NOBANIS –Invasive Alien Species Fact Sheet

Mustela vison

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Species description

Scientific names: *Mustela vison*, (L.) Mustelidae.
Synonyms: *Mustela canadensis*, *Mustela rufa*, *Lutra vison*, *Vison lutreola*
Common names: American Mink, New World mink, Eastern mink (GB), Kanadischer Marder, Farmnerz, Nerz, Amerikanischer Mink, Amerikanischer Nerz (DE), Amerikansk mink (DK), Amerikansk flodilder (DK), Mink (EE), Minkki (FI), Minkur (IS), Amerikas ūdele (LV), Kanadinė audinė (LT), Norka amerykańska (PL), Американская норка (RU), Mink (SE).

Fig.1. *Mustela vison*, photo by Remek Meel.

Species identification
M. vison is a medium-sized carnivore. It has an elongated body with relatively short limbs, a typical feature of the weasel family (Mustelidae). Another characteristic feature of the family is its sexual dimorphism, *i.e.* males and females differ greatly in body characteristics. The males often attain a head and body length of 34 to 45 cm and a weight of 1500 g. In some localities animals are generally smaller, *e.g.* in Iceland the average weight of adult males has been observed to be only 1200 g (Róbert A. Stefánsson, pers. comm.). The females are much smaller, having a head and body length of 31 to 38 cm and a weight of 400 to 800 g (*cf.* Stubbe 1975, 1988, 1993). The coat is dark brown, often with white markings in individual patterns on the ventral side. Various color mutations have been bred into the species, among them black, Aleutian, Palomino, pastel, pearl, various hues of gray, and even white (Stubbe 1993). The natural brown fur sometimes becomes bleached, especially on *M. vison* in coastal habitats.
Although *Mustela vison* is from its appearance quite similar to *Mustela lutreola*, there is one feature that helps to differ between them: the upper and lower lip and the chin of *Mustela lutreola* is usually white while *Mustela vison* does not have this feature (Maran 2002).

Native range
The native range of *M. vison* is almost all of North-America (except in the north-east and southern parts).

Alien distribution

History of introduction and geographical spread
M. vison was introduced for fur farming or released in many parts of Europe in the 1920's - 1930's but the modern intensive fur farming did not start until in the 1950's. Consequently, in addition to the animals deliberately released, *M. vison* escaping from farms initiated the feral populations. At present, *Mustela vison* is common in most European countries (Stubbe 1993).
It was introduced to Latvia in 1944 and was first found on the River Gauja. In Latvia *Mustela vison* also escaped from fur farms (Tauriņš 1982). In USSR *Mustela vison* was introduced for fur farming in 1928 (Doppelmair *et al.* 1966, Chylyat'ev 1975, Ivanov and Tymanov 1974, Michailov 1974, Popov 1964). In 1933-1977 about 21 300 individuals were introduced to the U.S.S.R. where they created a wild population and increased their range (Czesnokov 1989, Sinicyn 1990, Sokolskyi 1990).

Pathways of introduction
M. vison repeatedly escaped from fur farms, as well as being deliberately introduced. Furthermore *M. vison* may be deliberately "liberated" by animal rights activists.

Alien status in region
In Estonia, *M. vison* is fully naturalized. In Denmark, Sweden, Norway and Finland *M. vison* is found almost everywhere (Kauhala 1996, Hammershøj and Asferg 2000). Besides Fennoscandia they are also found in the British Isles, Iceland, the Netherlands, France, Spain, other Baltic countries, Russia (Altay, Eastern Siberia, Tatarstan, Bashkiria) (Doppelmair *et al*. 1966), the Czech Republic and Italy (*e.g.* Lever 1985, Ozolinš and Pilāts 1995) (see table 1, next page, for details).

Country	Not found	Not established	Rare	Local	Common	Very common	Not known
Denmark					X		
Estonia						X	
European part of Russia					X		
Finland					X		
Faroe Islands	X						
Germany					X		
Greenland	X						
Iceland						X	
Latvia					X		
Lithuania				X			
Norway					X		
Poland					X		
Sweden					X		

Table 1. The frequency and establishment of *Mustela vison*, please refer also to the information provided for this species at www.nobanis.org/search.asp. Legend for this table: **Not found** –The species is not found in the country; **Not established** - The species has not formed self-reproducing populations (but is found as a casual or incidental species); **Rare** - Few sites where it is found in the country; **Local** - Locally abundant, many individuals in some areas of the country; **Common** - Many sites in the country; **Very common** - Many sites and many individuals; **Not known** – No information was available.

