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CONSUMPTION OF THE BARENTS SEA CAPELIN BY COD AND HADDOCK

by V.P. Ponomarenko and I.Ya.Ponomarenko

Food of the Barents Sea cod (Gadus morhua morhua L) is extremely various. More than 200 species of invertebrates and fishes are revealed in cod stomachs. However comparatively few food objects play the significant role in cod feeding. They are capelin, herring, cods (the young of cod and haddock, polar cod) and krill (Euphausiidae and Hyperiidae). Fish food consitutes the bulk of adult cod diet (Zatsepin and Petrova, 1939, Grinkevitch, 1957). Usually, cod feed intensively on those animals, which are met in quantities in the areas of cod dwelling. But capelin and herring are followed by cod during the significant period of a year. When the abundance of some species pointed out decreases their frequency in cod stomachs decreases respectively as well, and when it increases, the abundance increases too. In

[x/] PINRO, Murmansk, USSR

the last few years herring was not observed in cod diet at all, because of a sharp reduction of its abundance. Consumption of capelin, both by cod and haddock increased as well.

On the basis of data on diurnal diet of cod haddock in the period of feeding on capelin (Novikova, I962) we tried to calculate the number of the Barents Sea capelin, consumed by cod and haddock at present.

According to N.S. Novikova (I962) diurnal diet, or to be more exact, the diurnal coefficient (d.c.)[x/] for cod 35–45 cm long in the period of intensive feeding on capelin was very high and made up 5 • 30% in I960, on the average it amounted on 5 • 40% from a body weight; for haddock 35 – 45 cm long the diurnal coefficient made up 2 • 58% and 4 • 72% respectively, on the average it accounted for 3 • 65%, That means that one metric centher of cod consumed about 5.4 kg of capelin a day, while one metric centher of haddock fed on 3.65 kg of capelin a day.

The diurnal coefficient for cod and haddock, that were different in size and more than 45 cm. in length, in I96I accounted for 3.37% and 3.64% respectively. In calculations given below we use average meanings of these indices, taking into account that the diurnal coefficient of cod made up 4• 385% and that of haddock accounted for 3• 645%. The period of intensive feeding on capelin by cod and haddock lasted for about 2 – 3 months (February, March,

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x/ The average daily quantity of food, consumed by fish is given in per cents to a body weight

April);[x/] when calculating we consider this period to be equal to two and half a month (75 days).

According to data of ICES (1973, 1974, 1975) the total yield of the Lofoten - Barents Sea cod in Subarea I, Divisionr IIa, IIb ir 1971 - 1973 made up 724, 642, 827 thou.t. respectively, including that of the southern Barents Sea (Subarea I) that accounted for 236, 222 and 458 thou.t. and for haddock the total yield made up 79, 187, 294 thou.t. and 50, 155, 236 thou.t. respectively. [xx/]

Let us assume that the total mortality of cod and haddock made up 50% that approximately corresponded to the present - day rate of mortality of these fishes. Then in 1971 the total stocks of cod accounted for not less than 1448 thou.t. in 1972 - 1284 thou.t. and in 1973 - 1654 thou.t. including the atocks of the southern Barents Sea cod, that made up not less than 472, 444 and 916 thou.t. respectively. The total stocks of haddock in 1971, 1972, and 1973 made up not less than 158, 374 and 588 thou.t. respectively, including the stocks of the southern Barents Sea haddock that made up not less than 100, 310 and 472 thou.t.

Taking into account the diurnal coefficient of cod and haddock (4 • 385% and 3 • 645% a body weight), the stocks of these

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x/ According to data on five-year observations for feeding of cod (Zatsepin and Petrova, 1939) one can calculate, that about 34% of consumption of capelin by cod fell within February, 41% - March, 17% - April, 8% fell within all the rest months of a year

xx/ In Report of the North-East Arctic Fisheries Working Group (ICES, C.M. F:7) provisional total yield of cod and haddock was given

fishes in weight and duration of the intensive feeding on capelin, let us calculate the quantity of capelin, consumed by cod and haddock in I97I - I973, assumptions mentioned above including.

