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On modern tendencies in the dynamics of red hake (*Urophycis chuss*, Walbaum) population in the Northwest Atlantic

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Abstract

In 1971-1972, the commercial stock of red hake in the Southern New England was contributed by the abundant 1968-1970 year-classes which was accompanied by a high mortality of the older age groups. As a result, a considerable increase of the proportion of young fish and a decrease of mean weight of fish in the stock could be observed. But by the beginning of 1973 the biomass of the commercial stock had greatly increased due to the total influence of the strong 1969-1970 year-classes and reached the level of 1966.

No distinct tendency to the abundance fluctuations of the Georges Bank stock was revealed.

Recently, the red hake stock on Georges Bank and in the Southern New England area suffered great fluctuations which were reflected by the biomass indices, based on the data obtained by *Albatross IV* during joint USA - USSR surveys (Table 1). The indices for the period preceeding the joint operations are also given for comparison purposes (Grosslein *et al.*, 1972).

Table 1. Estimates of the mean weighed catches (pounds) and their accuracy for the groups of strata 13-25 and 1-12.

Survey years	Strata 13-25		Strata 1-12	
	Mean catch	±2C°	Mean catch	±2C°
1963	17.3	-	16.8	-
1964	5.8	-	9.6	-
1965	4.6	-	12.4	-
1966	3.1	-	6.4	-
1967	1.4	-	7.0	3.6
1968	2.9	1.6	10.3	5.3
1969	3.0	1.2	13.5	6.1
1970	1.2	0.6	8.5	2.2
1971	4.0	2.4	7.6	3.1
1972	2.8	1.1	12.2	6.8

In the period from 1967 to 1972 the maximum size of the stock was more than 3 times higher than the minimum size on Georges Bank and 2 times higher than in the Southern New England area (Table 1). It should be noted that the autumn indices actually reflect the stock abundance expected by the beginning of the year following the survey. Thus, the maximum biomass of stock 1 was observed in 1972, that of stock 2 in 1970, while the years 1971 and 1972 were characterized by the decrease of this stock. But the survey data for 1972 indicate that the stock of the Southern New England area increased markedly again.

Of course, using the biomass indices only we cannot yet be completely sure in our judgement on the dynamics of one or another population. One should have the data characterizing the stock abundance in various

years. Table 2 gives indices of the mean weighed catches in numbers of specimens.

Table 2. Estimates of the mean weighed catches (in numbers) for the strata of layers 13-25 and 1-12.

Strata	Survey years					
	1967	1968	1969	1970	1971	1972
13-25	-	6.1	11.1	2.7	12.3	6.8
1-12	14.8	21.5	25.5	24.4	20.1	33.9

The comparison between biomass and abundance indices shows an obvious discrepancy in size of red hake stock 2 given in numbers and weight for 1970-1972. While early in 1971-1972 the biomass decreased 1.59 and 1.78 times as compared with 1970, the abundance in the same periods decreased only 1.04 and 1.27 times, respectively. It can be assumed that in recent years some changes took place in the stock structure resulting in an increase of the proportion of young fish and a decrease of the mean weight of individuals (Table 3). At the same time the year-classes making up the bulk of the commercial stock were rather abundant.

Table 3. Mean age, length and weight of red hake from two stocks according to the data of the joint surveys. (young-of-the-year was excluded from estimates of mean indices.)

Survey years	Mean age (years)		Mean length (cm)		Mean weight (g)	
	13-25	1-12	13-25	1-12	13-25	1-12
1967	-	3.0	-	30.3	-	216
1968	2.9	2.8	32.9	29.7	230	213
1969	3.0	3.1	35.2	31.0	283	240
1970	3.6	2.3	35.4	27.2	290	157
1971	3.1	2.2	33.4	27.6	240	161

The data given in Table 3 confirm our assumption of the substantial change in the structure of the stock in Southern New England in 1970-1971, resulting in the fact that by the beginning of 1971-1972 the commercial stock consisted mainly of 1968-1970 year-classes at the age of 2-3 years. The abundance of older age-groups was considerably lower (Table 4).

Table 4. Age composition (%) of red hake in the Southern New England area in 1971-1972 based on the commercial catches.

Years	Age (years)						Total
	1	2	3	4	5	6	
1971	0.6	56.5	27.0	10.8	4.7	0.4	100.0
1972	-	56.5	30.9	8.3	2.4	1.9	100.0

Low abundance of four-year-old individuals is most likely caused by a high natural mortality, since in 1970 the fishing effort was rather negligible and in 1969 only 10% of catches consisted of the 1967 year-class. The sharp decrease of 1968 year-class could not be caused by the 1971 fishery only. It is likely that the rate of renewal of stock 2 has accelerated recently. Table 5 given some idea of the abundance of the year-classes which had contributed to the commercial stock in 1967-1972. The indices are based on the joint survey data.

Table 5. Mean catches of red hake (numbers) at the age of 2+ years per tow for the groups of strata 13-25 and 1-12.

Strata	Year-classes					
	1965	1966	1967	1968	1969	1970
13-25	-	0.9	0.4	0.5	1.7	0.6
1-12	2.6	4.0	3.9	9.3	12.0	11.6

It is evident that the red hake stock in the Southern New England area in 1971 was recruited by relatively abundant 1968-1970 year-classes. Simultaneously, the period of 1970-1971 was characterized by a high total mortality of 1967-1968 year-classes which resulted in a rather low biomass of the exploited stock in the beginning of 1971-1972. Probably, a sharp change of year-classes took place.

For the period of joint surveys the total abundance of stock 2 reached its maximum by the beginning of 1973 (Table 2), because 1969-1970 year-classes had contributed to the stock. Judging from the biomass indices (Table 1), weight value of the stock reached the level of 1966 when 65,000 tons of red hake were taken from the Southern New England area (Anderson, 1972). It can be concluded that the depression was followed by a rapid increase in the abundance and for the time being the abundance of stock 2 approached the high level of 1966.

Sharp variations in the abundance of year-classes caused by natural factors gave no chance for successful use of the methods developed by Schaefer (1954) and Pella and Tomlinson (1969) to calculate maximum sustainable yield of red hake. However, using the catchability factor (total factor) suggested by Edwards (1968) we can calculate the approximate estimate of the exploited stock (Rikhter, 1972) on the base of the survey data. Total sustainable yield can be calculated if optimim fishing intensity is known (Rikhter, 1970). The calculations show that by the beginning of 1973 mean estimate of red hake on Georges Bank and in the Southern New England area was 24,000 and 132,000 tons respectively.

Judging by the optimum fishing intensity in the area west of 69°W, which is close to 50%, the catch of 65,000 tons should be recommended for 1973, which exceeds by more than 40% the maximum sustainable catch estimated by Anderson (1972) using the model of Pella and Tomlinson (1969).

The tendency to the abundance growth observed lately allows to predict the high level of the red hake stock in Southern New England for 1974. The situation on Georges Bank is less clear. However, a great abundance of the young-of-the-year observed during 1971 autumn survey (Anderson, 1972) suggests that the commercial stock in the area will increase to some extent by 1974 as a result of recruitment of strong 1971 year-class.

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