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A COMPARISON OF SURVEY METHODS FOR CRESTED NEWTS (*TRITURUS CRISTATUS*) AND NIGHT COUNTS AT A SECURE SITE, 1983-1993

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Breeding crested newts (*Triturus cristatus*) were studied in two ponds at a privately-owned secure site. Numbers counted at night were found to be positively related to numbers trapped or netted using standardized techniques. Night counting was used to monitor changes in breeding numbers from 1983 to 1993. In one pond, counts declined to zero by 1990 as a result of siltation and drought conditions. In the main breeding pond, considerable year-to-year fluctuations occurred, with annual mean counts ranging from 3 to 183. A significant rise was recorded in 1985, that was attributed to exceptional recruitment to the adult population. Counts remained high until 1988, but then declined. Numbers decreased even further during the drought years of 1991 and 1992, despite small pools being dug. These small pools were evidently unattractive and were mainly ignored. After heavy rain recharged the pond in autumn 1992, counts returned to a similar level in 1993 to that recorded at the start of the study, 9-10 years before. Catches of larvae varied considerably from year to year. Larval numbers were not related to counts of adults, but were positively correlated with catches of larvae of smooth newts *T. vulgaris*, which also breed at the site. Implications for the conservation of crested newts are discussed.

INTRODUCTION

In Britain the crested newt (*Triturus cristatus*) receives protection as a Schedule 5 species under Part I of the Wildlife and Countryside Act, 1981. In addition, exceptional populations may be protected under Part II of the Act by their breeding sites and immediate terrestrial habitat being notified as Sites of Special Scientific Interest (SSSIs). This latter approach requires the ability to recognise populations worthy of protection in SSSIs. Counting in the breeding site at night with a powerful torch is frequently used as an assessment technique and has enabled at least some of the best populations to be identified (Oldham & Nicholson, 1986; Swan & Oldham, 1993). Night counting is an example of a visual encounter survey technique (Crump & Scott, 1994). One problem during the 1980s, when guidelines for SSSI selection were being formulated, was that little information was available on population stability as indicated by night counting. The guidelines (Nature Conservancy Council, 1989) eventually recommended that populations in sites that exceeded the appropriate threshold (100 newts counted at night) should be checked for stability over three breeding seasons.

Numbers and ranging of a population of crested newts at Shillow Hill in Cambridgeshire were studied in 1984 and 1985 (Cooke, 1985, 1986). During the period 1984-1986, night counting was compared with other survey techniques, particularly bottle trapping (Griffiths, 1985) and netting. From 1986, it was decided to continue with night count surveillance of this population to monitor gross changes in the long-term. The site is privately owned and is free from most of the urban, agricultural and other pressures that affect many British crested newt sites (Hilton-Brown & Oldham, 1991). This work has assumed extra importance in view of the recent global interest in declines of amphibian species and long-term monitoring to look into the perceived problem (Wake, 1991; Pechmann *et al*., 1991; Beebee, 1992; Griffiths & Beebee, 1992). The decline of the crested newt in Britain continues to give cause for concern (Hilton-Brown & Oldham, 1991; Griffiths & Beebee, 1992). This is the first report of a population of this species being monitored annually for a period of ten or more years. Published population studies on crested newts on the European mainland extend to four (Glandt, 1982) or six consecutive years (Hagström, 1979; Arntzen & Teunis, 1993).

SITE DESCRIPTION

The Shillow Hill site (grid reference TL28-82-) extends to about 2 ha, and is a mosaic of woodland, scrub, hedge, marsh, orchard, grassland, gardens and buildings. It comprises two domestic properties, the owners of which are sympathetic to the needs of the newts and other wildlife. There are four semi-natural ponds, probably resulting from clay-digging earlier this century. Two of these ponds rarely hold water in the breeding season and will not be referred to again. The principal breeding site has been Top Pond (48 m perimeter at high water) with some breeding in Wood Pond (20 m perimeter) during the 1980s; these two ponds are about 60 m apart. On the eastern side of the site is a main road, the B1040; no newt casualties have been found on this road (Cooke, 1985). Beyond the road and also on the other three sides of the site is arable farmland. No pond is shown on the local 1:25 000 map closer than 500 m and no other crested newt site is known within 1 km. At other sites, while immature newts are known to travel up to 500 m, few adults are found more than 250 m from their breeding ponds (Oldham & Nicholson, 1986). Newts are sometimes found on the arable farmland around the Shillow Hill site in summer (Cooke, 1986). Therefore, while some emigration may occur across the arable land at Shillow Hill, significant immigration is extremely unlikely. Smooth newts (*Triturus vulgaris*) also breed at the site and some comparative information is provided in this paper.

