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Biomass Estimates of the Short-finned Squid, *Illex illecebrosus*, in ICNAF Division 4W, 1978

by

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Abstract

The biomass (3.54×10^5) and abundance (3.052×10^9) of Illex illecebrosus for 3 367 square miles of ICNAF Div. 4W were estimated from the catch statistics. In calculations diurnal vertical migrations were taken into consideration. In July the majority of squids descends to near-bottom layers in the period between 12.00 and 4 p.m. The size groups of 19 and 20 cm are most representative in biomass, while the individuals of 18 and 19 cm in length are most numerous.

Standard methods for the Illex illecebrosus stock assessment are not still available which entails certain difficulties in the research work. Therefore, it may be suggested to subordinate all separate expeditions of scientific-research ships contributing to the problem of assessment of mass commercial species stocks in the Northwest Atlantic to a common program. All the ships should be provided with standard (optimum) fishing gears and standard searching equipment.

It is highly desirable to conduct the surveys on Illex illecebrosus abundance simultaneously in different parts of the distribution area of the species according to a single method. Comparable data for 3-5 years by all parts of the distribution area and by season will allow to deduce the mean value of generation survival and ontogenetic migrations of squids from one part of

the distribution area to another. These studies will result in determination of the actual estimate of natural and commercial stocks.

Introduction

In the recent years the assessment of actual stock size of Illex illecebrosus in the Northwest Atlantic has become one of the most important problems for the scientists of a number of countries.

The number of papers tackling this problem increases exponentially and may be subdivided into three groups: papers dealing with some biological aspects of the species, analyzing the catch statistics and giving biomass estimates of the species for one or another area. The papers by a group of Canadian scientists (Squires 1957, 1967, Mercer 1973b, 1973c; Durward et al. 1978, Amaratunga et al. 1978a, 1978b; O'Dor et al. 1977), the papers by Mesnil (1976 and 1977) and some other reports undoubtedly bring to light the possibilities of forecasting using the biological criteria. Among the papers of statistic-mathematical characters those by Ikeda et al. (1973), Au (1975), Mercer (1975), Tibbetts (1975), Sissenwine and Tibbets (1976), Amaratunga et al. (1978) and other may be distinguished. Chevalier (1978), Mari et al. (1978) and Lipinski (1978) make attempts to estimate the squid biomass. The presentation of Halliday (1978) gives interesting generalizations.

Attempts aimed at developing the methods for calculation of the squid biomass are characteristic of all statistic-mathematical papers.

The presentations concerning the squid biomass for different shelf parts of the Northwest Atlantic only state the biomass and abundance estimates calculated by the existing methods. Catch data are summed and averaged without regard for the trawling time although it should be remembered that the squids perform active diurnal vertical migrations (Froerman, 1977).

Biomass estimates determined by the vessels of different countries are not comparable since the fishing gears used are not standard. To date, a single attempt has been made to develop standard methods (T.Amaratunga and R.D.Durward, 1978), but it rather concerns the collection of materials on the species biology.

In the present report the short-finned squid biomass and abundance estimates are given for the oceanic edge of Sable Island and Emerald Banks. Besides, the measures aimed at the determination of actual biomass estimate and possible commercial exemption of the short-finned squid are suggested.

Materials and Methods

A total of 648 catches (directed fishery with the squids comprising over 3% of the catch) taken by large-capacity vessels of BMRT and RTM type in July 1978 throughout 3 367 square miles of ICNAF Div. 4w were analysed (fig. 1). The fishing gears used were bottom trawls with horizontal opening of 14–17 m and vertical opening of 5–8 m.

