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Polish Cod Tagging Experiments in the Gdańsk Area
in 1957 - 1962

by

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The Gdańsk Bay area is the main region of Polish cod catches. In 1957-62 the landings in this area fluctuated from about 15.000 to 27.000 tons per year. During this period 7371 cod were tagged, and of this number 1044 individuals, i.e., 14.1%, were recaptured. The results of tagging for particular years are shown in Table 1.

Table 1

Y e a r s	No. of fish tagged	No. of fish recaptured	% of fish recaptured
1957	960	49	5.1
1958	1220	133	10.9
1959	1753	248	14.1
1960	1811	325	17.9
1961	1107	225	20.3
1962	520	64	12.3

For tagging in the years 1957 and 1958, two types of tags, silver and plastic tags, were used. The results of tagging were different, depending on the type of tags used. In 1957-58 the recaptures were 3.6% and 2.6% for silver tags, whereas by the application of plastic tags they were 10.1% and 14.6%, respectively. The observations proved that silver tags were more easily lost, and consequently less fish were recaptured with silver tags than with plastic tags. In 1959 it was therefore decided to use only plastic tags. From the figures given in Table 1 it appears that the percentage of recaptures increased in consecutive years. One of the reasons for this increase is to be attributed to increasing intensity in catches in the Southern Baltic.

Table 2 Periods of recaptures of cod

Year of tagging	The months of recaptures					
	1 - 3	4 - 6	7 - 12	13 - 24	25 - 36	36 (39)
1957	35	6	2	3	-	1
1958	59	27	22	13	9	-
1959	134	30	38	16	9	-
1960	162	60	47	23	5	-
1961	131	37	34	13	-	-
1962	43	13	5	-	-	-

The figures in Table 2 show number of recaptured fish in relation to the time passed since tagging. This table shows that the most numerous recaptures fall within a period of three months after tagging, while the number of recaptures decreases in the subsequent months. The longest period recorded for fish remaining in the sea after tagging till recapture is 39 months.

Figure 1 shows the relation between fish size and the length of its migration in the sea.

Cod of 21 - 40 cm in length showed less tendency for long migration:- 83% of fish of this length were caught within a range of 25 miles from the place of tagging. Migrations over 25 miles were made by 17% of fish tagged. The cod of the next two groups, 41 - 65 cm and above 65 cm long showed greater tendency for long migrations. The curves show that large fish made longer migrations than the small ones.

Of the total number of 1044 individuals 575, i.e., 55.1%, were recaptured within the region of tagging. To the west of the region 277 individuals were caught, i.e., 26.5%, and to the north 83 individuals, i.e., 8.3%. For 105 tags no information on the place of recapture was available. The cod was recaptured mainly in the region of tagging, both in the pre-spawning period and at the beginning of spawning, from December till April. In the other months of the year there was in general a small number of recaptures since at this period cod catches were also low.

The cod tagged in the autumn months in the coastal region was recaptured on the southern slopes of Gdańsk Deep at the end of December, in January and February, and in the Deep itself in March and April, whereas cod tagged in the period from January till April was recaptured also at Gdańsk Deep and over its western slopes. Among the cod recaptured there were fish representing almost all length groups of fish tagged, i.e., from 22 - 72 cm.

The average length of fish, recaptured in this region, was 43.6 cm. The spots of cod recaptures beyond the region of tagging are shown in Figure 2.

To the west of the tagging region 277 individuals were recaptured, namely:- in the region of Slupsk Furrow (57 individuals); in the region of Bornholm (194 individuals); in the region of Arkona (23 individuals) and in the region of Fehmarn Island and the entrance to the Great Belt (3 individuals). Cod recaptures westwards of the tagging region and their distribution in particular months and places are given in Table 3.

Table 3

Region of recapture	Month of recapture											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Slupsk Furrow	4	8	11	12	10	4	1	3	3	1	2	-
Bornholm Basin	11	16	51	37	27	24	6	4	7	4	-	-
Arkona Basin	1	-	8	6	3	3	1	1	-	-	-	-
Western Part of Baltic	-	1	-	2	-	-	-	-	-	-	-	-

Most of the cod, migrating towards west, were caught from February till June. The cod tagged in the Gdańsk region most probably start their migration towards west already in the second half of December, since, for instance, the fish tagged in Puck Bay in the autumn were caught in the Bornholm area already in January. The average length of the individuals migrating to the west was 52.3 cm. Three individuals made particularly long travels to the west, covering distances over 300 miles. They were big fish - 50, 70 and 71 cm long. It appears thus that long migrations are rather made by more grown-up individuals.

