



Serial No. 2622
(D.c.3)

ICNAF Res.Doc.71/124

ANNUAL MEETING - JUNE 1971

An Analysis of Data on Population Abundance
of Herring in ICNAF Subareas 5Z and 6

by

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Introduction

The decline in herring stocks in ICNAF Subareas 5Z and 6 has been documented in the report of the Assessments Subcommittee. The fish in 5Z and 6 are considered to be one stock. This paper compares the abundance trends derived from USSR catch-per-unit effort data in the ICNAF statistical tables with the abundance trends derived from Albatross IV spring survey cruises conducted since 1968.

Methods

Standardization of effort units

A days fishing by 150-500 GRT otter trawlers was selected as the standard unit of effort. Most of the USSR catch is taken by these vessels. To connect the other units of effort to the standard, the ratio of catch-per-non-standard-unit-of-effort to that of the standard gear was computed for every month and division for which data was reported. A mean ratio was then calculated for each type of non-standard gear (Table 1). These mean ratios were used to connect the total annual effort of the various types of gear to the standard. The annual index of abundance was obtained by dividing total catch by the total standard effort.

This procedure was applied to two different sets of data - those month's and division's where 10 percent or more and 50 percent or more of the total catch was herring.

The catch-per-unit of effort was also calculated for the month of September only for otter trawlers of 150-500 GRT and 1800+ GRT in Division 5Ze. This index has been utilized by the Assessment Subcommittee to provide a consistent estimator of relative abundance. It applies particularly to the spawning population.

Calculation of total mortality

The catch-per-day of 1800+ GRT trawlers in September was converted to numbers of fish by using the estimated mean weight per fish reported in the Sampling Yearbooks. The numbers caught per day per age group was estimated by applying the age-length frequencies reported in the Sampling Yearbooks.

Estimates of relative abundance from surveys

The catch-per-tow, in numbers, obtained on spring cruises of the Albatross IV were utilized. These cruises provided reasonably consistent catches of herring in Subarea 6 and Division 5Zw.

A stratified mean catch-per-tow, including strata 61-76 in the set we have labeled SA6 and strata 1-12 in the set labeled 5Zw, was calculated for each cruise.

Results

Abundance trends

All of the indices (Tables 2,3 and figure 1) provide evidence of a marked decline in abundance of herring over the last three years. The groundfish survey index shows the sharpest decline. Between 1968 and 1970, the catch rate decreased by 70 percent in Division 5Zw and by 90 percent in Subarea 6. The index derived from USSR catch in September on Georges Bank decreased by about 50 percent from 1968-1968 for both vessel classes. The least decline was shown by the index derived from all USSR trawlers, about 25 percent, on the average, for both areas and both sets of data.

The differences in the year to year changes of the various indices is about what one would expect under the hypothesis that the catch rates of commercial trawlers are biased by changes in fishing strategies. The data from the entire USSR fleet, encompassing varied gear, is likely to be most affected by diversion of effort to other fisheries, particularly as abundance of herring decreases.

Mortality

The average of survival ratios from year to year within year classes (Table 4) for 1966-1969 indicate a decrease with age. The equivalent total mortality coefficient, Z , increased from about 0.5 at ages 5 and 6, to 2.5 at age 9. These rates are somewhat higher than the values of about 0.8-0.9 estimated by Anthony (1970) using virtual population procedures and covering data from earlier years of the fishery.

We cannot assign causes to these changes in mortality, at the present time, but it is extremely important to do so because increased fishing rate is likely to have been a major factor.

Droganik and Rast (1960) have concluded that fecundity of older fish, 7-9 years of age, is about twice that of younger ages. The high mortality on older fish and consequent rapid reduction of population size may thus be a significant factor in decreasing the production of the stock.

Literature Cited

Draganik, B. and B. Rast. 1970. The fecundity of Georges Bank herring. ICNAF Res. Doc. 70/63. 5 p.

Vaughn, A. 1970. Estimates of mortality for Georges Bank herring. ICNAF Res. Doc. 70/76.

Table 1.--Ratio of catch per day between 150-501 MT trawlers and other USSR vessels used to estimate standard days fished

<u>Category</u>	<u>Mean Ratio</u>
<u>1800+ Trawlers Standard</u>	2.0
<u>900-1800 MT Trawlers Standard</u>	0.5
<u>500-900 MT Trawlers Standard</u>	1.0
<u>500-900 MT Purse Seiners Standard</u>	2.5
<u>150-500 Purse Seiners Standard</u>	2.0
* <u>150-500 Paired Trawlers Standard</u>	0.7
* <u>150-500 Gill Netters Standard</u>	1.7
* <u>151-900 Pair Trawlers Standard</u>	1.4