FIELD METHODS

DEVELOPMENT STAGES

Crested newts lay their eggs during the spring and early summer. The larvae develop over a period of months, with the efts emerging in late summer; overwintering as larvae is rare at this site. The efts attain a maximum length of 64-69 mm by late autumn in their first year (Cooke, 1986). An immature stage can be recognized with a maximum length of 89 mm. The duration of this stage has not been quantified at Shillow Hill. Information from populations on the European mainland demonstrates that, while crested newts can mature at two years of age, some or most individuals require longer (Hagström, 1979; Dolmen, 1983; Arntzen & Teunis, 1993). In the autumn at Shillow Hill, males in the length range 90-99 mm can be found with secondary sexual characteristics and these are termed sub-adults, following Oldham & Nicholson (1986). Sub-adult females are assumed to be of the same size, with adults of both sexes being 100 mm and longer.

NIGHT COUNTING AND COMPARISON WITH OTHER METHODS

Changes in abundance of adult newts in the breeding sites were followed by means of night counts. Such counts may be affected by changes in the ease with which individuals can be seen because of fluctuations in turbidity and density of water plants. A stick was used while counting, to move aside submerged and floating vegetation. Visual estimates of turbidity and plant cover were routinely recorded in order to check whether changes in numbers of newts counted might be explained by such factors. Throughout the study, access to the entire perimeters of both Top and Wood Ponds was always possible. To facilitate recording since 1984, the edge of Top Pond was divided into 16 sections of equal length (3 m with the pond full). To minimize the effects of behavioural changes, counts were restricted to peak breeding season and were undertaken during 50-120 min after sunset.

During 1984-1986, bottle trapping (Griffiths, 1985) was compared with night counting in order to determine whether a totally different method supported the results obtained by torch counting. Bottle traps were used by Griffiths & Mylotte (1987) to indicate seasonal changes in numbers of crested newts in the water at a pond in Wales, and to provide information on the relative use of pond microhabitats. At Top Pond, night counting

TABLE 1. Rainfall prior to summers when Top Pond retained water (n=6) or desiccated (n=5). *Notes*: [a] Arbitrarily taking July as month when pond desiccated. ** significantly different by t test from mean rainfall when pond retained water, P<0.01; *** P<0.001.

period covered	months before July in the summer under scrutiny[a]	mean rainfall in period ±SE (mm)	
		pond retained water	pond desiccated
April - June of that year	1-3	198±12	131±15**
January - March of that year	4-6	106±12	112±9
October - December of previous year	7-9	176±13	114±14**
July - September of previous year	10-12	161±27	115±22
January - June	1-6	304±7	243±12**
October - June	1-9	480±19	357±5***
July - June	1-12	641±34	472±18**

was undertaken mid-week and bottle trapping at weekends. Total catches during trapping regimes of 64 traps for one night or 32 traps for two nights were compared with the mean of night counts undertaken during the previous and the following weeks. Traps were evenly distributed around the edge at 0.75 or 1.5 m intervals.

Counts made in Top Pond at roughly weekly intervals throughout the breeding seasons of 1984-1986 indicated that peak season could be regarded as extending from the second week of April to the first week of June (nine counts). Accordingly weekly counts were made during this nine week period in 1987. Thereafter, five counts per season were undertaken with a count made in weeks 1, 3, 5, 7 and 9. Single counts were made in Wood Pond each breeding season except 1985. Whenever possible, counts were made under favourable conditions (calm, mild, dry nights). In 1986, to determine whether this seasonality could be confirmed by an alternative method, daytime netting was undertaken in Top Pond at weekly intervals from mid-March to early July; a pond net was used to make 2 m sweeps from deep to shallow water at each metre station around the 48 m perimeter.

