

Coarse fishing close season on English rivers

Appendix 3b – Dace (*Leuciscus leuciscus*) feeding and spawning behaviour – a literature review

Background

The dace is considered a common species throughout most of England and Wales (Mills, 1981) and is an important component (in terms of population biomass) in the many chalk streams of southern England (Mann and Mills, 1986). Dace also have a similar diet to salmonids, feeding on aquatic invertebrates, including insects and crustacea but also some vegetation (Mann, 1974). Dace are highly mobile, capable of extensive migrations up and downstream (Lucas, 2000), including movements upstream past weirs (Clough and Beaumont, 1998). Dace spawn relatively early compared with other cyprinids (Mann, 1974), with annuli laid down mainly in the second half of May in the River Frome (Mann, 1974).

Dace are considered to be particularly susceptible to habitat degradation, and therefore they are considered to be good indicators of habitat quality (Mills, 1981). Dace are known to circumvent weirs elsewhere in England (Clough and Beaumont 1998, Lucas et al., 1999), with large shoals of dace reported to congregate below the weirs prior to spawning, waiting for a spate to permit passage (Clough and Ladle, 1997). Dace eggs are known to be particularly sensitive to silt deposition, and in the River Frome the majority of egg mortality was attributed to the effects of silt and other fine sediments (Mills, 1981; Mann & Mills, 1986).

Feeding

Dace feed all year round, with a peak in feeding activity during the summer. Feeding slows considerably during the winter as water temperatures decrease, although there is no winter fast (Hartley, 1947). However, it has been shown on the River Frome that dace do not grow in length between October and early April (Mann, 1974). Dace is omnivorous, with a highly varied diet (Cowx, 2001). Prey selection is seasonal. During the summer, insects, such as ephemeroptera and chironomid larvae, are common prey with algae also making up a large proportion of the diet. In winter, the algal content of the diet is much lower and detritus becomes more important, with trichopterans and molluscs being the most common animal prey (Mann, 1974; Hellawell, 1974). The dace feeds low down in the water column during winter months, but during the summer it feeds extensively off the surface.

Recruitment

In dace caught from the river Stour and river Frome in UK, it was found that Annuli were laid down in late May to early June at the start of the growth period. Minimal growth occurred from November to April. Male dace grew minimally faster than females. Spawning occurred in the second half of March (Mann, 1974). In the river Frome, both sexes are mature after four years' growth (age 3+), though some faster-growing individuals may spawn one year earlier. Maturing females aged 2+ had a mean length of 160 mm (95% CL \pm 9 mm) compared with 143 (\pm 3) mm for immature females of the same age (Mann, 1974).

Only a single cohort of 0+ year dace was observed each year in several UK Rivers, suggesting that recruitment was based upon a single spawning event (Nunn et al., 2007). In the river Trent, dace hatched between the third week of April (2003) and the first week of May (2002), whereas in the River Ouse catchment hatching occurred 3 or 4 weeks later. Comparatively few dace were captured from the Avon, but they hatched circa. 1 week later than in the Trent (Nunn et al., 2007).

Largely as a result of the influence of abiotic factors, chiefly water temperature, dace recruitment varies widely from year to year. The problems of such variation, especially those that could ensue from a succession of poor year-classes, are offset by the spread of reproductive effort by each female over several years (Mann & Mill, 1986).

Spawning

It has been observed on the River Frome (UK) that dace lay their adhesive eggs on gravel beds, usually over a two or three week period in March or early April. Each female lays a single batch of eggs each year, but may spawn annually for up to seven successive years (Mann & Mills, 1985). Observation of the seasonal gonad cycles indicated that spawning occurred in March or April. Fecundity was estimated at about forty eggs per gram of total weight. A seasonal cycle of feeding activity was established with highest food consumption during summer. There was evidence of a fast during the spawning period (Hellawell, 1974). Males form large aggregations, each male defending a small territory. Females spawn only once a year and, in some populations, during a very short period (3-5 days). Females lay sticky eggs into excavations made in gravel. Fecundity is estimated at between 1550 and 22600 eggs (Zhukov, 1965; Movchan and Smirnov, 1981).

Dace lay negatively buoyant adhesive eggs in fast-flowing water which rapidly sink and attach to the gravel substratum, and these eggs deposits are resilient to being washed out of the gravel. For Mills (1981) has calculated that even under severe spate conditions, egg loss is only 2.4% of the estimated egg population. Spawning usually occurs after a short upstream migration, with a sand or gravel substrate being preferred (Penczak, 1967). Dace eggs hatch approximately one month after spawning (Mills, 1981). Fecundity is estimated at between 6,550 and 9,500 eggs for a 20cm female (Cowx, 2001).

Aggregations of spent dace in the downstream ends of tributaries after the known spawning season might be taken as an indication that the tributary had been used as a spawning site on the river Frome. However, Clough et al., 1998 suggests that at least some of the dace found in the lower ends of tributaries of the River Frome spawned elsewhere. After spawning, dace quickly leave the spawning grounds and occupied slow-flowing shaded sites out of the main river channel. Within these areas, the fish were situated in the deepest and slowest-flowing positions available, (Clough et al., 1998). Few items were found in the guts of the fish captured in the tributaries (mean < one item per fish), with 66% of the guts being completely empty. This suggests that the fish were not aggregated in these areas in order to take advantage of a rich supply of food. Possibly the advantages of remaining as part of a large shoal outweigh the net benefits of searching elsewhere for food at this time of year (Clough et al., 1998). In addition Clough et al., (1998) postulated that it is possible that dace select low velocity areas to minimize energy expenditure and that predator avoidance may be a factor in the apparent selection for the generally un-vegetated downstream ends of tributaries.

Conclusions

Males form large aggregations and defend their gravel territory but dace quickly leave spawning areas to rest in spent dace shoals in deeper un-vegetated tributary waters. There is evidence to say dace fast or show no growth during the spawning period (Hellewell 1974; and Mann, 1974). Spawning times vary from rivers to rivers but the spawning period is short between 3-5 days. Most spent dace do not actively feeding post spawning and seek refuge and shelter in deeper water to recover (Clough et al., 1998). The species is highly fecund, fast growing and has an omnivorous diet. Its reproduction cycle is so successful, outside its native range it is regarded as a highly invasive species, thus so long as habitat and water quality are maintained dace can rapidly reproduce. Largely as a result of the influence of abiotic factors, chiefly water temperature, dace recruitment varies widely from year to year. The problems of such variation, especially those that could ensue from a succession of poor year-classes, are offset by the spread of reproductive effort by each female over several years (Mann & Mill, 1986).

Sokolov and Berdicheskii, (1989) reported that common dace regularly undertake migration of some tens of kilometres to spawning sites, which are often situated in tributaries. Thus barriers to migration, the availability of suitable spawning gravels and water quality issues are more likely to impact on dace more so than any short term exposure to angling pressure if the close season was lifted early. However, even though dace are unlikely to feed much in spawning mode, it would be wise to review options for avoiding disturbance of known spawning beds, especially to reduce the risk of stirring up silt, e.g. no wading or no fishing near weir pools during March 15th to April 15th.

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Literature search parameters:

- Google scholarly - “Search parameters = dace and feeding; *Leuciscus leuciscus*; and *leuciscus* and spawning
- Scopus search 8th Nov. 2018- search words “Dace & Spawning”
- Source - <https://www.cabi.org/isc/datasheet/77316>