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Frogs and toads in the food of the Great Grey Shrike (*Lanius excubitor*): larders and skinning as two ways to consume dangerous prey

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Abstract—In this note we present several previously unpublished cases of Great Grey Shrike, *Lanius excubitor*, predation in western Poland on adult amphibians, including poisonous toads, and a novel special behaviour — skinning toads. We briefly discuss the potential implications of these observations for understanding shrike foraging behaviour and gaps in our current knowledge on bird-toad interactions.

Keywords: food; foraging; *Lanius excubitor*; novel prey; predator-prey relationship.

INTRODUCTION

Shrikes (*Lanniidae*) are small to medium size passerines characterised by a predatory mode of foraging. This group of birds is known to be very flexible in exploitation of different food spectra and is therefore considered as a food generalist (e.g., Cade, 1995; Hromada and Krištín, 1996). The size of prey taken by shrikes might vary from ants to grouse (Tyler, 1991; Cramp and Perrins, 1993). It is known that the diet of several shrike species includes some amphibians, mainly frogs. However, we are not aware, to date, of toads (*Bufo* sp.) described as prey for shrikes (c.f. Yosef, 1996; Lefranc and Worfolk, 1997; Harris and Franklin, 2000 for reviews).

In general, predation is considered as a potential regulatory factor in amphibian populations, but via predation of tadpoles rather than adults (Beebee, 1996; but see Merilä and Sterner, 2002, for other examples). This is probably connected with several anti-predator strategies displayed by adult amphibians — both frogs and toads — such as low activity throughout the day and/or, especially, secret toxins located in their skin (Duellman and Trueb, 1986; Beebee, 1996).

Hence we present a few previously unpublished cases of Great Grey Shrike *Lanius excubitor* predation in western Poland on adult amphibians, including poisonous toads, and, a behaviour not previously recorded, skinning toads. We then briefly discuss the potential implications of these observations for understanding shrike foraging behaviour and gaps in our current knowledge on bird-toad interactions.

MATERIALS AND METHODS

Study area

Field research was conducted in the Wielkopolska region, mainly near the town of Odolanów (51°34′N, 17°40′E) between 1999-2003, where one of the most dense, stable and sedentary populations of the Great Grey Shrike in Europe exists (Lorek, 1995; Tryjanowski et al., 1999; Antczak et al., 2004). The study area was covered by farmland composed mainly of arable fields, meadows, pastures and woodlots of different ages. During the study period we investigated several aspects of Great Grey Shrike ecology including diet composition (for details see Hromada et al., 2002; Antczak et al., 2004). As part of more general studies, data on potential food sources were also collected (unpubl.).

Methods of diet analyses

To analyse shrikes' diet composition, four different methods were applied simultaneously: collar sampling of nestlings, pellet analysis, searching larders and direct observation of nest provisioning and foraging birds.

Collar sampling and nestling provisioning

To establish the food composition of the nestlings we used two methods: collar sampling and direct observation. The collar sampling sessions were performed between 06.00 and 10.00. To avoid hurting the nestlings (see Orians, 1966; Jenny, 1990), neck-collars were applied only on birds 4-15 days old. A maximum of two collar sessions were conducted per nest, with a minimum of 1 day in between the sessions. Collars were applied only on days with suitable weather, when parents could continue feeding immediately after the session (for discussion about the method in shrike studies see Tryjanowski et al., 2003b). Two hours after collars were installed on the necks of nestlings, the prey items were removed and preserved in alcohol for later identification. The second method used to determine the food of nestlings was direct observation of hunting adults during foraging sessions throughout the day. Videotaping was also classified as a direct observational method. Panasonic NV video cameras were placed near nests and recordings were analysed after the breeding period. The prey items delivered by parents to nestlings were identified as precisely as possible.

Pellet analyses

Pellets were collected from beneath the most frequently used perches and active nests from the start of the breeding period to a few days after the young had left the nests.

The diagnostic remains of prey items found in the pellets (e.g., head capsules, mandibles, legs, wing cases, bones, skulls and scales, etc.) were separated, counted and identified according to our reference collection.

