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SUMMARY ON OBSERVATIONS CONCERNING THE TROUT IN THE ISOJOKI (FINLAND)

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ÜBER DAS VORKOMMEN DER RELIKTFORM DES SEELACHSES (**SALMO SALAR** L. M. **RELICTUS** MALMGR.) IN EINIGEN BINNENGEWÄSSERN FINNLANDS. VORLÄUFIGE MITTEILUNG

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Summary on observations concering the trout in the Isojoki (Finland)

by

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Studies on the trout initiated by the Board of Agriculture Bureau for Fishery Investigations and the Fishery Foundation have been continued in a small river system draining into the Gulf of Bothnia (Isojoki: XXXVII water district, O l i n,1936). The first observations were made before the Second World War, but investigations proper were begun 1947, when data regarding the chemical and physical conditions were obtained from the whole district.

The waters of the Isojoki flow into the Gulf of Bothnia about 8 km south of the town of Kristiinankaupunki. The total area of the district is 1125 sq.km, of which only 0.4 per cent is water. In the absence of lakes forming base-levels, the whole system of rivers and streams is extremely liable to flood. After rains the sea-trout is therefore sometimes able to enter the river even in the middle of the summer. There are several low dams in the river without any fishways.

Since in Finland there is little variation in the average yield for long periods in the same river basin, the mean water volume can be calculated by multiplying the area of a district by its average yield as follows:

$$Q = F \cdot q,$$

where Q is the water volume in l/sec., F the area of the basin in sq.km and q the average yield in l/sec. · sq.km. In the basin of the Isojoki the average yield is about 8 l/sec. · sq.km (S i- r e n, 1955). Consequently, the mean water volume of the Isojoki at its outflow into Gulf of Bothnia is about 9 cu.m./sec. The areas and the mean water volumes of the water districts of the

main river and its tributaries are shown in Table 1 (cf. also Map 1).

Table 1. The areas and the mean water volumes of the basin of the Isojoki and its tributaries.

Place	No	F sq. km	Q cu.m./sec.
Isojoki before Uuronjoki	(10)	170	1,4
Uuronjoki	(9)	200	1,6
Isojoki before Karijoki	(5)	530	4,2
Karijoki	(4)	225	1,8
Isojoki before Kärjenjoki	(3)	760	6,1
Kärjenjoki	(2)	260	2,1
Isojoki, outlet to sea	(1)	1125	9,0

With the exception of the clear brooks in the area of the source, the water of the Isojoki is brown in colour owing to the presence of humus colloids from wide expanses of peatland. Furthermore, it is poor in electrolytes and slightly acid. These properties are more or less characteristic of almost all the rivers flowing into the Gulf of Bothnia. The oxygen content is relatively high even in the winter, although in the slowly running brooks in the area around the source of the Kärjenjoki the oxygen supply becomes exhausted in the middle of the winter. The limit of visibility varies between 0.5 and 1.5 metres. Certain figures showing the quality of the water according to observations made during the winter of 1947 - 1948 are given in Table 2. In addition to the main stream and its tributaries, certain streams in the upper part of the system are included because of observations on the river trout to be reported in what follows.

The most rapid part of the river are its middle course (between points 5 and 6 on Map 1), where there are five rapids with in a total length of 4 km and a total fall of 23 m.

Table 2. Colour, electrolytic conductivity ($\varkappa_{18} \times 10^6$) and pH of the water in the Isojoki district.

Place	No.	Colour of the water mg/l Pt	Electrolytic conductivity µS	pH
Lylyluoma	(20)	60	-	6,4
Lohiluoma	(19)	50	-	6,5
Isojoki	(18)	80	38	6,4
Riitaluoma	(17)	70	63	6,8
Isojoki	(16)	70	63	6,7
Kattelusluoma	(15)	80	62	6,8
Haukiluoma	(14)	400	92	5,3
Isojoki	(13)	100	36	6,4
Keisahainen	(12)	0	98	6,7
Isojoki	(11)	50	61	6,7
Isojoki	(10)	60	58	6,6
Uuronjoki	(9)	110	61	6,5
Isojoki	(8)	90	60	6,6
Pajuluoma	(7)	160	62	5,8
Isojoki	(6)	90	50	6,6
Isojoki	(5)	80	59	6,6
Karijoki	(4)	170	86	6,6
Isojoki	(3)	90	57	6,7
Kärjenjoki	(2)	320	73	5,9
Isojoki	(1)	130	66	6,6

