

International Commission for



the Northwest Atlantic Fisheries

Serial No. 3843  
(D.c.3)

ICNAF Res.Doc. 76/VI/57

ANNUAL MEETING - JUNE 1976

Estimation of stock size and allowable catch of silver hake  
on the Nova Scotia Shelf in ICNAF Division 4W

by

A.S. Noskov  
AtlantNIRO  
Kaliningrad, USSR

INTRODUCTION

Silver hake is one of the major fishery objects in the Nova Scotia area. The bulk of the landings by the USSR come from Sub-area 4W. In the present report the stock assessments by VPA, and the calculations of allowable catch for 1977 at different natural and fishing mortality rates are given.

LANDINGS

Before 1962 silver hake from Nova Scotia area was taken as a by-catch in the fisheries of other fish species. Beginning from 1962 the Soviet fleet began to fish silver hake directly. Landings increased rapidly from 8854 tons in 1962 to 123028 tons in 1963. Then landings declined to 81147 tons in 1964, and in 1967, 1968 they decreased to 2477 and 3447 tons, respectively. From 1969 landings increased again numbering maximum of 298621 tons in 1973, then declined ( Table 1 ). A 1964-1968 landing decline can be attributed to decreased stock size due to recruitment of a series of the poor 1961-1965 year-classes. In the period from 1966 to 1974 the stocks were supplemented by a new year-class series of high and average abundance, and a sharp landing increase followed.

Landing decline in 1974 and 1975 can be first of all explained by introduction of the limits into the hake fishery.

### DISTRIBUTION

Major silver hake concentrations are distributed in the Eme-Deep area in winter moving in spring through the trough to the continental slope, where the concentrations between the La Have Bank and the Deep of Hali are formed by the end of summer. With heating of water silver hake concentrations move to the shoals off the Sable Island where the spawning takes place. Smaller concentrations of hake are located on the Georges Bank slopes. Massive hake spawning in the Georges Bank area occurs in June. It is likely that a small separate hake stock does occur on the Georges Bank, while in the Sable Island area ( 4V and 4W ) an abundant silver hake stock is fished, which contributes on the average 90% of landings from Subarea 4. Therefore, the stock size assessment is made for Subarea 4.

### CATCH COMPOSITION

Silver hake catch composition has been studied by means of massive measurements on board the commercial vessels and simultaneous collection of otolith samples for age determination. A fork length of fishes was measured to the nearest centimetre. The age was read by Whole otoliths placed in dark alcohol containing cuvette, and examined under a binocular in reflected light. At present the USA ichthyologists have changed the methods of age reading. They begin age reading from thin otolith sections and come to a conclusion that the former determinations of silver hake age from the whole otoliths are overestimated, although the life cycle of silver hake appeared short according to the former determinations as well. The bulk of this species population is represented by age 1-5 fish. It is evident from Table 2 that the fish of 27.2 to 31.3 cm in length predominated in the landings. Mean length in 1962-1975 fluctuated from 27.2 to 31.3 cm. Age composition of catches for 1973-1975 is given in Table 3. In catches silver hake was represented by the individuals at age 1-12, while the bulk of the catches was made of the 3.4-5 year old fish. It should

be remembered that the number of 5 year old fish was increased in the years of depression, which can be attributed to a decline in recruitment.

#### GROWTH

The data on linear and weight composition as well as von Bertalanffy growth parameters, we adopted from the paper by R.G. Halliday ( ICNAF Res. Doc. 73/103 ).

AGE	LENGTH, cm	WEIGHT, g
1	14.0	-
2	23.3	95
3	27.4	151
4	30.7	214
5	34.0	319
6	36.8	478
7	41.6	550
8	44.6	636
9	47.9	845

According to Halliday , von Bertalanffy growth parameters for ages 4 - 9 are as follows :

$$L_{\infty} = 52.67 \text{ cm } (W_{\infty} 1.18 \text{ kg } )$$

$$K = 0.229 \text{ and } t_0 = 0.141$$

#### MORTALITY

For estimation of total mortality silver hake catches per hauling hour by BMRT - class vessel transformed in age composition for 1970-1975 were used (Tables 4 and 5). For silver hake made the bulk of the catches in these years, it can be admitted that the fishing effort was directed to hake removal only. Total instantaneous mortality at age 3 and older changed from 0.35 to 1.58 . At the beginning of fishing activities in 1962-1969 it equalled 1.5 . In the Browns Bank area where the fishery for hake is insignificant and, therefore, does not greatly effect the stock size, the value of Z for age groups 3-6 averaged to 0.93 in the period from 1970 to 1974.

