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Preliminary Report on Tagging Experiment of Sea-Trout in the Region of Vistula Firth

by

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Introduction

The Vistula Firth is connected with the Gdansk Bay by a narrow strait. It is a shallow basin (average depth about 2 m) of low salinity. Its fish-fauna consists almost solely of freshwater fish. Here among the sea fish only a few flatfish species are found and in the spring herring immigrates sometimes for spawning in considerable quantities. Among the migratory fish eel and sea-trout are found. Before migrating into the rivers the latter species are fished in rather small quantities in the waters of the Firth. In the post-war period the landings of sea-trout from the Vistula Firth did not exceed 500 kg. The length of this sea-trout was much smaller than that of the sea-trout caught in the Vistula river and in other Polish rivers. According to the measurements its average length was 56 cm.

Sea-trout is a valuable fish both for commercial fisheries and for angling sportsmen. Therefore the necessity arose of increasing the amount of this species in the waters of the Firth and in the inflowing rivers. Bonitation of the rivers was first carried out in order to ascertain rearing possibility for smolts and the amount of fingerlings necessary for increasing the stock. Local stock was small in number and therefore the eggs of sea-trout for production of fry from the river Slupia were put out in several consecutive years. Environmental conditions, prevailing in the river Slupia, are similar to those of the river Balda and other rivers flowing into the Firth of Vistula, and the sea-trout of the Slupia river is notable for its large size. Tagging experiments were carried out in order to control the results of the stock, as well as to clear up some problems connected with the biology of sea-trout introduced into new environments.

Material and method

Sea-trout, being two summers old, were reared in the earthen ponds at Suchacz on the Firth of Vistula. The ponds were rather scantily stocked, so that the available natural food played a main role. The condition of release has been very good, the tagged fish were without any visible defects.

In the first year of experiment the tags used were made of cardboard coated with celluloid bearing a number at one side and a message to the fishermen at the other giving required particulars and the address to which it should be returned. In the following two years the tags were substituted by plastic tags (19 x 5 mm) bearing only a number without the message to fishermen. In respect of colour white tags were first used, but later, during the last years of the experiment, tags were green or yellow-green. The tags were attached by means of a sort of movable hinge of stainless steel wire of 0.4 mm in diameter.

Taggings were carried out according to Dr. Carlin's method given in his paper "Tagging of salmon smolts in the river Lagan" published in 1955. Ths fish were anaesthetized by using a 2% solution of ethyl urethane.

Releases

The fish tagged were released into the river Balda, which is running among morainal hills and flowing into the Vistula Firth. As a rule the tagging and release of the fish took place every year in about the middle of October. A small number of individuals was released in November. The following number of fish was released in particular years: 1957 - 996; 1958 - 1.000; and in 1959 - 1.648 individuals.

The size of tagged fish and the recaptures.

The lengths of fish were different in particular years and were in general in:-

1957	-	12-22 cm	(average 16.9 cm)
1958	-	14-28 cm	(average 18.1 cm)
1959	-	14-27 cm	(average 16.6 cm)

The fish of different size gave different percentage of recaptures respectively. The results obtained show that the percentage of recaptures increases in accordance with the increase of fish size. It thus confirms the observations of Dr. Carlin and other authors. The correlation between the length of fish and the recaptures is shown in the Figure 1. We note that in one case the percentage of recaptures was lower for the largest fish. Though there are some exceptions from the rule we can see that the tagging of bigger smolts gives better results.

Migrations

No evidence was found that fish migrate in autumn to sea waters directly after release. Only in spring, in April-May, there were recaptures of smolts migrating to the sea via Firth. A rather quick rise of temperature of the shallow waters of the Firth, which in June may surpass 20°C, probably speed up the migration of fish.

An attempt was made to follow the migration of fish in the sea by means of analysis of their distribution in catches. It is interesting in this respect to confront the number of sea-trout caught by fishermen of various countries (till June 1963). This is shown in Table 1.