In addition to the sea-trout and the river trout, the grayling (Thymallus vulgaris) is found in this river, most abundantly in its middle course. The pike (Esox lucius) occurs in all parts of the river system in question, the swift streams in the area of the source excepted. It is even found in the small streams on the large moors which in summer dry up almost to pools. The perch (Perca fluviatilis), the roach (Leuciscus rutilus)and the bleak (Alburnus lucidus) are common in the lower and middle courses of the river.

The id (Leuciscus idus) and the bream (Abramis brama) occur only in the lower course, near the mouth. The burbot (Lota vulgaris) is common throughout the river system and has occasionally been found even in the streams near the source, but in the small dark-watered lakes of the Kärjenjoki it is missing. The brook lamprey or pride (Petromyzon fluviatilis planeri) is relatively common both in the main stream and in its tributaries. The lampern (Petromyzon fluviatilis) is generally found only in the lower course, where it is caught, but in summers with an exceptionally high water level it has ascended even as far as point 6 (Map 1). Of small fish, mention should also be made of the stone loach (Cobitis barbatula) and the Miller's thumb (Cottus gobio), the former being commoner and occuring even in the streams at the source. The crayfish (Astacus fluviatilis) was also very common, but in the years 1954 - 1955 the whole population perished in an epizootic destructive to this species.

The sea-trout ascend their spawning river to some extent during the floods in May, and in exceptionally rainy years also in the middle of the summer, but the majority do not go up until September. Spawning mostly occurs in the most swiftly flowing part of the river (between points 5 and 6, Map 1), but some of the fish continue their journey as far as the upper course of the Uuronjoki. At the Uuronjoki - Isojoki junction the sea-trout nowadays choose the Uuronjoki, which has a somewhat larger volume of water. They also ascend the Karijoki to some extent, but not the Kärjenjoki. Since the water volume of the latter is larger than that of the Karijoki (cf. Table 1), it seems that the high humus concentration in the Kärjenjoki must be responsible for this (cf. Table 2). The rapidly flowing water of this stream is intensely brown (colour 320 mg/l Pt) and acid (pH 5.9). The sea-trout do not ascend the tributory streams along their path.

The sea-trout which have entered the river in the spring spend the middle of the summer in the rapids where these are deepest or in the quiet waters between them. Towards the end of the summer they often gather in the twilight just above the rapids.

In the rivers flowing into the Gulf of Finland the sea-trout mostly spawns in October, in the Tornionjoki (Bothnia Sea) either before or after October 1. (Segerstråle, 1937). In the Isojoki the

sea-trout generally spawns during the last days of September, when the temperature of the water is about 8° C. Spawning occurs where the river bed is gravelly and the water very low, often only 10 - 15 cm. Sometimes the back and the tail of the spawning fish are visible above the water surface. The spawning places in the rapids are the same year after year, and often several pairs of fish spawn in the same place. In the most typical cases gravel and spawn accumulate in crescent-shaped elevations behind the spawning fish. Two or three weeks later the river trout (Salmo trutta fario) spawns in the same sites. In the second half of October their finer spawn is found in the uppermost layers of the gravel mounds grubbed up by the sea-trout. To what extent the trout is capable of destroying the spawning places of the sea-trout by rooting up the layers of gravel which are on top pf the developing spawn is a question that still remains to be answered.

In the main, the male river trout have already attained spawning maturity when the sea-trout spawns in the end of September and eagerly attempt to participate. The fish shown in Fig. 3 were found at the same spawning site. The lower one is a 5 summers old female sea-trout, the upper one is a male river trout of the same age (cf. also Fig. 4). Last summer the offspring of this pair was marked and introduced into the rapids of the Isojoki.

