International Commission for the Northwest Atlantic Fisheries

Serial No. 5333

ICNAF Res. Doc. 79/II/8

SPECIAL MEETING OF STACRES - FEBRUARY 1979

Abundance Estimates and Fishing Mortality Rates of Squid (*Illex illecebrosus*) in Subareas 3 and 4

by

A. Marí, E. Valdés
Centro de Investigaciones Pesqueras
Havana, Cuba

and

R. Domínquez
Flota Cubana de Pesca
Havana, Cuba

1. Abstract

Using the areal expansion method the biomass and fishing mortality rate for the short-finned squid (Illex illecebrosus) from Divisions 4VWX and 3NO was estimated.

For determining the resource abundance, the catch and effort data of the cuban long-distance water fleet which operated in the above mentioned ICNAF Divisions were used.

It was estimated the monthly biomass during the fishing period in which the cuban vessels fished in Divisions 4VWX (July-October) and 3NO (July-September), finding out a maximum biomass value of 434 580 tons in October for Divisions 4VWX and a maximum value of 76 200 tons in August for Divisions 3NO.

The fishing mortality rate (F) estimates were also determined on a monthly basis and for the former fishing periods, ranging from 0.001 to 0.009. These estimates should be used as approximations rather than exact or accurate values because of the possible deficiencies and source of the data used.

2. Introduction

Last year some assessments on squid (Illex illecebrosus) were made using the areal expansion method (Lipinski, 1978; Marí et.al., 1978, and Chevalier, 1978) and the cohort analysis (Hurley and Waldron, 1978). In the second of the mentioned documents, the under and overestimations and also the limitations of this method were discussed when commercial data were employed in the analysis.

During 1978 the cuban fleet conducted a directed squid fishery on the Scotian Shelf and south of the Grand Bank, obtaining 41.7 and 35.5 % of this species respectively in the catches.

The objective of this paper is to perform an assessment of the short-finned squid abundance in the main groundfishes from Divisions 4VWX and 3NO in order to know the situation of this stock.

3. Material and Methods

The monthly estimates of biomass were calculated using the catch and effort data of the cuban trawlers vessels type Atlantik and Tacsa 95, both of them stern trawlers belonging to the tonnaje category OT 7 (over 2 000 gross metric tons). Similarly, the trawls positions and type of fishing gear were registered. A catchability coefficient of q = 1 was considered in all cases.

In the analysis, data compiled during July-October for Divisions 4VWX and July-September for Divisions 3NO were used. The fishing activities were mainly developed in Division 4W and in the Grand Bank in the region known as Tail of the Bank (Figs. 1-3). Althought the fishery in Divisions 4VWX was carried out until November, at the time this assessment was made, data were only available for the period July-October.

Trawling operations were conducted using several types of commercial fishing gears, from which, models M-32.0 and M-50.2 were chosen to accomplish biomass calculations after considering them as representative of the fishery. The technical characteristics of the last fishing gear and also the methodology followed in the biomass calculations are widely explained in the paper by Marí et. al. (op. cit.).

The characteristics of the M-32.0 net are as follows:

Gear name or number	M-32.0
Head rope lenght	32 m
Foot rope length	-
Winspread	35-40 m
Lenght of bridles	120 m
Area of doors	5 m^2

In the analisys were considered 518 trawls during the July-October period for Divisions 4VWX, while for Divisions 3NO were analized 251 trawls in the July-September period.

With the effort and catch data and following the areal expansion methodology, the catch per unit of area (Kg/hect) for each trawl was calculated. Subsequently, the values obtained were grouped by week and after this, the mean ($\bar{X}$) and variance (S^2) of each group was computed. According to Taylor's power law, the variance of a population is proportional to a fractional power of its mean, that is:

$$S^2 = a\bar{X}^b \qquad (1)$$

$$\text{and } \log S^2 = \log a + b \log \bar{X} \qquad (2)$$

Considering equation (2) which corresponds to a straight line, the slope (b) was determined, indicating its value the transformation to be applied to the catch per unit of area values of each trawl, thus normalizing the data for each month and Division, following the methodology described by Buesa and Pérez (MS, 1978). Once the data were transformed, calculations of confidence intervals were made for each of the mean catch per unit of area values used in estimatig the biomass. A confidence level of 95 % was employed in all months. Results are shown in table 2.

