NATURAL HISTORY NOTES

Natural History Notes features short articles documenting original observations made of amphibians and reptiles mostly in the field. With few exceptions, an individual 'Note' should concern only one species, and authors are requested to choose a keyword or short phrase which best describes the nature of their observation (e.g. Diet, Reproduction). Format details and other guidelines are available in *Herpetological Bulletin* No. 78, Winter 2001.

RANA TEMPORARIA (Common Frog): TADPOLES OF THE COMMON FROG EATING THE SHELLS OF POND SNAILS

I was very surprised to see tadpoles of the Common Frog *Rana temporaria* eating the shells of water snails *Limnaea stagnalis* in my pond during 2001. The pond (at TQ 5122 5520), which has an area of 6 m^2 and mean depth of about 50 cm, had a large population of Common Frog tadpoles, from five large clumps of spawn, and at least 100-200 pond snails/m^2. I noticed that the Common Frog tadpoles were congregating in masses over the shells of the pond snails. They were rasping at these shells and so eroding the outer layers that the shells became chequered with large white/silvery patches (Fig. 1).

On inspection, all shells had been attacked at the apex while the more basal areas showed more or less damage (Fig. 1). The reason for the universal attack at the apex is not clear; either this zone is easier for the tadpoles to attack or, as this is the oldest part of the shell, would have been subject to attack longer than other places. I had not seen this behaviour previously even though I had been observing the pond for ten years. The tadpoles in question came from spawn deposited on 10th March 2001. The first time that I noticed the tadpoles on the shells was in May when they were already well grown but with no evident limbs. Two ponds close by, with tadpoles and pond snails, did not show the same phenomenon although the density of tadpoles and snails in both was much lower.

Typical attack by the tadpoles is shown in the scanning electron micrograph (Fig. 2). Two circular lesions are indicated at a) and b); these penetrate all but the deepest layer(s) of the snail's shell. Many such lesions together lead to extensive erosion shown at the top left of the micrograph (Fig. 2, c). The greatest depth of penetration in the lesions is at the centre with progressively more shallow penetration towards the edges. This is consistent with the shape of the mandibles of the Common Frog tadople. These are like a pair of shears with the outer edge of the upper mandible convex in shape. When such a mandible cuts, its central portion will dig deepest, accounting for the difference in depth across the cut in the shell. More unusual is the fact that the cut created is circular. This appears to result because tadpoles hold themselves more or less at right angles to the shell, flexing their tail to remain in place. In so doing, they rotate on their long axis rasping as they go and so eroding at the surface like a drill. The

Figure 1. Shells of the pond snail (*Limnaea stagnalis*) with, left to right, successive stages of erosion by Common Frog tadpoles (*Rana temporaria*).

two circular lesions in Figure 2 (a and b) were presumably made by tadpoles of different sizes. It is noticeable that none of the lesions actually penetrates the shell completely although occasionally they are associated with cracks due to other mechanical damage. The deepest layer(s) of shell, probably the nacreous layer, is either of no interest, unpalatable or too tough to attack.

My pond is mostly rainfed and in dry years requires topping up with tap water, but the year 2001 was wet enough that no topping up was required until July/August. It seems possible that the concentrations of one or more essential minerals/elements in the pond are particularly low, exacerbated by the high density of tadpoles and

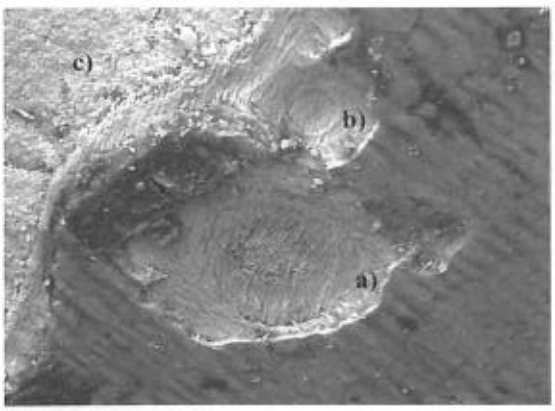

Figure 2. Scanning electron micrograph showing details of damage to a snail's shell caused by tadpole feeding, a) and b) are circular lesions and c) an area of extensive erosion (1 mm = 4 mm).

addition to the pond of only soft rain water instead of our hard tap water. In March 2002, a check of the snails showed all but the very smallest to have eroded shells, presumably from the previous year. Where shells were intact, these appeared to be particularly fragile, suggesting that indeed there was some degree of mineral shortage. Testing the pond water at this time with universal indicator and a water hardness kit, showed that it was near neutral at pH 6.5, and hard.

Competition between tadpoles and snails is well known. Egg production and growth of *L. stagnalis* are reduced in the presence of high densities of *R. temporaria* tadpoles whereas increasing snail density has a positive effect on tadpole weight and growth rate. This has been attributed to nutrient cycling by snails from algae less favourable for tadpoles, such as *Cladophora* sp, which in turn increases the growth of micro-algae. Micro-algae are a preferred food source for tadpoles for which they are competitively dominant over snails (Brönmark et al., 1991). However, Brönmark et al. make no mention of any feeding direct from snails' shells and I have not been able to find any reports of similar behaviour by tadpoles. I can only conclude that this is a rare occurrence dependent on specific conditions of mineral/food scarcity and perhaps triggered by particularly high population densities of snails and tadpoles.

If anyone one would like to examine eroded snail shells I would be happy to supply them on request.

ACKOWLEDGEMENT

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REFERENCE

Brönmark C., Rundle, S.D. & Erlandsson, A. (1991). Interactions between freshwater snails and tadpoles: competition and facilitation. *Oecologia* **87**, 8-18.

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