These data suggest that the natural mortality rate ranged between 0.5 and 0.9 . Therefore, the estimations of fishing mor-

27

tality and stock size by virtual population analysis are made for two values of  $M = 0.5$  and  $0.8$ . The values of  $F$  estimated by VPA are given in Tables 6 and 7. The data in Table 6 indicate that  $F$  ranged from 0.03 to 2.27 by years if  $M = 0.5$  at mean age 3 and older, and in 1974 it was 0.66. If  $M = 0.8$ ,  $F$  ranged from 0.01 to 1.01.

#### STOCK SIZE

The stock size estimated by VPA at  $M = 0.5$  and  $0.8$  is presented in Tables 8 and 9. When estimating the abundance of the 1973 and 1975 year-classes it was admitted that their numbers at age 1 equalled to mean abundance for 1968-1972. The 1974 year-class was strong and its abundance at age 2 was equalled to mean value of numerous 1968-1969 years-classes.

The results of trawling surveys on abundance conducted by "Belogorsk" in the Emerald Deep area are also indicative of high abundance of the 1974 year-class. So, from Table 10 it is evident that the young-of-the-year with the length ranging from 5 to 10 cm were taken in large numbers in October 1974, and in 1975 hake landings increased twice due to the rich 1974 year-class. This fact suggests that silver hake abundance in 1975 increased significantly as compared with 1974.

To estimate the optimal fishing effort the optimal age of exploitation was determined by the formula of Kutty M.K. and Qasim S.Z. (1968):

$$t'_p = \frac{\ln(3K + M) \ln M}{K} + t_0.$$

$L_c$  - the body length at which the fish is first exploited - is determined by von Bertalanffy equation:

$$L_c = L_{\infty} (1 - e^{-K(t'_p - t_0)}).$$

In calculations the following parameters were used:

$$L_{\infty} = 52.67 \text{ cm};$$

$$K = 0.23;$$

$$t_0 = 0.141;$$

$$M = 0.5 \text{ and } 0.8.$$

If  $M = 0.5$ ,  $t'_p = 3.91$ ,  $L_c = 30.38$  cm.

If  $M = 0.8$ ,  $t'_p = 2.84$ ,  $L_c = 24.33$ cm.

Then the values of  $C = L_c/S_\infty$  and  $E = \frac{F}{F+M}$  were estimated, and by Beverton and Holt Tables (1968) a dependence of yield on recruitment,  $Y/R$ , was determined ( Fig.1 ), as well as  $F_{opt}$ .

If  $M = 0.5$ ,  $F_{opt} = 0.7$ . If  $M = 0.8$ ,  $F_{opt} = 0.8$ . For the beginning of 1976 the stock size was determined from an assumption that  $F = 0.7$  for age groups 3 and older. For age groups 1 and 2, if  $M = 0.65$ ,  $F = 0.1$  and  $0.2$ , respectively. If  $M = 0.8$ ,  $F = 0.1$  and  $0.3$ , respectively.

In estimating of the stock size for 1977 the same values of  $F$  were used.

As a result it appeared that the stock size at age 2 and older would be  $34.101 \times 10^5$  ( 408 thous. tons ) in 1976, if  $M = 0.5$ .

If  $M = 0.8$ , the stock size in 1976 would number  $61.403 \times 10^5$  ( 671 thous. tons ), and in 1977 -  $45.362 \times 10^5$  ( 575thous.t ).

If  $F = 0.7$  for 3 year old fish and older, and  $0.2$  and  $0.3$  for two year old fish, the catch in 1974 will be 124thous.t., if  $M = 0.5$ , and 229 thous.t., if  $M = 0.8$ .

