**Ecology of European mink in Danube delta Biosphere Reserve (Romania)**

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**Abstract**

European mink (*Mustela lutreola* L.) is critically endangered species listed in Annex II and IV of Fauna and Flora Habitat Directive. Danube Delta including Biosphere Reserve in Romanian part is one of the few last refuges of the species. Long term monitoring of the species conducted since 2003 shows that the local population of European mink in Danube Delta is still widespread in the area. Totally 74 individuals were caught, however trapping effort fluctuated between years and areas without any clear reason. Significant weight differences between sexes were found. Analyses of 34 genetic samples of the minks from Danube Delta showed high genetic homogeneity of the population and closer relatedness to population of Russian minks than to other populations in the Europe. No American mink was proved within the Romanian part of the Delta, however the species occurs in surrounding areas including Ukraine part of Danube Delta. Other serious risks have been defined: by-catch, poaching, habitat destruction, low genetic diversity.

**Introduction**

European mink (*Mustela lutreola* L.) is small semi-aquatic mustelid, with dark brown coat and white patches around the upper and lower lips. Despite very similar general appearance to the American mink (*Mustela vison*) his closest relatives are western and steppic polecats (*Mustela putorius* and *M. eversmanii*), kolonoks (*Mustela sibirica* and *M.* *itatsii*) and black footed ferret (*Mustela nigripes*) (Satto *et al.* 2013).

European mink originally inhabited rivers and streams across the whole Europe. However even during the historic time the species occurrence has diminishing and decrease of the range has continued even more rapidly with the establishment of the feral populations of the American mink on the European continent. Recently only few populations are existing. European mink is occurring in the northern Spain and western France, Danube Delta (Romania and Ukraine) and probably in some areas of Russia and has been reintroduced in the northern Germany and two islands of Estonia (Hiiumaa and Saaremaa). Nowadays the species is considered as critically endangered and listed in Annex II and IV of Fauna and Flora Habitat Directive.

The present contribution is summing up the effort of several expeditions conducted by authors in the Romanian part of the Danube Delta during the years 2003- 2011 (Gotea & Kranz 2000, Kranz *et al.* 2002, Kranz *et al.* 2003, Kranz *et al.* 2004, Marinov *et al.* 2012).

**Study area**

Danube Delta is located in the north-west part of the Black Sea at the mouth of the River Danube. It is spreading over territories of two states, Romania and Ukraine. The Romanian part is included into the protected area Danube Delta Biosphere Reserve and apart of the Delta itself it encompasses also adjacent brackish lagoon complex. The Delta is a huge wetland area with total area of about 5 800 km2. It constituted of various habitats such as extensive reed beds, freshwater lakes and canals lined by old trees, sand dunes with oak forests and brackish lagoons providing the space for over 5 000 different plant and animal species.

**Methods**

In order to prove the presence of the species within the area life trapping using one door wire cage traps of dimensions of 50 x 16 x 16 cm baited with the sardines in vegetable oil were used. The trapping occurred in late winter/early spring (February, March, April) depending on the local weather conditions.

Caught minks were sexed, weighted and tissue sample was taken for further genetic analysis.

In some animals the blood sample was taken in order to analyse the blood plasma for presence of diseases’ such as Aleutian disease.

Apart of the life trapping extensive search for the tracks and scats within the trapping area was conducted. Collected scats were analysed in order to reveal the diet composition of the mink.

**Results**

Long term monitoring of the species conducted since 2003 shows that the local population of European mink in Danube Delta is still widespread in the area. Totally 74 individuals were caught (56 males and 18 females). However trapping success fluctuated between years and areas without any clear reason (Table 1). The presence of the mink was proven in different habitats of the Delta including canals of various sizes, lakes and brackish lagoons (Fig. 1). No American mink was proved within the Romanian part of Delta.

Table 1. The number of caught European minks in different years.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2010 | 2011 |
| Nbr. of minks | 28 | 7 | 0 | 2 | 6 | 2 | 25 | 4 |

Significant weight differences between sexes were found. While the average male was weighting 904 grams (450-1250 g, N=52), females only 475 grams (380-600 g, N=17) being slightly heavier than the minks from Spain.

During the autumn of the year 2000 two different habitats were surveyed for the scats of the European mink: the lake Miazazi characterised by plaur (extensive floating reed islands) and area around the village Uzlina constituted by network of canals fringed by old grown willow stands. Totally 74 scats were analysed for main prey species (Uzlina 30 scats, lake Miazazi 44 scats). Fish (*Misgurnus fossilis*, *Esox lucius*, *Rutilus* sp., *Lepomis gibossus*, *Leucaspius delineatus*, *Carassius* sp., *Cyprinus carpio*, *Perca fluviatilis*) was most frequently found comprising almost 38%, followed by mammals with 22%, birds 20%, amphibians 11%

and invertebrates 7%. While in Uzlina the diet was composed mainly from birds and several fish species, in the lake Miazazi it was composed mainly from mammals and one fish species (*Misgurnus fossilis*).(Kranz *et al.* 2002)

Analyses of 34 genetic samples of the minks from Danube Delta showed high genetic homogeneity of the population and closer relatedness to population of Russian minks than to other populations in the Europe (Michaux *et al.* 2005).

