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Estimation of Abundance Index of Illex Squid on the Southern Edge of the Scotian Shelf in September 1980

by

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Introduction

Japanese squid fishery in Subarea 4 had commenced in 1976. It was greatly expanded in 1978 based upon the quota arrangement between Canada and Japan, and the fishing operations by Japanese trawlers had covered the greater part of the southern edge of the Scotian Shelf since 1978. The present report estimates the abundance index of Illex squid for 1980 fishing season based on the haul-by-haul catch and effort data in September reported from all Japanese commercial trawlers engaged in the squid fishery.

Standardization of Fishing Effort

For calculating the abundance index, the conversion factors were estimated for the time period of a day (every four hours), company (5), type of gear (3) and tonnage class (4).

a) Time Period of a Day

Illex CPUEs in relative value at every four hours by the type of gear, company and tonnage class in the respective depth zones (7 zones in 70 - 200 fathoms) of the division is shown in Fig. 1. The values were the highest in three time periods from 04 to 16 hours, and dropped to around two thirds in 16 - 20 hours. Although there was no substantial effort in the periods at night time (00 - 04 and 20 - 24 hours), the CPUEs were considerably low. These trends were similar to those in the previous two years. Therefore, all of the night operations are excluded and the CPUE values in every four hours from

08 to 20 hours are standardized to those in early morning (04 - 08 hours).

b) Company and Type of Gear

These two categories were combined and treated together, and Illex CPUEs by company and gear type, in terms of same time period and tonnage class in the respective depth zones of the division, are shown in Fig. 2. No distinct difference is observed for the cases of 1,000, 1,500 and 3,000 tonnage classes. But in case of 2,000 tonnage class, the values of off-bottom gear of company 05 were smaller than those of bottom gear of companies 01 and 02. Fishing effort of chain type Off-bottom gear was extremely few, so that the data of this gear were not included in the estimation.

c) Tonnage Class

The relative CPUE values of each tonnage class standardized to the bottom trawl gear of 2,000 tonnage class of company 01 are shown in Fig. 3. The result that the value of 1,000 tonnage class was larger than that of 1,500 tonnage class is not understandable, but larger vessel size has higher CPUE value in general.

All of the relative CPUE values against the value of 2,000 tonnage class of company 01, namely, the conversion factors for standardization of fishing effort, are listed on Table 1.

Estimation of Abundance Index

The standardized fishing efforts were calculated based on the conversion factors, and Illex CPUEs by depth zone in each 30'-square block were obtained. Then, the abundance indices in each depth zone, irrespective of 30'-square blocks, were calculated by following equation;

$$AI_i = \frac{\sum_j CPUE_{ij} \times Area_{ij}}{\sum_j Area_{ij}}$$

AI_i : Abundance index in i depth zone
$CPUE_{ij}$: Catch per hour (kg) in i depth zone in j block
$Area_{ij}$: Area ($mile^2$) in i depth zone in j block, refferd to the charts, L-8007, L-8008, L-4012 and Professional Paper 529-C

Furthermore, the Illex biomass are estimated by areal expansion method, based on the abundance indices and the total area of the southern edge of the Scotian Shelf including the areas not covered by the Japanese trawlers (Fig. 4). Calculations of areal expansion were made

on the following assumptions; the average distance between wing nets of trawl gear used by 2,000 tonnage class is 26 m and the towing speed is 3.5 knots. Therefore, the area of 0.0491 square miles is covered by one hour haul. All squid in the area covered were assumed to be caught.

The results obtained are shown in Table 2, together with the corresponding values in 1978 and 1979 (Nagai and Uozumi, 1980).

The abundance indices in 1980 were the lowest among the latest three years in every depth zone, and the values in 1980 were about one third to one fourth of those in 1978 and one fourth to one seventh of those in 1979 in the depth zones within 90 - 140 fathoms where around 90 % of the fishing effort were expended. Especially in the blocks east of 64°W, Illex CPUEs were considerably low, compared with the values in the previous two years. Consequently, the abundance indices dropped to low level. Some descriptions on the block-by-block CPUEs are given in another document (Hatanaka, 1981).

