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International Council for the
Exploration of the Sea

C.M. 1963
Gadoid Committee
No. 127 6



# FURTHER OBSERVATIONS ON THE AGE-COMPOSITION AND ABUNDANCE OF TRISOPTERUS (GADUS) ESMARKII (NILSSON) IN THE NORTH SEA

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## Introduction

Since 1960 regular sampling of the Trisopterus (Gadus) esmarkii population in the North Sea has been carried out by ships of the Marine Laboratory, Aberdeen. This work has been part of a programme of research on fish species which are important, either as the food of the larger commercial species, or as industrial species for fish-meal production. With four years' detailed data to hand (in addition to the Laboratory's North Sea trawling records etc. for the last 30 years) it is possible to make a better assessment of our knowledge of the life-history and general biology of T. esmarkii. This report provides further information of the abundance and age-composition of this species in the North Sea in these years.

## Abundance and Age-Composition

In the years 1960-1963 routine trawling surveys have been carried out in spring (March), summer (June) and autumn (October) over the northern North Sea by F.R.S. "Scotia", using a Vinge trawl with small-mesh cod-end. The results for the March surveys from 1960 to 1963 are shown in Table I, which gives the numbers of each age-group of T. esmarkii caught per hour. It can be seen that the catches in 1963 were small, only 16 per hour compared with nearly 400 in previous years. This was due mainly to very low numbers of 1-year-olds which, for the first time, were less abundant than 2-year-olds. Whereas in the earlier years the 1-year-olds accounted for between 65% and 95% of the population (Raitt, 1961), in 1963 they contributed only 40% of the stock. This is also demonstrated in Fig. 1 where the percentage distributions of the different age-groups in the March surveys from 1960 to 1963 are shown.

The corresponding data from the June surveys, excluding those for 1961 when bad weather prevented the survey being completed, are shown in Table II. Although substantially more 1- and 2-year-old fish were caught in the June than in the March surveys, the data show the same general features: viz, a comparatively small number of 1-year-olds, and for the first time in the four years' sampling there were fewer 1-year-olds than 2-year-olds. Indeed the percentage age-compositions for the June surveys (shown in Fig. 2) are almost identical to those found for the March surveys. Since it might be expected that the "availability" of the fish at the two different times of sampling, in March, during the spawning season, and in June, during the feeding season, would be different, the consistency of the age-composition and abundance estimates in the two months is quite striking. Therefore, on the basis of surveys in both March and June, it can be concluded that the 1962 year class was a very weak one.

In Fig. 3 the numbers of 1-year-old T. esmarkii caught per 10 hr trawl during the March North Sea surveys from 1935 to 1963 are compared. The data from 1935 to 1955 are taken from the trawl records of the old "Explorer" using an Aberdeen trawl. The 1960-1963 data are from "Scotia" Vinge trawl surveys. The available evidence points to the Vinge trawl being, in general, substantially more efficient than the Aberdeen trawl in catching these small fish. Therefore when the points for 1960-1962 are taken they must be considered as having much the same magnitude as the higher figures for the previous period. Thus the drop from 1962 to the 1963 figure is very great

and the numbers caught in 1963 are far lower than in any year sampled so far. This provides further evidence of a weak recruit year class from the 1962 spawning.

Mortality Rates

In a previous paper (Raitt, 1961) provisional estimates of the instantaneous total mortality rate, Z, were given for T. esmarkii. These estimates were calculated from the March, North Sea surveys of 1960 and 1961 and trawl records from 1935 to 1955. It was stated then that although the gear used for the two sets of data was different it was probable that the order of magnitude of the results was the same. It was also stated that the high figures obtained were probably due to a high natural mortality rate since T. esmarkii is a very important food species, particularly of whiting and cod. These estimates are repeated in Table III together with those calculated from the 1962 and 1963 surveys. These data show that while in the period up to 1955 the estimated mortality rate was 1.6 and in 1960/61 it was 0.7 in the last two years (1961/62 and 1962/3) it has increased greatly to 3.1 and 3.4 respectively. Thus in two consecutive years the total mortality rate appears to have more than doubled.