Blood samples of 4 caught European minks were scanned for the presence of Aleutian disease with negative result.

**Discussion**

Up to dated result show that European mink is widespread in the Romanian part of the Danube Delta occupying all available range of the wetland habitats there. Despite intensive trapping effort no single individual of American mink has been found there and the population of the European mink is not in serious risk of decline due to the presence of the American mink. However the American mink occurs in surrounding areas of the Delta including Ukraine part of Danube Delta so the situation can change rapidly and regular monitoring of the potential presence of the American mink should be conducted. Other serious risks: by-catch, poaching, habitat destruction and generally low genetic diversity have been defined but their effect on the population should be further investigated.

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*A long way from home - American mink in Finland*

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My first encounter with American mink took place in Eastern Finland one summer long time ago. I was standing on a boulder on the shore of a small lake, admiring the view, when I heard rustling to my right. A small, dark shadow was quickly approaching me among the bushes. I couldn’t identify the animal before it entered the water only a few meters away from me – a mink! The animal swam along the shoreline, then noticed me standing on the rock and started approaching. Instead of escaping – the most common reaction of wild mammals when detecting human presence – the mink swam next to the boulder, looked up from the water at me and emitted a series of fast chirps. After making the point that ”this lake is mine, piss off stranger” (my antropomorphic interpretation) the mink continued its way along the shoreline. I just stood there stunned, in awe of the boldess and impudence of this animal.

It is the same boldness, adaptability and capability of seizing any prey when the opportunity arises that have made this mid-sized North-American mustelid such a successful alien predator. The reason why these animals have been transferred all around the world is their shiny, brownish-black fur, which is turned into fur coats, jackets, capes and stoles. First mink farms in Europe (including Finland) were established in the 1920s, and before long escapees from these farms established feral populations. The first free-living minks in Finland concentrated in areas along the western and southern coast where most of the mink farms situated, but mink also arrived across the eastern border as they had been deliberately released in the Russian Karelia on several occasions. By the 1980s mink had invaded the whole country, including northernmost Lapland. Besides Europe feral populations now occur also in South America and Asia.

Across its new distribution range mink has been accused of the decline of numerous native species, such as water voles and several ground-nesting seabirds in the United Kingdom and European mink in Spain, Estonia, and France. As far as we know, no such drastic effects have occurred on the Finnish mainland. This could be just because we don’t really have systematic evidence of mink (and only mink) impacts on any of its prey groups: crustaceans, fish, reptiles, amphibians, birds or mammals. There is a general agreement that mink predation affects e.g. breeding waterfowl, but solid research on the subject is currently scarce. Theoretically the detrimental impacts of invasive mink might also be diluted in the bigger community of predators including raptors, owls, foxes, other mustelids like otters, and also another alien predator, the raccoon dog. On mainland mink has to find its niche under the competitive pressure of all these predators, some of which may also act as a predator towards mink.

So would things be different for mink when there are no other predators around? How would you study the sole impact of mink presence? The answer lies along the Finnish coastline. While Finland is known as the “land of thousands of lakes”, it is also the land of tens of thousands of islands. Archipelago Sea in the southwestern corner of Finland is one of the largest archipelagoes in the world. The bigger forested islands near the mainland transform into small, rocky, treeless skerries and islets towards the open sea; these different zones have their own characteristics and they are called inner, middle and outer archipelago. Archipelago National Park (ANP), established in 1983, protects most of this unique area. However, for a semi-aquatic mammal like mink, reaching even the outermost islands was not a problem.

Actually, there was a completely free niche out there, just waiting to be filled. There are seals in the sea, but the outermost islands harbor no resident terrestrial mammalian predators. On larger islands there may be the occasional raccoon dog or red fox that has wandered out on the ice during the winter, but they don’t survive very long as they run out of food in the autumn at the latest. European mink was never an archipelago species, but otters used to roam around the islands before their populations declined drastically in the 1960-70s. While otters have been increasing on the mainland in the recent decades, they haven’t reached the archipelago yet. So, besides white-tailed sea eagles and eagle owls the mink in the outer archipelago have very few competitors and enemies – for them life has been good and rather peaceful out there.

