

Future challenges for European mink conservation

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Content

- Present situation:
 - *Ex situ*
 - *In situ*
 - Policy
- Future challenges
 - *Ex situ*
 - *In situ*
 - Policy





Present situation *ex situ*

Demography



Table 2. Demographic status of the EEP under the assumption that the Spanish European mink Association will become a non-EAZA EEP participant, current to 30 April 2017.

	Population size (N)* ₁	Institutions* ₂
Total population	140.127.0 (267)	25
Eastern population	118.102.0 (220)	17
Western population	22.25.0 (47)	8

NB! Part of institutions managed under Euronorz

*₁ Current population size shown as Males.Females.Unknown Sex (Total). *₂ Institutions currently holding individuals.



European mink EEP report 2017



Institution	Status (2017-01-01)			Births			DNS			Transfer EAZA in			Transfer EAZA out			Transfer Non-EAZA in			Transfer Non-EAZA out			Deaths			Status (2017-12-31)		
	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U
Ahtari	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Bojnice	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0
Calviac	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	2	0	
Chomutov	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
Decin	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
Euronorz	30	28	0	10	7	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	3	11	35	32	
Helsinki	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	
Kerkrade	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
Pavlov	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	
Poznan	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	
Ranua	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
Riga	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	3	0	
Tallin	62	47	0	12	23	0	0	0	0	0	0	1	0	0	0	0	0	22	3	0	3	6	0	48	61	0	
Zoodyssee	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	5	3	0		
	115	95	0	22	30	12	0	0	0	1	0	0	1	0	0	0	0	22	3	0	11	13	11	Total			
																								104	109	1	
																								Cross-check			
																								104	109	1	

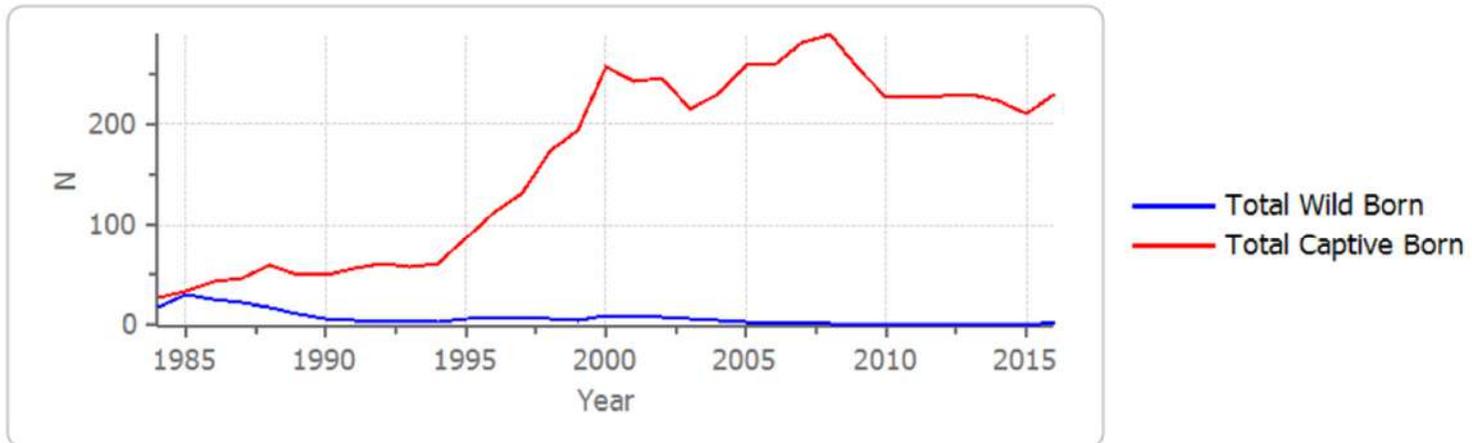


Figure 1: Census by origin, for the Eastern European mink population since 1984.

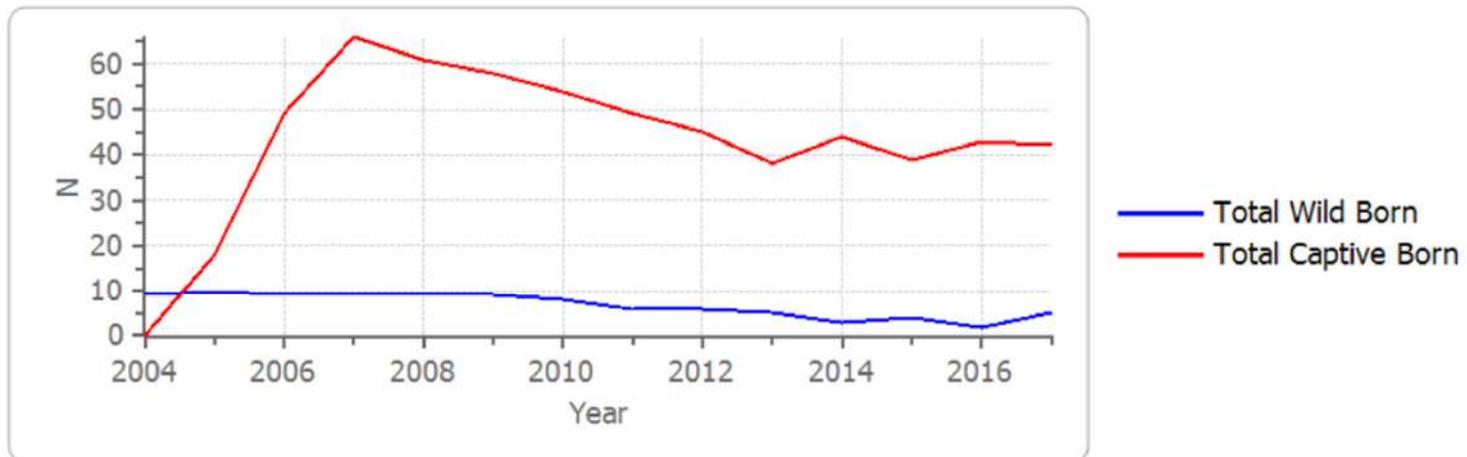


Figure 3: Census by origin, for the Western European mink population since 2004 when the population was established.

