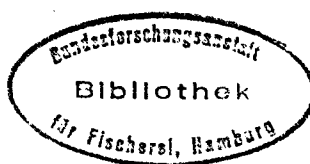


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Flounder Migrations and Mortality Rates  
in the Southern Baltic

by

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In the tagging experiments conducted during 1960-1962, 2550 flounder (Pleuronectes flesus L.) were liberated in the Southern Baltic, mainly in the Gdańsk Bay. Until the 30th of June 1963, 532 fish were recaptured. The percentage of recapture in these experiments, amounting to 20.9%, is higher than that obtained in our pre-war experiments, when the total recapture after several years only amounted to 16.17% (Cieglewicz, 1947). This difference may be caused by the greater intensity of fishing in the last period.

The comparison of the place of liberation and the place of recapture as presented on Figures 1-5, affirmed the conclusions on the migrations of the flounder, drawn on the basis of our previous experiments.

In the southern Baltic, the flounder undertake seasonal movements between the coastal and deep water of the Gdańsk Bay and Bornholm Basin, which are the spawning and feeding migrations. Apart from these short-distance movements, some percentage of flounder undertake much longer migrations (150 s.m., or even more), mostly directed westwards. In several cases flounder liberated in Gdańsk Bay was recaptured in the Bornholm or Arcona Basin. Migration of the flounder from Gdańsk Bay to Bornholm and Arcona Basin, may probably be explained as the return of the fish to their place of birth, from which they were passively shifted eastwards by the current in the stage of egg and larvae.

In several cases distinct length increments of the tagged flounder were observed. The largest length increment amounting to 13 cm, was reached during the date of liberation 6.IX.1960 and the date of recapture 5.IV.1963.

From the number of recaptured flounder in the 3-month period summed together in all experiments conducted during 1960-62 (Table 1), the fishing mortality is calculated similarly as in my previous contribution (Cieglewicz, 1962), using the following formula given in the book of R.J.H. Beverton & S.Holt (1957):

$$F = \frac{\frac{n_1}{T} \log_e \left( \frac{n_1}{n_2} \right)}{N_0 \left( 1 - \frac{n_2}{n_1} \right)} = 0.72$$

This value corresponds to the annual mortality rate 51.3%, and is little lower than that obtained in my previous contributions, based on the tagging experiments conducted in 1960 and 1961, when it amounted to 52.2% (F = 0.76).

Table 1 Number of recaptures (n) and logarithm of the number of recaptures (log<sub>e</sub> n) in 3-month period

Year of tagging	1960		1961		1962		Total	
Number of tagged fish	400		1159		991		2550	
3-month period	n	log <sub>e</sub> n	n	log <sub>e</sub> n	n	log <sub>e</sub> n	n	log <sub>e</sub> n
1	55	4.01	103	4.63	165	5.11	323	5.78
2	20	3.00	24	3.18	46	3.83	90	4.50
3	14	2.64	23	3.14	27	3.30	64	4.16
4	8	2.08	19	2.94	14	2.64	41	3.71
5	4	1.39	7	1.95	3	1.10	14	2.64
Total	101		176		255		532	

As the annual total mortality rate of the flounder in the southern Baltic calculated on the basis of the age composition of the catches in 1957-61 was 64.6% ( $F + M = 1.04$ ), hence the natural mortality rate is about 13%.

It is interesting to compare the annual fishing mortality rate calculated on the basis of the recaptures in separate years with the yearly Polish catches of the flounder in the Baltic.

Year	F	Annual fishing mortality rate (in %)	Yearly Polish catch of flounder (in tons)
1960	0.69	49.8	1631
1961	0.71	50.8	2157
1962	0.76	53.2	2319

The increasing fishing mortality rate corresponds with the growing intensity of fishing in the last years.

In order to compare the usefulness of different types of tagging, two types of tag were used:- in the experiments conducted during January 1962 the plastic flag-tag produced in Poland, and the Petersen ebonite disc-tag, kindly given us in exchange for Polish tags by Dr. Otterlind, Sweden, were used.

From 498 flounder tagged with plastic flag-tag 107 were recaptured - 20.7% were announced within 18 months, while from 496 Petersen disc the number of recaptures in the same period was 148 or 29.8%.