If you only gave them a quick look, the outermost treeless islands would appear very harsh and bare compared to mainland or larger islands, but they still provide enough resources for mink to flourish all year round. Spring and summer are seasons of plenty as dozens of bird species like terns, gulls, eiders, ducks, waders, and passerines return to breed on the islands. Mink will not only try to catch incubating adult birds but will also feast on eggs and chicks. Mink might also snack on the few species of amphibians and reptiles that are active during the summer months, and feed upon the populations of small mammals (two species of voles and the occasional shrew) that also peak during the summer. But in the autumn the days grow shorter and the winds turn cold, and the diet of mink is cut back as birds migrate to south and the ectotherms enter their hibernation dens. But there are still voles around and, most importantly, plenty of fish in the sea to keep mink going until next spring.

So a mink doesn’t seem to need very much to survive. Although food may be scarce during winter, there is still enough to keep the population alive. Large fields of low juniper, cracks in bedrock and rocks and boulders along the shores offer plenty of refugia and shelter both from weather and avian predators. Crossing several kilometers of open water or ice is not a problem either; males uphold large home ranges that may encompass those of several females, and they will roam great distances to find receptive females during the mating season. Although a far away from home, the mink seems well adapted to the Finnish archipelago environment - but how have the native species living there adapted to mink?

The arrival of a new predator to an essentially predator-free system was not without dire consequences. Colonial birds typical of the outer archipelago, like black guillemot and razorbill, were the first to suffer. Both species nest in hollows and caves under boulders, and a mink entering this kind of colony may destroy it completely especially via surplus killing. Also tern and gull colonies were affected by mink predation and many well-known breeding islands emptied out when the birds moved away, trying to find someplace safe to lay their eggs and raise their chicks.

The decline of the flagship species aroused concern about the effects of mink in the National Park. In 1992 Metsähallitus (a state enterprise managing e.g. National Parks in Finland) launched a pilot project to remove mink from a small group of islands at the southern edge of the Park. The primary removal method consisted of active hunting by a team of two hunters and a dog. This type of hunting could be inefficient because of the phenomenal hiding capabilities of mink: when threatened, they can squeeze themselves into incredibly small cavities and they also disappear quickly in the vast bushes of juniper. However, dogs made finding and driving mink a lot more effective, and the behavior of the dogs would also quickly reveal if there were no mink at all on the island. In the case the mink took refuge under a boulder, the hunters still had one ace in their hand: a leaf-blower. While all kinds of things like fire and smoke have been unsuccessfully tested in order to drive a mink out of its hiding place, the air streaming from the blower will verifiably frighten the mink out in the open where it will be dispatched.

Traditionally mink are mostly caught using passive methods, i.e. either by live trapping or lethal traps. However, live trapping was out of the question in the archipelago environment where sudden bad weather could prevent hunters from checking the traps for days. Instead, lethal traps have been used as a sort of a backup for active hunting. Lethal traps can be left behind for the winter, to capture any animals that were missed during the autumn hunting season. Lethal traps can be used on those remote islands where landing may be difficult, because they don’t need to be checked regularly. Strategic placement of traps can be used to create a buffer zone around island groups where mink have already been eradicated.

The results of the pilot project were very promising as the number of removed mink declined within a couple of years from 30-40 mink per hunting season to only 0-6 individuals per season. The project continued with more people and more funding, and researchers like me were also taken aboard from the University of Turku to study the impacts of mink removal on the ecosystem. Another removal area was established in the southwestern part of the Park in 1998 and removal was extended even further in 2006. Currently the mink removal area covers the southern part of the ANP, ca 750 km2 of sea with scattered small islands and islets in the outermost part of the Archipelago Sea.

The mink removal project offered us researchers a unique experimental setup with large mink removal areas that could be compared to areas where mink were left undisturbed. First research efforts were directed into studying mink impacts on several bird species breeding in the ANP. Results showed that most species (14 out of 22 studied) benefited from mink removal: numbers of breeding pairs increased and, most importantly, species like razorbill and black guillemot that were already locally extinct, returned to breed on mink-free islands. Research on mink predation on voles revealed that although the island ecosystem may look simple on the surface, there is a maze of complex interactions between voles, mink, weather and vegetation. On average years mink predation had no impact on vole densities, as voles were already limited by food availability, but during years with above average rainfall mink predation would keep the escalating vole populations in check and thus interfere with vole metapopulation dynamics between the islands. Mink predation effects would also cascade down to vegetation via their effect on voles, the most important grazers on the islands. Mink predation impacts were also observable in common frogs whose numbers increased significantly in the mink removal areas. More recently, preliminary results suggest that mink presence is also detrimental for the two snake species on the islands, European adder and common grass snake, probably due to a combined effect of mink killing snakes and competing for resources with them.

