Evidence of amphibian occupation of artificial hibernacula

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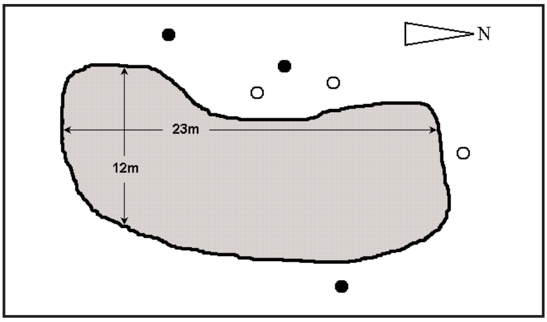
ABSTRACT – Evidence is presented that *Triturus vulgaris* and *Rana temporaria* successfully overwinter in artificially constructed hibernacula of a design recommended by conservation bodies in the U.K. However, *T. cristatus* while present at the site, was not found to use the hibernacula. After emergence, Common frogs showed a tendency to move away from the hibernacula in the direction of the pond.

THE use of artificial hibernacula in amphibian conservation is widely accepted within the U.K., often as part of mitigation associated with land use change (e.g., Marshall *et al.*, 1997). Hibernacula are created to provide suitable overwintering sites where otherwise there may be a shortage, and so help maintain population numbers from one season to the next (Beebee & Griffiths, 2000; English Nature, 2001). While there is evidence that artificial hibernacula have been effective in the conservation of some threatened or endangered species elsewhere (Packard & Packard, 1997; Seburn & Seburn, 2000; Ernst, 2003), and newts have been shown to overwinter in areas containing artifical hibernacula (Kinne, 2004), there is, as yet, no evidence that in Britain, the recommended design effectively fulfils its purpose.

In the UK, artificially constructed amphibian hibernacula are particularly associated with conservation of the Great crested newt *Triturus cristatus*. Briefly they consist of a mound of logs, rocks and bricks loosely filled with topsoil and covered with turf or moss (Langton *et al.*, 2001:31). The mound can be a metre tall above ground level where drainage is relatively poor, or can be buried within the ground and flat-topped in free-draining soils. While there seems to be a general acceptance that the design is effective, and there is anecdotal evidence for the same (e.g., Butt *et al.*, 2002), we considered it useful to test the design more quantitatively. We did this by monitoring vernal emergence from hibernacula using polythene fencing and pitfall traps, which also allowed us to record the direction of emergence and look for patterns therein.

Figure 1. Dimensions of Harris Park Pond and relative positions of hibernacula. Filled circles are hibernacula included in this study.



STUDY AREA AND METHODS

The investigation was carried out around a pond at Harris Knowledge Park, Preston, Lancashire. Surveys in 2002 revealed populations of *T. cristatus*, *T. vulgaris* and *Rana temporaria* to be present at the Park, and individuals of these species were relocated to the pond as part of mitigation during building an extension to one of the nearby buildings. Six hibernacula of a design intermediate between those for impermeable and permeable soils (Langton *et al.*, 2001) were constructed at this time as further mitigation (Landmark Environmental Ltd., 2002), see Figure 1. The pond had relatively gently sloping banks, and was the only water body in the area, though there are some wetter areas, including a ditch, within a hundred metres. Our own survey in April and May 2004 showed that populations of all three species were still present, *T. cristatus* through the presence of eggs, and *T. vulgaris* and *R.*

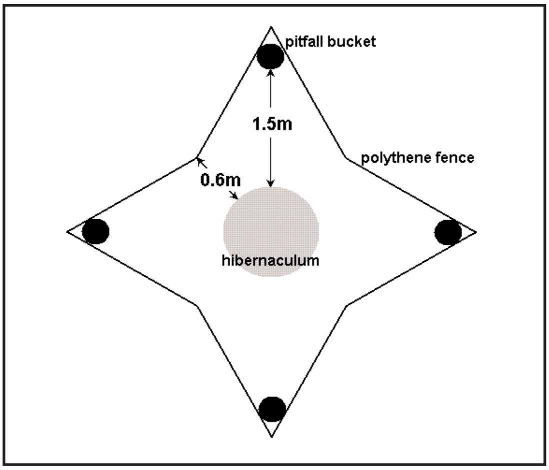


Figure 2. Layout of fencing and pitfall traps with respect to hibernacula.

temporaria through the presence of eggs and adults (bottle traps and torchlight survey).

