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Eurasian Beaver (*Castor fiber* L., 1758), Pine Marten (*Martes martes* L., 1758) and Stone Marten (*Martes foina* / Erxleben, 1777) in the Danube Delta (Romania)

Key words: Danube Delta, Eurasian Beaver, Pine Marten, Stone Marten, Romania

1. Introduction

The last decades brought a number of changes, both quantitative as well qualitative for the mammal fauna of the Danube Delta. The Wolf (*Canis lupus* L., 1758) disappeared, while a two new species appeared and colonised the area: the Racoon Dog (*Nyctereutes procyonoides* Gray, 1843) and the Golden Jackal (*Canis aureus* L., 1758), becoming common residents in the Delta.

The last three years provided records of another three new species for the area, the European Beaver (*Castor fiber* L., 1758), the Stone Marten (*Martes foina* Erxleben) and the Pine Marten (*Martes martes* L., 1758) (Almăşan 1995; Anghelescu 2002; 2004; Kiss 2004, 20010; Kiss et al. 2012, 2012a, 2013; Pocora & Pocora 2010, Rösler 2013, 2013a).The causes for these range changes may be complex. While the two canids benefited by the extinction of Wolf (Kiss 1999, 2004), most likely occupying the vacant niche.

The European Beaver is a rodent species which is currently extending its territory due re-colonisation process, while the two mustelids (and partly the Castor too) is benefiting from a complex of causes, primarily the crash of fur-market, as well the designation of the Danube Delta as a protected area and the following increase in conservation measures therein.

2. Study site

The study area is primarily the Danube Delta and the Razim-Sinoie brackish-water lagoon complex, while in the case of Stone Marten this area was extended to the Dobrogea plateau. The Romanian side of the Danube Delta (incorporating the lagoons of Razim-Sinoie to the south) has an area of 4655 km². More than 83,2 % is wetland, made up by a complex network of river branches, lakes, marshes and bogs, together with managed fisheries connected to the main branches and extensive reedbeds with seasonal or continuous water cover. Some 1,996 km² has a permanent reed cover. Surfaces lacking at least seasonal water cover occupy cca. 16,8 %, with a mean altitude of 0,52 m, forest cover is found on 260 km² (Hanganu et al. 2002; Munteanu 2005). The Dobrogea plateau was only tangentially surveyed, especially in the seashore area and along the permanent watercourses (for a survey of European Otter – *Lutra lutra* L., 1758).

3. Methods

The records of Pine Marten presence were the side results of an intensive research project on the European Mink (*Mustela lutreola* L., 1761). In this project the Danube Delta National Institute for Research and Development, Tulcea organised 7 surveys targeting European Mink in the period 2003–2008, followed by two more in 2010–11, using live capture of animals. We used box-traps, which are harmless to the animals, which were released after capture and processing (Kranz et al. 2004, 2005; Kiss 2010; Marinov 2011). The data collected on European Beaver and Stone Marten are related to incidental observations which were made during a number of field surveys targeting other projects. These later surveys in the Delta were performed from boat (Brates type, with Yamaha 15 HP engine), while outside the Delta the observations were made on foot or from car. In most cases record photos were made to document the observations. The distribution maps were obtained using the field collected GPS coordinates of the exact location of the records, transferred to Arc GIS 9 software.

4. Results and discussion

4.1. European Beaver

European Beaver used to be common in prehistoric and historic times in Romania in many areas, proofs of its presence were found in a number of archaeological sites, with toponymy providing several additional records, too. In contrast to the rest of the country, its past presence in the Danube Delta area is scarce, with only a handful of archaeological records and only one toponymy at Brebeni (Călinescu 1931, Filipaşcu 1969, Ionescu et al. 2010; Necrasov & Ştirbu 1975). It was however common in several areas in Dobrogea, with prehistoric records at Cernavoda (Chalcolithic era of Hamangia culture), where skeletal remains of at least ten different individuals were found. Another Chalcolithic site with Beaver remains is Văcăreni (*** *Cronica cercetărilor* 2010). More later records of its presence were found at Dinogetia dating from centuries IV – VI. (Ştefan et al. 1967). Beavers were found also fairly close to the Danube Delta, in Isaccea (Bălăşescu 2000), while the remains of 3 Beavers from early medieval fortress of Halmyris (near Murighiol) suggest their hunting in the Danube Delta (El Susi 2008), although this area does not present proper river sides for Beaver habitats. There are also a number of other late medieval (XI–XIII Century) sites, all along the course of Danube, from where Beaver finds are known, like Capidava, Hârşova, Oltina, Ostrov, all upstream of the Delta, with the easternmost (and closest to the Danube Delta) being Isaccea (Stanc 2009). As a conclusion, up to now there are no proven records of the past presence of European Beaver in the proper Delta, neither in form of faunal remains, nor as toponymy. Moreover, most sources discussing the species agree that this species it has disappeared only in the late medieval period from the whole region (El Susi 2008; Haimovici 1996). The Chalcolithic site of Mila 23-Taraschina provided fairly rich faunistic remains, with more than 60 species of animals identified, from hundreds of bones, including European Hare (*Lepus europaeus* L.), but no Beaver, thus underlining the theory that the Danube Delta was not holding Beavers in the past (Carozza et al. 2010).