Mink removal has continued for over 20 years and a new generation of hunters has taken over the task from the pioneers. We can actually declare that mink has been eradicated from parts of the ANP, but the downside is that if removal was ceased today, things would return back to square one in just a couple of years. There are no natural barriers wide enough to prevent mink from immigrating to the archipelago from mainland; thus mink removal will be a never-ending task, although novel methods like automated CO2-powered kill traps may transform the ways of trapping and the manpower needed in the near future. We may also hope that natural enemies would help us keep mink populations in check; radiotracking indicated that increasing predation risk by white-tailed sea eagles may limit at least female mink movements. Hypothetically, this could lead to a reduced mink population and thus could mitigate the impacts of mink invasion.

Mink eradication is an important conservation issue and experiences from the ANP mink removal will be of use when Metsähallitus enhances similar actions in other protection areas along the Finnish coast. Actions will be reinforced on mainland as well, as mink has recently been listed as a particularly harmful introduced species in Finland’s National Strategy on Invasive Alien Species. Personally, my feelings about mink are a bit conflicted. Despite all their detrimental impacts, I also feel respect for these animals that resourcefully survive the harsh winters of the archipelago. Mink research has let me experience unforgettable moments on the outermost skerries and I’ve met and made friends with some spectacular people on the way. None of this would have happened if mink hadn’t been introduced, but in the bigger picture… *Dear mink, I wish you’d stayed at home!*

*Suggested titles for the photos:
Tern: Terns (Sterna hirundo and S. paradisaea) nest in colonies that are very vulnerable to mink predation in the Archipelago Sea (SW Finland).
Mink: An American mink taking refuge in a deep bedrock crevice.
Plover: Ringed plover (Charadrius hiaticula) is one of the wader species that clearly benefited from mink removal in the Archipelago National Park, SW Finland.
Island1+2: The landscape of the outer archipelago at the Archipelago National Park (SW Finland) is characterized by scattered small and rocky islands that nevertheless harbor a rich and unique fauna and flora.*

**The new regulation of Invasive Alien Species of the EU and some examples of addressing Invasive Alien Species in Central and Eastern Europe - Agnes Zolyomi, CEEweb for Biodiversity** (with contribution from Iris Benes, BED, Croatia, Annamária Fenesi, Milvus Group, Romania and Danas Augutis, Lithuanian Fund for Nature, Lithuania)

**SUMMARY**

One of the main drivers inducing biodiversity loss is Invasive Alien Species (IAS) next to habitat change, climate change, pollution and overexploitation. While EU policy tools had existed to deal with the factors above, a comprehensive legislation was needed on IAS to reach the goal of halting the loss of biodiversity by 2020 stated in the EU Biodiversity Strategy 2020. Besides, as IAS are also major economic threat to the EU costing at least 12 billion EUR every year, a comprehensive policy tool was more than needed[[1]](#footnote-1). In 2014, a new regulation of the EU was adopted setting the rules to prevent, minimise and mitigate the adverse impacts of the introduction and spread of IAS within the European Union. The regulation seeks to reach its objective through measures to ensure coordinated actions, focusing resources on priority IAS species and on elevating preventive steps, which include actions that address both the unintentional and intentional introduction of IAS into the European Union and their intentional release into the environment, setting up an early warning and rapid response system as well as monitoring, and the management of the IAS spread in the whole EU.

**the Invasive Alien Species – Regulation Overview**

According to the new EU regulation on the prevention and management of the introduction and spread of invasive alien species (2013), “Invasive alien species are species that are initially transported through human action outside of their natural range across ecological barriers, and that then survive, reproduce and spread, and that have negative impacts on the ecology of their new location as well as serious economic and social consequences.” 1

These species have negatively impacted native biota in almost all ecosystem types of our planet, and have affected all major taxonomic groups[[2]](#footnote-2). At a global level, the continuously increasing costs of IAS annually, including agricultural and environmental damages as well as control measures, were estimated to be in the hundreds of billions of dollars, more likely more than one trillion[[3]](#footnote-3). As a result of acknowledging both the economic and environmental risks and the need to address them in a cooperative manner, the Convention of Biodiversity Diversity calls for action within its signatories (including the EU) as in Article 8. „*Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species”.*

Incorporating this global target to the EU’s Biodiversity Strategy 2020, Target 5 sets out an even more ambitious objective *"by 2020, IAS and their pathways are identified and prioritised, priority species are controlled or eradicated, and pathways are managed to prevent the introduction and establishment of new IAS.[[4]](#footnote-4)*

Such target and based on it, a comprehensive policy tool was needed as scientific evidence showed that 10-15 % of the 12000 alien species occurring in the territory of the EU are invasive causing a significant negative impact on biodiversity as well as serious economic and social consequences: these are the Invasive Alien Species (IAS). IAS are estimated to have cost the EU at least €12 bio/yr over the past 20 years. They affect businesses, including small and microenterprises (e.g. coypu impacting agricultural production), citizens (e.g. ragweed causing allergies), public authorities (e.g. muskrat damaging infrastructure) and biodiversity (e.g. ruddy duck threatening the native white headed duck)[[5]](#footnote-5).