The curves in Figure 3 show that the greatest number of cod was recaptured in the region of tagging. A considerable number (25 - 39%) of cod, tagged in the period from December till March had migrated to the west. The fish were recaptured in general within the few months following tagging. The fish tagged from April till June and from September till November showed a somewhat different behaviour. They did not show any stronger tendency to migrate westwards directly after tagging. This tendency appeared at a later period - but not until the winter months.

For a certain number of recaptured cod the stage of the gonads maturity was ascertained. For example in the Bornholm region 10 individuals were found with gonads in VI and VII stage according to Meier's scale. One of the fish caught in the Arkona Basin and one caught eastwards of the Fehmarn Island had gonads in V stage. The

state of maturity of the gonads leads to the conclusion that a certain number of cod undertakes migration to the west in order to spawn.

A much smaller number of fish (6-10%) made migrations towards the north than to the west. No seasonal migrations were observed in any of the year's periods. Evidently both the salinity and the biomass of bottom organisms decrease in northern direction. From this one may assume that the area of the northern Baltic is less favourable to cod and that consequently only a small number of individuals undertake migrations in this direction. The average length of fish, migrating to the north, was 51.7 cm, whereas the cod, which went to the farthest distance in the north had a mean length of 56 and 62 cm. Thus we see that the longest migrations both to the west and to the north are undertaken by more grown-up individuals.

In all months of the year the fish were caught northwards from the tagging region. Mostly the recaptures take place in the period from March till June. The particulars are given in Table 4.

Table 4

Region of recapture	Month of recapture											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Northwards of tagging region	2	4	19	15	12	10	6	2	7	2	5	2

It is regrettable that only in few instances there was reported on the maturity stage of the gonads of the fish landed from the northern part of the middle Baltic. Hence it was not possible to conclude as to whether such migrations are being undertaken for feeding or spawning purposes.

The lowest salinity, necessary for eggs to remain afloat in the water, according to Mielck & Künne (1932-1935) and Mielck (1926), is 10 - 11‰. Chrzan (1951) points out that the cod of Gdańsk Deep spawns at a salinity of 11‰. The salinity necessary for cod's development is found only in the deeps. However, the salinity of the bottom layers is not uniform and decreases in a direction from west to east. The state of the salinity of the bottom layers depends on inflows of salt water from the North Sea via the Belt Seas.

In the years 1956-62 the salinity of the bottom layer of Gdańsk Deep was subject to considerable fluctuations (Figure 4). It appears from the curves that the lowest salinity was found in the years 1958 and 1959. Figure 5 shows curves of migration tendencies in relation to the years of tagging. According to taggings carried out in 1958 more cod than previously migrated westwards. A similar tendency was observed for cod tagged in 1959. In the subsequent years, however, and in spite of an increase in salinity, the number of cod migrating westwards, remained high. There is, therefore, no reason to state that the migration of cod towards the west is the result of a low salinity in the Gdańsk Deep.

In his work published in 1955, Z. Mulicki made the hypothesis that the cod originating from the eggs and larvae brought along by currents from the Bornholm region into the eastern regions, when once grown, returns to its place of origin. Our observations seem to confirm this hypothesis.

