Assessing the use of artificial hibernacula by great crested newts *Triturus cristatus* and other amphibians for habitat enhancement, Northumberland, England

Dorian Latham* & Mark Knowles
A-one, Valley House, Valley Street North, Darlington, DL1 1TJ, UK

*Corresponding author e-mail: lathamdm@halcrow.com

SUMMARY

Use of purpose-built hibernacula by great crested newts *Triturus cristatus* and other amphibians was evaluated at three sites (eight hibernacula in total) in autumn and a single site (two hibernacula) in spring. Autumn monitoring entailed regular checking under roofing felt tiles placed on the ground (these provide damp, dark refugia which are attractive to newts) in the vicinity of the hibernacula. Although no great crested newts were found under the tiles, six common frogs *Rana temporaria* and nine common toads *Bufo bufo*) were recorded at two of the sites. A combination of drift fencing and pitfall trapping was used during spring surveys; a total of 21 amphibians (six great crested newts, six smooth newts *T.vulgaris*, seven common toads, two common frogs) were caught in the pitfalls in the vicinity of the two hibernacula. In addition, one smooth newt and two toads were caught in a drift fence 'control' situated away from the hibernacula but at a similar distance from the breeding pond.

The results appear to demonstrate that the hibernacula are being used (at least in small numbers) by amphibians, including great crested newts at one site.

BACKGROUND

In Britain, the great crested newt *Triturus cristatus* is protected under both UK and European legislation. The species is considered a habitat specialist with specific terrestrial and aquatic habitat requirements (Oldham 1994 and Oldham *et al* 2000). In England, the species is widely distributed and as such is often the subject of conflict between development and conservation. When this occurs, the developer is legally obliged to mitigate for detrimental impacts on the species, this frequently includes terrestrial and aquatic habitat enhancement or creation to compensate for losses or damage. This paper investigates the benefits of habitat enhancement for the great crested newt as part of the Highways Agency Biodiversity Action Plan (HABAP).

Within the HABAP, the Species Action Plan (SAP) for great crested newts aims to maintain and enhance existing newt populations on or adjacent to the Highways Agency soft estate (e.g. land such as road embankments and undeveloped marginal areas) through appropriate management of suitable habitat, and to prevent or adequately mitigate any adverse impacts of new road schemes (HABAP 2001). As part of steps to implement the HABAP in Northumberland (northeast England) newt hibernacula have been constructed at three locations (A1/A19 inter-change at Seaton Burn, adjacent to the A19 at Silverlink Trading Park and adjacent to Shibdon Pond near Blaydon on the A1, Gateshead to Newcastle Western Bypass). Two hibernacula at Seaton Burn and two at Shibdon Pond were constructed during 2005. Four hibernacula in the soft estate along the A19 adjacent to the Silverlink Trading Estate were constructed in

2006. The hibernacula were constructed in accordance with 'Design Manual for Roads and Bridges' (Highways Agency 2005).

Construction of hibernacula to improve the terrestrial habitat for amphibians and reptiles is a popular mitigation (DMRB 2001, English Nature 2001); however there have been limited studies to consider the benefit of such actions (e.g. Showler, Aldus & Parmenter 2005, Neave & Moffat 2007). The principal aim of the current study was to determine if the artificial hibernacula were used by great crested newts and any other amphibians in order to develop further landscape enhancement recommendations as part of future HABAP works.

ACTION

Hibernacula construction: All hibernacula were constructed in accordance with Natural England's guidance in 'The Great Crested Mitigation Guidelines' (English Nature 2001) and 'Design Manual for Roads and Bridges' (DMRB 2005). Briefly, for each, an area of approximately 2 m in length x 1 m wide x 0.5 m deep was excavated. This was filled with hardcore (brick waste and rubble), and voids to provide locations to over-winter and access points were created. Brash (tree cuttings) and leaves were placed on top of the hardcore, and overlain with a permeable geotextile fabric. The excavated soil and grass turves were then spread on top. The purpose of the geotextile was to prevent the soil from falling through the brash and filling the voids in the central part of the hibernaculum. Final dimensions of each hibernaculum were approximately 2 m length x 1 m width x 1 m height.

The three sites where the hibernacula (eight in total) were constructed were:

Seaton Burn - two hibernacula were constructed in 2005, located at the base of a steep wooded embankment at the A1/A19 intersection within the HA soft estate. The newt breeding pond is approximately 100 m from the hibernacula.