Before the very recent adoption (16th April, 2014) of a new regulation of IAS by the European Parliament at the EU level, European Union legislation had addressed only pests and disease agents that have impacted various species as well as alien species introduced for aquaculture, leaving a huge gap in policy. Also, very few Member States of the European Union have had coherent legislation to tackle IAS - actions were mostly reactive, seeking to minimise the damage already being caused without focusing on prevention or to detecting and reacting to new threats. Besides, varying restrictions on the commercialisation of IAS between Member States are highly ineffective as species can easily be transported or spread across EU[[6]](#footnote-6).

As a result of the economic and environmental risks and costs and the need to fill the policy gap, the new EU regulation on the prevention and management of the introduction and spread of invasive alien species (COM(2013)0620 – C7-0264/2013 – 2013/0307(COD)) was adopted. The legislation will require Member States to control the routes of introduction and spread of invasive alien species (IAS) and set up surveillance systems as well as action and management plans. Species to be included in the annex of the legislation listed as of “Union concern” should not be introduced, transported, placed on the market, kept, bred, grown or released in the environment. A dedicated scientific forum will be organized to provide advisory on the scientific aspects of the new rules and the “polluter pays” principle. Member States will have to set appropriate penalties for breaches of the legislation. For those breaching the regulation, Member States will have to define adequate penalties. Nonetheless, where authorised by the European Commission, Member States can grant specialized establishments permits to conduct particular commercial activities with IAS. The regulation will enter into force on 1 January 2015[[7]](#footnote-7).

However, these steps above will be specifically focusing on those IAS that will be listed by Member States in the annex of the new legislation. The species contained there will have to be agreed on based on specific criteria – species have to occur in at least 2 Member States and non-native in the area of the whole EU. Since limited resources should be targeted on fewer species, the species with major concerns should be listed in the annex. These species should affect detrimentally environment and economy and/or additional social aspects, such as health. Member States have to carry out a risk assessment considering costs of actions and impacts showing that the measures of the regulation at an EU level is needed.

For the risk assessment, Member States have to prepare data on species characteristics, spread patterns and scenarios, risks of spread under various conditions (e.g. climate change), current and potential further impacts, costs of measures and social and economic benefits of the species. Species that will become part of the annex of the legislation will not be allowed to brought into the EU, be kept, bread, transported, sold, used, exchanged and released to environment. Member States will have to work out action plans on the annex species actions targeting the prevention of the spread of the species, monitoring and management and they will have to report on the statuses every six years.

**Addressing the issue by NGOs in Central and Eastern Europe**

Although regulations at the national level are limited and their implementation mainly focusing on damage management, other stakeholders including NGOs have been researching and fighting with invasive alien species on various fronts collaborating with other actors.

**Tackling invasive species with local breeds in Croatia**

A protected landscape GAJNA near Slavonski Brod, in the northern-east part of Croatia is a pasture periodically flooded by Sava River. It has been protected since 1990 and has entered into ecological network in Croatia as a protected site thanks to the grass root ecological CSO (Brod Ecological Society – BED). The area is important due to the large wet grasslands, old oxbows and wetland vegetation as well as numerous alluvial depressions in which in spring and autumn floods water is retained. It harbours over 250 plant species of marshy and pasture flora. It is important bird feeding and fish spawning area with more than 100 birds (cranes, plungers’ cools, spoonbills, egrets, various species of ducks, swallows, river gulls, kingfishers, white storks, black storks etc.). From the list of nationally protected and strictly protected species there are 12 mammal species, 37 bird species, 11 amphibian and 24 fish species on GAJNA. The site is a Natura 2000 site candidate due to Marsilea Quadrifolia and community importance habitats.

The site, formed by anthropogenic factors, is directly dependant on local community activities. Common grazing practices have been a key ecological process with revitalization processes connected to water level. Unfortunately, abandonment of extensive grazing practice causes overgrowth of invasive species including *Amorpha fruticosa L., Erigeron annuus L., Ambrosia artemisiifolia L., Echinocystis lobata (Michx.), Bidens frondosa L., Asclepias syriaca L.*). To address this, BED has been actively taking care of the GAJNA area over the last two decades with the project "Protection, conservation and enhancement of biodiversity and the development of environmental awareness through the breeding of Croatian indigenous breeds and encouragement of organic farming" stimulating local community to reintroduce Croatian indigenous species. The introduction and protection of indigenous breeds was important economically – they are resilient to diseases, modest in need for food; ecologically they balance the landscape and preserve it from deterioration and scientifically conserving gene pool as well as socially and culturally preserving heritage.