It seems from this comparison that the Petersen disc-tag is more useful for tagging of flatfish than the plastic flag-tag. This difference may also be caused by the difference in colour of the tag, which in the case of plastic flag-tag (red) was less noticeable on the pigmented side of the flounder than the colour of the Petersen disc (black).

#### References

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|------------------|------|--|
| Beverton, R.J.H. | 1957 | "On the dynamics of exploited fish populations" Fish. Investig. Ser. II, XIX.  |
| Cieglewicz, W.   | 1947 | "Wedrówki i wzrost znakowanych storni ( <u>Pleuro-nectes flesus</u> L.) z Zatoki Gdańskiej i Basenu Bornholmskiego". Arch. Hydrobiologii i Rybactwa T. XIII. |
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- ☼ 5.IX.60, 10.XI.60, 19.X.61
- ☉ 6.IX.60
- △ 9.XI.60
- ⊗ 13.XII.61
- ⊗ 12.XII.61
- ☉ 7.XII.61

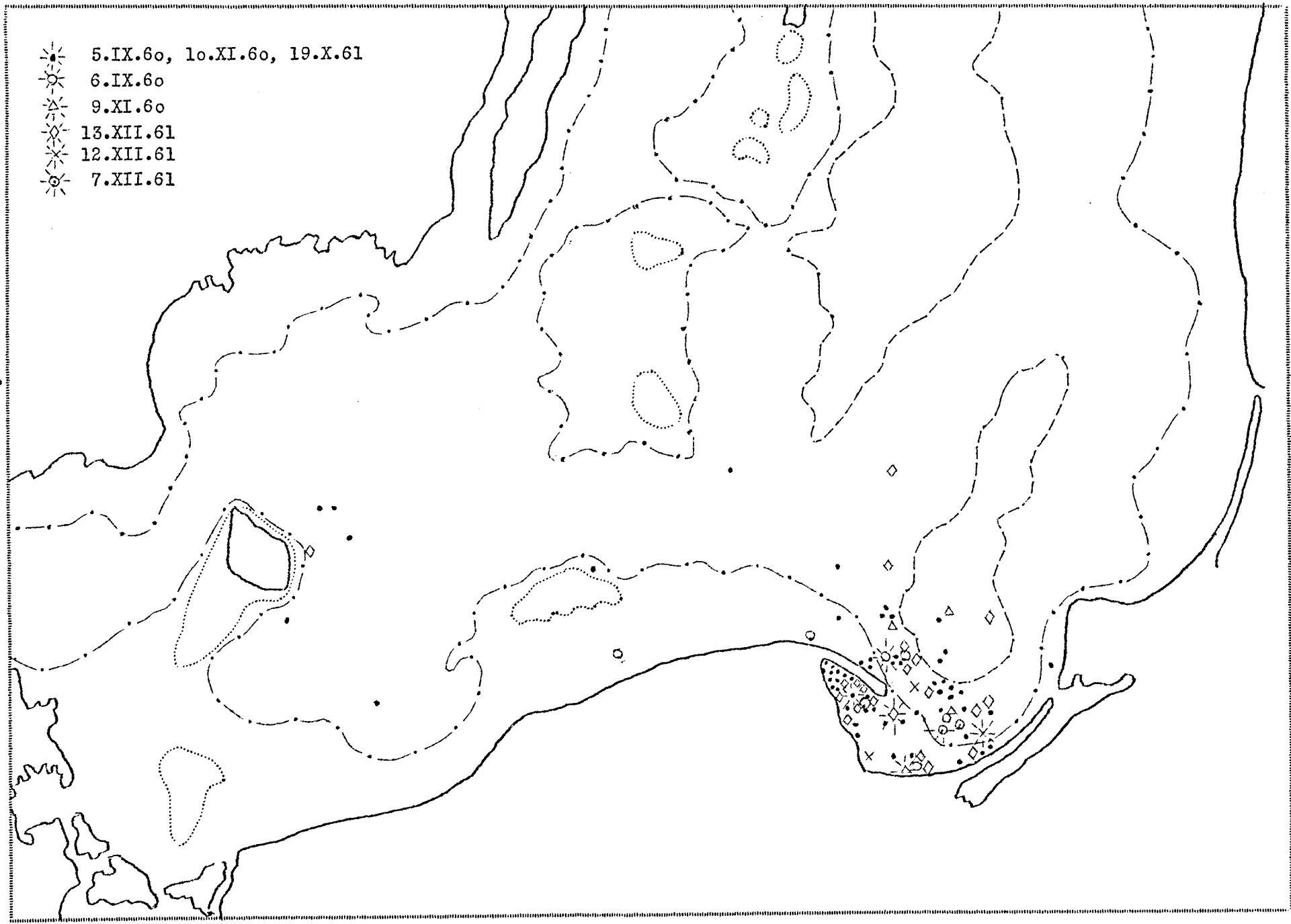


Figure 1. Migrations of the flounder tagged in autumn 1960 and 1961.

