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HERPETOLOGICAL JOURNAL, Vol. 1, pp. 175-177 (1987)

# HABITAT DESTRUCTION AND ITS EFFECT ON A POPULATION OF SMOOTH NEWTS, *TRITURUS VULGARIS*: AN UNFORTUNATE FIELD EXPERIMENT

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*(Accepted 20.8.86)*

## ABSTRACT

Partial clearance of the terrestrial vegetation surrounding a pond in southern England resulted in a significant decrease in the size of the smooth newt (*Triturus vulgaris*) population breeding there, relative to a nearby, intact pond. This finding supports the suggestion of Beebee (1981) that the terrestrial habitat surrounding a pond is an important determinant of that pond's suitability for amphibians.

## INTRODUCTION

In a survey of the status of British amphibians in which England, Scotland and Wales were divided into 12 'survey regions', populations of the smooth newt (*Triturus vulgaris* L.) were reported to have suffered declines in three regions. Over 70 per cent of the respondents in this survey blamed these declines on loss of suitable habitat due to human activity (Cooke and Scorgie, 1983).

Loss of ponds is an obvious cause for concern amongst those involved in the conservation of amphibian populations. However, loss of the terrestrial habitat surrounding extant ponds can also have detrimental effects on the amphibians which visit the ponds in order to breed and feed. The importance of such habitat was stressed by Beebee (1981), who surveyed a large number of ponds in southern England and found that those with marginal scrub habitat were more likely to support amphibian populations than were those without (all other requirements being equal).

In 1986, the author was afforded the opportunity to study the effect of terrestrial habitat destruction on smooth newts at a local level. In 1985, as part of an investigation into the reproductive biology of this species, breeding population size was assessed at two, closely-situated ponds. In the autumn of that year, about one half of the marginal terrestrial vegetation was removed from one pond; the other pond was left intact. In 1986, the two ponds were surveyed once more, and the influence of habitat destruction on smooth newt breeding population size was determined.

## METHODS

The two study sites are ponds situated on the Conniburrow housing estate in Milton Keynes, Buckinghamshire, southern England. They are approximately 0.25 miles from one another. In 1985, both

| | Marigold Pond | Cleaver Pond |
|---|---|---|
| Ordnance survey reference | 851398 | 851394 |
| Surface area (sq. m.) | 200 | 250 |
| Maximum water depth (cm) | 23 | 60 |
| Pond substrate | Thick clay mud and plant litter | Thick clay mud and plant litter |
| Shore | 1985 and 1986: stony, with some support from wooden slats | 1985: muddy banks. 1986: muddy banks, with some support from slats |
| Amphibians present | *Triturus vulgaris, T. cristatus, Bufo bufo, Rana temporaria* | *T. vulgaris, B. bufo* |
| Dominant terrestrial vegetation | *Crataegus monogyna* | *C. monogyna* |
| Dominant aquatic vegetation | *Elodea canadensis, Lemna minor, Potamogeton pectinatus* | *E. canadensis, L. minor, P. natans* |

TABLE 1: Summary of some physical and biological characteristics of the two study sites.

ponds were subjected to a detailed physical and biological survey, some of the results of which are summarised in Table 1. Marigold Pond was not subjected to removal of vegetation between the breeding seasons of 1985 and 1986, and can thus be regarded as the 'control' pond. Cleaver Pond was subjected to vegetation removal along its northern shore, and is thus the 'experimental' pond. The vegetation was cleared by local government to improve access to Cleaver Pond and render it safer when visited by children (the latter is clearly a laudible reason for the clearance).

Censuses of the smooth newts in each pond were initiated in March in both of the two years of study. Each site was visited two or three times per calendar week, from between 1930 and 1100 hr (at or around the time of dusk). At Marigold Pond, each visit consisted of slowly walking a circuit of the perimeter of the pond, scanning the shallower and less-vegetated areas by torchlight. The number of smooth newts seen in the water was recorded. At Cleaver Pond in 1985, only a small area at the western end of the pond was accessible for torching, due to the thick vegetation surrounding the pond elsewhere. During each visit, the author stood at a spot at this end of the pond, and counted the number of smooth newts which were visible during a period of 10 minute in duration. In 1986, access to Cleaver Pond was greatly improved, but the same method of census was employed as in the previous year.

In 1985, visits to the ponds were terminated in mid-June; in 1986, visits were continued until early July. For analytical purposes, the numbers of smooth newts seen at each pond from week 10 to week 19 in both years of the study are considered.