***Solidago canadensis* impacts on native plant and pollinator communities in different stages of old-field succession in a Natura 2000 site in Romania**

Abandoned croplands in Romania covering larger areas can become species-rich communities with high conservation interest providing valuable ecosystem services such as pollination. However, secondary succession might be altered by the rapid colonization and aggressive spreading of invasive alien species triggering community-wide impacts on the grasslands. Therefore, to analyse the potential impact of the invasive species, Milvus Group, Romania aimed to inventory the effect of a highly invasive species, *Solidago canadensis* on plant and pollinator communities along a gradient of invasion severity, and along early, mid, and late successional stages of abandoned croplands in a highly diverse, traditionally managed farmland landscape and also Natura 2000 site in Southern Transylvania, Romania. According to the results of Milvus Group, *S. canadensis* can colonize arable fields immediately after abandonment, but may invade or persist into later successional stages, as well. The invasion reduced the native plant species richness throughout succession, although the most profound negative effect on diversity and naturalness was exerted mainly in late-stage communities. Moreover, the invasion of *S. canadensis* had a negative effect on the abundance of bees, but enhanced the abundance of hoverflies irrespective of the successional stage. Native flowers experienced reduced visitation by both pollinator groups due to the augmented presence of *S. canadensis*. These results highlight the need for urgent prevention and eradication efforts to restore the natural, mutualistic links between the native elements of the communities and to govern the trajectory of succession towards valuable, semi-natural communities.

**Eradicating invasive species from protected sites with stakeholder cooperation on 11 sites in Lithuania**

With the lead of Lithuanian Fund for Nature and with the support of the Lithuanian Ministry of Environment and European Union, a national project has been realized since 2012 to remove invasive species from habitats witch have community importance value and are inside protected areas, to remove potential treat of invasive species for neighboring habitats and to o restore formerly important habitats, which were degraded or lost due to invasions of *Acer negundo* *and Lupinus polymorphus*. All sites of the project are located throughout the country on protected areas and Natura 2000 sites with the total number of 11 sites with *Lupinus polimorphus* invasions and 4 sites with *Acer negundo*. Approximately half of the locations belong to private owners, therefore their inclusion as well as the involvement of protected areas managers was a must. The activities have included the removal of *Lupinus polymorphus* from sensitive grasslands in protected areas as well as eradication of *Acer negundo* invasions in river valley grasslands. Restoring sites using forestry and agriculture practices was also a major part of the project.

As a result, only within the two years interval of the project, *Lupinus polimorhus* were removed in 70 ha of grasslands on protected areas. In 2013-2014 using chemical injections and forestry practices 150 ha of forests and grasslands in river valleys have become *Acer negundo*-free. Besides, further implications of the project include the know-how's how to deal with these invasive species for private landowners and farmers, awareness raising of the treat invasive species among stakeholders and public and restoration of the habitats for biodiversity at the sites.

**Situation of the European mink in Spain and actions undertaken to save this endangered species**

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European mink is a semi-aquatic mammal, with long body, long tail (½ body length), small ears and short legs. With fur brown-coloured, and white spot on upper and lower lips. Males are greater than females.

**Distribution**

In century XIX, European mink inhabits Central and Northern Europe. In century XX, it disappeared from more than 20 European countries. Now, there are only three populations: Eastern (North and Central European Russia), Danube Delta (Romania and Moldavia?) and Western (SW France and Central-North Spain: less than 1.000 mink).

European mink presence in Spain is known since 1955, and this population is studied since 1992. It inhabits the Atlantic and Mediterranean basins, along of 2.300 km of rivers. We estimate a population of 450 - 500 minks. The western population arrived from Central Europe. There are no European mink records in France before century XIX and the Spanish population was formed by minks from France. It was a natural expansion or human introduction? Nobody knows but it caused a “bottleneck” effect.

**Habitat**

In Spain it inhabits mainly in rivers, with dense and wide riparian vegetation. It needs a good quality of water, with no PCBs and heavy metals pollutants. The preference use zones are to find refuge and food, and for reproduction. Elevation range is between 0 and 200 m (Atlantic basin) and, 300 and 1,200 m (Mediterranean basin).

**Population**

In the great river (Ebro), we studied 50 European minks: 33 males and 17 females. Sex-ratio was 1.94/1 (p<0.005). The average longevity of males was of 19.01 months and 16.56 months for females. This river is a good habitat for males, for dispersal movements (ecological corridor).

In a medium river (Najerilla), we studied 43 European minks: 20 males and 23 females. Sex-ratio was 0.87/1 (p<0.5). The average longevity of males was of 16.23 months and 23.10 months for females. This river is a good habitat of reproduction for females.

