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Short communications

PRELIMINARY FIELD OBSERVATIONS OF LAKE TROUT (*SALMO TRUTTA M. LACUSTRIS* L.) REDD STRUCTURE, AND FRY EMERGENCE IN THE UPPER WDA RIVER SYSTEM (NORTHERN POLAND)

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ABSTRACT. Some parameters of spawning redds and the emergence of lake trout fry were investigated at spawning areas in the upper Wda River system. Redds were located and selected in late fall 2003 and a few of their parameters were identified, *i.e.*, dimensions, water velocity, and grain fraction content. The sand content varied in particular redds from 5.1 to 24.8%. Fry was captured with traps at five of the six observed redds. Trout emerged from late April until mid May when temperatures increased within the range of 11.0-16.0°C. The most numerous trout fry was observed in the two biggest redds, which had less sand and high water velocities.

Key words: LAKE TROUT (*SALMO TRUTTA M. LACUSTRIS*), SPAWNING REDDS, FRY EMERGENCE

Knowledge of the characteristics of the spawning sites of salmonid fishes and the effects of their natural reproduction are of primary importance in the protection and proper management of resources of these species. The general characteristics of the spawning grounds of lake trout, *Salmo trutta m. lacustris* L., from Lake Wdzydze are relatively well known (Sakowicz 1961), and the number of spawning redds has been recorded for many years (Radtke and Dębowski 1996). The fry in the spawning grounds are also monitored regularly. Investigations conducted to date lack information regarding the emergence of fry from redds under natural conditions and the effectiveness of trout spawning. Since fry is stocked annually, the estimated abundance of fry refers to the combined number of fry from natural spawning and stocking. The majority of studies on the emergence of salmonid fry and its relation to environmental factors

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have been conducted under either artificial (controlled flow through canals) or semi-natural (artificial redds in streams) conditions. The aim of this study was to conduct preliminary observations of the moment when lake trout fry leaves the redd under natural conditions and in relation to selected environmental parameters.

SPAWNING REDDS

The investigation was conducted in the drainage basin of the upper Wda, a left-side tributary of the lower Vistula River in the Kashubian Lakeland in northern Poland. The spawning grounds were located in the Wda River and its tributary the Trzebiocha and in the upper Trzebiocha-Pilica drainage area following the introduction there of trout fry in 1991 (Fig. 1). The redds that were studied were chosen during routine spawning ground monitoring, which included counting all lake trout redds, in late fall 2003. Six of the most clearly defined redds were chosen: there was only one large redd in the Wda, in the Trzebiocha there was one mid-sized redd and one large one about 200 m lower, and in the Pilica there were three average-sized redds about thirty meters apart. The width, length, and height of the redd and the depth of the depression were measured. The water velocity above the redd was measured with a hydrometric current meter. After the fry had emerged from the redd, substrate samples of 4.4 to 7.7 kg were collected from the front end of the redd. Data on the size of the redds as well as water velocity is presented in Table 1.

TABLE 1

Redds dimensions and water velocity above the redd tails (* – measured from water surface)

Spawning river or stream and redd symbol	Length of tail (cm)	Width of tail (cm)	Depth of tail*	Depth of pot*	Water velocity (m s ⁻¹)
Trzebiocha No. 1 (T 1)	110	90	28	49	0.83
Trzebiocha No. 2 (T 2)	150	110	35	59	0.83
Wda (W)	150	120	20	50	0.98
Pilica No. 1 (P 1)	110	95	27	43	0.68
Pilica No. 2 (P 2)	80	90	29	48	0.66
Pilica No. 3 (P 3)	100	90	25	38	0.75

The percentage share in weight of the various grain fractions was calculated with the standard method using sieves with ten mesh sizes. The analysis of the substrate used to build the redds indicated that there was considerable variation among the various redds (Fig. 2). During the development of salmonid fish eggs and fry, the presence of the smallest substrate particles, which halt the flow of water through redds

