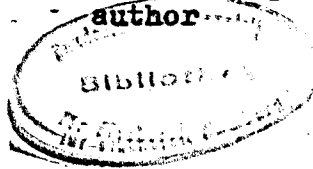


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author



A.A. Efremov,

A.S. Malkov

AtlantNIRO

Kaliningrad, USSR

International Council for the  
Exploration of the Sea

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Demersal Fish (Northern)  
Committee

ON RATIONAL FISHING OF WHITING  
IN THE NORTH SEA

A.A. Efremov

A.S. Malkov

AtlantNIRO

Kaliningrad, USSR

ON RATIONAL FISHING OF WHITING IN  
THE NORTH SEA  
(Theses)

1. The state of whiting fishery in 1962-1973 is studied.
  2. The biological and statistical data indicate the existence of two distinct whiting stocks in the North Sea with a conditional boundary dividing these stocks along 55°N.
  3. To solve the problem of rational fishery, an attempt was made to estimate the mortality of whiting and the intensity of fishing.
  4. The calculations were based on the material collected by the Soviet commercial ships in 1967-1973. This material was used in obtaining the parameters of growth equation according to Bertalanffy, the correlation between the length and weight of the fish, the mortality rates, the age of optimal exploitation for both stocks.
- It is demonstrated that the fishing intensity in these years did not reach the optimum level.

Whiting is one of the traditional fishery objects among the gadoids of the North Sea. The yield of this species on a world scale for 1962-1973 is given in table 1 ( 5 ).

TABLE 1  
THE YIELD OF WHITING FROM THE NORTH SEA

YEARS OF FISHING	CATCH IN THOUS. TONS
1962	87.3
1963	118.1
1964	91.5
1965	112.8
1966	157.7
1967	92.1
1968	145.2
1969	199.0
1970	181.5
1971	112.2
1972	108.7
1973	141.5

In some years, when especially strong year-classes entered the fishery, its total catch by the European countries exceeded the catches of haddock and considerably exceeded a total saithe catch. Thus, for the period of five years from 1966 to 1970 a total catch of whiting reached 775.5 thous. tons, while that of saithe was 548,2 thous. tons.

A series of studies on biology and fishing of whiting suggests that there exist two distinct whiting stocks in the north-west and south-east parts of the North Sea (6 - 8, 10).

Since 1967 AtlantNIRO has been carried out the studies of the North Sea whiting stock conducting regular trawling surveys, the results of which are annually published in the ICES materials. The parallel of 55°N was taken as a conventional border between the two stocks because of the lowest occurrence of whiting in this area. In relation to increasing tensity of fishery in the North Sea due to undermined source of sea-products and a decrease of catches of major commercial gadoid species, we have made an attempt to estimate the mortality and fishing intensity of whiting, to solve a problem of its rational fishing.

The calculations were based on the material obtained by the Soviet fishing ships for the period 1967-1973. To specify a dependence between the length and weight of the fish, a total of 11500 measurements of whiting weight and length was processed which gave the following ratio:

$$W = 0.0073 \times e^{3.0624}$$

The regularities in whiting growth were studied basing on the data collected in the North Sea northward and southward of 55°N. Mean lengths of whiting for the fourth quarter of 1968-1973 are given in table 2 by areas.

MEAN LENGTH OF WHITING ( IV quarter, 1968 - 1973 )

TABLE 2

AGE :	A R E A	
	Northward of 55°N	Southward of 55°N
0	15.76	16.00
1	22.54	22.13
2	29.42	27.65
3	34.36	32.43
4	38.80	35.01
5	42.46	36.67
6	44.94	38.20
7	45.90	38.30

Based on these data the following parameters of Bertalanffy's equation were calculated:

Northward of 55°N

$$L = 55.31$$

$$t_0 = -0.90$$

$$K = +0.21$$

Southward of 55°N

$$L = 41.52$$

$$t_0 = -0.81$$

$$K = +0.32$$

The material collected by the Soviet fishing ships made it possible to get an idea of age composition of whiting catches from the North Sea (tables 3,4 ).

TABLES 3

AGE COMPOSITION OF WHITING FROM COMMERCIAL  
CATCHES, %, northward of 55°N

AGE GROUPS	Y E A R S						
	1967	1968	1969	1970	1971	1972	1973
0	-	-	-	-	-	-	-
1	30.4	27.9	6.7	1.4	13.7	41.4	59.6
2	20.5	38.8	47.8	13.4	20.9	25.8	25.1
3	18.7	15.1	27.1	63.9	15.1	10.7	9.7
4	13.8	7.4	9.8	16.4	33.4	4.3	3.0
5	13.6	2.0	3.7	3.4	9.5	11.5	1.8
6	3.0	8.8	0.7	0.8	3.3	3.4	0.5
7	-	-	3.4	0.7	1.5	1.8	0.2
8	-	-	0.8	-	1.6	0.1	0.1
9	-	-	-	-	1.0	-	-
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 4