References

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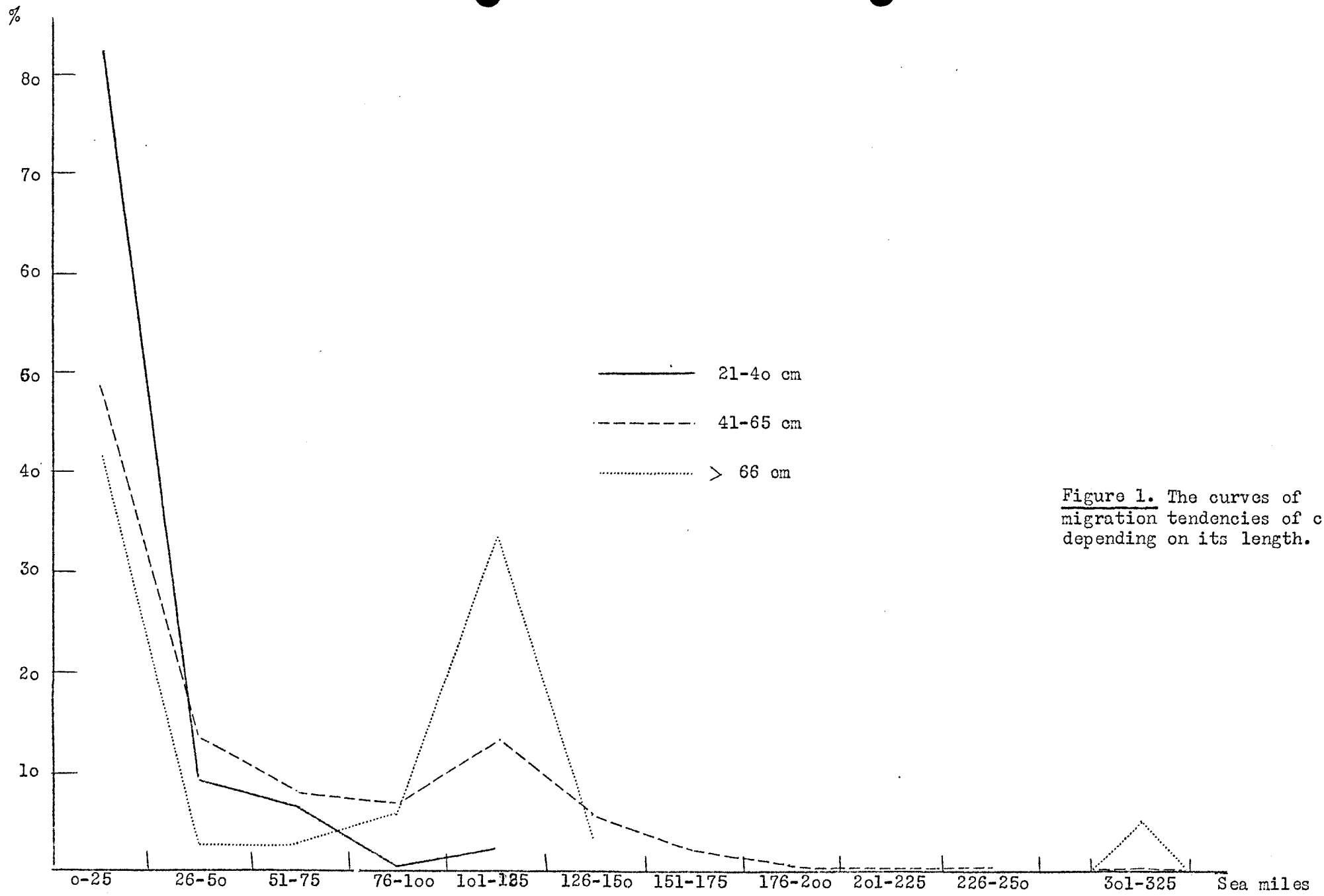


Figure 1. The curves of migration tendencies of cod, depending on its length.

