Reptiles and amphibians of a village in Somerset, England

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ABSTRACT - Surveys were carried out to identify the presence and abundance of four widespread British reptiles (*Anguis fragilis, Zootoca vivipara*, *Natrix natrix* and *Vipera berus*) and five amphibians (*Rana temporaria, Bufo bufo, Lissotriton vulgaris, L. helveticus* and *Triturus cristatus*) in and around the Somerset village of Westbury-sub-Mendip. All five species occurred within < 1 km of the village centre. Slow-worms (*A. fragilis*) were widespread within the built-up area whereas grass snakes (*N. natrix*) were frequent but mostly seen around the periphery. Adders (*V. berus*) were rare and also peripheral and there was just a single record of viviparous lizard (*Z. vivipara*). Common frogs (*R. temporaria*) and palmate newts (*L. helveticus*) were the commonest amphibians in garden ponds while great crested newts (*T. cristatus*) only occurred in two ponds after deliberate introductions many years ago. There was a cline of increasing relative abundance of palmate to smooth newts along a north transect through the village corresponding to a change from low-lying alluvial soils to limestone-based substrates in higher parts of the village. Evidently village gardens can provide sanctuary for most of Britain's widespread herpetofauna.

Four species of reptiles and five amphibians are widespread in Britain and occur in a wide range of habitats across the country. The two lizards (viviparous lizard *Zootoca vivipara* and slow-worm *Anguis fragilis*), two snakes (adder *Vipera berus* and grass snake *Natrix natrix*), two anurans (common frog *Rana temporaria* and common toad *Bufo bufo*) and three urodeles (smooth newt *Lissotriton vulgaris*, palmate newt *L. helveticus* and great crested newt *Triturus cristatus*) are all resident and widespread in Somerset, south-west England (Beebee, 2013). However, at least some of these animals have undergone recent declines in many areas of Britain. These certainly include *V. berus* (Wilkinson & Arnell, 2013), *B. bufo* (Carrier & Beebee, 2003) and *T. cristatus*, (Jehle et al., 2012) and perhaps also *Z. vivipara* (anecdotal observations). These declines have various but always anthropogenic causes, especially agricultural intensification but also increasing road mortality and possibly climate change (Beebee, 2013).

Urban habitats offer a potential sanctuary for at least some of these widespread species. In the Brighton (Sussex, UK) area *A. fragilis* was the only reptile commonly seen in gardens while *N. natrix* was a rare visitor to some garden ponds. Amphibians fared rather better with many populations of *R. temporaria, B. bufo and L. vulgaris* (Beebee, 1979). However, Brighton is a heavily urbanised region and outlying rural developments may be more accommodating, especially for reptiles. This paper reports on the results of reptile and amphibian surveys in a small rural village surrounded by relatively low intensity farming activity.

METHODS

Study area

Westbury-sub-Mendip is a village of about 290 households and 800 people at the foot of a south-facing scarp slope of the Mendip Hills in Somerset, UK (centred at 51°14'7.43N, 2°42'56.15W). It lies on the main road (A 371) between Wells and Cheddar at a mean altitude of about 45 m ASL. The Mendips, a limestone formation, rise steeply to about 250 m ASL within 2 km to the north of the village while to the south the land flattens out, within < 1 km, to < 15 m ASL on the alluvial soils of the Somerset Levels wetlands. Landscape around the village is primarily pasture with some woodland, demarcated by extensive hedgerows and dry-stone walls.