Ecology

Habitat description

M. vison is mostly nocturnal and lives semi-aquatically along the coast and on the banks of rivers and lakes. It is commonly found on brook and river banks with dense vegetation, in (alder) forest marshes (Kirschey 2000), reed beds in sedimentation areas of lakes, and marshes furrowed by channels. Furthermore *M. vison* inhabits sea coastlines and archipelagos (Dunstone 1993, Kauhala 1996). *M. vison* is adaptable to a variety of habitats, spanning from habitats in central Europe to harsh, pristine habitats of Iceland.

In Denmark *M. vison* has furthermore widened its range to urban areas. There have been sightings of *M. vison* by the canals in the center of Copenhagen and an interview study showed that *M. vison* had been seen within a year in 58 % of the 145 harbors investigated (Meier 2005). *M. vison* is furthermore an opportunist, so it has repeatedly been sighted near fowl and fish farms.

Reproduction and life cycle

The principal mating season is in March and April, according to various authors. The breeding biology of female *Mustela vison* includes superfecundation (multiple ova from a single ovulation) and superfoetation (multiple ovulations within one mating season) and delayed implantation (Enders 1952, Yamaguchi *et al.* 2004).

The young are born in late April and early May, after a gestation period of about 50 days. The duration of the gestation period becomes shorter as temperatures increase. Stubbe (1988) reports litter sizes of 2 to 6 young in Eastern parts of Germany, but larger litter sizes (up to 12 young) are reported from Scandinavia. In Iceland, the average number of placental scars is 6, 8 (Skírnisson 1992). The young become capable of hearing after 3 to 4 weeks and capable of seeing after 4 to 5

weeks. The exclusive nursing period is 25 days. The males do not participate in rearing the young, who begin their first independent forays in July. The family breaks up in August and September. The turnover of wild populations of *M. vison* takes place in three-year periods; in captivity the animals may live for 10 years. Swedish investigations have shown that 84% of the animals in the wild live for only one year (Stubbe 1988). In western Poland daily survival rate in each season declined from 0,989 in autumn-winter to 0,977 in spring. Probability that *Mustela vison* would survive the whole season is only 0,1351 in autumn-winter and decreases to 0,1203 in spring. Many *M. vison* are killed on the roads, but their numbers are quickly replaced by an influx of new animals (Bartoszewicz and Zalewski 2003).

According to Stubbe (1993), stable populations may establish themselves rapidly in vacant habitats lacking predators, and the population size then depends mostly on food availability and territorial behavior. Studies conducted in several northern European and North American habitats have shown that territories are 0.3 km (in Warta Mouth National Park – western Poland) to 6 km in length on the average. Animals of the same sex are not tolerated within the territory, and migrants lacking their own territory keep to the waterways. However they are able to cross areas considered hostile to *M. vison*, *i.e.* large fields, highways and railways (Meier 2005). In Warta Mouth National Park, where *M. vison* density is very high, territories of males overlap very often to a high degree – 44,2% during autumn-winter season and 55,0% in spring. Common space utilization can be caused by abundance of food supplies (Bartoszewicz 2003).

Dispersal and spread
The abandonment of agriculture in wetlands and the resulting emergence of reed belts and willow and alder shrubbery lead to an expansion of possible *M. vison* habitats (Schmidt 1985). Highlands with dense conifer forests *e.g.* the Fichtelgebirge and the Thuringian Forest, on the other hand, represent a barrier to the dispersal of *M. vison* (Kraft and van der Sant 1999).
A cause for dispersal and spread of *M. vison* may also be "liberations" by animal protection activists (Skirnisson 1992, Kraft and van der Sant 1999), and insufficient precautionary measures on the farms - captures of 20 to 50 animals per year in the immediate vicinity of the farms were not unusual (Stubbe 1975).

Impact

Affected habitats and indigenous organisms
M. vison affects indigenous animals by competition and is suspected of displacing its relative, the European mink, *Mustela lutreola* (which is threatened by extinction), and the European polecat, *Mustela putorius* (Schröpfer 1999). In Estonia the most serious effect of *Mustela vison* is its competition and intra-guild aggression with *Mustela lutreola* (European mink) (EU LIFE project, Kull 2005). In Denmark there are also concerns about the damage that *M. vison* may cause to polecats (*Mustela putorius)* and otters (*Lutra lutra*) (Hammershøj 2004). On the other hand, it has been suggested that the otter may be a stronger competitor for food and space, and thus may lead to local declines in the *Mustela vison* population (Jędrzejewska *et al.* 2001, Bonesi and Macdonald 2004, Bonesi *et al.* 2004).