4. Results and discussion

The cuban commercial fleet began to catch squid in a successful way as a directed species in July on the Scotian Shelf and south of the Grand Bank.

The area covered by the fleet in these fisheries, in comparison with the ones of former years, was larger during 1978, fishing not only in the area of the shelf but also in the banks slopes.

After normalizing the catch per unit of area data for the different months and Divisions, the corresponding biomasses were estimated, being the values shown in table 1.

It is observed for Divisions 4VWX (considered as Subarea 4 in table 1) a decrease in the biomass from July to September, and a posterior increase and maximum value in October. In former years (1976 and 1977), which have been added to table 1 as an element of comparison, estimates of biomasses for the months of September and October are not observed, as the fleet did not have an allocation of squid as a directed species, catching it as by-catch in a directed silver hake fishery. This situation provoked a short fishery on squid. In 1978, however, the situation changed, because squid began to be fished in a directed way, and as a result, a longer

fishery was carried out, having October the best values of biomass and catches per unit of area respectively (see tables 1 and 2).

Table 1.- Monthly estimates of the biomass for the period 1976-1978.

Year	Month	Subarea	No. of trawls	Area (hect) 10^6	Biomass (M.T.)
	June	4	180	2.1	60 972
1976*	July	4	216	1.4	33 106
	August	4	277	1.9	10 146
	June	4	163	2.4	115 000
1977*	July	3	156	0.9	115 625
	July	4	62	1.2	133 326
	July	3	48	0.6	29 284
	July	4	131	1.8	124 390
	August	3	101	1.3	76 200
1978	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

* Taken from Marí et. al., (1978)

Table 2.- Monthly fishing mortality rates (F) and mean catch per unit of area in Divisions 4WX and 3NO, 1978.

Month	Division	Mean catch per unit of area and confidence interval	F
July	4WX	66.07±2.33	0.003
	3NO	43.01±14.21	0.004
August	3NO	56.18±7.11	0.004
	4WX	14.29±2.35	0.002
Sept.	3NO	60.93±6.25	0.009
	4WX	28.32±3.51	0.001
October	4WX	193.38±10.18	0.001

In subarea 3 (Division 3NO) the maximum value of biomass was observed in August, with a slight decrease in September (see table 1) possibly due to the completion of the assigned quota.

According to Beverton and Holt (1956), the fishing mortality coefficient (F) resulting when a commercial trawler makes a trawl, is equal to the fraction of the population that is caught. If the stock is distributed evenly and the gear catches all squids in its path, the ratio of the swept area to the total area of the fishing ground is an estimate of F. Similarly, it may be generalized for the entire fleet during an interval time if the sum of the area trawled by all vessels is divided by the total area of the fishing ground.

In table 2 are given the F estimates calculated from the swept area by the fleet during the different months used in this paper. These estimates of the fishing mortality rate calculated in this way should not be considered as exact values.

The estimates of biomass given in this paper may be used as an element of comparison in the management of this stock.

5. Acknowledgments

We highly appreciate the valuable suggestions given by Mr. A. Pérez and Mr. R.J. Buesa.

6. References

Beverton, R.J.H. and S.J. Holt. 1956. A review of methods for estimating mortality rates in exploited fish populations, with special reference to source of bias in catch sampling. Rapp. P.-V. Reun. Cons. perm. int. Explor. Mer., 140 p.

Buesa, R.J. and A. Pérez. MS 1978. Normalización de datos primarios. Comisión de Normas y Métodos del Consejo Científico, 13 p.

Chevalier, R. 1978. Biomass estimates of squid, Illex illecebrosus in Subdiv. 3Ps. Spec. Meet. Int. Comm. Northw. Atlant. Fish. Res. Doc., No. 78/II/12, Ser. No. 5164.

Hurley, G.V. and D.E. Waldron. 1977. Population estimates for squid (Illex illecebrosus) in ICNAF Subarea 4 from the international fishery in 1977. Ann. Meet. Int. Comm. Northw. Atlant. Fish. Res. Doc., No. 78/VI/61, Ser. No. 5034.

