EVALUATION OF GREAT CRESTED NEWT AND SMOOTH NEWT POPULATIONS AT BAR HILL CREMATORIUM

Steve J.R. Allain & Mark J. Goodman

INTRODUCTION

Surveys were undertaken in order to help assess the population sizes of Great Crested Newts (*Triturus cristatus*) (GCNs) and Smooth Newts (*Lissotriton vulgaris*) at Cambridge City Crematorium. The investigation was carried out after Cambridge City Council Nature Conservation Officer Guy Belcher (GBel) contacted Cambridgeshire and Peterborough Amphibian and Reptile Group (CPARG) after a potential sighting in one of the concrete-lined ponds at the crematorium. GBel also told us that he had seen Smooth Newts previously in the ponds. As members of CPARG, the authors undertook the surveys with a small number of volunteers from Anglia Ruskin University.

The GCN (Fig. 1) is legally protected by a number of UK and EU laws such as the 1981 Wildlife and Countryside Act. Their populations have declined rapidly over the past 50 years and so it is important to conserve and manage any remaining populations. Underlying reasons for such drastic declines in many amphibian populations are habitat loss and disease. The smooth newt does not have the same level of legal protection as the GCN and their numbers have declined slightly in recent years for similar reasons to their larger cousins.

Fig. 1. Male Great Crested Newt seen in Pond 3.

Ponds are important for biodiversity but their presence has been greatly reduced due to human activity during the 20th century. Dragonflies and amphibians are intrinsically linked to ponds and are endangered in most European countries where they occur. Six ponds are present at the crematorium (Fig. 2) but only four (ponds 1–4) were surveyed for newts. Ponds 5 and 6 are situated in wooded areas away from the main complex. All four ponds surveyed are in direct sunlight and receive light for approximately 90–100% of the duration of the day. Two of the ponds are 4.8 m × 4.8 m and the other two 4.8 m × 3.6 m.

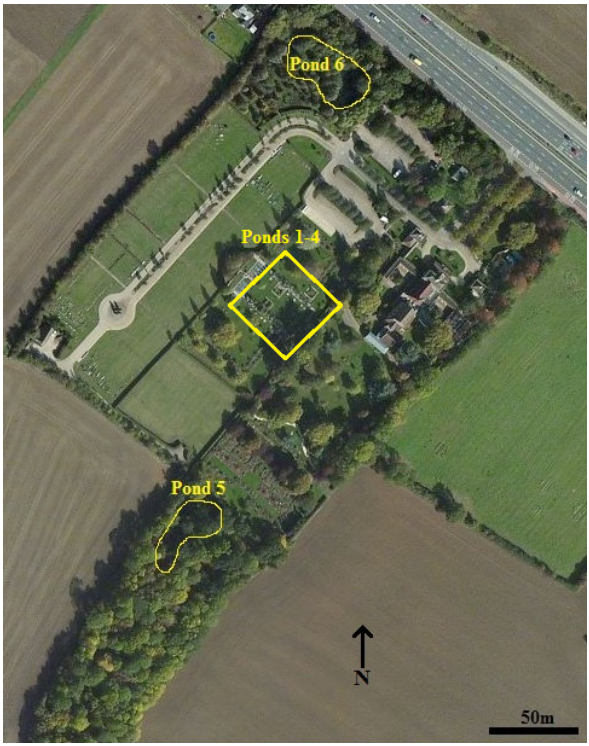

Fig. 2. Map of the crematorium with ponds 5 and 6 outlined within the wooded areas. Ponds 1–4 are in the boxed central area.

Fig. 3. Great Crested Newt juvenile from the pre-survey visit, note its deformed extremities.

A pre-survey visit was carried out in order to assess the area and to gain some knowledge of the ponds. GBel observed a GCN in Pond 4 and MJG confirmed the newt was a juvenile GCN (see Fig. 3). On closer inspection, the juvenile exhibited deformations of its extremities, these were on its front left foot and its hind right foot. Confirmation of GCNs at this site and the fact that the individual observed was a juvenile, led us to believe there was a moderate population of breeding adults at the site. After the discovery of the juvenile, six surveys were carried out to assess further the population sizes of both newt species.

METHODS

Six newt surveys were carried out over a 3-week period at Bar Hill Crematorium (grid reference: TL3993162625), Cambridgeshire between May 31st and June 17th 2013. These were simple torchlight surveys (standard methodology for largely nocturnal adult GCNs), carried out in the evening with amphibian sightings noted on a record sheet. On appropriate evenings some egg searches were also carried out.