The first record of Eurasian Beaver in the Danube Delta was received from Maliuc, where an adult was captured by Dogs on 24.04.2011. The find was documented with pictures, unfortunately the corpse was not saved. Another female was accidentally killed by the screw of a motorboat on 06.07.2011. It had a weight of 17,6 kg, thus it is assumed to be a sub-adult (Herr & Rosell 2004), however based on Jankowska et al. (2005) it could be a small adult. The corpse was deposited in the collections of the Institute for the Eco-Museum Research, Tulcea. The third observation of live animals came from outside the Danube Delta, upstream of the branch-divide, on 12.02.2012, (*** Press release ARBDD 2012). While doing field surveys in this later area, we found two Beaver lodges, both active on 05.06.2013 and 15.11.2013 inside a small pond. The last record came from the central part of the Delta, where a drowned individual was found in fish basket-traps. This young female of 13.5 kg was found on 08.08.2013 and it was deposited in the collections of din the Institute for the Eco-Museum Research, Tulcea. The sight

records of Eurasian Beaver are represented on the map in the Fig. 1.

We have no information on the origin of the Beavers found in the Danube Delta. There are no known records or colonisation projects of Beavers neither in Republic of Moldova, nor in the neighbouring Bulgaria. Although in Ukraine a number of colonisation attempts were initiated along rivers of Desna, Horyn, Liubech, Ovruch etc. (*** Encyclopedia of Ukraine), these sites are distant and without a direct (freshwater) link to the Danube Delta.

A Beaver re-colonisation project was launched in Romania in the last decade of the XX century, with a total of 182 Beavers released on several locations of the rivers Olt, Mureş si Ialomiţa in the central part of the country. This project was successful, with an estimated 1500 individuals estimated to be present in these areas in 2010 (Ionescu 2010; Ionescu & Troidl 1997; Ionescu et al. 2010; Popescu & Murariu 2001). A number of 34 individuals were released on the Danube tributary river Ialomiţa in 2003, with 64 individuals recorded in 2010. The slow increase was suggested to be caused by high emigration towards the Danube river (Ionescu et al. 2010). We suggest that this colonisation site may provided the Beaver individuals which reached the Danube Delta, as the Ialomiţa river is only 250 km in distance. We would like to mention that there is a controversial project launched to re-colonise the Eurasian Beaver and the Red Deer (*Cervus elaphus* L., 1758) inside the Danube Delta by *Rewilding Europe*. Although, based on the prior knowledge, neither of the species is a candidate for re-colonisation, more-

