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Biomass Estimates of Squid (*Illex illecebrosus*) in Divisions 4VW, 1979

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ABSTRACT

The squid biomass was estimated by the swept area method, using the data of the Cuban commercial fleet which operated in the Division 4VW from July to September, 1979.

Catch data per unit area (Kg/hectarea), with 80/416 midwater trawl model used in the analysis, were normalized, and after the Taylor Power Law was applied it was found that the logarithmic and square root made up the best transformation.

In order to estimate the biomass, it was used the square area in which the fishery was carried out with the already mentioned trawl and it was found that the best catch per unit area was the one with a biomass of 102 400 tons reported in August.

Introduction

A review of *Illex* catches by subarea indicates that the highest increase was found in subarea 4, where the catches rose from an average of 4 000 tons during 1970-74 to 53 000 tons in 1978.

Since 1978 Cuban commercial vessels started a directed fishery on squid in the Scotian Shelf having always into account that the aim of the fleet is to operate on the hake-squid complex, as these fisheries overlap in time and space.

Many papers have been written (Lipinsky 1978, 1979; Marí et. al. 1978; Marí et. al. 1979; Froerman 1979; Nagai and Kawahara 1979) on the squid resource assessment using commercial data for biomass estimates for the different areas and months in which commercial fleets have been operating, after the meeting held in Habana in 1978.

All these biomass estimates were obtained using the swept area method, whose errors and limitations were extensively discussed by Sissenwine (1979) and Marí et. al. (1978), the latter ones making emphasis on the Cuban commercial fleet.

This paper attemps to estimate the squid biomass in Division 4VW, taking into account the distribution of the Cuban fleet in July, August and September.

Taking into consideration the results obtained by the assessment done, new biomass estimates which can be used for the resource management are given here.

Materials and Methods

Data employed for the assessment were taken from type Tacsa 95 commercial vessels (over 2 000 tons) which operated in the Division 4VW of the Scotian Shelf. A total of 582 hauls corresponding to the months of July, August and September 1979 were analysed, using squid catch data, tow duration and position of the 80/416 midwater trawl model.

The technical characteristics of the net are given below.

Gear name or number	80/416
Head rope length	80 m
Foot rope length	80 m
Wingspread	60-64 m
Length of bridles	120 m
Area of doors	8 m^2

The method used for abundance estimation was the swept area applied by Marí et. al. (1978). As a first approximation one can assume that q is equal to 1.0 to give the lower limit of that proportion of the stock which is large enough to be retained by the trawl. It should be pointed out that when the swept area method is applied it is assumed that the stock is uniformly distributed over the area (Gulland 1969), and that is fairly difficult to find out within pelagic species, which prefer to move in shoals of different sizes in the water column.

Taking into account the squares in which the Cuban fleet made the hauls by means of the 80/416 midwater trawl, it was calculated the fishing ground area where this fleet carried out its operation, attempting thus to avoid any overestimation in the calculations.

The Cuban fleet operational zone was found between Emerald Basin and Gully Deep (Fig. 1) with a eastward movement ocurring as the fishing season advances (Figs. 2 - 4).

The catch per unit area data utilized in the calculus of the biomass were transformed following Taylor (1961) statement that the variance of a population is proportional to a fractional power of its mean:

$$S^2 = a\bar{X}^b$$

$$\log S^2 = \log a + b \log \bar{X}$$

The slope of the linear regression between the log S^2 and log $\bar{X}$ for a series of tows is an estimated of b. After finding the regression line slope, the data –catch per unit area– were normalized (Buesa and Pérez, MS) in order to perform the usual statistical tests. After doing this, the data were transformed back to their former values (Quenouille, 1966).

Results and Discussion

Taking into account the present regulations on the opening of the fishing season, the Cuban fleet started a directed fishery for squid in July 1979. The area covered by the fleet in this fishery was smaller than in 1978, fishing mainly near the small mesh gear line, between Emerald Basin and Gully Deep.

The Cuban fleet operational zone shows an area decrease probably due to this years area restricctions. However, the squid abundance in this zone made easier its catching, in spite of the complex operation of the hake-squid fishery.

The data of catch per unit area were normalized using the log transformation in July and September, and the square root transformation $(x_i + 3/8)^{1/2}$ in August.

Once the analysis had been carried out using transformed data, there is usually some difficulty concerning the presentation of results. Thus we may obtains means, differences between means and standard errors for the transformed data and then require to transform back to original scale to interpret the results and probably to compare them with untransformed data (Quenouille, 1966).

In 1978, the Cuban fleet started a directed fishery for squid so its values of catch per unit area can be compared with those estimated for 1979. The results of the two years are given in table 1, showing that in 1978 the highest values of Kg/ha were obtained in July, while in 1979, the highest were found in August.

The figures shown in table 1 are difficult to understand, considering the operation of the fleet and that squid is a migratory species that can be influenced by enviromental conditions and food availability in the area. These two characteristics mask the conclusions that can be reached.

It has been observed that in Division 4VW (considered as subarea 4 in table 1) the biomass increased in August 1979 and then decreased in September of the same year.