Discussion

There are then two facts which can be stated from the data described above:

1) There were fewer 1-year-old fish in March 1963 than in any year of sampling since 1935, so few in fact that there were more 2-year-olds, a year class which they normally outnumber by up to 8 to 1.

2) There has been an increase in instantaneous total mortality rate over the last two years from a mean value of about 1.6 to a mean value of over 3.

It is known that many gadoid species are subject to large brood strength fluctuations and that in some years there may be considerable numbers of young fish entering the adult stock and in other years much fewer. In these species the spawning stock consists of several year classes with the result that when any year class is poorly represented, this is often compensated for by other good year classes. In a paper presented to this Committee two years ago (Raitt, 1961), it was shown that T. esmarkii in the North Sea reach sexual maturity for the first time at the end of their second year and that the life-span is very short. The oldest fish recorded so far from the North Sea has been 4 years of age and during the spawning season from March to April the 3- and 4-year-olds make up no more than about 45 of the population (Fig. 1). Therefore nearly all the spawners in any one year belong to one year class. Clearly in such circumstances a poor recruit year class may even seriously affect future generations.

It would be premature, however, to predict the effect that the apparently weak 1962 year class will have on the T. esmarkii population in the future, but since T. esmarkii is an extremely important fish in the sea and is one of the main food species of whiting and cod, the accumulation of the two factors described above would, therefore, seem bound to have some effect on the population and possibly on the food supply of its predators. Any large reduction in the size of the stock could also affect the important industrial fishery for this species.

Reference

Raitt, D. F. S. 1961. "Further studies on the age, growth and maturation of Gadus esmarkii (Nilsson)." I.C.E.S., C.M. 1961, Gadoid Fish Comm., Paper No. 24.

Table I.

Abundance of T. esmarkii age groups per 1 hr trawl haul. March North Sea surveys 1960-1963.

| Year | Numbers of each age-group per one hour trawl haul | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | Total |
| 1960 | 392.0 | 27.7 | 5.0 | + | 424.7 |
| 1961 | 381.7 | 195.3 | 9.1 | 3.3 | 589.4 |
| 1962 | 406.6 | 16.4 | 3.9 | - | 426.9 |
| 1963 | 16.5 | 22.8 | 0.2 | 0.3 | 39.8 |

Table II.

Abundance of T. esmarkii age groups per 1 hr trawl haul. June North Sea surveys 1960-1963 (except 1961).

| Year | Numbers of each age-group per one hour trawl haul | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | Total |
| 1960 | 1251.0 | 163.0 | 33.0 | | 1447.0 |
| 1962 | 906.0 | 12.6 | 5.5 | 0.5 | 924.6 |
| 1963 | 146.4 | 322.6 | 1.3 | 0.5 | 470.8 |

Table III.

Instantaneous mortality rates calculated from March survey data.

| | 1-2 | 2-3 | 3-4 | Mean total mortality |
|---|---|---|---|---|
| Average 1935-1955 (except '37-'47) | 1.1 | 2.2 | 1.4 | 1.6 |
| 1960/61 | 0.7 | 1.1 | 0.4 | 0.7 |
| 1961/62 | 3.2 | 3.9 | 2.2 | 3.1 |
| 1962/63 | 2.9 | 4.7 | 2.6 | 3.4 |