The standing biomass of Illex squid in September 1980 was estimated to be 69,000 tons, which is about one third of the value in 1978 and one tenth of 1979. The abundance index in 70 - 80 fathoms which was the widest depth zone was notably low, so the total biomass decreased to such a low level.

Discussion

The estimates of standing biomass, thus calculated, may include bias originated from commercial data, and the values are not so reliable in the shallower waters than 90 fathoms, because of insufficient fishing effort expended. Therefore, it is more appropriate to compare the abundance indices in the depth zone of 90 - 140 fathoms in successive three years than to evaluate the estimates of the total biomass.

It will be concluded that the abundance of Illex squid in September 1980 on the southern edge of the Scotian Shelf is about one third to one fourth of that in 1978 and one fourth to one seventh of that in 1979.

References

H. Hatanaka, 1981: Outline of Japanese squid fishery in NAFO Subarea 3 and 4. NAFO SCR Doc., 81/VI/30.

T. Nagai and Y. Uozumi, 1980: Estimation of the abundance index of Illex based on Japanese fisheries operations on the edge along the Scotian Shelf, 1979. NAFO SCR Doc., 80/II/9.

Table 1. Conversion factors in terms of relative value of CPUE for the estimation of abundance index of Illex squid in Subarea 4. The values of 0.00 mean the data excluded from the estimation.

a) Time periods of a day

Time interval	00-04	04-08	08-12	12-16	16-20	20-24
Conversion factor	0.00	1.00	0.95	0.97	0.65	0.00

b) Tonnage class, gear and company

Tonnage	Gear	Company	Conversion factor
1,000	OBT-C	03	0.00
1,000	OBT-B	04	0.82
1,000	BT	03	0.82
1,000	BT	05	0.82
1,500	BT	02	0.73
1,500	BT	04	0.73
1,500	BT	05	0.73
2,000	OBT-C	01	0.00
2,000	OBT-B	05	0.83
2,000	BT	01	1.00
2,000	BT	02	1.00
3,000	BT	01	1.67
3,000	BT	03	1.67

BT : Bottom trawl gear

OBT-C: Chain type off-bottom trawl gear

OBT-B: Bobbin type off-bottom trawl gear

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

Depth zone (fathom)	TS	1980				1979		1978	
		S	X	AI	TB	AI	TB	AI	TB
70 - 80	1,579	264	16	452	15	8,759	281	2,691	86
80 - 90	963	301	89	712	14	7,290	143	1,083	21
90 - 100	507	134	225	976	10	4,136	43	3,001	31
100 - 120	606	138	806	1,002	12	6,729	83	2,765	34
120 - 140	361	58	337	991	7	7,331	54	4,115	30
140 - 160	243	34	45	605	3	7,335	36	3,912	19
160 - 200	507	64	16	716	7	2,601	27	1,155	12
Total	4,766	993	1,534		69		667		233

S : Area of strata fished by Japanese trawlers ($mile^2$)

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

X : Number of hauls

AI: Abundance index (kg/hour)

TB: Standing biomass in the overall area (10^3 tons)