OTHER OBSERVATIONS

As a supplementary activity, information indicative of relative larval abundance was obtained for Top Pond from 1986 onwards by netting during July and August, prior to emergence (Cooke & Cooke, 1993). For each metre of edge, a 2 m sweep was made with a pond net. In 1991 and 1992, when the pond was much reduced in size, one sweep was made per 2 m^2 of water surface. There were netting sessions on four different days each summer.

Records have been kept about when the breeding sites dried out. This information has been compared with precipitation records gathered at the meteorological station at Monks Wood, 9 km away.

RESULTS AND OBSERVATIONS

DESICCATION AND RAINFALL

Top Pond desiccated by late summer in five years during the study period: 1984, 1989, 1990, 1991 and 1992. Examination of meteorological records from Monks Wood revealed the importance of rainfall in early summer (Table 1) but also indicated that rainfall for up to at least the previous year could influence whether desiccation occurred.

This area of Britain suffered prolonged drought from early 1990 to mid 1992. Rainfall in 1990 and 1991 was 63% and 78% respectively of annual mean rainfall during the 1980s. Top Pond dried during the summer of 1990, but unlike previous drought years, it was not recharged during the following winter. Because of the conservation importance of this population (during 1985-1988 it had one of the highest night counts documented in Britain) a decision was taken before the 1991 season to excavate a new small pool with 10-12 m of edge in the dry bed of the pond. By 1992, the water table had lowered still further (in January 1992, 1.5 m below high water compared with the original water depth of 0.7 m) necessitating deeper excavation. This pool was lined with plastic and filled with rain water; it had an area of 3-3.5 m^2 (equivalent to about 3% of the original pond) and a shoreline of 8 m (17% of the original). Heavy and persistent rains during the second half of 1992 refilled the original pond completely by January 1993, i.e. the water table rose by 1.5 m in one year.

The second pond, Wood Pond, was never more than 50 cm deep and suffered from progressive siltation. During the 1980s it became shallower. With the additional effects of the drought, Wood Pond was dry

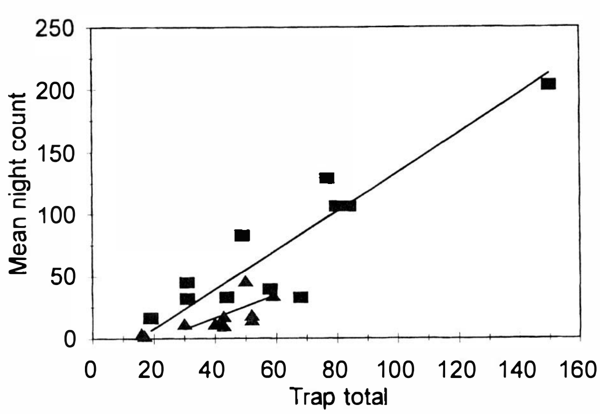

FIG 1. Relationships between total numbers of newts caught in bottle traps in Top Pond and the mean of the previous and following night counts. See text for further details. Equation of line fitted to crested newt data (squares): $y = 1.57x - 23.7$; line for smooth newt data (triangles): $y = 0.92x - 20.2$.

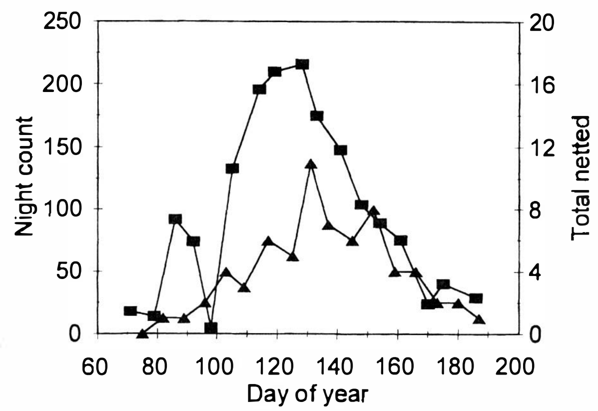

FIG 2. Night counts (squares) of crested newts in Top Pond, March-July 1986, compared with daytime netting totals (triangles). Day 100 = 10 April, day 200 = 19 July.