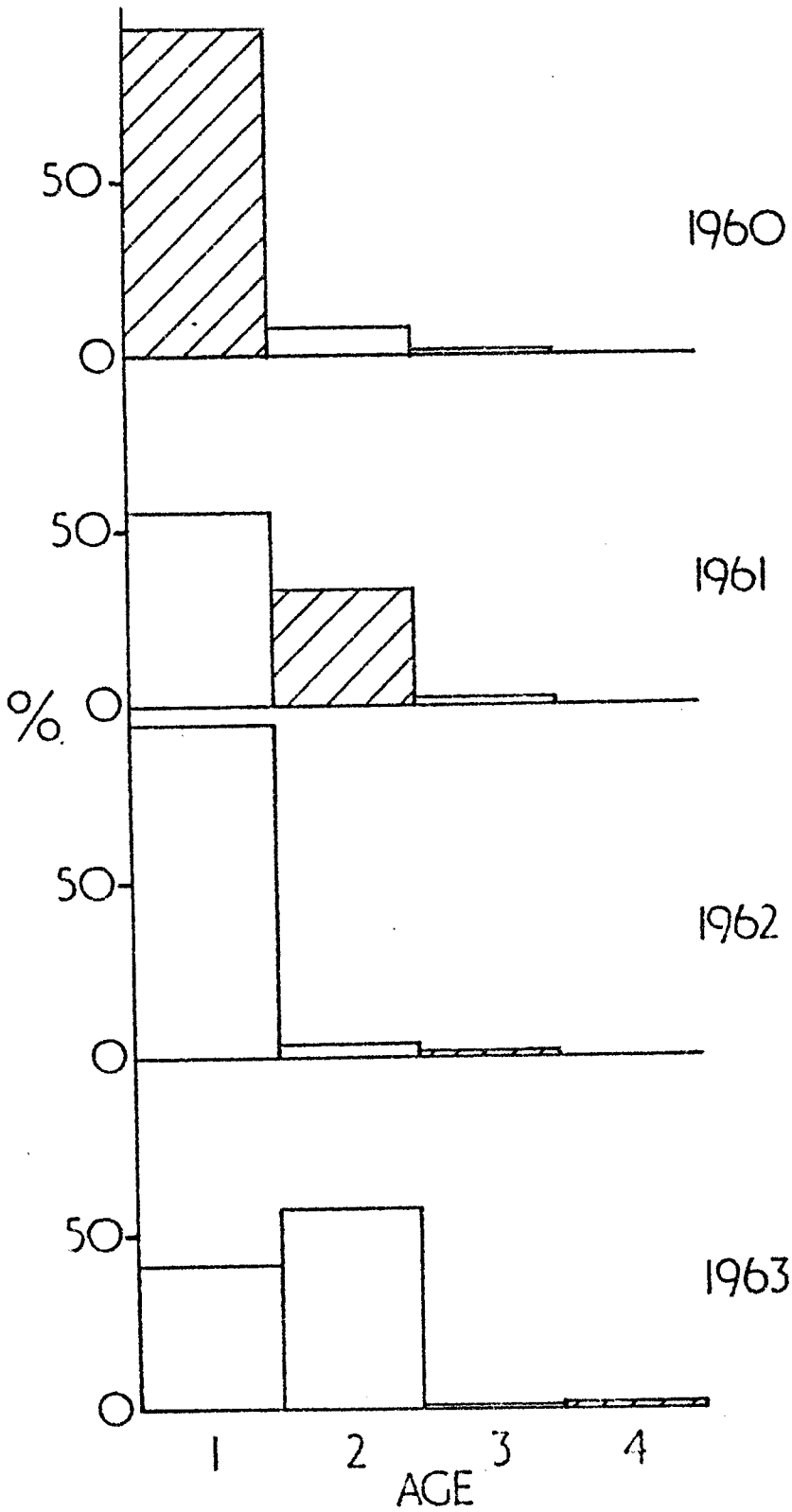


FIGURE 1

T. esmarkii % age distribution N. Sea. March 1960-63
(1959 year class shaded)