Age Distribution in Eastern and Western program

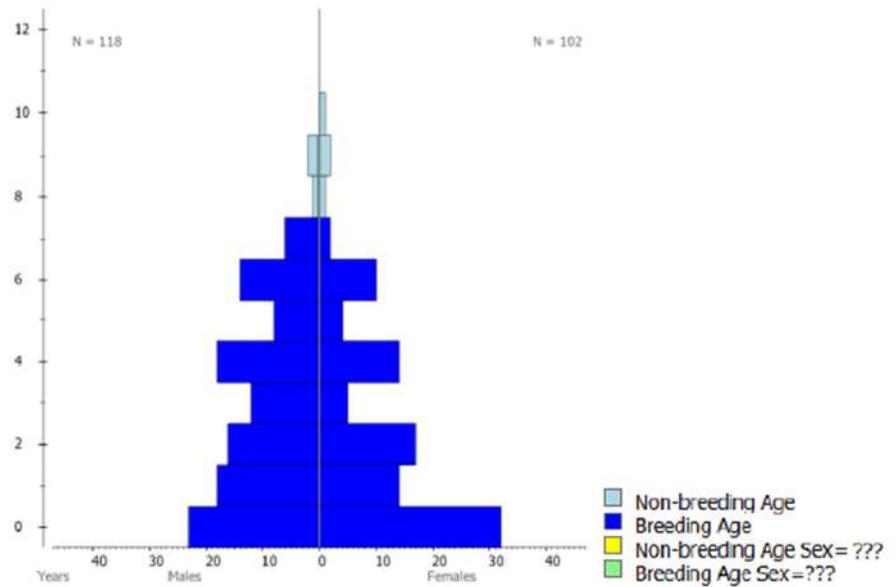


Figure 7: Age distribution of the Eastern population of European mink.

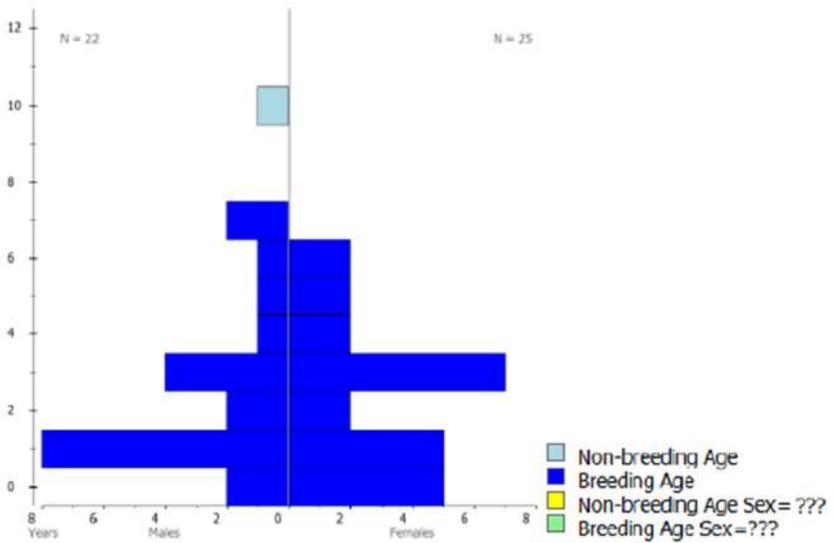


Figure 8: Age distribution of the Western population of European mink

Table 3. Annual births and deaths in the EEP in the Western population in the last five years.

Western population					
Year	2012	2013	2014	2015	2016
Births	4	4	13	10	12
Deaths	10	12	10	15	9
Number of births per year needed to maintain the population at the current size* ₁					7

*₁ For projections "Birth Flow" in PMx settings was changed from "Continuous" to "Pulse".

Table 2. Annual births and deaths in the EEP in the Eastern population in the last five years.

Eastern population					
Year	2012	2013	2014	2015	2016
Births	114	120	143	95	90
Deaths	39	52	65	47	49
Number of births per year needed to maintain the population at the current size* ₁					40

*₁ For projections "Birth Flow" in PMx settings was changed from "Continuous" to "Pulse".

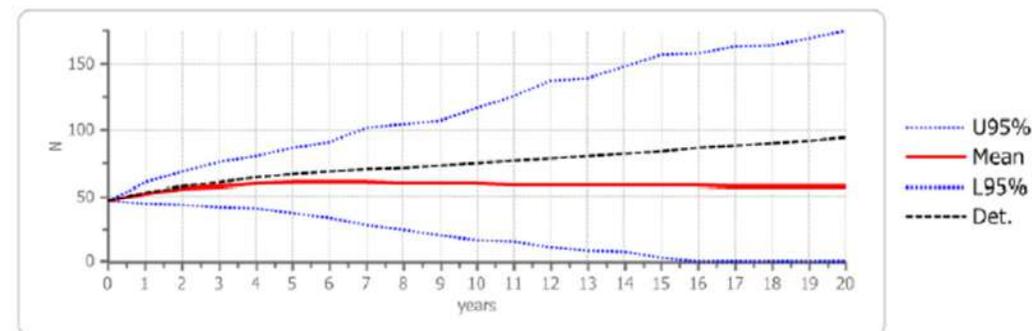


Figure 10. The expected development of the Western population based on the current population parameters, assuming there are no reintroductions and no population size limit. For projections "Birth Flow" in PMx settings was changed from "Continuous" to "Pulse".