Therefore, for Subarea 4W and 4VWX a silver hake catch within 125 thous. t. to 225 thous.t. can be recommended.

#### REFERENCES

1. Beverton R.G.H., Holt S.I. Manual of Methods for Fish Stock Assessment. Part II. Tables of yield functions. FAO Fisheries Technical Paper No 37 (Rev. 1 ), Rome, 1966.
2. R.G. Halliday. The Silver Hake Fishery on the Scotian Shelf. ICNAF Res. Doc.73/103
3. M.K. Kutty, S.Qasim. The estimation of optimum age of exploitation and potential yield in fish populations. J. du Cons., v. 32, No 2, 1968.

Table 1. Landings of the USSR and all other countries from Subarea 4W in 1962 - 1975.

YEARS	4	4	4X	TOTAL	Total USSR catch
1962	-	8825	29	8854	8825
1963	168	116388	6472	123028	123023
1964	32	62905	18210	81147	81147
1965	182	49461	379	50022	49987
1966	40	3860	6423	10323	10323
1967	-	1834	643	2477	2476
1968	239	3150	58	3447	3471
1969	1226	43543	1554	46323	46323
1970	5116	158938	4991	169045	168957
1971	3011	119452	6190	128653	128633
1972	75	108769	5204	114048	113774
1973	3431	265105	30085	298621	298533
1974	712	86927	8106	95745	95371
1975 <sup>1)</sup>	-	-	-	-	107945

<sup>1)</sup> 1975 catches for the USSR only.

Table 2. Length frequency of silver shke ( cm ) in ICMAF Subarea 4W in 1962-1975

YEARS	B O D Y L E N G T H ( cm )																				TOTAL	MEAN LENGTH, cm		
	10-11	12-13	14-15	16-17	18-19	20-21	22-23	24-25	26-27	28-29	30-31	32-33	34-35	36-37	38-39	40-41	42-43	44-45	46-47	48-49			50-51	52-53
1962	-	-	-	-	0,2	0,7	3,2	23,7	28,1	13,0	11,4	8,6	6,0	3,0	1,4	0,5	0,2	+	-	-	-	-	100,0	28,1
1963	-	-	-	0,1	0,6	1,9	10,8	19,7	20,3	16,5	11,1	6,8	6,6	2,4	1,5	0,6	0,6	0,4	0,2	+	+	+	100,0	27,9
1964	-	0,2	0,1	0,1	0,3	2,3	6,2	13,1	21,5	24,7	14,6	8,3	3,5	2,7	1,1	0,7	0,3	0,2	0,1	+	+	+	100,0	28,3
1965	-	-	-	-	0,4	1,8	2,0	1,8	4,2	16,0	26,0	20,3	11,4	6,9	4,8	2,7	1,2	0,3	0,2	+	+	+	100,0	29,3
1966	-	-	-	-	-	0,5	4,9	15,0	15,2	11,6	16,3	19,0	8,9	4,7	2,2	1,0	0,6	0,1	+	+	+	+	100,0	31,3
1967	-	-	-	-	-	-	0,2	0,7	7,8	28,6	28,4	17,1	7,7	3,8	2,8	1,9	0,4	0,6	+	+	+	+	100,0	31,0
1968	-	-	-	-	0,7	2,7	5,3	11,9	25,7	20,4	15,9	6,7	4,2	3,0	1,8	0,9	0,5	0,3	+	+	-	-	100,0	28,4
1969	0,1	0,2	0,3	0,4	2,4	5,2	6,8	10,0	15,8	24,8	17,8	9,2	4,3	1,4	0,6	0,4	0,2	0,1	+	-	-	-	100,0	27,8
1970	-	+	0,1	0,9	1,7	3,3	5,5	10,9	21,9	24,4	18,5	7,2	2,9	1,5	0,7	0,3	0,1	0,1	+	+	+	+	100,0	28,4
1971	-	-	-	-	-	-	1,4	16,1	25,9	21,4	22,2	9,6	1,9	0,4	0,2	0,1	0,3	0,1	0,1	0,2	0,1	-	100,0	27,2
1972	-	+	0,4	1,1	3,6	6,8	5,8	11,3	19,6	18,2	16,3	9,9	5,1	1,3	0,3	0,1	+	+	+	+	+	+	100,0	28,1
1973	-	0,2	0,3	0,4	0,9	2,2	4,3	9,8	24,7	27,6	17,0	6,5	3,1	1,5	0,7	0,4	0,2	0,1	0,1	+	+	+	100,0	28,8
1974	+	+	0,1	0,3	0,5	1,6	4,4	11,8	16,6	20,5	23,7	12,6	4,5	1,6	0,7	0,5	0,3	0,2	0,1	+	+	+	100,0	29,6
1975	-	+	0,2	0,5	1,0	2,4	5,3	10,3	9,7	15,0	21,3	18,0	9,1	3,8	1,6	0,8	0,4	0,3	0,1	0,1	0,1	+	100,0	29,6

