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DISTRIBUTION AND MIGRATIONS OF TAGGED RAINBOW TROUT (*SALMO GAIRDNERI* RICH.) RELEASED TO THE BALTIC SEA

ROZSIEDLENIE I WĘDRÓWKI ZNAKOWANYCH PSTRĄGÓW TĘCZOWYCH (*SALMO GAIRDNERI RICH.*) WYPUSZCZONYCH DO BAŁTYKU

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41502 tagged rainbow trouts were released into the Baltic Sea, mainly to the Gulf of Gdańsk, and to some Polish rivers, mainly to the River Vistula. 2504 returns from "older" fishes and 1486 from "younger" fishes made it possible to determine distribution and migrations of the released fishes. Rainbow trouts migrated all over the Baltic Sea, but most were caught in the Gulf of Gdańsk and in coastal Polish waters. They were also fairly abundant in Danish Straits, and single specimens were caught in the North Sea and Norwegian Sea, The fishes tended to migrate westward. This trend was more pronounced in the fishes released at Jastarnia. Site of release and fish age affected the distribution and migrations of rainbow trout.

INTRODUCTION

Introductions of rainbow trout into the Baltic Sea, carried out since 1964, showed that the fishes adapted quite well to the new conditions, and were caught by Polish fishermen as well as by Baltic fishermen from other countries (Bartel 1973).

The objective of studies was to determine the distribution and migrations of tagged rainbow trout, and of the factors influencing this distribution.

MATERIAL AND METHOD

41502 tagged rainbow trouts were released in 1963–1980. The fishes were at the age of 0+, 1 and 2 years, of body length 11–49 cm. They were released to the Vistula River mouth at Świbno, and to the Gulf of Gdańsk in Gdańsk and Jastarnia, in the direction of the open sea. Some trouts were also released into the rivers Słupia, Wieprza, Reda and Łeba, and into Puck Bay, Vistula Firth, and Baltic Sea at Mielno (Tab. 1, Fig. 1). Part of the released one-year old fishes had the pigmentation typical of rainbow trout. Apart from these there were also silver specimens, similar to smolts (Fig. 2), which easily lost scales. The latter fishes should migrate downstream, to the sea. In order to confirm this assumption 3161 tagged one-year old trouts were released in spring 1968–1970 into the Vistula River at Nieszawa (Tab. 1, Fig. 1).

Rainbow trouts were tagged with silver oval tags, or celluloid rectangular (15 x 5 mm) ones, attached with silver or monel wire under the dorsal fin, in its front part (Bartel 1975). The fishes were anaesthetized in urethane or MS 222. They were kept in flowing water for at least 8 hours after tagging.

Distribution and migrations of rainbow trout were analysed separately for the returns from "younger" fishes, i.e. caught within the first 3–4 months after the release (till the end of July), and "older" ones, i.e. caught later on.

In order to facilitate the description of fish distribution and migrations, the Baltic Sea was divided into regions (Tab. 2, Fig. 3).

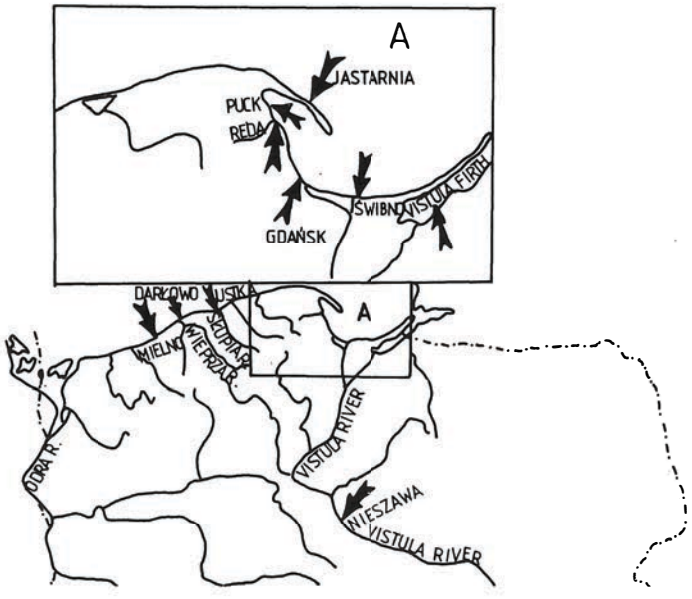


Fig. 1. Sites of releasing tagged rainbow trouts (marked with arrows)

Table 1

Tagging experiments on rainbow trout

No of experiment[1]	Released						Receptured				
	Year	Place		Age	Average length cm	Length range cm	Number of fish	"older" fish[3]		"younger" fish[2]	
								no of specimens	%	no of specimens	%
1	1963	Gulf of Gdańsk	Gdańsk	0+	14.9	13–21	1804	3	0.2	99	5.5
2– 9	1964–1972	Gulf of Gdańsk	Gdańsk	1	17.9	12–27	9571	686	7.2	340	3.6
10–16	1967–1972	Gulf of Gdańsk	Gdańsk	2	23.2	14–49	6756	1062	15.7	421	6.2
17–20	1965–1968	Vistula mouth	Świbno	1	18.4	13–24	6133	523	8.5	524	8.5
21	1966	Gulf of Gdańsk	Jastarnia	1	18.5	17–20	1164	165	14.2	4	0.3
22–23	1967–1968	Vistula Firth	Suchacz	1	17.5	14–24	2160	12	0.6	42	1.9
24–26	1968–1970	Vistula River	Nieszawa	1	15.8	12–22	3161	21	0.7	54	1.7
27	1968	Reda River	Mrzezino	2	24.8	18–22	237	4	1.7	–	–
28	1968	Puck Bay	Puck	2	23.2	15–27	100	1	1.0	–	–
29	1968	Baltic Sea	Mielno	1	16.3	13–20	621	8	1.3	–	–
36–37	1978	Wieprza River	Darłowo	1	19.6	14–33	3995	10	0.2	1	0.0
38–39	1979–1980	Słupia River	Ustka	1	17.7	15–27	5800	9	0.2	1	0.0
	Total:						41502	2504	6.0	1486	3.6

[1] Number of experiments and their detail data are presented in paper by Bartel (1985)
[2] "younger" fish – rainbow trout caught till the end of July in the first year after release
[3] "older" fish – rainbow trout caught later on

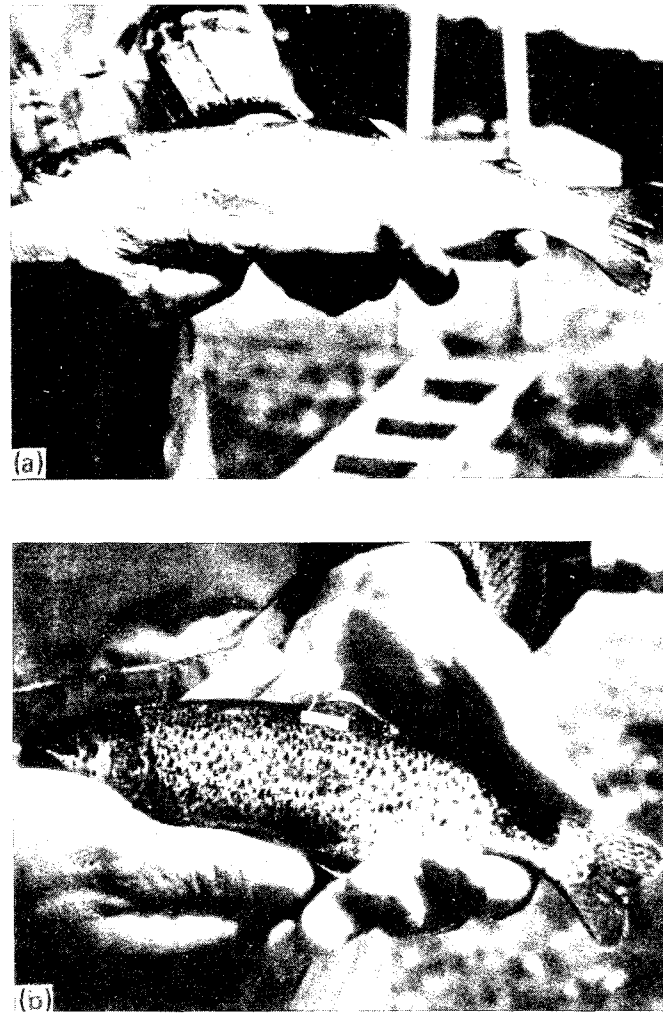


Fig. 2. Rainbow trout at the age of 1 years' a) smolt, b) fish lacking smolt features

Description of trout migrations has been limited to the fishes released to the Gulf of Gdańsk in Jastarnia and Gdańsk, and to Vistula mouth at Świbno, as the returns from these fishes were most numerous. The migrations were analysed in three-month periods: summer (July – September), autumn (October – December), winter (January – March), and spring (April – June). Only in the first year, when the fishes were released, the spring period was prolonged till July, while the summer one limited to August and September, according to the assumed division of the fishes into "younger" and "older".