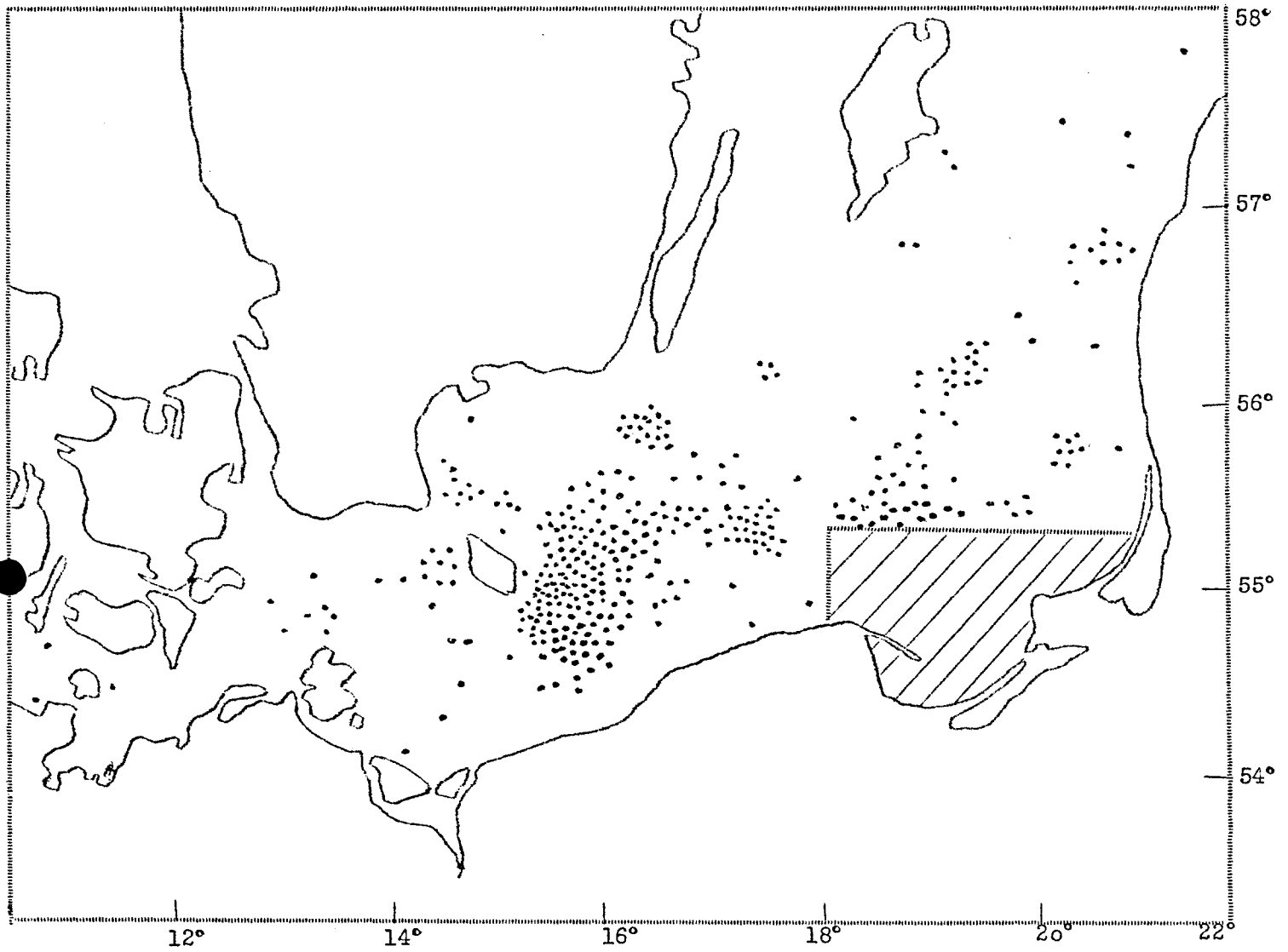


Figure 2. The spots of cod recaptures beyond tagging region.