AGE COMPOSITION OF WHITING FROM  
COMMERCIAL CATCHES , %, southward of 55°N

AGE :	Y E A R S						
GROUPS :	1967	1968	1969	1970	1971	1972	1973
0	-	-	-	-	-	-	-
1	8.9	3.6	0.03	11.7	79.5	61.1	49.8
2	30.8	45.0	48.9	29.7	14.6	29.7	39.7
3	45.5	24.8	21.7	53.5	2.7	7.9	9.7
4	13.8	13.5	13.5	3.9	2.4	1.0	0.6
5	0.7	10.7	10.0	0.9	0.7	0.2	0.1
6	0.3	0.5	2.7	0.3	0.1	0.1	0.1
7	-	0.1	2.4	-	-	-	-
8	-	-	0.77	-	-	-	-
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Basing on the data on length-age composition and using an empiric correlation between the length and weight we have calculated the catches in numbers. Then the data obtained were analysed by virtual population method modified by Schumacher (II) in order to estimate the instantaneous mortality rate, and the size of the stock in numbers (tables 5,6, 7,8).

TABLE 5  
FISHING MORTALITY RATE (F) FOR WHITING,  
( northward of 55°N -)

AGE :	Y E A R S										
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971: F MEAN
I					0.39	0.29	0.70	0.09	0.36	0.87	0.450
II					0.50	0.78	0.29	1.14	0.86	0.83	- 0.734
III				0.66	0.78	0.49	0.70	0.79	0.92	-	- 0.723
IV			1.36	0.66	0.69	0.89	0.58	-	-	-	- 0.840
V		0.60	0.61	0.31	0.48	1.20	2.16	-	-	-	- 0.893
VI	0.80	0.90	0.18	0.11	0.77	1.90	-	-	-	-	- 0.780
VII	0.91	0.56	0.34	2.15	1.90	-	-	-	-	-	- 1.170
VIII	-	1.05	-	-	-	-	-	-	-	-	- 1.05

TABLE 6  
SOUTHWARD OF 55°N

AGE :	Y E A R S										
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971: F MEAN
I					0.07	0.03	0.02	0.001	0.03	0.30	0.09
II					0.32	0.63	0.65	2.31	0.03	0.09	- 0.67
III				0.43	0.67	1.64	2.38	1.15	0.13	-	- 1.07
IV				0.30	0.47	2.16	2.03	1.86	1.84	-	- 1.44
V		0.04	0.92	2.34	2.23	1.98	0.65	-	-	-	- 1.36
VI	0.79	0.08	-	-	-	-	-	-	-	-	- 0.43



TABLE 7

WHITING ABUNDANCE NORTHWARD OF 55° N ( sp.  $\times 10^6$  )

YEAR- CLASS :	Y E A R S					
	1967	1968	1969	1970	1971	1972
1971						274
1970					122	57
1969				93	54	15
1968			126	67	22	5
1967		697	351	176	59	30
1966	480	214	67	27	8	2
1965	134	55	17	6	2	1
1964	77	27	9	5	3	
1963	36	6	2	1		
1962	39	14	4	1		
1961	5	2				

TABLE 8

WHITING ABUNDANCE SOUTHWARD OF 55°N, (sp.  $\times 10^6$  )

YEAR- CLASSES	Y E A R S					
	1967	1968	1969	1970	1971	1972
1971						1473
1970					2893	1867
1969				2180	1045	767
1968				471	17	4
1967		2048	1300	464	9	1
1966	890	569	203	26	2	
1965	445	218	75	5		
1964	289	127	54			

YEAR) :	Y E A R S					
CLASSES :	1967	1968	1969	1970	1971	1972
1963	106	53				
1962	25	17				
1961	1					

Mean fishing mortality rates (F) for northern and southern stocks were 0.83 and 0.84 accordingly.

The estimation of instantaneous natural mortality rate of whiting was made according to E.Shemina and P.Tjurin (2,3). In both cases the value was 0.4.

Therefore, the values of total mortality rate for whiting in the period of 1967-1972 were 1.23 northward of 55°N and q 1.24 southward of 55°N.

The age at optimal exploitation was determined by the formula of Kutty and Qasim (9). The estimate of age together with corresponding length are given in table 9.

TABLE 9  
AGE AND LENGTH OF WHITING AT OPTIMAL EXPLOITATION

Northward of 55°N	Southward of 55°N
$t_o = 3.40$	$t_o = 3.01$
$l'_c = 30.91$	$l'_c = 29.35$

Further we attempted to specify the optimal exploitational

level at average level of recruitment by means of a model suggested by Beverton and Holt (2).

The analysis of variability in yield per recruitment data ( $Y_w/R$ ) subject to fishing intensity indicated that the maximum yield per recruitment could be reached, if fishing intensity corresponded to instantaneous fishing mortality rate of 1.2.

From the comparison of this value with the mean fishing mortality rate for 1967 - 1972 it is evident that the fishing intensity for these years was far from optimal level.

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