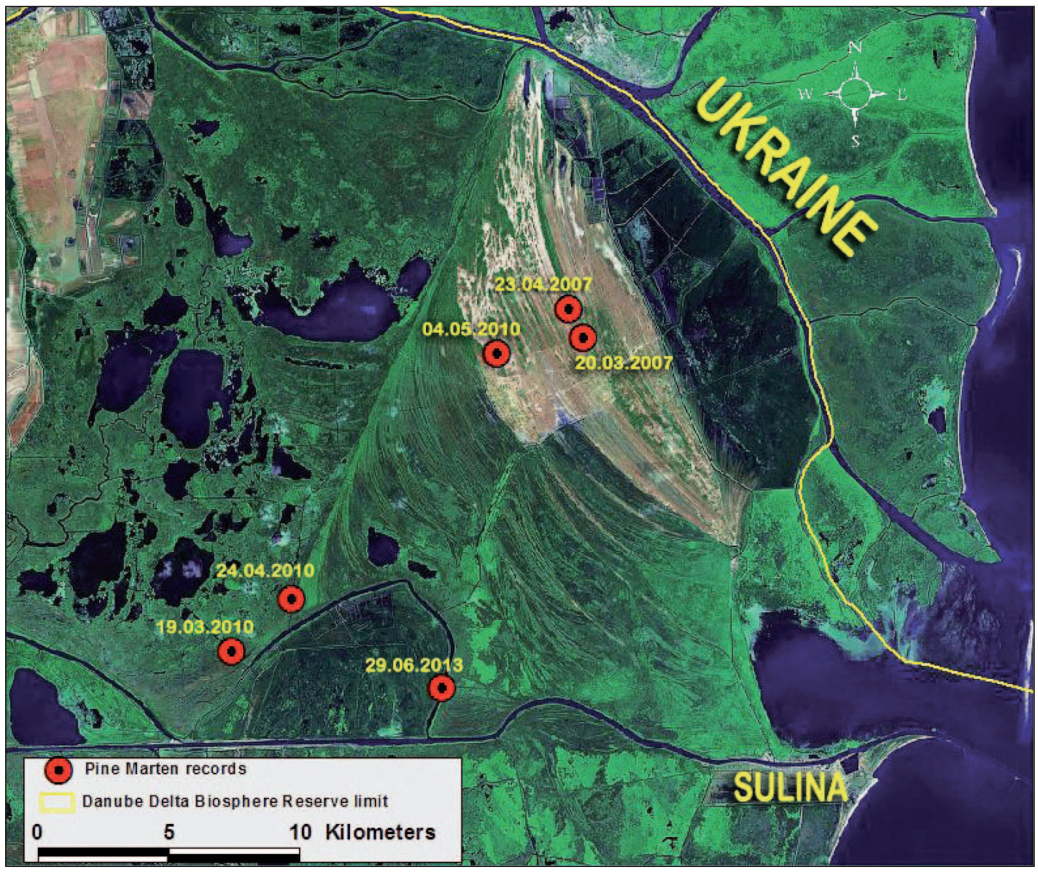

Fig. 1 Map with the location of Eurasian Beaver (Castor fiber L., 1758) records from the Danube Delta and it close proximity.

over a re-stocking (for Beaver) and colonisation (Red Deer), so unjustified effort in both cases. There is no information on the future impact of an Eurasian Beaver population might have on the ecosystems of Danube Delta. In addition, Beavers as ‚ecosystem engineers' may require management actions in the future from the administration of the protected area. These actions may be of a wide range, in case of a number of re-colonisation projects even requiring culling (Nitzsche 2012), an option hardly acceptable in case of a protected area like the Danube Delta Biosphere Reserve.

4.2. Pine Marten

As biotope, this species prefers compact and large forests with old stands of deciduous forest with rich undergrowth, or conifers, up to the Alpine area. Local preferences are consistent with the preferences and abundance of prey. Forest stand' age is a determining factor for establishing populations in an area due to the presence of hollows (Birks et al. 2005; Brainerd et al. 1995; Slavinschi & Ion, Stubbe & Krapp 1993; Zalewski 1997), especially if anthropic disturbance is high. In the southern part of the range, it may use smaller forests, around 100 ha and areas covered with shrubs, if there is an abundant rodent fauna, as well as the *maquis* plant association type on Sardinia and Elba (Spagnesi et al. 2000), or in the forest steppe and steppe areas, forming isolated populations (Ognev 1962). In north-west Italy, it may enter into agricultural areas, sometimes down to altitudes of 70 m above the sea (Balestrieria et al. 2010). From Romania it is known especially in hilly and mountain areas, rarely at lowlands (Bodea et al. 1962; Botnariuc & Tatole 2005; Colibaba & Damian 1977; Cotta 1982; Cotta et al. 1998; Cuzic & Murariu 2008; Geacu 2007; Geacu & Loghin 2003; Ionel & Vasile 1973, 1983; Murariu 2003; Negruţiu et al. 2000; Simionescu 1983; Slavinschi & Ion 2006). The lowest altitudes, where we found references on its presence, are in the counties of Ilfov and Teleorman (Botnariuc & Tatole 2005; Cotta & Bodea 1968; Murariu 1989, 2003, 2006; Murariu & Munteanu 2005), but also Galaţi and Vaslui (Geacu 2007; Geacu & Loghin 2003, *** 1952). There are two reports from Dobrogea in the early XX Century: Măcin, in Tulcea County and Pazarlia, Constanţa County (Călinescu 1931). In this regard, we found a reference on 'Tulcea forests' also, without other specifications (Simionescu 1983).

