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Fish biology

DESCENT OF TROUT (*SALMO TRUTTA* L.) SMOLTS GROWN
IN RIVER MOŁSTOWA CATCHMENT AREA

OKRES SPŁYWANIA SMOLTÓW TROCI (*SALMO TRUTTA* L.)
WYROSŁYCH W ZLEWNI MOŁSTOWEJ

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The paper present data on the descent of trout (*Salmo trutta* L.) smolts grown in the Mołstowa catchment area, with a particular reference to the fish length and water temperatures.

INTRODUCTION

Larsson and Erikson (1979) found a relationship to exist between the water temperature at spring release of smolts and the magnitude of return. Therefore studies on the descending smolts grown under natural conditions and on the water temperatures on descent can have both cognitive and practical aspects. It seems purposeful to stock open waters with smolts grown in stock-producing centres at a period of time most similar to the period of descent under natural conditions. Results given by Chełkowski (1978) on the time of descent of trout smolts grown under natural conditions of the Rega catchment area, water temperatures considered, were not, as mentioned by the author himself, adequate in terms of fish length owing to the selectivity of the fishing gear used, biased towards larger individuals. Hence it seemed purposeful to repeat the study on a group of



Fig. 1. The river Rega catchment area.
 ● trout smolt capture sites in the Mołstowa

fish more representative of a natural stock of smolts. The study* was based on trout smolts grown in the Mołstowa, a rightbank tributary of the river Rega (Fig. 1), the latter opening directly into the south-western Baltic.

MATERIALS AND METHODS

The smolts examined were obtained from the trout hatch stockings performed in three subsequent years (1976–1978) in that part of the Mołstowa where no natural spawning takes place (Chełkowski, 1974; Chełkowski and Chełkowska, in press). As the Rega smolts are known to descend from late March to early June (Chełkowski, 1974), smolt fishing in the Mołstowa was commenced on 21 March and terminated on 15 June 1979. The fishes were caught with a fyke net barring the lower Mołstowa near the town of Mołstowo upstream of the dam terminating the homing migration of the anadromous trout. The smolts caught were narcotised with aquaceous MS-222, identified to species and developmental stage, and their caudal length (*longitudo caudalis*) was measured. For instance, the 10-cm class contained those specimens measuring 9.0–9.9 cm, the 11-cm class – those measuring 10.0–10.9 cm, and so on. A total of 3197 trout smolts were examined (Fig. 2), 47 parrs found being disregarded. Water temperature of the river at Mołstowo was measured at 8.00 hrs to the nearest 0.1°C.

RESULTS

The first smolt was caught on 19 April, the last on 8 June. Numbers of juvenile trout caught on each day and in each decade are summarised in Figs. 2 and 3. The smolts were found to descend mainly in four consecutive decades starting from the third decade of April to the third decade of May, 97.3% of the total number of fish being caught over that period. Low numbers were found to descend in the second decade of April when the migration began and in the first decade of June when it came to an end. The peak numbers of descending smolts were found in the second decade of May, a slightly lower peak being observed in the third decade of April.