Lipinski, M. 1978. Stock assessment of Illex illecebrosus (Le Suer, 1821) in ICNAF Division 4W determined by area-density method. Spec. Meet. Int. Comm. Northw. Atlant. Fish. Res. Doc., No. 78/II/10, Ser. No. 5162.

Marí, A., J.J. Terré and R. Domínguez. 1978. Stock assessment of Illex illecebrosus in ICNAF Subareas 3 and 4. Spec. Meet. Int. Comm. Northw. Atlant. Fish. Res. Doc., No. 78/II/17, Ser. No. 5169.

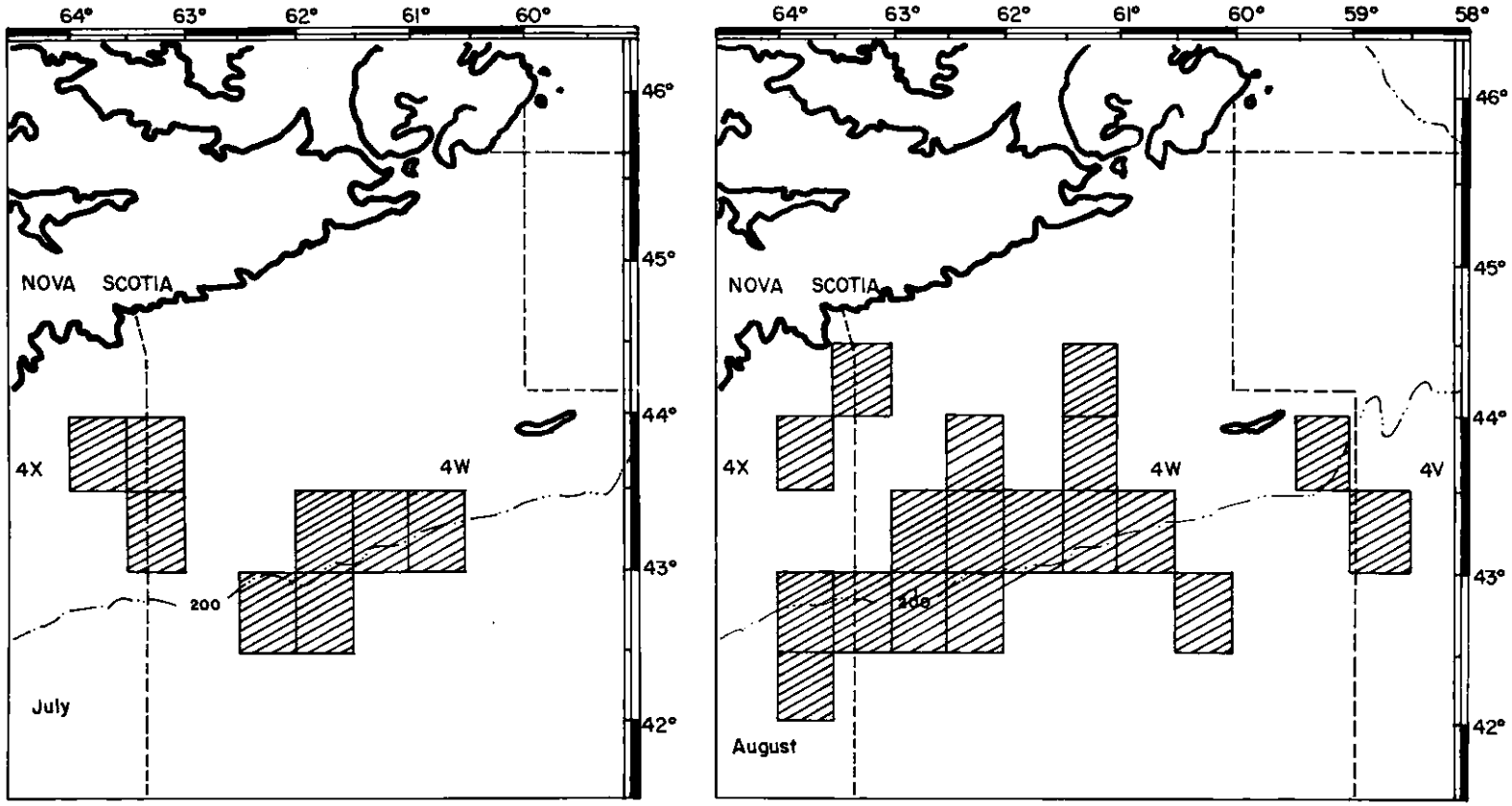
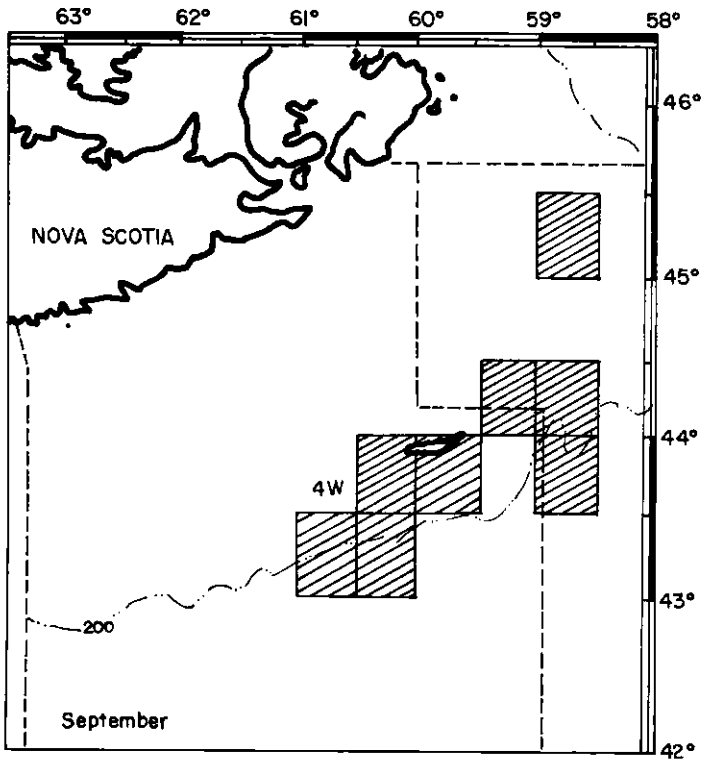


