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Field observations of the spawning behaviour of European grayling

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During observations of the River Ourthe, Belgium, 70 spawning attempts were recorded during the reproductive period of the European grayling. Thirty-six per cent of the spawning attempts proceeded to completion, while interference by another male may explain some of the incomplete acts. Sneaking behaviour was observed and one spawning act included two males and one female.

Key words: *Thymallus thymallus*; spawning sequence; mating success.

The reproductive and agonistic behaviour of the European *Thymallus thymallus* L., and Arctic *T. arcticus* Pallas graylings have been described in detail (Fabricius & Gustafson, 1955; Kratt & Smith, 1980; Northcote, 1995). Results on mating success in *T. thymallus* are given by Poncin (1996) and in *T. arcticus* by Kratt & Smith (1980) who in addition described the sequence of events in 55 spawning attempts. The present paper reports similar field observations in the European grayling.

Observations were made at the River Ourthe, Belgium, on 7 and 8 April 1996 during the spawning period of the European grayling which ran from 6 to 8 April. Average daily temperature was 8·8° C and two spawning areas (50 m apart) were studied. The upstream site was 0·5 m wide and 1 m long whereas the downstream site was 2 m wide and 10 m long. The stream beds consisted of fine gravels (1–2 cm) mixed up with larger pebbles (5–10 cm) and stones (15–25 cm). Most spawnings occurred in 20–55 cm water depth. Due to light reflection on the water surface, observations were possible only from 0830 to 1800 hours. A spawning act was considered successful when the behavioural sequence observed in a pair of fish included ' approach ', ' quivering ', ' dorsal fin clasping ', ' tail crossing ', ' head- and tail-up posture ' and finally ' gaping ', associated with the release of eggs and sperm, as described by Fabricius & Gustafson (1955) and Kratt & Smith (1980). The aggressive behaviour considered here included the behavioural patterns described by Fabricius & Gustafson (1955) and used in our previous observations (Poncin, 1996). They involved sequences ended by an attack (with or without biting) in which one fish pushed away the competitor. Lengths of fish were estimated from video-tape recordings.

On each spawning area, only one male grayling (31 cm total length for the upstream site; 34 cm for the downstream site) was territorial for 2 days. Two other males (both about 30 cm total length) did not appear to defend territories. Two females (total lengths 25 and 30 cm) were distinguished from the males by their pale colour pattern. Seventy spawning attempts (3·5 male^{-1} h^{-1} on average, range 0–14) were witnessed on the two sites and pooled together due to their similarity (Fig. 1). Twenty-five spawning attempts (36%) led to the release of eggs and sperm (average: 1·25 male^{-1} h^{-1}, range 0–6), while 45 (64%) were incomplete. Of the 25 spawning acts observed, 24 included the female and the territorial male while one spawning act included two males and one female. Of the 70 behavioural sequences, 18 involved a second male that joined the pair before spawning;