Various observations have shown that the sea-trout leaves the river of its birth and migrates to the sea after 1 - 7 years. Even in the same river, the number of fingerling years spent there varies (e.g. H u i t f e l d - K a a s, 1927 and N a l l, 1934). The majority of the sea-trout seem, however, to follow the habits of their parents and migrate from the river to the sea after a fixed fingerling period. According to J ä r v i´s (1940) investigations, more than half the number of sea-trout in the Bothnian Sea have spent f o u r years in the river where they were born, although a considerable number migrate after three fingerling years, and a few individuals spend their first five years in the river, S e g e r s t r å l e (1937) found that the sea-trout in the rivers of the county of Uudenmaa (Gulf of Finland) migrate to the sea at the age of two years, whilst the sea-trout fingerlings of the Carelian Isthmus spend three years in their birth rivers.

According to J ä r v i, the time of migration is dependent mainly on the size attained: "Migration from the river to the sea is determined by the size attained, the most rapidly growing individuals migrating after three years, individuals with slow growth after five years, and those with moderately rapid growth after four fingerling years" (in the Bothnian Sea). Thus, the amount of food available seems to be the main factor determining the length of the river stage, and this, in turn, is dependent on both the population of sea-trout fingerlings and the number of their competitors for food as compared with the amount of food available in the area. The temperature of the river water is also of significance. From the southern parts of the Baltic it has been reported (H e s s l e, 1935 and A l m, 1936) that in exceptional cases the sea-trout may even migrate to the sea after one fingerling year, although the majority spend two growth periods in the rivers there, too.

The material of trout scales collected from the Isojoki system is still small (totalling 28 specimens), and does not as yet justify any definite conclusions. The fish investigated were obtained from the most rapid parts of the river (between points 5 and 6, Map 1). With one or two exceptions, they had been caught in late summer or autumn. With the exception of three individuals, which had spent three years in the river, the sea-trout in question had attained the size for migration after two fingerling years in the Isojoki. Thus, as a rearing place for sea-trout the Isojoki seems to resemble the rivers in somewhat more southern parts of the country. The lenght of the sea-trout investigated indirectly determined, was an average of 9.0 cm after the first fingerling year and 19.0 cm at the end of the second year. The three individuals which had remained in the river for three years had attained a mean length of 26.2 cm. None of the fish in this material had migrated to the sea after one fingerling year.

According to J ä r v i's investigations, sea-trout which have spent four years in one of the Bothnian Sea rivers have a mean lenght of 20.0 cm. As compared with these, the sea-trout fingerlings hatched in the Isojoki had thus grown twice as rapidly during their river years.

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It cannot yet definitely stated whether the last ring in the scales, showing more rapid growth, developed during the summer after the fish had entered the river. Since the scales in the material were clearly of two different types, some scales having a relatively narrow last ring, whilst in others the last ring was almost as broad as the preceding ring, which showed more rapid growth, it is here presumed that the last ring had developed during the summer when the fish ascended the river. Individuals ascending in spring grow less during the summer of the same year than those ascending in autumn.

Most of the sea-trout here concerned had entered the Isojoki after spending two complete growth periods in the sea. Their weight varied between 2.8 and 4.2 kg. Eight individuals had been in the sea for three years before ascending the river. As calculated from the scale specimens, the mean length of the fish was 36.2 cm after their first year in the sea. Thus, in this period the majority of the sea-trout investigated had attained the minimum size stipulated by the Finnish fishery law. Only five individuals would have fallen below this limit after one year in the sea. During the second year in the sea the fish had attained a mean length of 54.1 cm.

In the areas to which the sea-trout ascends, the river trout of the Isojoki grow at the same rate, broadly speaking, as the sea-trout fingerlings. (Those which do not migrate to the sea are here regarded as river trout.) Fig. 4 shows the scales of the pair of trout found in autumn 1956 at the same spawning place. It is seen that during their first two years the two fish had grown at more or less the same rate, but in autumn 1956 there was a weight difference between them of 3,815 g(cf. also Fig. 3), the male (river trout) weighing 385 g and the female (sea-trout) weighing 4,200 g (before the spawn was collected).