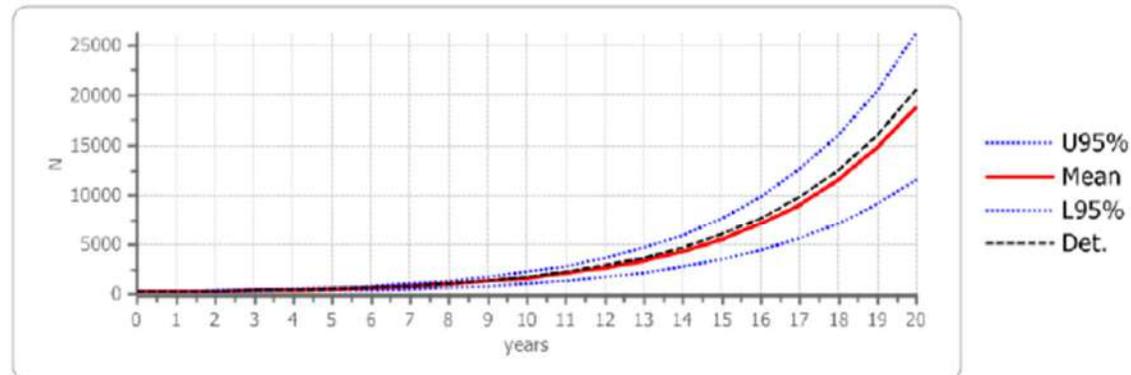
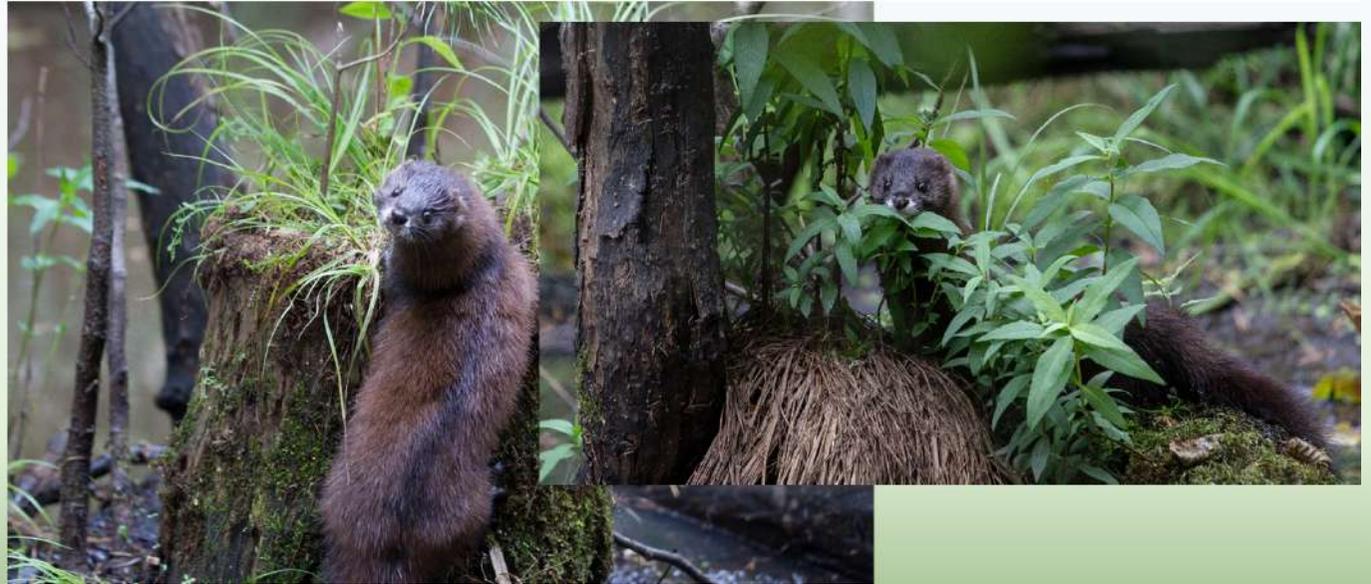


Figure 9. The expected development of the Eastern population based on the current population parameters, assuming there are no reintroductions and no population size limit. For projections "Birth Flow" in PMx settings was changed from "Continuous" to "Pulse".





Present situation *ex situ*

Genetics: Spanish and EEP population combined



Analytical overlay – assumptions for calculations

- To calculate the **population genetic parameters of the Western population**, an analytical overlay was used, assigning a **kinship of 0.375** between **all founders originating from the Spanish wild population**. This was done because molecular genetic data of wild European mink populations suggests that the Spanish wild population is less genetically diverse than the Russian wild population (**Cabria et al. 2015**). The EEP aims to verify these molecular genetic results.



Table 5. Genetic status of the European mink EEP population as of 30 April 2017, under the assumption that the Spanish European mink Association will become part of the EEP.

	Eastern* ¹		Western* ²		Total* ³	
	Current	Potential	Current	Potential	Current	Potential
Founders	23	0	12	4	35	4
Founder genome equivalents (FGE)	7.3	11.6	1.18	1.5	8.3	13.1
Genetic diversity (GD)	93.2%	95.7%	57.5%	62.5%	94.0%	96.2%
Population mean kinship (MK)	0.068		0.425		0.060	
Mean inbreeding (F)	0.079		0.364		0.136	
Pedigree known before assumptions and exclusions	91.2%		100%		92.8%	
Pedigree known after assumptions and exclusions	91.9%		100%		93.4%	
Effective population size/census size ratio (Ne / N)	0.283		0.073		0.258	
Projections						
Years to 90% Gene Diversity	11		-		16	
Years to 10% Loss from Current Gene Diversity	To 83% GD in 38 years		To 47.5% in 4 years		To 84% in 43 years	
Gene Diversity at 10 generations from present* ⁴	87.3%		16.6%		88.6%	
Gene Diversity at 100 Years from present	69.3%		0.7%		72.8%	

- Eastern population relatively healthy ($F=0,079$ & $GD= 93,2\%$)
- Western population ($F= 0,364$, $GD=57,5\%$, to be increased to $62,5\%$)
 - Western population more inbred than full siblings !