**Threats**

European mink is the second most threatened mammal in Europe. The small size of Spanish population means a low genetic variability (only 1 haplotipe of 5 known in Europe) and likelihood of inbreeding and genetic drift. Western population is very surely divided in two (Spain and France).

Other threats are the loss and destruction of habitat, the water pollution (heavy metals and PCBs), the presence of Aleutian Mink Disease –ADV- (parvovirus) and distemper –CDV-, the high mortality by traffic road, and the poor knowledge of people towards this species and its conservation problems.

**American mink**

Currently, the main threat for European mink is the presence and competition with American mink. The invasive mink is larger, stronger, more aggressive, and has higher reproduction. In short, it has more ecological plasticity. There are American mink farms, inside or very close to European mink distribution area. Non native species has passed on of ADV. Besides, this species prey on other endangered species: crayfish, Iberian desman, Mediterranean water vole, amphibians, reptiles and fish.

**Habitat loss**

European mink is a habitat specialist: rivers and wetlands. Riparian forest and vegetation destruction is the second threat at present. First steps we must take are to preserve the current riparian forest (quality and quantity), to avoid the draining of wetlands, and at last, to recovery the riparian forests and wetlands. The water pollution by organochlorine and heavy metals affect reproduction and growth of European mink.

**Road casualties and other non natural mortality causes**

In Spain we have studied the high non natural mortality, with more than 120 road casualties. There are more data in the last years in Navarra. Rivers are lineal habitats and roads crossing rivers and there are roads in parallel with rivers. There are black spots and stretch of roads where minks are mainly knocked down. Minks killed on the road are visible (we can count them). But, there are other non natural mortality sorts are not visible (irrigation channels, hydroelectric power station, etc.). Measures to implement are the underpass of fauna (dry stretch 60-80 cm). As European mink is an habitat specialist, so to build corrective measures for it is less expensive.

In the course of 1950s and 1960s, captures with traps and snares was the main mortality cause. Shoots was also important through 1950s, 1960s and 1970s. Since 1970s, road casualties increased. Drowns in irrigation or hydroelectric power stations channels are a no visible cause, as European mink dead by crushing, inside of dens and resting sites because of river-works.

**Genetic problems**

The atomization of population and loss of genetic variability are important problems for Spanish population. Isolated populations are vulnerable in front severe catastrophes; besides, the small distribution and limited to rivers means a small number of minks. Small populations are more vulnerable in front extinction by random process (genetic drift). And there is a high probability of inbreeding, with the associated reproduction and embryonic development problems, and a low survival.

In Spain, we have identified the hybridization with European polecats. Hybridization is possible where one or both species are scarce. We have captured 9 hybrids (5 males and 4 females). Hybrids are larger than European mink and European polecat. They are distinguishable by fur and later by genetic analysis. The solution is the remove from environment.

**Diseases**

The Aleutian mink disease (parvovirus –ADV-) is an important pathology with no preventive and curative treatments. It has a very high prevalence in Spanish population (30%; n=79). It causes different syndromes according to host and strain (decrease of fertility, spontaneous miscarriages, etc.), and the direct mortality. Besides, it may be more liable to suffer secondary bacterial infections. In short, it causes a population decline.

**Conservation measures**

First measures were the legal protection. European mink is classified “In danger of extinction” (in Spain) and as “Priority species” (in European Union). There is a “Spanish European mink Working Group”, a “Spanish European mink Conservation National Strategy” and several Regional Conservation Plans in La Rioja, Álava and Guipúzcoa. The conservation measures what must be applied effectively are:

* Avoid the American mink expansion: control and eradication.
* Diseases, pollution and inbreeding control.
* Protection and recuperation of riparian habitat, with native species.
* Improve black spots and stretch (underpass of fauna) on roads.
* Greater knowledge of European mink and its problems by local population.
* Monitoring the presence of European mink and the expansion of American mink.
* Greater scientific knowledge on mink ecology and biology.
* Spanish captivity breeding program.
* Reintroduction and reinforcement projects.

**Captivity breeding programme**

The goal is to create a European mink Spanish population stock, to avoid a crash in wildlife. This programme allows carry out different breeding, release experiences and population reinforcements. First Centre was built in El Pont de Suert, Catalonia, with 11 founders in 2004. Between 2005 and 2012 we have had 37 births, with 108 kits (49 males and 59 females). The average has been of 2.92 kits/birth (SD = 1.09). At present, the Spanish programme has more than 10 centres, with 50 minks.

**Population reinforcement project**

We have carried out a population reinforcement project through three years (2008-2010), in Salburua wetlands, Álava. We built two pre-release facilities (soft release) and 24 minks (9 males and 15 females) were released. The survival of 75% of minks was of 31 days, of 50% of minks was of 89 days, and the 25% of mink survived 138 days. The predators were raptors, cats, dogs or foxes, and also American mink.

