the state of the fishery.

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