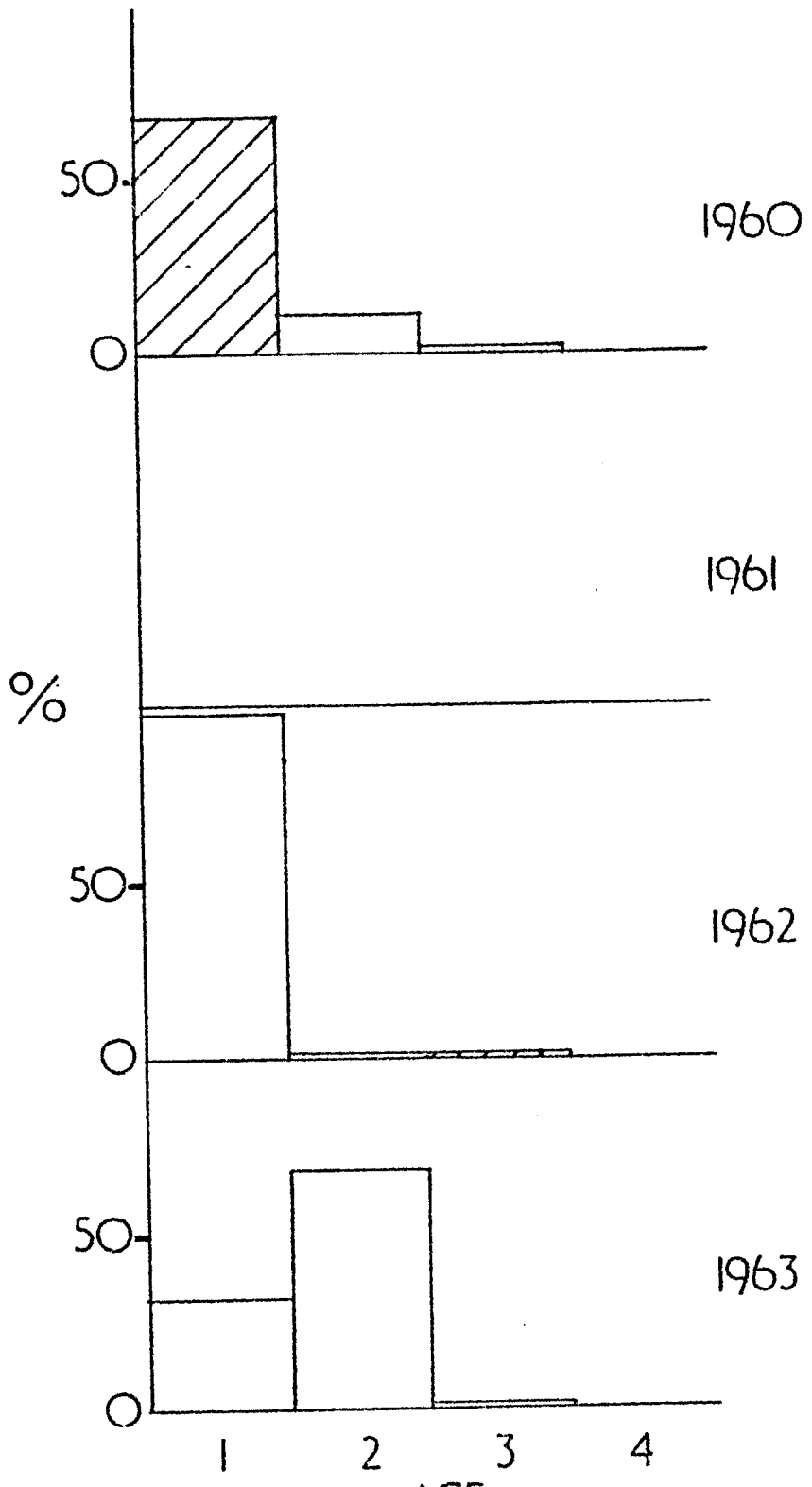


FIGURE 2

T. esmarkii % age distribution N.Sea. June 1960-63
(1959 year class shaded)

