Risk analysis report of non-native organisms in Belgium


# Risk analysis of the American mink

## *Neovison vison*

(Schreber 1777)

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# Risk analysis of the American mink *Neovison vison* (Schreber 1777)


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Etienne Branquart (Cellule Espèces Invasives, Service Public de Wallonie) developed the risk analysis template that was used for this exercise.

The general process of drafting, reviewing and approval of the risk analysis for selected invasive alien species in Belgium was attended by a steering committee, chaired by the Federal Public Service Health, Food chain safety and Environment. RBINS/KBIN was contracted by the Federal Public Service Health, Food chain safety and Environment to perform PRA's for a batch of species. ULg was contracted by Service Public de Wallonie to perform PRA's for a selection of species. INBO and DEMNA performed risk analysis for a number of species as in-kind contribution.

Steering committee members were:

| | |
|---|---|
| Tim Adriaens | Research Institute for Nature and Forest (INBO) |
| Olivier Beck | Brussels Environment (BIM) |
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| Hans Van Gossum | Agency for Nature and Forest (ANB) |
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## Rationale and scope of the Belgian risk analysis scheme

*The Convention on Biological Diversity (CBD) emphasises the need for a precautionary approach towards non-native species. It strongly promotes the use of robust and good quality risk assessment to help underpin this approach (COP 6 Decision VI/23). More specifically, when considering trade restrictions for reducing the risk of introduction and spread of a non-native organisms, full and comprehensive risk assessment is required to demonstrate that the proposed measures are adequate and efficient to reduce the risk and that they do not create any disguised barriers to trade. This should be seen in the context of WTO and free trade as a principle in the EU (Baker et al. 2008, Shine et al. 2010, Shrader et al. 2010).*

*This risk analysis has the specific aim of evaluating whether or not to install trade restrictions for a selection of absent or emerging invasive alien species that may threaten biodiversity in Belgium as a preventive risk management option. It is conducted at the scale of Belgium but results and conclusions could also be relevant for neighbouring areas with similar eco-climatic conditions (e.g. areas included within the Atlantic and the continental biogeographic regions in Europe).*

*The risk analysis tool that was used here follows a simplified scheme elaborated on the basis of the recommendations provided by the international standard for pest risk analysis for organisms of quarantine concern*[1] *produced by the secretariat of the International Plant Protection Convention (FAO 2004). This logical scheme adopted in the plant health domain separates the assessment of entry, establishment, spread and impacts. As proposed in the GB non-native species risk assessment scheme, this IPPC standard can be adapted to assess the risk of intentional introductions of non-native species regardless the taxon that may or not be considered as detrimental (Andersen 2004, Baker et al. 2005, Baker et al. 2008, Schrader et al. 2010).*

*The risk analysis follows a process defined by three stages : (1) the <u>initiation process</u> which involves identifying the organism and its introduction pathways that should be considered for risk analysis in relation to Belgium, (2) the <u>risk assessment stage</u> which includes the categorization of emerging non-native species to determine whether the criteria for a quarantine organism are satisfied and an evaluation of the probability of organism entry, establishment, spread, and of their potential environmental, economic and social consequences and (3) the <u>risk management stage</u> which involves identifying management options for reducing the risks identified at stage 2 to an acceptable level. These are evaluated for efficacy, feasibility and impact in order to select the most appropriate. The risk management section in the current risk analysis should however not been regarded as a full-option management plan, which would require an extra feasibility study including legal, technical and financial considerations. Such thorough study is out of the scope of the produced documents, in which the management is largely limited to identifying needed actions separate from trade restrictions and, where possible, to comment on cost-benefit information if easily available in the literature.*

*This risk analysis is an advisory document and should be used to help support Belgian decision making. It does not in itself determine government policy, nor does it have any legal status. Neither should it reflect stakeholder consensus. Although the document at hand is of public nature, it is important to realise that this risk assessments exercise is carried out by (an) independent expert(s)*

[1] A weed or a pest organism not yet present in the area under assessment, or present but not widely distributed, that is likely to cause economic damages and is proposed for official regulation and control (FAO 2010).

*who produces knowledge-based risk assignments sensu Aven (2011). It was completed using a uniform template to ensure that the full range of issues recognised in international standards was addressed.*

*To address a number of common misconceptions about non-native species risk assessments, the following points should be noted (after Baker et al. 2008):*

- *Risk assessments are advisory and therefore part of the suite of information on which policy decisions are based;*
- *The risk assessment deals with potential negative (ecological, economic, social) impacts. It is not meant to consider positive impacts associated with the introduction or presence of a species, nor is the purpose of this assessment to perform a cost-benefit analysis in that respect. The latter elements though would be elements of consideration for any policy decision;*
- *Completed risk assessments are not final and absolute. New scientific evidence may prompt a re-evaluation of the risks and/or a change of policy.*

## Executive summary

**PROBABILITY OF ESTABLISHMENT AND SPREAD (EXPOSURE)**

| | |
|---|---|
| Entry in Belgium | It is very likely that American mink will continue entering and escaping in the wild in Belgium in the near future because of the presence of numerous farms, wherein new animals are frequently imported. |
| Establishment capacity | The American mink is likely to establish self-sustaining populations in Belgium because it has a very high adaptation capacity and appropriate climatic conditions, habitats and prey are encountered. |
| Dispersion capacity | The American mink can easily spread naturally beyond introduction points and has the capacity to colonise most of the country in a few decades. It has a mean natural expansion rate of 5 kilometres per year, mainly due to the dispersal of juveniles away from their natal home range. |

**EFFECT OF ESTABLISHMENT**

| | |
|---|---|
| Environmental impacts | Based on impacts observed in other European countries, there is high confidence that establishment of feral populations of American mink in Belgium will contribute to the decline of native amphibians, waterfowl and rodents populations because of predation. Ramsar sites and other protected wetlands are especially at risk as they host numerous threatened waterfowl and amphibian species. |

**RISK MANAGEMENT**

A natural immigration of the American mink to Belgium is unlikely to occur in the coming years as no large feral population is currently present in the immediate vicinity and its natural expansion rate does not exceed 10 km per year. On the other hand, the presence of breeding farms and holding by pet owners represent a high risk for future establishment in the wild as minks are reported to escape easily from captivity.

It means that the risk of entry and future establishment in the wild of the American mink could be significantly reduced through restriction measures on importation, trade and holding conditions in breeding farms. Establishment of mink farms should not be allowed in districts deprived of existing farms. Strict rules on facilities should be imposed as soon as possible where mink farms are already established, e.g. taller and better fences, placement of mink traps around the farm perimeter, inspection of breeding facilities by public authorities, etc.

At last, contingency plans and surveillance systems should be established in the areas where breeding farms are present, so that minks can be rapidly killed after accidental escape or release by animal right activists.