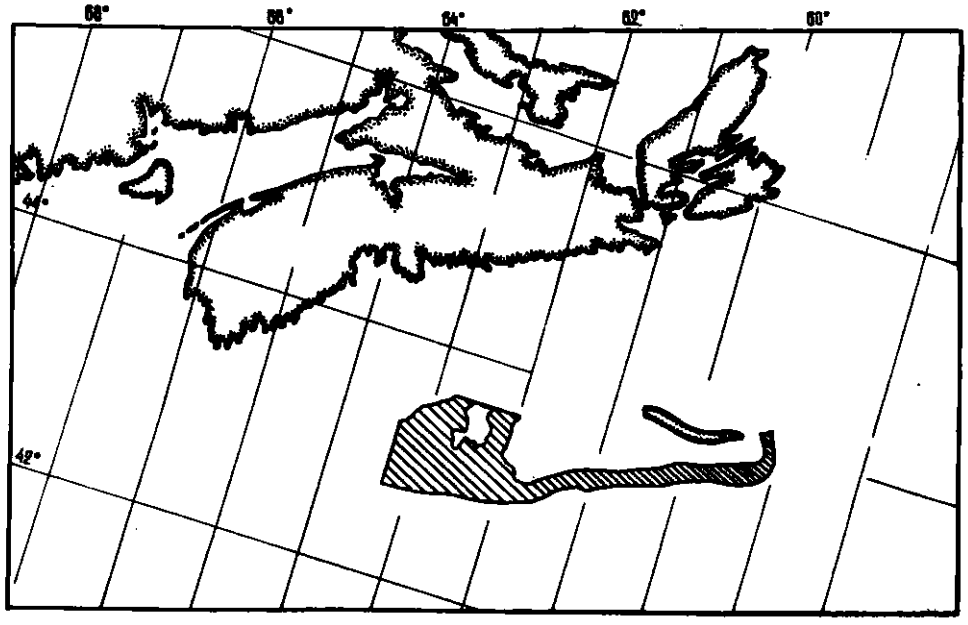

Fig. 1. The area investigated for *Illex illecebrosus* biomass on the Scotian Shelf, based on Soviet catch statistics for 1978. (Shaded part is the area of strata 53, 54, 66, 65.)

Catch data per hauling hour were grouped on a ten-day period basis, and the data for each ten-day period were subdivided by six four-hour period of the day (4-8; 8-12; 12-16; 16-20; 20-24; 24-4). Biomass estimate per square mile for each four-hour period was calculated from the formula

$$b = b_1 \frac{1}{S_1}$$

where b is the squid biomass per square mile, b_1 is the squid biomass per hauling hour and S_1 is the area covered per hauling hour.

This calculation method was selected in order to eliminate an error typical of estimating the bimass of the species performing vertical migrations.

The squid biomass estimate obtained in the third ten-day period of July in the time intervals between 12.00 and 4 p.m. was taken as the optimum stock size.

Since the positions of haulings cannot be always associated with the definite stratum the biomass was estimated according to the method of area expansion for the total area of strata 53, 54; 66 and 65 (3 367 square miles).

Results

The maximum recorded squid aggregations in the first ten-day period of July were within the range of 5-8 m off the bottom in the time intervals between 12.00-4 p.m. and 4 p.m.-8p.m.

In the second and third ten-day periods the number of squids descending from the pelagial to near-bottom layers was also the largest between 12.00 and 4 p.m. (fig.2).

In the third ten-day period of July the mean catch per hauling hour from 12.00 to 4 p.m. amounted 3.4 tons at the mean vessel speed of 4.25 knots, while the biomass per square mile was 105.26 tons.

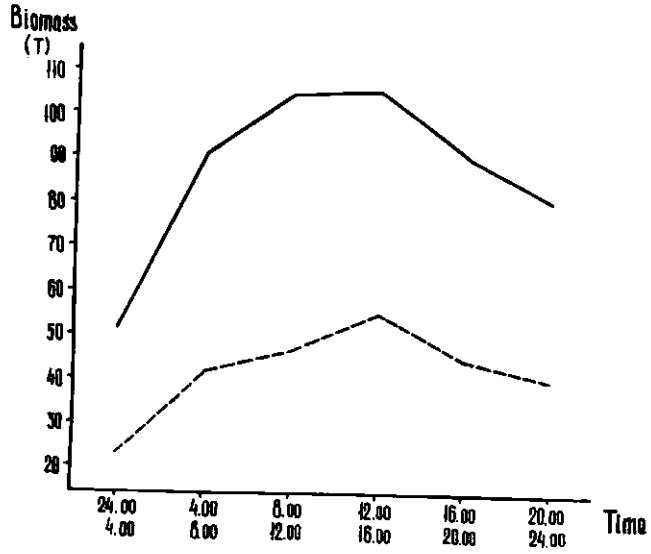

Fig. 2. Diurnal variability of *Illex illecebrosus* on the Scotian Shelf within the near-bottom layer in the second (dashed line) and in the third (solid line) ten-day period of July 1978.