Fig. 1 - Fishing areas in subarea 4 during 1978.



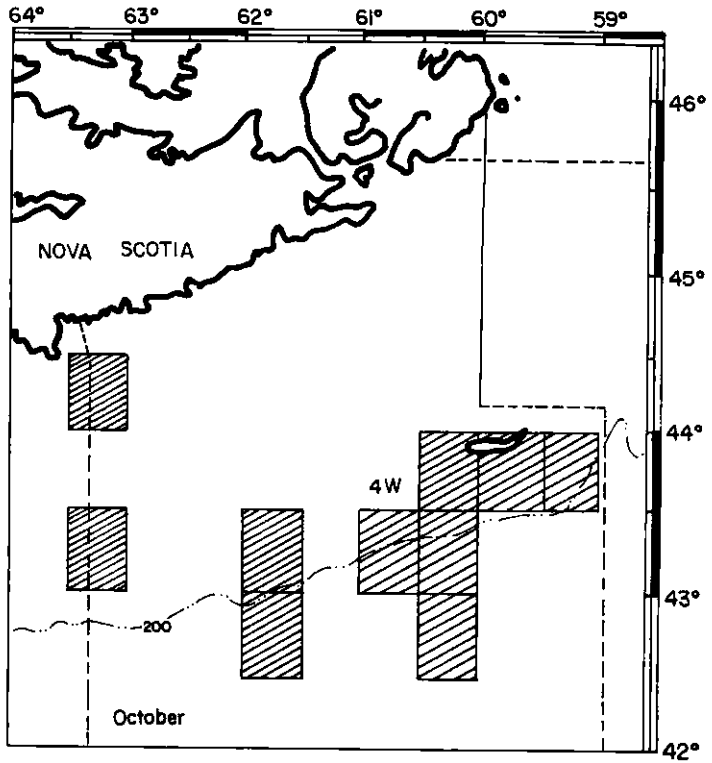


Fig. 2 – Fishing areas in subarea 4 during 1978.

