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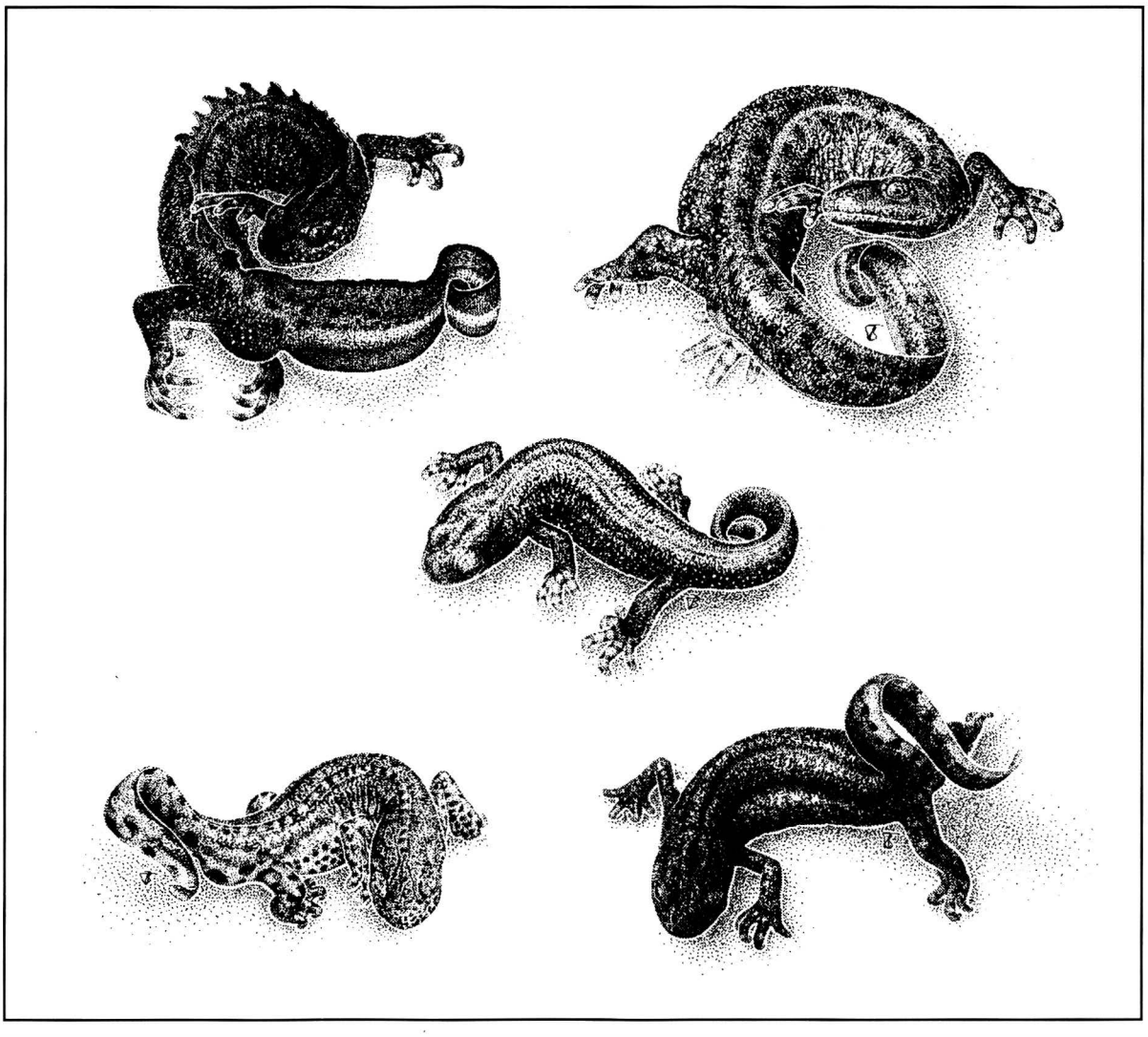

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SHORT NOTES

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FIELD OBSERVATIONS OF ANTI-PREDATOR BEHAVIOURS IN THREE SPECIES OF NEWT (GENUS: *TRITURUS*)

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Key words: newt behaviour, anti-predator, *Triturus*

Newts and salamanders react to potential predators by displaying their aposematic colour patterns, and releasing toxic skin secretions whilst maintaining a rigid posture (Hinsche, 1926; Griffiths, 1996). This response forms an effective protection against predators (Brodie, Nowak & Harvey, 1979; Brodie, Nussbaum & Digiovanni, 1984). However, the posture is highly variable, especially within the family Salamandridae (e.g. Brodie, 1977).