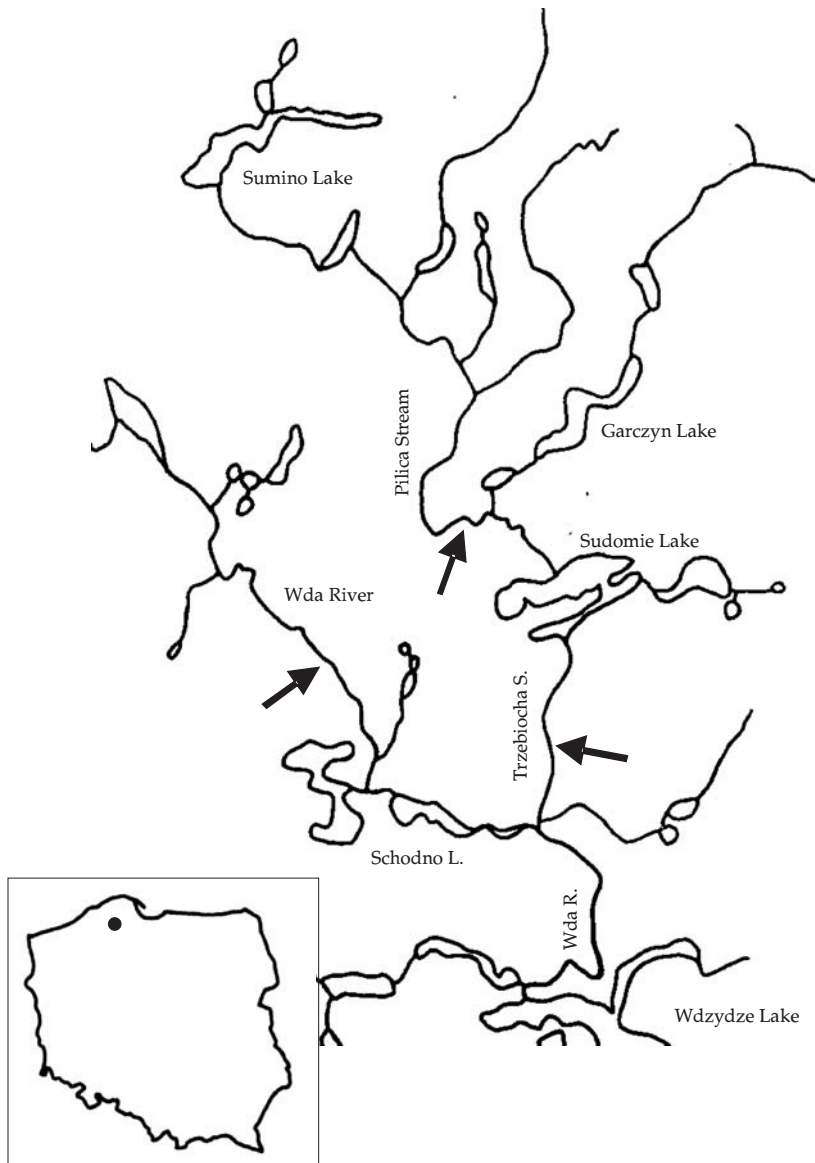


Fig. 1. Location of investigated lake trout redds in the spawning areas of the upper Wda River system (arrows).

causing weaker oxygenation of the eggs and fry, is critical (Phillips et al. 1975, Hausle and Coble 1976). In the redds studied, the content of the sandy fraction (< 1.5 mm) ranged from 5.1 to 24.8%.