Another effect of *M. vison* is as a predator. Its main food consists of fish, which may inflict serious damage on fish cultures (*e.g.* in Iceland, Sweden and England) (Skirnisson 1979), birds and small mammals, but it may also subsist on *e.g.* crustaceans, berries, amphibians and even carcasses (Dunstone and Birks 1987, Niemimaa and Pokki 1990, Jędrzejewska *et al.* 2001). The prey composition varies with the seasons (Skirnisson 1979) and also depends on the habitat (*e.g.* coast or inland waters).

In its area of origin of *M. vison*, one of its principal prey species is the muskrat (*Ondatra zibethica*), Stubbe (1993) reports that this is also the case in Germany (*cf.* Schmidt 1985) and wetlands of western Poland (Bartoszewicz and Zalewski 2003). Muskrat lodges appear to be an important feature of the *M. vison* habitat and are used for shelter (Stubbe 1993). In Poland the main winter diet of *M. vison* in Warta Mouth National Park are mammals, but after several years of exploitation of the muskrat population their number decreased and this species was replaced in the *M. vison* diet by voles *Microtus sp.* (Magdalena Bartoszewicz, pers. comm.). In the UK, populations of water voles (*Arvicola terrestris*) have declined, probably because of the interaction between habitat fragmentation and *Mustela vison* predation (*e.g.* Woodroffe *et al.* 1990, Rushton *et al.* 2000, Telfer *et al.* 2001).

Many scientists across the breeding range of *M. vison* have expressed concerns about its effects on the survival and breeding success of native bird species. *M. vison* may further inflict serious damage on domestic fowl. In Estonia, *M. vison* represents a threat to water-birds, and attacks on bird nests are considered to be a problem (Kukk *et al.* 2001). Predation by *M. vison* has had devastating effects on some bird species, especially for colonial species and on islands in northern Europe and the UK (*e.g.* Hario *et al.* 1986, Andersson 1992, Kilpi 1995, Ferreras and Macdonald 1999, Craik 1997, 2000, Opermanis *et al.* 2001, Clode and Macdonald 2002, Hario 2002). In Poland *M. vison* has negatively affected the breeding success of water birds (Bartoszewicz 2003, Brzeziński 1998). Also in Denmark a number of incidents have been reported (by ornithologists) on *M. vison* having negative effects on local colonies of ground nesting birds (Meier 2005). Nordström *et al.* (2003) studied the effects of removing introduced *Mustela vison* on the number of birds breeding on small islands in the Baltic Sea. The breeding densities of some birds (*Charadrius hiaticula*, *Stercorarius parasiticus*, *Anthus petrosus*) increased markedly in the removal areas in comparison to the control areas. Two species (*Alca torda, Cepphus grylle*) already extinct in one of the removal areas, returned to breed in the area. Breeding densities of other birds like *Larus marinus* and *Motacilla alba* were unaffected. The authors conclude that it is possible to remove feral *Mustela vison* from large archipelagos with many small islands, and that *M. vison* removal increases the breeding densities of many bird species in this habitat.

Another possible effect of *M. vison* on other species could be as a transmitter of infectious diseases (Macdonald 1996).

Genetic effects
Hybridisation between *M. vison* and native mustelids is possible (but not with European mink – Janis Ozolins, pers. comm.). According to Ternovskii (1977) and Lariviére (1999) crossing between *M. vison* and *M. lutreola* may lead to resorption of hybrid embryos. However, hybridisation under natural conditions between mustelids has only been described on a few occasions (Rozhnow 1993; Davison *et al.* 1999), none of which included *M. vison* and the problem is therefore considered hypothetical.

Human health effects
No reported effects on human health.

Economic and social effects (positive/negative)
In Estonia, the conditions for fur-farming are very strict resulting in relatively high costs for farm keepers. In the future it is planned to close all fur farms on the islands (Lilika Käis, pers. comm.). Intensive development of fur farms in western Poland is regarded to be dangerous for the native fauna because of *M. vison* escapes. Some owners of fishponds in Denmark and in Poland have also

observed *M. vison* predation on their fish (Hammershøj 2004, Magdalena Bartoszewicz, pers.comm.). In Germany the costs of economic impacts caused by *M. vison* are estimated to be 4,200,000 € (Reinhardt *et al.* 2003).

Management approaches

Prevention methods

The Bern Convention on the Preservation of European Wild Plants and Animals and their Natural Habitats lists *M. vison* in Recommendation no. 77 among the species that should be eradicated. This has not been implemented yet. No decision has been reached at the national levels.