DISTRIBUTION OF TAGGED RAINBOW TROUT

General trends

Totally 2504 tags from "older" fishes were returned. From these in 2456 cases place of the catch has been located, i.e. in 98.1% of cases. Basing on this material it can be stated that rainbow trouts were caught all over Baltic Sea, Danish Straits included (Tab. 2, Fig. 3).

Most returns originated from the Gulf od Gdańsk and the Vistula mouth, 45.6 and 15.9% respectively. Many tagged trouts were caught in the region of Gotland (7.8%), Bornholm (5.2%) and Danish Straits (6.4%), as also West and Middle Pomerania (3.6%). A few trouts were caught in Estonian and Lithuanian coastal waters (2.2%), in the gulfs of Finland, Bothnia and Riga (0.5%). Some trouts were caught in the Vistula River (2.8%) and the rivers of Middle and West Pomerania, Gulf of Szczecin (3.6%) and small rivers flowing to the Gulf of Gdańsk and Vistula Firth (3.7%). Tagged trouts were also caught in middle Vistula, Skagerrak, rivers of Denmark, Sweden, Soviet Union, German Democratic Republic, and in North and Norwegian Sea, north of Trondheim (Tab. 2, Fig. 3).

More than 3/4 of all released rainbow trouts were caught in the Gulf of Gdańsk and Polish coastal and inland waters. As regards the remaining fishes, catches west of Gotland) Bornholm, Danish Straits and more to the west) were five times more frequent (14.2%) than to the east and north (Estonian and Lithoanian coast waters, gulfs of Finland, Bothnia and Riga (2.7%).

More numerous returns in some of the experiments allowed for determining dependence between place of fish release and fish distribution and migrations.

Distribution of fishes released into the Gulf of Gdańsk at Jastarnia and Gdańsk, and to the Vistula mouth.

Trouts caught in the Gulf of Gdańsk and Polish coastal and inland waters originated in 75.0 to 80.9% from the releases in Gdańsk and the Vistula mouth, and in 52.8% from the releases at Jastarnia (Fig. 4, Tab. 2).

Trouts caught most frequently in the Gulf of Gdańsk originated from the releases in Gdańsk, respective numbers being 49.5 and 62.4% for one- and two-years old fishes. Less frequently fishes released at Jastarnia were caught here (21.8%), and least frequently those released at Świbno (18.2%). Fishes released at Świbno were most frequently caught in the Vistula mouth (45.9%), while those released in Gdańsk and Jastarnia were less frequent in this region – from 7.0 to 9.9%. In Pomeranian rivers fishes released at Jastarnia were caught more frequently than those released at Świbno (Tab. 2). Considerable numbers were caught in coastal waters, at small depths.

Differences were observed in the distribution of rainbow trout in the Gulf of Gdańsk, depending on the site of fish release. Fishes released at Jastarnia and Świbno were more frequent east of the Vistula mouth (54.3% and 74.2% respectively) compared to the west part, where they constituted 17.1% and 8.6% of total returns. Contrarily to this, one- and

Table 2

Catches of tagged rainbow trout in the distinguished regions
(fish caught after July in the first year after release)

Released					Receptured														
					Per cent													Place	
Place	Age	Consecutive No	Number of experiments	%	Gulf of Gdańsk	Vistula Mouth	Vistula River	Western and Middle Pomerania Coast	Gotland	Bornholm	Danish Straits	Kattegat Skagerrak North and Norwegian Sea	Coast of Latvia and Estonia	Gulf of Riga Finland and Bothnia	Rivers of the Gulf of Gdańsk and Vistula Firth	Rivers and lakes of West and Middle Pomerania and Szczecin Firth	Rivers and lakes outside of Poland	Known	Unknown
Jastarnia	1	21	1	average	21.8	9.9	1.2	5.0	10.6	11.2	15.5	6.2	3.1	–	5.6	9.3	0.6	161	4
Vistula mouth Świbno	1	17–20	4	average range	18.2 9.8–23.3	45.9 42.2–48.9	10.0 7.8–12.2	2.5 0–5.6	5.9 4.1–14.6	2.7 0–3.4	4.9 0–9.8	3.3 2.2–3.1	1.7 0–4.4	0.6 0–4.8	2.7 1.1–3.4	1.6 0–3.3	–	512	11
Gulf of Gdańsk Gdańsk	1	2–9	8	average range	49.5 25.0–73.3	8.6 2.9–16.7	0.9 0–6.7	6.8 0–17.1	7.7 0–28.0	3.8 0–7.3	7.5 0–13.8	3.4 0–8.2	1.9 0–4.0	0.3 0–1.0	5.2 0–10.1	4.0 0–11.3	0.4 0–1.5	676	10
Gulf of Gdańsk Gdańsk	2	10–16	7	average range	62.4 54.8–70.4	7.0 3.2–12.2	0.5 0–1.8	1.8 0.5–4.1	8.2 2.6–9.8	6.3 4.3–8.6	4.5 3.1–6.5	0.8 0–3.2	2.4 0–8.2	0.6 0–0.9	2.4 0.8–6.1	2.7 1.4–6.5	0.4 0–2.0	1040	22
Sub. Total: Gulf of Gdańsk, Gdańsk, Świbno, Jastarnia spring +1 autumn exper.no 1	0+ 1–2	1–21	21	average range	46.4 9.8–73.3	16.0 2.9–48.9	2.7 0–12.2	3.6 0–17.1	7.7 0–28.0	5.2 0–11.2	6.2 0–15.5	2.4 0–8.2	2.2 0–8.2	0.5 0–4.8	3.5 0–10.1	3.3 0–11.3	0.3 0–1.0	2392	47
Vistula Firth Suchacz	1	22, 23	2	average	16.7	25.0	–	–	–	–	8.3	–	–	–	50.0	–	–	12	
Vistula River Nieszawa	1	24, 26	2	average	25 0	20.0	15.0	–	25.0	5.0	10.0	–	–	–	–	–	–	20	1
Reda, Puck Bay, Baltic Sea Mielno	1	27–29	3	average	23.1	–	–	15.3	23.1	7.7	23.1	–	–	–	7.7	–	–	13	–
Słupia, Wieprza Rivers	1	36–39	4	average	5.3	5.3	–	5.3	–	10.5	10.5	5.3	–	–	–	52.6	–	19	–
Total:	0+,1,2		32	average	45.6	15.9	2.8	3.6	7.8	5.2	6.4	2.4	2.2	0.5	3.7	3.6	0.3	2456	48

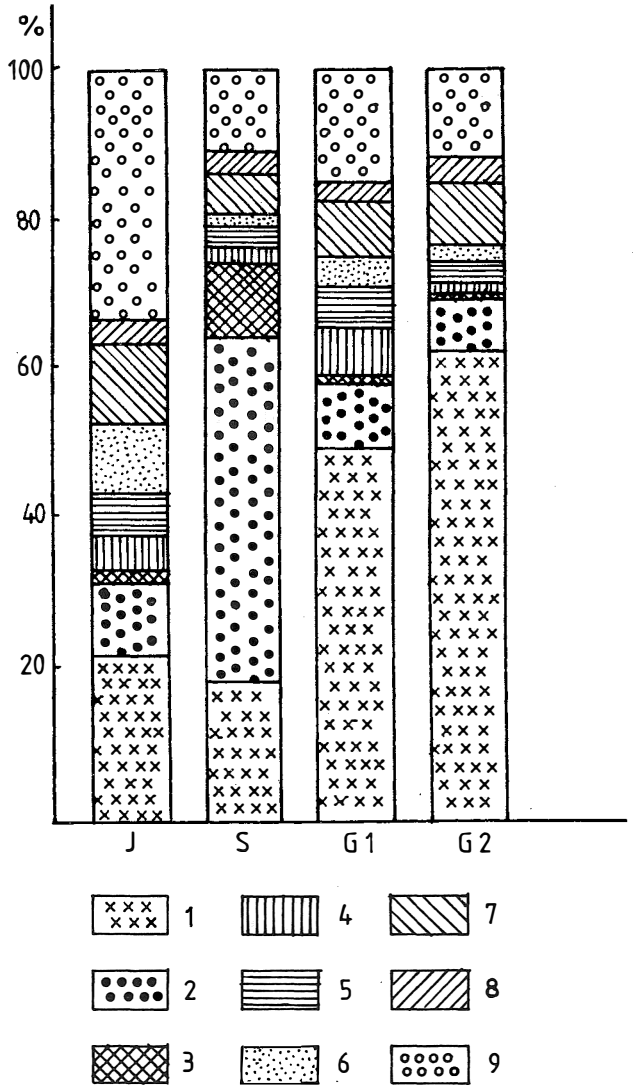


Fig. 4. Catches of "older" rainbow trouts in per cents in the distinguished regions. One-year old trouts released at Jastarnia (J), Świbno (S), Gdańsk (G1), and two-years old ones released in Gdańsk (G2). Distinguished regions: 1 – Gulf of Gdańsk, 2 – Vistula mouth, 3 – Vistula River, 4 – Middle and West Pomerania 5 – rivers of the Gulf of Gdańsk, 6 – rivers of Middle and West Pomerania, 7 – Gotland Island region, 8 – east and north of Gotland (coasts of Estonia and Latvia, Gulf of Bothnia, Gulf of Finland), 9 – west of Gotland (Bornholm, Danish Straits, Kattegat and westward).

two-year old fishes released in Gdańsk were more frequently caught west of the Vistula mouth (72.1 and 86.0% respectively) compared to the east part (20.7% and 7.1%).

