

THE WINTER HABITATS OF AMPHIBIANS IN MILTON KEYNES, ENGLAND

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INTRODUCTION

Where do amphibians go in the winter? Most biologists would probably answer that they 'hibernate' under rocks and logs in the terrestrial environment. However, it seems that this answer is too general. In this paper, I briefly review some of the European literature on amphibian overwintering habits and then present some new data on the winter habitats of amphibians in Milton Keynes, a 'new-town' in southern England.

I examined the literature for references to the winter habits of common frogs (*Rana temporaria*), common toads (*Bufo bufo*), smooth newts (*Triturus vulgaris*) and crested newts (*T. cristatus*) in northern Europe. The common frog appears to be the most aquatic of these amphibians; overwintering in water, usually at the breeding site but sometimes in rivers or streams, has been reported in England (Hazelwood, 1969; Verrell & Halliday, in press, a), Germany (Blab, 1982), Poland (Kowalewski, 1974), Sweden (Hagstrom, 1982) and Finland (Koskela & Pasanen, 1974). Several of these authors note that males are more likely to spend the winter at the breeding site than are females. Some also describe overwintering on land. Ashby (1969) found that frogs residing in an English walled garden remained in dense vegetation and gaps in the wall over the winter.

Although common toads may also spend the winter in water in England (Waddington, 1952) and Sweden (Hagstrom, 1982), most authors report that toads overwinter on land. It seems that, after wandering quite extensively during the summer, toads migrate towards their breeding site in the autumn and remain close to the water over the winter (Heusser, 1969; Moore, 1954).

Smooth newts have been recorded as overwintering in water after autumnal migration in England (Bell, 1977) and Germany (Blab & Blab, 1981); these newts are thought to be newly-matured adults about to breed for the first time. Older adults spend the winter on land. Griffiths (1984) found that smooth newts reside under stones in the early part of the winter, migrating vertically into the soil as the temperature decreases. He suggests that aquatic overwintering may only occur in large bodies of water; then, temperature fluctuations may be sufficiently buffered to prevent extensive freezing with subsequent 'winterkill' (see also Bradford, 1983).

The crested newt is similar to *T. vulgaris* in its winter habits. Autumnal migration and aquatic overwintering have been noted for small adults, although most authors agree that at least part of crested newt populations remain on land in England (Verrell & Halliday, in press, b), Germany (Blab & Blab, 1981) and Sweden (Hagstrom, 1982).

METHODS

Five amphibian breeding sites within or near Milton Keynes were monitored to varying degrees from 1979 to the present. These sites were:

- (1) Yrrell Pond, Soulbury: an extensively studied site on private arable/pasture farmland.
- (2) Marigold Pond, Conniburrow: situated on a council housing estate, this site was subject to heavy dumping of domestic refuse and garden debris.
- (3) Cleavers Pond, Conniburrow: as (2) above.
- (4) University Pond, Walton Hall: Situated in the managed gardens of the Open University campus.
- (5) Walton Lake, Woughton: a large, marshy site in managed parkland, with some grazing pasture nearby.

All of these sites were known to contain common frogs, common toads, smooth and crested newts, except for Cleavers Pond, which contained only toads and smooth newts. At each site, I searched the water and adjacent terrestrial habitat, and recorded in which type of habitat amphibians were found. In this paper, I summarize data collected over the months of November to March; I regard this period as 'the winter'.

RESULTS AND DISCUSSION

Data on the winter habitat selection of amphibians at the five sites studied are summarized in Table 1.

The only adult amphibians known to have overwintered in water were common frogs and crested newts at Yrrell Pond. This pond was encircled by a drift fence in 1983 and part of 1984, making the autumnal migration of these two species very obvious (see Verrell & Halliday, in press, *a, b*). Frogs were not found in the terrestrial habitat around Yrrell Pond during the winter, but their appearance at the drift fence in the spring indicated that they were present in the vicinity. Although adult smooth newts were never found in water over the winter, larvae are believed to have overwintered in Yrrell Pond in 1983 (Verrell, in press).

Newts were more frequently encountered in the terrestrial habitat during the winter, and common toads exclusively so. All three species were found in garden debris consisting of dumped soil and/or rotting vegetation, with some individuals buried to a depth of up to 10cm. This finding supports Griffiths' (1984) suggestion of vertical migration in cold weather. Amphibians were seldom found under single rocks and logs. It was more common to find newts, especially *T. vulgaris*, 'sandwiched' between the bark and wood of logs and fallen trees. This microhabitat is probably ideal for an overwintering newt; it is damp, contains a plentiful supply of invertebrate prey and, due to microbial activity, is probably relatively warm. At Walton Lake, small groups of smooth newts (from between three to six individuals) were often found in physical contact beneath the same piece of bark. The possibility that individuals in such groups experience some advantage in terms of temperature regulation and/or water conservation awaits empirical investigation.