According to Estonian List of Invasive Alien Species (Regulation of the Minister of Environment, No. 126 of October 7th 2004) it is forbidden to bring *M. vison* into the country for artificial breeding or keeping. The paragraphs §49 and §57 of The Nature Protection Law describe the cases when particular prevention actions should take place regarding the problems of (invasive) species and their massive distribution. The plan is to make farming conditions very strict (in existing farms) where new species could be brought into the country only for breeding activities.

A recent Danish government order (No. 610 of July 19th 2002) places restrictions on *M. vison* farmers to more effectively keep mink from escaping (Hammershøj 2004).

Eradication, control and monitoring efforts

In Europe there is some experience with species-specific control measures, but the results of these eradications campaigns have varied. In Iceland the feral populations of *M. vison* are still present all over the country, despite the new law programme (Hersteisson 1999). In Iceland, the first law which stated categorically that *M. vison* should be eradicated, was passed by the Althingi (parliament) in 1949 (Hersteinsson 1999). With the new law, each local authority was made responsible for employing hunters to search for and kill mink within the boundaries of the community. Approximately seven thousand minks are killed in Iceland every year, but that does not seem to severely affect the total population size in the country, since the number of killed minks has risen steadily since the hunting began with a bounty for each killed mink in 1939. In 2006, the Icelandic government will start a project with the aim to eradicate mink in three chosen areas, which will indicate if a total eradication is possible or feasible. (Róbert A. Stefánsson, pers. comm.)

In Britain an (unsuccessful) eradication campaign of the Ministry of Agriculture in a 5-year trapping programme cost £105,000 between 1965 and 1970 (Dunstone 1993). The cost of the campaign (excluding associated research costs) has been estimated, at 1990 costs, at £552,000 (Baker 1990).

According to the Danish government order LBK No. 818 of December 12th 1987, escaped fur animals that are not recaptured within two months are considered game, and are thus included in government order BEK No. 801 of September 22th 1999, which states that escaped fur animals that are considered game can be hunted/controlled all year, *i.e.* they are not protected in the breeding season (Hammershøj 2004). In the control campaign, carried out in Thy State Forest District (north-western Jutland) by the Danish Forest and Nature Agency, 209 *M. vison* were killed during the three-year control scheme, but with unintentional deaths of non-target animals such as polecats, stoats, weasels, as well as a number of rodents and birds (unpubl. data). Therefore the adverse effects on the environment of control measures should be considered carefully (Usher 1986, Zavaleta *et al.* 2001). According to Hammershøj (2004) all eradication campaigns have been unsuccessful whenever they have been performed on national scale.

In Poland *M. vison* is also considered a game animal. Hunting is allowed between August 1st and March 31st . In Warta Mouth National Park the number of *M. vison* is monitored since 1996 and protection plan for the national park includes controlling *M. vison* (Magdalena Bartoszewicz, pers. comm. 2005).
M. vison can be hunted in all three Baltic countries without restrictions in terms of season. Selective trapping is also allowed. (Janis Ozolins, pers.comm.) In order to protect species in habitats and protected areas management plans and measures are provided to eradicate *Mustela vison* in Latvia (National Programme on Biological Diversity). The EU LIFE project (2001-2004) for recovery of European mink (*Mustela lutreola*) in Estonia included besides different other activities also a removal of the alien *Mustela vison* from the Saaremaa Island (Estonia). According to the final report of the project, *M. vison* does not have any viable and stable population in Saaremaa. Only a few individuals (mostly males) migrate from mainland to island Saaremaa, but are not able to start a viable population (EU LIFE project summary).

In East Germany (former GDR, now the "new states") it is permitted since 1984 to hunt or trap *M. vison* between 1 October and 31 March. Of the 29 animals found in northeastern Bavaria, 12 were captured with muskrat traps, and 5 in box traps (Kraft and van der Sant 1999). Lethal traps are not being used, to avoid possible threats to otters (van der Sant. pers. comm.; Schmidt 1985).
In the south-western archipelago of Finland in the Baltic Sea, a *Mustela vison* removal project has been conducted since 1992 (enlarged in 1998) (the Metsähallitus and University of Turku). In two areas, consisting of ca 60 islands within 72 and 125 km^2, *Mustela vison* has been removed during each autumn and spring. Responses in prey populations have been monitored in these two removal areas and compared with results from two control areas where *Mustela vison* populations have not been hunted. Some bird populations (*e.g.* velvet scoter (*Melanitta fusca*), tufted duck (*Aythya fuligula*), turnstone (*Arenaria interpres*), common gull (*Larus canus*) and arctic tern (*Sterna paradisaea*)) and populations of common frog (*Rana temporaria*) increased significantly after *Mustela vison* removal compared to control areas (Nordström *et al.* 2002, 2003, Ahola *et al.* 2006).