# Résumé

**PROBABILITE DE NATURALISATION ET DE DISSEMINATION DANS L'ENVIRONNEMENT**

| | |
|---|---|
| Introduction en Belgique | Il est très probable que le Vison d'Amérique continuera à s'échapper dans la nature et à être introduit en Belgique dans un proche avenir, et ceci en raison de la présence de nombreuses fermes d'élevage dans lesquelles de nouveaux animaux sont fréquemment importés. |
| Capacité de naturalisation | En raison de sa très bonne capacité d'adaptation, des conditions climatiques favorables ainsi que de la disponibilité en habitats et en proies que lui offre la Belgique, il est probable que le Vison d'Amérique puisse y développer des populations viables. |
| Capacité de dissémination | Le Vison d'Amérique peut facilement étendre sa distribution à partir des sites où il a été introduit. Il est capable de coloniser la majorité du pays en quelques décennies à peine. Son taux moyen d'expansion est de 5 km par an. Sa dispersion est essentiellement liée à la dispersion des jeunes en dehors de leur territoire natal. |

**EFFETS DE LA NATURALISATION**

| | |
|---|---|
| Impacts environnementaux | Sur base des impacts observés dans d'autres pays européens, il est hautement probable que la prédation par le Vison d'Amérique consécutive à l'établissement de populations sauvages en Belgique puisse contribuer à la diminution de populations d'amphibiens, d'oiseaux aquatiques et de rongeurs indigènes. Les sites Ramsar et les autres zones humides protégées sont plus particulièrement à risque étant donné qu'elles abritent de nombreuses espèces menacées d'oiseaux aquatiques et d'amphibiens. |

**GESTION DU RISQUE**

A court terme, une immigration naturelle du Vison d'Amérique vers la Belgique est peu probable car son taux d'expansion naturelle ne dépasse pas 10 km par an et il n'y a aucune population férale confirmée à proximité immédiate du pays. En revanche, la présence de fermes d'élevage et la détention du vison par des particuliers représente un risque élevé d'établissement dans la nature étant donné que cette espèce peut facilement s'échapper des sites où il est détenu.

Cela signifie que les risques d'introduction et de naturalisation du Vison d'Amérique en Belgique pourraient être réduits de manière significative par des mesures de restriction de l'importation et du commerce ainsi que par un renforcement des conditions de détention de cette espèce dans les fermes d'élevage. L'installation de nouvelles fermes d'élevage de Visons d'Amérique ne devrait pas être autorisée dans les zones du pays où aucune ferme d'élevage n'a été installée jusqu'ici. Des règles strictes de sécurité devraient être imposées le plus rapidement possible au niveau des établissements d'élevage existants : pose de clôtures plus hautes et plus solides, placement de pièges autour du périmètre de la ferme, mise en place de mesures d'inspection des installations d'élevage par les autorités publiques, etc.

Enfin, des plans de contingence et des systèmes de surveillance devraient être mis en place dans les zones où sont installées des fermes d'élevage de telle sorte que les visons puissent être rapidement éliminés lorsqu'ils s'échappent accidentellement ou lors des évasions massives provoquées par des activistes pour la défense des droits des animaux.

# Samenvatting


**WAARSCHIJNLIJKHEID VAN VESTIGING EN VERSPREIDING (BLOOTSTELLING)**

| | |
|---|---|
| Introductie in België | Door de aanwezigheid van talloze fokkerijen die frequent nieuwe dieren importeren, is de kans bijzonder groot dat in de nabije toekomst steeds meer Amerikaanse nertsen in België zullen worden geïntroduceerd en in het wild zullen ontsnappen. |
| Vestigingsvermogen | Door zijn hoog aanpassingsvermogen en door de geschikte klimaatomstandigheden, habitats en prooien die hij hier aantreft, is het waarschijnlijk dat populaties van de Amerikaanse nerts zich hier zullen handhaven. |
| Verspreidingsvermogen | De Amerikaanse nerts kan zich op natuurlijke wijze gemakkelijk buiten de introductiepunten verspreiden en is in staat om in enkele decennia het grootste deel van het Belgische grondgebied in te palmen. De gemiddelde natuurlijke expansiesnelheid bedraagt 5 kilometer per jaar; dit heeft er alles mee te maken dat jonge specimens zich ver van het leefgebied waar ze werden geboren, kunnen verspreiden. |

**EFFECTEN VAN VESTIGING**

| | |
|---|---|
| Milieu-impact | Uitgaande van de impact die in andere Europese landen werd waargenomen, is men er vrij zeker van dat de vestiging van verwilderde populaties van de Amerikaanse nerts in België door predatie zal bijdragen tot een achteruitgang van inheemse amfibieën, watervogel en knaagdierpopulaties. Met name Ramsargebieden en andere beschermde waterrijke gebieden lopen een groot risico omdat zich hier heel wat bedreigde watervogels en amfibieënsoorten ophouden. |

**RISICOBEHEER**

De komende jaren hoeft in België niet meteen gevreesd voor een natuurlijke immigratie van de Amerikaanse nerts omdat er zich momenteel geen grote verwilderde populaties in de onmiddellijke omgeving ophouden en omdat zijn natuurlijke verspreidingssnelheid niet meer dan 10 km per jaar bedraagt. Anderzijds zijn de aanwezigheid van fokkerijen en het (illegaal) houden van deze soort als huisdier een groot risico voor vestiging in het wild, omdat nertsen gemakkelijk uit gevangenschap ontsnappen.

Dit betekent dat het risico op introductie en toekomstige vestiging in het wild van de Amerikaanse nerts aanzienlijk kan worden verminderd door restrictieve maatregelen op de invoer, verkoop en op de omstandigheden waarin deze dieren in fokkerijen worden gehouden. De vestiging van nertsboerderijen in districten waar dergelijke bedrijven nog niet aanwezig zijn, zou niet mogen worden toegestaan. Waar er reeds nertsboerderijen aanwezig zijn, zouden er strikte regels voor de voorzieningen moeten worden uitgevaardigd, vb. hogere en betere omheining, het opstellen van nertsvallen rond de boerderijperimeter, inspectie van de fokvoorzieningen door de overheid, enz.

Tot slot dienen er toezichtsystemen in het leven te worden geroepen in gebieden waar fokkerijen aanwezig zijn, zodat onopzettelijk ontsnapte dieren of nertsen die opzettelijk door dierenrechtenactivisten werden vrijgelaten, kunnen worden onderschept en gedood.

## STAGE 1: INITIATION

*Precise the identity of the invasive organism (scientific name, synonyms and common names in Dutch, English, French and German), its taxonomic position and a short morphological description. Present its distribution and pathways of quarantine concern that should be considered for risk analysis in Belgium. A short morphological description can be added if relevant. Specify also the reason(s) why a risk analysis is needed (the emergency of a new invasive organism in Belgium and neighboring areas, the reporting of higher damages caused by a non native organism in Belgium than in its area of origin, or request made to import a new non-native organism in the Belgium).*

### 1.1 ORGANISM IDENTITY

| | |
|---|---|
| Scientific name : | *Neovison vison* Schreber, 1777 |
| Synonyms: | *Mustela vison, Mustela canadensis, Mustela rufa, Lutra vison, Vison lutreola* |
| Common names : | American mink (GB), Amerikaanse nerts (NL), Amerikanischer Nerz (DE), Vison d'Amérique (FR). |
| Taxonomic position: | Chordata (Phylum) > Mammalia (Class) > Carnivora (Order) > Mustelidae (Family). |

Note: The American mink *Neovison vison* or *Mustela vison* has been referred to as a superspecies with the Siberian weasel *Mustela sibirica* and the European mink *Mustela lutreola* and numerous subspecies have been described (Corbet & Harris 1991). Its taxonomic position in the genus *Mustela* has been recently questioned and it has been elevated to a distinct mustelid genus, *Neovison* (Kurose et al. 2008, Harding & Smith 2009). Domesticated forms reared in fur farms result from cross-breeding of different local North American subspecies of *Neovison vison* for artificially selected traits including fur colour and size; wild native American mink are uniformly dark brown but breeding in fur farms has resulted in a wide range of pelage colours (Dunstone 1993, Trapezov 2000, Birnbaum 2006, Kidd *et al.* 2009, Demontis *et al.* 2011).