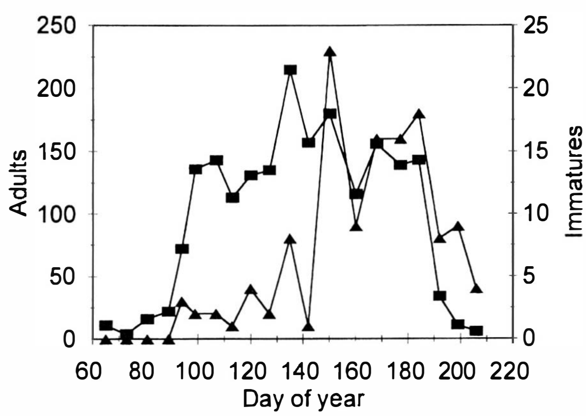

FIG 3. Night counts in Top Pond, March-July 1985, for adult crested newts (squares) and immatures (triangles). Day 100 = 10 April, day 200 = 19 July.

throughout the second half of 1991 and the beginning of 1992, despite having been deepened by about 30 cm the previous winter. Rains at the end of 1992 recharged this pond to a depth of 40-50 cm by early 1993.

Comparison of Night Counting With Other Methods

A comparison of night counting with bottle trapping is shown in Fig. 1 for both newt species. The trapping regimes of 64 traps for one night or 32 traps for two nights yielded comparable results and are not distinguished in Fig. 1 or in the analysis. There was no significant difference between mean catches on the first and second nights when 32 traps were used (*t* test, $P>0.05$). Because night count and trap total could not be regarded as dependent/independent variables, reduced major axis analysis was undertaken, as this treats both variables comparably. Night counts for both species were positively associated with trap totals (slopes significantly different from zero: crested newt $P<0.001$, smooth newt $P<0.01$). Trapping seemed more efficient with low numbers of crested newts in the pond, but night counts were more productive at high densities. For a given increase in trap total there was a proportionately greater increase in night count. To give an example, from the regression line, a five-fold increase in trap total from 20 to 100 would have been associated with a seventeen fold increase in night count from 8 to 134.

Results for night counting and netting are shown in Fig. 2 for crested newts in Top Pond. The smoothness of the seasonal curve for night counting was interrupted by freezing conditions in early April. Apart from early April, the ratio of numbers counted to numbers netted was higher in the early part of the season than later on. For data for the whole season, there was a positive relationship between netting total and the mean of the previous and following night counts (slope significantly different from zero: $P<0.001$).

Annual Variation in Night Counts

During the 11 year period under study, mean crested newt counts fluctuated considerably in Top Pond, with significant differences between two pairs of years: 1984 and 1985; 1988 and 1989 (Table 2). There was no evidence to suggest that these differences had been caused by changes in turbidity or weed cover. For each of these four years, plant cover at the surface developed from less than 20% in April to up to about 50% in early June, with only intermittent periods of turbidity (often following heavy rain). During 1984-1993, there were no significant differences between consecutive years for counts of smooth newts (Table 2).

For the crested newt, there was almost a five-fold rise in mean numbers counted from 1984 to 1985. Numbers remained high till 1988, then decreased in 1989 to roughly the 1984 level. From 1984 to 1989, apart from the water level being about 30 cm down in 1986, spring levels were high. Mean counts declined progressively to a minimum of only three in 1992, despite attempts to create small pools in the drought years of 1991 and 1992. Spring water levels returned to normal in 1993 and numbers of crested newts recovered to a level not significantly different from that at the start of the study. The mean in 1987 was sixty times higher than the mean in 1992 (i.e. comparing the highest with the lowest). In contrast, comparable data for the smooth newt showed a fluctuation of less than four fold (apart from the single count in 1983). Only in the small plastic-lined pool in 1992 was the mean count for the smooth newt higher than that for the crested newt. Analysis of count data for Top Pond, 1984-1993, revealed that time of peak count occurred significantly earlier in the season as the monitoring study progressed (Spearman Rank Correlation Coefficient $r_s = 0.66$, $P<0.05$).