- ☼ 24-26.I.61
- ⊙ 10-24.I.61, 3.II.60
- △ 19.II.60
- ◇ 19.II.60
- ⊙ 11.I.61
- ✕ 11.I.61

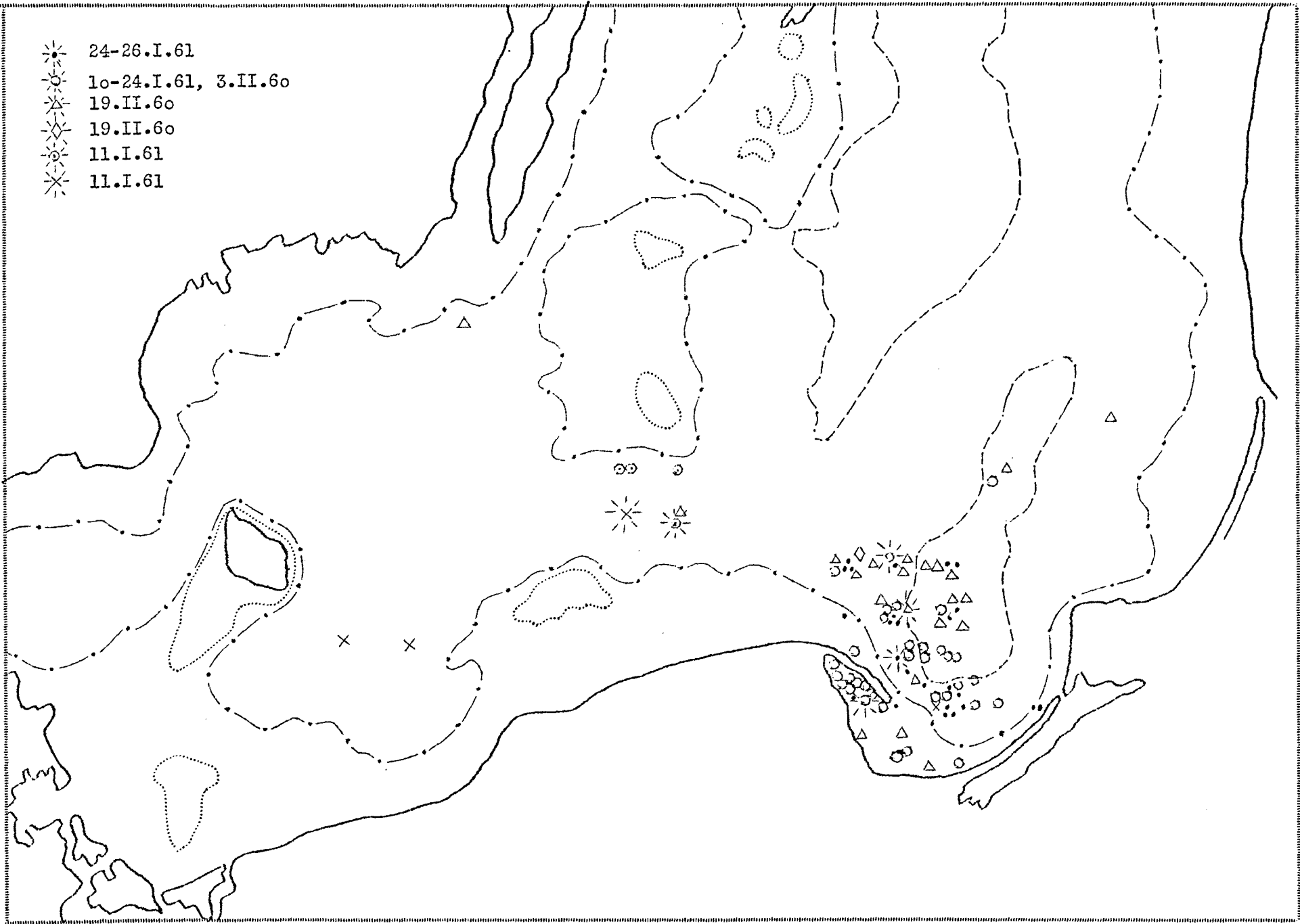
