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Estimation of the Abundance Index for *Illex* Based on Japanese Fishery Operations Along the Edge of the Scotian Shelf, 1979

by

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The main aim of this paper is to estimate abundance index of Illex stock on the edge of the Scotian Shelf in 1979 on the basis of haul-by-haul catch and effort data from 14 Japanese trawlers, and to compare the results with those obtained by same method in 1978. For calculating abundance index, original effort data(hours hauled) are standardized for the time period of a day(every four hours),companies(5), tonnage class(4) and the type of gear (2).

Haul-by-haul data with thus calculated effort were sorted by three keys, namely: month, fishing block(30'x 30') and depth zones(12 zones). Abundance index for each month is calculated from CPUE weighted by area of the stratum. Area by fishing block and by depth zone are calculated by planimeter on the following four charts: L-8007,L-8008, L-4012 and Professional Paper 529-C.

a) Time periods of a day

Change of CPUE by the time periods fished indicates that the values are highest in the morning irrespective month, tonnage class and type of gear. During night time from 20 to 4 hour, the values drop to about one half of those in the morning(Fig. 1). Accordingly, the CPUE values in every four hours from 8 to 4 hour are adjusted based on those early in the morning(4 to 8 hour). Fig.1 also indicates that diurnal change in CPUE values are smaller in 1979 than in 1978. This is one of the characteristics observed in the fishing operation in 1979.

b) Companies

Significant difference in CPUE values are observed between companies only in the off-bottom trawl gear of 2,500 tons class. However,no significant differences among different companies are found on any other tonnage class and type of gaer(Fig.2). Therefore, all data other than these of 2,500 tons class are combined regardless companies.

c) Tonnage class and type of gear

In both gear types, CPUE values are highest in the 2,500 tons vessel class of company 01 with large variation. To the contrary, the 2,500 tons class of company 05 shows lowest CPUE among various tonnage classes. No satisfactory explanation can be made for the present results observed in the 2,500 tons vessel class. Except these, however, it is apparent that larger the vessel size higher the CPUE values(Fig. 3).

Conversion factors are calculated for each tonnage class against CPUE of 2,500 tons class of company 01 (designated as the unity).

Comparison between two types of gear can not be made, since the bottom trawl gears were used in the Canadian silver hake box and the off-bottom trawl gears in the east of the box.

The previous paper(Nagai and Kawahara,1979) indicated the difference between gear types were smaller than those among different tonnage classes. For these reasons, the bottom trawl data which are rather few are standardized by using the conversion factors calculated for the off-bottom trawl gear.

Conversion factors used are listed on Table 1.

Based on these conversion factors, all original data are standardized and abundance indexes are calculated in September and October. The results are shown on Table 2. Abundance index of the biomass in September of 1978, higest throughout the last year fishing season, are also shown on the table.

It is noted from the table that abundance indexes are higher in any depth in 1979 than the last year. In the main fishing grounds with the depth of 90- 140 fathoms, the abundance indexes in 1979 are 1.4 - 2.4 times higher than those in 1978. Moreover, it seems that the abundance of Illex in shallower water than 90 fatoms is as high as those in the depth zones mainly operated.

The Illex biomass are estimated based on abundance indexes given on Table 2.

In the off-bottom trawl gear of 2,500 tons class used as the unity for abundance estimation, the average distance between wing net is 26 m and the speed of towing is usually 3.5 knots. Therefore, area of 4.91×10^{-2} square miles is covered by one hour haul. All squids in the area covered are assumed to be caught.

The area used for biomass estimation covers all the southern edge of the Scotian Shelf (70-200 fathoms in depth) as shown in Fig.4. There are no operation west of 63°30'W in 1979. Since the Japanese trawlers directing squids and argentines operated in the area mentioned abouve in 1978, the biomass estimated in the previous report did include the biomass in that area. In order to compare the estimated biomass of two years on the same basis, the biomass estimation in 1979 was extraporated to the area west of 63°30'W on the basis of index given in Table 2.