In Wood Pond, numbers of both species declined to zero as the pond silted up and ultimately desiccated completely during the drought (Table 2). No newts were recorded in 1993 despite the pond holding water.

Immature crested newts were recorded separately from adults from 1985 onwards (Table 2). Mean numbers recorded in the water during the breeding season counts decreased progressively from 1985, reaching zero in 1991. A special study was made of immatures in 1985 by extending the weekly night counts through till the end of July (Fig. 3). Peak counts of immatures occurred from late May to early July, a period during which they represented about 10% of the total number of newts counted in the water.

Catches of Larvae

Details of larval catches in Top Pond are summarized in Table 3. For any particular year, replicate catches were relatively similar, so standard errors were small. For neither species was there a significant relationship between mean number of adults counted in spring and mean number of larvae counted in summer.

TABLE 2. Night counts in Top Pond and Wood Pond. *Notes*: [a] Adults and immatures not differentiated. * significantly different by *t* test from mean of previous year, $P<0.05$; *** $P<0.001$.

year	Top Pond: mean count ±SE				Wood Pond: count	
	no. of counts	crested newts		smooth newt adults	crested newts	smooth newts
		adults	immatures			
1983	1	25[a]		1	11	11
1984	9	33±4[a]		26±6	4	8
1985	9	150±11***	7.3±2.6	22±4	No count	
1986	9	145±18	4.7±1.4	21±4	6	4
1987	9	183±17	3.9±0.6	10±3	8	2
1988	5	136±32	3.6±1.4	7±3	3	0
1989	5	39±12*	1.0±0.4	13±2	2	1
1990	5	34±11	1.0±0.3	8±2	0	0
1991	5	19±5	0.0	9±3	0	0
1992	5	3±1	0.0	13±1	Pond dry	
1993	5	43±14	0.2±0.2	24±5	0	0

TABLE 3. Larvae caught in Top Pond. *Notes*: * significantly different by *t* test from mean of previous year, $P<0.05$; ** $P<0.01$; *** $P<0.001$.

year	no. of netting sessions	mean larval catch ±SE	
		crested newt	smooth newt
1986	4	33±4	12±3
1987	4	16±2**	21±5
1988	4	71±3***	43±5*
1989	4	19±3***	10±3**
1990	0	pond dry	
1991	4	6±3	6±4
1992	4	0.3±0.3	3±2
1993	4	53±4*	31±7

There was, however, a significant positive relationship between mean numbers of larvae of the two newt species (Spearman Rank Correlation Coefficient $r_s = 0.93$, $P<0.01$). Not surprisingly, larval catches were significantly higher in years when Top Pond did not dry out (*t* test, $P<0.05$). There was, however, probably some emergence each year except 1990, when the pond desiccated by July.

DISCUSSION

FLUCTUATIONS IN COUNTS 1983-1993

Night counts have been used to indicate gross changes in breeding numbers of newts over a period of years. Night counts were found to be positively related to trap total (Fig. 1), an independent quantitative measure. This gives some assurance that night counting can be used to detect change, especially when attempts are made to standardize the method. The marked and consistent seasonality in numbers counted and netted (Fig. 2) provides further confidence in the ability of the technique to detect changing numbers in the breeding pond. The proportion of the population using the pond at any one time and their duration of stay will presumably depend on the pond's suitability, weather conditions and newt behaviour. Numbers counted will depend not only on the actual number present when the count was made, but also on the ease with which newts could be seen due to plant cover, turbidity, newt behaviour etc. Capture/mark/recapture studies during both aquatic and land phases in 1984 (Cooke, 1985) concluded that the average night count in Top Pond represented 6% of the whole site's adult population with the peak count representing 10%. The adult population at the site was estimated at about 500 in 1984, giving a terrestrial density of roughly 250 per hectare.