Outside the Gulf of Gdańsk and Polish coastal and inland waters, fishes released at Jastarnia were caught two times more frequently (47.2%) than the fishes released in Gdańsk and Świbno (19.1–25.0%). In the region of Gotland the highest percentage of returns (10.6%) was represented by trouts released at Jastarnia, and the lowest (5.9%) by those released at Świbno.

As regards tag returns from the open sea it was observed that the fishes tended to migrate westward. In the region of east and north Baltic (coasts of Estonia and Latvia, gulfs of Riga, Bothnia and Finland) 2.2–3.1% were caught, and west of Gotland (Bornholm region, Danish Straits and more to the west) 10.9–32.9% (Tab. 2, Fig. 4). Westward trend was more pronounced in case of the fishes released at Jastarnia and one-year old trouts released in Gdańsk. These fishes were caught respectively 10.9 and 6.7 times more frequently to the west of Gotland than to the east. On the other hand, fishes released at Świbno, and two-years old ones released in Gdańsk were 4.7 and 3.9 times more frequent in the west part of the Baltic Sea than in the east and north.

Distribution of rainbow trout released into the Vistula Firth

Not many returns were obtained from the fishes released into the Vistula Firth, into Vistula at Nieszawa, to rivers Reda Słupia and Wieprza, to Puck Bay and to the Baltic Sea at Mielno: altogether 65 tags from "older" and 98 from "younger" fishes (Tab. 1). Hence, these data can be treated only as suggestions as to the fish behaviour.

From among the rainbow trouts released into the Vistula Firth, 42 "younger" fishes were caught, mainly in Polish part of the firth (32 tags) and its tributaries: Naruż (4 tags), Bauda (1 tag) and Elbląžek (3 tags). Two tags were returned from Soviet part of the Pregoła river and the firth. As regards 12 returns of "older"trouts, 5 were caught in the Vistula Firth, 3 in Dead Vistula, 2 in the Gulf of Gdańsk, 1 in Radunia River, and 1 in Danish Straits (Tab. 2).

One-year old trouts released into the Vistula River at Nieszawa were caught mainly during a few days at the site of release. From among 54 "younger" trouts, 50 originated from the site of release. Some fishes migrated downstream, and after 3 or 6 days were caught by anglers in Toruń, 32 km below the release site, and one was caught 19 days later in Solec Kujawski, 60 km below Nieszawa. Assuming that these fishes took the shortest route, they must have migrated at the speed of 3.2 – 8 km/day. One rainbow trout was caught 70 days later in Abbekas, west of Ystad. This trout made about 570 km, at average speed of 8.1 km/day.

"Older" trouts were caught not only in the Gulf of Gdańsk and Vistula mouth, but also in the middle Baltic, in the region of Gotland and Bornholm islands, and even in Danish Straits (Tab. 2). These trouts also returned to the Vistula River and were found in lower Vistula, in the vicinity of Nowe and Nieszawa, i.e. 89–236 km from the Vistula mouth (Tab. 2, Fig. 3).

A few returns of rainbow trouts released to Słupia and Wieprza rivers do not allow for describing distribution of these fishes. The picture is additionally distorted by trout catches in Słupia and Wieprza in August of the same year. It can be assumed that these fishes never migrated to the sea. Some tags were obtained from both east of the release site (3 tags in the Gulf of Gdańsk, Vistula mouth and coast of Latvia and Estonia) and west of this site (3 tags, Danish Straits, Kattegat) (Tab. 2).

Catches of tagged rainbow trout in a few seasons after the release

Many fishes, up to 50% of total returns from "older" and "younger" fishes released at Świbno, were caught in the first period after the release (till July). In the same period 33.1% of one-year old fishes and 28.4% of two-years old ones were returned, and only the fishes released at Jastarnia were not caught so soon (2.4%) (Tab. 1).

The next period was defined as summer. It embraced August-September. Trout catches in this period were rare and amounted to from 5.0 to 13.4% of total returns from "older" fishes (Fig. 5).

Un autumn of the first year number of returned tags increased noticeably, reaching the maximal values – 24.7% and 55.2% for one- and two-years old fishes released in Gdańsk,

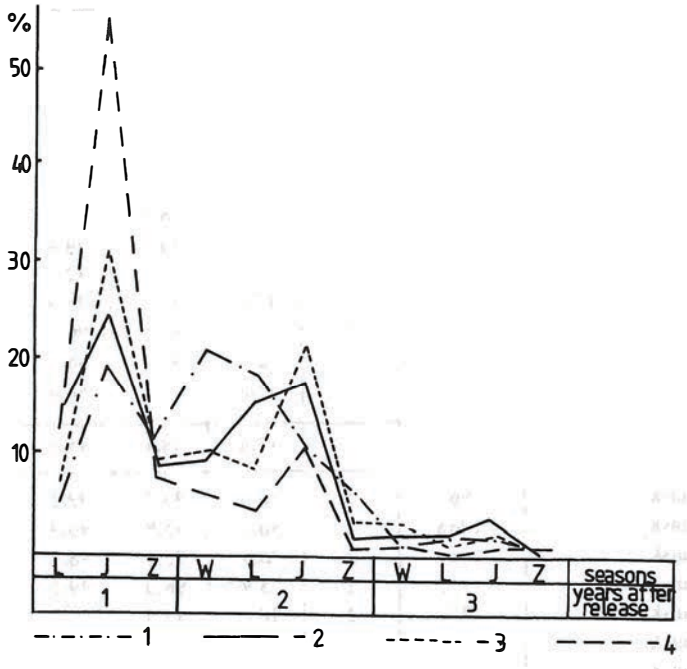


Fig. 5. Catches of rainbow trouts in per cents of total returns of "older" fishes in successive seasons after the release at: 1 – Jastarnia, 2 – Świbno, 3 – Gdańsk one-year old fishes, 4 – Gdańsk two-years old fishes, W – spring, L – summer, J – autumn, Z – winter.

and 19.5% for the fishes released at Jastarnia. In winter percentages of tag returns decreased (Fig. 5).

In the second year after the release relative intensification of the exploitation of Jastarnia trouts differed compared to the catches of trouts released at the two other sites. In spring fishes from Świbno and Gdańsk were caught in similar proportion as previously, while the returns from Jastarnia trouts reached a maximum (20.7%). In summer catches of the fishes released in Gdańsk decreased to 4.3 and 9.9%, whereas trous from Świbno were caught more intensively, the returns reaching the same level as for Jastarnia (Fig. 5).