Table 1. Distribution of recaptures by fishermen from different countries

Year of tagging	Number of recaptures								
	Smolts		Larger Sea-Trouts						
	Poland	USSR	Denm.	Finl.	G.F.R.	G.P.R.	Poland	Sweden	USSR
1957	12	9	-	-	1	-	31	3	6
1958	7	7	-	-	4	1	39	5	1
1959	7	7	2	3	2	3	42	14	3

Occasionally smolts were caught in the Firth with gillnets or eel-traps and in the river with fishing rods. Detailed analysis of 49 smolts, recaptured by Polish and Soviet fishermen, shows that about 80% of fish migrate as two year old smolts to the sea in the spring months, about 5% migrate during the summer months, and about 15% remains in the river or in the Firth until autumn or even until the next spring. The latter, as three year old smolts attain the length of over 30 cm.

There were no recaptures of smolts after they had left the Vistula Firth for the Baltic Sea. Also feeding grounds of sea-trout in their post-smolt stage are unknown, though it seems probable that sea-trout is feeding in various areas of the eastern part of the Baltic, from Gdansk Bay to the Gulf of Riga and along the coasts of Finland and Sweden. This assumption is based on the recaptures of fish in the pre-grilse stage and on fish, which were recaptured at sea at the end of the first summer season. One of them, tagged on 18th October1957, migrated into the sea in the spring of 1958 and was recaptured in November the same year in Kuronian (Kurski) Firth. Meanwhile it had grown from 17 cm to 36 cm. Another fish of the same tagging was recaptured on 4th October 1958 off West Ristna, at Island Dagö. It grew from 19 cm to 46 cm. The third fish tagged in 1957 was recaptured in the region of Archipelago Söderhanen, at Gävleborg.

From the fish tagged in October 1958 one was recaptured in the region of Sikvik-Gävle on 9th April 1960. This fish, according to back calculation, migrated as a smolt of 24 cm length into the sea in the spring of 1959. On its recapture it had the length of 47 cm.

From the tagging of 1959 one individual of sea-trout of 36 cm was recaptured in the region of Hörnefors, towards the end of the first summer season of its remaining in the sea. Another individual of similar length was recaptured in Kuronian (Kurski) Firth. Within a year the fish tagged in 1959 migrated into the Gulf of Riga and even up to the coast of Finland.

Besides migrating in a northern and eastern direction the sea-trout migrate also to the western Baltic. As it may be seen from the attached chart the range of migration of sea-trout is a vast one and covers almost the whole of the Baltic Sea.(Figure 2.). Owing to lack of material it is not possible to determine the factors on which depend the range and variety of directions of migration of our sea-trout.

Returns.

Recaptures show that Gdansk Bay is in some seasons the feeding ground not only of young sea-trout, but also of bigger individuals. From October to April or May there appear, in Gdansk Bay along with small individuals, also larger ones, which after returning from the open sea finish their feeding period and gradually shift into the waters of the Firth. The most intensive catches of these fish take place in November and December and in February and March. In January the catches are generally poor, which,to a considerable degree, is caused by unfavourable weather conditions.

As shown in the Figure 3B.) two length groups may be observed among fish landed from Gdansk Bay. The group of smaller fish, also less numerous, consists of individuals of 45-56 cm length. They were recaptured after the following period of their remaining in the sea: one summer season (about 25%); one winter season (about 45%); one year and one summer season (about 25%) and after two winters (5%). The group of larger fish is more numerous and consists of older individuals. Roughly 40% of this trout were recaptured after two summer seasons of their remaining in the sea, and 35% after two winters. The other were fish, which spent three summer seasons in the sea (about 15%) or three winters (about 10%). In the spring - in April or May - the catches of sea-trout cease in Gdansk Bay. The fish leave the coastal waters and part of them migrate to more distant regions of the Baltic Sea. Adult trout shift gradually via the strait of Baltijsk into the waters of Vistula Firth. Some of the first individuals were recaptured in the Firth in April. In May, June and July, however, the catches were poor. It seems that a rather high water temperature during the summer is preventing the migration of fish into the river via Firth. First in the second half of August the number of landed fish begins to increase markedly. Most of the fish were recaptured in October and specially around the mouth of Balda river, where they were released.