Shibdon Pond - two hibernacula were constructed in 2005 with a further two created in the autumn of 2007. They are located at the base of a roadside embankment beside the A1 (Gateshead Newcastle Western Bypass). Shibdon pond is a Site of Special Scientific Interest designated for the mosaic of wetlands that has developed on the former mine workings. There are large areas of wetland with several records of breeding great crested newt. The hibernacula were constructed at the base of a steep embankment within the HA soft estate and within 200 m of the breeding site.

Silverlink Trading Estate - four hibernacula were constructed in early autumn 2006 on the A19 highway verge close to the Silverlink Trading Estate, North Tyneside. The breeding pond is located within the trading estate, approximately 200 m from the hibernacula.

Amphibian monitoring: The aim of the monitoring was to determine if the hibernacula were used by great crested newts or other amphibians. A two fold approach was used: first to determine if newts orientated towards the hibernacula during autumn; and second to catch newts in the immediate vicinity of the hibernacula during the spring migration to breeding ponds. Monitoring in the autumn made use of roofing felt tiles (approximately 50 x 50 cm), with six placed around the perimeter of each of the hibernacula at all three study sites. These tiles provide refugia which are attractive to newts (Fig. 1). The tiles were checked throughout the period 31 August to 1 October 2007. Amphibians found under the tiles were sexed, age recorded as juvenile or adult, and then released.

Figure 1. Hibernaculum (to right) with felt roofing tiles placed adjacent to the main accesses holes, Seaton Burn, autumn 2007.

To determine if any newts used the hibernacula to over-winter, newt-proof drift fencing with pitfall traps was constructed directly in front of both hibernacula at Seaton Burn on the side facing the breeding pond in January 2008. The drift fencing was constructed in a semi-circle (Fig. 2). The hibernacula were located on a steep embankment of the A1 (North) / A19 interchange. Given the volume of traffic at the interchange this is considered to be a significant barrier to newts and therefore it is highly unlikely that newts would be over-wintering outside the embankment where they would need to cross the roads. It is therefore considered that over-wintering habitat was restricted to the embankment on the north side of the slip road where the hibernacula were located.

Due to potential disturbance through vandalism or other interference, spring monitoring was only undertaken at Seaton Burn. Access to this site is only possible via the road network and the site is located away from footpaths and residential / business premises.

The fencing followed recommendations provided in Arntzen *et al.* (1995) and detailed in the 'Great Crested Newt Mitigation Guidelines' (English Nature 2001). Fencing was constructed using heavy gauge plastic 'damp coarse sheeting' buried into the ground, held taught and stapled to wooden posts. The fences were approximately 10-15 m in length and 0.8 m high. Four pitfalls (plastic buckets diameter 28 cm, depth 25 cm) were placed at intervals along the drift fencing (one at either end and two spaced about evenly in between). Leaves were placed at the bottom to provide cover. Mammal 'ladders' (a piece of wooden dowel) were placed in all traps to provide an opportunity for small mammals (i.e. mice, voles, shrews) to escape the buckets should they fall in. Fences were constructed in a semi-circle on the pond-facing side of the hibernacula. The location of the fencing was designed such that amphibians leaving the hibernacula and heading towards the breeding pond would be intercepted by the fencing and trapped in the pitfalls. A similar length of drift fencing within a similar distance from the breeding site but away from the hibernacula was constructed to act as a control.

Pitfalls were checked regularly dependent on night-time temperature (used as an indicator of likely amphibian movement). Amphibians caught were identified, sexed and aged (yearling, juvenile or adult). Adult great crested newt bellies were photographed to allow individual recognition. Amphibians were then released away from the drift fencing at the edge of the breeding pond. All traps were closed at the end of April as it is believed that newts would have left over-wintering hibernation sites by this date.

Figure 2. Drift fence encompassing the lower edge and pond facing side of a hibernaculum at Seaton Burn.

Trapping and trapping licences: All trapping was conducted by Dorian Latham under licence from Natural England.

CONSEQUENCES

Autumn surveys: Surveys of terrestrial habitat using roofing felt tiles for the soft-estate adjacent to Silverlink, Seaton Burn and Shibdon Pond were conducted between 31 August and 1 October 2007. Results are summarised in Table 1. No great crested newts were recorded. However, a total of 15 amphibians (two adult and four juvenile common frogs, one adult and eight juvenile common toads) were recorded at Seaton Burn and the Silverlink Trading Estate. No amphibians were recorded at Shibdon Pond.