Table 3. Silver hake catches in ICNAF Subarea 4W in numbers ( 10<sup>5</sup> )

Y E A R S	A G E													TOTAL	Catches in tons
	0	I	2	3	4	5	6	7	8	9	10	11	12		
1963	-	11	652	2628	1935	418	20	6	6	3	1	-	-	5680	116,388
1964	-	8	67	920	1318	265	64	5	-	-	-	-	-	2647	62,852
1965	-	-	5	447	1038	298	44	4	-	-	-	-	-	1836	49,461
1966	-	+	38	46	68	40	6	+	-	-	-	-	-	198	3,860
1967	-	-	1	15	51	16	2	+	-	-	-	-	-	85	1,834
1968	-	7	69	96	18	8	5	4	1	-	-	-	-	209	3,150
1969	-	411	244	783	735	281	96	19	11	-	-	-	-	2580	43,543
1970	-	866	1316	3430	1835	589	42	27	12	1	-	-	-	8118	158,938
1971	-	187	1488	2571	2561	721	86	26	38	18	-	-	-	7696	119,452
1972	-	410	1310	2496	1460	968	139	26	8	5	11	-	-	6833	108,769
1973	12	525	871	6758	6006	2039	469	130	31	9	4	1	+	16855	265,105
1974	-	302	983	2470	1496	329	75	32	19	6	2	-	-	5714	86,927
1975	-	323	961	1993	1379	395	101	46	13	2	-	-	-	5213	101,945

Table 4. Total and silver hake catches taken by  
big trawlers BMRT in ICNAF Subarea 4W per trawling  
hour in 1970-1975.

YEARS	Catches in tons		Silver hake ( % )	Trawling hours	Catch per trawling hour in tons		Catch per trawling hour of silver hake in numbers
	Total	Silver hake			Total	Silver hake	
1970	187727	143198	76,3	70302	2,67	2,04	10408
1971	195263	99742	51,1	82500	2,37	1,21	7,06
1972	152934	102033	66,7	61793	2,47	1,65	10377
1973	295684	225691	76,3	90996	3,25	2,48	15796
1974	156146	108807	69,7	57263	2,73	1,90	11728
1975	126656	67127	53,0	48180	2,63	1,39	6714



Table 5. Estimation of total mortality rates of silver hake in ICNAF Subarea 4W by age composition of catches taken by big trawlers BMRT per trawling hour.

Y E A R S	A G E									Means for 3+
	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	
1970-71	-0,30	-0,44	0,53	1,16	2,18	0,82	0,23	0,47	-	0,66
1971-72	-2,37	-0,92	0,16	0,57	1,27	0,72	0,83	1,36	0,27	0,66
1972-73	0,28	-1,16	0,40	0,15	1,20	0,50	0,27	-	-	0,35
1973-74	-1,41	-1,82	0,72	2,12	2,53	1,84	1,28	0,98	-	1,58
1974-75	-0,68	-0,24	1,05	1,80	1,67	0,93	1,68	1,61	-	1,46