It is to be assumed that the fish, recaptured in the waters of Vistula Firth, were migrating to the river Balda for spawning. A number of these fish was caught after spawning. In the Polish part of the Firth 53 individuals were recaptured and in the river Balda 23 grown-up tagged fish (total 76), besides 7 individuals were recaptured in the Soviet part of the Firth. From a total number of 160 recaptured adult fish taken near the tagging area the recaptures amounted to 52%. Only two individuals were recaptured in other Polish rivers - one in Vistula and one in Grabowa river. No fish were caught in the river Slupia from which the eggs of sea-trout were taken for our experiments. The high number of recaptures of adult fish in the region of their release gives evidence that the home-instinct of the fish used for the experiment had strongly developed in the period preceding their migration to the sea.

Number of years in the sea.

Only three of the tagged fish returned to the river after one summer season spent in the sea. They were males of 0.60, 0.73 and 1.34 kg. The first two were recaptured at the mouth of Balda river in October 1958. The third one of 51 cm length was recaptured at the mouth of Balda river in October 1961. On the basis of scale examination it appeared that after tagging the last fish remained in the fresh water for about 1 1/2 years and as a smolt of 30 cm length migrated into the sea in the spring of 1961.

Approximately two thirds of recaptured fish were grilse, which after one winter in the sea ceased their feeding and migrated back for spawning. The reading of the scales and the time of recapture points to the fact that most of these fish left sea waters only towards the end of summer. The length of fish in this group was 50-70 cm (average about 62 cm).

About one fourth of the number of recaptured trout spent two winters in the sea. Also most of these fish commenced their migration for spawning only at the end of the summer season. Their length was 62-80 cm - average about 70 cm.

Only three individuals of the trout were recaptured during migration after they had spent three winters in the sea. Of these fish the smallest one - 70 cm - participated twice in the spawning; the other two were 86 and 90 cm long.

The assessment of the experiments

Though the tagging experiments did not result in a high number of recaptures, which among other reasons depends on the specific conditions of fishery, they gave, however, the explanation, at least partly, to some of the problems connected with the biology of trout and its artificial stock. The results obtained indicate that more grown

smolts ought to be tagged. Also the number of recaptures depends on the season of release. In our experiments the tagged fish were released in autumn, which exposed them to predatory attacks still for some months of their stay in the fresh waters and therefore increased the natural mortality.

It was not possible to estimate the influence of tag colour upon the number of recaptures, since in specific years when tags of different colours were used, the smolts were of different size. From the comparison of total percentage of recaptures and from the size of tagged smolts it appears, however, that when the used tags bear the message to fishermen better results are obtained.

The tagging experiment enabled us to follow the part of sea-trout migrating to feeding grounds via Vistula Firth. It made it possible to make an outline drawing of the directions and the range of migrations of the trout in the Baltic Sea. On the basis of recaptures of adult trout from Vistula Firth and from the river Balda it was possible to establish that over 90% of fish return to the river of their origin, i.e. the river into which they were liberated. It has also been ascertained that most of the fish migrate for spawning after one winter spent in the sea and that a large number returns for spawning after two winters in the sea.

A very essential result of our tagging and stock experiments is the ascertainment that on introduction of a new population it is possible to improve the quality and quantity of the stock of the trout. In the Figure 3 the diagrams A and C show the distribution of fish of the old and new stocks in length groups. We can see that the fish of the new stock are considerably larger in size than the fish in 1953, i.e. before the commencement of the stock campaign. Also total landings of the trout increased considerably. The catches in the Vistula Firth reached almost 10 tons in 1962. Having in view both the results of our experiments and the results of commercial fisheries in the Firth after some years of the stock campaign we can see that the artificial breeding of sea-trout may lead to advantageous economical results.

References

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Chrzan, F. 1962 "The Scales of Sea-Trout of known Age". ICES, C.M. 1962, Salmon and Trout Committee, no. 25.