The estimated biomass by month are also shown in Table 2. The estimate in September 1979 is 690,000 tons which is about 2.8 times compared with the corresponding value in 1978. In the main fishing grounds with depth of 90-140 fathoms, the ratio is 1.9 times.

The abundance of Illex in the area shallower than 90 fathoms in depth seems to be fairy high in 1979. And then all catch of 7 Japanese jigging vessels under Canadian quota were made all over the Scotian Shalf. These facts indicate that the estimates calculated for the whole biomass in Subarea 4 are more or less underestimated. On the other hand, the biomass estimates are not so reliable in the shallower water than 90 fathoms, due to insufficient number of hauls.

For these reasons, it is more appropriate to compare the abundance index in successive two years than to evaluate the estimated biomass, though the ranges covered by trawlers were slightly different. Accordingly, it is concluded that the abundance of Illex in the main squid fishing area in 1979 is 1.4 to 2.4 times compared with those in 1978 (the weighted mean by area is 1.9) .

Literature cited

Nagai, T and S. Kawahara, 1979. Estimation of the Illex biomass on the edge along the Scotian Shelf, 1979. ICNAF Res. Doc. 79/II /20. 8p.

Table 1. Conversion factors in terms of relative values of cpue for the estimation of standing biomass of Illex.

1) Concerning the time periods of a day

Time interval	00-04	04-08	08-12	12-16	16-20	20-24
Conv. factor	0.60	1.00	1.01	0.81	0.69	0.48

2) Concerning tonnage class, gear and company

Tonnage	Gear	Company	Conversion factor
1000	OBT	03	0.50
1000	BT	03	0.50
1000	OBT	04	0.50
1000	BT	04	0.50
1000	OBT	05	0.50
1000	BT	05	0.50
1500	OBT	01	0.62
1500	BT	01	0.62
1500	OBT	02	0.62
1500	BT	02	0.62
1500	OBT	03	0.62
1500	BT	03	0.62
1500	OBT	04	0.62
1500	BT	04	0.62
1500	OBT	05	0.62
1500	BT	05	0.62
2000	OBT	02	0.60
2000	BT	02	0.60
2500	OBT	01	1.00
2500	BT	01	1.00
2500	OBT	05	0.45
2500	BT	05	0.45

OBT: Dangling chain off the bottom trawl.

BT: Bottom trawl.

Table 2. Estimated abundance index of Illex and the corresponding standing biomass on the southern edge of the Scotian Shelf.

Depth zone		Sept.				Oct.				Sept(1978)				Sept.
(fathom)	TS	S	X	AI	TB	S	X	AI	TB	S	X	AI	TB	AI('79)/AI('78)
70 - 80	1,579	141	2	8,759	281	12	1	1,258	138	35	5	2,691	86	3.2
80 -	963	67	12	7,290	143	24	3	2,010	110	292	38	1,083	21	6.7
90 -	507	73	60	4,136	43	51	33	3,924	58	129	115	3,001	31	1.4
100 -	606	137	751	6,729	83	72	504	3,449	81	162	619	2,765	34	2.4
120 -	702	91	289	7,331	105	122	194	7,789	83	108	285	4,115	59	1.8
140 -	158	40	19	7,335	24	17	3	2,517	19	71	23	3,912	13	1.9
160 -200	254	29	3	2,601	13	-	-	-	-	12	1	1,155	6	2.3
Total	4,769	478	1,136		692	298	738		489	809	1,086		250	

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

TS: Overall area for biomass estimation($mile^2$).

X: Number of hauls.

AI: Abundance index(kg/hour).

TB: Total standing biomass estimated in the overall area(10^3tons).