These were the mean maximum estimates in 1978 for the investigated area, and the biomass calculated on this basis must most closely correspond to the real value.

The abundance calculated from the mean weighted values for each size group by strata 54, 53, 65 and 66 with the total area of 3 367 square miles was 3.052×10^8 specimens with the biomass of 3.54×10^4 tons (table 1). The size groups of 19 and 20 cm were most representative in biomass, while the individuals of 18 and 19 cm in length were most numerous.

Discussion

The short-finned squid biomass estimated for a relatively limited part of the feeding ground as a part of the species distribution area can hardly give a comprehensive idea of the natural stock size. Although the suggested biomass estimate (3.54×10^5) exceeds those reported earlier, it undoubtedly, is just a part of the total biomass in the species distribution area. The preliminary analysis of the squid distribution in the spring-summer period showed that the squid catch per effort in Subarea 5 in June-July is not smaller and in some years is even considerably larger than the squid catches in Subarea 4 (Froerman, unpublished).

Table 1. Abundance and biomass estimates of *Illex illecebrosus* in Div. 4W from the Soviet catch statistics, 21-31 July 1978.

Mantle length	Biomass (t)	Abundance
12	92.15	3.07×10^6
13	347,32	9.14×10^6
14	822.23	1.83×10^7
15	2183.17	3.97×10^7
16	5599.69	8.24×10^7
17	25368.70	3.02×10^8
18	75050.00	7.51×10^8
19	102445.90	8.91×10^8
20	78253.82	5.80×10^8
21	40027.11	2.50×10^8
22	15923.66	8.85×10^7
23	6712.53	3.05×10^7
24	1587.76	6.11×10^6
Sum	3.54×10^5	3.052×10^9

The most real estimate of the total species biomass may be obtained provided that all interested countries carry out joint annual surveys on abundance throughout the distribution area of the species during 3-5 years running. The surveys in different parts of the area should start and end at the same time using the standard near-bottom trawl (of Hake "M" type) exclusively in the light hours of the day when the squids are the least active (Froerman, 1977). In summer and in the fall the Grosslein's method of trawling surveys (1969) may be adopted. In spring and winter the haulings may be made at depths below 100 m in the continental slope area. The surveys should be preceded by the research work aimed at determining the intensity of diurnal vertical migrations in the survey areas in different seasons in order to deduce the coefficient of error which would eliminate the effect of variability of the illumination intensity at the water

surface. For this purpose, each vessel participating in the surveys should be provided with the photometer.

More detailed picture of vertical distribution of the squids, as well as the answer to the question as to the spawning area and depth may be provided by the undersea visual observations which should be made simultaneously with the trawling surveys.

The above pre-survey and survey activities will make it possible to collect comparable data by area to really estimate the biomass and the size of commercial exemption of both the squids and a number of commercial fish species.

Conclusions

1. The biomass and abundance of Illex illecebrosus throughout the area of 3 367 square miles in Div. 4w in July 1978 were 3.54×10^5 tons and 3.052×10^8 specimens respectively.

2. Biomass estimates for Div. 4w in July should be based on the directed squid fishing data for the time interval between 12.00 and 4 p.m.

3. During the surveys on Illex illecebrosus abundance conducted by the research vessel of differentcountries within the species distribution area standard methods and fishing gear (Hake "M" type) should be used.

4. During the surveys seasonal peculiarities of bathymetrical distribution of the squids, as well as the peculiarities of seasonal variability of hydrometeorological factors in different parts of the species distribution area should be considered.

5. Most comprehensive idea of Illex illecebrosus biomass may be obtained if trawling surveys and undersea visual observations are combined.

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