The ponds were heavily eutrophic with high algal growth on the surface (Fig. 4) diminishing much of the sunlight away from the outer fringes as the depth decreased. Light hand-dredging was undertaken prior to commencing the first survey. Time was then allowed for any disturbance caused by dredging to subside. Whilst we were waiting, we inspected the drainage ditches around the site. We did not find any newts, although we did find a number of Common Frogs (*Rana temporaria*).

Fig. 4. Pond 1, one of the four ponds surveyed, photographed before surveying started.

The survey method was designed to have as little impact on the newts as possible. All of the surveyors were on site before dusk to allow them to go through the risk assessment and survey procedure. When it was dark enough, the team headed over to the ponds to start surveying. On nights when a digital thermometer was available, air and water temperatures were measured before the surveys began. Commencing in one corner of each pond, we made our way around the perimeter.

During the surveys the number of Smooth Newts, GCNs and other species of interest, such as dragonfly larvae, Great Diving Beetles and other amphibians, were counted. Any tadpoles seen floating in the water column were assumed to be GCNs and those seen resting on the sides of the concrete lining were assumed to be Smooth Newt tadpoles. All species observed were recorded. On some evenings, attention was paid to the aquatic flora to gauge whether or not it was having a positive/negative effect on the pond ecosystem. It is important to monitor the growth of certain plants as they can have drastic negative effects on ponds; the viscosity of the algae was measured using a subjective scale. Other flora such as ornamental lillies and reeds were also recorded but not monitored as closely as the algae as they are less likely to bloom.

RESULTS

Using data collected from our surveys, we used a model to estimate the size of the newt populations. The formula used was a basic abundance to volume ratio based on the dimensions of the ponds and the numbers of newts we observed. Our method for estimating the populations of newts in the four ponds involved a number of assumptions. These include that the newts were distributed evenly throughout the ponds and that we did not count the same newt more than once. We also assumed that there was no immigration or emigration of newts from pond to pond, or to or from the local environment. A number of repeat surveys with a relatively high number of surveyors were carried out in order to maximise the detection probability of newts. This model predicted that there were 56 adult GCNs and 67 adult Smooth Newts on the site (Fig. 5).

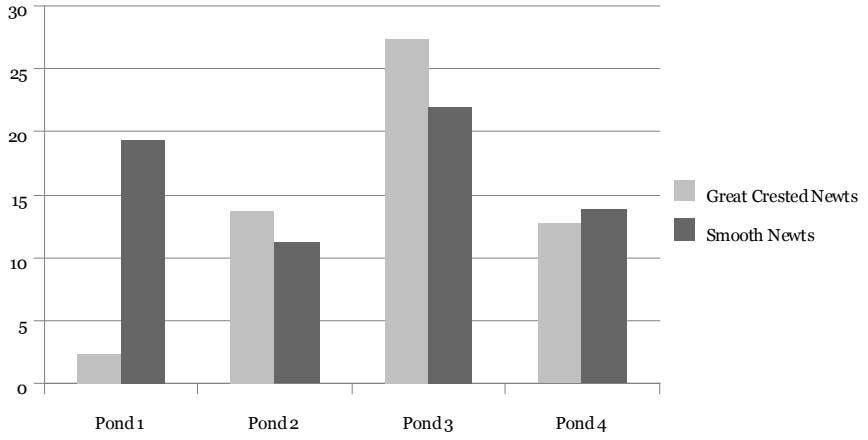

Fig. 5. Estimated population numbers of GCNs and Smooth Newts in the four ponds surveyed.

The Habitat Suitability Index (HSI) was also worked out for each of the six ponds at the site. Using ten suitability indices for each of the six ponds and following a standard equation (Oldham *et al.*, 2000), we found that ponds 1–4 were 'average'; pond 5 was at the very high end of the 'good' bracket, and pond 6 was 'poor'.

DISCUSSION

Newts may not inhabit a pond all year round, meaning that, as in this case, surveys must be carried out during the breeding season. The metapopulation of GCNs at the crematorium is a significant one. Using our formula and data from the surveys, we estimated that there were 56 adult GCNs in the four small concrete ponds. This metapopulation is substantial enough to colonise new ponds rapidly; if colonisation was to occur, it would take place in a logistical fashion (Gill, 1978). Due to the nature of logistical colonisation the new colony would be self sustaining; population increases would be incremental rather than explosive as in the colonisation of algae seen in ponds 1–4.