Table 6. Estimation of fishing mortality rate of silver hake in ICNAF Subarea 4W by VPA at  $M = 0.5$

YEARS	A G E									Means for 3+
	1	2	3	4	5	6	7	8	9	
1963	0,1	0,14	0,65	1,5	1,5	0,94	-	-	-	0,95
1964	0,0	0,04	0,4	1,31	1,53	1,94	1,0	-	-	0,82
1965	0,0	0,0	0,42	1,88	3,04	2,83	1,0	-	-	2,27
1966	-	0,03	0,05	0,14	0,46	1,19	1,0	-	-	0,11
1967	0,0	0,0	0,02	0,08	0,06	0,05	1,0	-	-	0,05
1968	0,0	0,01	0,03	0,03	0,02	0,03	0,18	-	-	0,03
1969	0,02	0,02	0,12	0,38	0,72	0,38	0,15	1,64	-	0,22
1970	0,03	0,08	0,33	0,6	0,88	0,3	0,24	0,18	1,0	0,42
1971	0,01	0,07	0,27	0,57	0,73	0,42	0,43	0,92	0,61	0,40
1972	0,03	0,08	0,21	0,34	0,72	0,42	0,3	0,31	0,4	0,29
1973	0,06	0,09	0,97	1,94	1,97	1,66	1,45	1,09	1,01	1,42
1974	0,08	0,18	0,54	0,9	0,82	0,5	0,68	1,53	1,0	0,66
1975	-	0,5	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0

Table 7. Estimating of fishing mortality rate for silver hake from ICNAF Subarea 4W by VPA at M = 0.8

Y E A R S	A G E											Means for 3+
	I	2	3	4	5	6	7	8	9	10	11	
1963	0,0	0,08	0,49	1,22	1,2	0,65	-	-	-	-	-	0,72
1964	0,0	0,01	0,26	1,1	1,28	1,5	0,7	-	-	-	-	0,58
1965	0,0	0,0	0,11	1,21	2,55	2,32	0,7	-	-	-	-	0,49
1966	-	0,01	0,01	0,04	0,24	0,86	0,7	-	-	-	-	0,02
1967	0,0	0,0	0,0	0,02	0,02	0,03	0,7	-	-	-	-	0,01
1968	0,0	0,0	0,02	0,01	0,01	0,01	0,12	-	-	-	-	0,02
1969	0,01	0,01	0,06	0,21	0,35	0,19	0,08	1,23	-	-	-	0,11
1970	0,02	0,04	0,19	0,36	0,5	0,15	0,14	0,11	0,7	-	-	0,24
1971	0,0	0,04	0,16	0,38	0,47	0,24	0,24	0,57	0,44	-	-	0,24
1972	0,02	0,05	0,15	0,24	0,52	0,30	0,2	0,2	0,26	1,23	0,7	0,21
1973	0,03	0,05	0,67	1,47	1,44	1,19	1,13	0,78	0,71	0,7	-	1,01
1974	0,04	0,11	0,35	0,63	0,56	0,33	0,45	1,13	0,7	0,7	-	0,43
1975	-	0,3	0,7	0,7	0,7	0,7	0,7	0,7	0,7	-	-	0,70

Table 8 Silver hake stocks in ICNAF Subarea 4W in numbers ( 10<sup>5</sup>) at M = 0.5

Age group Years	I	2	3	4	5	6	7	8	9	10	Stock of fish	
											in num- bers (10 <sup>2</sup> )	in thous. tons.
1963	3501	6305	6804	2984	645	40	-	-	-	-	16777	246
1964	2546	2168	3488	2177	405	88	10	-	-	-	8336	133
1965	1271	1591	1628	1448	357	54	8	-	-	-	5686	89
1966	+	1632	1196	658	135	10	2	-	-	-	3633	49
1967	1271	1271	962	840	348	52	2	-	-	-	3475	55
1968	8899	12566	4123	816	513	215	31	-	-	-	18263	224
1969	26354	15646	8755	2908	676	380	172	16	-	-	28554	386
1970	37189	21679	15297	5043	1234	203	159	92	2	-	43710	605
1971	34056	27888	13654	6746	1717	313	93	77	49	-	50537	691
1972	17607	21580	16600	6347	2327	506	126	38	19	16	47560	699
1973	11427	12812	13299	8275	2793	690	204	57	17	10	38157	620
1974	(25000)	7527	7358	3089	723	237	80	29	12	4	19058	281
1975	+	13720	3848	2663	763	195	89	25	4	-	21307	285
1976	(25000)	(25000)	6819	1158	802	230	59	27	6	-	34101	408
1977	+	13720	12400	2053	349	241	69	18	6	-	28858	388