In 1985, the mean night count in Top Pond increased significantly. Indeed the mean *count* in 1985 of 150 in Top Pond (Table 2) exceeded the mean mark-recapture *estimate* in 1984 of 141 (Cooke, 1985). Conditions for counting differed little between the two years; there was no significant difference in counts for smooth newts (Table 2). While there is little doubt that numbers of crested newts in Top Pond in 1985 considerably exceeded those in 1984, trapping newts in the pond revealed that the increase may not have been as great as suggested by night counting. Trapping in 1984 caught a mean of 39 per session (n=5, SE±8), while in 1985 the mean was roughly double at 80 (n=3, SE±2).

The most likely explanation for significantly increased breeding numbers in 1985 is exceptional recruitment to the adult population that year. Pitfall trapping at the site (Cooke, 1985, 1986 and unpublished data) indicated that immatures and sub-adults caught on land in summer and autumn were at least as numerous in 1984 as in 1985. Yet the latter year appeared better than any subsequent year in terms of numbers of immatures seen in Top Pond (Table 2).

From 1985 to 1988 inclusive, counts of adult crested newts remained at a high level (Table 2). In contrast to the relative stability shown by the crested newt counts, mean counts for smooth newts decreased progressively from 1985 to 1988. Mean numbers were significantly lower in 1988 than in 1985 (t test, P<0.05). This decline in numbers counted may have been due to high levels of predation or competition from the larger species. Over the years, several instances were noted of crested newts devouring adult smooth newts. There was no evidence of an adverse interaction between larvae; on the contrary, there was a significant positive relationship between numbers of the two species netted (Table 3). Neither were numbers of larvae inversely related to the numbers of adult crested newts, indicating that predation or cannibalism were not grossly affecting larval numbers. The year when the most larvae were netted was 1988, when counts of adult crested newts were still high. Elsewhere, studies on the food and feeding habits of newts have revealed adult crested newts to be mainly benthic while their larvae are pelagic (Dolmen & Koksvik, 1983; Griffiths & Mylotte, 1987). Although smooth newt larvae prefer a benthic habitat, their remains have not been reported in the stomachs of adult crested newts (Dolmen & Koksvik, 1983; Griffiths & Mylotte, 1987). Griffiths, de Wijer & May (1994) reported that, when confined in the laboratory or field at densities higher than likely to be found in the field, crested newt larvae predated significant numbers of smooth newt larvae. However, in a semi-natural pond such as Top Pond, the importance of interspecific larval predation appears to have been negated, probably mainly by microhabitat segregation and the ready availability of refugia, as suggested by Griffiths *et al.* (1994).

Mean night counts of adult crested newts declined significantly in 1989. There were no obvious changes in pond conditions that might explain the reduction in terms of newts being more difficult to detect or the pond being less attractive to them (smooth newt counts did not decrease). Night counts in 1989 did not differ significantly from those in 1983 and 1984. Larval catches were particularly poor for crested newts in 1987 (especially in relation to numbers of adults counted) and this may have contributed to a decrease in breeding numbers two years later in 1989. The decrease in mean night counts of adults from 1988 to 1989 was 71%. In view of the comments above about the extent of the increase from 1984 to 1985, as indicated by trapping, the decline between 1988 and 1989 may have been rather less than 71% and might be explained by a combination of poor recruitment and adult survival in 1989. Adult survival has been reported to range from 36 to 80% per annum (Hagström, 1979; Bielinski, 1986; Arntzen & Teunis, 1993). In the studies on crested newts on the European mainland, Hagström (1979) and Glandt (1982) found their populations to be reasonably stable. However, Arntzen & Teunis (1993), working on a population that had colonized a newly-created quarry pond, reported a reduction from an estimated 182 adults five years after colonization to only 16 adults in the following year. A range of factors was suggested as perhaps contributing: recruitment failure due to fish predation on larvae, collection of adults by people, loss of adults due to landscape reconstruction. Although Arntzen & Teunis (1993) estimated annual adult survival for the whole of their study at 49%, it was clearly markedly less than this during the year the population crashed.