Western and eastern populations combined

- 94.0%, with a potential genetic diversity of 96.2%.
- With populations growth to 330 ind only **72,8% GD maintained for 100 years**
- To increase the maintained GD – three options:
 - Continuous addition of new founders
 - Cryopreservation of gametes, stem cells ect.
 - Exchange animals with the reintroduced populations



European mink long-term management plan

- One-plan approach (ex situ+in situ) - analyses
- Planning meeting in Ploiesti, Romania 11 – 12 May 2017
- 12 attenders: EAZA office, Estonia, Spain, France, Romania, USA
- LIFE NGO funding
- Road-map for EEP for future
- Analyses situation and makes conclusions, formulates roles

**Long-term Management Plan
for the
European mink
(*Mustela lutreola*)**
European Endangered Species Programme (EEP)



EEP coordinator

Tiit Maran, Tallinn Zoo

Population Biologists

Elmar Fienieg and Kristine Schade, EAZA Executive Office

8 November 2017



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Already outdated



Future roles of the European mink EEP

- Maintain a **genetically diverse, demographically healthy and behaviourally competent population** as a back-up.
- Encourage, support and endorse **restoration and establishment of viable wild populations**.
- **Integrate *in situ* and *ex situ* conservation** activities to the benefit of both.
- Use **European mink as flagship** species for disappearing **small stream** and river ecosystems in Europe.
- Educate public about the plight of the European mink and the damage caused by American mink.
- Support **conservation research** on the European mink and encourage public and research institutions to become involved in this. By **collecting biomaterials**, the EEP also aims to facilitate research in the future.
- Lobby the EU and increase the awareness of other decision makers **to produce legislation and policies that favour the conservation status of the European mink**.



Pilot trial before combining Spanish and EEP population: trial breeding

- Experimental cross breeding of the European mink from east and west:
 - Three females sent from Tallinn to Spain and from Spain to Tallinn in 2018
 - No breeding in Spain
 - Two females delivered young:
 - 1 pup and 4 pups
 - Continues in 2019



Pilot trial before combining Spanish and EEP population: genetics

NB! Study underway, not completed !!!!

- Genetic diversity analysis between eastern and western captive population
- 206 samples
 - Mitochondrial DNA (mtDNA), autosomal and chromosomal DNA microsatellites
 - Actions:
 - Collection and transport of samples (completed)
 - DNA extraction (completed)
 - Selection of DNA markers and subsequent laboratory analysis (completed)
 - Amplification of sequences by PCR (to be finalized)
 - Analysis of the data (underway)



Pilot trial before combining Spanish and EEP population: genetics

Population	Origin	Faecal samples	Hair samples	Blood samples	Sample size
Eastern	Tallinn Zoo	87	11	7	105
	Ähtäri Zoo	-	1	-	1
	Ranua Zoo	-	2	-	2
	Riga Zoo	-	7	-	7
	Chomutov Zoo	-	1	-	1
	Decin Zoo	-	2	-	2
	Pavlov Zoo	-	2	-	2
	Poznan Zoo	-	2	-	2
	Zoodyssee	-	10	-	10
	Otter-Zentrum	-	5	-	5
	Euronertz	-	16	-	16
	Total		87	59	7
Western	Tallinn Zoo	3	-	-	3
	Alava	-	3	-	3
	FIEB	-	16	-	16
	Pont de Suert	-	12	-	12
	Sendaviva	-	2	-	2
	Zoo Madrid	-	2	-	2
	Zoobatanico Jerez	-	2	-	
	Salburua	-	7	-	7
	La Alfranca	-	3	-	3
	Merles	-	3	-	3
	Total		3	50	-
All individuals		90	109	7	206

Pilot trial before combining Spanish and EEP population: genetics

- 13 markers:
 - 2 mtDNA markers
 - 11 nuclear, microsatellite markers
- Total No of alleles: 48
 - 47 on eastern population
 - 25 in western population (only one unique allele)
- Allelic richness in the east 4,042 and 2,269 in the west
- Heterozygosity: Eastern - $H_e=0,469$, Western - $H_e=0,324$
- F_{is} (inbreeding coefficient) values not significant for western population



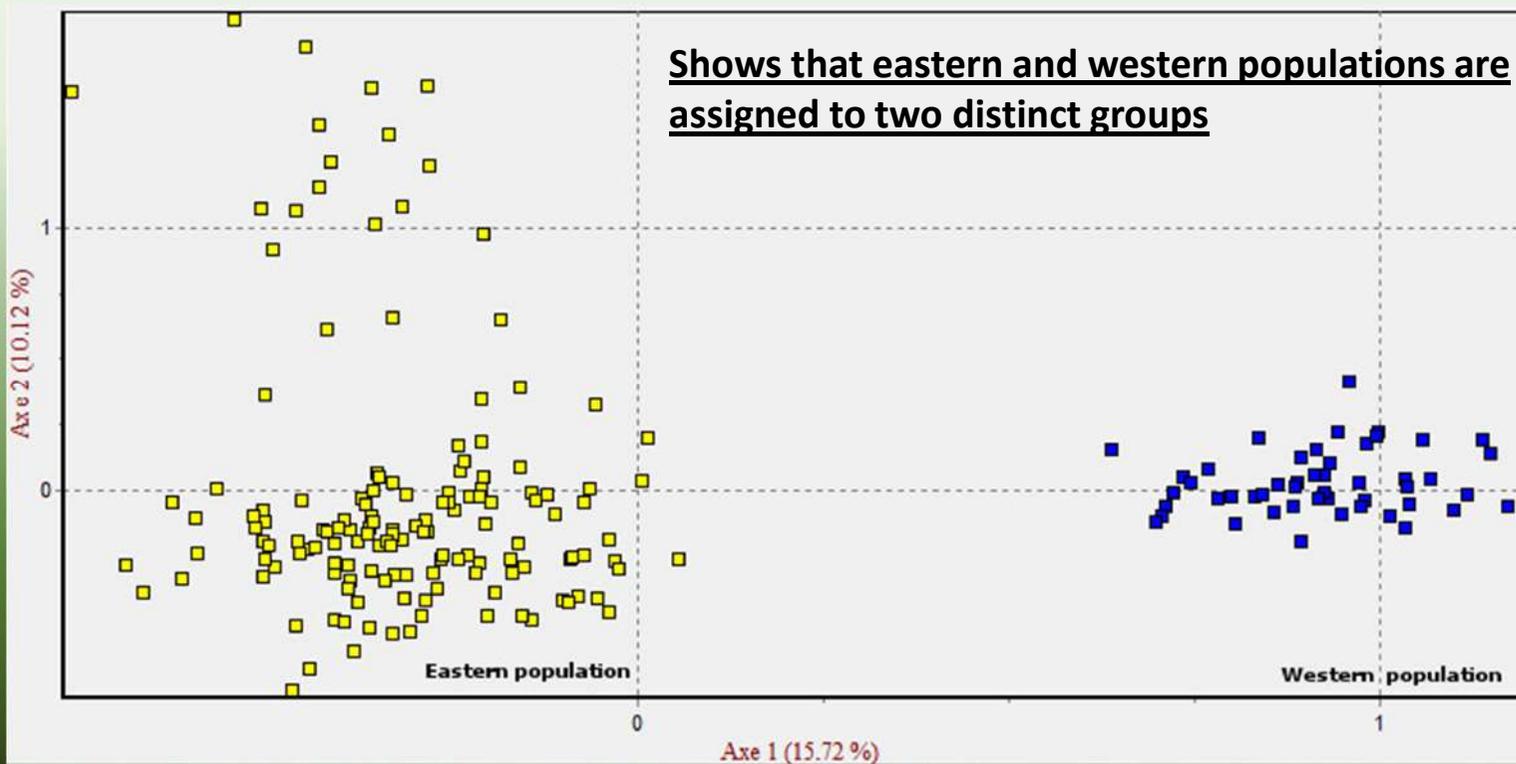
Pilot trial before combining Spanish and EEP population: genetics