From 1988 to 1995, a study of amphibian population dynamics and migrations was carried out in an area south-west of Bonn [Northrhine-Westfalia, Germany] (Kneitz, 1998; Kupfer & Kneitz, 2000). Amphibians migrating within this area were sampled by perimeter drift-fences and pitfall traps. During the daily censuses, some smooth newts (*Triturus vulgaris*), alpine newts (*T. alpestris*) and crested newts (*T. cristatus*) were found to display a particular posture, which was identified as anti-predator behaviour (Fig. 1).

The anti-predator behaviour could be induced by touching the newts with a dip-net, but some newts displayed it without any visible stimulus. During spring migrations the behaviour was observed only in terrestrial adults, but – while leaving the pond in August – five juvenile smooth newts, two juvenile alpine newts and one juvenile crested newt (Fig. 1c) expressed it as well. About 1% of the smooth and alpine newts caught in the traps showed anti-predator responses during the spring migration. In crested newts, the frequency was 12% in males and 7% in females (Table 1).

Great variation in the intensity of the posture was observed. Certain specific features in the smooth newt's anti-predator behaviour were noted, setting it apart from that of the other two species (Table 1). All observed newts arched their bodies laterally. The hindlegs were spread, while the forelegs and front of the body were lifted from the ground. In low intensity postures, a weak bending of the body was followed by a coiling of the tail, while in high intensity postures the body was arched strongly, forcing the snout tip to touch the distal part of the cloaca. During such extreme displays the newts kept their eyes closed.

Some smooth newts stretched their bodies and elevated their tails while keeping them straight, without any undulating movement; sometimes the tail was lashed (Fig. 1h). This behavioural pattern was not observed in the other two species.

The combination of drift-fences and pit-falls is not a very selective method of capture; often other animals are trapped with the migrating newts. During the present study many shrews and voles were encountered in the traps (Mühlschlegel, 1994), as well as carabid beetles of the genus *Carabus* (Strupat, 1995).

TABLE 1. Description of anti-predator coloration and postures adopted in the field by three *Triturus* species; descriptions of postures follow Brodie (1977).

Species &	no. of	no. of	aposematic colour		immob-	tail			body				venter exposed	
sex/stage	migrants	obs.	venter	dorsum	ility	lashed	wagged	undulated	arched	coiled	flipped	stretched	+tail up	+chin up
T. alpestris														
males	3174	32	+	-	+	-	+	+	+	+	-	-	+	+
females	3747	40	+	-	+	-	+	+	+	+	-	-	+	+
juveniles	-	2	+	-	+	-	+	-	+	+	-	-	+	+
T. cristatus														
males	51	6	+	-	+	-	+	+	+	+	-	-	+	+
females	73	5	+	-	+	-	+	+	+	+	-	-	+	+
juveniles	-	1	+	-	+	-	+	-	+	+	-	-	+	+
T. vulgaris														
males	3182	26	+	-	+	+	-	-	+	+	-	+	+	+
females	3879	37	+	-	+	+	-	-	+	+	-	+	+	+
juveniles	-	5	+	-	+	-	-	-	+	+	-	-	+	+