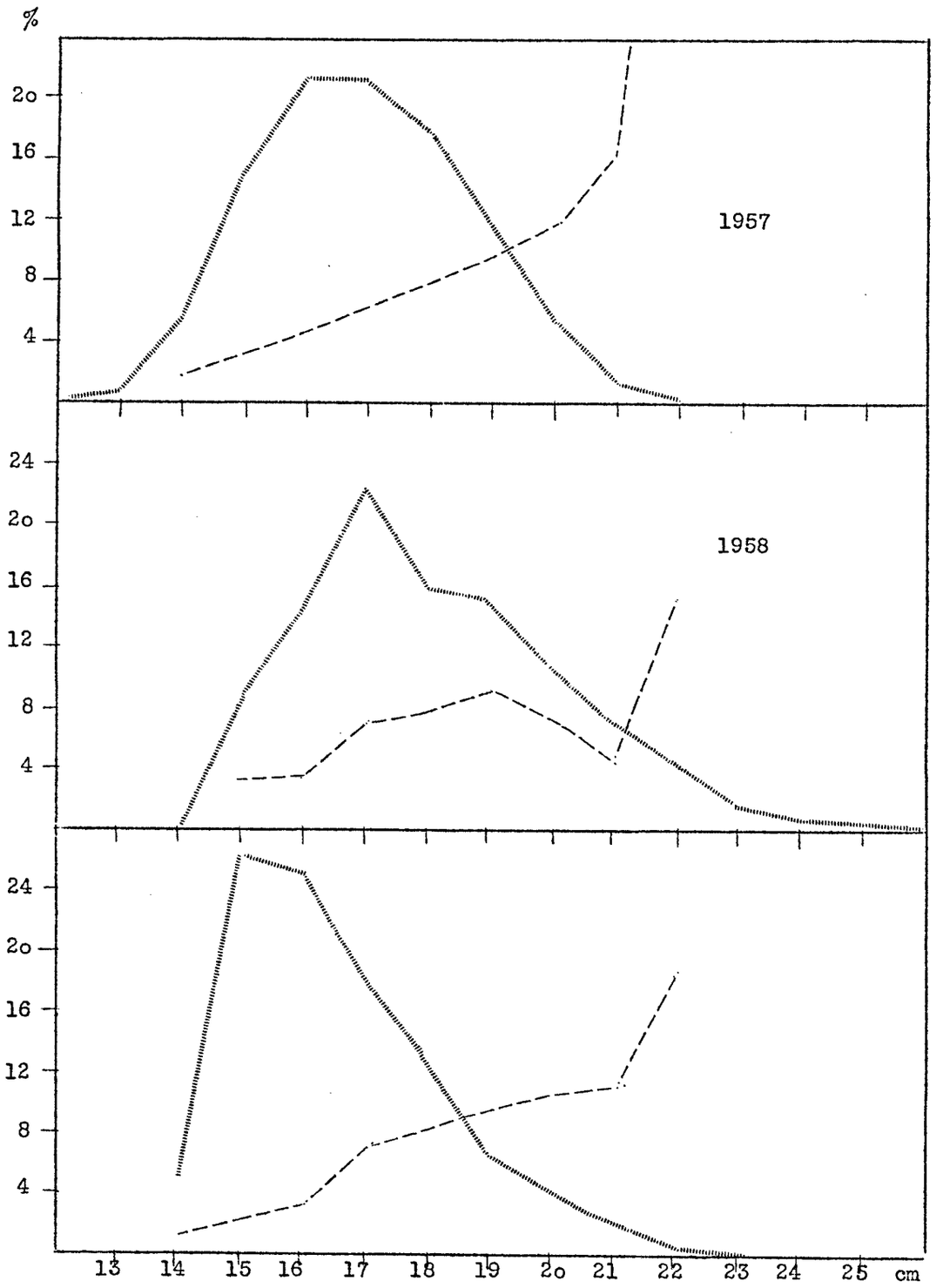

Figure 1. Diagrams showing the relation between length of tagged fish and the percentage of recaptures.