Information and awareness
The Estonian Ministry of Environment has published two booklets introducing invasive alien species of local importance (in 2001 and 2005). The purpose of those booklets is to make the general public aware of the problems going hand-in-hand with the spread of invasive species and to explain and show how the species look (through the pictures included in the booklets), and give some simple advice on how the spread of species could be controlled. During the EU LIFE project for the recovery of European mink on Saaremaa and Hiiumaa (Estonia) a public awareness campaign took place, which has created a highly positive public attitude towards the activities on the island (EU LIFE project activities).

Knowledge and research
The Danish Forest and Nature Agency has carried out a three-year *M. vison* control scheme in two areas, the Thy State Forest District in north-western Jutland and the State Forest District on Bornholm, a Danish island in the Baltic Sea. Animals were trapped in instant-kill traps. A PhD thesis (project) was based on these trial control schemes and gives a basic knowledge about the biology and population ecology of free-ranging *M. vison* in Denmark, including interactions between species and its surroundings (Hammershøj 2004). As a supplement to the research performed by Hammershøj, a master thesis study on *M. vison* in the Danish harbour environments and the harbours role as dispersal centres has been conducted at the Zoological Museum, Copenhagen. It was determined that *M. vison* is very common in the Danish harbours and it was demonstrated that three out of ten radio collared feral *M. vison*, dispersed from the harbour they were captured (Meier 2005).

In Germany research concerning *M. vison* has taken place (Böhmer *et al.* 2001). The Bavarian State Ministry of Food, Agriculture and Forestry (Germany) has commissioned the Zoological State Museum of Munich to investigate the distribution, population size, spreading and possibilities for controlling *M. vison* in the region of Schwandorf (Kraft and van der Sant 1999). Essential information for the study is being provided by fish farmers, hunters, recreational fisherman and muskrat trappers (Ring and Preusch 2000). The authors conclude that it has now become impossible to exterminate *M. vison*. Based on his observations in the Löcknitz region, Kirschey (2000) recommends undertaking control measures against *M. vison* (Böhmer *et al.* 2001)
The impact of the *M. vison* on native fauna was studied in eastern (Brzeziński 1998, Brzeźński and Marzec 2003, Brzeziński and Żurowski 1992) and western Poland (Bartoszewicz and Zalewski 2003). The biocenotical role of *M. vison*, its diet, space utilization and predator-prey relationships were studied on lakes and wetlands (Magdalena Bartoszewicz, pers. comm.). Furthermore within the confines of the Polish "National Strategy for the Conservation and Sustainable Use of Biological Diversity together with an Action Programme" - document approved by the Council of Ministers on February 25th 2003, it is recommended to study the impact of alien species on native species and ecosystems and also its social and economical effects. The result of such research should be “limiting of the number and expansion and controlling of the foreign species, especially those, which are the most dangerous for local biodiversity”. In the context of this strategy this is very important to study the ecology of the *M. vison* – one of the most recent invasive species in Poland.

Recommendations or comments from experts and local communities
Nationwide monitoring programs for *M. vison* are urgently recommended, focusing on the mechanisms by which *M. vison* displace native species, as well as the potential damage to fish farming (Böhmer *et al.* 2001). Without a common strategy based on detailed population biological knowledge, there may not be any major effects of controlling *M. vison* (Hammershøj 2004). Particular attention should be paid to the *M. vison* problem in countries with rich otter population (Baltic region). On one hand, Eurasian otter (*Lutra lutra)* is a considerable native competitor and to some extent even predator on *M. vison*, on the other hand *M. vison* may harm otter conservation policy because *M. vison* might be responsible for some of the predation, in particular on waterfowl that is normally attributed to *L. Lutra*. (Janis Ozolins, pers. comm.)

References and other resources

Contact persons

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Links

Fact sheet by Illinois Department of Natural Resources

Polish Invasive Alien Species database

Global Invasive Species Database - Factsheet

References

Ahola, M., Nordström, M., Banks, P. B., Laanetu, N. and Korpimäki, E. 2006. Alien mink predation induces prolonged declines in archipelago amphibians. – Proceedings of the Royal Society of London B (in press).

Andersson, Å. 1992. Development of waterbird populations in the Bullerö archipelago of Stockholm after colonization by Mink. - Ornis Svecica 2: 107-118. (In Swedish with English summary)

Baker, S. 1990. Escaped exotic mammals in Britain. – Mammal Review 20: 75-96.