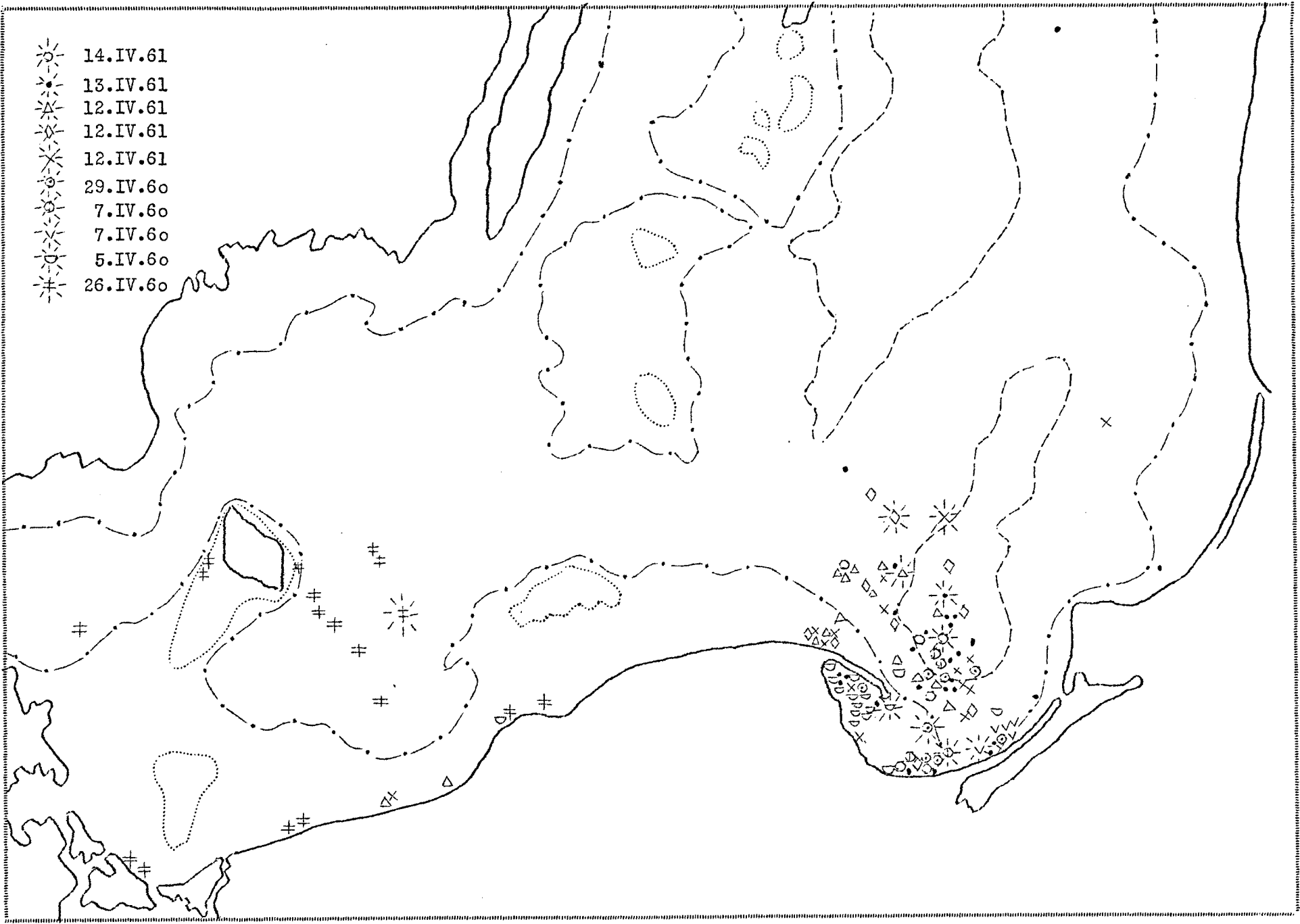


Figure 2. Migrations of the flounder tagged in winter 1960 and 1961.