Calculations are carried out next way: 4.385% make up 63495 t from the stocks of cod accounting for I448 thou.t. (I97I). This quantity of capelin was consumed in the period of intensive feeding a day. Hence, cod fed on 4762II0 t. or about 4.76 mln. t. of capelin for two and half a month (75 days) in I97I. All the rest figures presented in the following Table have been obtained by analogous way.

The total stocks of capelin in I97I as estimated by the Norwegian investigators made up I0.I mln.t. in I972 it was I3.5 mln,t. (Gjøsaeter, Midttun et al. I972). As for the stocks of capelin in I973 it is supposed in the paper to be higher than that in previous years.

Then correlating the calculation data on consumption and the stocks of capelin, one can define, that consumption of capelin by cod and haddock made up about 50% of the stocks in I97I, while in I972 it accounted for 39%. The commercial yield of capelin made up about I3% of the stocks on the average in these years, it was I.39 mln.t. in I97I, while it accounted for I.59 mln.t. in I972.

Undoubtedly our calculation data on consumption of the Barents Sea capelin by cod and haddock in I97I - I973 are fairly approximate. Probably, the diurnal coefficients of haddock and cod feeding on capelin in I97I - I973 somewhat differed from those in I960 - I96I. It is possible too, that duration of the intensive feeding on capelin didn't amount on two and half a

month in all the years. Nevertheless these calculations made it feasible to judge of possible rate of feeding or capelin by the most numerous predators.

It deserves attention, that our calculation data on consumption of capelin by the southern Barents Sea cod (I.46 - 3.0I mln. t., see Table) are similar to data on consumption of capelin by cod of the Newfoundland-Labrador area: I.5 - 3.0 mln.t. (Campbell and winters, I973). However the cod stocks of the southern Barents Sea is lower than that of the Newfoundland-Labrador area, hence the Barents Sea cod feed on capelin more intensively. It becomes clear, if one takes into account that in the last few years herring completely disappeared from Barents Sea cod diet; while they had been of equal importance together with capelin (Zatsepin and Petrova, I939).

Let us suppose now, that by some means fishery begulatory, the total mortality of the Lofoten-Barents Sea cod and haddock would be decreased to 30%. Then the cod stocks could make up not less than 24I3 thou.t. in I97I, in I972 - 2I40 thou.t., in I973 - 2757 thou.t.; while the haddock stocks would account for not less than 263, 56I and 980 thou.t. respectively.

Used the method of calculation, given above we can see that in this case not less than 8.66 mln.t. of capelin would be needed for the normal feeding of cod and haddock in I97I, in I972 - 8.52 mln.t., in I973 - II.75 mln.t. It should be noted that not only cod and haddock feed on the Barents Sea capelin but other fishes (Greenland halibut, long rough dab, redfish and others) and sea birds, too. Taking this into account and correlating

figures of consumption and stocks of capelin, one can come to a conclusion, that in the case of a significant increase in the stocks of cod and haddock in some years the capelin fishery would not take place at all, and cod would have to change partially for other food, the young of cod including.

Calculations, given above, show that at working out the means of fishery regulatory, it is necessary to think thoroughly of all possible consequences of it, economic as well as biological.

Table

Quantity of the Barents Sea capelin, consumed by cod and haddock in periods of intensive feeding in I97I-I973 (mln.t.)

a) by the total commercial stocks of cod and haddock (Subarea, I, Divisions IIa, IIb).

Consumers	I97I	I972	I973
Cod	4.76	4.22	5.44
Haddock	0.43	I.02	I.6I
Cod and haddock	5.I9	5.24	7.05

b) by the commercial stocks of cod and haddock of the southern Barents Sea (Subarea I)

Cod	I.55	I.46	3.0I
Haddock	0.27	0.85	I.29
Cod and haddock	I.82	2.3I	4.30

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