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**POSSIBILITY OF NATURAL SPAWNING OF VISTULA SEA TROUT
(SALMO TRUTTA L.) IN THE DRWEÇA RIVER**

by

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Abstract

The dam construction in the middle Vistula River in Włocławek has stopped the spawning migration of the sea trout. The Drwęca River, the largest tributary of the lower Vistula River, has been dammed at the distance of 10 and 11 km from its outlet to the Vistula. The sea trout spawners enter the Drwęca River mainly in October. Among the trouts caught in the fish ladders there were observed individuals which had been tagged and released into the Drwęca River. The length of fish caught in the fish ladders ranged from 39 cm to 83 cm, with the average being of 59.7 cm. Trouts were getting through the fish ladders at both dams and reached the spawning ground of the middle Drwęca River and its tributary the Brynica River. The number of released sea trout smolts was growing starting from 1978, and in 1987 and 1988 as many as 10600 tagged smolts were released. The tagged trouts were being mainly caught in the Vistula mouth and they constituted 48.3% of the total amount of this species caught there; their age was mainly in A, 1+ (26.2%) and A, 0+ (15.7%) age class. Out of the fish caught as much as 5.4% originated from the tagged fish from the Drwęca River and that number constituted 0.5% of the total number of smolts released there. All the trouts migrating up the Vistula River entered the Drwęca River and they were not caught above the Drwęca outlets. Apart from the stripped summer sea trouts there were also observed the winter sea trout kelts.

1. Introduction

The Vistula River, the largest Polish river, had the biggest population of the sea trout. The spawning grounds of the Vistula sea trout could be found in the tributaries of the upper and the middle Vistula River. The winter sea trout population, entering the Vistula mouth in late autumn and early winter, spawned in the tributaries of the upper Vistula during the autumn which followed. The second summer population would enter the Vistula mouth in summer and autumn and the individuals of this population would spawn in the tributaries of the middle Vistula during the same year. The degradation of environmental conditions resulted in dwindling of the Vistula trout population and in addition to that the tributaries of the middle Vistula were dammed with constructions having no fish ladders or having improperly functioning ones. That made it impossible for the spawners to reach the spawning grounds. The construction of dam in Włocławek in 1968 made it impossible for the winter sea trout population to reach the spawning grounds of the upper Vistula tributaries (Fig. 1; Bartel, 1993). That resulted in a drastic decrease in number of trout smolts migrating with the Vistula to the sea. There is only one larger river in the Vistula basin which has favorable conditions for the trout spawning and that is the Drwęca River which has two dams with fish ladders, one at the distance of 10 km and the other at the distance of 11 km from the river outlet to the Vistula River.

The aim of the study was to estimate the number of sea trout spawners entering the Drwęca River and evaluate their possibilities of crossing the fish ladders and reaching the spawning grounds in the Drwęca tributaries. The estimation of effectiveness of stocking of the Drwęca River with trout smolts was also of interest.

2. Material and methods

The observations of fish entering the Drwęca River, carried out in the years 1986–1989, consisted in keeping the records of commercial and angling fishing of trouts and in keeping records on sea trout spawners passing through the fish ladders in two dams. The observations were carried out during morning, afternoon, and night hours. The trouts caught in the fish ladders were tagged with Carlin tags.

Besides, in 1987 and 1988 as many as 10.600 two-year-old trout smolts were tagged with Carlin tags and released into the lower Drwęca River. That experiment brought about 1054 returns which were used for determination of entering the Vistula River by trouts and their returns to the place of release in the Drwęca River.

3. Results

The angling fishing in the Drwęca River demonstrated that the number of trouts entering the Drwęca River was inconsiderable. In order to facilitate better use of spawning possibilities in the Drwęca River and its tributaries the number of trout smolts released into the Drwęca River was increased beginning from 1987 (Tab. 1). That resulted in an increase in number of trouts caught by the individual anglers and by the Polish Angler Union (PAU) in the Drwęca River in 1988–1989. The number of fish observed in the fish ladders was also higher (Tab. 2).