In autumn of the second year the returns increased similarly as in the previous autumn, reaching a second maximum for the fishes released in Gdańsk (11.0% and 21.9%)

Table 3

Cumulative percentage of older rainbow trout caught in consecutive years after release, annual periods from April to March

Experiment No.	Released			Receptured (grand total)			
	Place	Year	Age of fish	years after release			Total number of indiv.
				1	2	3	
				%	%	%	
2	Gdańsk	1964	1	50.0	94.9	97.2	36
3	Gdańsk	1966	1	35.4	85.8	97.2	212
4	Gdańsk	1967	1	56.5	89.1	97.4	193
5	Gdańsk	1968	1	38.6	90.1	97.0	101
6	Gdańsk	1968	1	20.0	84.0	92.0	25
7	Gdańsk	1969	1	73.3	86.7	93.3	15
8	Gdańsk	1972	1	64.7	98.5	100.0	68
9	Gdańsk	1972	1	30.6	86.1	94.4	36
17	Świbno	1965	1	21.9	61.0	92.7	41
18	Świbno	1966	1	42.2	89.2	95.9	296
19	Świbno	1967	1	65.9	90.1	96.7	91
20	Świbno	1968	1	32.6	82.1	88.4	95
21	Jastarnia	1966	1	37.6	93.3	98.8	165
Average			1	43.6	88.4	95.6	1374
10	Gdańsk	1967	2	56.4	95.7	99.1	117
11	Gdańsk	1968	2	66.3	95.9	96.9	98
12	Gdańsk	1969	2	75.5	95.1	98.9	265
13	Gdańsk	1970	2	75.9	96.0	99.1	224
14	Gdańsk	1971	2	80.0	95.8	96.4	164
15	Gdańsk	1972	2	73.9	95.0	95.7	161
16	Gdańsk	1972	2	81.3	100.0		32
Average			2	73.3	95.7	97.9	1062

and Świbno (17.8%). On the other hand, returns from the fishes released at Jastarnia still decreased (to 11.3%). In winter of the second year the returns decreased for all groups (0.8% for two-year old fishes from Gdańsk, 6.9% for the fishes from Jastarnia). In the third year the returns were low and ranged from 0.2 to 3.8% in particular periods (Fig. 5).

Most fishes were caught in the first two years after the release. Returns from one-year old fishes amounted on the average to 43.6% in the first year (range (20.0% to 73.3%), and to totally 88.4% after the second year (range 61.0–98.5%). Returns from two-year old fishes were higher in the first two years, reaching 73.3% after the first year (range 56.4%–81.3%), and 95.7% after the second year (range 95.0–100%) (Tab. 3).

Migrations of rainbow trout released into the Gulf of Gdańsk at Jastarnia and Gdańsk, and to Vistula mouth at Świbno

MIGRATIONS OF "YOUNGER" TROUTS

Untill July trouts were caught near the site of release. As regards the fishes released at Świbno, 73.1% of total returns from "younger" fishes were obtained in the Vistula mouth, 20.7% to the east, and some to the west of it. Single specimens entered the Vistula River and were caught in its lower course near Tczew, and sporadically even higher – near Gniewo and Grudziądz (Tab. 4).

One- and two-year old trouts released in Gdańsk were in most part (73.5–64.2%) caught together with herring, west of the Vistula mouth, mainly between Gdańsk and Gdynia. Moreover, they were also caught in the Vistula mouth and east of it, but at low numbers. Quite a number migrated upstream to the rivers of the Gulf of Gdańsk – 17.2% and 20.3% (Tab. 4). One specimen was caught at Dziwno. This fish made a distance of 280 km during 11 days, at average speed of 25.1 km/day. Other two-year old trout was caught near Uznam Island, making a distance of 320 km, at a speed of 8.2km/day. In the region of the Gulf of Gdańsk, the distance between Gdańsk, Oliwa and Kąty (36 km) was made by the fishes in 15 days, at average speed of 2.4 km/day.

MIGRATIONS OF "OLDER" TROUTS

From among 4 sets of tags returned in successive seasons, the most frequent were those obtained in the Gulf of Gdańsk and in coastal and inland waters of Poland. Per cent of fishes caught in this region changed depending on the site of the release. Trouts caught in this region were usually released at Jastarnia (48.4% on the average), while those released at Świbno were most rare (19.7% on the average). These differences were noticeable also in particular seasons (Tab. 5).

Outside the Gulf of Gdańsk and Polish coastal and inland waters, trouts released at Jastarnia and Gdańsk were caught more frequently in August and September of the first year (17.8 to 25.0%) than those released at Świbno (4.8%, Tab. 5). They were also more

Table 4

Places of catches of tagged rainbow trout released in spring into Vistula mouth at Świbno and to the Gulf of Gdańsk in Gdańsk and Jastarnia (fish caught from April till July)

Released			Receptured											
Place	Experiments		Fish age %	Percentage									Number of returns Place	
	No	Number		East of Vistula mouth	Vistula mouth	West of Vistula mouth	Puck Bay	Jastarnia Hel	Jelitków-ka Stream Radunia River Motława River Dead Vistula	Lower Vistula Vistula Firth	Vistula River Tczew Grudziądz	Pomerania Bay Dziwna	Known	Unknown
Jastarnia	21	1	1 average					100.0					4	
Świbno	17–20	4	1 average	20.7	73.1	2.1				3.1	1.0		517	7
			range	2.0–42.2	56.9–93.7	0–15.3				0–19.4	0–2.1			
Gdańsk	2–9	8	1 average	3.6	5.4	73.5			17.2			0.3	332	8
			range	0–20.0	0–25.0	15.4–94.6			0–76.9			0–2.1		
Gdańsk	10–16	7	2 average	4.3	8.6	64.2	0.5	0.2	20.3	1.7		0.2	419	2
			range	0–12.5	0–15.7	28.7–80.4	0–2.7	0–1.4	4.2–50.0	0–7.1		0–1.4		
Total			1–2 average	10.7	33.8	41.5	0.2	0.4	11.0	1.8	0.4	0.2	272	17

Table 5

Percentage of "older" fish caught in consecutive years and seasons outside of the Gulf of Gdańsk, and Polish inland and coastal waters

Years after release	Season	Place of release and age of fish released			
		Jastarnia 1	Swibno 1	Gdańsk 1	Gdańsk 2
1	Summer	25.0	4.8	17.8	23.5
	Autumn	43.3	12.1	23.0	20.7
	Winter	31.6	27.9	19.0	35.1
2	Spring	57.6	28.9	36.4	37.7
	Summer	73.3	37.3	62.1	48.9
	Autumn	44.4	10.8	15.8	8.2
	Winter	27.3	50.0	34.8	11.1
3	Spring	0.0	10.0	25.0	11.1
	Summer	66.7	40.0	37.5	0.0
	Autumn	0.0	26.7	7.7	33.3
	Average	48.4	19.7	26.0	22.9
	Number of fish	155	467	635	1012

Note: Percentage calculated in relation to total tag returs from "older" fish in the given season.

frequent in west part of the Baltic Sea than in the east part. The situation was different only in case of the fishes released at Świbno (Tab. 6, Fig. 6–8).

In this period trout males and females were quite frequently observed in Polish rivers – Vistula (trouts from Świbno), Radunia, rivers of Pomerania, as well as in the rivers of German Democratic Republic (trouts from Gdańsk, Fig. 6–8).

In the Gulf of Gdańsk fishes released in Gdańsk were caught west and east of the Vistula mouth (Tab. 7), while fishes released at Świbno were caught at high numbers in the Vistula mouth (64.5%, Tab. 7, Fig. 7).

In autumn of the first year (October – December) share of trouts caught outside the Gulf of Gdańsk and Polish coastal waters increased considerably, especially as regards the fishes released at Świbno (to 12.1%) and Jastarnia (to 43.3%) (Tab. 5). Frequent catches were also recorded in the region of Gotland Island, especially of one-and two-year old fishes released in Gdańsk (11.0% and 7.8%, Fig. 11). East of this region returns of the fishes released at Świbno (30.0%) and Gdańsk (22.2 and 29.2%) were more frequent than of those released at Jastarnia (9.1%) (Tab. 6). In this period trouts from Jastarnia (13.3%) were more frequent in the Danish Straits than trouts from other groups (2.7–5.5%). In the waters of West and Middle Pomerania these fishes were rare (0.7–6.6%, Fig 9–11). As regards the fishes originating from Świbno 47.4% were caught in the Vistula mouth, 19.0% in the Gulf of Gdańsk, east of the Vistula mouth. Contrarily to this, one- and

Table 6

Percentage of older fish caught in consecutive years and seasons in eastern and northern part of the Baltic Sea (coast of Estonia, Latvia, Gulf of Finland and Bothnia) in relation to western part (region of Bornholm, Danish Straits and outside of the Baltic Sea)

Years after release	Season	Place of release and age of fish released			
		Jastarnia 1	Świbno 1	Gdańsk 1	Gdańsk 2
1	Summer	0	100.0	0	5.3
	Autumn	9.1	30.0	22.2	29,2
	Winter	20.0	20.0	0	23.8
2	Spring	5.5	7.7	13.0	4.8
	Summer	0	7.7	9.5	16.7
	Autumn	0	16.7	28.6	11.1
	Winter	0	25.0	0	0
3	Spring	–	0	20.0	0
	Summer	100.0	0	0	–
	Autumn	–	0	–	100.0
	Average	7.0	16.4	13.9	20.4
	Number of fish	57	61	115	157

two-year old trouts released in Gdańsk were mostly caught in the Gulf of Gdańsk – 60.9% and 70.8% respectively. They were more frequently caught west of the Vistula mouth (46.5 and 62.7%) than east of it (11.0% and 3.2%). In the Vistula mouth they were rare. Almost 1/3 of the returns from the fishes released at Jastarnia were obtained in the Gulf of Gdańsk (Tab. 7). Upstream migrations of trouts were also observed. One specimen went 100 km up the Vistula River (Fig. 9–11).

