Northwest Atlantic Fisheries Organization

Serial No. N510

NAFO SCR Doc. 82/VI/22

# Estimation of *Illex* squid abundance on the southern edge of the Scotian Shelf for the 1981 fishing season

by

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## Introduction

Japanese squid fishery off Canada, which commenced substantially in 1976, expanded greatly in 1978 as the result of quota arrangement between Canada and Japan. Since then, Japanese squid fishery has covered the greater part of the southern edge of the Scotian Shelf. Based on the catch and effort data of the Japanese trawlers, the present report estimates the abundance indices and biomasses of Illex by depth zones, and compares the results with those for the past three years.

## Materials and Methods

Haul-by-haul catch and effort data were collected from all of the 11 Japanese trawlers engaged in the squid fishery. For the subsequent analyses, compiling of the obtained data was confined to those in September for the reason that stock abundance of Illex squid has been estimated from Japanese commercial data for September since 1978 and substantial catches by Japanese trawlers in the 1981 fishing season (Aug. - Oct.) were made during August-September. The operations using the off-bottom trawl were a few, so that the data by this gear were deleted for compiling.

Before calculating abundance index, original effort data (hours fished) are standardized by comparing CPUEs for the time periods of a day (every four hours), companies (4), and tonnage classes (3). The comparison of CPUEs is made, after the data were sorted by Divisions (4V, 4W and 4X) and by depth zones (7 zones from 70 to 200 fathoms). Haul-by-haul catch and standardized effort are resorted by fishing blocks (30' x 30') and by depth zones.

Abundance index in each depth zones ($AI_i$) is calculated by the following equation

$$AI_i = \frac{\sum_j CPUE_{ij} \cdot S_{ij}}{\sum S_{ij}}$$

where $CPUE_{ij}$ is Catch per hour (kg) in depth zone i within block j, and $S_{ij}$ is Area (naut. $mile^2$) of depth zone i within block j.

The area of each depth zone was measured with a planimeter on the following four charts; L-8007, L-8008, L-4012 and Professional Paper 529-C.

The Illex biomass is estimated by areal expansion method, based on the abundance indices and the overall area between 57° W and 66°30' W on the southern edge of the Scotian Shelf (Fig.1). The average distance between the wing tips of the trawl used by 2,000 GRT vessels and the average towing speed were 26m and 3.5 knots, respectively. All squids in the path of the trawl were assumed to be caught.

## Results and Discussion

### Effort standardization

a) Time periods of a day

Illex CPUEs at every four hours expressed in relative value to those for 4:00 - 8:00 are shown in Fig. 2.

It may be suggested that periodical change in CPUE values of Illex in the daytime become smaller year by year. In 1978 Illex CPUE was high in the morning (4:00 - 8:00), and in the evening (16:00 - 20:00) the value dropped to around one half of that in the morning. The CPUEs in 1981 showed an irregular pattern with a few high values, and no significant difference among CPUEs in the daytime could be found. Therefore, effort standardization on the time period basis was not made in the 1981 fishing season, and CPUEs in the daytime (4:00 - 20:00) irrespective of time period were used for the subsequent analyses. No substantial operations being made at night, all of the data for night were excluded.

b) Companies

Comparison of Illex CPUEs among companies was made (Fig. 3).

As no significant differences were observed in CPUE values among companies, CPUEs for companies combined were used for the following analyses.

c) Tonnage class

The relative CPUE values for each tonnage class to those for 2,000 GRT class are shown in Fig. 4.

No difference was observed in average CPUEs between 1,500 GRT and 2,000 GRT class excluding an exceptionally high value. The 1,000 GRT class showed the lowest CPUE of three tonnage classes. Therefore, effort standardization was made on 1,000 GRT class.

The conversion factors for effort standardization are listed in Table 1.

### Abundance index and biomass estimates

The abundance indices obtained are shown in Table 2, together with the corresponding values in the past three years before 1981 (Hatanaka,1981).

It is apparent from Table 2 that the abundance indices by depth zones in September 1981 are generally lower than those in 1980. Especially, the indices indicate a decrese of 40 - 56 % comparing with those in the 1980 fishing season in the main depth zones fished (80 -160 fm in depth). The biomass of Illex squid in September of the 1981 fishing season was estimated to be 49,000 tons, which is about 70 % of that in 1980 and only 7 % of that in 1979 when the stock was most abundant in the latest four years.

The estimates of abundance index and biomass in the depth zone 70 - 80 fathoms are not so confident because of the fewer fishing effort expended which is apt to give a great influence on the biomass estimate. Accordingly, the abundance indices in the main depth zone may be more reliable as Illex stock abundance on the southern edge of the Scotian Shelf in September 1981.