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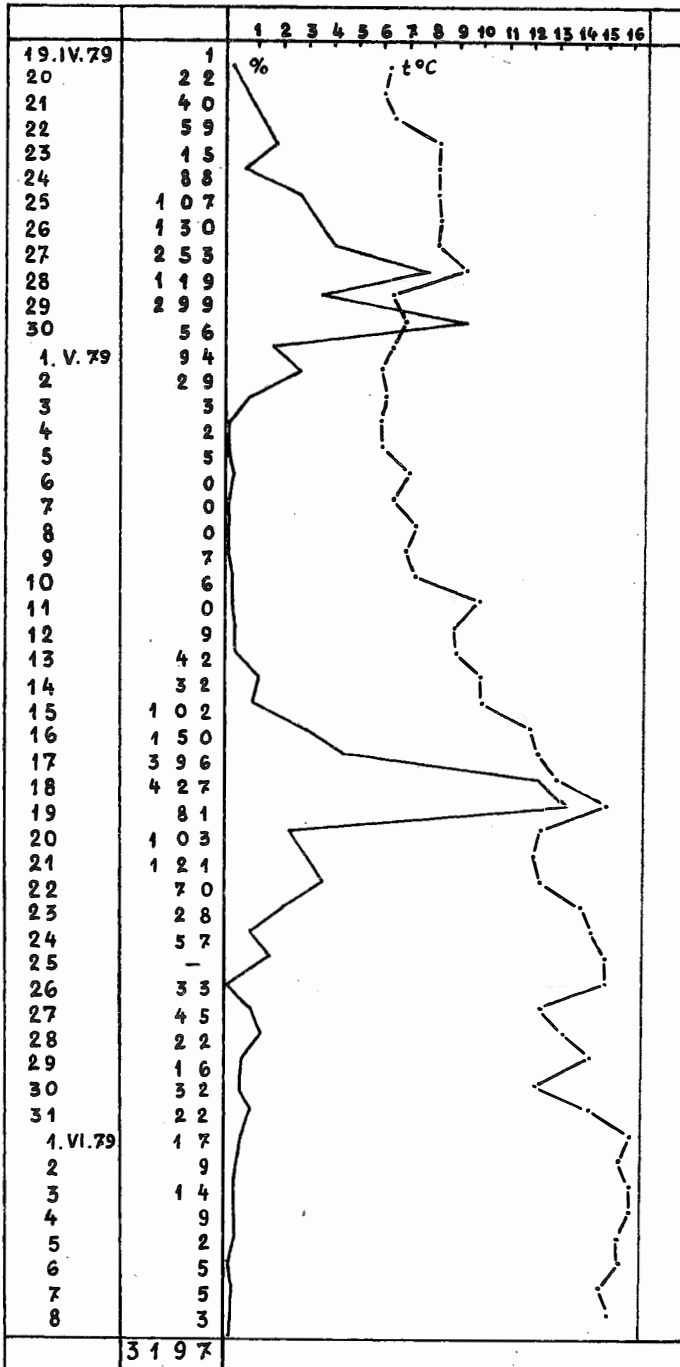


Fig. 2. The course of smolt fishing

Table 1

Time of smolt descent vs. water temperature

River	Year	Period of descent								Decade mean temperature °C									
		month and decade																	
		March		April			May			June	March		April			May			June
		III	I	II	III	I	II	III	I	III	I	II	III	I	II	III	I		
Rega	1965			X	X	X	x					7.3	7.6	9.7	11.3				
„	1966	x		X	X	x				3.9		5.2	9.0	13.7					
„	1967		x	X	X	X	x				6.0	8.5	8.1	10.5	15.8				
„	1974		x	x	x	X	X	x	x		7.7	8.9	11.0	7.6	12.3	15.1	13.0		
MOŁSTOWA	1979			x	X	x	X	x	x			6.1	7.7	7.0	11.5	14.0	15.2		