Survey methods

A request for information on recent (within the last five years) reptile sightings in and around (within c. 1 km) of the village was circulated to residents via the Westbury Society's email network in the spring of 2013. Appeals were also made in the Village Hall during Society meetings. Records were verified as far as possible by discussion with the providers. Amphibian breeding sites were investigated by a garden pond survey in spring 2014, also advertised by the Westbury Society as well as by a talk in the village hall in February and by posters distributed at 10 sites around Westbury. Methods followed standard procedures for amphibian survey in the UK (Griffiths et al., 1996; Gent & Gibson, 1998). Every pond on offer was visited twice during March and April. On the first inspection, use by *R. temporaria* or *B. bufo* (evidenced by spawn)

Species	Total number of reptile records	Reptile records at village periphery (%)	Number of amphibian breeding ponds (% of ponds surveyed)
Zootoca vivipara	1	0 (0)	
Anguis fragilis	13	3 (23)	
Vipera berus	4	4 (100)	
Natrix natrix	15	14 (93)	
Rana temporaria			12 (44)
Bufo bufo			2 (7)
Lissotriton vulgaris			10 (37)
Lissotriton helveticus			17 (63)
Triturus cristatus			2 (7)

Table 1. Summary of reptile and amphibian records

was determined. Numbers of spawn clumps or strings were counted. On the second visit, designed to detect newts *L. vulgaris, L. helveticus* and *T. cristatus*, the ponds were either searched after dusk using a powerful torch or 5-8 bottle traps were set in the evening and inspected the following morning. The first method was employed where there was abundant open water (13 ponds) and the second where aquatic vegetation was dense everywhere (14 ponds). Numbers of each species were recorded though only male *L. vulgaris* and *L. helveticus* were registered by torch survey due to the difficulty of identifying the females of these species.

Data analysis

Standard statistical tests were applied using the STATISTIX software package (Tallahassee, USA).

RESULTS

Reptiles

A summary of the reptile and amphibian records from Westbury-sub-Mendip is shown in Table 1. All four widespread reptiles were reported, by a total of 15 contributors, in or around the village. Evidently both *A. fragilis* and *N. natrix* were frequent while *V. berus* and *Z. vivipara* were much rarer. The geographical distribution of reptile sightings is shown in Fig 1. A general feature was for slow-worms to occur mainly within the built-up area while snakes were more often seen on the outskirts. Three of the four *V. berus* records, all of which were outside but within 500 m of the village centre, were road kills. By contrast, only three of the 15 *N. natrix* records were of dead animals. The behavioural difference between *A. fragilis* and *N. natrix* was significant, with the snake seen beyond the housing areas (7 records) or visiting gardens around the village edge from adjacent fields (8 records), in total 14 out of 15 'boundary' instances whereas only three of the 13 *A. fragilis* records were similarly peripheral (Yates-corrected $\chi^2 = 5.99$, df = 1, P <0.05). Indeed, *A. fragilis* occurred in one garden in the very centre of the village housing block.

Amphibians

All five of the widespread British amphibians bred in Westbury garden ponds (Table 1), 27 of which were surveyed.

A minimum of >9% (27/c.290) households in the village therefore had ponds, with an average surface area of 5.9 m^2. Only two ponds (7%) had no breeding amphibians. Two species were rare. *T. cristatus* was found in just two ponds, to both of which it was introduced >20 years ago. This newt has evidently maintained populations in both places but not spread to others. Toads *B. bufo* also only bred in two ponds in 2014 but this may underestimate their true abundance. Two other ponds apparently have toads in most years and animals are regularly encountered in gardens all over the village. In 2014 each of the two breeding ponds had only one spawn string and one of these was completely dead. The year may have been a poor one for *B. bufo* since unusually low numbers were seen in regularly monitored ponds elsewhere in the area (J. Dickson, personal communication). Three of the four 'usual' toad ponds (75%) contained ornamental fish, whereas overall fish were present in just seven of the 27 ponds (26%).