In winter of the first year percentages of returns obtained outside the Gulf of Gdańsk and Polish inland waters were similar for the four groups (19.0 to 35.1%, Tab. 5). Near Gotland Island this percentage ranged from zero (for one-year old trouts released in Gdańsk) to 13.5% (for two-year old fishes, Gdańsk). East of this region about 20% of trouts were caught, with the exception of one-year old fishes from Gdańsk (Tab. 6). Further increase of the relative numbers of caught trouts was observed in Danish Straits, from 6.8% (Gdańsk, age 2) to 15.8% (Jastarnia), and in the region of Bornholm Island, from 5.3% (Jastarnia) to 20.6% (Gdańsk, age 1). Trouts were also fairly numerous in the rivers of West and Middle Pomerania, from 2.7% (Gdańsk, age 2) to 15.9% (Gdańsk, age 1) (Fig. 12). In the Vistula mouth percentage of returns decreased compared to the previous period, to 13.9% for the fishes originating from Świbno, and to low numbers (5.3 to 6.3%) for the fishes from other sites. Percentage of fishes from Gdańsk caught in

Table 7

Percentage of "older" fish caught in the region of the Gulf of Gdańsk and Vistula mouth in consecutive years and season after release

Year after release	Season	Place of release and age of fish															
		Jastarnia 1				Swibno 1				Gdańsk 1				Gdańsk 2			
		Gulf of Gdańsk			Vistula mouth	Gulf of Gdańsk			Vistula mouth	Gulf of Gdańsk			Vistula mouth	Gulf of Gdańsk			Vistula mouth
		Total	West	East		Total	West	East		Total	West	East		Total	West	East	
1	Summer	25.0				17.7		17.7	64.5	48.9	20.0	28.9	13.3	54.6	38.6	12.9	10.6
	Autumn	33.4	20.0	13.4	3.3	25.9	1.7	19.0	47.4	60.0	46.5	11.0	4.0	70.8	62.7	3.2	4.6
	Winter	42.1	5.3	21.0	5.3	30.3		25.6	13.9	46.1	22.2	15.9	6.3	48.7	24.3	9.5	5.4
2	Spring	3.0		3.0	9.1	8.9		6.7	37.8	22.8	9.1	9.1	3.0	29.6	19.7	6.6	6.6
	Summer	16.7	3.3	13.4		22.7	1.3	20.0	33.7	15.5	5.2	10.3	6.9	24.4	24.4		15.5
	Autumn	50.0	11.1	27.8		16.9			50.6	71.9	61.9	8.6	4.3	80.9	71.8	7.3	5.5
	Winter	18.2	9.1	9.1		–			37.5	56.5	30.4	17.4	4.3	66.7	55.6		
3	Spring	100.0		100.0		20.0		20.0	20.0	20.0	10.0	5.0	5.0	33.3	11.1	22.2	33.3
	Summer					50.0		10.0	10.0	12.5		12.5	12.5				
	Autumn	50.0	50.0			6.7				76.9	76.9			66.7	66.7		
Total:		25.2	7.7	12.9	3.2	20.8	1.3	16.1	40.9	50.9	36.2	11.8	5.2	63.2	52.9	5.5	6.3

Note: Percentage in each group (place and age) were calculated in relation to the returns of "older" fish from this group in the given season.

the Gulf of Gdańsk decreased to 46.1 and 48.7% compared to the previous period, while it increased to 42.1% for the fishes originating from Jastarnia. From among the fishes released in Gdańsk, more were caught west of the Vistula mouth, while fishes from Świbno and Jastarnia were more frequent in the east part of the Gulf of Gdańsk (Tab. 7).

Also in this period trouts entered Pomeranian rivers, Oder and Vistula. In the latter river one trout was caught near Nowe (90 km from the mouth). Single specimens were caught in the rivers, in GDR and Denmark (Fig. 12).

In spring of the next year, after the next fish release, number of trouts from Jastarnia caught outside the Gulf of Gdańsk and Polish inland waters was higher (57.6%) than number of trouts originating from Gdańsk and Świbno (28.9–37.7%, Tab. 5). They were also found in east and north regions of the Baltic Sea, but in small per cents (4.8–13.0%) (Tab. 6). Returns from Gotland, Bornholm, West and Middle Pomerania decreased, while catches in Danish Straits and Kattegat increased to from 21.3% (Gdańsk, age 2) to 39,4% (Jastarnia). One specimen was even caught in the Norwegian Sea (Gdańsk, age 2). Upstream migrations also increased: to from 18.2% (Jastarnia) to 24.2% (Gdańsk, age 1). Trouts were most frequent in Radunia River, less so in Pomeranian rivers and Vistula. One specimen was caught in the Vistula River (130 km upstream from the river mouth). Single specimens were caught in rivers of GDR, Soviet Union and Sweden (Fig. 13 and 14).

Share of fishes caught in the Gulf of Gdańsk still decreased (3.0 dna 8.9%). In the Vistula mouth fishes released at Świbno were more frequent (37.8%), while those released in other places were fairly rare (3.0–9.1%) (Tab. 7).

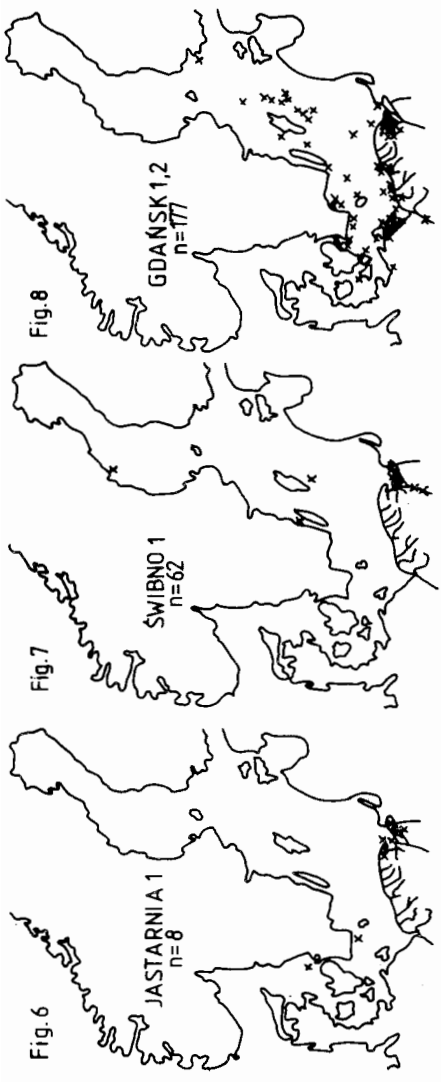
In summer of the second year there was a further increase of the returns from outside the Gulf of Gdańsk and Polish coastal and inland waters (Tab. 3). In the three sets of returns this percentage reached a maximum. Fishes from Świbno were less frequent (37.3%) but more numerous than in the previous periods. (Tab. 5). Fairly frequent catches were recorded in the region of Gotland Island: 18.7% for the fishes released at Świbno, 22.2% and 27.6% for one- and two-years old trouts from Gdańsk, 30% for the fishes from Jastarnia (Fig. 15 and 16). East and north of Gotland trouts were rare, from 0.0 to 16.7% (Tab. 6). They were, however, quite frequent in Danish Straits, especially those released at Jastarnia (30%, Fig. 15). Sometimes trouts were also caught in the region of Bornholm, and single fishes migrated as far as the North and Norwegian Sea. Some entered Polish rivers (Fig. 15 and 16).

In the Gulf of Gdańsk rainbow trouts were more frequently caught than in the previous season, especially east of the Vistula mouth (Tab. 7, groups: Jastarnia, Świbno and Gdańsk, age 1). At this time about 1/3 of the returns of Świbno fishes originated from the Vistula mouth, while the other groups were returned at low percentages (Tab. 7).

