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A FOX ON THE HUNT: RED FOX (*VULPES VULPES*) WAS ABLE TO SUBDUE AND KILL AN ADULT COYPU (*MYOCASTOR COYPUS*) IN A PROTECTED SITE IN SOUTH-EASTERN BULGARIA

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In the present study, we report on a rare predatory behaviour in the red fox (*Vulpes vulpes* Linnaeus, 1758). In the early evening of 03.03.2023 we detected a red fox attacking and killing a coypu (*Myocastor coypus* Molina, 1782). We were able to document the event by the use of camera with tele-lens. The red fox was known to feed on smaller prey like insects, smaller rodents, lagomorphs, birds and others. Data on attacks on large and potentially dangerous prey are rather scarce and we discuss on the potential trigger for that predatory behaviour.

Keywords: ecology, feeding, diet, mammal, predator-prey interactions, killing behaviour

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U ovom radu izvještavamo o rijetkom obliku predatorskog ponašanja lisice (*Vulpes vulpes* Linnaeus, 1758). Rano navečer 03.03.2023 promatrali smo lisicu kako napada i ubija nutriju (*Myocastor coypus* Molina, 1782). To smo i zabilježili fotoaparatom s teleobjektivom. Poznato je da se lisica hrani manjim plijenom kao što su kukci, sitni glodavci, zečevi i kunići, ptice i drugo. No podaci o napadanju velikog i potencijalno opasnog plijena su prilično rijetki te raspravljamo o mogućem uzroku takvog predatorskog ponašanja.

Ključne riječi: ekologija, ishrana, hranjenje, sisavci, odnos predator-plijen, ponašanje pri ubijanju

The red fox (*Vulpes vulpes* Linnaeus, 1758) is one of the most widespread carnivores in the world. This species occupies a variety of habitats and is characterized by high ecological plasticity (Voigt, 1987; Jedrzejewski & Jedrzejewska, 1992; Kidawa & Kowalczyk, 2011; Castañeda *et al.,* 2022). It also affects many species that are its prey and plays a role as a vector for spreading of infectious diseases (Plumer *et al.,* 2014). For these reasons, foxes are considered one of the most important predators in many ecosystems worldwide, including urban ones (Tryjanowski *et al.,* 2002; Plumer *et al.,* 2014).

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Carnivore feeding ecology is important in understanding ecosystem functioning through the study of predator-prey interactions. Therefore there is a lot of research of feeding habits of the red fox in different parts of Europe (Jedrzejewski & Jedrzejewska, 1992; Baltrunaite, 2002; Sidorovich *et al.,* 2006; Díaz-Ruiz *et al.,* 2013; Castañeda *et al.,* 2022). The red fox uses a wide food spectrum including mammals, invertebrates, fruits, seeds, carrion, garbage, birds, amphibians, reptiles and bird eggs (Baltrunaite, 2002; Sidorovich *et al.,* 2006; Soe *et al.,* 2017). Among mammals, small rodents and especially Microtidae are its preferential prey (Drygala *et al.,* 2013; Castañeda *et al.,* 2020). Since the availability of prey varies with habitat and environmental factors, it is not surprising, that the composition of the red fox's diet varies through geographic regions (Reynolds & Aebischer, 1991; Jedrzejewski & Jedrzejewska, 1992; Baltrunaite, 2002; Sidorovich *et al.,* 2006; Díaz-Ruiz *et al.,* 2013; Soe *et al.,* 2017; Castañeda *et al.,* 2022).

In research of carnivore diets, including the diet of red foxes, faecal analysis was preferred in some studies, because it does not involve killing of animals and allows to determine the identity and number of consumed prey (Reynolds & Aebischer, 1991; Jedrzejewski & Jedrzejewska, 1992; Baltrunaite, 2002; Balestrieri *et al.,* 2005; Sidorovich *et al.,* 2006). Some authors collected samples of stomach contents from specimens killed by hunters (Harris, 1981; Kidawa & Kowalczyk, 2011; Tsunoda *et al.,* 2017). In recent years methods of direct documentation and recording with a camera or photo trap gained importance in studying of feeding ethology of mammals (Medeiros *et al.,* 2019; Koynova *et al.,* 2020; Kachamakova *et al.,* 2022).