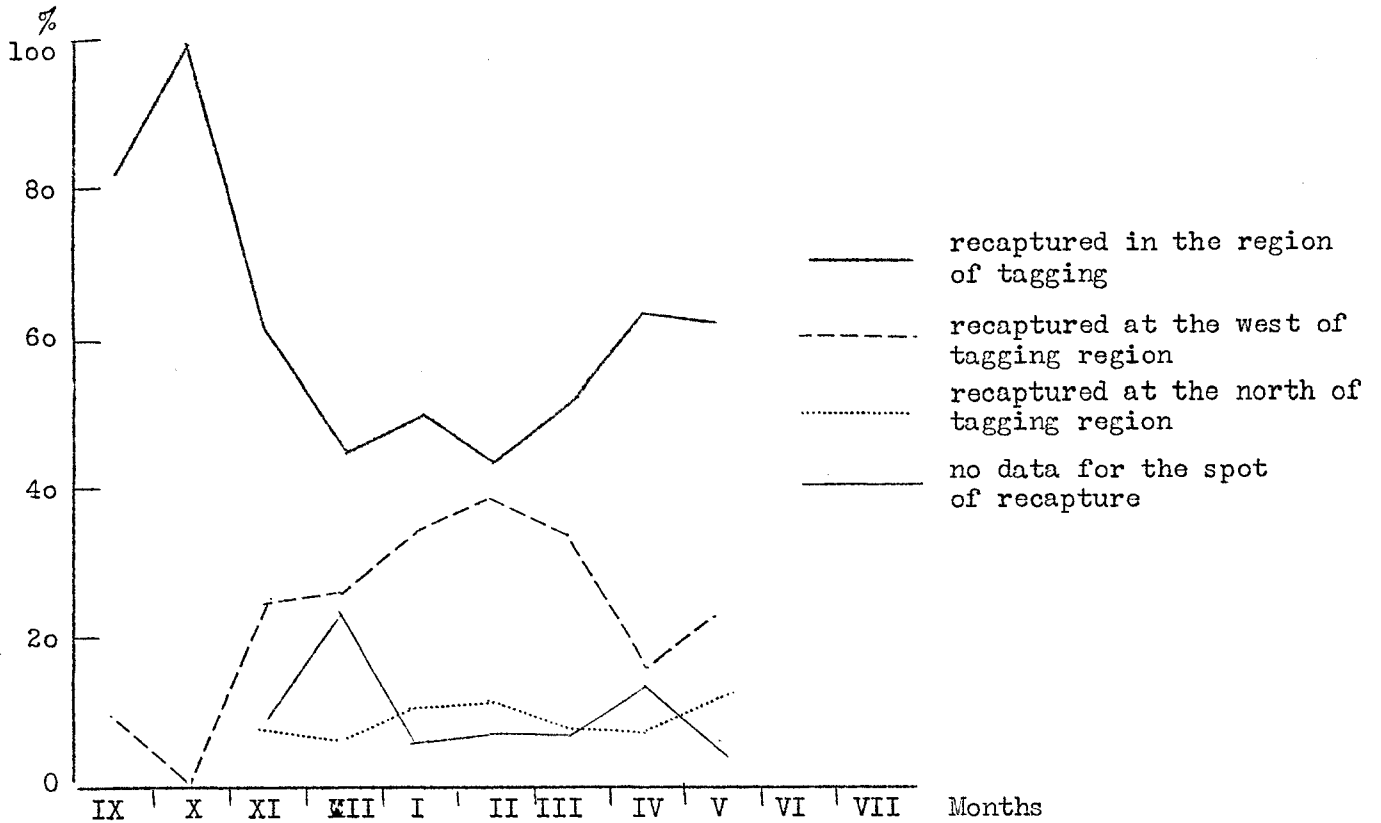


Figure 3. Migration tendencies depending on time of tagging.

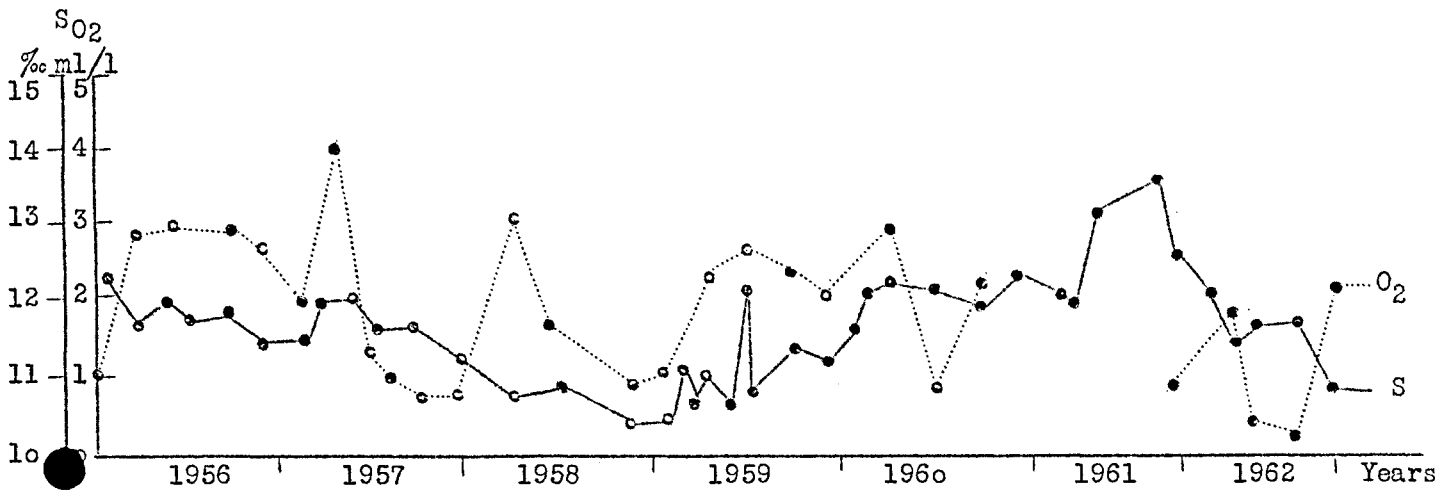


Figure 4. The level of salinity and oxydization of bottom layers of Gdańsk Deep.