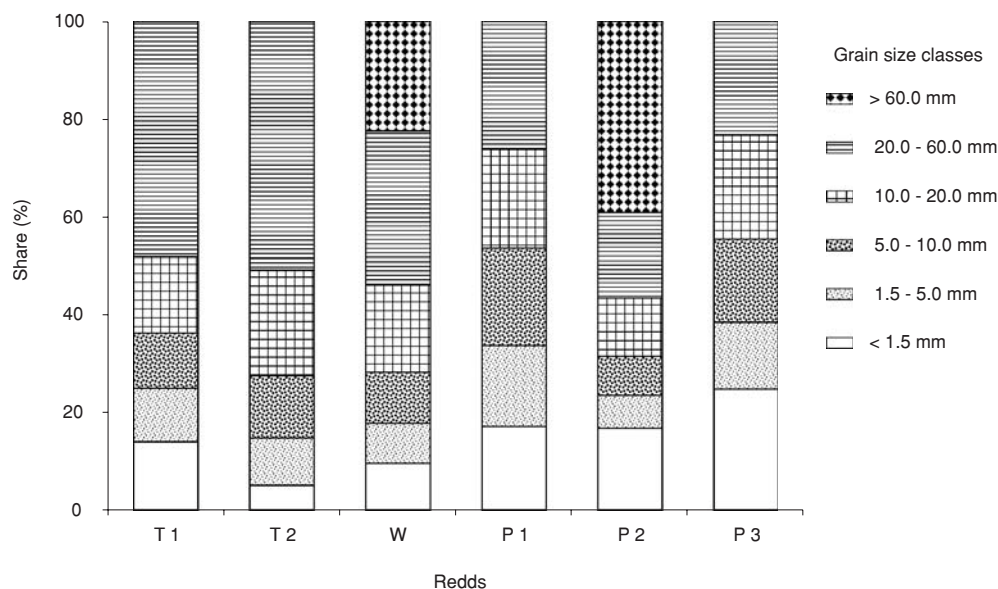


Fig. 2. Weight share (%) of grain size classes in particular lake trout redds. Symbols indicate particular redds (see Table 1).

CATCHING FRY

Attempts to catch fry emerging from the redds were begun in early April 2004. The traps were deployed in the redd at a distance of approximately 20-30 cm downstream from where eggs were most likely to have been deposited. Three to four traps were deployed at each redd depending on their widths. The traps were comprised of a 33.3 cm porcelain drainage tube with an inner diameter of 10 cm. The tube was attached to a sleeve made of mesh (bar length – 2 mm) that was finished off with a reservoir (Fig. 3). The traps deployed in the Wda and Pilica rivers were checked once or twice daily, but those on the Trzebiocha were checked twice or more daily. Additionally, two trap sets were deployed at a distance of 20 and 100 m from the largest redd in the Trzebiocha River. Water temperature measurements in all three rivers were taken between the hours of 15:30 and 19:00 when it was at its maximum. Water temperature was also recorded in the Trzebiocha and sporadically in the Wda and Pilica rivers in the morning hours between 06:00 and 08:00, when it is at its lowest.

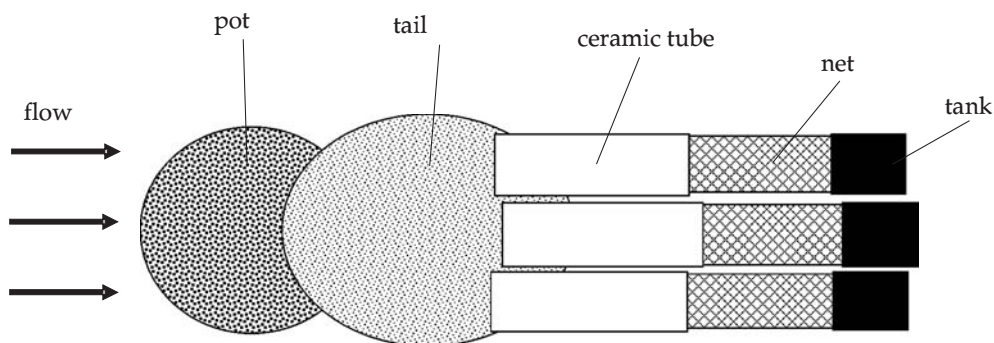


Fig. 3. Trap positioning at spawning redds.