The coypu, also called nutria, is a semi-aquatic herbivorous rodent indigenous to southern South America. Because of its valuable fur, the species was introduced into many regions around the world including Europe, North America, the Middle East, Africa, and Japan (Carter & Leonard, 2002; Gosling & Baker, 1991). In many of these regions, the nutria damages crops, native flora and fauna, other ecosystem elements as well as irrigation systems. Therefore the species is considered a pest (Gosling & Baker, 1989; Reggiani *et al.,* 1993; Panzacchi *et al.,* 2007).

In Bulgaria *M. coypus* was first introduced in 1948 on a farm east of Varna city called "Sherba" (Dragoev, 1978) and then in 1953 in lake Mandrensko and Arkutino Natural Reserve, at the Southern Black Sea Coast. Accidentally escaping from farms or deliberately released into the wild, coypus settled along river banks and in wetlands, creating resilient populations (Koshev *et al.,* 2022). Research by Mihaylov *et al.* (2017) found no evidence of environmental damage caused by nutria in the study area. On the contrary, the study showed that the presence of the rodent promoted vegetation reduction around water areas. The coypu is the biggest rodent in Bulgaria (Peshev *et al.,* 2004).

On 03.03.2023 at 17:15 h in the area of the village Tenevo, Yambol (N42.3549°, E26.5328°, 115 m a.s.l., Datum WGS 84) during a patrol on the banks of the river Tundzha, a red fox was spotted, attacking and killing a coypu (*Myocastor coypus* Molina, 1782). The fox killed the prey by biting, took the coypu in its mouth and ran away with it (Fig. 1). The air temperature was 8°C and there was no wind. Shortly afterwards, at 17:21 h, however, the red fox felt our presence and ran away, leaving the corpse of the rodent on spot. The predation event was documented by using a Nikon D4S and AF-S NIKKOR 300 mm f/2.8G ED VR with AF-S Teleconverter TC-14E II (Nikon Corporation, Tokyo, Japan). The location was recorded using a hand-held Garmin Etrex 30 GPS receiver (Garmin International Inc., KS, USA). The observation took place in the pro-

Fig. 1. A red fox (*Vulpes vulpes* Linnaeus, 1758) carrying a freshly killed coypu (*Myocastor coypus* Molina, 1782). The observation was made on 03.03.2023 in the area of the village Tenevo (Yambol, SE Bulgaria). Photo by R. Tsvetkov.

tected site "Reka Tundzha 2" (BG0000195), part of the Bulgarian NATURA 2000 network of nature protection areas. The habitat type in the area is 1530 "Pannonic salt steppes and salt marshes" and is protected under the Habitats Directive (92/43/EEC).

In 2012, fragments of a skull and lower jaws of a coypu were found next to the den of a red fox near the river Maritsa in the area of Harmanli town (Gruychev, 2012). Smith (1978) reported a single case of coypu remains found in the stomach contents of a male *V. vulpes* in the Louisiana. In 2012 Stefano Bettini uploaded a photo of a red fox catching a juvenile nutria. There is no information on whether these cases were of predation or scavenging. Only one study mentions the coypu as susceptible of predation by foxes, but no such predation events were recorded (Balestrieri *et al.*, 2005).

A possible explanation for the red fox hunting such a large and strong mammal is the increased population of golden jackals (*Canis aureus* Linnaeus, 1758) and the pressure they put on the red foxes. Bulgaria has the largest population of golden jackals in Europe and during the last two decades, their number had doubled, especially in lowland habitats (Tsunoda *et al.*, 2017; Raichev, 2020). In areas where *C. aureus* become abundant, *V. vulpes* populations decrease (Scheinin *et al.*, 2006) because the former may limit the extent to which red foxes feed on carrion.

The present article contributes to the scientific knowledge on the predatory behaviour of *V. vulpes*. More research is needed in order to improve our knowledge on predator behaviour of red foxes.

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