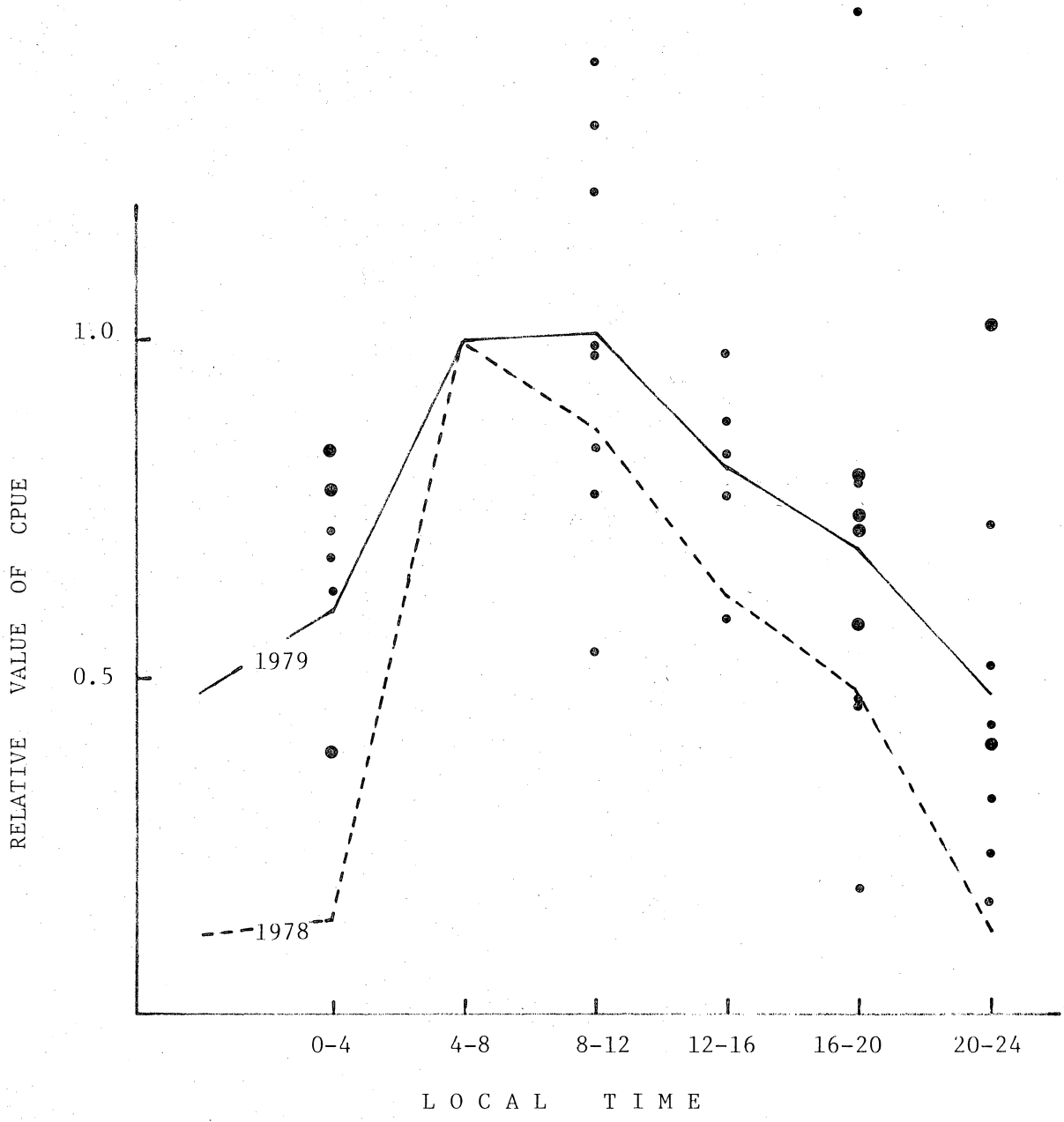

Fig. 1. The diurnal variation of CPUE of Illex.
(Hours fished: ● ; 20-40, ● ; > 40)