Trout fry were caught at five of the six redds investigated. They were caught in the Trzebiocha only at redd number 2 (30 individuals). The first individuals appeared on April 28 at a daily water temperature range of 11.6–12.8°C (Fig. 4). Trout were caught during water temperature increases, and the height of catches occurred in early May at a maximum temperature range of 15.2–16.0°C. The last fry were observed in the traps on May 10 at a maximum water temperature of 17.6°C. No fry were caught at the traps deployed 20 and 100 m downstream of the redds. No fry were stocked on the investigated stretch of the Trzebiocha River. The greatest number of fry were caught in the redd on the Wda River (46 individuals). The first fry were caught here on April 21 when the daytime water temperature rose from 11.2 to 13.9°C (Fig. 4). On April 23, the Wda River was stocked with fry reared at a hatchery, which could have had an impact on the catches. The greatest number of fry were caught on April 26 when the maximum daily temperature was 12.6°C. Trout were caught until May 15 at a maximum water temperature of 17.7°C. The longer period in which fry were caught in the Wda might be explained by the location of two redds in which spawning occurred at different times, or perhaps by stocked fry being caught. Only eight fry individuals were caught at all the investigated sites on the Pilica (Fig. 4). The first fry were observed on April 27 when the daytime water temperature rose from 8.3 to 11.5°C. Trout occurred in the traps until May 6 when the maximum water temperature increased to 15.9°C. The Pilica River was not stocked. During fry catches and in the several days following them, single young trout individuals were observed near or just below the redd. Several days prior to