x = descent, X = abundant descent

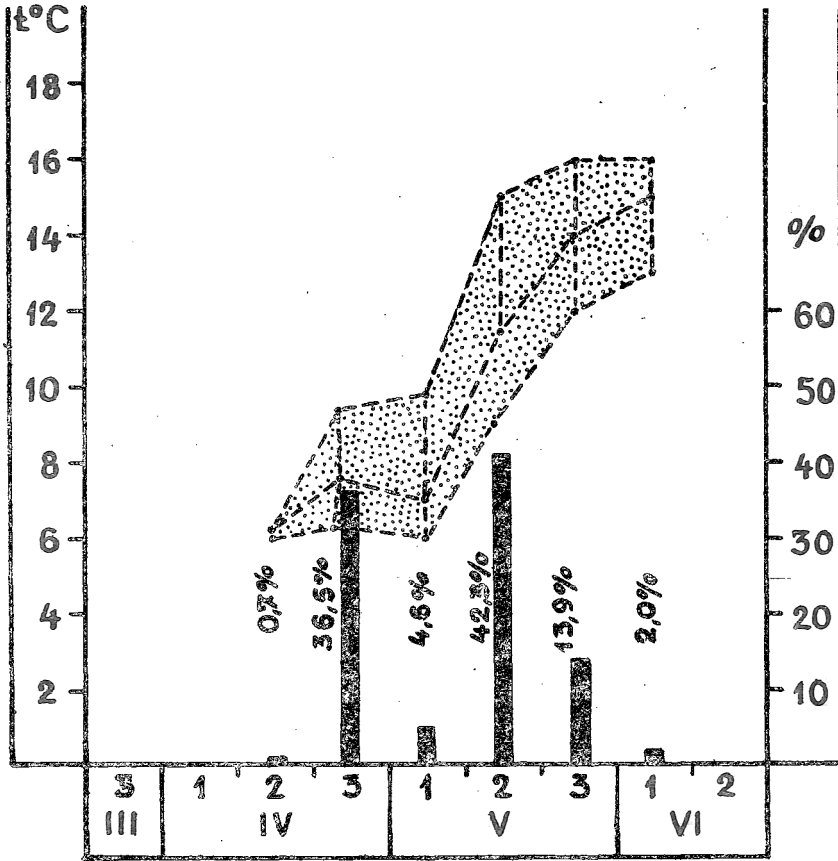


Fig. 3. The Mołstowa trout smolt descent in subsequent decades, with emphasis on water temperatures

The Mołstowa smolts were found to descend more frequently at night than during the daytime. Out of the total of 3197 smolts, 2574 ones (93%) were caught at night and 223 (7%) only during the day.

The descent took place during the spring water temperature rise from 6.0 to 16°C (Fig. 2). Based on decade means it can be assumed that the smolts descended mainly when the water temperature ranged within 7.7–11°C (Fig. 3). As seen from the graph, a decrease in the decade mean temperature from 7.7 to 7.0°C observed in between the third decade of April and the first decade of May affected the smolt migration by decreasing their percentage caught from 36.5 to 4.6%. A subsequent rise in the mean temperature in the second decade of May up to 11.5°C resulted in a peak descent of 42.3%. In this respect, particularly instructive are observations made between 24 April and 3 May (Fig. 2).

A rise in temperature from 8 to 9°C brings about an increased percentage of migrating fish, while a decrease from 9 to 6°C results in a decreased number of descending smolts. The highest numbers of migrating smolts were observed at water temperatures of 13.1–15°C.

The smolts from both the Rega and Mołstowa descend in the spring, from the third decade of March to the first decade of June in the Rega (Chełkowski, 1978), and from the second decade of April to the first decade of June in the Mołstowa (Table 1). A delayed descent found in the Mołstowa when compared to that in the Rega was undoubtedly related to the delayed spring of 1979. The periods of an intensive descent in the Mołstowa were found to concur with those in the Rega. Generally speaking, in the Rega catchment area including the Mołstowa smolts tend to descend in abundance over the period from the second decade of April to the second decade of May.

Table 2

Lengths of descending smolts (cm)

River	n	M±m	δ	ν	Length range	Remarks
Rega	191	19.6±0.18	2.43	12.39	12.6–26.1	Chełkowski 1974
Mołstowa	3197	15.2±0.03	1.88	12.37	9.3–23.9	present study

Table 3

Length distribution of descending smolts

No	Length class (cm)	Number of individuals	%
1	10	1	0.03
2	11	9	0.28
3	12	103	3.22
4	13	351	10.98
5	14	811	25.37
6	15	805	25.18
7	16	533	16.67
8	17	234	7.32
9	18	157	4.91
10	19	81	2.53
11	20	46	1.44
12	21	45	1.41
13	22	14	0.44
14	23	6	0.19
15	24	1	0.03
	Total	3197	100.00

Table 4

Temporal changes in lengths of descending smolts
(cm)

Period of capture	n	Mean length	Range (length classes)
19–20 April	23	17.5	12–23
21–27 April	692	16.6	10–24
28 April – 10 May	620	15.7	11–23
11–18 May	1168	14.6	11–22
19–30 May	608	14.2	11–18
31 May–6 June	78	14.3	12–17
7 June– 8 June	8	14.2	13–16
Total	3197	15.2	10–24

The decade mean temperatures at descent were similar in the two rivers. It is particularly true with respect to the water temperature range of 7–12°C prevailing during the period of the intensive descent.

It is interesting to note that the most numerous returns of tagged salmon smolts (*Salmo salar* L.) released into Swedish rivers occurred when the water temperatures at release ranged within 7–14°C (Larsson and Erikson, 1979). It can be thus presumed that the smolts were released during the descent of smolts grown under natural conditions, as indicated by our studies. It seems from these observations that smolts grown in stock-producing centres should be released into the Pomeranian rivers in the spring at water temperatures of about 8°C (7–9°C) prevailing usually in April.