Fur farmed animals have been bred in captivity for only about 50-60 generations, are not completely domesticated and may easily form feral populations in the wild (Nimon & Broom 1999). **Free-ranging American mink populations found in Europe all originate from "domesticated" animals escaped from fur farms** (Hammershoj 2005, Bonesi & Palazon 2007, Kidd et al. 2009, Zalewski *et al.* 2010 and 2011). Escape of ranch-raised mink is also common in its native area (North America) where feral minks contribute to wild mink decline through outbreeding depression (Bowman *et al.* 2007, Kidd *et al.* 2009). Most feral populations have reverted to wild-type colour (Mitchell-Jones et al. 1999).

### 1.2 SHORT DESCRIPTION

*Neovison vison* is a medium-sized carnivore with an elongated body approximately 30 cm long, relatively short limbs and a tail approximately one third of the body length. Wild native American mink are uniformly dark brown but breeding in fur farms has resulted in a wide range of pelage colours, and consequently escaped feral mink may vary in colour from white, grey or fawn through to black (CABI International 2011).

## 1.3 ORGANISM DISTRIBUTION

**Native range**

The native range of *Neovison vison* is almost all of North-America, excluding the north of the Arctic circle, the most southern part of United States and Mexico (Dunstone 1993; Bonesi 2006).

**Introduced range**

| | |
|---|---|
| Belgium: | The species is not established in Belgium. |
| Rest of Europe: | Established in Austria, Belarus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Iceland, Ireland, Italy, Latvia, Lithuania, Norway, Poland, Portugal, Slovakia, Russia, Spain, Sweden and United Kingdom (Bonesi & Palazon 2007). |
| Other continents: | Established in Argentina, Chile, Japan, Kazakhstan and New Zealand (CABI). |

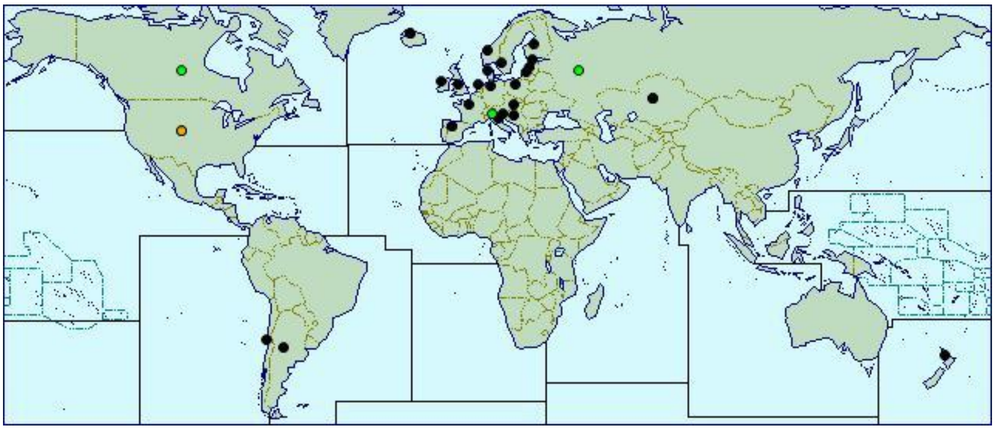

Figure 1: Worldwide distribution map of Neovison vison (source: CABI Invasive Species Compendium)

## 1.4 REASONS FOR PERFORMING RISK ANALYSIS

**No feral population of *Neovision vison* are currently known in Belgium despite the fact that the species is widely established in different parts of Europe, where they cause strong negative impacts on native biodiversity. The species could potentially establish in the future in Belgium due to escape from existing or new mink farms, wherein frequent importations of animals is reported to occur.**

## STAGE 2 : RISK ASSESSMENT

### 2.1 PROBABILITY OF ESTABLISHMENT AND SPREAD (EXPOSURE)

*Evidence should be available to support the conclusion that the non-native organism could enter, become established in the wild and spread in Belgium and neighbouring areas. An analysis of each associated pathways from its origin to its establishment in Belgium is required. Organisms intentionally imported maybe maintained in a number of intended sites for an indeterminate period. In this specific case, the risk may arise because of the probability to spread and establish in unintended habitats nearby intended introduction sites.*

#### 2.1.1 Present status in Belgium

*Specify if the species already occurs in Belgium and if it makes self-sustaining populations in the wild (establishment). Give detail about species abundance and distribution within Belgium when establishment is confirmed together with the size of area suitable for further spread within Belgium.*

Whereas this species is reared in several tens of fur farms established in Belgium and neighbouring areas and has already been observed in the wild several times due to occasional escapes from them, **it has not been reported to have developed viable populations so far** (Libois 1996, Van Den Berge & De Pauw 2003, Van Den Berge 2008, Van Den Berge & Gouwy 2009). Several hypotheses are advanced to explain the failure of establishment of feral populations like mink trapping as a side-effect of the intensive trapping campaigns against the muskrat or the possible impact of water pollutants (e.g. PCBs) on mink reproduction (see also the habitat preference section) (Ray 2000, Bonesi & Palazon 2007).

#### 2.1.2 Present status in neighbouring countries

*Mention here the status of the non-native organism in the neighbouring countries.*

The American mink is established in Eastern Germany, United Kingdom and Western France (Bretagne) (Bonesi & Palazon 2007). Casual observations are reported from Luxembourg, Netherlands and Western Germany but feral populations don't seem to be established there so far (Thissen & Hollander 1996, Schley 2001, Godin 2005, Müskens & Dekker 2010).

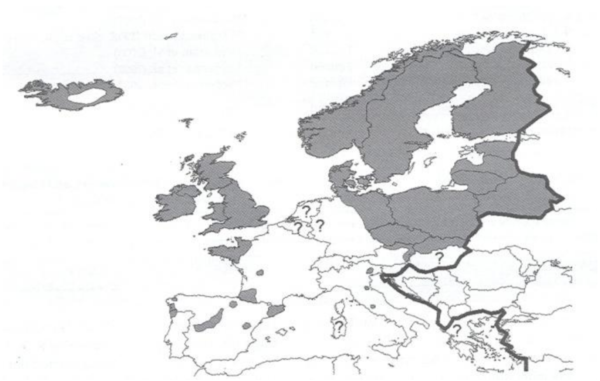

Figure 2: Distribution of the established populations of American mink since 1990 in Europe (source: Bonesi & Palazon 2007).

Observations of American mink were made in the Netherlands since 1958 and were increasing during the last decades (more than 100 annual sightings in recent years). Many individuals were reported from the muskrat trapping campaign; as an example, 145 sightings originated from trapping in 2008. Sightings were usually located near fur farms and were most frequent in the Southern part of the country (figure 3). In spite of regular sightings, there was no indication of reproduction and juveniles were never observed in the wild. Most observations refered to recent escaped/released animals which do not exclude that establishment could occur in the future (Dekker 2012).

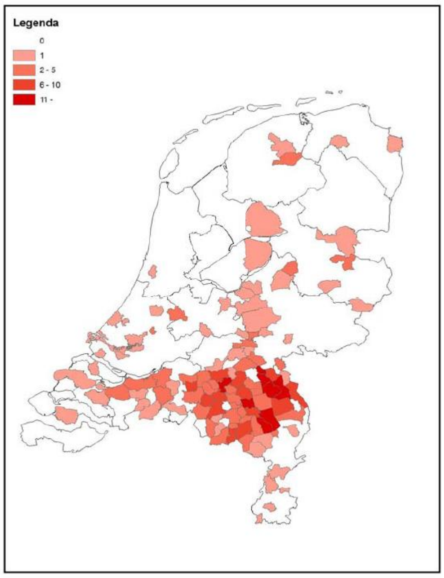


Figure 3: Sightings of *Neovison vison* in the Netherlands reported from 1998 to 2008 (n= 1250) in the Dutch mammal database (source: Dekker 2012).

