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### Predation by stone marten (*Martes foina*) on European mink (*Mustela lutreola*)

The European mink (*Mustela lutreola*) is a medium sized mustelid, with a geographic distribution principally in Europe. The species underwent a large scale decline in the last two centuries (Stubbe 1993b, Maran & Henttonen 1995), and only three fragmented populations survived, the second largest being located in the Danube Delta, Romania. Its status is that of a threatened species, with most populations still declining, and it is assigned the Endangered Red List criteria by IUCN (Maran et al. 2011). Main threats listed are current habitat loss, in the past over-exploitation, and the impact of alien American mink (*Neovison vison*), while introduced diseases, prey species decline, pollution, interspecific hybridization with European polecat (*Mustela putorius*) and intraguild predation were also presented as threats (Maran & Henttonen 1995, Maran et al. 2011). Here, we present a little-known predation event of stone marten (*Martes foina*) on fully developed European mink recorded in the Danube Delta, Romania.

A fragmented skull and several bones of a European mink were identified among the prey remains of stone marten, collected on the 15 May 2011 from Enisala, Danube Delta, Romania (44.884428N; 28.835360E). The remains were collected from holes in the walls of the Enisala medieval castle ruins, as part of an ongoing survey of stone marten diet. The site is long known area of stone marten presence in Dobrogea (Romanowski & Lesinski 1991) and was regularly surveyed for collecting scats and food remains in the period April 2007 to September 2013. Visits were performed seasonally and at each visit scats were collected from a fixed transect along the walls of the fortress, while food remains were extracted from the tunnels of the wall, used as resting sites by martens (Sándor et al. in prep).

The find consisted in a mummified skull, cervical vertebrae, fragments of left scapula and ventral ends of the ribs, covered by mummified skin. The skull – fully covered by mummified skin and tissues at the moment of collection – was fragmented, with braincase broken and opened in the dorsal part, but still retained measurable parts. After it was cleaned, it was identified based on form

and size of measurable elements (Table 1.) as a fully developed, young (little wear on teeth), presumably female individual. These prey remains were not present at the collection site on the previous collection-date (21.08.2010), thus the predation occurred most likely in the period of autumn/winter 2010. While we are not able to fully exclude the possibility that the stone marten found the mink dead (for example after road kill), the opened brain case points towards a predation event.

Up to our knowledge this is the first ever record of intraguild aggression between stone marten and European mink. Coupled with the recent expansion of the stone marten all over Europe (Abramov et al. 2006) and especially in the area of the last southern stronghold of the European mink (Kiss et al. 2014), it raises several questions.

The location of the prey remains lies on the southern border of European mink distribution range in Romania and Europe (Marinov et al. 2012) and it is a long known area of stone marten presence (Romanowski & Lesinski 1991). There are several records of minks in this area, the closest being at ca. 2.7 km from Enisala fortress. Live trapping in the area revealed a healthy mink population, too (Marinov et al. 2012), thus encounters between the two species may be more frequent than previously thought. The stone marten is much larger than the European mink, with even a female marten being in average ca. 2.78 times heavier, with the mean weight of female stone marten of 1233 g (n=123, male weight 1619 g, n=136, Stubbe 1993a) compared to a 474.70 g mean for European mink female in the region (n=17, Marinov et al. 2012), and regularly preys on species of the size of minks (e.g. rabbit, *Oryctolagus cuniculus*, see Stubbe 1993a). Medium sized carnivores in general and stone martens specifically, were recorded to regularly kill smaller carnivores like weasels, *Mustela nivalis* and house cats *Felis catus* (Lanszki et al. 2009), while the similarly built

pine marten (*Martes martes*) was even observed to kill fox (*Vulpes vulpes*) cubs (Brzeziński et al. 2014). Moreover, local stone marten diet included several prey remains of larger bird (*Gallus gallus*, *Phasianus colchicus*, *Coracias garrulus*, *Anas strepera*) and mammal species (*Lepus europaeus*, *Ondatra zibethica*) with average weight exceeding mean weight of European minks (Sándor et al. in prep).

Intraguild aggression and predation are important processes shaping the evolution and local composition of most mustelid assemblages' worldwide (Palomares & Caro 1999, de Oliveira & Pereira 2014). Moreover, intraguild aggression was already mentioned as a threatening factor for populations of European mink (Maran & Henttonen 1995), with the species most cited being the American mink (Maran et al. 2011). Competitive exclusion (Santulli et al. 2014) and even predation by American minks was already proven (Pödra et al. 2013). While the distribution ranges of the stone marten and the European mink overlap in the case of the two mink populations of southern Europe (on the Iberian Peninsula and the Danube Delta), in most areas habitat differences between the two species exclude their simultaneous occurrence. The European mink generally prefers fast flowing streams in Spain and France (Zabala et al. 2006), while the stone marten is a habitat generalist, with a noted preference for more dry, rocky habitats, also being well adapted to urbanized environments (Broekhuizen 1999). The Danube Delta presents a unique situation in this respect, as it is a lowland wetland, theoretically impenetrable for the stone martens. However, recent developments in the area (covering with boulder of all dams and the shores along main navigation channels, bridges constructed and the continuous expansion of concrete cover along roads inside the Delta) created suitable conditions for the penetration to and the invasive expansion of the stone marten in the Delta, and the species is rapidly colonizing the area. Just five years after its first record inside the

**Table 1.** Measurements of European mink (*Mustela lutreola*) skull, recovered from stone marten (*Martes martes*) prey remains, Enisala, Danube Delta, Romania.

Measured character	<i>Mustela lutreola</i>		
	Enisala individual (this study)	Males (n=48) (Abramov & Tumanov 2003)	Females (n=38) (Abramov & Tumanov 2003)
Maxillary tooth-row length	17.08	18.47 (17.6-19.47)	17.07 (16.2-18.3)
Length of upper carnassial teeth Pm4	6.22	6.78 (6.2-7.2)	6.26 (5.8-6.8)
Upper molar M1 breadth	4.71	5.31 (4.8-5.8)	4.79 (4.2-5.4)
Total length of the mandible	33.84	37.20 (35.1-39.8)	33.48 (31.3-36.2)
Mandibular tooththrow length	20.94	21.97 (20.4-23.3)	20.06 (18.9-21.5)
Length of lower carnassial teeth M1	6.87	7.33 (6.9-7.8)	6.70 (6.2-7.4)

proper Delta, the species regularly occurs in 27 localities and reached the seaside town of Sulina (Kiss et al. 2014, Kiss J.B. unpublished). Together with several diseases and parasites of the European mink found exclusively in the area of the Danube Delta (Gherman et al. 2012, Tăbăran et al. 2013, Oltean et al. 2014), intraguild predation may pose a further threat to the well-being of the populations of this endangered species in this specific location. With the expansion of stone martens and other recently detected predators like the pine marten and jackal (*Canis aureus*) in the region studied (Kiss et al. 2012, Kiss et al. 2014), there is an urgent need to clarify the conservation status of the European mink and to start a proactive management of its populations in the last SE European strongholds of European minks.

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