The only amphibians found at Cleavers Pond over the winter were smooth newts and common toads. I have observed both of these species emerging from rabbit burrows on mild nights in March; these burrows were situated about 3m or less from the margin of the pond. Indeed, the name of the housing estate in which this pond is situated, Conniburrow, comes from a derivation of the Latin word *cuniculus* (meaning 'rabbit') joined with 'burrow'. I have seen no evidence that these burrows are still inhabited by rabbits (e.g. faecal pellets), but they are undoubtedly suitable habitats for overwintering amphibians: damp and frost-free.

These data indicate that the majority of amphibian populations sampled in the Milton Keynes area overwintered on land. A variety of terrestrial habitats were occupied, including garden debris and domestic refuse provided by Man. I am most pleased to report that amphibians were present in ponds on a housing estate, despite illegal dumping and 'small-boy effects'. Following the survey work of Beebee (1979), I encourage householders in such areas to help conserve their amphibian fauna by constructing garden ponds suitable for colonization.

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Table 1. The winter habitats of amphibians at five sites in Milton Keynes, England.

	Common frog	Common toad	Smooth newt	Crested newt
In water at breeding site	1		1*	1
On land near breeding site:				
a. under single rocks			5	
b. under single logs		5	1	1
c. between bark and wood			1,4,5	1,5
d. in garden debris		1,4,5	1,4	1,4
e. in domestic refuse			2	
f. in mammal burrows		3	3	

Pond abbreviations:

1. Yrrell Pond; 1*. larvae only
2. Marigold Pond
3. Cleavers Pond
4. University Pond
5. Walton Lake

REFERENCES

- Ashby, K.R. (1969). The population ecology of a self-maintaining colony of the common frog (*Rana temporaria*) *Journal of Zoology (London)* **158**, 453-474.
- Beebee, T.J.C. (1979). Habitats of the British amphibians (2): suburban parks and gardens. *Biological Conservation* **15**, 241-257.
- Bell, G. (1977). The life of the smooth newt (*Triturus vulgaris*) after metamorphosis. *Ecological Monographs* **47**, 279-299.
- Blab, J. (1982). Zur Wanderdynamik der Frosche des Kaltenforstes bei Bonn — Bilanzen der jahreszeitlichen Einbindung. *Salamandra* **18**, 9-28.
- Blab, J. & Blab, L. (1981). Quantitative Analysen zur Phönologie, Erfassbarkeit und Populations dynamik von Molchbeständen des Kaltenforstes bei Bonn. *Salamandra* **17**, 147-172.
- Bradford, D.F. (1983). Winterkill, oxygen relations and energy metabolism of a submerged dormant amphibian, *Rana muscosa*. *Ecology* **64**, 1171-1183.
- Griffiths, R.A. (1984). Seasonal behaviour and intrahabitat movements in an urban population of smooth newts, *Triturus vulgaris* (Amphibia: Salamandridae). *Journal of Zoology (London)* **203**, 241-251.
- Hagstrom, T. (1982). Winter habitat selection by some North European amphibians. *British Journal of Herpetology* **6**, 276-277.
- Hazelwood, E. (1969). A study of a breeding colony of frogs at the Canon Slade Grammar School, near Bolton, Lancs. *British Journal of Herpetology* **4**, 96-103.
- Heusser, H. (1969). The ecology and life history of the European common toad *Bufo bufo* (L.). An abstract of a five-year study. *Forch-Zurich Heusser*.
- Koskela, P. & Pasamen, S. (1974). The wintering of the common frog, *Rana temporaria* L. in northern Finland. *Aquilo (Zoology)* **15**, 1-17.

- Kowalewski, L. (1974). Observations on the phenology and ecology of Amphibia in the region of Czestochowa. *Acta Zoologica Cracoviensia* 19, 391-460.
- Moore, H.J. (1954). Some observations on the migration of the toad (*Bufo bufo bufo*). *British Journal of Herpetology* 1, 194-224.
- Verrell, P.A. (In press). The emergence of postmetamorphic smooth newts from a pond in southern England. *British Journal of Herpetology*.
- Verrell, P.A. & Halliday, T.R. (In press, a). Autumnal migration and aquatic overwintering in the common frog, *Rana temporaria*. *British Journal of Herpetology*.
- Verrell, P.A. & Halliday, T.R. (In press, b). The population dynamics of crested newts (*Triturus cristatus*) at a pond in southern England. *Holarctic Ecology*.
- Waddington, L.F.G. (1952). Toad hibernating under water. *British Journal of Herpetology* 1, 112-113.