The larders

Breeding territories of the Great Grey Shrike were regularly observed from the mating period until fledging the young. During these visits the vicinity of nests, to a radius of several metres, was surveyed for impaled prey items and their remains. When impaled prey were found, information was collected on prey type, date of find, etc. Because the latter part of the breeding season of the Great Grey Shrike coincides with that of another impaling species — the Red-backed Shrike *Lanius collurio* — we distinguished larders by direct observation of impaling birds.

Potential food base

Information about potential food sources was obtained using two methods. Firstly, the shrike territories (radius 500 m from the nest) were searched for potential places (mid-field marsh patches, ditches) where amphibians might be found. Each year we checked 35 territories and the presence of several amphibian species (mainly in large concentrations) was recorded in 27 (77%) of them. The second method involved Barber traps scattered throughout the territories in the three main habitats — crops, westlands and meadows. Twelve traps per territory, three in each of three dominant habitats, were placed three times in the year (mid-April, mid-May and mid-June. Each trapping session lasted 3 nights. Information obtained in this way provided limited information on amphibians because of low catch success. In 110 Barber traps used in April to June in the years 2000-2001, we caught a total of only 18 amphibians: eight Common Frogs, *Rana arvalis*, nine Spadefoot Toads, *Pelobates fuscus*, and a single Green Toad, *Bufo viridis*.

RESULTS

Collar sampling

A total of 95 collar samples were taken from 13 nests (mean $\pm$ SD 7.3 ± 6.6 samples per nest). Among 98 prey items collected using neck collars, no amphibian remains were found.

Pellets

During the study period, a total of 723 Great Grey Shrike pellets were taken (99 pellets from eight territories in 1999, 512 pellets from 30 territories in 2000, 112 pellets from 14 territories in 2002). Among 3199 prey items identified from pellets only 11 (0.34%) were amphibians, exclusively frogs, *Rana* sp.

Larders

Among 285 impaled prey items found, only 19 (6.6%) were of amphibians. Of these, six individuals were the Common Toad, *Bufo bufo*, two were Spadefoot Toads, *Pelobates fuscus*, and 11 were frogs, *Rana* sp.

Direct observations

Among identified prey items collected by shrikes in regular hunting attempts (165 prey items) or delivered to nests (226 prey items) both during incubation as well as during the nestling stage, no amphibians were recorded.

However, we directly observed toad-skinning behaviour by shrikes three times. Our first observation was on 1 April 2001, when we observed a Great Grey Shrike skinning a single Common Toad on the top of a grass haystack among meadows near the village of Sobota, ca 10 km north of Poznań. The shrike began to rip the skin on the toad's abdomen, and skinned the prey expertly by pulling it toward the toad's head. After skinning, the shrike consumed a piece of the toad body, and the skin and the majority of the bones were left on the haystack. In the same place, on 19 April 2001, the shrike skinned three Common Toads in a manner similar to that described above. On 1 May 2001, ca 15 km to the north, in another Great Grey Shrike territory, we observed the male, which impaled a Common Toad on a thorn of a Wild Rose *Rosa canina* shrub, over 1.6 m above ground, and skinned it, also in a similar way to that described above. When the toad skin was removed the rest of the toad was taken to the nest located ca 25 m away.

Considering all samples (4432 prey items) as well as all methods used to analyse diet, amphibians comprised only 0.8% of prey taken by the Great Grey Shrike in the western Poland study area.

DISCUSSION

Shrikes are known to be very opportunistic and flexible predators in their use of different food spectra as well as in hunting tactics (Rahmani and Bhushan, 1985; Cade, 1995; Lefranc and Worfolk, 1997; Hromada et al., 2003; Tryjanowski et al., 2003a). The findings presented here indicate that, in western Poland, amphibians play a marginal role in the diet of the Great Grey Shrike. Similar results were obtained in other parts of the geographical range of this shrike (e.g., Cramp and Perrins, 1993; Hromada and Krištín, 1996).