## RESULTS AND DISCUSSION

The data obtained during the censuses are summarised in Table 2. For both ponds the numbers of smooth newts counted in 1986 were lower than in 1985. The decrease for Marigold (control) Pond was 29.7 per cent, compared with a decrease of 75.4 per cent for Cleaver (experimental) Pond. This difference is statistically significant ($X^2$ = 13.9, $P<0.001$). It is possible that this difference at Cleaver Pond merely reflects a change in the behaviour of the newts; although no direct alterations were made to the aquatic habitat, destruction of the terrestrial vegetation may have had indirect effects on the aquatic habitat. Whilst this possibility cannot be dismissed entirely, torching of those parts of Cleaver Pond rendered more accessible in 1986 did not result in a high count of aquatic newts (23 in total). This suggests that the between-years difference at Cleaver Pond was not due to a gross change in the distribution of newts in the pond.

| | Cumulative No. newts at: | | | |
|---|---|---|---|---|
| | Marigold Pond | | Cleaver Pond | |
| Week | 1985 | 1986 | 1985 | 1986 |
| 10 | 0 | 0 | 0 | 0 |
| 11 | 3 | 0 | 0 | [illegible] |
| 12 | 13 | 5 | 3 | 0 |
| 13 | 52 | 8 | 12 | 2 |
| 14 | 109 | —* | 22 | —* |
| 15 | 214 | 13 | 29 | 7 |
| 16 | 317 | 53 | 36 | 8 |
| 17 | 341 | 124 | 45 | 11 |
| 18 | 443 | 203 | 55 | 16 |
| 19 | 492 | 346 | 65 | 16 |

*No circuits made in that week.

TABLE 2: The cumulative number of smooth newts counted by torchlight at each of the study ponds in each of the two years of the study.

This result supports the hypothesis that destruction of the terrestrial habitat in the close vicinity of a pond can have a severely detrimental effect on the smooth newt population using that pond as a site for breeding and feeding. It also provides empirical verification of Beebee's (1981) conclusion that the presence of such habitat is important in determining the suitability of a pond for amphibians. The longer term consequences of habitat destruction at Cleaver Pond are unclear, but two obvious possibilities exist: first, the population of newts may fall below the 'effective population size' and thus risk extinction, or secondly, the population may stabilise at a new, lower level. Only long term field work would provide the answer.

The benefits afforded by terrestrial vegetation along the shores of a pond are of two types. The first, direct benefits, include the utilisation of the habitat as a refuge during the winter. This was certainly the case for Cleaver Pond in the winter of 1984, when the newts (as well as common toads, *Bufo bufo*) were known to have used rabbit burrows in the vegetation as hibernaculae (Verrell, 1985). These burrows were destroyed in the autumn of 1985. The second type of benefit can be termed 'indirect', and includes protection from human interference. Aside from the dumping of domestic and garden refuse, the most common form of interference in Conniburrow is the collection of breeding amphibians by children (the 'small child effect'). It seems unlikely that this effect was more severe for Cleaver Pond than for Marigold Pond in 1986, and thus unlikely that differential interference was the major factor responsible for the sharp decline in smooth newt population size seen at the former site.

In summary, the activities of a local government provided an unfortunate opportunity to assess the importance of the terrestrial habitat surrounding a pond for the smooth newt population breeding and feeding there. Destruction of this habitat resulted in a sharp reduction in the size of the breeding population, probably due to the removal of overwintering refuges. Improved accessibility to the pond, and a concommitant increase in the intensity of the 'small child effect', probably exacerbated this. It is thus clear that there can be a serious conflict over the interests of those committed to amphibian conservation and those who wish to make ponds safe and accessible public amenities. In such conflicts, it seems probable that the amphibians will be dealt the worst hand.

## ACKNOWLEDGEMENTS

This work was supported by a grant from The Open University Research Committee. I thank Norah McCabe for her assistance in the field, Irene Ridge for allowing me to examine the records of the pond survey and Milton Keynes Borough Council for providing the opportunity to examine the effect of habitat destruction.

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HERPETOLOGICAL JOURNAL, Vol. 1, pp. 177-180 (1987)

# ENZYME (ALDOLASE) ACTIVITY IN HYPEROSMOTIC MEDIA (NaCl AND UREA) IN THE TERRESTRIAL TOAD, *BUFO VIRIDIS* AND FROG *RANA RIDIBUNDA*

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*(Accepted 15.9.86)*

## ABSTRACT

In this study we examined the adaptation of the enzyme Aldolase from frogs and toads to different temperatures and to hyperosmotic media of 400-1000mOsm/Kg of urea or NaCl. Maximum enzyme activity was found between 200-400mOsm/Kg NaCl, both in enzymes from green toads and from marsh frogs. However, above 500mOsm/Kg, the activity of enzymes from green toads was significantly higher than the activity of enzymes from marsh frogs.

The activity of aldolase from green toads decreased very slowly as the media concentration of urea increased. However, the activity of aldolase from marsh frogs decreased rapidly under the same conditions.

The maximum activity of aldolase from both frogs and toads was at 25°C. The activity of aldolase from green toads was significantly higher than the activity of aldolase from marsh frogs when measured only at high temperatures (35°C). The results of this study support the idea that the biochemical systems of terrestrial amphibia are tolerant to hyperosmotic media.