*Vessels of these categories did not fish in 1968-1969

Table 2.--Indices of relative abundance of sea herring

<u>Year</u>	<u>Catch per standard days fished of USSR trawlers with herring catches</u>		<u>Catch per tow on spring surveys of Albatross IV</u>
	<u>more than 10%</u>	<u>more than 50%</u>	
	<u>Division 5Z</u>		
1968	5.90	5.69	120.6
1969	4.67	4.24	45.8
1970	-	-	34.7
	<u>Subarea 6</u>		
1968	6.11	5.42	17.4
1969	3.39	4.24	6.4
1970	-	-	1.2

Table 3.--Catch-per-unit-effort of herring in September in Division 5Ze

<u>Year</u>	<u>1800+ Trawlers</u>	<u>150-500 Trawlers</u>
1966	34.2	-
1967	17.2	8.1
1968	22.3	9.4
1969	10.0	4.3

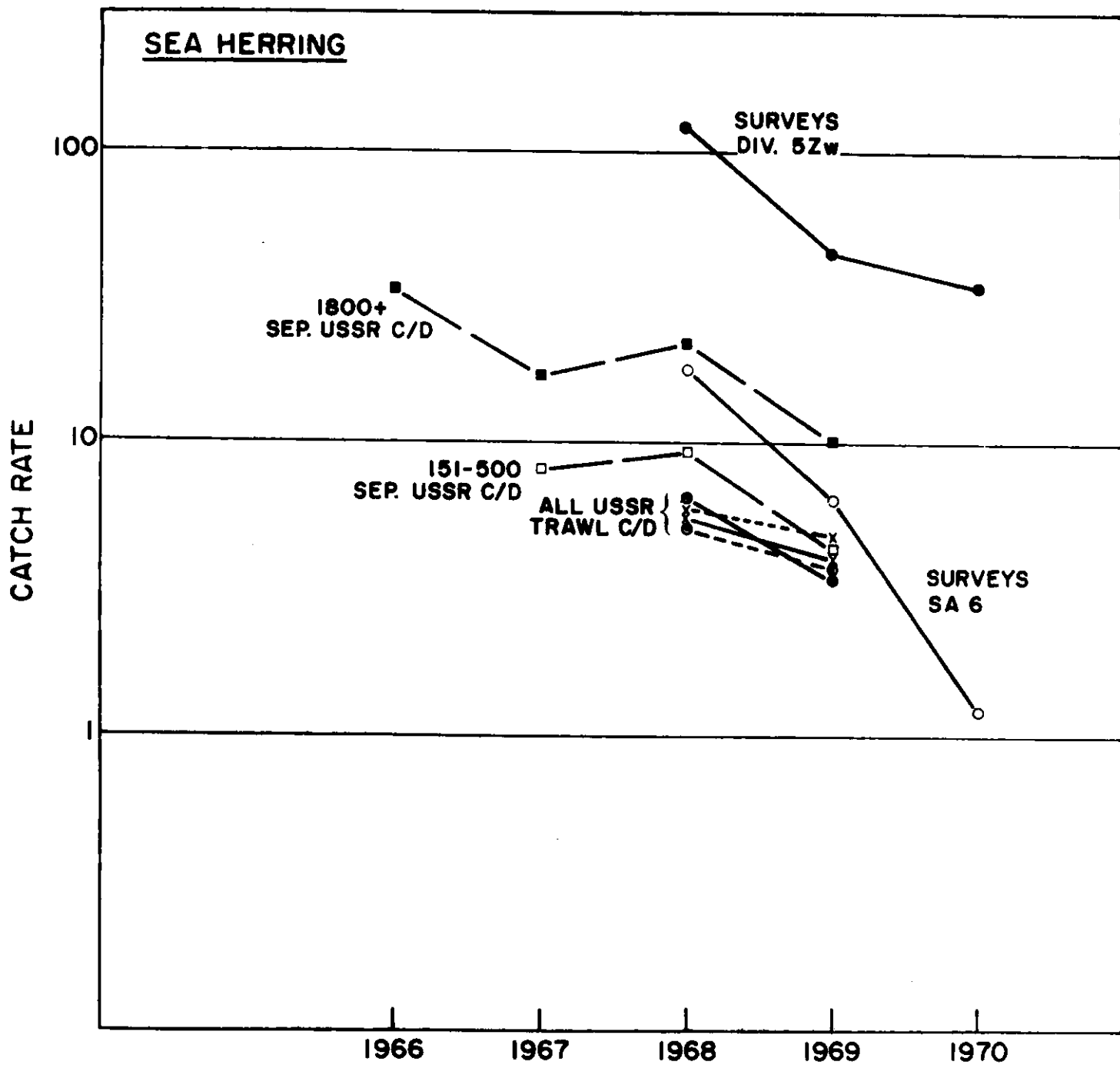


Figure 1.--Herring abundance indices.