Frogs *R. temporaria* and the two small newt species were widespread in garden ponds. Frogs preferred fish-free pools (Wilcoxon Rank Sum test, P = 0.013) and were

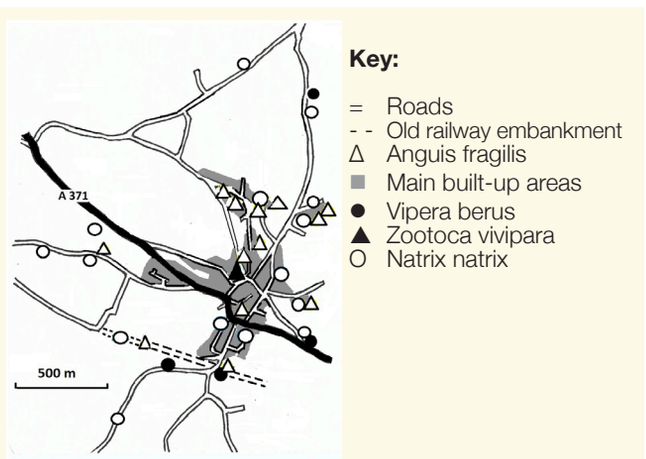

Figure 1. Distribution of Westbury-sub-Mendip reptile records.

found in ponds with one or both of the small newts more often than in newt-free ponds (Wilcoxon Rank Sum test, P = 0.017). There was however no significant relationship between numbers of spawn clumps and numbers of small newts, either individually or collectively summing both species together (r_s = -0.338, df = 15 , P = 0.086) although a trend towards an inverse relationship was suggested. There was also no preference of frogs for ponds of a particular size; spawn occurred in the smallest (0.5 m^2) and largest (15 m^2) of the ponds surveyed. The average number of spawn clumps was 5.5 and 10 was the highest number seen.

Smooth newts *L. vulgaris* were too rarely found with fish to test their response whereas palmate newts *L. helveticus* were more common in fish-free ponds (Wilcoxon Rank Sum test, P = 0.034) and collectively (pooling *L. vulgaris* and *L. helveticus*) the selection against fish was even more marked (P = 0.017). Neither separately or collectively was there any evidence of pond size preferences for the two small newts.

Of particular interest was the changing relative frequencies of *L. helveticus* and *L. vulgaris* along a south-north transect in the village (Fig 2) in the 16 ponds occupied by one or both species, excluding the two ponds where newts were deliberately introduced. The proportion of newt samples constituted by *L. helveticus* was low in the south but increased dramatically about 100 m north of the disused railway (roughly corresponding with the main A 371 road) and was consistently high further north. The relationship was probably asymptotic but there was nevertheless a significant linear relationship between relative *T. helveticus* abundance and latitude (r_s = 0.773, df = 15, P = <0.001).

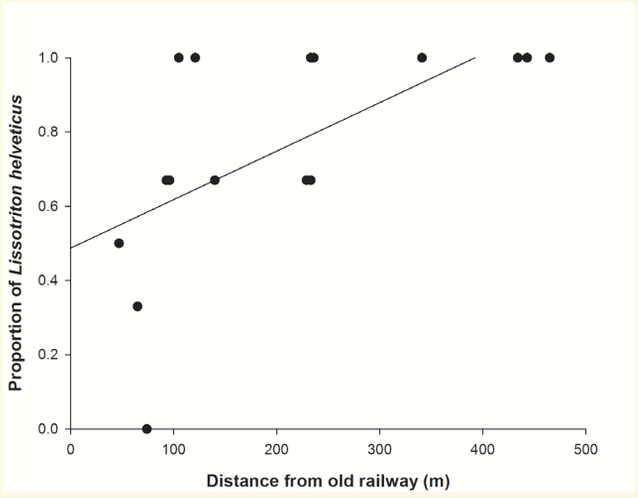

Figure 2. Gradient of palmate relative to smooth newt abundance.