The river trout occurs in the middle and upper courses of the Isojoki and in the numerous tributaries flowing into the main stream. But it is lacking in the Kärjenjoki part of the system. In the area where the main stream has its source the river trout has populated even the smallest of the permanent streams. Of the streams in the source area only the Haukiluoma (cf. point 14, Map 1) has a humus concentration which is too high for the river

trout (colour of the water 400 mg/l Pt., cf. Table 2). It has been observed that the river trout, too, migrates at the time of spawning, inasmuch as it ascends from the streams at the source to spawn in small tributaries, from the main stream into minor streams, and from the lower course of the main stream it ascends upstream, etc. The growth rate shows wide variations. In the main stream a 4-year-old individual, for instance, may weigh 410 g, whilst an individual of the same age in the streams at the source weighs only 160 g.

Striking variations also occur in the population. It may be mentioned that in 1954 the sea-trout entered the river in very great numbers. The next summer, fingerlings from that summer were found in the spawning repids in exceptional abundance. One year later this age group was still numerous, but in late summer the population suddenly decreased. The most probable explanation of this is that the majority of the fish had migrated to the sea. At present, however, there is an exceptionally large population of river trout of the same age group, weighing about 400 g.

The Board of Agriculture has arranged for the continuation of these investigations concerning the trout in the Isojoki. This year experimental markings have been made 162 2 summers old descendants of the trout pair shown in Fig. 3 being introduced into the river. A few of these individuals have already been caught in various parts of the stream. It is only to be regretted that the marking devices employed, which were of Swedish type, consisting of a plastic plate attached with wire, do not seem to be suitable for trout fingerlings in a river such as this where the large amounts of algae tend to get entangled in the wire when the fish are hiding.

References

A l m, G. 1936. Havslaxöringen i Åfvaån. - Stockholms Sportfiskeklubb: Årsbok.

H e s s l e, C. 1935. Gotlands havslaxöring. - Meddel. Statens anstalt för sötvattensfiske, 7.

H u i t f i e l d - K a a s, H. 1927. Studier over Aldersforholde og Vekstyper hos norske Ferskvannfisker. Oslo.

