

## **NATTERJACK TOAD EXTINCTIONS: THE MALES GO FIRST**

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Although extinction of plant and animal species is a subject of intense concern and public debate, few studies have been made about the process of extinction itself. This is perhaps not too surprising, bearing in mind the difficulties in finding ever-diminishing numbers of a species in terminal decline. Natterjack toads have experienced many local extinctions in Britain over the past century, and despite current conservation efforts some of the smaller populations of this species still hover close to, and occasionally go over, the brink. One aspect of these minor tragedies seems to be that the sexes do not fare equally during these declines.

Detailed studies of relatively healthy natterjack populations give some clues about what is likely to happen when things go wrong. Life tables consistently indicate that female natterjacks live longer in the wild than do males, although the extent of this difference between the sexes differs substantially between populations. Females probably live longer mainly because they enjoy a safer lifestyle during the breeding season; mostly they make a single night-time visit to a pond each year, lay their spawn and rapidly retire to the relative safety of their summer burrows. By contrast, males stay around the ponds for weeks or months and many are known to perish at the hands, claws, beaks or teeth of predators during this vulnerable time. Even this may not be the whole of the story, and males may also pay a further penalty as a result of their innate male physiology; there is often a sharp decline in male numbers when they reach the age of 6-7 years in the wild, for reasons difficult to explain on the basis of predation. Although some males certainly can live longer than this in captivity, many do seem to keel over at roughly this age no matter how well they are kept.

The prediction of these observations is that in the final stages of extinction, small numbers of females may be the last survivors in sites where no males remain to mate with them. This prediction is compatible with what has been seen over the past few years at three localities, all in north-west England, where natterjacks have almost or completely disappeared. At one site in Lancashire, numbers of calling males declined during the 1980s following interference with the breeding site water regime and a single one was last seen in 1988. In 1990, however, two females (one dead, one alive) were located near the old breeding pond. Apart from this, and despite fairly intense monitoring, no other natterjacks have been seen at this locality in the intervening or subsequent years. At a second site, on the Merseyside coast, an isolated population declined through lack of available breeding ponds during the early 1980s and in 1987 only four large females were found in the vicinity of a new pond made specially for them. In this case, a single male from nearby on the coast was brought over and since then the population has begun to revive. Finally, at another even more isolated Merseyside site a steady decline left apparently only a single male calling by 1991. No natterjacks were seen in 1992, but this year (1993) one or two females did spawn in a new pond made specially for them. However, no males were seen or heard and none of the spawn developed. This site is not intensively monitored, so we cannot be sure about events here, but it maybe that the females simply deposited their spawn in the absence of male partners. This has been observed, albeit rarely, in captivity.

The difference in longevity between male and female natterjacks probably only averages out at a year or two in most populations, but it can be much more and in the extreme case of the single surviving native heathland population in southern England females live up to twice as long as males, a net difference of some 7-8 years. Clearly natterjack site managers should be aware of the sex bias during population declines, and be prepared to address the problem (perhaps by supplementation with males from adjacent populations, or suitable captive-bred stock) if the need arises. Evidently the last calling male does not mean the last natterjack, and prompt action may still save the day even in such apparently dire circumstances.

It would be interesting to know how typical natterjacks are with respect to this aspect of population dynamics. It seems to me quite likely that similar sex biases will occur in numerous other amphibian species, since males generally have the riskier lifestyles. Indeed, female left-overs may be the common immediate precursor to extinction in a variety of animal groups. Could this situation create conditions for one possible escape route from extinction, notably the evolution of parthenogenesis? Although rare, all-female populations do appear from time to time and include some well-studied lizards in Europe and North America. Parthenogenesis seems to be one of Nature's side-shows, with little long-term prospects for the organisms which plump for it, but having no males around would certainly seem to provide one powerful force in this unenviable direction.