We set up enclosures around three of the hibernacula in mid December 2004 after a torchlight survey failed to reveal amphibians within the pond. The walls of the enclosures were made of one metre black polythene sheeting, sunk approximately 30 cm into the ground. The nature of the ground at the other three hibernacula made enclosure impossible. The arrangement was a four-pointed star orientated to the points of the compass with a pitfall trap (plastic bucket with mammal ladder) at the tip of each point (Figure 2). One of the points pointed directly towards the pond. The rationale was that the 0.6 m around the hibernaculum allowed an individual to follow a direction different to that of the exit of the hibernaculum, in case exits were restricted to certain locations.

Traps were checked daily between 2nd January and 12th March before 11:00 h. All captives were recorded (species, gender and trap location) before being released to other suitable refuge points around the pond. Whether one direction was followed over others was explored statistically using the Rayleigh z - test which determines whether the distribution is random or clustered, and the Rayleigh u – test which compares a distribution with a predetermined direction to deduce whether it is significantly different.

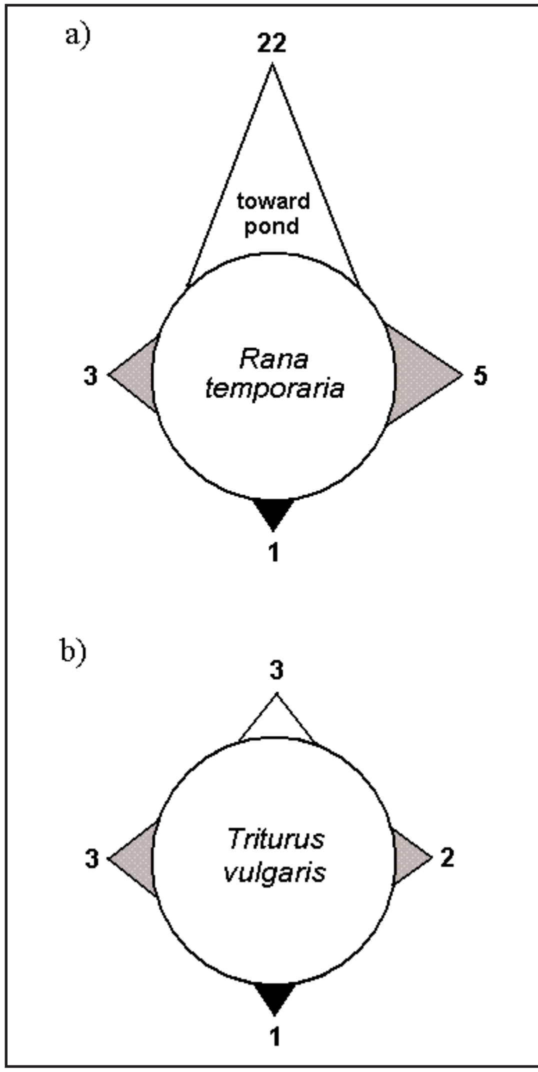


Figure 3. Distribution of captured individuals with respect to direction of pond.

RESULTS AND DISCUSSION

A total of 40 amphibians were trapped of which 31 were *R. temporaria* (20 males, 11 females) and nine were *T. vulgaris* (six males, three females), although three of these were retrieved from beneath the pitfall buckets. This shows that hibernacula are to some degree effective, though the absence of *T. cristatus* from the traps poses some questions. Perhaps *T. cristatus* prefers hibernacula further from ponds, consistent with Duff's (1989) observations that more than 120 m was typical for a population at Little Wittenham in Oxfordshire.

Figure 3 shows the distribution of individuals of both species in relation to the direction of the pond. Results of the Rayleigh tests shows that *R. temporaria* (3a) were significantly clustered (z = 13.03, P <0.001, n = 31) in the direction of the pond (u = 5.095, P<0.001), but whether it is breeding or feeding that is of primary concern after emergence was not addressed within this study. *T. vulgaris* (3b) were distributed randomly (z = 0.556, P >0.5, n = 9) around the hibernacula, though a stronger pattern may have been evident had more individuals emerged.

Temperature (maximum and minimum) and humidity data from the weather station at Harris Park were compared to the emergence dates of the amphibians, but no significant correlations were revealed.

These results support the claim that this design of hibernaculum is effective at providing overwintering sites for some amphibians, but perhaps their location requires further consideration, particularly regarding *T. cristatus*.

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