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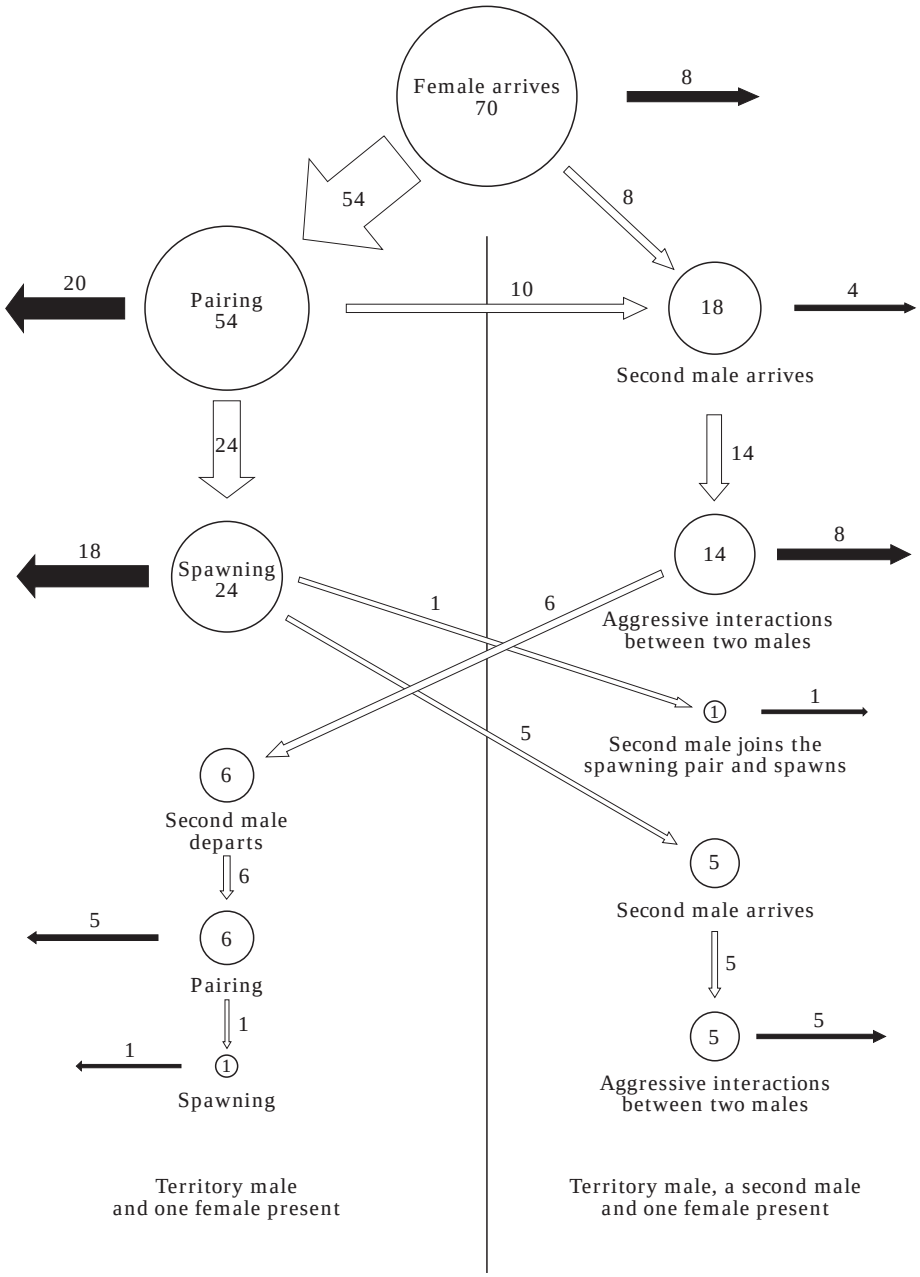

FIG. 1. The sequence of events observed in 70 spawning attempts. Numbers within the circles or above the arrows indicate the frequency of each event. Circle areas and arrow widths are proportional to this frequency. Closed arrows indicate the departure of the female. On the left of the diagram only the territory male and one female were present, while on the right a second male was present also.

the female departed resulting in an incomplete sequence 17 times, and the territorial male and the female spawned after the competitor was pushed away only once. Of the 52 remaining behavioural sequences, the female departed before spawning 28 times (eight times after arrival but before quivering) without any apparent reason. Kratt & Smith

(1980) suggest that occasionally the female Arctic grayling moves away before spawning when the male's orientation is improper, or that females may be 'testing' males, or simply that they are not ready to spawn.

The present data on the European grayling agree with the results of Kratt & Smith (1980) on the spawning sequence in the Arctic grayling. Aggressive behaviours exhibited by males seem to disturb the normal spawning sequence including pairing and spawning acts (Fig. 1). In the very low fish density conditions in which reproduction was observed (one territorial and few non-territorial males), the mating success of the territorial male, scarcely exhibiting aggressive behaviours, was clearly higher than those of the non-territorial sneaking males. This result can be compared to data recorded in 1993 (Poncin, 1996) in higher density conditions ($n=7$ males) when the reproductive success of the territorial male was similar to those of non-territorial males, but aggressive behaviours were three times lower in the latter. Thus, it would be interesting to analyse spawning sequences and the success of both territorial and sneaking tactics in even higher density conditions (e.g. 15 males on the same site as reported by Persat & Zakharia, 1992) when aggression increases.

References

Fabricius, E. & Gustafson, K. J. (1955). Observations on the spawning behaviour of the grayling, *Thymallus Thymallus* (L.). *Report of the Institute of Freshwater Research, Drottningholm* **36,** 75–103.

Kratt, L. F. & Smith, R. J. F. (1980). An analysis of the spawning behaviour of the Arctic grayling *Thymallus arcticus* (Pallas) with observations on mating success. *Journal of Fish Biology* **17,** 661–666.

Northcote, T. G. (1995). Comparative biology and management of Arctic and European grayling (Salmonidae, *Thymallus*). *Reviews in Fish Biology and Fisheries* **5,** 141–194.

Persat, H. & Zakharia, M. E. (1992). The detection of reproductive activity of the grayling *Thymallus thymallus* (L. 1758) by passive listening. *Archiv für Hydrobiologie* **123,** 469–477.

Poncin, P. (1996). A field observation on the influence of aggressive behaviour on mating success in the European grayling. *Journal of Fish Biology* **48,** 802–804.