## Reference

Hatanaka, H. 1981: Estimation of abundance index of Illex squid on the southern edge of the Scotian Shelf in September 1981. NAFO SCR Doc. 81/VI/31, Ser. No. N310,8p.

Table 1. Conversion factors in terms of relative value of CPUE for the estimation of abundance index of Illex squid in Subarea 4.

a) Time periods of a day

| Time interval | 00-04 | 04-08 | 08-12 | 12-16 | 16-20 | 20-24 |
|---|---|---|---|---|---|---|
| Conversion factor | 0* | 1.00 | 1.00 | 1.00 | 1.00 | 0* |

b) Tonnage class, gear and company

| Tonnage | Gear | Company | Conversion factor |
|---|---|---|---|
| 1,000 | BT | 05 | 0.53 |
| 1,500 | BT | 04 | 1.00 |
| 1,500 | BT | 05 | 1.00 |
| 1,500 | OBT-C | 05 | 0* |
| 2,000 | BT | 01 | 1.00 |
| 2,000 | OBT-C | 01 | 0* |
| 2,000 | BT | 02 | 1.00 |
| 2,000 | BT | 05 | 1.00 |

BT: Bottom trawl,

OBT-C: Off the bottom trawl with dangling chain.

*: The values mean the data excluded for the estimation.

Table 2. Estimated abundance index and the corresponding biomass of Illex squid on the southern edge of the Scotian Shelf in September of the latest four years.

| Depth zone (fathom) | TS | 1981 | | | | 1980 | | 1979 | | 1978 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S | X | AI | TB | AI | TB | AI | TB | AI | TB |
| 70 - 80 | 1,579 | 295 | 11 | 551 | 18 | 452 | 15 | 8,759 | 281 | 2,691 | 86 |
| 80 - 90 | 963 | 268 | 65 | 398 | 8 | 712 | 14 | 7,290 | 143 | 1,083 | 21 |
| 90 - 100 | 507 | 114 | 195 | 545 | 6 | 976 | 10 | 4,136 | 43 | 3,001 | 31 |
| 100 - 120 | 606 | 171 | 480 | 500 | 6 | 1,002 | 12 | 6,729 | 83 | 2,765 | 34 |
| 120 - 140 | 361 | 62 | 147 | 400 | 3 | 991 | 7 | 7,331 | 54 | 4,115 | 30 |
| 140 - 160 | 243 | 40 | 39 | 331 | 2 | 605 | 3 | 7,335 | 36 | 3,912 | 19 |
| 160 - 200 | 507 | 57 | 7 | 558 | 6 | 716 | 7 | 2,601 | 27 | 1,155 | 12 |
| Total | 4,766 | 1,007 | 944 | | 49 | | 69 | | 667 | | 233 |

S: Area of depth zone fished by Japanese trawler ($mile^2$),

TS: Overall area for the estimations between 57° W and 66° 30' W ($mile^2$),

X: Number of hauls,

AI: Abundance index (kg/hour),

TB: Estimated biomass in the overall area ($10^3$ tons).