Bartoszewicz, M. 2003. PhD thesis - Wpływ norki amerykańskiej (*Mustela vison)* na ptaki wodne i strategia ich ochrony w Parku Narodowym "Ujście Warty". Institute of Nature Conservation Polish Academy of Science. Poland.

Bartoszewicz, M. and Zalewski, A. 2003. American mink (*Mustela vison)* diet and predation on waterfowl in the Słońsk Reserve, western Poland. Folia Zool. 52 (3): 225-238.

Bonesi, L. and Macdonald, D. W. Impact of released Eurasian otters on a population of American mink: a test using an experimental approach. – Oikos 106: 9-18.

Bonesi, L., Chanin, P. and Macdonald, D. W. 2004. Competition between Eurasian otter *Lutra lutra* and American mink *Mustela vison* probed by niche shift. – Oikos 106: 19-26.

Brzeziński, M. and Żurowski W. 1992. Spring diet of the American mink (*Mustela vison*) in the Mazurian and Brodnica Lakelands in Poland. Acta theriologica 37 (1-2): 193-198.

Brzeziński, M. 1998. PhD thesis – Biocenotyczna rola norki amerykańskiej *Mustela vison* w strefie pobrzeża jeziornego. University of Warsaw. Poland.

Brzeziński, M. and Marzec, M. 2003. The origin, dispersal and distribution of the American mink (*Mustal vison)* in Poland. Acta theriologica 48 (4): 505-514.

Böhmer, H. J., Heger, T. and Trepl, L. 2001. Fallstudien zu gebietsfremden Arten in Deutschland - Case studies on Aliens Species in Germany. – Texte des Umweltbundesamtes 2001 (13), 126pp.

Chylyat'ev A.A. 1975. Amerikanskaya norka v Kirovskoy oblasty. Sbornik NTI (Ochota, pychnina, dich). VNIIOZ. V. 49-50: 106-107.

Clode, D. and Macdonald, D. W. 2002. Invasive predators and the conservation of island birds: the case of American mink *Mustela vison* and terns *Sterna* spp. in the Western Isles, Scotland. - Bird Study 49: 118-123.

Craik, J. C. A. 1997. Long-term effects of North American Mink *Mustela vison* on seabirds in western Scotland. - Bird Study 44: 303-309.

Craik, J. C. A. 2000. Breeding success of common gulls *Larus canus* in west Scotland II. Comparisons between colonies. - Atlantic Seabirds 2: 1-12.