Spring surveys: The pitfalls at Seaton Burn were operational from the 1 February to 9 April and 22 to 30 April 2008. The pitfall traps were operational for 78 trapping days.

Table 1. Amphibians recorded under felt roofing tiles in the vicinity of hibernacula at Seaton Burn, Silverlink Trading Estate and Shibdon, Northumberland, autumn 2007.

Species	Seaton Burn	Silverlink	Shibdon	Total
Common toad	1 m; 1 juv	7 juv	0	9
Common frog	0	2 m; 4 juv	0	6

m = adult male; juv = juvenile

A summary of the catches in the pitfall traps over the monitoring period is provided in Table 2. A total of six great crested newts were captured at one of the hibernacula. In addition around the two hibernacula, common toad (7), common frog (2) and smooth newt (6) were also caught. Similar numbers of smooth newt, common toad and common frog were caught at both hibernacula. Catches of all amphibians for the control were lower than around either of the hibernaculum.

popular element of mitigation and enhancement plans, although data are lacking to show that this improves great crested newt survival (Edgar & Griffiths 2004). There have been few studies investigating the use of hibernacula by great crested newts, either natural or artificial. Neave and Moffat (2007) investigated the use of artificial hibernacula within 50 m of a breeding pond located in a business park in northwest England. Pitfall trapping indicated that the hibernacula were used by common frog and smooth newt, but no great crested newts were

Table 2. Drift fence pitfall trapping survey results, Seaton Burn, Northumberland, spring 2008.

Species	Hibernaculum 1	Hibernaculum 2	Control
Great crested newt	6	0	0
Smooth newt	3	3	1
Common toad	4	3	2
Common frog	1	1	0

Discussion: Areas providing day-time refugia (e.g. dense vegetation) and over-wintering hibernation sites (e.g. log piles) are important features contributing to habitat quality for amphibians including the great crested newt (Duff 1989, Franklin, 1993, Oldham 1994, Oldham *et al.* 2000, Latham 2006). The basic concept of providing artificial hibernacula is to improve the quality of the terrestrial habitat through increasing the number of potential over-wintering sites. This form of habitat creation is a

captured. It was suggested that these hibernacula were located too close to the breeding pond and were not used for this reason. The current study has shown that great crested newts have almost certainly over-wintered in the vicinity of (and probably within) one of the two hibernacula located at Seaton Burn approximately 100 m from the breeding pond.

Rather than the distance of the hibernacula from the breeding ponds, it could be that the

availability of alternative habitat will govern their use. Habitat surrounding breeding ponds with ample cover and suitable over-wintering sites may have less need for provision of artificial hibernacula than landscapes with less woodland, hedgerows, scrub etc. In this latter case, hibernacula may have a greater benefit in enhancing the terrestrial habitat than in areas where the existing terrestrial habitat is considered to be of better quality for amphibians.

Great crested newts show high fidelity to terrestrial habitats and over-wintering locations, returning to such established areas year after year (Duff 1989, Philips & Sexton 1989, Franklin 1993, Latham *et al*. 1996). The hibernacula at Seaton Burn were constructed in 2005 and therefore had the winters of 2005, 2006 and 2007 to 'settle' and allow time for amphibians to locate them, therefore perhaps increasing the potential for these features to be used as over-wintering habitat. The programming of monitoring may need to take this into account, as over time usage may gradually increase.

Conclusions: Monitoring in the vicinity of all eight hibernacula in autumn using felt roofing tiles did not reveal the presence of any great crested newts even though they are know to breed in nearby ponds. However, common toads and common frogs were recorded at two of the sites in small numbers, indicating that these amphibia could be orientating towards the hibernacula. An increase in the sampling effort during the autumn might have increased the number of animals recorded.

During surveys of two hibernacula at one of the locations in the spring 2008 (using a combination of drift fencing and pitfall trapping) six great crested newts plus small numbers of smooth newts, common frogs and common toads were caught. The proximity of these trapped individuals to the hibernacula suggests that they are using the features for over-wintering.

The study supports the conclusion that the hibernacula have contributed to the fulfilment of HABAP targets and have enhanced the quality of the terrestrial habitats for amphibians.

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