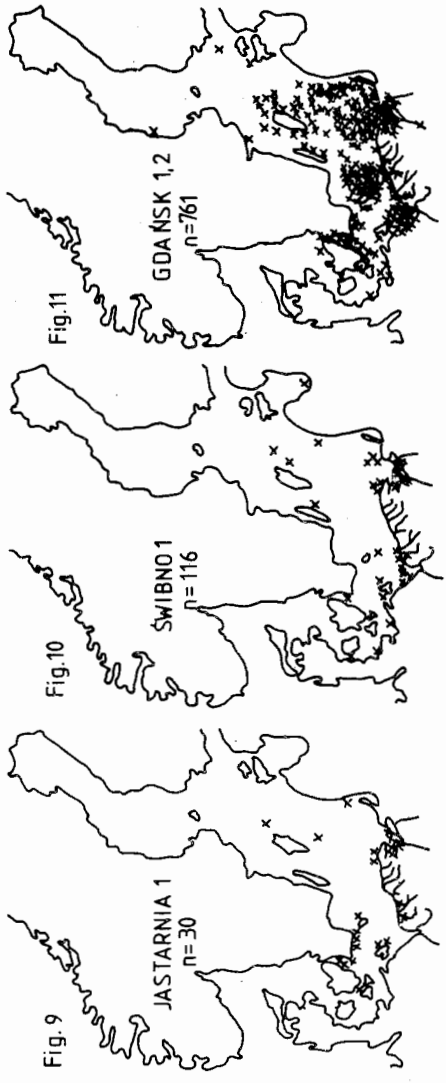
In autumn of the second year returns of the fishes from the regions outside the Gulf of Gdańsk and Polish coastal and inland waters decreased noticeably for all 4 groups, but they were still fairly high for the fishes released at Jastarnia (Tab. 5). Returns from Gotland region also decreased (2.7–5.8%). Only trouts released at Jastarnia were more

First year after release

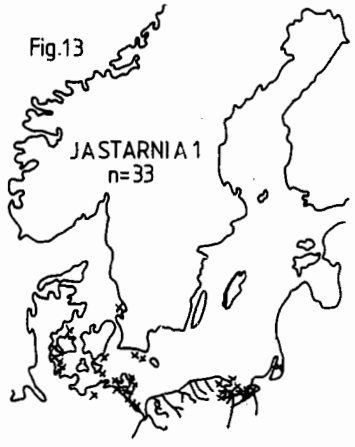
August - September

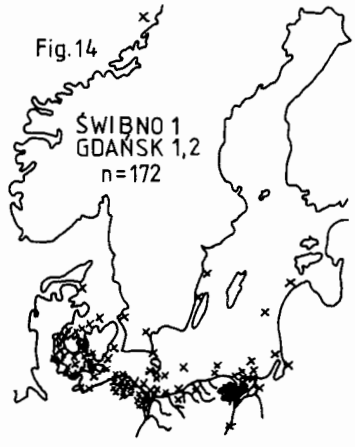


October - December

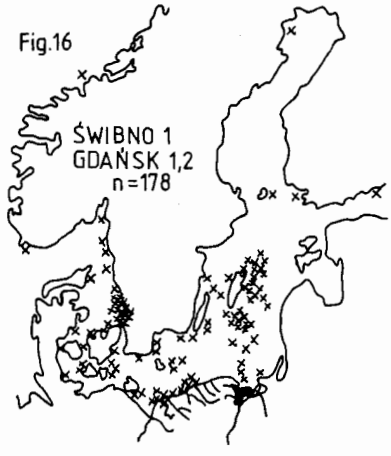


First year
January - March





Second year
April - June



Second year
July - September

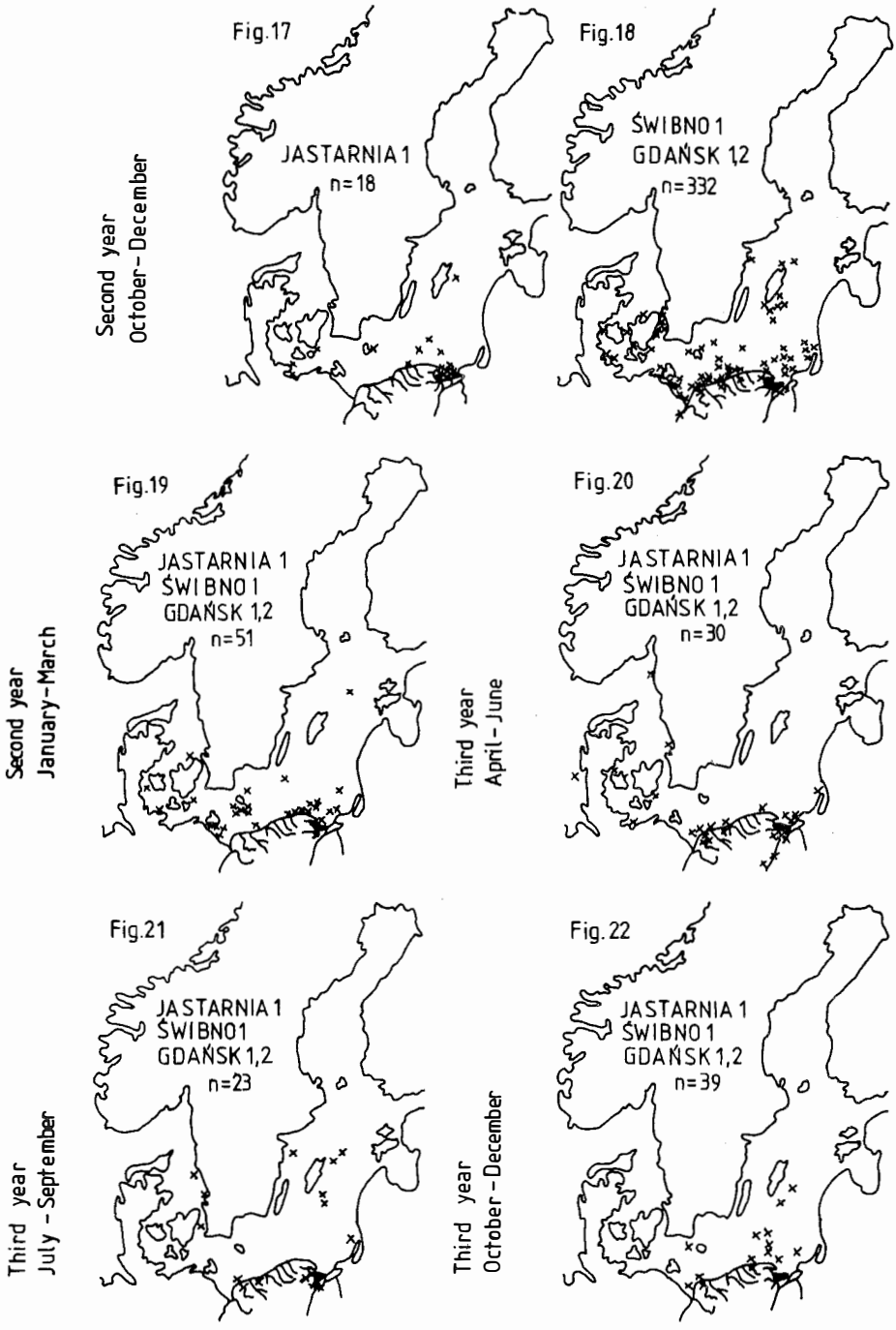


Fig. 6–22. Migrations of tagged rainbow trouts in successive seasons after the release in Gdańsk, Świbno and Jastarnia, n – number of returns, 1 and 2 close to the site name – age of the released fishes, crosses – returns

frequent (22.2%, Fig. 17 and 18). Fishes from the latter group were not found east and north of Gotland (Fig. 17), while trouts from other three groups migrated to these regions more frequently than previously (Tab. 6). They were caught in coastal waters of Lithuania and Latvia (Fig. 18). Percentage of returns from the region of Bornholm and Danish Straits decreased compared to previous periods, being still relatively high for Jastarnia fishes – 5.6% and 16.6% (Fig. 17), and much lower for other fish groups (0.7–2.4% and 3.6–6.5% respectively) (Fig. 18). Returns from the Gulf of Gdańsk increased noticeably: to 50.0% for Jastarnia trouts, and to 71.9% and 80.9% for one- and two-years old fishes released in Gdańsk. As regards the two latter groups, most fishes were caught west of the Vistula mouth (61.9% and 71.8%), while these released at Jastarnia were usually caught more to the east (27.8%). With respect to the fishes released at Świbno, more than half were caught in this period in the Vistula mouth (Tab. 7).

In winter of the second year from 11.0 to 50.0% of the returns were obtained outside the Gulf of Gdańsk and Polish inland and coastal waters (Tab. 5). The fishes were caught mainly west of Gotland, and only a few were caught in Lithuanian and Latvian waters (Fig. 19). Majority of trouts caught in the Gulf of Gdańsk originated from the releases made in Gdańsk (56.5% and 66.7%). They were usually faound west of the Vistula mouth. As regards the fishes released in the Vistula mouth, about 1/3 of the returns obtained totally during this winter originated from the same region (Tab. 7).

In spring of the third year returns from outside the Gulf of Gdańsk and Polish coastal and inland waters were low (0.0–25.0%, Tab. 5). Fishes were caught mostly in Danish Straits and Kattegat (Tab. 6, Fig. 20). Higher returns were recorded for the Gulf of Gdańsk and Vistula mouth. Some fishes were caught in Pomeranian rivers, in the middle Vistula, and Wda River mouth (Fig. 20).