In 1990, water levels in Top Pond were low in the spring, but night counts of crested newts differed little from those in 1989. However, the pond dried out in the summer and breeding newts were then dependent on the small hand-dug areas in 1991 and 1992. Night counts of crested newts declined to a minimum in 1992. During that year, because of the small size of the plastic-lined pool and because a cane was used to move aside water plants, it should have been possible to count all newts in the water (see Beebee, 1986). The mean night count in 1992 represented less than 2% of the mean number counted during 1987. Larval catches were minimal during the period 1990-1992.

In contrast, smooth newt night counts were maintained at a moderate level during the drought years.

1992 was the only year when smooth newt counts exceeded those of crested newts. During that year Top Pond more closely resembled a small highly-artificial garden pond rather than a semi-natural field pond. That crested newts found the small pools of 1991 and 1992 unattractive was confirmed in 1993 when numbers similar to those recorded in 1989 and 1990 returned to breed in the restored pond. From larval catch data (Table 3) most adults on the site in 1993 would be expected to be four years of age or older. The monitoring will continue; counts may decline in 1994 due to mortality of these older adults, but may increase again in 1995 as some newts from the 1993 cohort mature.

Avoidance of the small pools in 1991 and 1992 raises the question of the extent to which adult newts avoided the breeding ponds during other years. In all other years except 1986 and 1990, spring water levels were high; but counts did not decline in 1986 or 1990 (Table 2). In 1984, total numbers at the site estimated to be breeding in the spring were similar to numbers of adults estimated, from pitfall trapping, to be present in summer and autumn (Cooke, 1985). Thus there is no evidence of a significant level of non-breeding by adults in other years.

Counts in Wood Pond (Table 2) indicated a steady decline from moderate populations of both species in 1984 to zero in 1990. Countrywide, many populations of crested newts have become extinct as their breeding sites have been neglected, and have become overgrown and silted up (Hilton-Brown & Oldham, 1991). As Wood Pond is close to Top Pond and has been deepened, it is likely that it will be colonized again in the near future.

NEWT CONSERVATION

The study has provided a number of conclusions relevant to the conservation of crested newts. It has shown that site security has not been enough to prevent considerable fluctuations in count numbers. In Top Pond, the reductions in counts of adults in 1991 and 1992 could probably have been avoided by excavating the pond with machinery. Had that been done, however, when the pond recharged in 1993, this might have resulted in an excavation that was too deep and permanent in the long-term. Among the potential problems of such a pond are increased losses of larvae to vertebrate and invertebrate predators (Cooke & Frazer, 1976; Bell, 1979; Beebee, 1985; Arntzen & Teunis, 1993). Fish are particularly important predators (e.g. Swan & Oldham, 1993); fish have never been recorded in the Shillow Hill breeding ponds, presumably because of the ponds' propensity to desiccate. This study has indicated that more or less total breeding failure in Top Pond over three consecutive seasons has had no detectable long-term effect on numbers of adults counted at night. Exactly how many years of breeding failure can be tolerated before population decline or extinction results is not known, but will be related to longevity. It seems that up to three years need elicit no great alarm from managers of crested newt sites, unless there is evidence to the contrary.

With regard to SSSI notification, the study has shown that counting >100 adult crested newts over three consecutive breeding seasons is no guarantee that a population of SSSI standard will be maintained. Conservationists should view with suspicion sites with much lower peak counts in (some) previous years, for which there is no obvious explanation (eg. 1984 at Top Pond). Recent analysis by Griffiths & Raper (1994) has demonstrated considerable variation between ponds in the percentage of newts trapped or counted at night. It is not possible to predict accurately actual population sizes from such survey data. As more information becomes available, it may be necessary to refine the process by which SSSIs are selected.

As a contribution to long-term monitoring in the light of global concern over declining amphibian populations, this study has indicated that, although counts at the beginning and end of the period differed little, there was considerable fluctuation in the intervening years. It has also confirmed the role of rainfall in causing low reproductive output in dry years (see Banks *et al*., 1994) and temporary breeding population reductions during more prolonged droughts (see Pechmann *et al.*, 1991). Hopefully the recording scheme launched in 1994 by the Joint Nature Conservation Committee and the Institute of Terrestrial Ecology will *inter alia* help promote the monitoring of crested newt sites throughout Britain.

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