### 2.1.3 Introduction in Belgium

*Specify what are the potential international introduction pathways mediated by human, the frequency of introduction and the number of individuals that are likely to be released in Europe and in Belgium. Consider potential for natural colonisation from neighbouring areas where the species is established and compare with the risk of introduction by the human-mediated pathways. In case of plant or animal species kept in captivity, assess risk for organism escape to the wild (unintended habitats).*

American mink has been introduced to many countries in the world to set up mink breeding farms for fur production. Frequent importation and exchanges of animals between breeding farms occur to keep fecundity and genetic diversity as high as possible. In Europe, mink farms have been established since the 1920's; they are concentrated in northern countries where the climate favours the growth of fur of high quality (Denmark, Finland, Netherlands, Norway and Sweden) (Birnbaum 2006, Bonesi & Palazon 2007, Demontis *et al.* 2011).

In 2000, several tens of mink farms were in activity in Belgium and neighbouring areas, each of them about 2000 breeding females; 26 were registered in Belgium, and 208 in the Netherlands. **Today several tens of thousand of farmed animals are present in Belgium**, which might lead to future escapes and establishment of feral populations (Bonesi & Palazon 2007).

Mink has been frequently reported to escape from fur farms into the surrounding environment and to establish feral populations in many regions of the world (Asia, Europe and South America), either accidentally or due to intentional releases by animal right activists as it happened e.g. in the Netherlands in 2003 (6000 animals released) and in Belgium in 2003 and 2010 (some hundreds of animals released). Escapes may be facilitated by exceptional accidents like the storm that has been responsible for the release of 12 000 minks in Morbihan in 1987. In Europe, it escaped from breeding farms and became naturalized in several countries, e.g. British isles, Denmark, Germany, Spain and Western France (see map) (Gerell 1967, Hammershoj *et al.* 2004, Reynolds *et al.* 2004, Godin 2005, Birnbaum 2006, Bonesi 2006, Bonesi & Palazon 2007, Bowman *et al.* 2007, Zalewski *et al.* 2010). Genetic studies provide strong evidence that there is a very high proportion of newly escaped farm mink in the free-ranging population living in Denmark, Poland and Spain, which makes a good argument that fur farms have not been adequately secured against escapes of mink in those countries (Hammershoj *et al.* 2005, Lecis *et al.* 2008, Zalewski *et al.* 2010).

The survival rate of newly escaped mink is quite low, but a few surviving individuals may rapidly establish stable populations due to their very high reproductive potential, short generation time and good behavioural flexibility and adaptation capacities (Sidorovitch 1993, Stubbe 1993, Hammershoj 2004, Bertolino & Genovesi 2007, Zalewski *et al.* 2010, Dekker 2012). Interestingly, spatially-explicit models based on Danish data suggest that continuous escapes from fur farms may keep mink populations in nature at a genetically less well-adapted stage and at lower population sizes, than would be the case if there were no further escapes from fur farms (Hammershoj *et al.* 2006).

So far, observation of escaped minks in the wild are quite rare in Belgium but might be enhanced through animal right activism, deterioration of or accident impacting fur farming facilities (Thyssen & Hollander 1996, Schley 2001, Van Den Berge & De Pauw 2003, Godin 2005). **About 25 observations have been recorded in the wild between 1997 and 2013 in Flanders** (Van Den Berge & De Pauw 2003, Van Den Berge K. & Gouwy J., pers. comm. 2013).

In the near future, **immigration in Belgium of free moving animals coming from other populations established in Europe is unlikely because of long distances to be travelled (> 500 km)** and/or the presence of natural obstacles to animal dispersion like sea or highlands with dense conifer forests (Birnbaum 2006, Bonesi & Palazon 2007, Zalewski *et al.* 2009). However, potential establishment of feral populations in the Netherlands may represent another introduction pathway in the coming years (Dekker 2012).

**ENTRY IN BELGIUM**

**It is very likely that American mink will continue entering and escaping in the wild in Belgium and neighbouring areas in the near future because of the presence of numerous farms, wherein new animals are frequently imported.**

### 2.1.4 Establishment capacity and endangered area

*Provide a short description of life-history and reproduction traits of the organism that should be compared with those of their closest native relatives (A). Specify which are the optimal and limiting climatic (B), habitat (C) and food (D) requirements for organism survival, growth and reproduction both in its native and introduced ranges. When present in Belgium, specify agents (predators, parasites, diseases, etc.) that are likely to control population development (E). For species absent from Belgium, identify the probability for future establishment (F) and the area most suitable for species establishment (endangered area) (G) depending if climatic, habitat and food* *conditions found in Belgium are considered as optimal, suboptimal or inadequate for the establishment of a reproductively viable population. The endangered area may be the whole country or part of it where ecological factors favour the establishment of the organism (consider the spatial distribution of preferred habitats). For non-native species already established, mention if they are well adapted to the eco-climatic conditions found in Belgium (F), where they easily form self-sustaining populations, and which areas in Belgium are still available for future colonisation (G).*

In its native range, the American mink is generally considered to be abundant and its population status has remained essentially unchanged over the past hundred years, although local decline is sometimes observed. Unlike many other northeastern mesocarnivores, the number of pelts harvested since 1920 has not declined over time. It is considered as a highly adaptable and opportunistic species that may easily switch prey (Eagle & Whitman 1987, Sullivan 1996, Ray 2000).

*A/ Life-cycle and reproduction*

Life expectancy of American mink in the wild is 3-4 years. Animals reach sexual maturity at 12 months for females and 18 months for males. Females produce each year from 2 to 10 cubs (3.5 on average) in temperate conditions (Gerell 1971, Sidorovich 1993, Sullivan 1996, Bonesi 2006). The number of cubs reared per litter is directly linked to prey availability (Garcia-Diaz & Lizana 2012) and is usually enhanced during the establishment phase, when densities are low and resources are abundant (Sidorovitch 1993, Zschille *et al.* 2004).

*B/ Climatic requirements*[2]

The distribution of the American mink covers a **wide range of temperature zones**. They are distributed from Alaska to Florida in their native range and feral populations are found from the North of Scandinavia to Spain in Europe. Individual mink may endure large differences between summer and winter temperature, especially in the central parts of the continents. Mink molt their fur twice a year and have a thick underfur during the winter to minimize heat loss. The species is widely established within the Cfb climate zone throughout Europe (Dunstone 1993, Hansen & Jeppesen 2003, Bonesi & Palazon 2007).

*C/ Habitat preferences*[3]

**The American mink occurs in a wide variety of plant communities and is associated with water rather than with particular habitat types.** This semi-aquatic mammal inhabits the boundaries of lakes, slow flowing rivers, streams, coasts and estuaries surrounded by marsh vegetation, wooded marshlands and swamps, both in its native and introduced ranges. Habitats with broad littoral zones, irregular and diverse shoreline, dense tree and shrubby cover, reed beds, log jams and rockpools are particularly favoured. Slow flowing rivers (width > 5 meters) are preferred over brooks because prey diversity and biomass are higher in the former habitat. The American mink is furthermore an opportunist and inhabits suboptimal habitats if prey is available, so it has repeatedly been sighted near urban areas, fowl and fish farms (Allen 1989, Sullivan 1996, Sidorovich & MacDonald 2001, Yamaguchi *et al.* 2003, Godin 2005, Birnbaum 2006, Roy 2009, Sidorovich *et al.* 2010). In Europe,

[2] Organism’s capacity to establish a self-sustaining population under Atlantic temperate conditions (Cfb Köppen-Geiger climate type) should be considered, with a focus on its potential to survive cold periods during the wintertime (e.g. plant hardiness) and to reproduce taking into account the limited amount of heat available during the summertime.