**Conclusions**

Western population is set in SW France and North-Central Spain. The Spanish population is separated from French one. The Management of this species is complicated because administrative situation: 10 different administrations in Spain. Threats can be different according to different administrations, but all threats affect the same population. Conservation and recuperation steps must be coordinated if we want they will be effective. Despite everything, there is a coordination frame (Working Group). The main goals are: to fight against American mink, to preserve and recovery the habitat, and to increase de captivity breeding program. The secondary goals are: to reduce the non natural mortality, to reduce the effect of diseases (ADV and CDV), to reduce the effect of pollutants, to avoid hybridizations with European polecat, to continue the population reinforcements, and to continue the European mink and American mink populations monitoring and research.

Effects of raccoon settlement in Germany – a closer look at the ecology of an unfamiliar invasive species

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**Key words:** raccoon, *Procyon lotor*, invasive species, nutrition ecology, impact, economy, epidemiology, Müritz-National-Park

Invasive animal species like the North American raccoon (*Procyon lotor* L., 1758) play a significant role in the ecologic balance of their newly encountered biotope, particularly as their habits might overlap and compete with that of native animals. Against the background of a vast increase of raccoon numbers in Germany within the last years, a controversial discussion arose regarding the influence of the new inhabitant on indigenous respectively protected species and the potential transmission of diseases and parasites. Aiming to elucidate the wildlife biology of this invasive species, a large perennial project has been initiated in 2006 in the northeastern area of distribution (Müritz-Nationalpark, [Mecklenburg-Western](http://www.dict.cc/englisch-deutsch/Mecklenburg-Western.html) [Pomerania](http://www.dict.cc/englisch-deutsch/Pomerania.html); www.projekt-waschbaer.de). The National Park represents a characteris­tic wetland area which provides a very opportune habitat concerning the essential resour­ces for raccoons. Within 16 different sub studies profound data on the population biology of this invasive animal could be ascertained for the first time.

The research project on raccoon population biology involves among others the analysis of feeding ecology. Extensive knowledge about the effects of raccoon settlement, primarily in natural landscapes, and the possible occupation of an ecological niche in the [autochthonous](http://www.dict.cc/englisch-deutsch/autochthonous.html) fauna is lacking entirely so far. As raccoons are highly adaptable, especially in terms of different food sources, it is difficult to evaluate the nourishment composition against the bag drop of a potential threat to indigenous species - yet scat analysis is currently the most informative approach. Therefor profound investigations concerning the nutrition ecology are conducted as part of the described project (n=1300 fecal samples). In order to elementarily evaluate and interpret quantitative statements regarding the nourishment categories of raccoons it is furthermore essential to establish a special conversion factor. The examinations are still in progress– first results have expectedly shown that the nourishment of the raccoon basically consists of the three categories vertebrates (15,0%), invertebrates (43,7%) and plant material (41,3%). It could be approved that raccoons are omnivorous and have an opportunistic dietary behaviour. They can easily adapt to the local range of available food sources. Raccoons are very variable in their diet but prefer food within wetland habitats and food which is easily available in large amounts.

Raccoons were introduced in Germany more than 70 years ago and meanwhile represent an inherent part of the local fauna. This allochthonous species is nowadays designated as a „native species“ (BNatSchG § 5). If he is however a demonstrably invasive animal remains unclear hitherto. In accordance with the Biodiversity Convention of Rio (CBD) animals are stated as risky invasive, if they cause economic, health or ecological threats within their new habitat. According to necessity that basic knowledge about any particular animal species is indispensable in order to evaluate potential negative impacts, information was obtained regarding the current scientific level about those three levels of impact. Regarding the **economic effects** raccoons can cause local crop losses while foraging, but the overall agricultural damage is negligible. In urban habitats they can sometimes cause costly damages to real estate. The **epidemiological risks** can be considered as not very high. Raccoons rarely appear as carrier animals. The only known zoonosis is *Baylisascariosis* with so far three documented infections in Europe. Rabies, fox tapeworm or trichinas are irrelevant. However, the raccoon could function as a potential vector for Canine Distemper Virus and the parasite *Alaria alata*.

As to the potential **ecological impact** the presumption exists that raccoons could cause negative effects on autochthone species, but proper scientific studies about that issue are lacking. Since raccoons are opportunistic foragers, this could mitigate their force of predation on single native species. Also a pressure of competition on native carnivores was not proven, yet.

Due to the fact that an obliging definition about the size of damages caused by an invasive species is missing, a definite appraisal of the invasiveness remains difficult. Especially in the ecological sector the state of knowledge is extremely low, that´s why a final classification should actually not be undertaken, yet.

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