- Genetic bottleneck – no evidence in three mutation models
- Not enough markers !!!! Need for study of genome ..



Pilot trial before combining Spanish and EEP population: genetics

Genetix - principal components analysis (PCA).



Western population has only one unique allele



- Very provisional results
- Mostly confirms Cabria et al results
- Not enough markers
- Most important result to achieve is to have comparison of gene diversity between east and west in the form possible to feed into PMX model
- Currently available markers will not be sufficient of solid conclusions
- Need to study the full genome of the European mink



In situ status



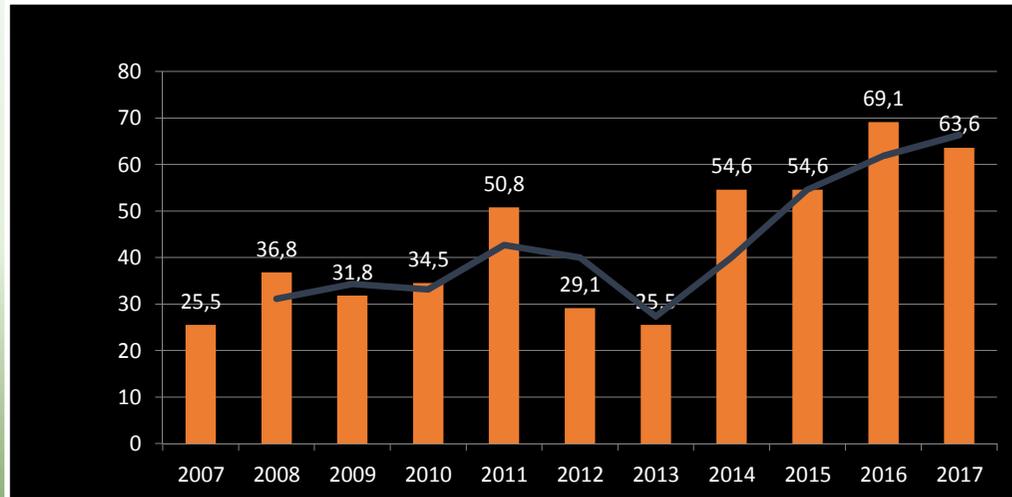


ESTONIA

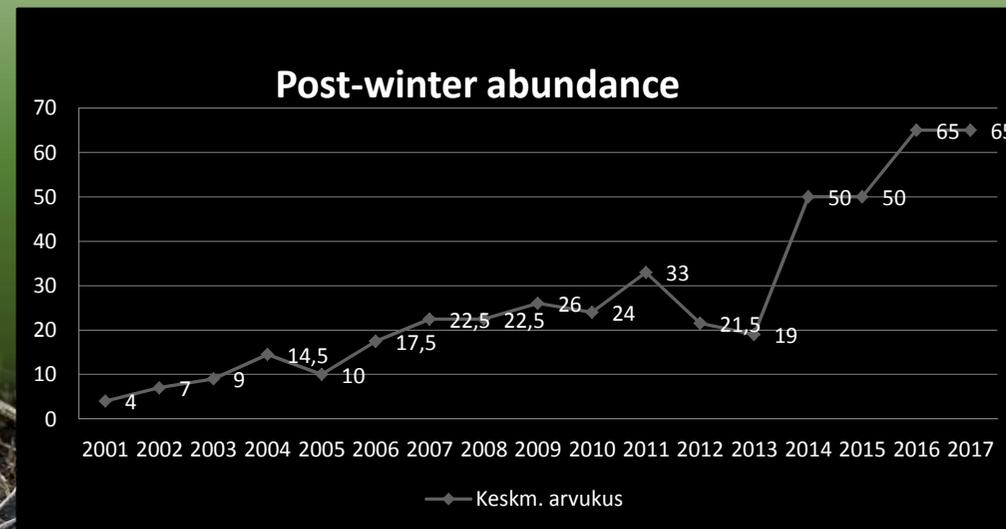
In situ status



- Monitoring in Hiiumaa Island in 2017



- No release in 2017 & 2018
- Most of the trapped mink wildborn



Genetic comparison of island population and *ex situ* population

- Is the island population genetically less diverse than *ex situ* population?
- Study done in the lab in Tallinn Zoo
- Samples: 22 from island & 64 from Tallinn Zoo
- Results:
 - some haplotypes studied are less frequent or missing
 - Inbreeding is not higher in island population
 - The action to increase the genetic diversity might be merited.