In summer of the third year trouts were caught in central Baltic, Danish Straits, and Kattegat region (Tab. 5 and 6), as also in the Gulf of Gdańsk, Vistula mouth (Tab. 7) and some Polish rivers (Fig. 21).

In autumn of the third year returns were obtained from central Baltic, but most of all from the Gulf of Gdańsk and lower Vistula. Two tags were returned from Pomeranian rivers (Tab. 5–7, Fig. 22).

DISCUSSION

Distribution of "older" rainbow trout released in the Gulf of Gdańsk and the Vistula mouth differed noticeably from the distribution of sea trout released into the same regions and to Drwęca River (Backiel and Bartel 1967), and to Dunajec River (Pałka 1977). It was also different than the distribution of sea trout and its hybrids with brook trout (Salmo trutta m.fario) released to Raba River (Skrochowska 1969), or the distribution of salmon and sea trout from Finland (Toivonen 1973), Toivonen and Tuhkunen 1975), from Swedish river Indals (Carlin 1959), and of salmon from the Vistula (Backiel and Bartel 1967, Jokiel and Bartel 1983) and Drava rivers (Chrzan 1964, Bartel 1976).

Both sea trout (Backiel and Bartel 1967) and rainbow trout were most frequently caught in the Gulf of Gdańsk and the Vistula mouth, but rainbow trouts at a lower rate. Some rainbow trouts were caught in the Gulf of Bothnia, in middle and south Baltic, more frequently than sea trout but noticeably less frequently than salmon from the Vistula River (Backiel and Bartel 1967, Jokiel and Bartel 1983). Salmon released into the mentioned regions was found in Danish Straits, while sea trout was sporadic there. On the other hand, rainbow trouts were quite frequently caught in Danish Straits. They were found even in Kattegat and Skagerrak, and single specimens migrated as far as the North and Norwegian Sea. Also trouts released into the Bay of Kiel were found in these regions (Institut für Küsten u. Binnenfischerei, Hamburg 1970), as well as those released to Wieprza, Grabowa, Gulf of Szczecin and Pomerania. As regards the trouts released in the latter places, they were more frequently caught in the Gulf of Gdańsk (Trzebiatowski 1979).

Distribution of tagged trouts differed depending on the site of their release. Rainbow trouts released at Świbno were caught 2.5 times more frequently in the Vistula mouth than in the Gulf of Gdańsk, whereas those released at Jastarnia and in Gdańsk were caught respectively 2, 6 and 9 times more frequently in the Gulf of Gdańsk than in the Vistula mouth. Moreover, differences were observed in the ditribution of trouts within the Gulf of Gdańsk. Fishes released in Gdańsk were more frequent west of the Vistula mouth, while trouts from Jastarnia and Świbno – east of it. It can be assumed that rainbow trouts released in the Vistula mouth were affected by river waters, while those released in Gdańsk (at the mouth of small Jetlinówka Stream) were more frequently caught at the place of release. Most probably this resulted from an imprinting of the water smell (Hasler 1966). Trouts released at all sites seemed to "be lost" and entered many rivers, even outside of Poland. This phenomenon became more noticeable along with increasing distance of the release sites from the Vistula mouth. It was most pronunced in trouts released at Jastarnia, and least pronounced in those released at Świbno.

Contrarily to Meyer's (1939) suggestion that ranbow trouts remain at the release site, it can be stated that they migrate at long distances, even as far as the Norwegian Sea. The same was observed for fishes released to Kiel Bay (Inst. f. Küsten u. Binnenfisch. 1970).

As regards the fishes released to the Vistula mouth and Gulf of Gdańsk, most returns were obtained from coastal waters. Similar distribution was observed by Trzebiatowski (1979) who stated also that trouts released to rivers and Szczecin Bay migrated eastward along the coast, reaching the Gulf of Riga and Gotska Sandon Islands. Hence, they behaved differently than trouts released to the Vistula mouth in Gdańsk and Jastarnia, which migrated wesward. (especially those released at Jastarnia). It could be assumed that the fishes migrated toward higher salinities, but this suggestion is contradicted by more frequent returns from coastal waters and close to river estuaries. It is possible that westward trend id specific of this species. Steelhead trout in Pacific Ocean migrated far to the west, to Kodiak and Aleutial Islands, and even to Bering Sea (Sutherland 1973, Hart 19733, Calaprice 1976).

The above suggestion can be supported by the results of the experiments with *Oncorhynchus gorbuscha* and *O. keta* introduced into Barents and White Sea. Both species originate from the Pacific Ocean, similarly as rainbow trout. The introduced fishes were caught in both seas, and east of Pechora River, as also near Novaya Zemlya. However, considerable number of the fishes migrated westward, and were caught along Norwegian, Island and Scotland coasts (Azbelev and Jakovlenko 1963, Burmakin 1963, Kamyšnaja and Smirnov 1968, Smirnov and Kamyšnaja 1975).

Rainbow trouts released in spring into the Vistula River migrated downstream. Most of them were silver. Silver colouring of rainbow trout was mentioned in 1929 by Sawicki, who discussed the results of breeding rainbow trout imported from Sweden in 1924. This would confirm earlier suggestions by Różański (1914) and Kulmatycki and Mieszkowski (1927) that rainbow trouts migrated downstream and were caught in river estuaries. Jackson (1977) is of the opinion than rainbow trout has no smolt stage, but in Polish conditions it is difficult to speak of pure rainbow trout. Needham and Behnke (1962) stated that imported trouts which originated from McCloud River were the hybrids of many varieties. These authors suggested that the trouts were a cross-bred of migrating and stationary form, and also of cutthroat trout (*Salmo clarki*). Also Schaperclaus (1961) stated that when first rainbow trouts were imported to Europe in 1882 also their migratory form and *Salmo clarki* were brought, so that the rainbow trout bred at present must be a hybrid of these forms. Consequently, both forms of rainbow trout might have occurred.

Spring introductions of rainbow trouts into the Vistula River confirmed the suggestions on smolt downstream migrations, similarly to those observed for sea trout from the Vistula (Żarnecki 1936, Skrochowska 1969, Epler and Bieniarz 1973, Pałka 1977), Rega River (Chełkowski 1966), and salmon from Drawa River (Bartel 1976). The same was observed in rainbow trout from McCanaughy reservoir (Van Velson 1974) and in migratory rainbow trout introduced into Kura River (Kjazimov and Safonov 1973). On the other hand, no autumn migrations of rainbow trout were observed, as those recorded for migratory rainbow trout in Chilliwack River (Maker and Larkin 1954) and Sacramento River (Hallock et al. 1961). In these two rivers most fishes migrated downstream in spring. Also in Waddel Stream maximal migrations were observed in spring, but fishes migrated downstream throughout the year (Shaporalov and Taft 1954).

Trouts released to the Vistula River at Nieszawa were caught 4–6 days later 30 km downstream. It can be assumed that at least part of the fishes migrated downstream after a brief period of adaptation. Their speed ranged between 5.3 and 8 km/day, being much lower than maximal speed of Drawa salmon smolts (70 km/day, Bartel 1976) or Vistula sea trout (95.5 km/day, Skrochowska 1969) or than 48.7 km/day (recalculated) attained by salmon in the River Penobscot (Fried et al. 1978). It was also lower than maximal speed of Vistula trout smolts (14 km/day, Żarnecki 1936). On the other hand, it was close to average speed calculated for sea trout (5.08 km/day, Żarnecki 1936), or salmon from Penobscot River (Fried et al. 1978).

It can be assumed that rainbow trout can also attain higher speed, considering that one specimen was caught near Ystad after 70 days, i.e. at a distance of 570 km from the release site. Average speed of this trout amounted to 8.1 km/day. This trout probably made 240 km length of the Vistula at a higher speed.

Rainbow trouts released at Świbno, Gdańsk and Jastarnia entered smaller river of the Gulf of Gdańsk and the Vistula River. In the latter case they were the fishes released to the Vistula mouth. Trouts were also observed in the rivers of Middle and West Pomerania, in most cases these released at Jastarnia, while those released at Świbno being least frequent. These fishes entered the river all the year around, but most intensively in spring of the second year. Moreover, many of the fishes released in Gdańsk were found in autumn of the first year in the rivers of the Gulf of Gdańsk, and West and Middle Pomerania. All year migrations to the rivers were also observed in the rivers Waddell (Shapovalov and Taft 1954) and Sacramento (Hollock et al.,1961), but in the first river most intensive migrations took place at the begining of the year, while in the second one – by the end of September. Trouts from McConaughy reservoir (Van Velson 1974) went upsream in spring, and those released to coastal waters of Middle and West Pomerania commenced migrations in autumn, with a peak in spring (Trzebiatowski 1979). Withler (1966) distinguished winter and summer forms of rainbow trout enetring 8 rivers of British Columbia. The first form was present in the rivers Coquitlan, Chechalia and Alovette. These commenced migrations in November, which lasted till April in the first river, and till March in the other two. In the Cheakamus River upstream migration took place only in April and May. In three other rivers both forms were present. Trouts entered the rivers Capilano and Coquihalla all year around, but most intensive migrations were observed in the second half of July and first half of August.