Czesnokov, N. I. 1989. Dzikije zywotnyje mieniajut adriesa. Mysl, Moskwa. Russia.
Davison, A., Birks, J. D. S., Griffiths, H. I., Kitchener, A. C., Biggins, D. and Butlin, R. K. 1999. Hybridization and the phylogenetic relationship between polecats and domestic ferrets in Britain. – Biological Conservation 87: 155-161
Doppelmair G.G., Malchevskyi A.S., Novikov G.A., Falkenshtein B. Yu. 1966. Biologia lesnykh ptic i zverey. Vyshaya shkola, Moskow.
Dunstone, N. 1993. The mink. – T and AD Poyser Ltd., London. England.
Dunstone, N. and Birks, J. D. S. 1987. The feeding ecology of mink *(Mustela vison)* in a coastal habitat. - Journal of Zoology 212: 69-83.
Enders, R.K. (1952) Reproduction in the mink (Mustela vison). – Proc. Am. Phil. Soc. 96: 691-755.
Ferreras, P. and Macdonald, D. W. 1999. The impact of American mink *Mustela vison* on water birds in the upper Thames. - Journal of Applied Ecology 36: 701-708.
EU LIFE project LIFE2000NAT/EE/7081 entitled "Recovery of *Mustela lutreola* in Estonia: captive and island populations". Covering period: 1. September 2001 – 30. November 2004. Report compiled by Tiit Maran. Foundation "LUTREOLA". Paldiski road 145, Tallinn 13522. Estonia. (Web version of project, final report of the project and short summery of the project; [English])
Hammershøj, M. and Asferg, T. 2000. Mink and Polecats in Denmark: status, control and damage to poultry. Mammal review, 30: 228.
Hammershøj, M. 2004. PhD thesis – Population ecology of free-ranging American *mink Mustela vison* in Denmark. National Environment Research Institute. Ministry of Environment. Denmark (web-version).
Hario, M. 2002. Mink (*Mustela vison*) predation on black guillemots at Söderskär in 1994-1999. - Suomen Riista 48: 18-26. (In Finnish with English summary)
Hario, M., Komu, R., Muuronen, P. and Selin, K. 1986. Population trends among archipelago birds in Söderskär bird sanctuary. - Suomen Riista 33: 79-90. (In Finnish with English summary)
Hersteinsson, P. 1999. Methods to eradicate the American mink (*Mustela vison*) in Iceland. In: Workshop on the control and eradication of non-native terrestrial vertebrates, Sliema, Malta, 3-5 June 1999. – Council of Europe, Strasbourg, Report no. T-PVS (99) 26: 17-21.
Ivanov P.D. and Tymanov I.L. 1974. Amerikanskaya norka v Leningradskoy oblasty. Sbornik NTI (Ochota, pychnina, dich). VNIIOZ. V.42: 3-9.
Jędrzejewska, B., Sidorovich, V. E., Pikulik, M. M. and Jędrzejewski, W. 2001. Feeding habits of the otter and the American mink (*Mustela vison*) in Bialowieza Primeval forest (Poland) compared to other Eurasian populations. - Ecography 24: 165-180.
Kauhala, K. 1996. Distribution history of the American mink (*Mustela vison*) in Finland with special reference to the trends in otter (*Lutra lutra*) populations. Ann. Zool. Fennici 33: 283.
Kilpi, M. 1995. Breeding success, predation and local dynamics of colonial common gulls *Larus canus*. - Annales Zoologici Fennici 32: 175-182.
Kirschey, T. 2000. Das „Neozoen-Problem" aus Sicht des herpetologischen Artenschutzes. – In: NABU (ed.), Was macht der Halsbandsittich in der Thujahecke? Zur Problematik von Neophyten und Neozoen und ihrer Bedeutung für den Erhalt der biologischen Vielfalt, S. 65-72.
Kraft, R. and D. van der Sant. 1999. Bestandssituation und Ausbreitungstendenz des Amerikanischen Nerzes (*Mustela vison* Schreber, 1777) in Nordostbayern. – Säugetierkd. Inf. 4 (23): 447-452.
Kukk, T., Kull, T., Lilleleht, V., Ojaveer, H. 2001. Alien species in estonia.[Võõrliigid Eestis]. Keskkonnaministeerium. Tallinn. Estonia.
Kull, T., 2005. Invasive alien species in Estonia. [Invasiivsed võõrliigid Eestis]. Keskkonnaministeerium. Tallinn. Estonia.
Lariviére, S. 1999. *Mustela vison*, Mammalian Species. no. 608 pp.1-9, Pub. American Society of Mammalogists.
Lever, C. 1985. Naturalized mammals of the world. Longman Group Ltd., Essex.
LUA - Landesumweltamt Brandenburg (1999): Artenschutzprogramm Elbebiber und Fischotter. - Potsdam (LUA Brandenburg), 51 S.
Macdonald, D. W. 1996. Dangerous liaisons and disease. – Nature 379: 400-401.
Maran, T. 2002. Mammals of Europe. [Euroopa imetajad]. Eesti Entsüklopeediakirjastus
Meier, S. B. 2005. Master thesis – American Mink *Mustela vison* in the Danish harbour environments and the harbours role as dispersal centres. Zoological Museum University of Copenhagen.
Michailov V.B. 1974. Akklematizaciya amerikanskoy norki v gorno-lesnoi zone Chelyabinskoi oblasty. Sbornik NTI (Ochota, pychnina, dich). VNIIOZ. V.43: 3-8.
Niemimaa, J. and Pokki, J. 1990. Food habits of the mink (*Mustela vison*) in the outer archipelago of the Gulf of Finland. - Suomen Riista 36: 18-30. (In Finnish with English summary)