[3] Including host plant, soil conditions and other abiotic factors where appropriate.

American mink are known to invade mainly the following EUNIS habitat types: coastal dunes and sand habitats (B1), coastal shingle habitats (B2), rock cliffs and shores (B3), surface standing waters (C1), surface running water (C2) and littoral zone of inland surface waterbodies (C3), most of them being well represented in Belgium and neighbouring areas (Bonesi 2006).

The principal threats to mink populations in native and invaded ranges are **water pollution** and **habitat destruction or degradation** as a result of landuse practices and chemical pollutants. By virtue of their dependence on aquatic habitats, mink are highly susceptible to mercury, PCB, and pesticide contamination. Those pollutants are known to cause a reproductive depression and could explain establishment failure in some areas (den Boer 1984, Eagle & Whitman 1987, Broekhuizen 1989, Haffner et al. 1998, Osowski *et al.* 1995, Ray 2000).

The species avoids dense conifer forests, open habitats resulting from intensive farming activities and industrial and urbanised areas; it is known to suffer from elimination of aquatic vegetation and degradation of wetland habitats. Stream channelization has a negative impact on its activity since suitable prey abundance is reduced when shallow, detritus-rich sloughs associated with meandering streams are replaced with abrupt, monotypic interfaces between aquatic and terrestrial cover types (Sidorovich 1993, Sullivan 1996, Yamaguchi *et al.* 2003, Birnbaum 2006, Basu *et al.* 2007, Reid & Helgen 2011, Iordan *et al.* 2012).
The availability of den sites used for concealment, shelter and litter rearing is known to limit population density. The more preferred den sites are log jams, hollow tree trunks, cavities between tree roots and abandoned beaver, muskrat or rabbit burrows located nearby water (Allen 1989, Halliwell & MacDonald 1996, Yamaguchi et al. 2003, Harrington & MacDonald 2008).

*D/ Food habits*[4]

**American mink are opportunistic predators with a high feeding plasticity; they are almost exclusively carnivorous.** They are excellent swimmers and pursue both aquatic and terrestrial prey. American mink diets vary with season, habitat, and availability of prey. Both in their native and in their introduced range, they feed on rodents, fish (e.g. bleak and pumpkinseed), birds (mostly waterfowl), frogs, salamanders, crayfish, clams, and insects. **Local specialization on specific prey like crayfish, frogs, muskrats or rabbits is often reported** (Allen 1986, Dunstone & Birks 1987, Dunstone 1993, Sullivan 1996, Ferreras & MacDonald 1999, Birnbaum 2006, Brzezinski *et al.* 2008, Garcia-Diaz & Lizana 2012).

*E/ Control agents*

In its native range, American mink mortality due to predators other than humans is not substantial. Occasional predators include red fox (*Vulpes vulpes*), lynx (*Lynx lynx*), gray wolf (*Canis lupus*) and great horned owl (*Bubo virginianus*) (Sullivan 1996). A similar situation is expected to occur in Europe.

Due to its larger size, the native Eurasian otter (*Lutra lutra*) behaves as a dominant competitor that may induce a shift of feeding niche of the American mink towards a higher proportion of terrestrial

[4] For animal species only.

prey items (Bonesi *et al.* 2004). Local reintroduction and recovery of the populations of the native otter are suspected to have precipitated the decline of feral mink populations in Britain (Bonesi *et al.* 2006, MacDonald *et al.* 2007).

Several diseases and parasites are known to affect population density in North America. **Aleutian disease** is of particular concern because it may cause acute, rapidly progressing pneumonia with high mortality rates and may be contributing to the long-term decline of native mink populations (Nituch *et al.* 2011). The disease has been reported to occur in some European countries without causing strong impacts on the dynamics of feral populations (Manas *et al.* 2001, Yamaguchi & MacDonald 2001, Fournier-Chambrillon *et al.* 2004). No data is available about its prevalence in Belgium.

*F/ Establishment capacity in Belgium*

Potential for future establishment of American mink is considered to be likely in Belgium as the species has strong adaptation capacities and suitable climatic conditions, habitats (e.g. water bodies and slow flowing rivers) and prey are encountered. In addition, numerous cases of establishment of minks escaped from fur farms have been observed in European countries (Bonesi & Palazon 2007). The establishment of the American mink may be favoured by a combination of factors: the decrease in the intensity of trapping campaigns as a result of muskrat eradication in Flanders (Stuyck 2011), the rareness of its native competitor, the Eurasian otter (Mcdonald et al. 2007), and the on-going efforts for amelioration of the pollution state of surface waters (Dumortier et al. 2005).

It is however unclear why minks are so rarely observed in the wild and have not yet established feral populations in spite of the presence of numerous mink farms and observations of occasional escapes both in Belgium and in the Netherlands (Bonesi & Palazon 2007).

*G/ Endangered areas in Belgium*

The most important factors for habitat selection are the presence of suitable prey followed by the availability of den sites. As in other European countries, wetlands with high densities of crayfish, fish, frogs, muskrats, rabbits and/or beavers are thought to be especially suitable for the establishment of feral mink populations (Yamaguchi *et al.* 2003, Bonesi & Palazon 2007, Garcia-Diaz & Lizana 2012). Areas suitable for the establishment of the American mink are widespread all over the country. Only landscapes characterized by highly degraded wetlands and riparian areas or resulting from dense conifer plantations or intensive agricultural activities are likely to be avoided.

The areas where the highest densities of American mink could occur are the lower part of rivers with good water quality, natural river banks and extensive wetlands as it can be found in the Kempen and the Southern part of Belgium. The high densities of prey species native from North America found in those areas like the signal crayfish (*Pacifastacus leniusculus*), the pumpkinseed (*Lepomis gibbosus*) and the muskrat (*Ondatra zibethicus*) are likely to facilitate mink establishment. The Maritime, Flandrian and Brabant districts are considered as suboptimal because of strong human density, building development and stream channelization, which have a negative impact on mink prey availability (Garcia-Diaz & Lizana 2012, Iordan *et al.* 2012).

Polecat is known to share similar habitat preferences, food resources and den sites with American mink; both species are often reported to jointly inhabit similar sites overall in Europe (Blandford 1987, Lodé 1993 & 1994, Sidorovich & MacDonald 2001, Bonesi & Palazon 2007, Harrington & MacDonald 2008, Brzezinski *et al.* 2010a). The current distribution of polecat probably gives a good idea of the potential range of American mink. Up to the recent past, the species was found at normal densities in the whole country and in neighbouring areas. However, population surveillance performed under Article 11 of the Habitat Directive indicates that polecats ecently turned into an unfavourable conservation status in Belgium due to a strongly decreasing population trend – although the species still remains present all over its former area (Louette et al. 2013 in prep., B. Manet, comm. pers. 2013).

Establishment capacity in the Belgian geographic districts:

| **Districts in Belgium** | **Environmental conditions for species establishment[5]** |
|---|---|
| Maritime | Suboptimal |
| Flandrian | Suboptimal |
| Brabant | Suboptimal |
| Kempen | Optimal |
| Meuse | Optimal |
| Ardenne | Optimal |
| Lorraine | Optimal |

**ESTABLISHMENT CAPACITY AND ENDANGERED AREAS IN BELGIUM**

**The American mink is likely to establish self-sustaining populations in Belgium because it has a very high adaptation capacity and appropriate climatic conditions, habitats and prey are encountered.**

### 2.1.5 Dispersion capacity

*Specify what is the rate of dispersal once the species is released or disperses into a new area. When available, data on mean expansion rate in introduced territories can be specified. For natural dispersion, provide information about frequency and range of long-distance movements (i.e. species capacity to colonise remote areas) and potential barriers for spread, both in native and in introduced areas, and specify if the species is considered as rather sedentary or mobile. For human-assisted dispersion, specify the likelihood and the frequency of intentional and accidental movements, considering especially the transport to areas from which the species may easily colonise unintended habitats with a high conservation value.*

*A/ Natural spread*

*Home range*

In favourable habitats, American mink reaches high densities with several individuals per kilometre of shoreline and tend to use a core area nearby water. However, when prey are scarce, they may

[5] For each district, choose one of the following options : optimal, suboptimal or inadequate.

extend their home range up to 6 kilometres of shoreline. They move to another den and core area several times a season (Dunstone 1993, Sullivan 1996, Bartoszewicz & Zalewski 2003).