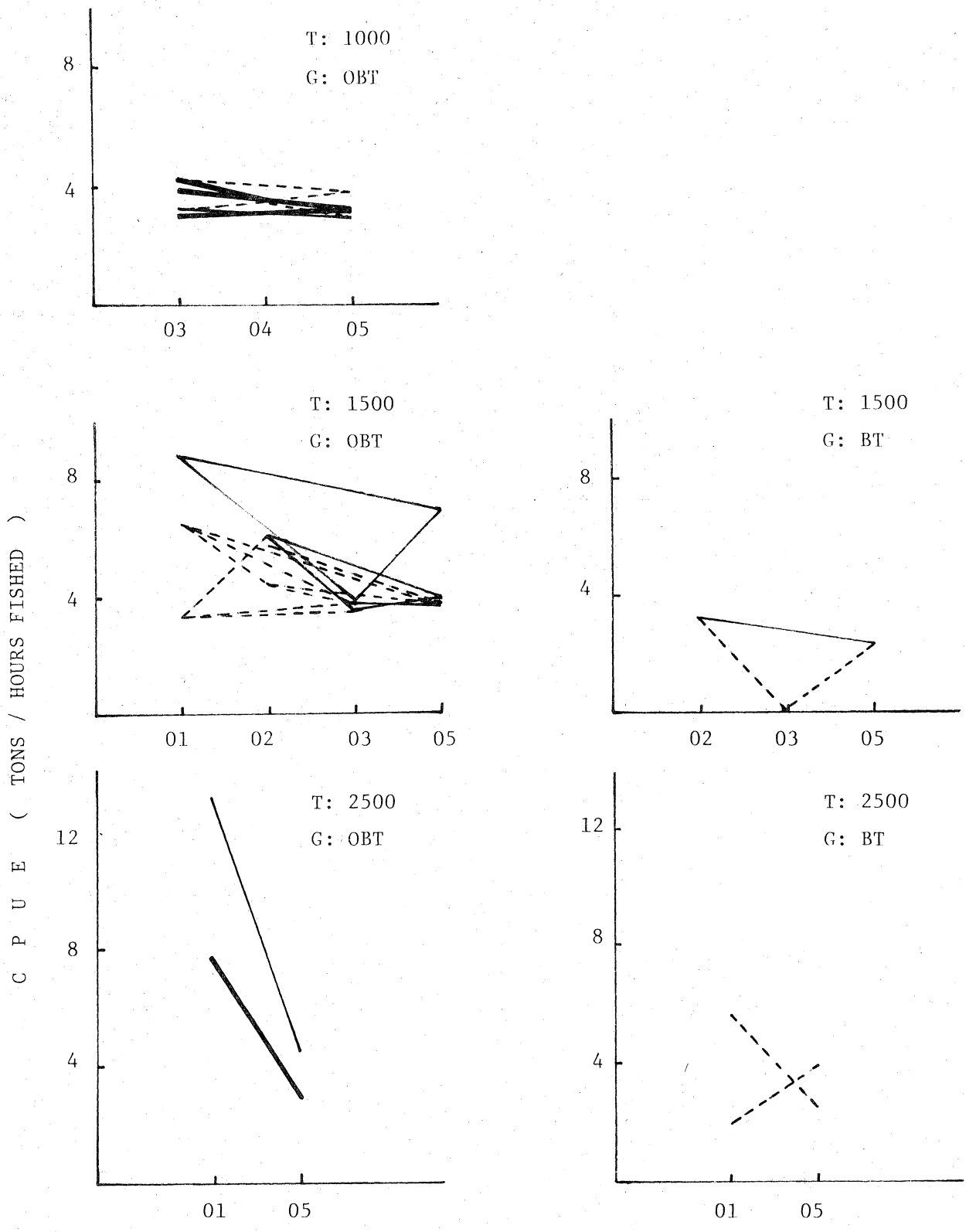

Fig. 2. Comparisons of the cpue values among the companies by tonnage class(T) and type of gear(G). (Hours fished: - - - ; 20-40, ——— ; 40-80, ▬▬ ; >80)