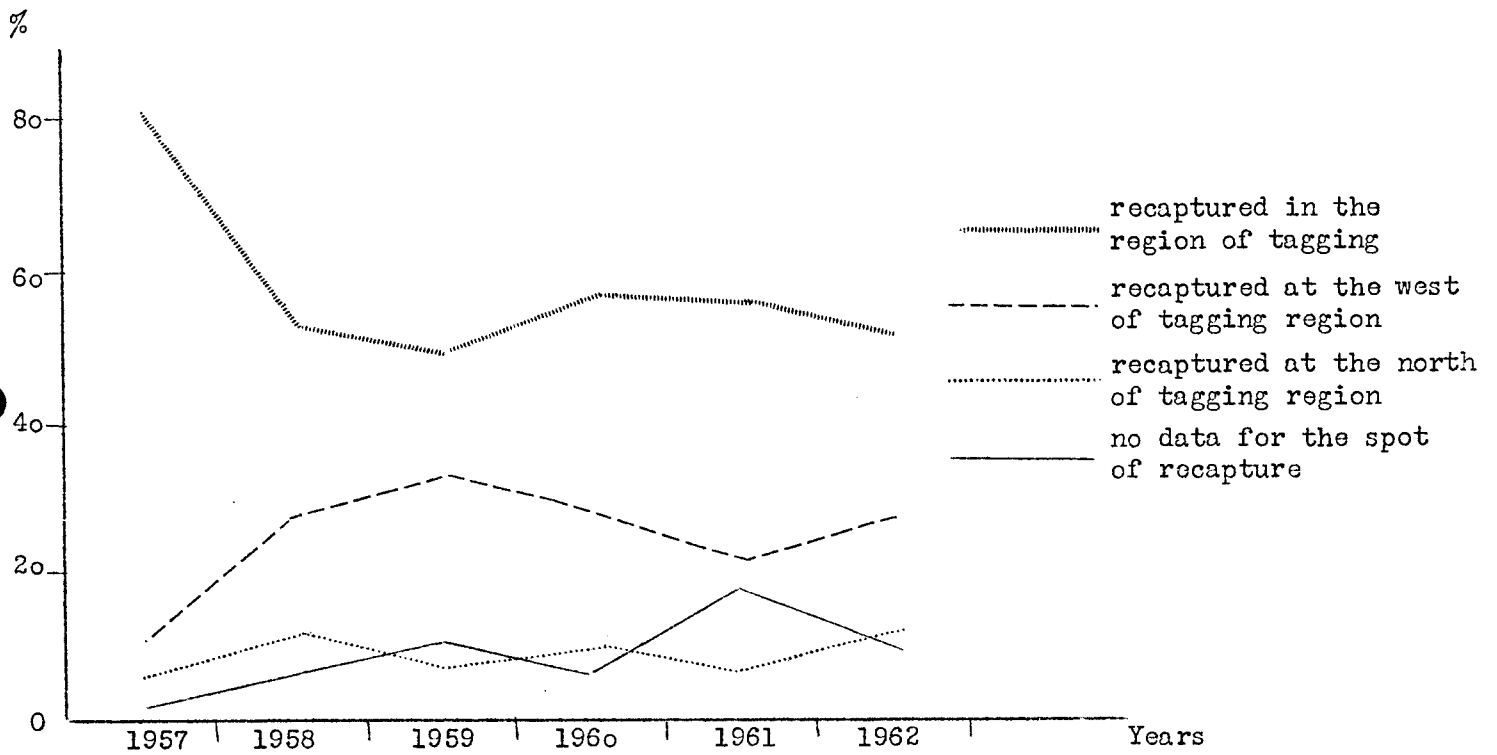


Figure 5. Curves of migration tendencies, depending on the years of tagging.