The trouts migrating for spawning appear in the lower Drwęca between June and December, with the highest frequency observed in October. During this time of the year they are caught by the anglers and by the PAU and the fish caught is considered to have a commercial value. The fish caught by the PAU between September and November are kept as spawners which provide eggs for the smolts rearing.

During the observations in 1986–1988 the water level in the Drwęca River was low, which resulted in a fact that the water was only flowing through the lower openings in the fish ladders and did not reach the upper ones. It made the spawners migration through the ladders more difficult.

The observations focused on entering the fish ladders by the sea trout were carried out in different periods of 1988–1989 and with different frequency. In 1986 only random control of fish ladders was carried out and that was done between October and December. In 1987 the study period was extended and it lasted from 27 July to 13 November, which allowed to make 121 observations. The data showed that the trouts were mainly present in the fish ladders in October and no fish were found in November. That observation inclined the researchers to limiting the study in 1988 and 1989 to October mainly and in those years as many as 91 and 43 observations were made, respectively.

The fish caught in the fish ladders was tagged and released but only part of individuals would follow the lower water; some of the fish were caught two or even three times in the fish ladder. The distance of 1 km between the lower and the upper ladder the trouts covered within 1–3 days.

Among the trouts caught in the fish ladders there were spawners originating from stocking in 1987 and 1988. In 1988 as many as 11 tagged fish from the stocking in 1987 and 1 from the stocking in 1988 were caught. In 1988 five fish from the tagging in 1987 and one from the tagging in 1988, were caught.

These observations confirmed the earlier information that the trouts get through the fish ladders in the lower and the upper dam and in that way migrate to the spawning grounds of the middle Drwęca and its tributaries.

Trouts were getting through the first ladders in the upper and lower dam at various time of a day, with more frequent passings being observed in the morning hours (Tab. 3).

The electrofishing and the field observations conducted in autumn in the middle Drwęca River and on the spawning grounds of the Brynica River indicated the presence of concentrations of trouts and spawners having length in the range 54–70 cm.

The trouts caught in the fish ladder in 1987–1989 had their length varying from 39 to 83 cm, with the average (long. totalis) being of 62.8 cm. However, the average length was variable over the period studied, changing from 59.7 (18 individuals) in 1987, through 58.5 cm (36 individuals) in 1988, up to 66.0 cm (68 individuals) in 1989.

In order to control the behaviour of smolts after the stocking the untagged fish was, in 1987 and 1988, mixed with 3675 individuals of two-year-old smolts released into the Drwęca in Elgiszewo (at some 15 km distance from Lubicz), and 6925 individuals of two-year-old smolts released in Lubicz (below dams) (Tab. 4). Slightly lower percentage of returns was obtained from the fish released below the dams i.e. in Lubicz (on average 9.8%) as compared with those released above the dams (on average 10.2%). The average percentage of tag returns was equal to 9.9%, with variations from 2.6 to 18.4% (Tab. 4).

Smolts released into the Drwęca River were migrating down the rivers until they reached the sea and then they begun their return migration up the Vistula and then Drwęca River. There was no single case observed that the fish migrating up the stream would pass the Drwęca outlet and go further on up the Vistula River (Fig. 1). The trouts were being caught for 5 years in the sea, for 4 years in the Vistula mouth, and for 3 years in the Vistula and Drwęca River. Fish in the age class A.1+ constituted 54.7% of the whole fish tagged and then caught. The age class A.0+ and A.2+ constituted 22.0 and 19.7% respectively. The older fish i.e. A.3+ and A.4+ were rather not numerous, constituting 2.1 and 1.4%, respectively.