The population of newts was not closed so some immigration or emigration may have taken place. Newts were also observed swimming into the centre of the ponds or into the leaf litter at the bottom of the ponds. Due to the newts' natural camouflage, they may have been able to conceal themselves, meaning that the surveys may not have counted all newts present. A number of abiotic and biotic factors exist which may influence the detection of newts.

Individual surveyors attempted to keep track of individual newts that had already been counted during their progression around the ponds. In the future, a mark–capture–recapture study or double-observer survey may be more accurate and less open to errors than our visual count method. A capture–recapture study can also be used over a longer period to determine juvenile and adult survival at the site. Traditional bottle traps are not suitable for use at Bar Hill Crematorium due to the ponds being lined with concrete, hence they would need to be modified. Pitfall traps and a drift fence are other suitable methods which could be used in the future.

There was no frog/toad spawn or frog/toad tadpoles present in the ponds. Both sexes of both species were present and exhibiting breeding behaviour (much like the newts) at the site. The lack of spawn and tadpoles may be due to the fact that GCNs are voracious predators that particularly feed on the spawn and tadpoles of other amphibians (and thus are considered harmful to the spawn). During our surveys we observed many female GCNs laying eggs in the corner areas of Ponds 2 and 3 where there was substantial cover and leaf litter, acting as refugia. Cover is essential as when a female newt lays an egg, she positions it to give her young the best possible protection. During this time, the female appears briefly to enter an unresponsive state, making her vulnerable to predation. Areas which were high in submerged leaf litter appeared to provide a better location for female newts to lay their eggs, with many taking advantage of the opportunity. Despite observing the newts laying eggs, no newt eggs were subsequently found on any of our daylight egg searches or found whilst surveying was taking place.

A large number of aquatic invertebrates were seen on the surveys. Both Smooth Newts and GCNs eat freshwater crustaceans as well as frog and toad tadpoles, when in the aquatic environment. With the abundance of suitable prey, it is reasonable to suggest that the ponds may be able to support a larger population of newts than recorded here. Additionally it would be of interest to try to establish if there is a relationship between newt abundance and predation of tadpoles by dragonfly larvae. During our surveys it was observed that ponds with high numbers of tadpoles had few dragonfly larvae present. This may simply mean that dragonfly

larvae emerged earlier from some of the ponds, before the tadpoles hatched, giving an appearance of their absence. An alternative explanation may be linked to the behaviour of adult GCNs living in small ponds. Males will often return to the pond early in the breeding season, before the females, and remove any aquatic predators that may pose a threat to themselves or their larvae. This gives the larvae a better chance of survival compared to a pond where this has not occurred.

During the surveys there were no sightings of any invasive/alien newt species, such as the Alpine Newt (*Triturus alpestris*) and the Italian Crested Newt (*Triturus carnifex*), which can hybridise with the GCN. Such hybridisation poses a threat to the GCN as the hybrids are infertile and can displace their parent species, leading to local extinction events. If invasive/alien newt species are found in the ponds in the future, it is vital they are removed and destroyed immediately as they could have a serious negative impact on the crematorium's metapopulation.

No fish were found during the surveys; fish can affect amphibian populations by eating their eggs and larvae. Unwanted ornamental fish that are introduced into ponds also have the potential to spread disease to local populations of amphibians. It is vital therefore, that ornamental fish are not artificially introduced to the ponds.

In conclusion, Bar Hill Crematorium is an important site for Smooth Newts and GCNs with significant metapopulations at the site. It is also an important haven for other amphibian species and shows great potential for biodiversity growth with future work and careful habitat management. We recommend that future surveys are carried out using more accurate methods to calculate population sizes.

REFERENCES

Gill, D. E. (1978). Effective population size and interdemic migration rates in a metapopulation of the red-spotted newt, *Notophthalmus viridescens* (Rafinesque). *Evolution* **32**, 839–849.

Oldham, R.S., Keeble, J., Swan, M.J.S. & Jeffcote, M. (2000). Evaluating the suitability of habitat for the great crested newt (*Triturus cristatus*). *Herpetological Journal* **10(4)**, 143–156.

Steve Allain and Mark Goodman were awarded the CBC Bob Scott Prize 2013 for the research summarised in this article.