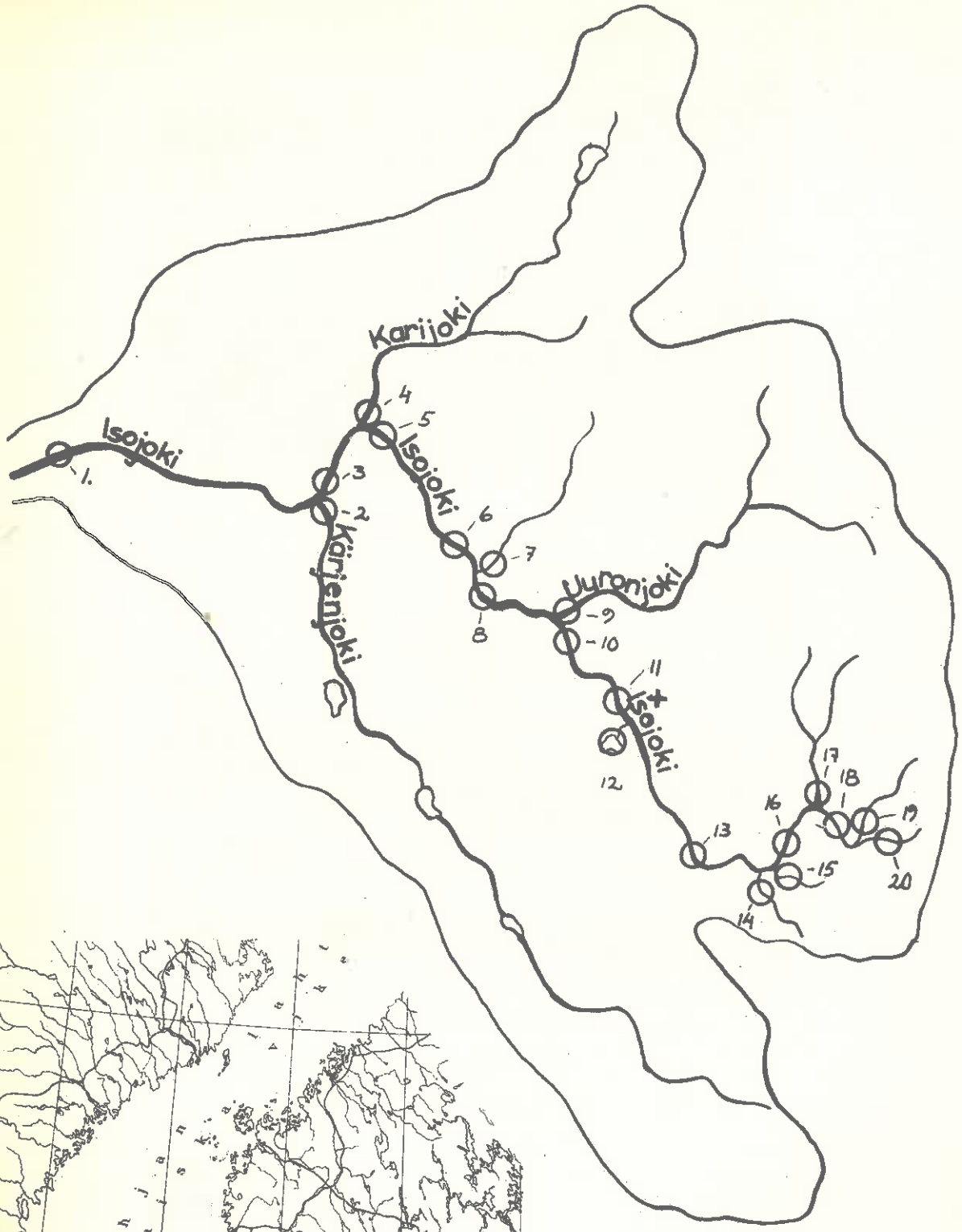
J ä r v i, T.H. 1940. Tietoja Perämeren taimenista.- Maatalous-hallituksen tiedonantoja, 270. Suomen Kalatalous, nide 15.

N a l l, G. 1934. Sea Trout of the Montrose District. Part I. The District and its Sea Trout. - Fishery Board of Scotland, Salmon Fisheries, III:1.

O l i n, T. V. 1936. Suomen vesistöjen alueet ja järvet- Hydrografisen toimiston tiedonantoja VII.

S e g e r s t r å l e, C. 1937. Studier rörande havsforellen (Salmo trutta L.) i Södra Finland. - Acta Soc. pro Fauna et Flora Fennica. Vol. 60.

S i r e n, A. 1955. Suomen vesistöalueet ja keskimääräiset valuma-arvot. - Hydrografisen toimiston tiedonantoja XV.