The highest number of fish was caught in the Vistula mouth, 48.3% in total, and those were represented by the fish at age A.1+ (26.2%) and A.0+ (15.7%). The tagged fish was being caught over 5 seasons in the sea, giving in total 28.3% of whole fish caught, and those were mainly represented by age group A.1+ (22.0%) and A.2+ (10.8%) (Fig. 1). The tagged fish originating from the Drwęca River made up 5.4% of a total number of tagged fish caught; the percentage is much lower (0.5%) when referred to tagged fish released there.

4. Discussion

The historical observations (Bartel, 1969; Skrochowska, 1969; Palka and Bieniarz, 1983; Zarnecki, 1963, 1964) indicate that before the damming of the Vistula River the trouts entering that river would reach the spawning grounds of tributaries of the upper

Vistula. Damming of the Vistula nearly entirely cut off the access of the winter sea trout to the spawning grounds. This fact evoked the feeling of threat that the winter sea trout population may become extinct. There are, however, some indications that the winter sea trout spawns also in the Drwęca River and analyses of scales of fish caught in the Drwęca speak for that. The analyses indicated that among the sea trout kelt caught in that river there were individuals belonging to the winter population (Borzęcka, personal communication).

Out of the smolts released into the Drwęca those spawners which entered the Vistula River demonstrated a very high degree of homeinstinct and similar phenomenon was observed in the case of the Vistula trouts released into the tributaries of the upper Vistula and into the Drwęca River (Dębowski and Bartel, 1994).

The size distributions of fish caught in the fish ladders were similar to size distributions (long. caud.) of fish caught in Tczew, at a distance of about 40 km from the outlet to the Vistula River. Based on age readings from the scales (142 ind.) (Sych, personal communication) the average trout length for summer 1986 was equal to 64.2, varying from 49 to 81 cm, while for winter 1986 it was equal to 68.2, varying from 51 to 83 cm (50 individuals). The average length obtained for 1987 was lower in summer and winter, being of 65.3 cm and 64.1 cm, respectively. The average trout weight in summer 1986 and 1987 amounted to 3.67 kg and 3.69 kg, respectively, while in winter it reached 4.36 kg and 3.51 kg for the subjected years. The average weight for the entire year 1986 and 1987 was equal to 4.01 and 3.6 kg, respectively (Borzęcka, personal communication).

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Table 1. Number of sea trout smolts released into the Drwęca River in 1984–1990.

| Year | Number of smolts |
|-------------|-------------------------|
| 1984 | 8890 |
| 1985 | 5890 |
| 1986 | 8000 |
| 1987 | 50563 |
| 1988 | 48474 |
| 1989 | 98879 |
| 1990 | 128039 |

Table 2. Number of sea trout caught in the Drwęca River in 1987–1989.

| | 1987 | | 1988 | | 1989 | |
|---|---------------|-------------|---------------|-------------|---------------|-------------|
| | Number | [kg] | Number | [kg] | Number | [kg] |
| Polish Angling Union commercial catch | 30 | 35.9 | 43 | 88.4 | 131 | 457 |
| Angler fishing | 20 | 70.0 | 40 | 160.0 | 120 | 430 |
| Inland Fisheries Institute (Catching in fish ladder) | 19 | – | 50 | – | 72 | – |

Table 3. Number of sea trout spawners caught in fish – ladders in the lower and the upper dams in the Drwęca River.

| Date | Time of the day 7 -12 a.m. | | | Time of the day 14 - 19 p.m. | | | Time of the day 22 - 24 p.m. | | | Number of obser- vations |
|-------------------------------|-------------------------------|--------------|-------|---------------------------------|--------------|-------|---------------------------------|--------------|-------|--------------------------------|
| | lower dam | upper dam | Total | lower dam | upper dam | Total | lower dam | upper dam | Total | |
| 1986 Oct. - Dec. | - | 5 | 5 | - | - | - | 1 | - | 1 | - |
| 1987 27 July - 13 Nov. | - | 8 | 8 | 2 | 9 | 11 | No observation | | | 121 |
| 1988 4-18 Oct. 8-9 Nov. | 24 | 4 | 28 | 15 | 4 | 19 | 2 | 1 | 3 | 91 |
| 1989 18-28 Oct. | - | 51 | 51 | 3 | 18 | 21 | No observation | | | 43 |