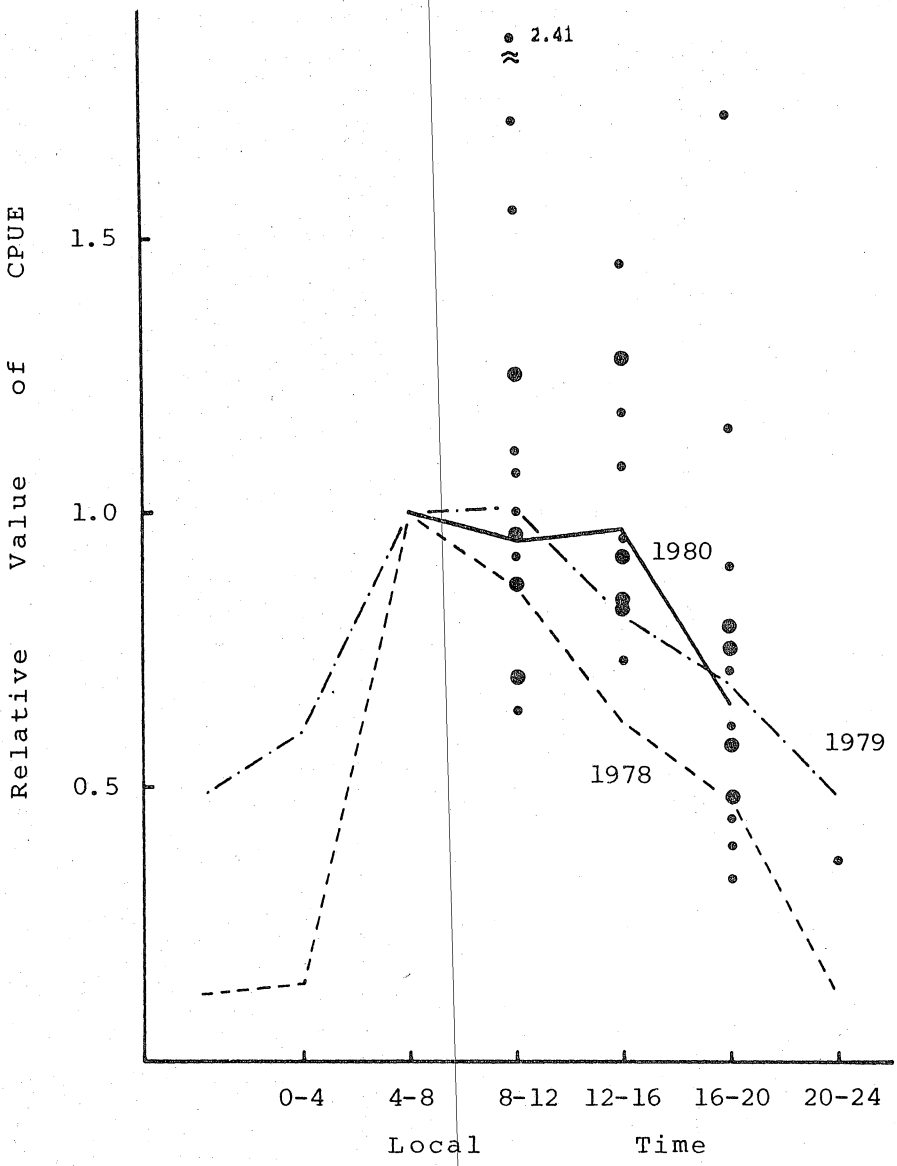

Fig. 1. The diurnal variation on CPUE of Illex squid in Subarea 4, September 1980. Large and small dots indicate over 40 and 20 - 40 hours fished, respectively.