The capture of the first Pine Marten took place on 19.03.2010, near the intersection of Bogdaproste Channel with Old Danube branch, inside the Danube Delta. The specimen was an adult female, weighing 720 g, much lower than the average measurements for the species (Cotta & Bodea 1968; Ionel & Vasile 1973; Ivănescu 1983; Murariu & Munteanu 2005; Negruţiu et al. 2000; Ognev 1962; Stubbe & Krapp 1993; Zalewski 1997). The captured individual had an apathetic behavior without the aggression and the agility characteristic to the Mustelidae family. After determining the sex and body mass, the animal was released on the spot, it moved slowly and climbed to a nearby willow (*Salix* sp.). It was found dead a day later in another trap, close to the first one (Alexe & Marinov 2010). Currently, it is deposited in the zoological collection of Eco-Museum Research Institute in Tulcea, inventory no. 64/2010.

Another Pine Marten was observed early in the morning on 24.04.2010, around the Ddbra guest house on the Dovnica Channel, at a distance of approx. 225 m from the capture site of the first individual. The animal was located on a willow containing an inhabited nest of Hooded Crow (*Corvus cornix*). This animal was highly active and mobile, and let us to observe it a few minutes before it left.

After capturing one individual and this unusual observation, a large scale documentation campaign was launched, to obtain more information on the species in the Danube Delta. Thus, on two occasions (20.03.2007 and 23.04.2008), Pocora V. noticed a Pine Marten in Letea Forest, around Haşmacul Mare (Pocora & Pocora 2010). At the same time, Lupu C. (local ranger and an experimented observer), reported verbally on the identification of two individuals of Pine Marten on 04.05.2010, also on Letea Island, at Hasmacul Roşu. He described these animals, as moving quite fast through the trees, then one of them got hidden into a tree hollow (a specific behaviour of the species), which fa-

cilitates the identification of the Pine Marten, a species unknown in the area (Kiss et al. 2012). The last observation was made on 29.06.2013, when an individual was observed and photographed swimming across an oxbow of the Danube at a distance of ca. 7,3 km from the previous observations. The locations of all the observed animals are shown on map in the Fig. 2. Analysing this information, it can be noticed that all observation points are located in the north-eastern part of the maritime Delta and we may consider that in the future new observations may arise from other parts, too.

4.3. Stone Marten

Literature references on the distribution of Stone Marten are only scanty, with generally describing only from the Dobrogea plateau and mentioning only 6 small regions (Călinescu 1931; Cuzic & Marinov 2002; Murariu & Munteanu 2006), while another discrete record is mentioned by Romanowski & Lesiński (1991).

Our observations came from incidental records and mostly relate to individuals seen or tracks or remains found. In contrary to the belief of the authors above, we managed to record the Stone Marten in more than 50 new locations in the last 10 years. The records are distributed all over the Dobrogea Plateau, east and south from the Danube, and east towrds to the seashore. Moreover, its presence was recorded even inside the lagoon system, with an individual shot on the frozen lake Razim, near the locality of Sălcioara, in February 2004. Another record came from the proper Delta, an individual was captured and photographed by local inhabitants of Maliuc, in the central part of the Danube Delta, on 23.01.2012. Stone Martens were observed in the maritime part as well, with two records from Letea on 04.05.2012 and on 01.11.2013. We suppose that these individuals reached this