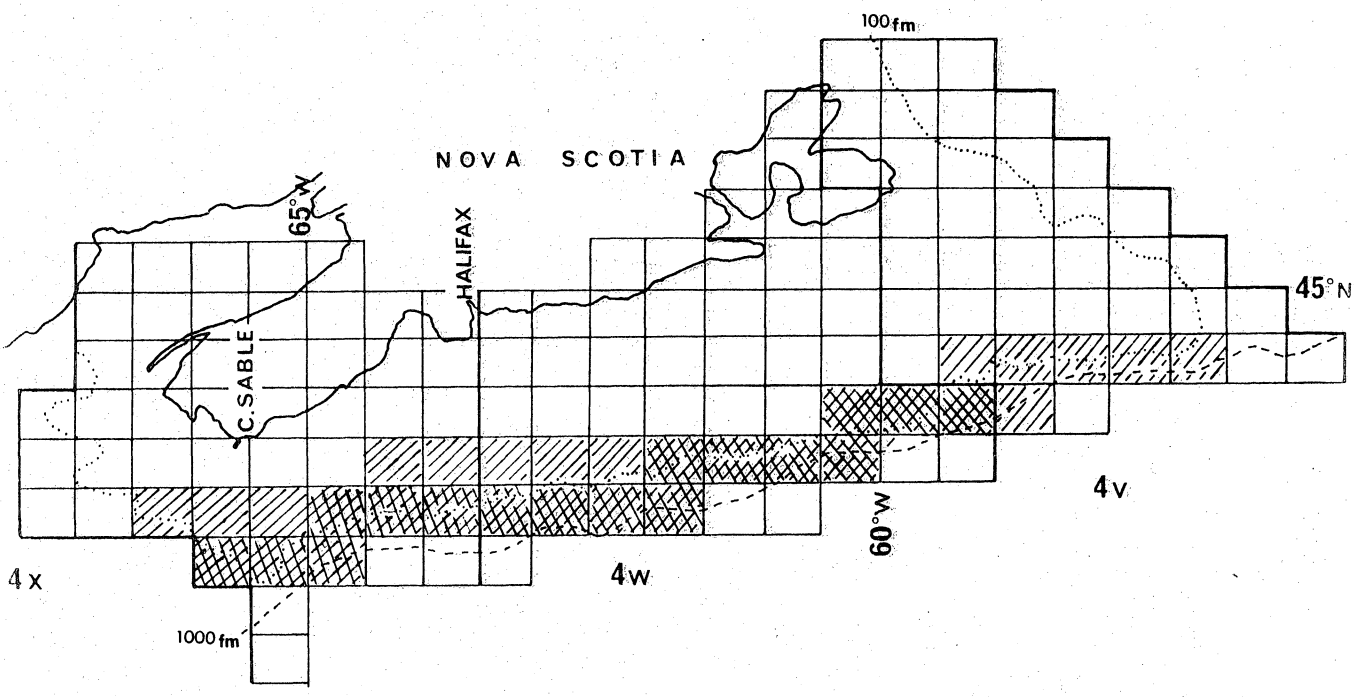


Fig. 1. The shadowed area represents the overall area shown in half-a-degree square blocks for biomass estimation, and that double shadowed indicates the blocks in which Japanese catch and effort data were obtained actually.