Attempts to minimize errors were made considering a suitable trawl and the feasibility of making a large number of hauls in and area of uniform density.

The biomass estimates given in this paper can be used for comparisons in the management of this resource.

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Table 1.- Monthly estimates of the biomass for the period 1976-1979.

Year	Month	Subarea	N° of Trawls	Area (hect) 10^6	Biomass (M.T)
1976	June	4	180	2.1	60 972
	July	4	216	1.4	33 106
	August	4	277	1.9	10 146
1977	June	4	163	2.4	115 000
	July	3	156	0.9	115 625
	July	4	62	1.2	133 726
1978	July	3	48	0.6	29 284
	July	4	131	1.8	124 390
	August	3	101	1.3	76 200
	August	4	155	4.0	57 990
	Sept.	3	102	0.6	41 149
	Sept.	4	120	1.7	56 450
	Oct.	4	112	2.2	434 580
1979	July	4	165	1.7	85 567
	August	4	138	1.5	102 416
	Sept.	4	279	2.4	96 841

Table 2.- Mean catch per unit of area in Division 4VW during 1978 and 1979.

Year	Month	Division	Mean catch per unit of area and confidence interval[1]
1978	July	4WX	66.07 ± 2.33
	August	4WX	14.29 ± 2.35
	Sept.	4WX	28.32 ± 3.51
1979	July	4VW	47.56 ± 0.14
	August	4VW	65.24 ± 0.68
	Sept.	4VW	39.17 ± 0.08

[1] With 95 per cent confidence level.

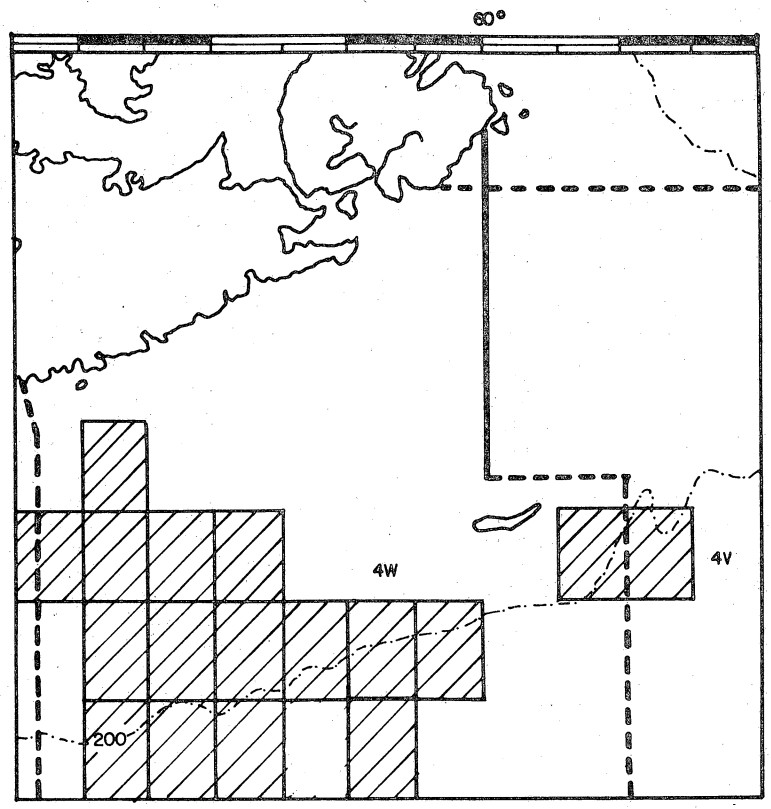

Fig. 1. Fishing areas during 1979.