*Dispersal distances*

**Juveniles are known to disperse over distances of 10-50 km from their natal home range** in a few days in autumn to search for suitable territories free from other mink, with higher dispersal distances recorded for young males. They can be observed far from water during the mate and during this dispersion period (Mitchell 1961, Gerell 1967 & 1971, Van Den Berge & De Pauw 2003, Yamaguchi & MacDonald 2003, Bonesi 2006, Nituch *et al.* 2011, Iordan *et al.* 2012).

*Expansion rates*

The good dispersal capacity of the American mink has allowed it to colonise entire countries from a few introduction points in several decades (Bonesi & Palazon 2007, Brzezinzki *et al*. 2010). At a regional level the observed linear expansion rate from single introduction points is between 3 and 10 km per year, with an **average value of 5 km per year** (Ruiz-Olmo *et al.* 1997, Fasola *et al.* 2011, Iordan *et al.* 2012).

*B/ Human assistance*

The natural dispersion capacity of the American mink is strongly enhanced by the development of fur farming activities, leading to frequent escapes in the wild. As a result, its establishment in a country is often the result of multiple releases into the wild (Hammershoj *et al.* 2005, Bonesi & Palazon 2007, Lecis *et al.* 2008, Zalewski *et al.* 2010). Multiple introductions are responsible for an increase of the observed expansion rate of the American mink up, with observed linear expansion rates between 10 and 20 km per year (Usher *et al.* 1986). The figure 4 illustrates the range expansion of *Neovison vison* in Great Britain from 1950 to 2010, leading to the colonisation of several thousands of square kilometres each year during the exponential phase of increase; it represents a combination of both natural and human-mediated dispersal.

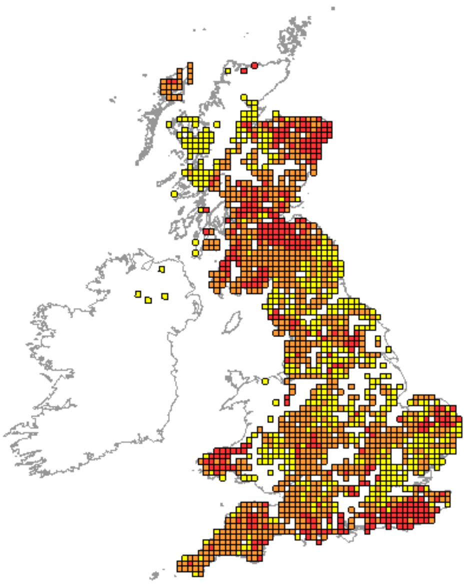

Figure 4: 10 km distribution map of *Neovison vison* in United Kingdom. Red = 1950 to 1969 (top), orange = 1970 to 1989 (middle) and yellow = 1990 to 2010 (bottom).
Source: NBN gateway.

**DISPERSAL CAPACITY**

**The American mink can easily spread naturally beyond introduction points and has the capacity to colonise most of the country in a few decades. It has a mean natural expansion rate of 5 kilometres per year, mainly due to the dispersal of juveniles away from their natal home range.**

## 2.2 EFFECTS OF ESTABLISHMENT

*Consider the potential of the non-native organism to cause direct and indirect environmental, economic and social damages as a result of establishment. Information should be obtained from areas where the pest occurs naturally or has been introduced, preferably within Belgium and neighbouring areas or in other areas with similar eco-climatic conditions. Compare this information with the situation in the risk analysis area. Invasion histories concerning comparable organisms can usefully be considered. The magnitude of those effects should be also compared with those caused by their closest native relatives.*

### 2.2.1 Environmental impacts

*Specify if competition, predation (or herbivory), pathogen pollution and genetic effects is likely to cause a strong, widespread and persistent decline of the populations of native species and if those mechanisms are likely to affect common or threatened species. Document also the effects (intensity, frequency and persistency) the non-native species may have on habitat peculiarities and ecosystem functions, including physical modification of the habitat, change to nutrient cycling and availability, alteration of natural successions and disruption of trophic and mutualistic interactions. Specify what kind of ecosystems are especially at risk.*

*A/ Competition*

Field studies performed in Belarus, Estonia, Finland, Poland, Spain and United Kingdom suggest that **interference and resource competition may favour feral American minks over native mustelids living in riparian habitats** (e.g. *Mustela herminea**[6], *M. lutreola* and *M. putorius**) and may induce shifts in their diet and habitat use and their local decline, especially during periods of limited food resources (Maran & Henttonen 1995, Maran *et al.* 1998, Sidorovich *et al.* 2000, MacDonald & Harrington 2003, Harrington & MacDonald 2008, Brzezinski *et al.* 2010a, Sidorovich *et al.* 2010, Melero *et al.* 2012). The decline of native mustelid populations may be very pronounced in the presence of the American mink in some instances (Maran *et al.* 1998, Sidorovich & MacDonald 2001, Melero *et al.* 2012), while coexistence at relatively high densities of *N. vison* and *M. putorius* has been also reported in other areas (Harrington & MacDonald 2008, Brzezinski *et al.* 2010a). Today, it is widely acknowledged that the American mink most likely played an important role in displacement and decline of the endangered European mink, *M. lutreola* and that the high frequency of the American species across Europe makes the efforts for European species recovery a very complicated task (Maran & Henttonen 1995, Maran *et al.* 1998, Sidorovich *et al.* 1999 & 2010).

*B/ Predation/herbivory*

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[6] * Indicates native species occurring in Belgium.

*Neovison vison* is a voracious predator which has been reported to kill more preys it can eat and wil store the surplus for further consumption (surplus killing), a habit displayed by many carnivores (MacDonald & Harrington 2003). **Predation by mink has been shown to be a major cause affecting survival and reproductive success of native prey species.** It has the potential to severely reduce the diversity and the density of numerous colonial ground nesting bird species breeding on sea islands (e.g. alcids, gulls, skuas and terns), leading sometimes to local species extinction. Removal of mink in those habitats always increases breeding bird densities, which provides a good experimental evidence of its impact (Craik 1997, Clode & MacDonald, 2002, Nordström *et al.* 2002 & 2003, Ibarra *et al.* 2009, Schüttler *et al.* 2009).