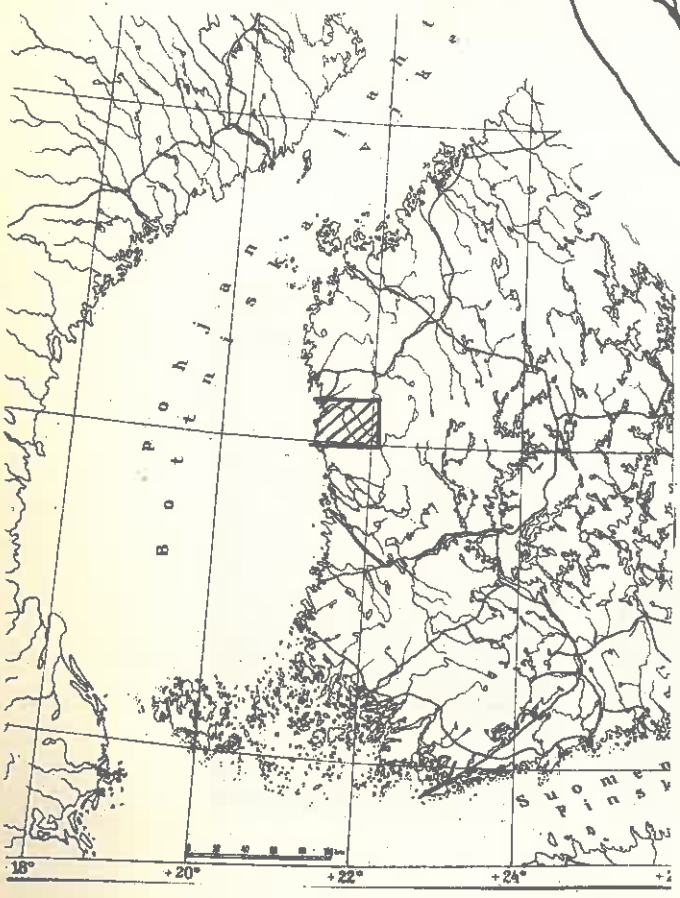


Fig. 1. The basin of the Isojoki.

Fig. 2. Spawning sites of the sea-trout.

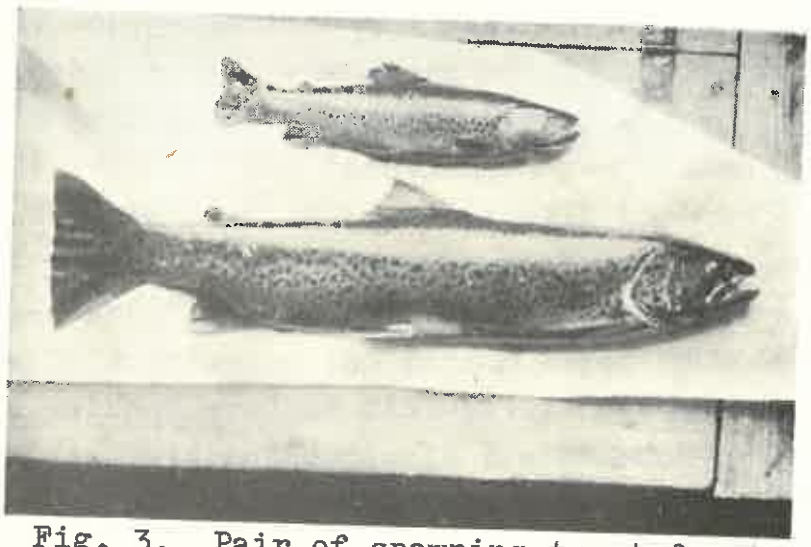


Fig. 3. Pair of spawning trout found at the same spawning site. ♂ 385 g, ♀ 4,200 g (before the spawn was collected).

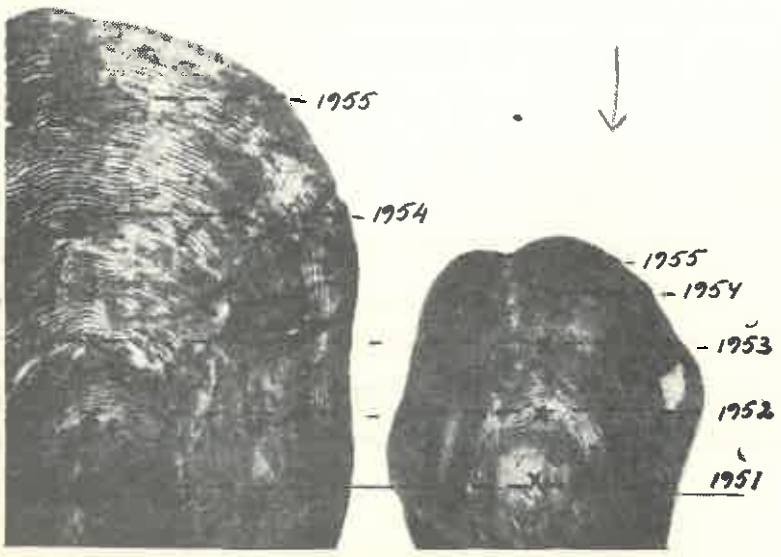


Fig. 4. Scales of a pair of spawning trout (cf. Fig. 3).