2018 in Hiiumaa Island



Exceptional draught

In 2018:

- Fish gone
- Small mammal abundance very low

Plans:

- Release mink in 2019 if needed
- Start action in Saaremaa Island

FRANCE

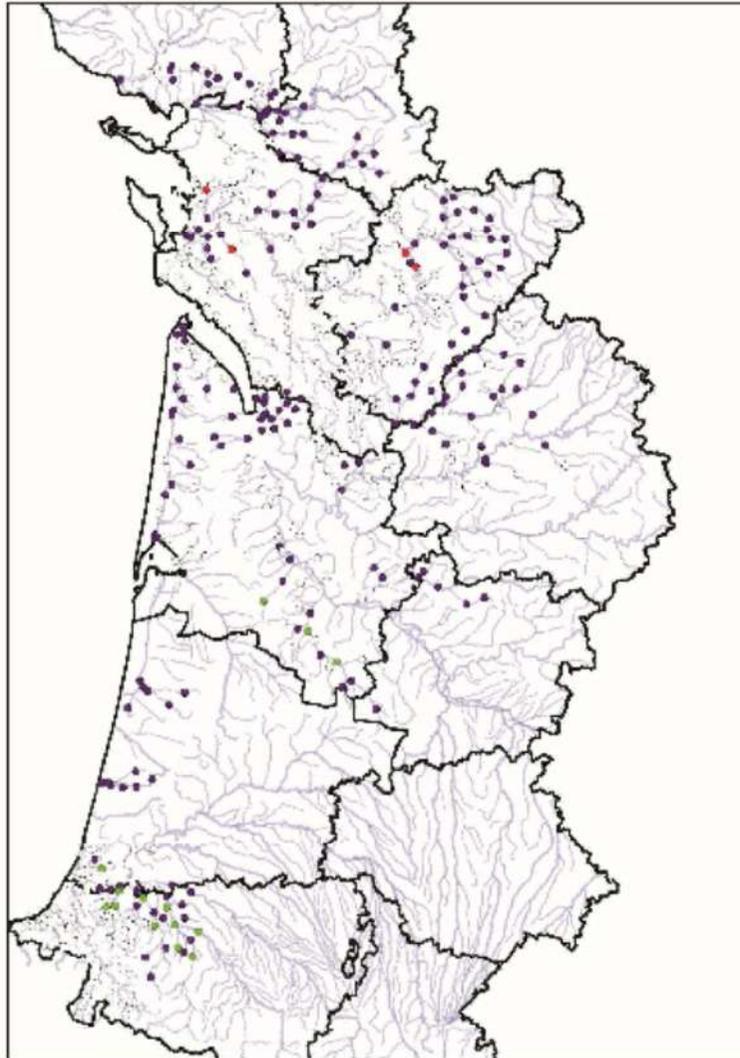
In situ status



Prospections

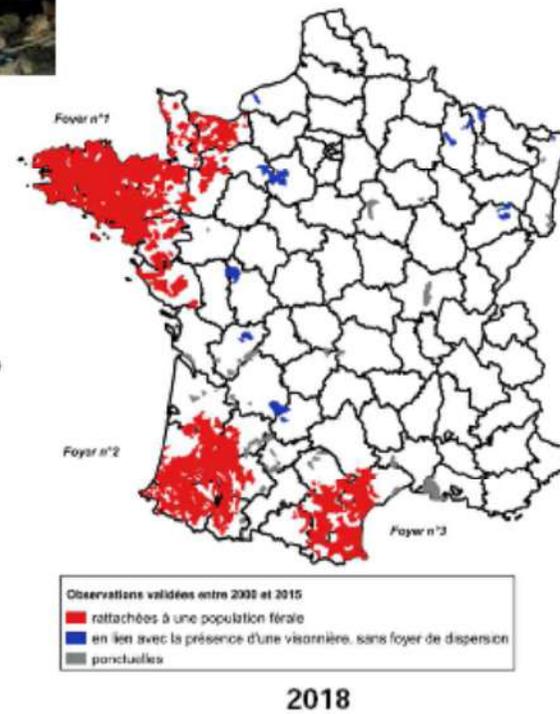
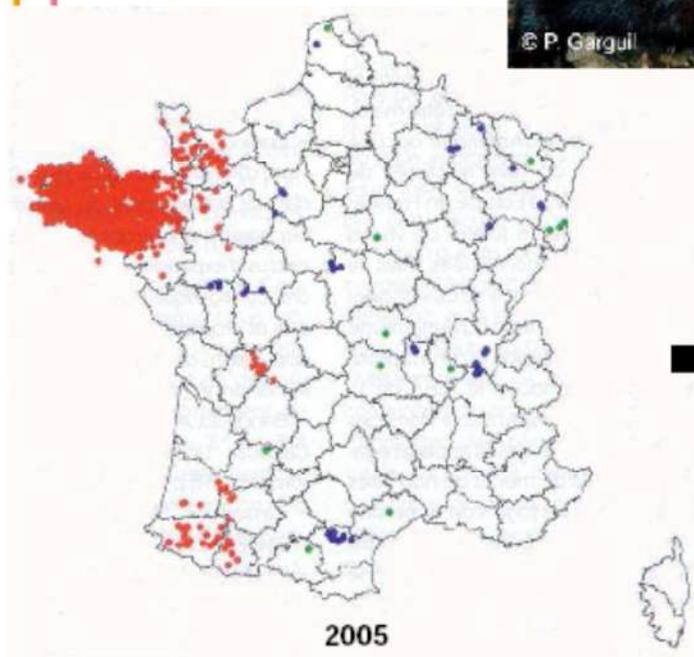
Results (Oct. 2016 - March 2018)

- Negative trapping
- 9 trapping E. Mink
→ 2 ♂ et 1 ♀ in 2017
→ 2 ♂ et 4 ♀ LIFE-LPO in 2018
- 16 trapping A. Mink in 14 campaigns
- Still not done (42%)