Strong negative impacts on prey populations (crayfish, salmonids, amphibians, waterfowl and rodents) have been also reported from wetlands colonised by American mink in Belarus, Czech Republic, Latvia, Lithuania, Finland, Poland, United Kingdom; however no evidence of a wide-scale threat to native species has been found in some countries (Denmark, Germany, Ireland and Sweden) (Bonesi & Palazon 2007). A significant detrimental impact of mink in mainland habitats has been highlighted on the breeding success and the abundance of the the crayfishes *Austropotamobius torrentium* (Fischer et al. 2009), the salmonids *Salmo salar** and *S. trutta** (Heggenes & Borgstrøm 1988), the common frog *Rana temporaria** (Ahola *et al.* 2006), of waterfowl (e.g. great crested grebe *Podiceps cristatus**, Northern shoveler *Anas clypeata**, garganey *Anas querquedula**, gadwall *Anas strepera**, tufted ducks *Aythya fuligula**, coots *Fulica atra**, moorhens *Gallinula chloropus**, and water rail *Rallus aquaticus**) (Ferreras & MacDonald 1999, Opermanis *et al.* 2001, Bartoszewicz & Zalewski 2003, Brzezinski *et al.* 2012), the water vole *Arvicola terrestris** (Woodroffe et al. 1990, Rushton et al. 2000, Aars et al. 2001, MacDonald *et al.* 2002, MacDonald & Harrington 2003) and the muskrat *Ondatra zibethicus* (Bartoszewicz & Zalewski 2003, Brzezinski *et al.* 2010b). Nest predation by American mink on riparian birds (*Alcedo atthis**, *Cinclus cinclus**, *Riparia riparia**) has been also documented in Ireland and United Kingdom (Smiddy *et al.* 1995, Smith 2006, Cummins *et al.* 2010). It is also known to exert a stronger predation pressure on grebes and small duck species than native carnivorous birds and mammals (Opermanis *et al.* 2001)

*C/ Genetic effects and hybridization*

Concern for hybridization between *Neovison vison* and the European mink *Mustela lutreola* has been raised several times. Both species differ in chromosome numbers and mating between the two mink species results in non-viable embryos. However, hybridization between these two species is not supported by any evidence (Birnbaum 2006).

*D/ Pathogen pollution*

Due to high animal densities and the frequent importation of new animals, mink farms often act as sources of infectious wildlife diseases like the transmissible mink encephalopathy or the highly pathogenic Aleutian parvovirus affecting minks and other mustelids (CFSPH 2008, Nituch *et al.* 2011). The latter is suspected to have been introduced in Europe via imported minks from America for the fur farming industry. It is often found in feral populations of American mink; **the virus is increasingly detected and may contribute to the population decline of several native carnivore species in France, Spain and United Kingdom but no evidence of lethal effects has been found in the wild so**

**far** (Manas *et al.* 2001, Yamaguchi & MacDonald 2001, Fournier-Chambrillon *et al.* 2004, Nituch *et al.* 2011).

*E/ Effects on ecosystem functions*

American mink may potentially impact vegetation dynamics through predation on herbivorous mammals (beaver, rabbit). Alteration of food webs is also likely to occur where high density of mink is found.

**ENVIRONMENTAL IMPACTS**

**Based on impacts observed in Europe, there is high confidence that establishment of feral populations of American mink in Belgium and neighbouring areas will contribute to the decline of native amphibians, waterfowl and rodents populations because of predation. Ramsar sites and other protected wetlands are especially at risk as they host numerous threatened waterfowl and amphibian species.**

### 2.2.2 Other impacts

*A/ Economic impacts*

*Describe the expected or observed direct costs of the introduced species on sectorial activities (e.g. damages to crops, forests, livestock, aquaculture, tourism or infrastructures).*

Mink can inflict economic damage to poultry runs, reared game birds and fisheries (Bonesi & Palazon 2007). From the few economic data available, **no huge cost whether through damage, control costs or hidden constraint has been identified**. However, in Britain, (i) mink is reported as the species most frequently associated with predator damages to domestic poultry; (ii) rare mass kill events are reported each year to individual holdings of pheasants and reared mallards and (iii) regular damage is reported on trout farms (but with a lower occurrence than for heron or cormorant) (Harrison & Symes 1989). Considerable damage to fish farming interest has been reported from Denmark, Germany, Poland and Outer Hebrides (Moore et al. 2000, Rheinardt et al. 2003, Birnbaum 2006). Prevention by trapping and proofing appear to be satisfactory solutions to most types of damage (Harrison & Symes 1989).

B/ Social impacts

*Describe the expected or observed effects of the introduced species on human health and well-being, recreation activities and aesthetic values.*

No specific social impact is expected to occur due to establishment and spread of American mink in Belgium.

## STAGE 3 : RISK MANAGEMENT

*The decision to be made in the risk management process will be based on the information collected during the two preceding stages, e.g. reason for initiating the process, estimation of probability of introduction and evaluation of potential consequences of introduction in Belgium. If the risk is found to be unacceptable, then possible preventive and control actions should be identified to mitigate the impact of the non-native organism and reduce the risk below an acceptable level. Specify the efficiency of potential measures for risk reduction.*

### 3.1 RELATIVE IMPORTANCE OF PATHWAYS FOR INVASIVE SPECIES ENTRY IN BELGIUM

*The relative importance of intentional and unintentional introduction pathways mediated by human activities should be compared with the natural spread of the organism. Make use e.g. of information used to answer to question 2.1.3.*

In the near future, immigration in Belgium of free moving animals coming from other populations established in Europe is unlikely because of long distances to be travelled (> 500 km) and/or the presence of natural obstacles to animal dispersion like sea or highlands with dense conifer forests. A much higher probability of entry and establishment in the wild is associated with the **presence of numerous farms, from which animals are frequently reported to escape** (Birnbaum 2006, Bonesi & Palazon 2007, Zalewski *et al.* 2009).

### 3.2 PREVENTIVE ACTIONS

*Which preventive measures have been identified to reduce the risk of introduction of the organism? Do they reduce the risk to an acceptable level and are they considered as cost-effective? Specify if the proposed measures have undesirable social or environmental consequences. Consider especially (i) the restrictions on importation and trade and (ii) the use of specific holding conditions and effect of prohibition of organism introduction into the wild.*

*(i) Prohibition of organism importation, trade and holding*

Strong restrictions on importation, trade and holding may be proposed to be adopted in areas where American mink is not yet established, as a mechanism to avoid the installation of mink farms from where *Neovison vison* could escape and establish feral populations in the wild. Preventing the establishment of mink farms would be indeed the most effective action, especially in areas where there are threatened native species that could be vulnerable to mink predation and competition. One may also envisage to license mink farming only in areas where the habitat is unfavourable to mink establishment, characterized by a scarcity of waterbodies and low abundance of mink prey (Bertolino & Genovesi 2007, Bonesi & Palazon 2007). To reduce the risk of accidental release, the development of new mink breeding farms should be avoided in Belgium, especially in districts where no farm is currently established.

The American mink may not be hold as a pet animal in Belgium due to the Belgian law on animal welfare (M.B. 03.12. 1986), which doesn’t necessarily mean that there is no illegal holding in the country. Awareness should be raised amongst the general public about the potential consequences of the illegal holding of this species.

*(ii) Use of specific holding conditions and effect of prohibition of organism introduction into the wild*

It is generally recommended in the scientific literature to improve fencing and increase the security in and around the breeding farms to reduce the risk for escapes and avoid the establishment of feral populations. Contingency plans for addressing escapes should be developed, including setting up (i) of a rapid communication between farmers and the competent authorities when animals escape from farms, (ii) of a surveillance system for recording presence and trapping minks around farms (see next section) and (iii) of emergency teams trained to use capturing methods. Early detection may be facilitated by the use of a survey method based on floating rafts that detects mink footprints and that can be used also to trap mink. A rapid response to escapes should be ensured (not longer than 24 hours), when most animals can be easily taken by hand or hand-nets (Reynolds *et al.* 2004, Bonesi & Palazon 2007).

Strong security measures have been imposed recently by Danish authorities (Executive Order of 19th July 2002 and Governmental Decree of 12th April 2006), e.g. use of high fences that are well buried in the soil (at least 50 cm below soil surface), uppermost 50 cm of the fence in a slippery material that prevents the mink from climbing, installation of life-traps in and around mink facilities, farm inspection by public authorities once every two years, etc. However, in spite of those regulatory measures, a majority of free-ranging minks collected in Denmark during the recent years still originate from fur farms which demonstrate that it is very difficult to prevent them for escaping. **As a consequence, it is considered unlikely that the adoption of security measures can reduce the environmental risk to an acceptable level** (Asferg 2010, Flindt-Egebak & Svendsen 2010).