Table 9. Silver hake stock in Subarea 4W (  $10^5$  specimens ) at  $M = 0.8$

Y E A R S	A G E										Stock of two-year-olds and older fish	
	1	2	3	4	5	6	7	8	9	10	$10^5$ sp.	thous. tons
1963	15987	12255	9546	3694	806	58	-	-	-	-	26359	364
1964	11627	12209	5739	2677	492	109	14	-	-	-	21240	276
1965	1453	7267	6189	1991	406	62	11	-	-	-	15926	215
1966	+	11065	8382	2513	268	14	3	-	-	-	22245	291
1967	1453	1453	5457	3737	1172	98	3	-	-	-	11920	214
1968	10174	33457	7034	2772	1665	730	51	-	-	-	45709	565
1969	99774	59233	19456	5560	1351	795	357	21	-	-	86791	1074
1970	63452	48630	28440	8613	2105	434	298	166	3	-	88689	1188
1971	68035	54986	24997	10584	2709	576	174	122	71	-	94219	1253
1972	30041	38894	25777	9785	3353	764	206	63	31	21	78894	1056
1973	25756	25860	19254	10343	3550	908	260	79	25	11	60290	931
1974	(60000)	13611	11876	4464	1075	379	125	38	17	6	31591	465
1975	+	24420	5497	3804	1089	279	127	36	6	-	35261	453
1976	(60000)	(50000)	8987	1226	848	243	62	28	8	1	61403	671
1977	+	24420	18400	2004	273	189	54	14	6	2	45362	575

Table 10. Silver hake catches per 20 30-minute tows on R/V "BELOGORSK" by Khek-815 trawl over Emerald Hollow ( IONAF Subarea 4W ) in 1972-1975.