Fight against threats

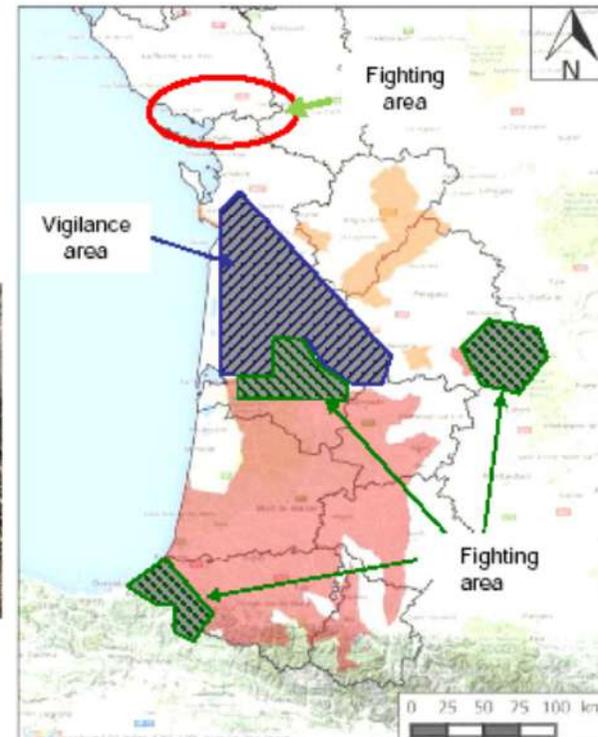
Range of American Mink in France



Fight against threats

Strategy to fight against wild A. Mink

Mink rafts network in the North and South of A. Mink range



ROMANIA

In situ status



European mink in Danube

- IUCN SCSG mission in 2014
- Estimate of the population size **1000 -1500 ind.**

Most viable population in the world



Shifting mink-farms

Mink farming prohibited in UK (2000) and in the Netherlands (2013)

>>>>> inflow of capital for mink-farming into Spain, Poland, Baltic countries and Romania.

Shift to countries with weaker regulations, but more biodiversity



...the danger is looming
not far

***American mink invasion - almost
impossible to reverse once reality***



- May 2017 – EAZA TAG European mink meeting in Romania – suggestion to make EMINK WG
- Increase awareness and interest to action among NGOs
- No clear conservation actions yet
- European mink Romanian working group established:
 - Headquarter in Brasov Zoo
 - Contact the Ministry of the Environment: ToR
 - Contact National Veterinary Agency: review of mink farming
- 28th of December second meeting



RUSSIA

2015: of 16 regions with mink in 12 the mink is expected to disappear in 12 regions

In situ status

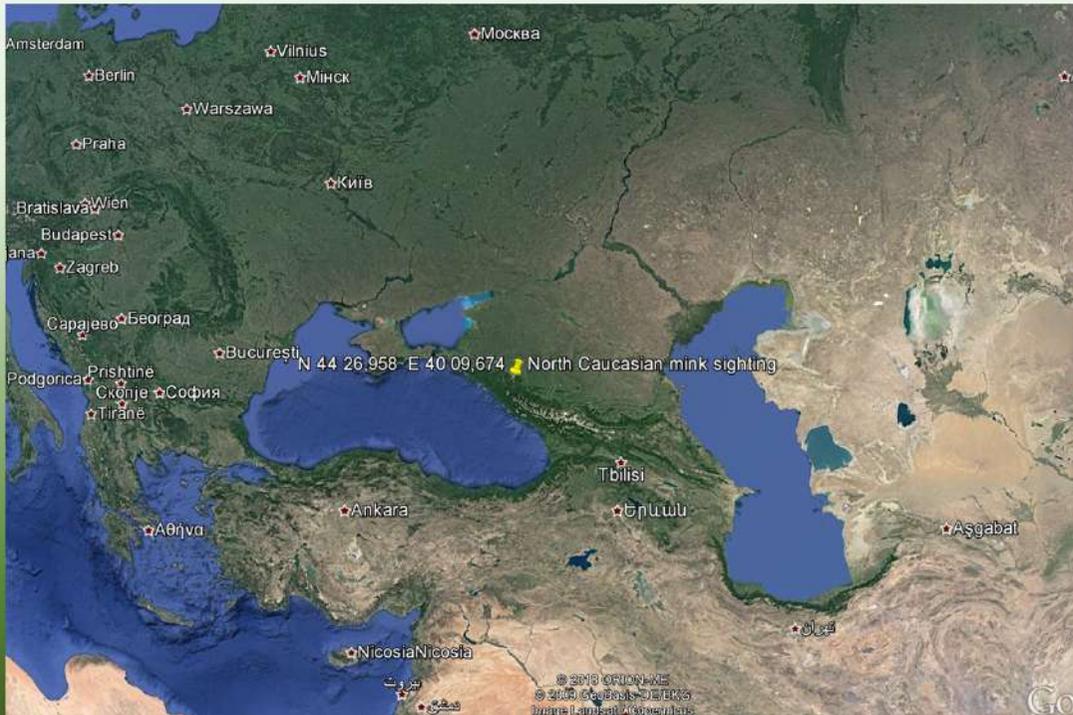


Status – Redlist assessment 2015

- In 61 regions (subcountry units) within the species's historical range it is extinct or believed to be extinct (**40 regions, 66%**).
- In seven regions the species is known to be extant, and in nine regions is believed still to survive.
- From those only in 12 regions is European Mink expected to survive for longer than 10 years.
- The American Mink is now present within the whole remaining range of the European Mink, although it may be absent or very scarce in Northern Caucasus and in the north

