Short Notes

Inflammation due to toe-clipping in natterjack toads
(*Bufo calamita*)

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Since toe-clipping for amphibians was introduced by Bogert (*for Bufo terrestris*) in 1947, numerous scientists have used this method for the recognition of individual amphibians if they are observed for long time periods, and especially for more than one season. After Heusser’s experience (1958) in amputating the phalanges of 1500 common toads (*Bufo bufo*), very few workers have amputated the first three fingers of males (important for amplexus) or the long fourth toe of the hind legs of both sexes (important for moulting).

Toe-clipping has also been the most commonly chosen method for recognition in natterjack toads (*e.g.* Boomsma and Arntzen, 1985; Flindt and Hemmer, 1967, 1968; Heusser and Meisterhans, 1969; Niekisch, 1982; Schwabe, 1977; Sinsch, 1988, 1992a, 1992b; Tejedo, 1988). However, evaluation of possible increased morbidity or mortality has only rarely been carried out. Clarke (1972) published a study concerning this topic in *Bufo woodhousei fowleri*. He found a dramatically increased mortality due to toe amputations. Underhill (cited by Honegger, 1979) noticed a loss of weight in *Rana pipiens* after treatment. In view of these data, it seemed necessary to evaluate the risks of toe-clipping in the natterjack toad to determine the safety of the method.

We marked 96 natterjack toads of a length between 3.8 and 7.7 cm between 12 April and 9 May 1991 by amputating the ends of phalanges from front and/or hind legs as described by Heusser (1958). One toe-end was amputated in 44 toads and two toe-ends were removed in 52 toads. Photographs of the bellies of the toads, from which the animals could be recognized individually (unpublished data), were taken. The method was evaluated by recapturing the marked toads and recording the amount of healing.

Sixty-six of the marked toads were captured again at least once. There were complications following toe amputation in 12 of them. Seven of the 12 damaged toads were
Figure 1. Inflammation and recovery in 12 toads. Vertical lines show times of recapture. Thick horizontal lines and large stars show periods of severe inflammation (necrosis), lines of medium thickness and small stars show periods of slight infection. Dashed lines indicate periods when healing was occurring (the wound was healthy at the next capture). An arrow at the end (no. 3 and 9) indicates that the toad was recaptured during the following year. A question mark indicates that the injured toad was not recaptured.

Individuals which had one toe-end removed, and 5 had two toe-ends amputated. Inflammation was found on front and hind legs. The symptoms varied from infection of the stump (2 toads), necrosis of the stump (3 toads), necrosis of the entire foot (5 toads) to metastatic infection and necrosis of toes on limbs on which there had been no amputation (2 toads).

Figure 1 shows the progress of inflammation and recovery. Inflammation did not follow immediately after surgery. In at least 6 individuals there was a minimum of one month between the amputation and the detection of inflammation. Ten of the toads were caught at least once between surgery and the appearance of their symptoms. Their wounds were closed and looked well healed. Healing of the inflamed wound was documented by recapture in 4 of the toads. A wound was declared "healed" if it cicatrized without showing signs of inflammation.

Ten of the inflammations were in males which had spent every night between marking and the appearance of inflammation in the water in order to call (toads no. 3 and 6 in fig. 1 were females). In the 4 toads with healed inflammation, the code of the missing toes had become unrecognizable. These animals could only be classified as "probably marked". Their individual recognition was only possible from the photographs of their bellies.