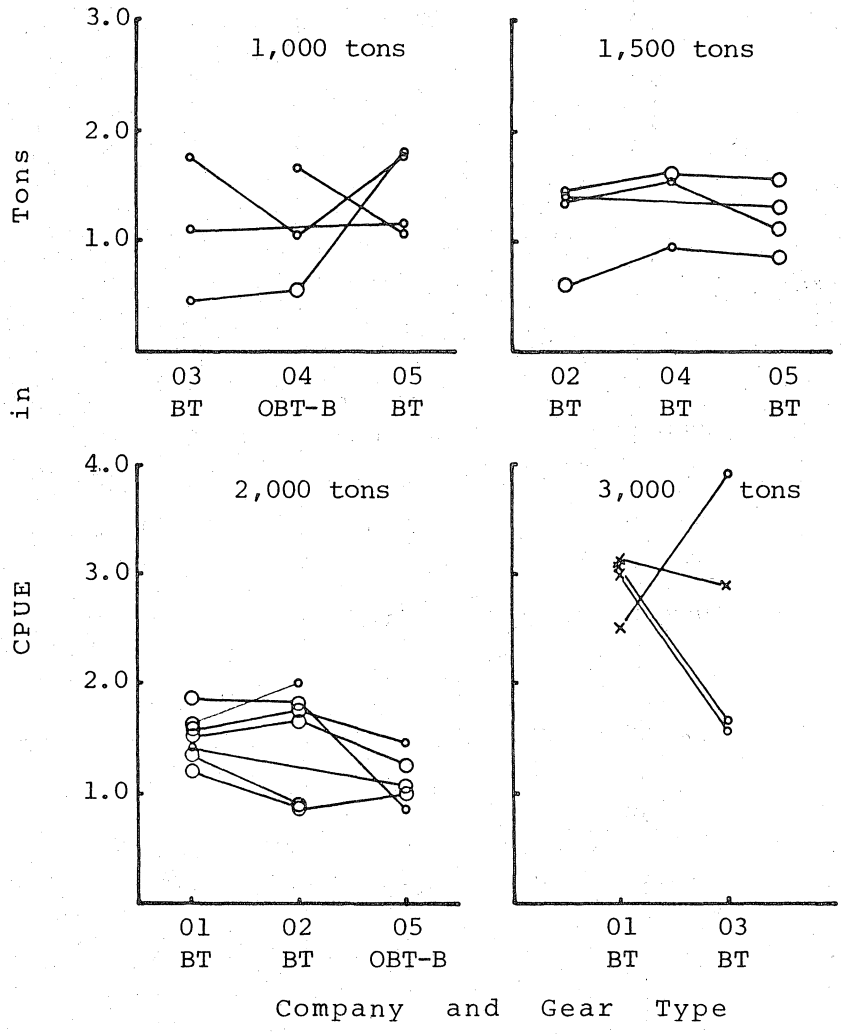

Fig. 2. Comparisons of the Illex CPUE among company and gear type in Subarea 4, September 1980. Cross, small and large circles correspond 10 - 20, 20 - 40 and over 40 hours fished, respectively.

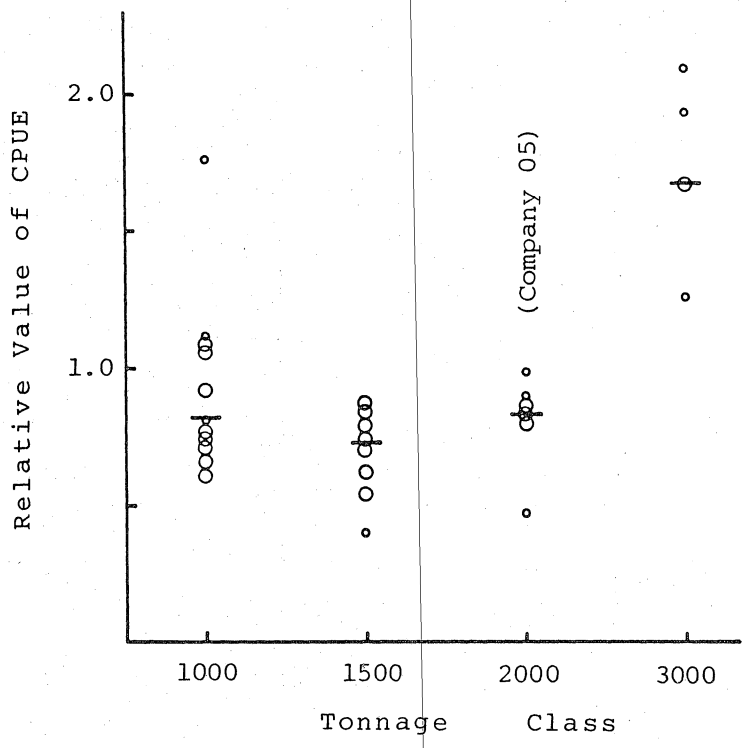

Fig. 3. The relative CPUE value of Illex in each tonnage class against the value of 2,000 tonnage class of company 01 in Subarea 4, September 1980. The lines indicate mean values, and large and small circles correspond over 40 and 20 - 40 hours fished, respectively.