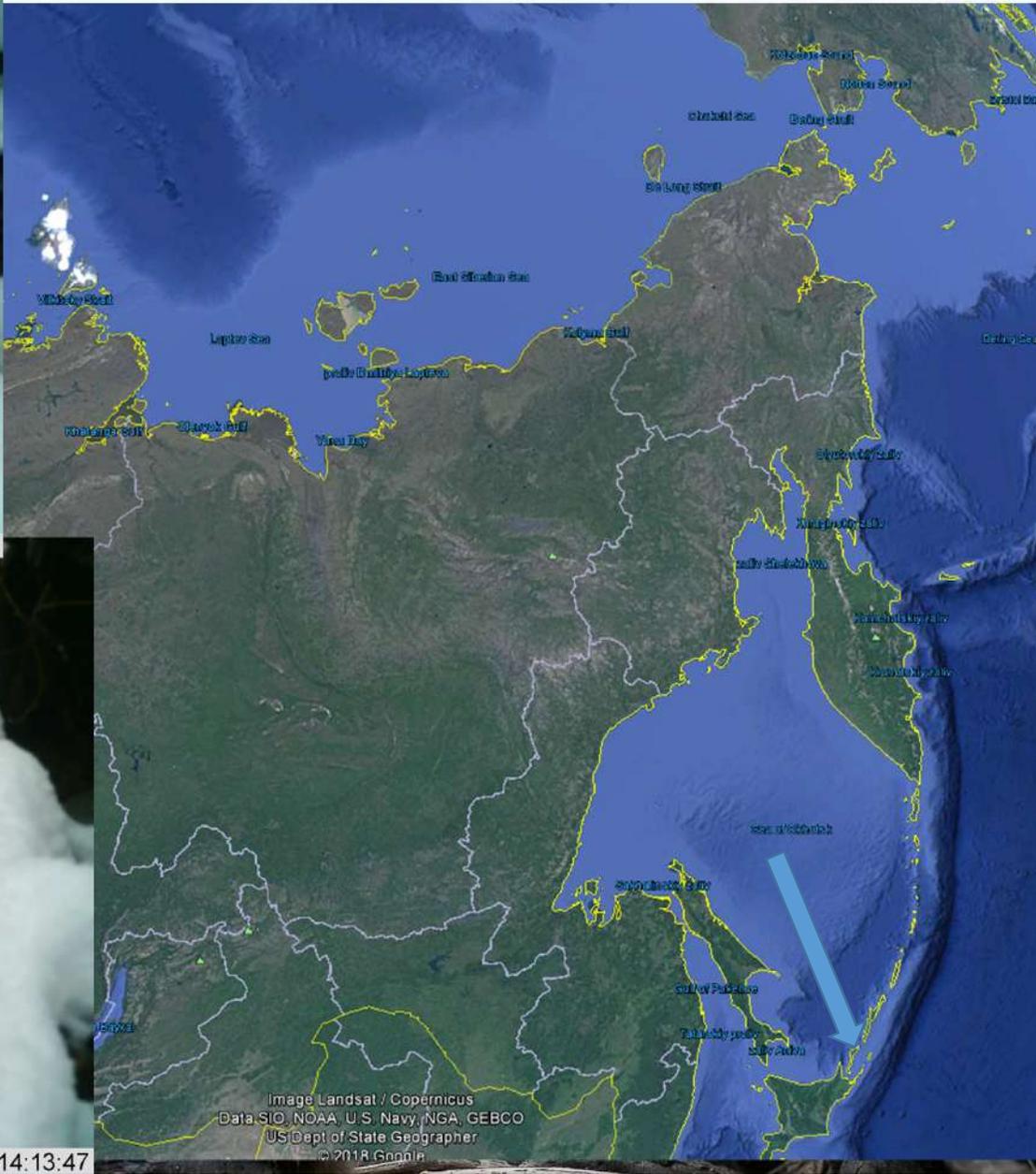


New evidence from North-Caucasia



Two animals: DNA samples in Tallinn DNA lab





GERMANY

In situ status



Lower-Saxony in Germany – Steinhuuder Meer



Timeline

2010: 12 mink released (9♂, 3♀)

2011: 31 mink released (17♂,
14♀)

2012: 21 mink released (7♂,
14♀)

So on



News in 2015: First trailcamera image of wild born mink in Germany !!!!



Release stopped





Policy issues: status



- No All-European plan for European mink
- No coordinated actions between Memberstates
- No political will for actions in Romania
- No political will for actions in Russia and in the Ukraine



Recent advances:

- European mink critically endangered in Spain and in France
 - Obligations to the government



2015, January 1st: EU Invasive Alien Species Regulation entry into force

- Core of the system is the “**list of IAS of Union concern**”



EU Invasive alien species – actions to get American mink into list

- Preparation of the Risk-assessment:
 - 25 experts all over Europe
 - Preparation over a year (unpaid!)
 - Consensus
 - > 60 page document
- Actions to get it tabled in European Commission
- In 2017, it was tabled
- European Commission postponed adding species into the list till 2019 spring
- Bad news for Romanian population of European mink.



Photo Remek Meel

Future challenges in *in situ* conservation



Romania

Future challenges in *in situ*
conservation



Danube population

- Need for good survey on the status on European mink: no well-designed monitoring methodology
- Survey the presence of Carpathian population
- Prohibition of mink-farming
- Breeding operation
- Effective, supported and respected **European mink Working Group**
 - **IUCN**
 - **European Commission**
 - **EAZA**
- Strong actions expected from IUCN SSC



**Spain -
France**

Future challenges in *in situ*
conservation



- Long-term effective American mink control
- Mink monitoring: both species
- Conservation breeding to be incorporated into EEP
- Planned Re-introductions ?
- Public awareness



Russia

Future challenges in *in situ*
conservation



- Survey of European mink status in
 - North Caucasia and
 - Kunashir Island - Kuril Archipelago
- Promote the start of captive breeding program in EARAZA



Estonia

Future challenges in *in situ*
conservation



- Habitat improvement in Hiiumaa Island
- Release operation in Saaremaa Island



Future challenges in *ex situ* conservation



- Merging Spanish and EEP population: research and political issues...
- Establishing EEP subpopulation structure
- Increasing number of committed facilities with > 10 mink
- Increasing interest in keeping mink in Zoos
 - Developing training techniques to make mink more visible for visitors
- Solving problem of inefficient males in breeding:
 - Behavioral research
 - Biobanking
 - Cryopreservaton of stemm cells



- Adding founders:
 - Romania
 - Spain
 - Russia
 - France
- **Joint management of *ex situ* populations and *in situ* populations:
How?**



Major concerns:

- Lack of all-European approach
- No ALL-European Action plan
- No collaboration between governments for conservation of European mink
- Lack of policy instruments for international collaborations between countries



Future challenges in policy



Invasive species Regulation

- Getting the American mink into the list of species of community concern
 - EU minimum standards for farms - to reduce likelihood of escapes
 - „Polluter pays principle“
 - escapees from farms = pollution
 - elaboration methods to identify the origin of feral mink
 - Identification of ecologically sensitive areas, where mink-farming must be prohibited
 - Eradication programs in biologically sensitive areas

Convention on the Conservation of Migratory Species of Wild Animals

- Adding European mink into Appendix II
 - which **require international agreements for their conservation and management**, as well as those which have a conservation status which would significantly benefit from the international cooperation that could be achieved by an international agreement.





Thank you