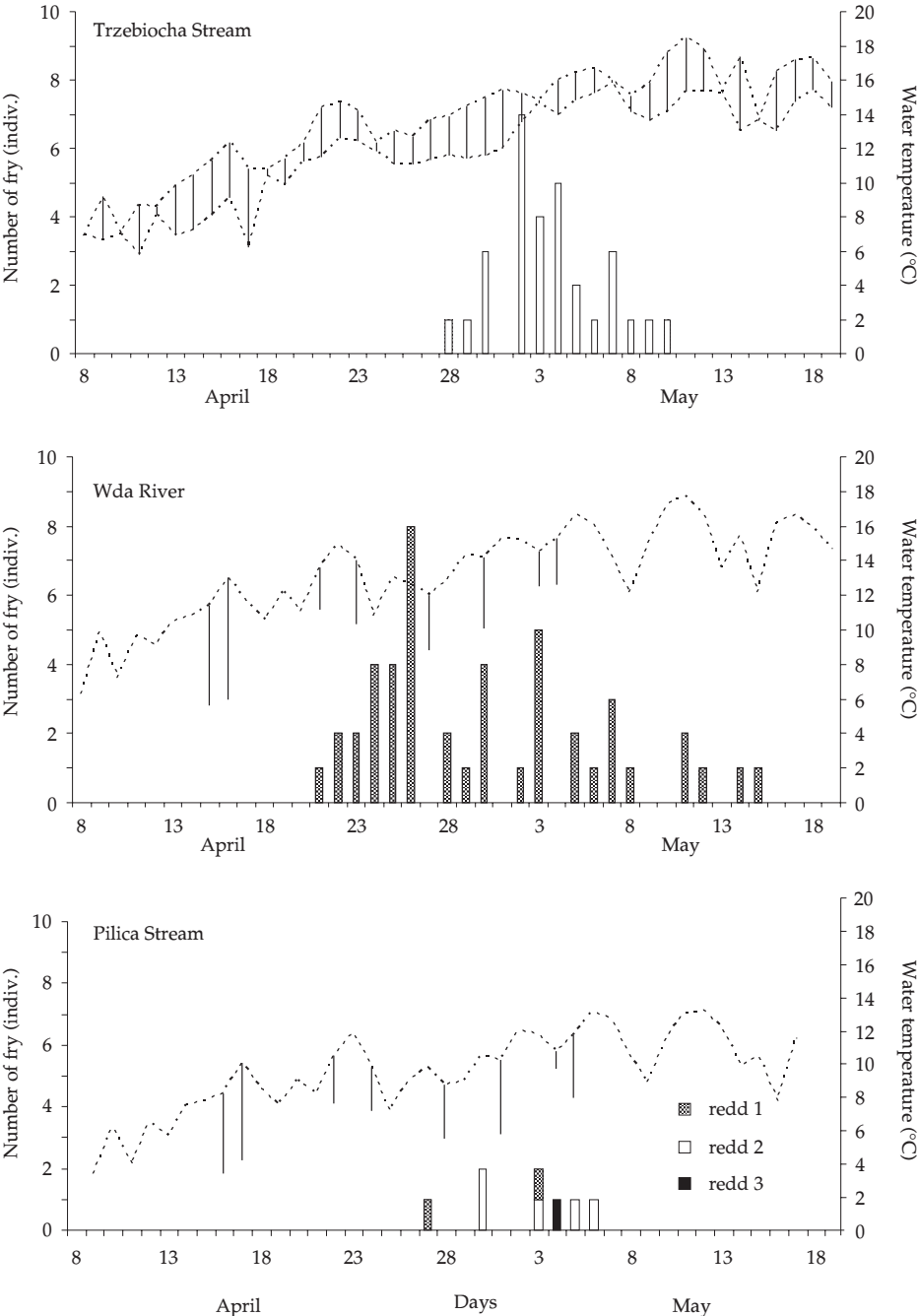


Fig. 4. Number of fry captured from particular redds (columns) and maximum-minimum water temperature (lines).

the appearance of trout fry in the Pilica River traps, numerous fry were observed approximately 100 m above the investigated redd; these trout had certainly emerged from a redd located upstream from the trap. One fry individual was also observed near redd number 1 in the Trzebiocha River, where no trout were caught in the traps.

Due to the small size of the traps and their deployment directly below where the eggs had most likely been spawned, it is not probable that the fry caught came from either stocking or redds located farther upstream. This was confirmed by the lack of fry in the traps deployed in the Pilica while they occurred numerously near other redds located upstream as well as in traps deployed 20 and 100 m below redd number 2 in the Trzebiocha River. It is not possible to determine the exact number of fry using the catch method applied in the current investigations. The number can only be estimated by determining the ratio of the surface area of the trap opening to that of the water column above the red, which was approximately 10%, on average. The trout fry had no yolk sacs or only traces of it were visible. Approximately half of the fry obtained were dead; this was most probably due to water turbulence in the traps, which forced increased fry movement and rapid exhaustion. Although the total number of fry caught was small, there was no difference in the numbers of them caught throughout the day. However, most of the fish observed during trap monitoring in the morning were dead, all of those observed in the afternoons and evenings in the Trzebiocha River and most in the Wda River were alive. This may suggest that emergence occurred either during the day or evening when increased daily temperature was the main impetus for leaving the redd.

The size of the redd and the quantity of eggs deposited is proportional to female size (Elliott 1984, Crisp and Carling 1989). Generally, the number of fry emerging from the redd is considered to be inversely proportional to the sand content (Chapman 1988). In the current investigation, the most fry were caught in the two largest redds (T2 and W), where the share of sand was the lowest (Fig. 5). The water flow velocity above redds was the highest in the Wda and the Trzebiocha and the lowest in the Pilica, as was also confirmed by the number of fry caught (Fig. 5). Sakowicz (1961) reported water flow velocities of 0.55 and 0.63 m s⁻¹ above two large lake trout redds in the Trzebiocha in 1955 where the most fry were observed. These values were lower than those noted in the current study. While no significant differences were noted in the water velocity above brown trout, *Salmo trutta* m. *fario* L., redds among various tributaries of the upper