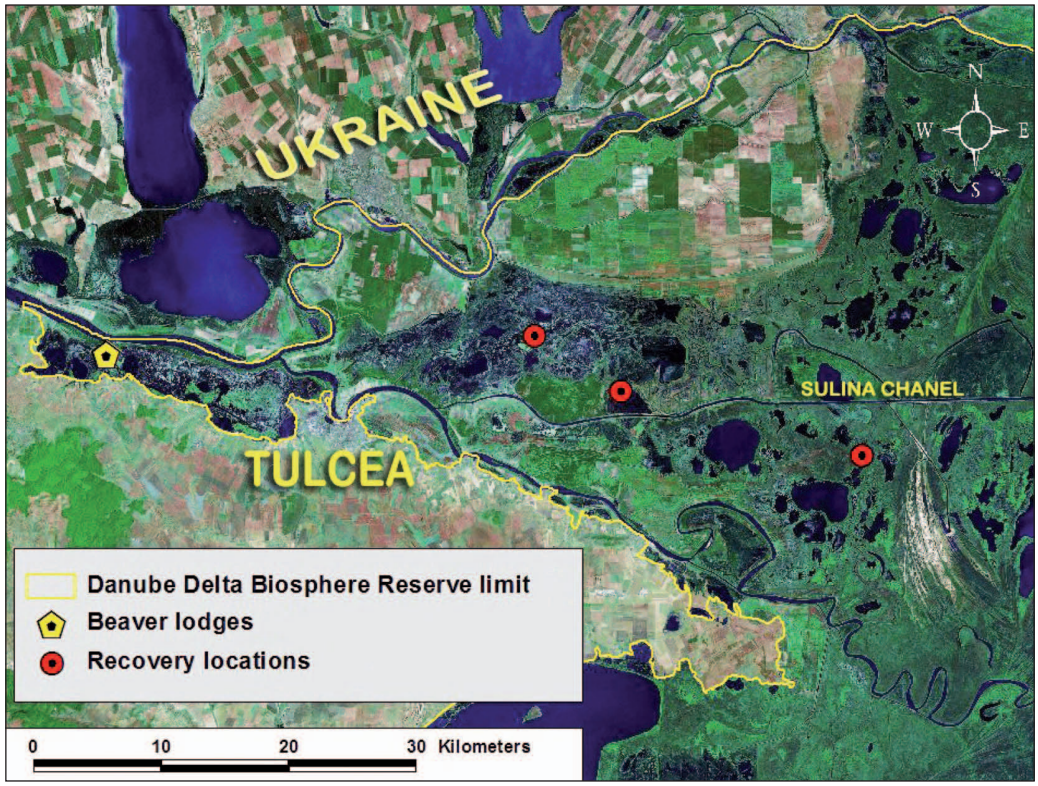

Fig. 2 Map with the locations Pine Marten (Martes martes L., 1758) records from the Danube Delta.

later area along the dams built from Tulcea to Sulina (Sulina navigable channel) and covered by boulders, which may facilitate their movement in a wetland system otherwise impenetrable for such a species.

Based on a survey of otter distribution in Dobrogea, we found a partial overlap in the geographical distribution of otters and Stone Martens in certain areas of the region. This was visible along the coast of the Black Sea, especially in those sections where boulders were present to decrease wave erosion. In these locations we found usually excrements from both species fairly close to each other. A similar situation was witnessed along the Sulina branch, where in the centre of a dense Otter population Stone Martens were observed. See Fig. 3 for a map of Stone Marten records from the region.

Based on the results presented on the map it may be stated that the Stone Marten is a not a rare species as it was known before our survey. In contrast to the 6 historical records, here we present more than 50 new locations, where the species presence was proven by tracks, scat, road traffic casualties or breeding individuals photographed. The observations came not only from the Dobrogea plateau, but from the lagoon system (Sălcioara), as well the central part of