DISCUSSION

Until recently there have been no studies reported of reptiles in British gardens. However, a wide-ranging investigation of urban amphibians and reptiles, with several thousand participants across the country, revealed that *A. fragilis* occurred in 16% and *N. natrix* in 13% of gardens overall (Humphreys et al., 2011). The other species were very rare, as also found at Westbury. Slow-worms are clearly well-suited to gardens, probably because their secretive behaviour minimises risks from predation or disturbance. Grass snakes in Westbury were regular visitors to garden ponds on the village margins, a relatively large habitat in this small community with a high edge:centre ratio. At least one compost heap was used for breeding, as evidenced by relict egg membranes. Adders (*V. berus*) were rarely encountered, perhaps because of past persecution (one respondent had been bitten in her garden) but are fairly common on the Mendip Hills. The scarcity of *Z. vivipara* was more difficult to explain. It too is common on the hills and much of the habitat around the village looks suitable. Perhaps disturbance and predation (by cats or birds) are too high for this species which basks conspicuously but this lizard may be experiencing declines in some parts of Britain (H. Inns, personal communication, and personal experience) and is in considerable difficulty in the Netherlands (Zuiderwijk & Janssen, 2008). The single record, by an experienced zoologist, was of an animal basking on a compost heap.

The value of garden ponds as a habitat for amphibians has been recognised for some time and began to compensate for pond losses in the wider countryside more than 40 years ago (Cooke, 1975). Studies in the south-east and north-east of England confirmed widespread use of gardens by all five widespread amphibians, though *T. cristatus* and *L. helveticus* were relatively uncommon compared with *R. temporaria*, *B. bufo* and *L. vulgaris* (Beebee, 1979; Banks & Laverick, 1986). The present study, however, confirms that gardens can also provide excellent habitat for *L. helveticus* when conditions (probably water quality) are appropriate. Cooke & Frazer (1976) found that this species preferred potassium and sodium-rich waters, often of low pH, and was less often associated with calcareous circumneutral ponds. The abundance of *L. helveticus* in an area dominated by calcium-rich limestone where ponds are invariably circumneutral (data not shown) is therefore somewhat surprising though I have no data on concentrations of the other metal ions. Evidently Westbury is on the cusp of a habitat transition between limestone-rich soils in the north and alluvial sediments in the south, fortuitously revealing how the two small newts respond to this difference. An alternative explanation, that palmate newts are advantaged by increasing altitude, seems unlikely (Cooke & Ferguson, 1975). All three species of newts occur at higher elevations on the Mendips but *L. helveticus* seems to be the most common and widespread there. By contrast, on the Somerset Levels south of Westbury it is rare to find any newt other than *L. vulgaris*. Thorough survey of amphibian breeding sites in rural areas requires substantial effort to establish absence, ideally with four visits per pond, using four different methods (Sewell et al., 2010). However, garden ponds are relatively easy to survey and although species may occasionally have been missed I believe that this would have been a rare event in these small pools. No non-native species of reptiles or

amphibians were encountered during the Westbury surveys.

The convenience of garden amphibian populations has facilitated several studies. Griffiths (1984) investigated *L. vulgaris* activity and behaviour in a London garden pond; Beebee (1995; 2007; 2012) reported on the population dynamics of several species in a Sussex garden pond including phenological responses to climate change and the consequences of a Ranavirus outbreak; Baker & Beebee (1997) demonstrated competition between *Rana* and *Bufo* larvae in garden ponds; and several studies have implicated genetic changes in *Rana* and *Bufo* populations, including increases in larval mortality, deformities and albinism (Hitchings & Beebee, 1997; 1998; Pash et al., 2007; Zeisset et al., 2010), some of which may imply inbreeding problems in small, isolated breeding sites.

Garden habitats seem likely to be important safeguards for at least some of Britain's widespread reptiles and amphibians into the foreseeable future. Villages such as Westbury are particularly well placed because of the relatively low impact of road vehicles and the extensive margins of good rural habitat, all of which should minimise inbreeding problems. These features were also identified as optimal in the national survey (Humphreys et al., 2011) together with fish-free ponds and high permeability fencing between gardens. Evidently there is scope for more research on garden-based herptile populations as well as opportunities for volunteer input ('citizen science') in future monitoring schemes.

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