It should be noted that it is not easy to document all diet items. Shrikes rarely use amphibians as a food source and therefore it is only possible to detect them (by chance) in large data sets, as documented above. Another methodological problem is the fact that particular methods of diet analysis might underestimate some taxa and overestimate others, as was shown by Tryjanowski et al. (2003b). However, despite the fact that we used four methods of diet analysis in one study area, amphibians did not even comprise 1% of food composition. These findings provoke an obvious question: how frequently are shrikes predators of amphibians and what are the consequences of these relations for both birds and amphibians?

One of the possible explanations for such a small percentage of amphibians in the shrike diet is that amphibians were for the most part only found in small mid-field marshy patches that might form only a small part of the Great Grey Shrike territory. However, references to amphibian density in the agricultural landscape of western Poland (Rybacki and Berger, 1997), as well as our data suggest that, in general, amphibians occur in the majority of the shrike territories. Indeed, the Great Grey Shrike territories contained a wide variety of microhabitats and birds foraged mainly on meadows and pastures (Tryjanowski et al., 1999). Hence frogs and toads should be available at least during spring when amphibians reach the peak of their reproductive activity. On the other hand, the peak of activity of several amphibians takes place mainly during the night, and shrikes are diurnal predators.

Another anti-predator adaptation displayed by several amphibians, particularly adult toads, is the presence of secret toxins located in the skin (Duellman and Trueb, 1986; Beebee, 1996). Our findings show that shrikes might catch, cache and consume even toxic species of amphibians (toads) after preparation of the prey via skinning. Even in tropical habitats where amphibians, including toads, have dense populations, toxic compounds in toad skin ensure that they are rarely taken by birds (Poulin et al., 2001). On the other hand, there is some evidence that several birds species, such as owls, raptors, storks and herons, catch and eat toads (Cook and Cook, 1981; Spirett, 1984; Meshaka, 1994; Mitchell et al., 1995; Gonzalez, 1998) and among passerines, corvids do so regularly (Beiswenger, 1981; Caswell, 1987; Entwisle and Entwisle, 1993; Vogrin and Vogrin, 1998). Moreover, it is documented that Ravens (*Corvus corax*) were the main mortality factor in a local population of Western Toads (*Bufo boreas*) in the Cascade Mountains of Oregon, USA (Olson, 1989). However, to our knowledge, there is no information that birds can skin toads before consumption.

Skinning behaviour was described in mammals feeding on toads, and appears to be typical for mustelids and otters, which consume toads regularly (Lode, 1997; Duff and Hewitt, 1999; Jędrzejewska et al., 2001). Skinning is logical, because toad skin and parotid glands behind the eyes are poisonous, containing irritant bufotoxins (Duellman and Trueb, 1986; Beebee, 1996).

We can only speculate as to why shrikes skin toads. These carnivorous passerines can consume toads, because they find skinning reduces their toxicity. This is not too surprising, since shrikes regularly feed on prey which other predators and

generalists avoid, such as bees, orthopterans, bugs, isopoda and snakes (Cramp and Perrins, 1993; Hromada and Krištín, 1996; Lefranc and Worfolk, 1997; Vogrin and Vogrin, 1999; Harris and Franklin, 2000; Tryjanowski et al., 2003b). Processing the poisonous prey before consumption is already known in shrikes; they eat dangerous locusts, after impaling them for several days. During such delay, dangerous chemical substances in the prey's body degrade (Yosef and Whitman, 1992; Yosef et al., 1996). Therefore, skinning is another interesting and very clever foraging behaviour of the shrikes. Despite amphibians occurring in a large number of the studied shrike territories, we recorded cases of predation on amphibians, including toxic species, in only a few of them. This indicates that individual experience may play a crucial role. Only a few adult shrikes from the population studied were able to feed on toxic amphibians. Such extra foraging skills may play an important role in increasing individual fitness, since, in some periods, e.g., rainy days when insect activity is low, amphibians may provide alternative prey.

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