Table 4. Number of tagged sea trout released into the Drwęca River in 1987 and 1988.

| Place of release | Date of release | Number of fish released | Recovers | |
|-----------------------------------|--------------------|----------------------------|----------|------|
| | | | Number | % |
| Lubicz below a dam | 31.03.87 | 2000 | 368 | 18,4 |
| Elgiszewo 14 km above a dam | 28.04.87 | 1100 | 29 | 2,6 |
| Elgiszewo above a dam | 07.05.87 | 2575 | 348 | 13,5 |
| Lubicz below a dam | 28.04.88 | 2000 | 172 | 8,6 |
| Lubicz below a dam | 06.05.88 | 2925 | 137 | 4,7 |
| Total | | 10600 | 1054 | 9,9 |

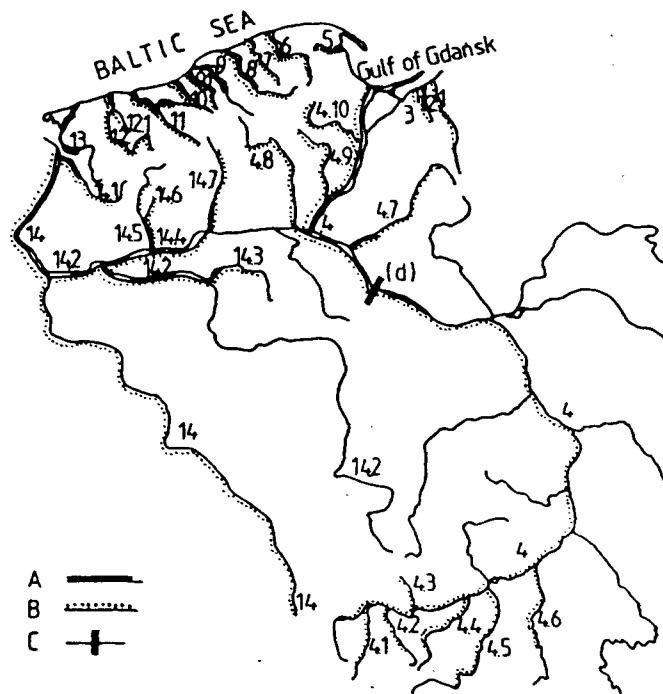


Fig. 1. Sea trout rivers in Poland (modified after Christensen, Johanson 1975). A - recently, B - in former time, since 17th century, C - the dam built in 1968, 1 - Pasłęka River, 2 - Bauda River, 3 - Narusa River, 4 - Vistula River, 4.1 - Soła River, 4.2 - Skawa River, 4.3 Rudawa River, 4.4 - Raba River, 4.5 - Dunajec River, 4.6 - Wisłoka River, 4.7 - Drwęca River, 4.8 - Brda River, 4.9 - Wda River, 4.10 - Wierzyca River, 5 - Reda River, 6 - Łeba River, 7 - Łupawa River, 8 - Słupia River, 9 - Wieprza River, 9.1 - Grabowa River, 10 - Unieście River, 11 - Parsęta River, 11.1 - Radew River, 12 - Rega River, 12.1 - Mołstowa River, 13 - Gowienica River, 14 - Odra River, 14.1 - Ina River, 14.2 - Warta River, 14.3 - Wełna River, 14.4 - Noteć River, 14.5 - Drawa River, 14.6 - Płociczna River, 14.7 - Gwda River