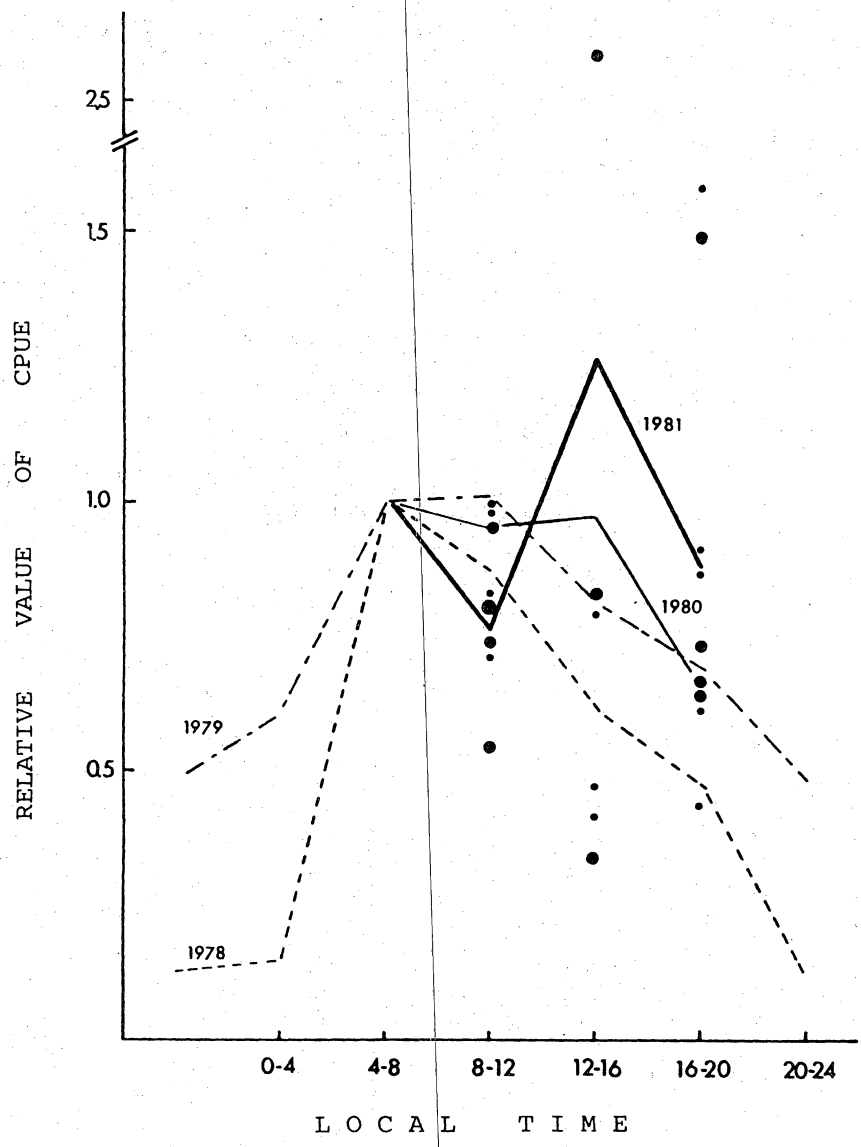


Fig. 2. The diurnal variation in CPUE of Illex squid in Subarea 4, September1981.(Hours fished: • ; 20-40, ● ;>40).

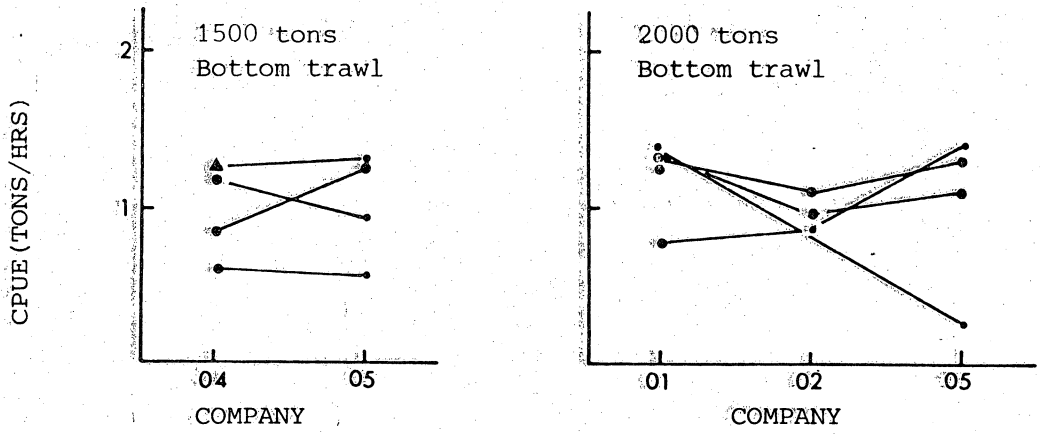


Fig. 3. Comparisons of the Illex CPUE among companies by tonnage classes in Subarea 4, September 1981. ( Hours fished: ▲ ; 10-20, • ; 20-40, ● ; >40)

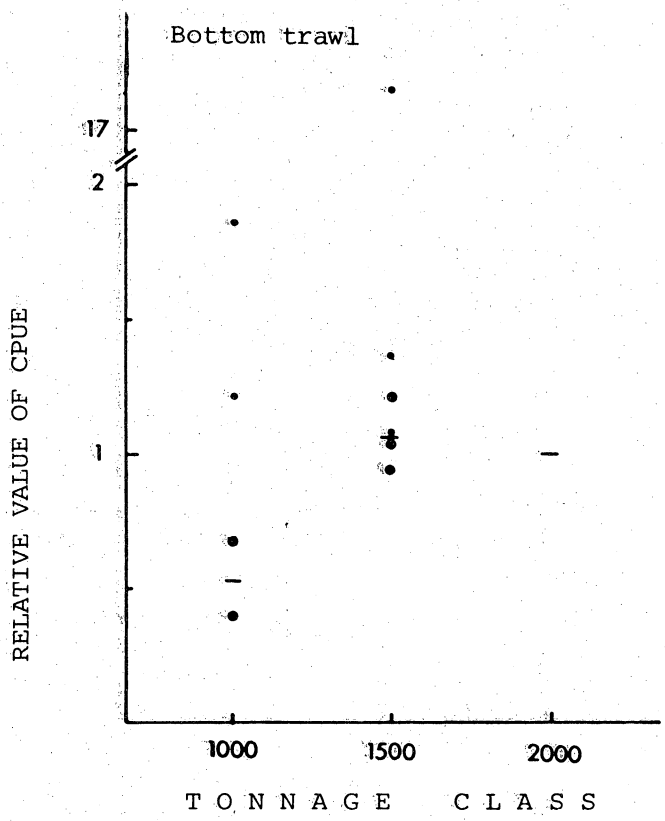


Fig. 4. The relative CPUE values of Illex in each tonnage class against the CPUE of 2,000 tonnage class designated as unity, in Subarea 4, September 1981. The lines indicate mean values. ( Hours fished: • ; 20-40, ● ;>40)