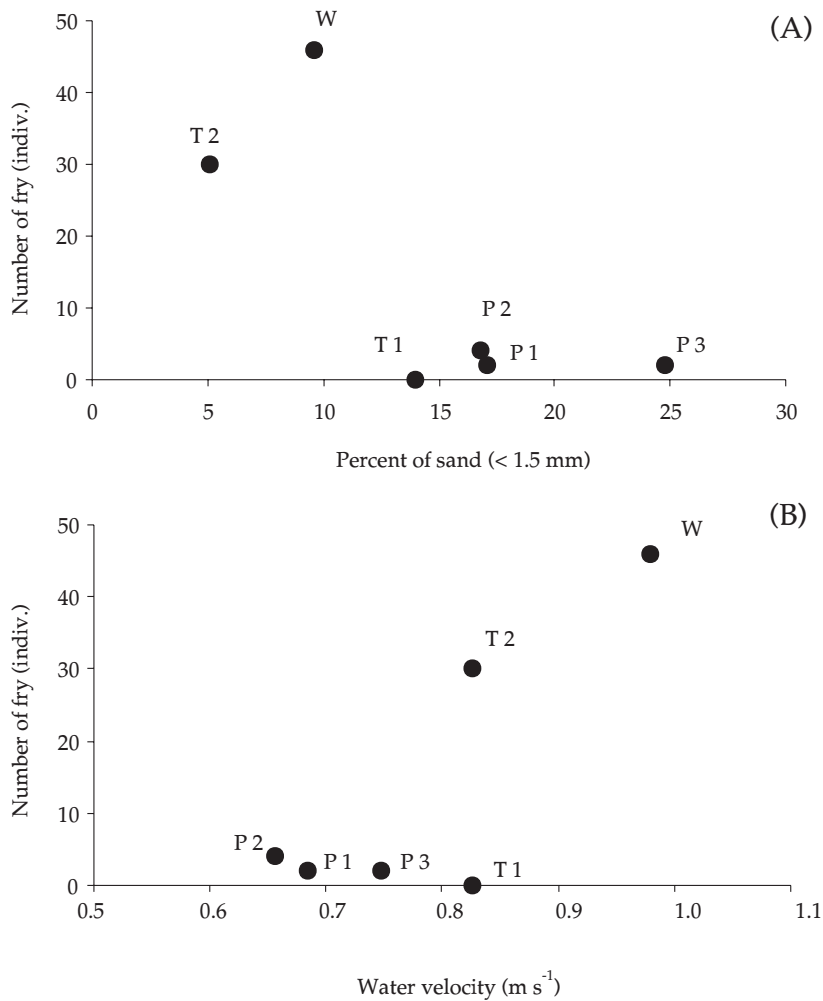


Fig. 5. Number of fry captured in relation to the percentage of sand in the redd tail (A) and water velocity above the tail (B). Symbols indicate particular redds (see Table 1).

Vistula River, there were differences in the share of the sand fraction (Mikołajczyk et al. 2003). Although the organic material content suspended by the water current in the investigated rivers made it difficult to deploy larger traps, in order to determine precisely the number of fry in individual redds it is necessary to construct a trap that would encircle the redd but not inhibit the fry from emerging from it.

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STRESZCZENIE

WSTĘPNE OBSERWACJE STRUKTURY GNIAZD I WYCHODZENIA WYLĘGU
TROCI JEZIOROWEJ (*SALMO TRUTTA* M. *LACUSTRIS* L.) W DORZECZU GÓRNEJ
WDY

Na tarliskach troci z jeziora Wdzydze położonych w dorzeczu górnej Wdy dokonano pomiarów wielkości i struktury substratu kilku gniazd tarłowych troci jezirowej. Pomiaru objęły takie parametry jak: długość, szerokość i wysokość kopców, głębokość dołków, prędkość przepływu wody nad kopcem oraz udział wagowy frakcji substratu (tab. 1). Zaobserwowano znaczne różnice uziarnienia w poszczególnych gniazdach, przy czym udział frakcji piaszczystej mieścił się w zakresie od 5,1 do 24,8% (rys. 2). Wiosną 2004 r. podjęto próbę połowu wychodzącego z gniazd wylęgu. W 5 na 6 badanych gniazd złowiono wylęg troci w pułapki. Ryby pojawiały się od końca kwietnia do połowy maja przy wzroście temperatury wody głównie w zakresie 11,0-16,0°C (rys. 4). Najliczniej wylęg obserwowany był w dwóch największych gniazdach we Wdzie i Trzebieosze, w których występowała najmniejsza zawartość piasku i największa prędkość przepływu (rys. 5). Najmniej wylęgu lub jego brak obserwowano w gniazdach, w których udział piasku był najwyższy.