Mink farming activities are currently allowed in Belgium providing that an environmental permit is issued by the regional authorities. No specific condition related to escape prevention is imposed in this regulation, which means that a permit may easily be granted for unsecured farms.

**Belgian regional nature conservation legislation strictly prohibits intentional release of American mink into the wild** as for other non-native species. In spite of current legal instruments, those events cannot be completely prevented.

## 3.3 CONTROL AND ERADICATION ACTIONS

*Which management measures have been identified to reduce the risk of introduction of the organism? Do they reduce the risk to an acceptable level and are they considered as cost-effective? Specify if the proposed measures have undesirable social or environmental consequences. Consider especially the following questions.*

*(i) Can the species be easily detected at early stages of invasion (early detection)?*

Due to the naturally low density of mink and their nocturnal and elusive nature, estimates of relative abundance for this species is difficult and usually rely on indirect methods. The use of track-recording rafts at the rivers' edge has however proved interesting as it allows to detect mink at low densities along linear riparian habitats with a limited amount of man power (Reynolds *et al.* 2004, Harrington *et al.* 2009). This device may be successfully used for early detection and intervention against minks in areas where mink farms are present but feral populations have not yet established in the wild, as it is the case in Belgium (Bonesi & Palazon 2007, Harrington *et al.* 2009). In Belgium and particularly in the northern region where traffic infrastructure density is extremely high, the systematic reporting (and collecting for necropsy) of traffic kills among mustelid species by an established network of volunteers gives an indicative picture of the presence and possible settlement of the species (Van Den Berge 2008, Van Den Berge & Gouwy 2009).

*(ii) Are they some best practices available for organism local eradication?*

It is possible to manage and eradicate American mink populations through **mechanical control (live- and kill-traps) along the banks of linear riparian habitats**. Live-trapping has been shown to be the most publicly acceptable, humane and successful control technique. Mink are relatively easy to catch, especially in autumn during juvenile dispersion, but removing the last animals is likely to be the greatest challenge as it is the case with many eradication campaigns (Moore *et al.* 2003, Harrington *et al.* 2009). Two techniques have however been found to increase mink trappability at low mink densities and to improve the efficiency of large-scale trapping programmes: the use of live-traps baited with mink scent glands (Moore *et al.* 2003, Roy *et al.* 2006) and the use of floating rafts on which traps are set after having found evidence of mink activity (Reynolds *et al.* 2004, Harrington *et al.* 2009, Reynolds *et al.* 2010). Dogs may also strongly enhance the efficiency of control programmes as they have proved very successful in locating active den sites and mink sign which had gone unnoticed by trappers (Moore *et al.* 2003).

*(iii) Do eradication and control actions cause undesirable consequences on non-target species and on ecosystem services ?*

Kill-trapping campaigns of American mink in Denmark have caused unintentional deaths of non-target animals such as polecats, stoats, weasels, as well as a number of rodents and birds (Birnbaum 2006, Flindt-Egebak & Svendsen 2010). However, the use of floating rafts and live trapping for mink removal strongly reduces unintended killing of non-target species. Live capture trapping is extremely time consuming, resulting in high costs to check the traps, unless SMS-transmitters are connected to them (Nordström *et al.* 2003, Reynolds *et al.* 2004, Harrington *et al.* 2009, Flindt-Egebak & Svendsen 2010).

*(iv) Could the species be effectively eradicated at early stage of invasion?*

The success of eradication actions highly depends on the size of invaded area and available resources and manpower. **Some actions carried out in small areas and in early stages of invasion have been considered as cost-efficient**; there have been successful mink eradication programs on some islands in Scotland and in the Baltic sea where re-invasion is easier to control (Moore *et al.* 2003, Nordstrom *et al.* 2003). American mink eradication from some continental areas at local or even regional scale has been considered as feasible by several authors. Between 50 and 200 trap-nights per kilometre of stream have been assessed as necessary to reach the eradication target, to be supplemented with alternative methods to kill the small percentage of individuals avoiding traps or living in very small streams (Zubergoitia *et al.* 2006, Harrington *et al.* 2009, Zabala *et al.* 2010).

Control actions of the American mink in invaded areas performed through live trapping combined with adequate awareness and education usually receive a high social support, which is an important prerequisite to eradication plans (Bremner & Park 2007, Zabala *et al.* 2010, Bryce *et al.* 2011). However, less support to mink trapping is provided by the general public in rat-infested urbanized and harbour areas in Denmark, where mink are supposed to play some role in the control of rat populations (Flindt-Egebak & Svendsen 2010).

**American mink is neither a protected species nor a game species in Belgium. In Wallonia and in Flanders, culling by hunters, private owners and foresters is allowed during the whole year, providing that a hunting permit is held** (see e.g. the ministerial guideline n°2688 on the control of non-native animal species in Wallonia).

*(v) If widely widespread, can the species be easily contained in a given area or limited under an acceptable population level?*

In the practice, nearly all large-scale eradication campaigns undertaken in European countries have been both very expensive (several EUR millions) and poorly effective, leading to the conclusion that a total eradication of mink is not possible at that scale (Reinhardt *et al.* 2003, Hammershoj 2004, Birnbaum 2006, Roy *et al.* 2006, Bonesi & Palazon 2007, Flindt-Egebak & Svendsen 2010). More encouraging results were however recently obtained in the Cairngorms National Park (Scotland) through an adaptive approach combining mink detection and trapping, initiated by scientists and implemented by voluntaries from local communities (Bryce *et al.* 2011).

Also, attempts to maintain their populations below a critical threshold may have less impact than expected due to density-dependent effects (compensatory natality or decrease in mortality) and will require to undertake permanent and prohibitive control programmes. Reducing mink density is more manageable where control is more localised, e.g. when removal trapping may be concentrated in areas of high ecological value to create sanctuaries with low American mink densities (McDonald & Harrington 2003, Bertolino & Genovesi 2007, Bonesi *et al.* 2007, Harrington *et al.* 2009).

## CONCLUSIONS OF THE RISK MANAGEMENT SECTION

**A natural immigration of the American mink to Belgium is unlikely to occur in the coming years as no large feral population is currently present in the immediate vicinity and its natural expansion rate does not exceed 10 km per year. On the other hand, the presence of breeding farms and holding by pet owners represent a high risk for future establishment in the wild as minks are reported to escape easily from captivity.**

**It means that the risk of entry and future establishment in the wild of the American mink could be significantly reduced through restriction measures on importation, trade and holding conditions in breeding farms. Establishment of mink farms should not be allowed in districts deprived of existing farms. Strict rules on facilities should be imposed as soon as possible where mink farms are already established, e.g. taller and better fences, placement of mink traps around the farm perimeter, inspection of breeding facilities by public authorities, etc.**

**At last, contingency plans and surveillance systems should be established in the areas where breeding farms are present, so that minks can be rapidly killed after accidental escape or release by animal right activists.**

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**Cellule interdepartementale**
**Espèces invasives**

La CiEi est chargée depuis novembre 2009 de coordonner les actions visant à limiter les dommages causés par les espèces invasives en Wallonie. Ses activités se fondent sur l'engagement du Gouvernement wallon à prévenir l'installation de nouvelles espèces invasives et de lutter contre celles dont la prolifération pose problème

http://biodiversite.wallonie.be/invasives
Email : invasives@spw.wallonie.be

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DGO 3