Rainbow trouts entered the rivers in the first and second year after the release, similarly as in the rivers Waddell (Shapovallov and Taft 1954), Snake (Gilbreat et al. 1976) and reservoir McConaughy (Van Velson 1974). On the other hand, in the River Chilliwack, spawning population consisted of the fishes after two or three years of sea life (Maker and Larkin 1954).

CONCLUSIONS

1. Rainbow trouts migrated all over the Baltic Sea, and single specimens were caught in Skagerrak, North Sea and Norwegian Sea. The fishes tended to migrate westward, especially those released farer from the Vistula mouth. Hence, site of the release was of considerable significance for trout migrations and distribution.
2. Rainbow trouts were most numerous in the Gulf of Gdańsk and Polish coastal and inland waters. 74 to 80.3% of the returned fishes originated from stockings made in Gdańsk and Świbno, and 51.6% from stockings in Jastarnia.
3. Concentration of the fishes close to river mouths was more pronounced in autumn. Fishes entered the rivers all year around, but most intensively in spring.

4. Most intensive trout catches were recorded in autumn of the first year after the release. The fishes were exploited mostly during the first two years. 88.4% and 95.7% of the one- and two-years old fishes respectively were caught during this period.

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ROZSIEDLENIE I WĘDRÓWKI ZNAKOWANYCH PSTRĄGÓW TĘCZOWYCH (*SALMO GAIRDNERI* RICH.) WYPUSZCZONYCH DO BAŁTYKU

STRESZCZENIE

Z 41.502 znakowanych pstrągów tęczowych w wieku 0+, 1 i 2 lata o długościach 11–49 cm wypuszczonych głównie do ujścia Wisły i Zatoki Gdańskiej oraz do kilku rzek pomorskich otrzymano 1.496 zwrotów z ryb „młodszych" złowionych do końca lipca w roku wypuszczenia i 2.504 z ryb „starszych" łowionych po tym terminie. Zwroty te były podstawą do określenia rozsiedlenia i wędrówek pstrągów tęczowych. Wśród znakowanych pstrągów wyróżniano smolty.

Znakowane pstrągi wędrowały po całym Bałtyku, jednak najwięcej pochodziło z Zatoki Gdańskiej i ujścia Wisły, odpowiednio 46 i 16%. Dość licznie występowały one w Cieśninach Duńskich i rejonie Gotlandu a pojedynczo w Morzu Norweskim i Północnym. Miejsce wypuszczenia miało wpływ na ich wędrówki i rozsiedlenie. Z grupy pstrągów wypuszczonych w Gdańsku i Świbnie odpowienio 75 i 80,9% złowiono w Zatoce Gdańskiej oraz wodach przybrzeżnych i śródlądowych Polski, a jedynie 52,8% z grupy wypuszczonej w Jastarni.

W pierwszym okresie po zarybieniu (do lipca włącznie) odłowiono znaczne ilości ryb, sięgające nawet 50% ogólnej liczby zwrotów. Maksymalne połowy pstrągów po tym okresie obserwowano w jesieni pierwszego roku i nieco mniejsze w jesieni drugiego roku. Większość pstrągów złowiono w ciągu dwu pierwszych lat po zarybieniu. Średnio z tego okresu pochodziło 88,4% z jednorocznych i 95,7% z dwurocznych ryb.

Ryby młodsze były głównie poławiane w okolicy miejsca zarybiania. Niektóre z nich wstępowały do Wisły (z wypuszczonych w Świbnie) i do rzek Zatoki Gdańskiej (z Gdańska). Pstrągi wypuszczone do Wisły spływały niemal natychmiast. Szybkość wędrówki smoltów dochodziła do 8,2 km/dobę.

Procent poławianych pstrągów w kolejnych sezonach poza Zatoką Gdańską oraz wodami przybrzeżnymi i śródlądowymi Polski zmieniał się w kolejnych sezonach osiągając maksymalne wartości latem drugiego roku. Był on uzależniony od miejsca wypuszczenia i średnio około dwukrotnie częściej poławiano tu ryby pochodzące z Jastarni niż z Gdańska i Świbna. Widoczna była tendencja do wędrówki w kierunku zachodnim, szczególnie wśród ryb pochodzących z Jastarni.

Z pstrągów wypuszczonych w Gdańsku złowiono w Zatoce Gdańskiej na zachód od ujścia Wisły łącznie ponad połowę pstrągów. Natomiast ryby pochodzące z Jastarni i Świbna poławiano w tym rejonie około 2–3 krotnie rzadziej. Z wypuszczonych w Świbnie ponad 40% złowionych ryb pochodziło z ujścia Wisły. Maksymalne ich liczby obserwowano w jesieni pierwszego i drugiego roku.

Pstrągi wstępowały do rzek przez cały rok do Wisły (głównie z wypuszczonych w Świbnie), do rzek Pomorza Zachodniego i Środkowego (głównie z Jastarni) oraz pojedynczo do rzek poza Polską. Nasilenie wstępowania do rzek obserwowano wiosną.

Р. Бартэль

РАССЕЛЕНИЕ И МИГРАЦИИ МЕЧЕНОЙ РАДУЖНОЙ ФОРЕЛИ (SALMO GAIRDNERI RICH.) ВЫПУЩЕННОЙ В БАЛТИЙСКОЕ МОРЕ

Резюме

Из 41502 особей меченой радужной форели, 0+, 1 и 2 годовников, длиной 11-49 см, выпущенных в основном в устье Вислы и Гданьский залив, а также в несколько рек Поморья, получено 1496 „возвратов" меток „младших" рыб, выловленных в период до конца июля в год зарыбления и 2504 меток „старших" рыб, выловленных позднее. Возвраты были основой для определения расселения и миграций радужной форели. Среди меченых форелей особо отмечена молодь.

Меченые форели мигрировали по всей Балтике, но большинство из них вылавливали в Гданьском заливе и устье Вислы, соответственно 46 и 16%. Довольно часто наблюдали мечение особи в проливах Дании и районе Готландии, а одиночные - в Норвежском море и в Северном. Место зарыбления имело влияние на их миграции и расселение. Из группы форелей, выпущенных в Гданьске и Свибне, соответственно 75 и 80,9% выловлено в Гданьском заливе и в прибрежных водах, а также во внутренних водоёмах Польши, а только 52,8% из группы, выпущенных в Ястарни.

В первый период после зарыбления (по июль включительно) отловлено значительное количество рыб, доходящее до 50% от общего количества „возвратов". Максимальные уловы форели после этого периода наблюдали осенью первого года и немного меньшие осенью следующего года. Большинство форелей выловлено в течение двух первых лет после зарыбления. В среднем из этого периода 88,4% составляли годовики и 95,7% - двугодовики.

Особи „младшие" были в основном выловлены в месте зарыбления. Некоторые из них заходили в Вислу (из выпущенных в Свибне) и в реки Гданьского залива (из Гданьска). Форели, выпущенные в Вислу, почти сразу спускались вниз по течению. Скорость миграции этой молоди достигала 8,2 км/сутки.

Процент отлавливаемых форелей в очередных сезонах за районом Гданьского залива, прибрежными водами и внутренними водами Польши, менялся, достигая максимальных результатов летом второго года. Он зависел от места зарыбления и в среднем в два раза чаще здесь вылавливали рыбы, выпущенные в Ястарни, чем рыбы из Гданьска и Свибна, Выявлялась тенденция миграции в западном направлении, особенно среди рыб из Ястарни.

Из форелей, выпущенных в Гданьске, выловлено в Гданьском заливе на запад от устья Вислы больше чем половина Форелей. Тогда как рыбы из Ястарни и Свибна вылавливали в этом районе в 2-3 раза реже. Из выпущенных в Свибне больше 40% выловленных рыб происходило из устья Вислы. Максимальные их

количества наблюдали осенью 1 и 2-го года.

Форели находили в реки в течение всего года. В Вислу (в основном из выпущенных в Свибне), в реки Западного и Среднего Поморья (в основном из Ястарни) а также единичные особи наблюдались в реках за пределами Польши. Увеличение заходов в реки наблюдалось весной.

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