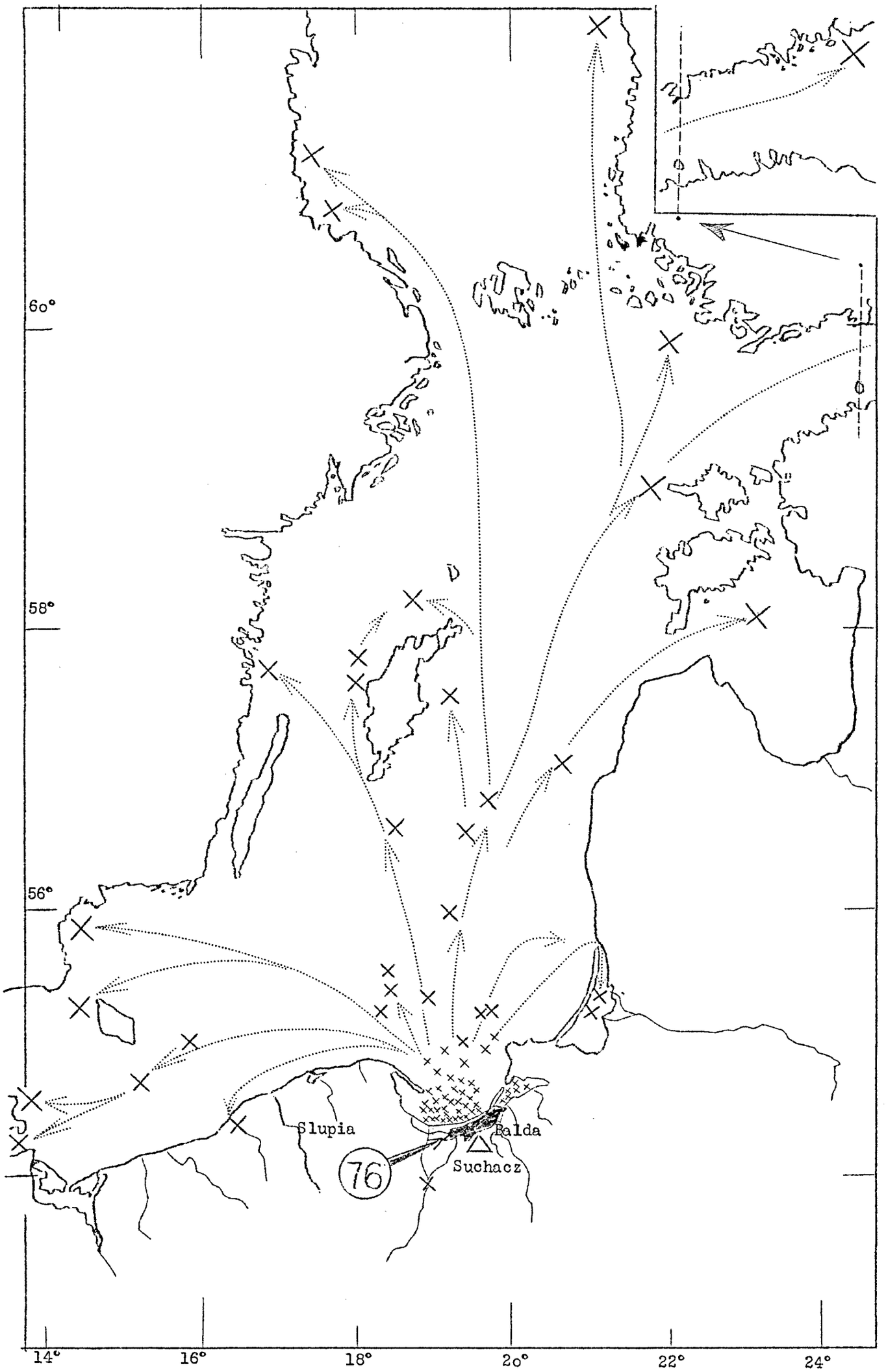

Figure 2. Map showing recaptures of sea-trout in grilse stage and as adult.