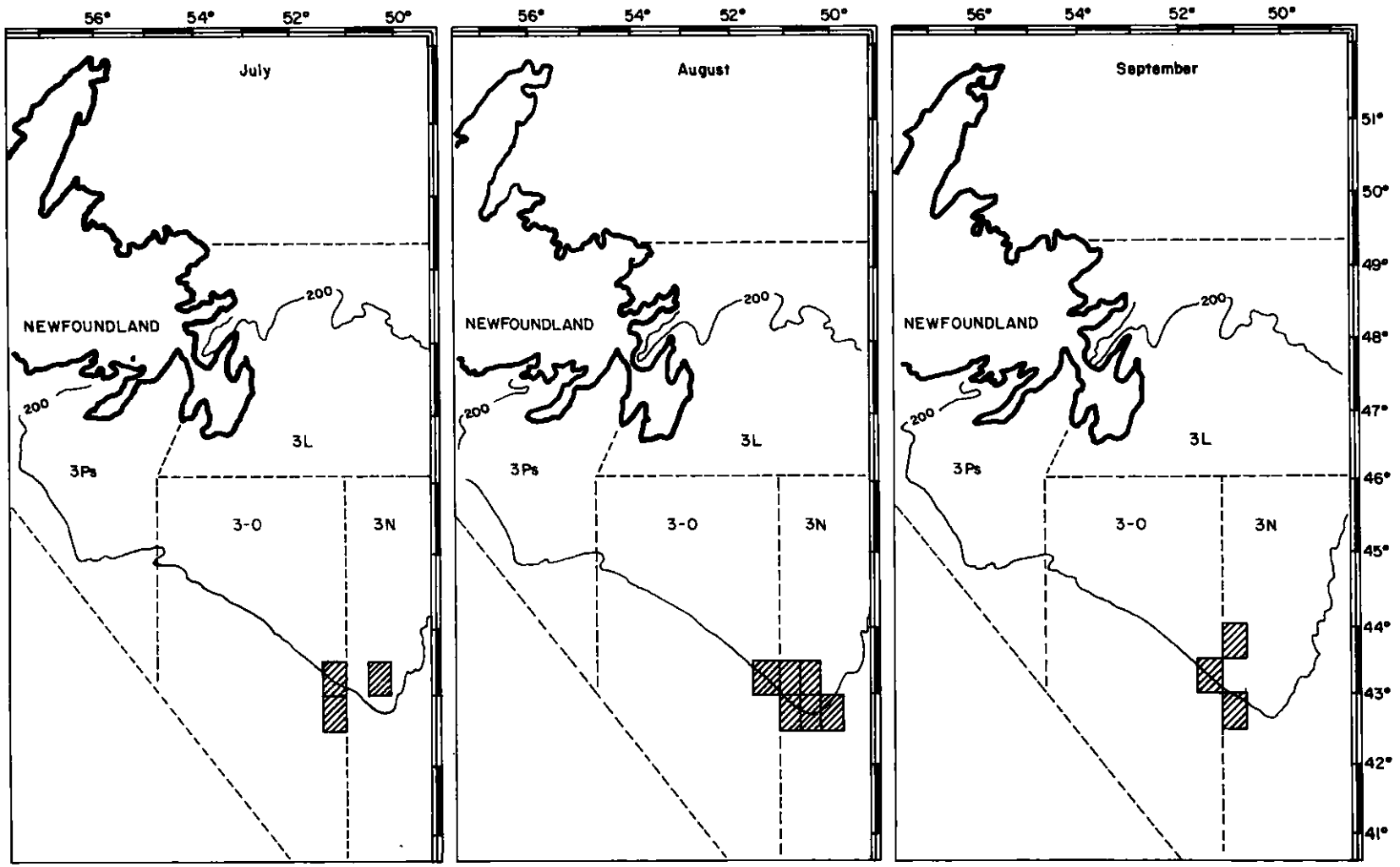


Fig.3 – Fishing areas in subarea 3 during 1978.