The examined smolts measured 9.3–23.9 cm, the mean length being 15.2±0.03 cm ($M \pm m$; $n = 3197$), i.e., less than the mean for trout smolts in the Rega (Chełkowski, 1978) 19.6 cm; Table 2). The length distribution (1-cm intervals) of the descending smolts is presented in Table 3. The length classes within 12–19 cm were the most abundant ones and contained 96.2% of all the smolts caught.

Additionally, changes in fish length during the descent were analysed (Table 4). The mean length was found to decrease with time, from 17.5 at the onset to 14.2 cm at the outset of the descent.

CONCLUSIONS

The trout smolts in the Mołstowa were found to descend over the period from the second decade of April to the first decade of June, the most intensive descent being observed from the third decade of April to the second decade of May.

The smolts descended at water temperatures ranging within 6.2–16°C, the peak descent occurring at the temperature range of 7–12°C.

Length of the descending smolts ranged from 9.3 to 23.9 cm with the mean of 15.2 ± 0.03 cm.

The mean length of descending smolts was found to decrease with time.

A view is expressed that smolts grown in stock-producing centres should be released during periods of major migrations of smolts grown under natural conditions, i.e., in spring (April) at water temperatures of about 7–9°C.

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OKRES SPŁYWANIA SMOLTÓW TROCI (*SALMO TRUTTA* L.) WYROSŁYCH W ZLEWNI MOŁSTOWEJ

Streszczenie

W pracy przedstawiono okres spływania smoltów troci (*Salmo trutta* L.) wyrosłych w warunkach naturalnych zlewni Mołstowej z uwzględnieniem długości ryb i temperatury wody. Ryby występujące w badaniu pochodzą z zarybień wylęgiem troci dokonanych wiosną w latach 1976–1978 i to w tej części zlewni w której nie odbywa się tarło naturalne. Materiał badawczy pozyskiwano w 1979 r. żakiem skrzydłowym przegradzającym dolną Mołstową. Z badań odrzucono 47 troci pozyskanych w fazie parr. Ogółem do badań pozyskano 3197 sztuk smoltów troci.

Smolty w połowach wystąpiły w okresie 19 kwietnia do 8 czerwca. Główny okres zstępowania przypada od III dekady kwietnia do II dekady maja. Zstępowanie smoltów przypada przy temperaturze wody od 6,2 do 16°C, natomiast główny okres spływania przy temperaturze 7 do 12°C. Smolty wystąpiły w zakresie długości 9,3–23,9 cm ($M \pm 15,2 \pm 0,03$ cm). Stwierdzono, że w miarę upływu czasu zstępowania zmniejsza się średnia długość smoltów. Wydaje się, że wsiedlanie do rzek smoltów wyrosłych w ośrodkach zarybieniowych winno być dokonywane w okresach głównych wędrówek smoltów wyrosłych w warunkach naturalnych tj. w kwietniu przy temperaturze wody około 7 do 9°C.

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ПЕРИОД УХОДА К МОРЮ СМОЛТОВ КУМЖИ (*SALMO TRUTTA L.*)
ИЗ РЕКИ МОЛСТОВОЙ

Р е з ю м е

В работе представлен период ухода к морю смолтов кумжи (*Salmo trutta L.*) выросших в естественных условиях реки Молстовой с учетом длины рыб и температуры воды. Выступающая в исследованиях рыба происходит из той части реки, зарыбленной весной 1976-1977 годов, в которой не имеет места естественное икрометание. Исследуемый материал был получен в 1979 г. комбинированной ловушкой (яентерь) перекрывающей нижнюю Молстовую. Из исследований отброшено 47 экземпляров кумжи которые не достигли стадии "смолт". Всего до исследований получено 3197 штук смолтов кумжи.

В уловах смолты наблюдались с 19 апреля по 8 июня. Наиболее интенсивный ход смолтов имеет место с III декады апреля по II декаду мая. Уход смолтов имеет место при температуре воды от 6,2 до 16 град по Цельсию, наиболее интенсивный при температуре 7-12 град. Длина смолтов колебалась от 9,3 до 23,9 см ($M \pm m = 15,2 \pm 0,03$ см). Установлено что по мере течения времени ухода уменьшается средняя длина смолтов. Кажется, что вселение в реки мальков выведенных в искусственных условиях, следует проводить в период наиболее интенсивной миграции смолтов выросших в естественных условиях т.е. в апреле при температуре воды около 7-9 град.

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