LENGTH, cm	1972		1973		1974		1975	
	Quantity		Quantity		Quantity		Quantity	
	specimens	%	specimens	%	specimens	%	specimens	%
5	27	0,1	2	+	10	+	-	-
6	83	0,4	2	+	81	0,3	-	-
7	249	1,3	56	0,3	195	0,7	-	-
8	258	1,3	46	0,3	244	1,0	2	+
9	426	2,2	23	0,1	131	0,5	-	-
10	429	2,2	6	+	81	0,3	6	+
11	348	1,8	-	-	35	0,1	-	-
12	96	0,5	-	-	50	0,2	-	-
13	23	0,1	-	-	28	0,1	-	-
14	4	+	-	-	-	-	11	+
15	5	+	3	+	13	+	9	+
16	5	+	3	+	-	-	78	0,1
17	46	0,2	8	+	8	+	176	0,3
18	14	0,1	52	0,3	181	0,4	440	0,8
19	68	0,4	193	1,1	107	0,4	800	1,5
20	412	2,1	439	2,5	187	0,7	1052	2,0
21	1239	6,4	852	4,9	471	1,8	2527	4,8
22	2152	11,2	1452	8,4	951	3,8	3783	7,2
23	2179	11,3	1871	10,8	1773	6,9	4973	9,5
24	3140	16,3	1382	8,0	1945	7,7	8605	16,4
25	1742	9,1	1138	6,5	2180	8,6	7755	14,8
26	1128	5,9	827	4,7	2390	9,5	6502	12,4
27	972	5,1	597	3,4	1774	6,9	3634	6,9
28	768	4,0	950	5,4	1335	5,3	1842	3,5
29	569	3,0	1556	9,0	1523	6,0	1972	3,8
30	724	3,8	1804	10,4	2485	9,8	1254	2,4
31	582	3,0	1465	8,5	2346	9,3	2169	4,1
32	645	3,4	1097	6,4	2207	8,6	1473	2,8
33	311	1,6	416	2,4	1107	4,4	1359	2,6
34	205	1,1	285	1,6	654	2,6	1041	2,0
35	97	0,5	220	1,3	340	1,3	376	0,7
36	99	0,5	192	1,1	144	0,6	238	0,5
37	90	0,5	45	0,3	137	0,5	174	0,3
38	-	-	64	0,4	18	0,1	65	0,1
39	36	0,2	58	0,3	69	0,3	57	0,1
40	5	+	88	0,5	42	0,2	6	+
41	13	0,1	24	0,1	36	0,1	34	0,1
42	14	0,1	51	0,3	20	0,1	2	+
43	1	+	36	0,2	32	0,1	9	+
44	1	+	17	0,1	37	0,1	8	+
45	1	+	31	0,2	32	0,1	17	+
46	7	+	11	+	29	0,1	40	0,1
47	4	+	8	+	21	0,1	8	+
48	25	0,1	24	0,1	48	0,2	26	0,1
49	1	+	6	+	7	+	17	+
50	10	0,1	10	+	35	0,1	-	-
51	1	+	33	0,2	66	0,1	21	0,1
52	-	-	-	-	4	+	9	+
53	-	-	-	-	10	+	2	+
54	-	-	10	+	4	+	-	-
55	-	-	14	0,1	-	-	11	+
56	-	-	-	-	8	+	1	+
57	-	-	-	-	-	-	-	-
58	-	-	9	+	-	-	-	-
59	-	-	-	-	-	-	-	-
60	-	-	-	-	11	+	-	-
	19254	100	17433	100	25532	100	52584	100
Mean length, cm	23,8		27,0		27,4		25,7	
Mean weight, g	0,105		0,140		0,152		0,130	

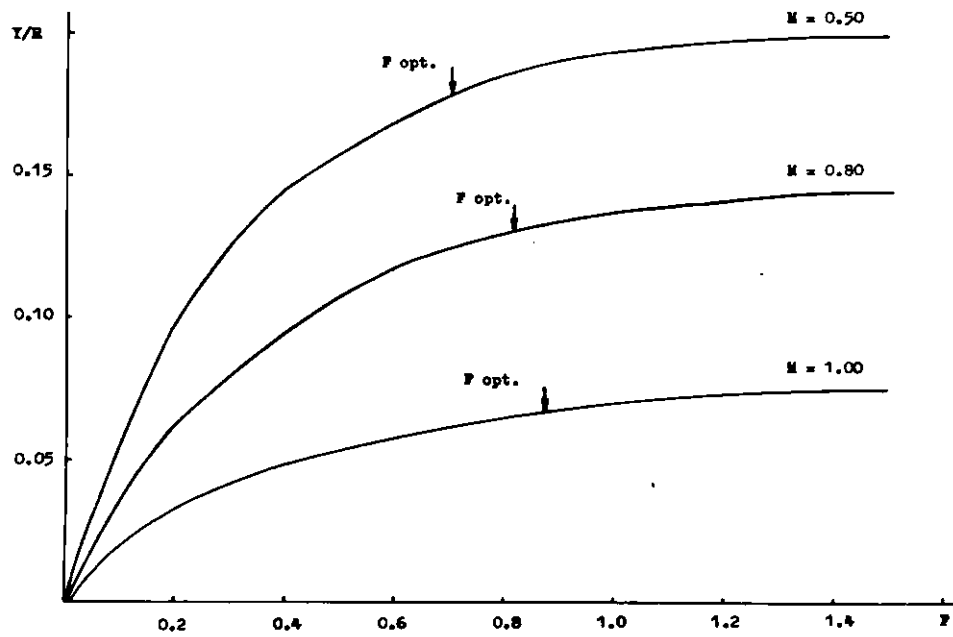


Fig. 1. Fishing mortality (F) and yield per recruit (Y/R) of silver hake at different values of natural mortality (M).