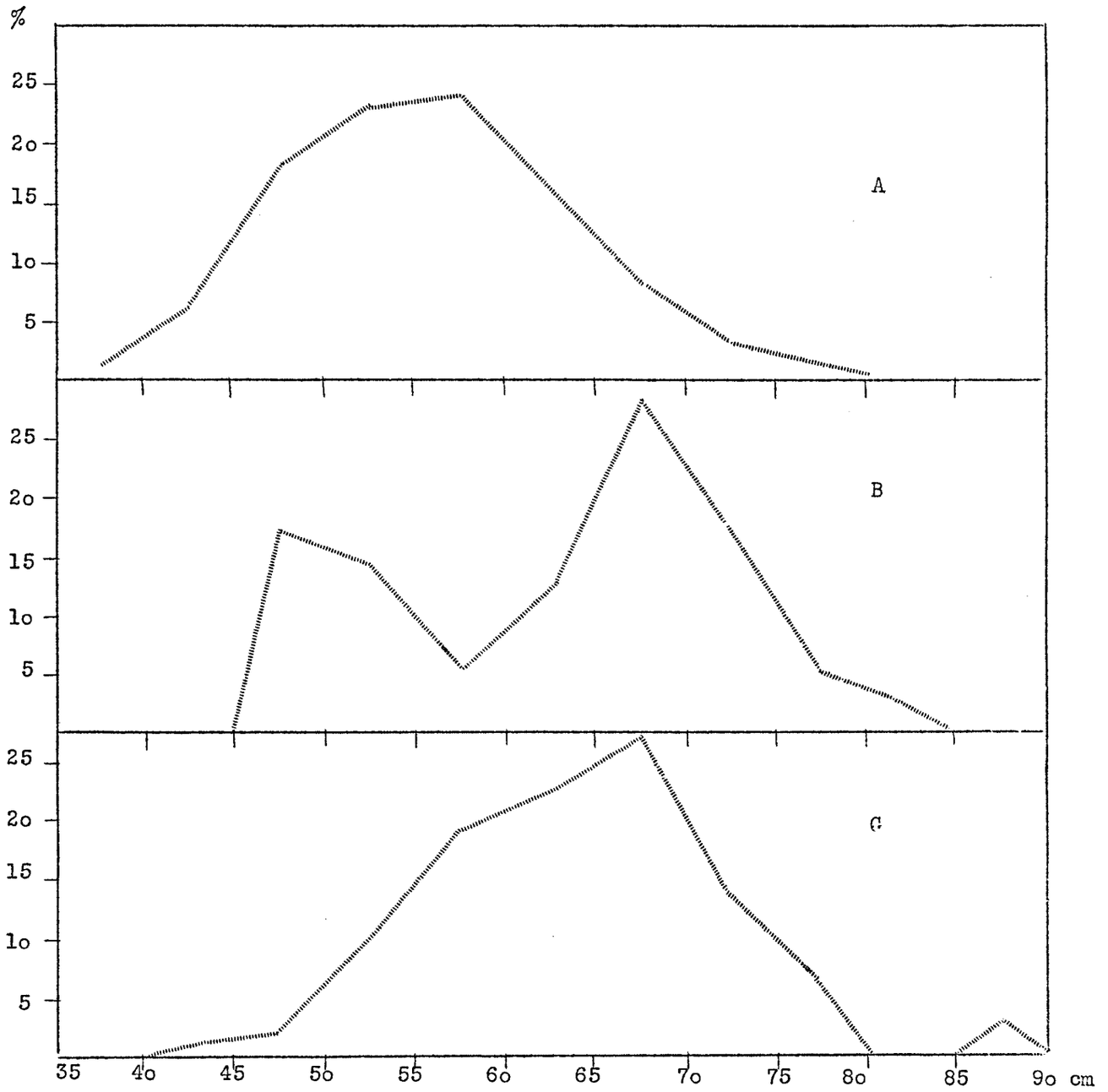

Figure 3. Diagrams showing the distribution in length-classes:-

A = old stock of Vistula Firth as measured in 1953.

B = tagged sea-trout recaptured in the Gulf of Gdańsk (feeding and returning fish).

C = tagged fish as representatives of the new stock recaptured in the Vistula Firth.