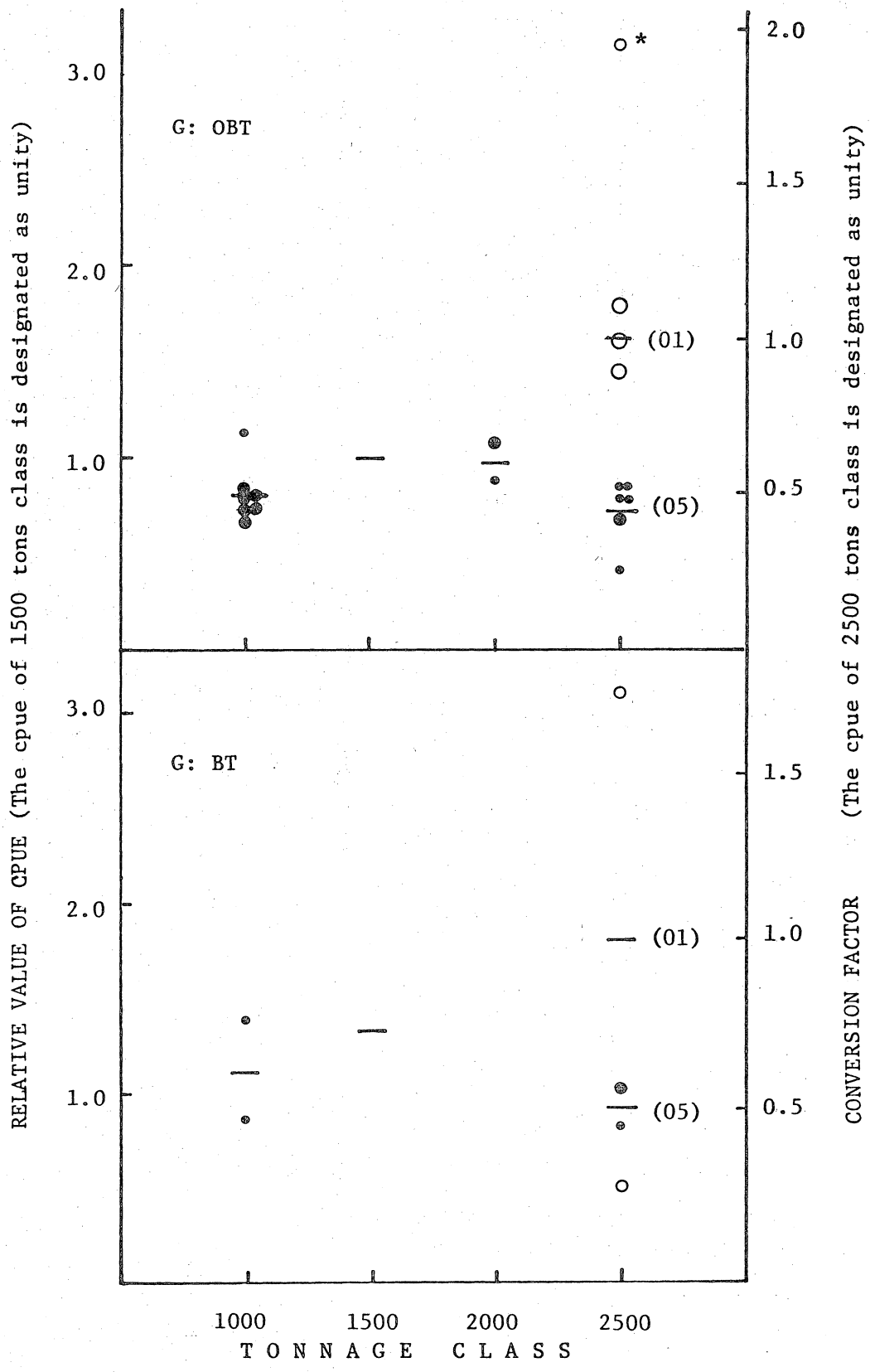

Fig. 3. Relative value of the cpue by tonnage class and type of gear. The lines represent average values, and the numerals in parentheses indicate the code number of companies. (Hours fished: ● ; 40-80, ● ; ⩾80) *: Exceptionally high value omitted in the average calculation.