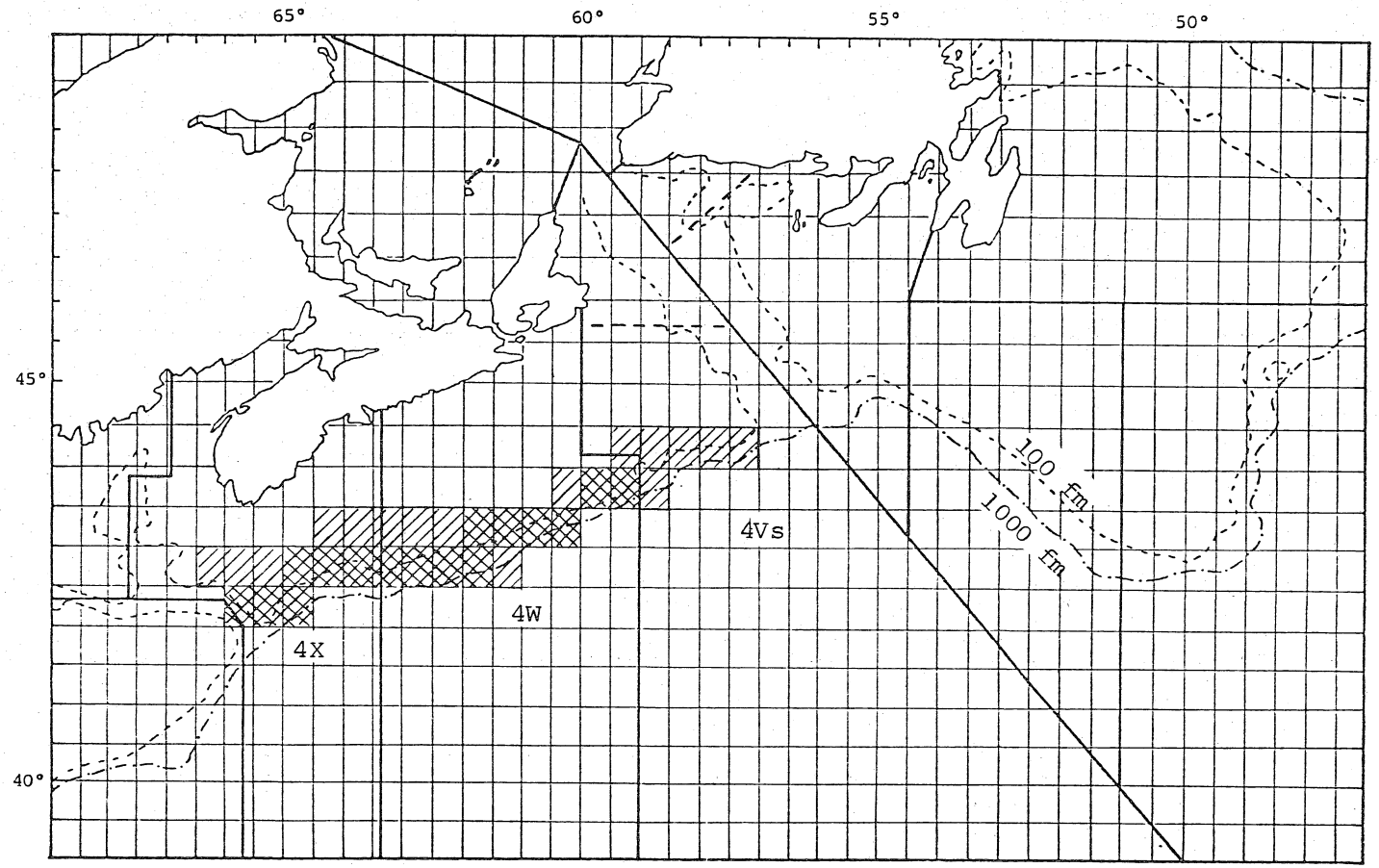

Fig. 4. The extent of the area treated in this report in the unit of 30'-square block (oblique lines), and the blocks where catch and effort data obtained by Japanese trawlers in September 1980 (crossed lines).