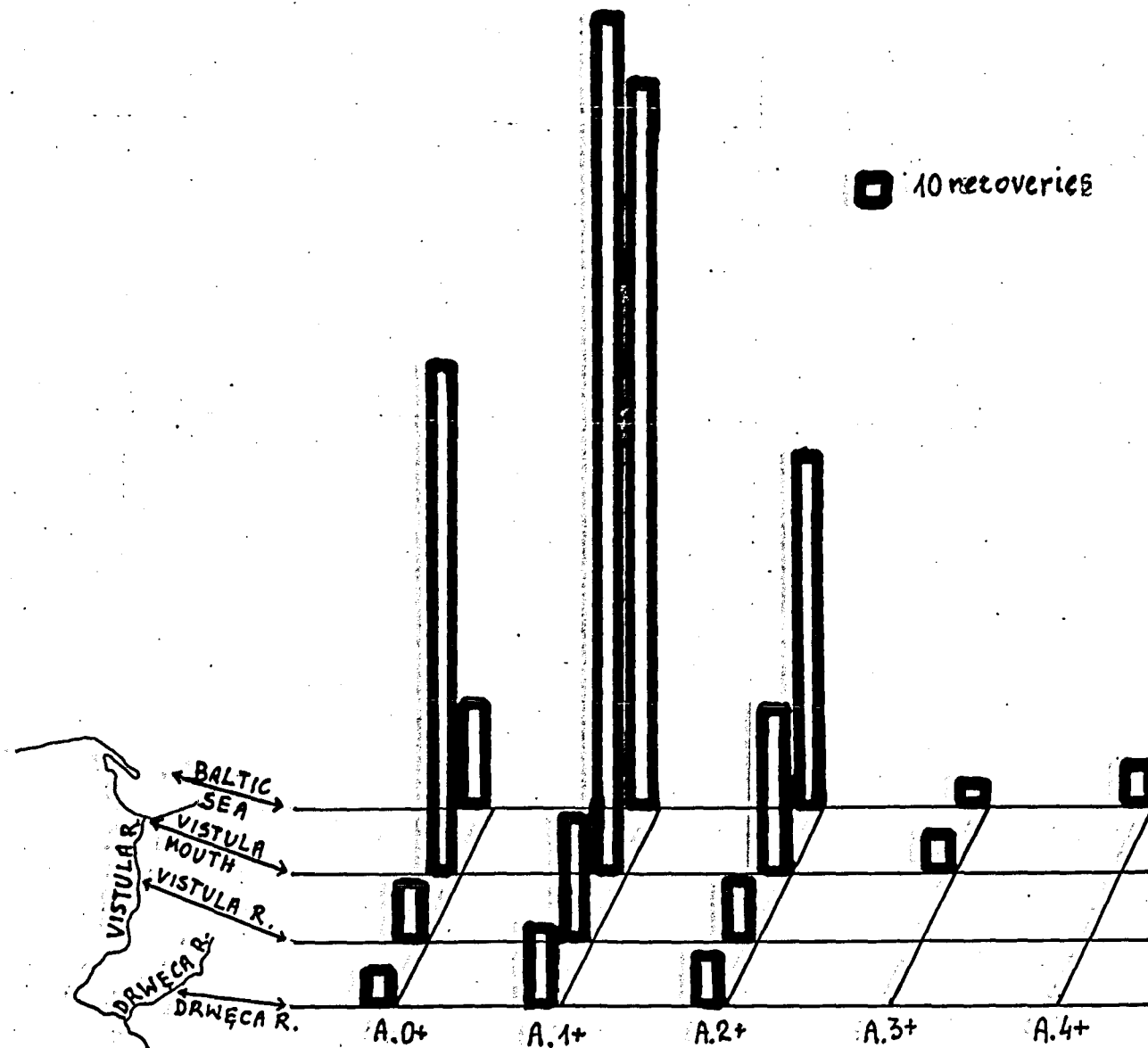


Fig. 2. Percentage of recovers of tagged sea trout released as smolt into the Drwęca River in 1987 and 1988 and caught in the Baltic Sea, the Vistula River and the Drwęca River. Number of recoveries 989.