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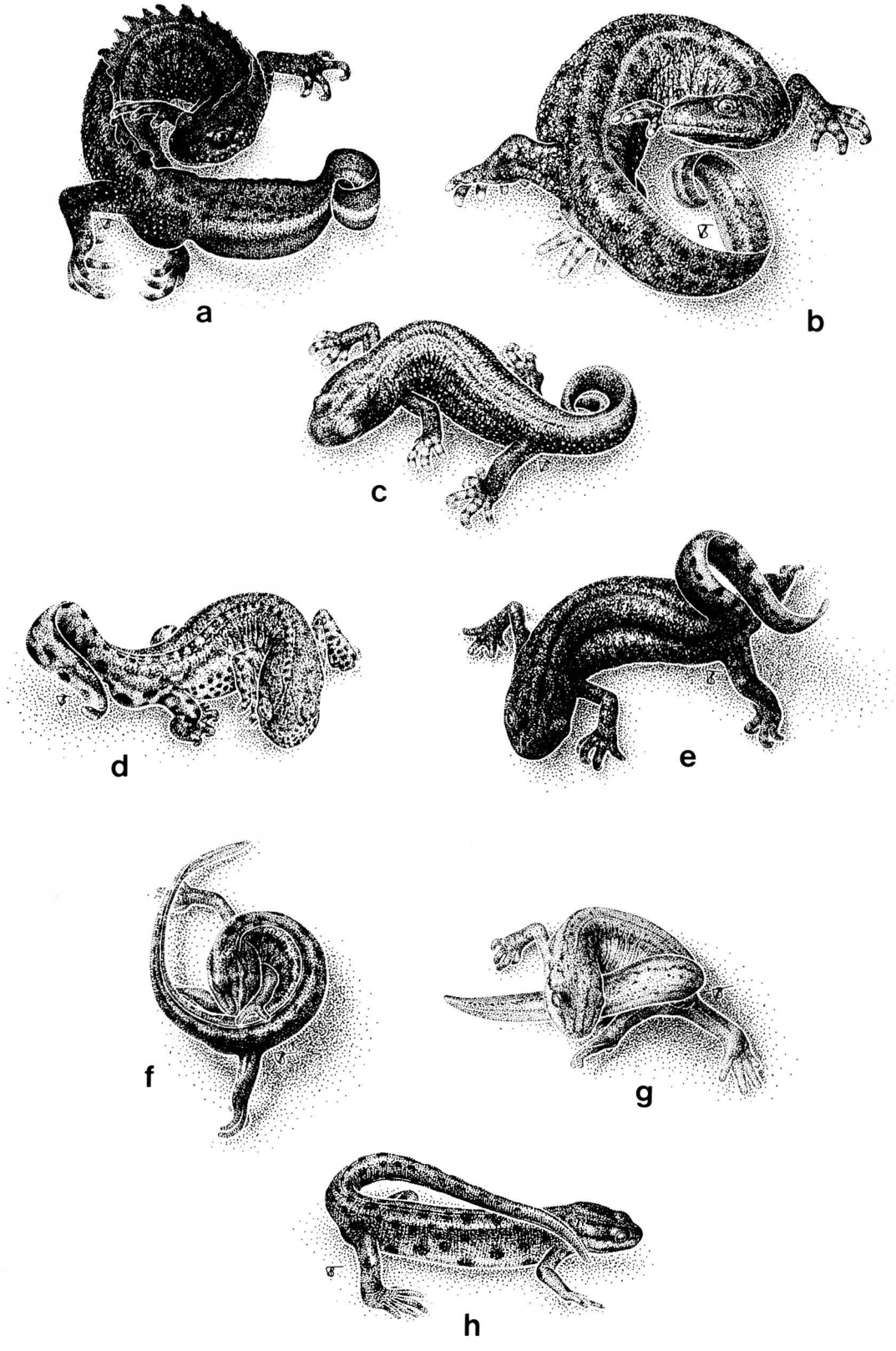

FIG. 1. Anti-predator behaviour of newts (genus *Triturus*): (a) *T. cristatus* male; (b) *T. cristatus* female; (c) *T. cristatus* juvenile; (d) *T. alpestris* male; (e) *T. alpestris* female; (f) *T. vulgaris* male; (g) *T. vulgaris* female; (h) *T. vulgaris* male, tail-lashing posture.

Shrews are known to prey upon smooth newts (Bell & Lawton, 1975; Pernetta, 1976). In addition, Thiesmeier (1990) identified carabids such as *Carabus nemoralis* and *Carabus hortensis* as predators of juvenile fire salamanders in pitfall traps. Therefore, the shrews and beetles trapped with the newts should be considered an important factor in inducing the newts' anti-predator postures.

Field records of anti-predator behaviour in the European *Triturus* species are rare and restricted to small numbers of animals, with few quantitative data available. Grillitsch (1983) described a female crested newt which had turned on its back, exposing its belly pattern. Denton (1990) induced a very strong defensive reaction in a female crested newt by grasping it firmly. Similar postures were observed in *Triturus carnifex* as it was removed from traps (Andreone, 1985). Alpine newts displaying anti-predator postures were observed by Zavadil (1992) and Kupfer (1995). For the smooth newt, no field data were available prior to the present note.

As mentioned above, some smooth newts showed an unusual anti-predator posture, in which the tail was displayed. A similar posture was described by Herrmann (1993) in *Triturus montandoni*. The tail of the smooth newt has a glandular dorsum (e.g. Nobis, 1949; Eber, 1954) and may be unpalatable, as we have observed a water shrew (*Neomys fodiens*) eating a male smooth newt, but leaving its tail. Displaying the tail might therefore serve to draw the predator's attention to this particular part of the body.

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