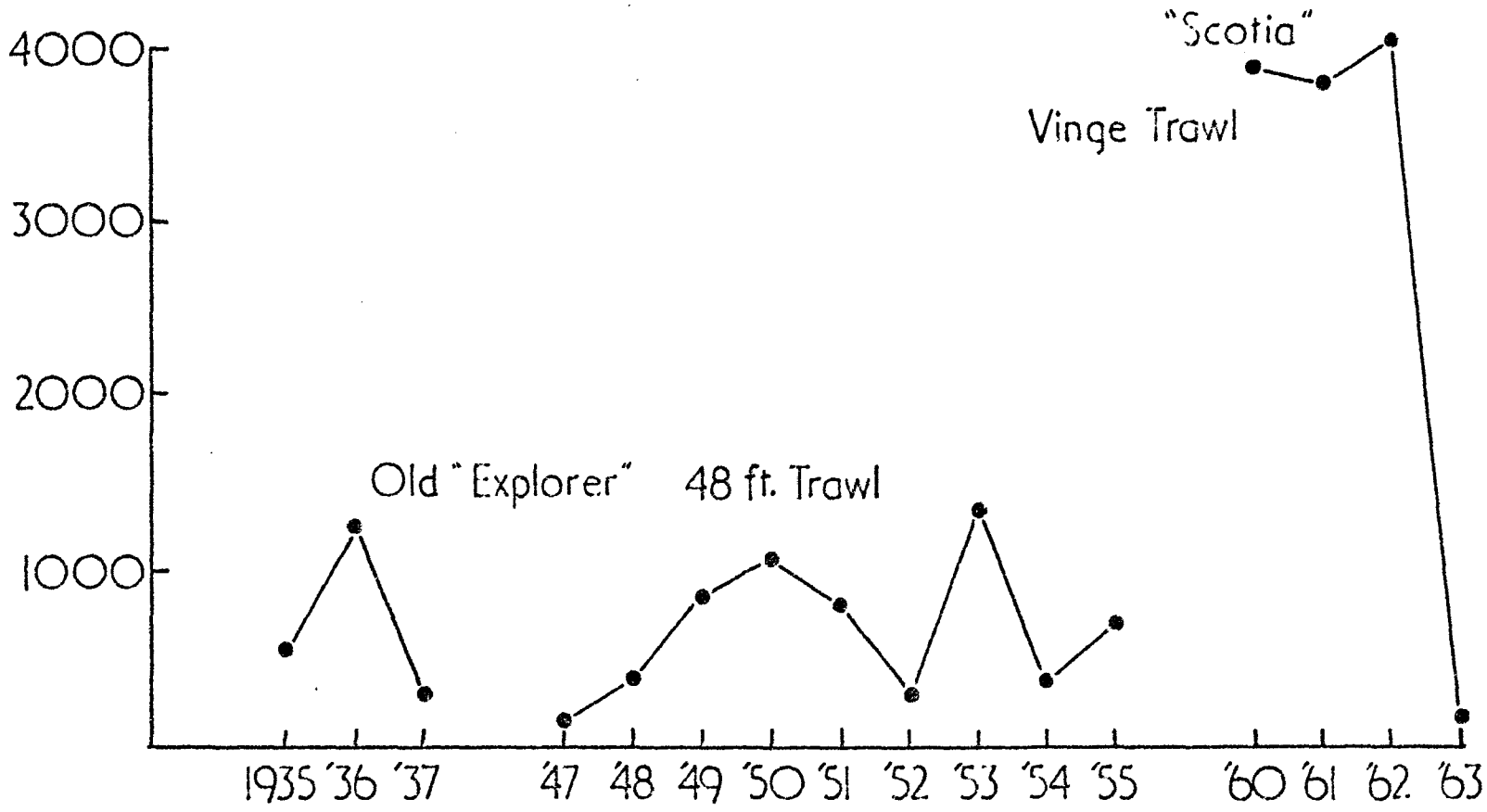


FIGURE 3.

Numbers of 1 year old T. esmarkii per 10 hours trawl — MARCH surveys 1935 — 1963