# TOAD AGGREGATIONS UNDER STREET LAMPS

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The summer this year (1989) has seen a prolonged dry spell. The breaking of this weather was the cue for large migrations of newly metamorphosed toads *(Bufo bufo)* away from their larval ponds. One such migration was observed at Walton Lake, in one of the linear parks in Milton Keynes. This breeding site is a large, but shallow (less than 30 cm in most places) balancing pond, bordered on its southern side by a 'redway' (public footpath/cycleway). On rainy or humid nights (7-7-89, 9-7-89 and 10-7-89) large numbers of toads were seen on the path between dusk and midnight. It was noticed that many toads seemed to have congregated under street lamps. To ascertain whether or not this was the case and not just a phenomenon caused by the fact that toads were more visible along the lighted sections of the path, numbers of toads were systematically counted on 9-7-89. Twelve sites were sampled, six directly under street lamps and six at points midway between street lamps, alternating lighted and dark sites as I moved along a 330 m length of path. At each sampling point three sweeps were made across the path, capturing all toads possible by hand and with the aid of torchlight (although this was superfluous in the lighted areas). The path is 3 m wide and each sweep of the path covered a length of path of approximately 1.2 m, so the area of path sampled at each point was approximately 10.8 $m^2$. Numbers of toads captured and densities of toads at each sampling point are given in the table. These figures are undoubtedly lower values than the actual toad densities, since some toads evaded capture by moving off the path where they were hidden in grass.

Table. Numbers of toads captured at each sampling point. Figures in brackets are densities of toads per $m^2$.

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|---|---|---|---|---|---|---|
| Light | 14 (1.3) | 51 (4.7) | 38 (3.5) | 43 (4.0) | 19 (1.8) | 27 (2.5) |
| Dark | 4 (0.4) | 3 (0.03) | 7 (0.6) | 0 (0) | 5 (0.5) | 4 (0.4) |

The distribution of these toads is clearly clumped, with large numbers gathering under the street lamps (mean densities of toads under street lamps and in unlit areas are 3.0 per $m^2$ and 0.4 per $m^2$ respectively). The toads captured were predominantly those that had recently metamorphosed. Only two adults and three immatures were captured and so it is not clear whether toads of all ages had gathered under the street lamps, or whether it is just the recently transformed toadlets that did so. The most obvious explanation for this behaviour may be that they are responding to high densities of prey items. Flying insects could be seen flying around the lamps and presumably some eventually move or fall to the ground where the toads are able to capture them. Smith (1973) reports *Bufo bufo* waiting for prey at bee-hives and trees baited with sugar, by entomologists, to attract moths, whilst Green Toads *(Bufo viridis)* are reported to forage under street lamps (Arnold, Burton and Ovenden 1978, Ballasina 1984). Distribution of predators according to prey density has been recorded among non-amphibian species eg. sticklebacks, cichlids and mallards (see Parker and Sutherland 1986 for review). Various methods may be employed by predators to assess prey density, for example they might be attracted to areas where large numbers of prey items are visible or they may actually assess their own rate of prey capture. Most of the insects that were attracted to the light were flying around the lamp itself – beyond the range that toads normally respond to prey items. Only two toads, a juvenile and an adult, were seen to capture prey items within one hour of observation. Since the density of toads under the lights is very high, average prey capture rate must be quite low, which makes high rates of individual prey intake seem an unlikely cause for those toadlet aggregations. Since they had only recently left the larval environment it would also seem unlikely that they had learned to associate lighted areas with high prey densities. So why do they aggregate under street lamps? There are certainly good reasons not to do so, since the street lamps light a path, there is a high risk of being squashed

by cyclists and pedestrians. The number of squashed toadlets seemed similar to the number of survivors, even on this infrequently used path. Other potential predators are carabid beetles. Two species *(Carabus violaceous* and an unidentified *Fernia* species) were also seen foraging in the lighted areas of the path. However none was seen to attack toadlets, despite the fact that one of both species were seen attacking earthworms, larger prey items than the toadlets, and both species were seen eating recently squashed toadlets.

As an alternative hypothesis, the aggregations of toadlets may not actually be a response to high prey levels, but may be related to the levels of luminance generated by the lamps. Toads are capable of using vision to detect prey at very low levels of illumination (as low as 10 ulux, which is as dark as a 'dark wood at midnight' [Larsen and Pedersen 1982]). However, if the eyes of toads function better under conditions of semi-brightness rather than darkness of night then they may find it easier to forage under lighted street lamps rather than in unlit areas. Jaeger and Hailman (1973) experimentally tested the light intensity preferences of anurans in the laboratory. The majority of bufonids that they tested showed a photopositive response, but as the authors point out, the range of stimulus illuminances provided was lower than that of daylight. They speculate that each species will have an 'optimum ambient illuminance', and so their 'photopositively' responding species may well have been those with crepuscular activity rhythms, and given a full range of stimulus illuminances would select a level corresponding to twilight. This conclusion could also explain why the toadlets in this instance moved towards lighted areas of path, since the street lamps may provide levels of light close to the optimum ambient illuminance.

To summarize, recently transformed Common Toads aggregated in large numbers under street lamps. These lighted areas of footpath did not seem to provide individual toadlets with high prey capture rates, and presented the toadlets with a high risk of being squashed by pedestrians/ cyclists.

## REFERENCES


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