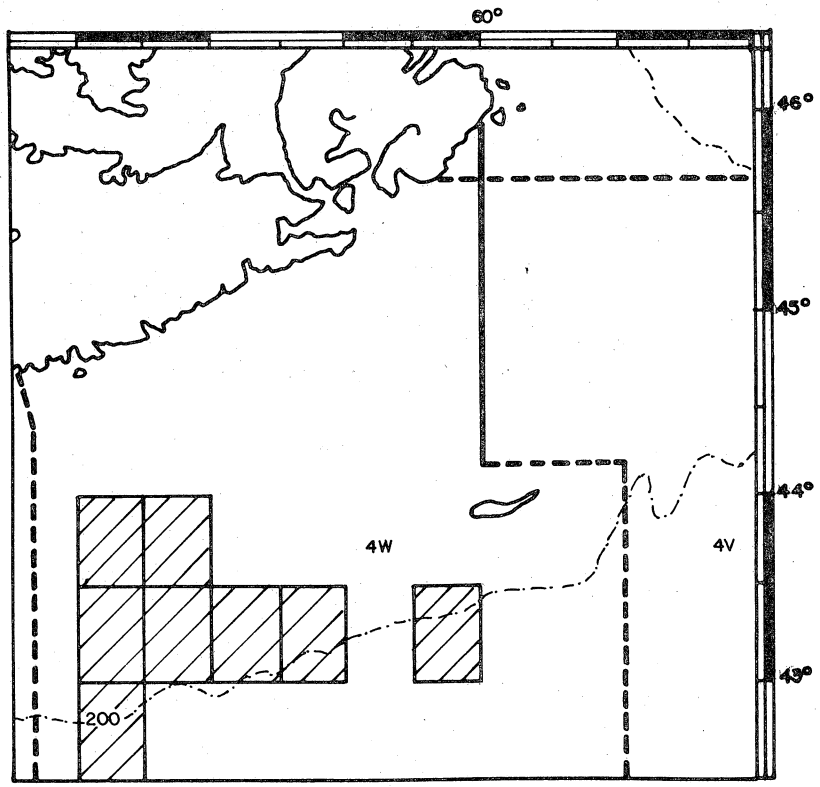

Fig. 2. Fishing areas during July 1979.

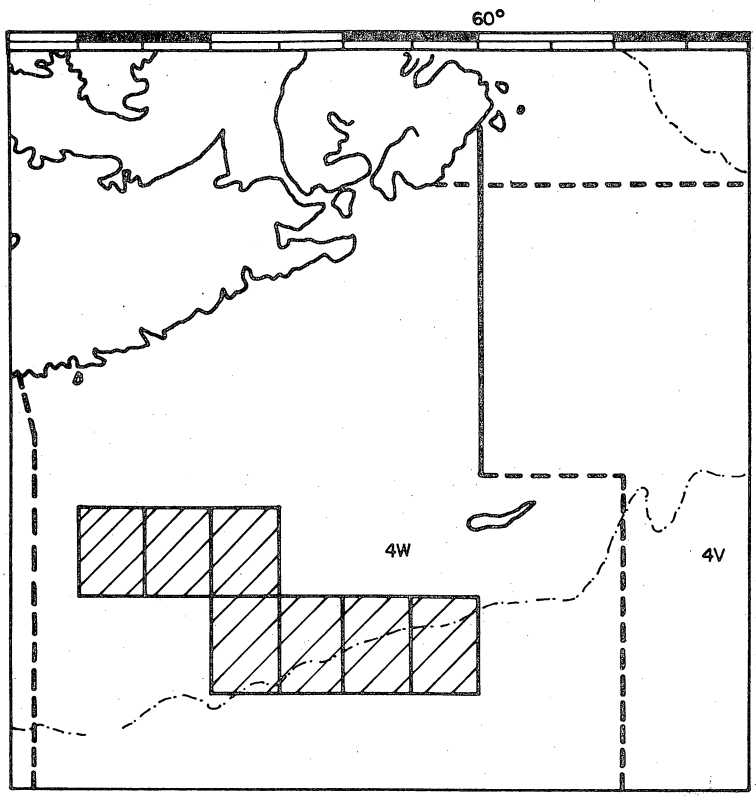

Fig. 3. Fishing areas during August 1979.

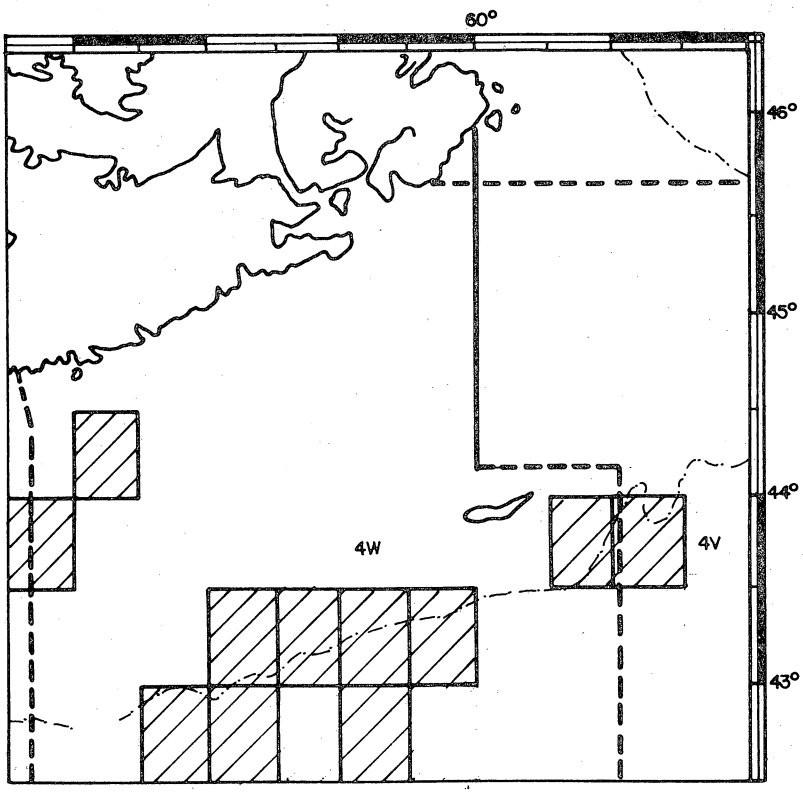

Fig. 4. Fishing areas during September 1979.