Nordström, M., Högmander, J., Nummelin, J., Laine, J., Laanetu, N. and Korpimäki, E. 2002 Variable responses of waterfowl breeding populations to long term removal of introduced American mink (*Mustela vison*). - Ecography 25: 385-394.
Nordström, M., Högmander, J., Laine, J., Nummelin, J., Laanetu, N. and Korpimäki, E. 2003 Effects of feral mink (*Mustela vison*) removal on seabirds, waders and passerines on small islands of the Baltic Sea. - Biological Conservation 109: 359-368.
Opermanis, O., Mednis, A. and Bauga I. 2001. Duck nests and predators: interaction, specialisation and possible management. - Wildlife Biology 7: 87-96.
Ozolinš, J. and Pilāts, V. 1995. Distribution and status of small and medium-sized carnivores in Latvia. Ann. Zool. Fennici 32:21-29.
Popov V.A. 1964. Rezultaty akklematizacii amerikanskoy norki (Mustela vison Br.) v SSSR. Prirodnye resyrsy Volgsko-Kamskogo kraya (jyvotnyi mir). Moscow, Nayka: 5-15.
Reinhardt, F., Herle, M., Bastiansen, F., Streit, B. 2003. Economic Impact of the Spread of Alien Species in Germany. pp 183.
Rushton, S. P., Barreto, G. W., Cormack, R. M., Macdonald, D. W. and Fuller, R. 2000. Modelling the effects of mink (*Mustela vison*) and habitat fragmentation on the water vole. - Journal of Applied Ecology 37: 475-490.
Ring, Th. and Preusch, E. 2000. Minkvorkommen 1999 nach Erhebungsbögen des Fishereiverbandes Oberpfalz. – Unveröff. Studie, Regierung der Oberpfalz. Regensburg.
Rozhnov, V.V. 1993. Extinction of the European mink: ecological catastrophe or a natural process? – Lutreola 1: 10-16.
Schmidt, A. 1985. Zum Vorkommen des Minks *Mustela vison* (Schreber 1777) im Süden des Bezirkes Frankfurt/Oder. – Säugetierkd. Inf. 2 (9): 292-297.
Schröpfer, R. 1999. Gewinner Mink – Verlierer Nerz. Nischenkämpfe. – Wild und Hund 102 (4): 32-34.
Sinicyn A.A. 1990. Rezultaty akklematizacii amerikanskoy norki v ravninnoy chasti Zapadnoi Sibiri. Intesifikaciya vosproizvodstva resyrsov ochotnychiikh jivotnykh. Kirov: 170-180.
Skirnisson, K. 1979. Food habits of Mink (*Mustela vison* Schreber) in Grindavik, south west Iceland. – Natturufrädingurinn 49: 194-203.
Skirnisson, K. 1992. Die falsch verstandene Freiheit. – Fauna 4/92: 12-14.
Skirnisson, K. 1992. Zur Biologie der Isländischen Minkpopulation. Semiaquatic Mammals. (Herausg. R. Schröpfer, M. Stubbe and D. Heidecke). Wiss. Beiträge Univ. Halle 1992: 277-295.
Sokolskyi S.M. 1990. Mustela (Lutreola) vison Schreber, 1777 - Amerikanskaya norka. Mlekopitayuchie, Kitoobraznye, Parnopalye (Fauna evropeyskogo Severo-Vostoka Rossii. Mlekopitayuchie. T.II. ch. 2. Spb., Nayka:159-169.
Stubbe, M. 1975. Der Amerikanische Nerz *Mustela vison* (Schreber, 1777) in der DDR. – Beiträge zur Jagd- und Wildforschung 9: 364-386.
Stubbe, M. 1988. Die expansive Arealerweiterung des Minks *Mustela vison* (Schreber, 1777) in der DDR in den Jahren 1975-1984. – Beiträge zur Jagd- und Wildforschung 15: 75-90.
Stubbe, M. 1993. *Mustela vison* – Mink. – In: J. Niethammer, F. Krapp (ed.), Handbuch der Säugetiere Europas. Band 5: Raubsäuger – Carnivora (Fissipedia). Wiesbaden.
Tauriņš, E. 1982. Latvijas zīdītājdzīvnieki. Zvaigzne, Rīga, 256 pp.
Telfer, S., Holt, A., Donaldson, R. and Lambin, X. 2001. Metapopulation process and persistence in remnant water vole populations. - Oikos 95: 31-42.
Ternovskii, D.V. 1977. The biology of the Mustelidae. Akademii Nauk. Novosibirisk, 280 pp.
Usher, M.B. 1986. Invasibility and wildlife conservation: invasive species on nature reserves. – Philosophical Transactions of the royal Society of London, B 314: 695-710.
Woodroffe, G., Lawton, J. and Davidson, W. 1990. The impact of feral mink *Mustela vison* on water voles *Arvicola terrestris* in the North Yorkshire Moors National Park. - Biological Conservation 51: 49-62.
Yamaguchi, N., Sarno, R.J., Johnson, W.E., O'Brien, S.J. & Macdonald, D.W. (2004) Multiple paternity and reproductive tactics of free-ranging American minks, Mustela vison. – Journal of Mammalogy 85: 432-439.
Zavaleta, E. S., Hobbs, R. J. and Mooney, H. A. 2001. Viewing invasive species removal in a whole-ecosystem context. – TREE 16: 454-459.

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