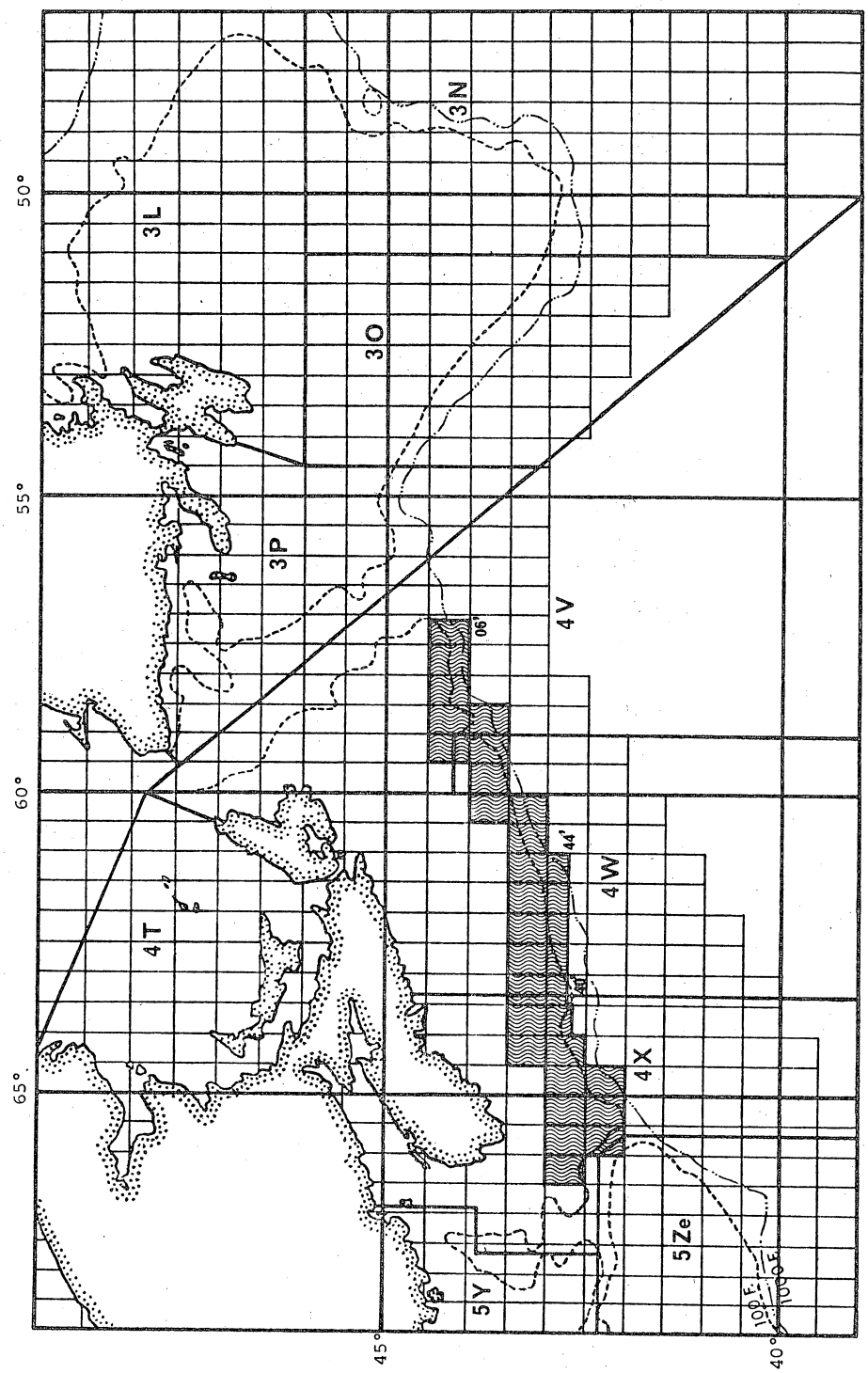

Fig. 4. Range and locality of fishing grounds, shown in half-a-degree square blocks, for biomass estimation.