Figure 5. Migrations of the flounder tagged in spring 1960 and 1961.



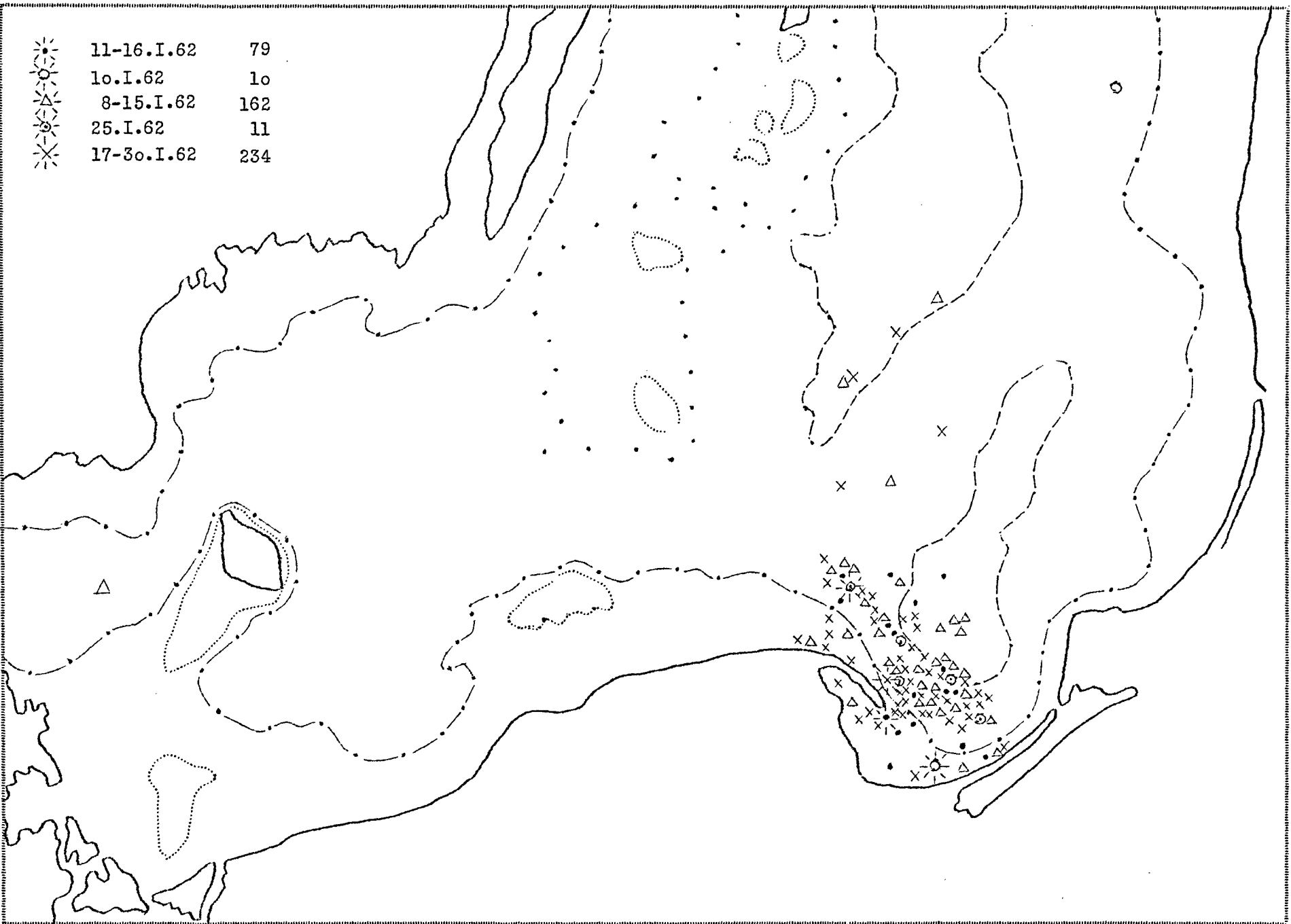


Figure 4. Migrations of the flounder tagged in winter 1962 with the plastic flag-tag.

Figure 5. Migrations of the flounder tagged in winter 1962 with the Petersen ebonite disc-tag.