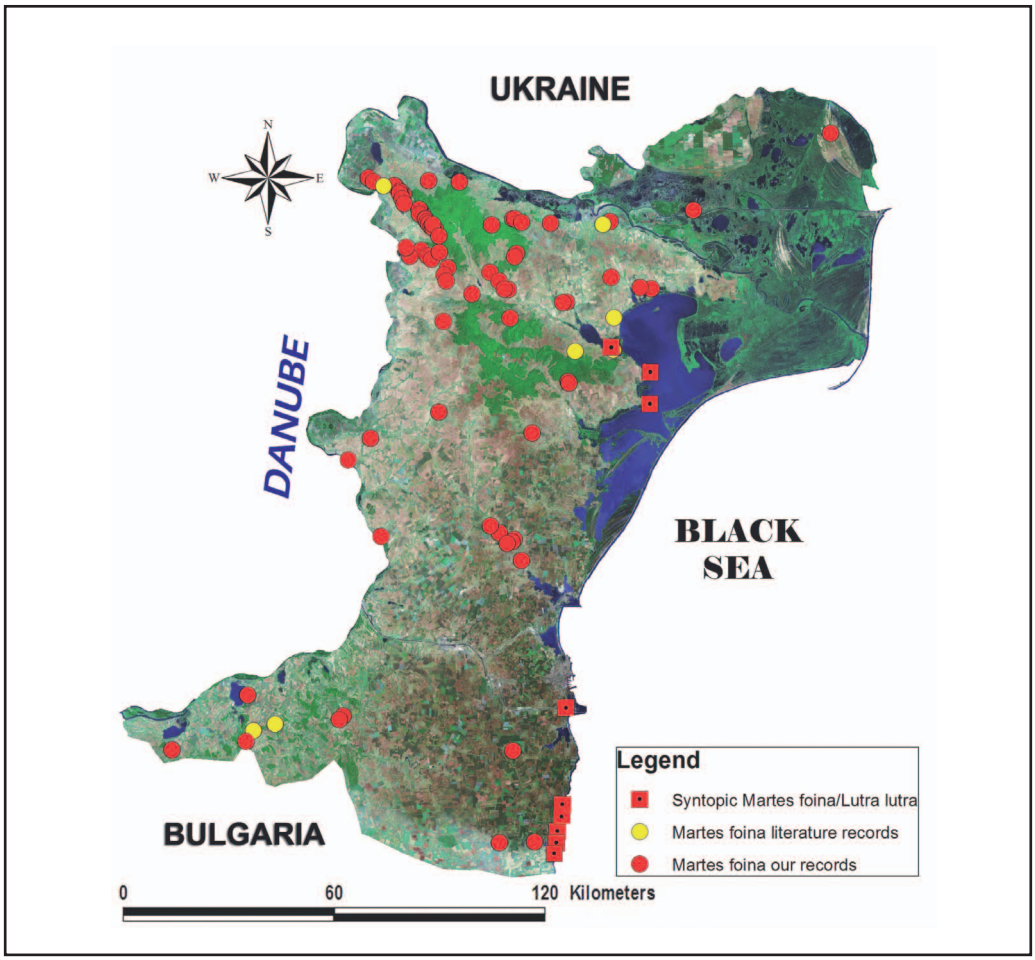

Fig. 3 Sight records of Stone Marten (Martes foina /Erxleben 1777) from Dobrogea (Romania). Historic records (yellow circles) and own observations (red circles), overlapping areas with Otter (Lutra lutra L., 1758) marked by red squares.

the Danube Delta (Maliuc, C.A. Rosetti), thus documenting the intrusion of this small carnivore from the mainland towards the delta. While such incidental records may broaden our knowledge upon the presence of carnivore mammals in the area of Dobrogea and the proper Delta, there is a need for a well founded project to evaluate the importance and impact of the three new species of mammals in the ecosystems of Europe's second largest wetland,

Conclusions

In the period 2000–2013 we documented the natural occurrence of three new mammal species for the Danube Delta: Eurasian Beaver, Pine Marten and Stone Marten.

These new faunistic elements should be introduced into the biodiversity related documentations and management plans of the region.

The colonisation process for these three species has a complex network of causes behind, with the crash of European fur-market, protected area management, re-colonisation projects and infrastructure development as major contributors.

The survey of areas from the Dobrogea plateau provided substantial information for the redrawing of Stone Marten's range in the region, this species being much more common than previously thought.

Based on our records there are several areas where Otter and Stone Marten have overlapping territories, a fact not yet reported from Romania.

To evaluate the importance and impact of these newcomers in the Danube Delta's natural balance a new well-founded project is needed, to oversee and to monitor the expansion and colonisation process, as well the impact exercised by these species on the unique biodiversity of the region.

Although we consider that the presence of two mustelids is unlikely to provoke major changes in the region's ecosystem, an increasing population of Eurasian Beavers should be monitored to be able to prepare the necessary management interventions if required.

Abstract

The authors present new information on the presence of three new mammal species for the Danube Delta: Eurasian Beaver (*Castor fiber* L., 1758), the Pine Marten (*Martes martes* L., 1758) and the Stone Marten (*Martes foina* / Erxleben 1777). The range extension of these three species is presented in detail, while discussing the causes underlying the phenomena. The colonisation process for these three species has a complex network of causes behind, with the crash of European fur-market, protected area management, re-colonisation projects and infrastructure development as major contributors. The origin of colonising Beavers observed in the Danube Delta is most likely a recolonising stock released on a tributary of the Danube, some 250 km upstream, a site on the Ialomita river. The population of Pine Martens from the Danube delta is one of the lowest altitude known populations. There is an overlap among territories of Stone Martens with territories of otters, especially in the coastal areas. There is a need to closely follow the increase and distribution of Beavers because the species known impact on wetlands.

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