The importance of the marine ecosystem to the American mink

Rannveig Magnúsdóttir[1,2], Menja von Schmalensee[1,2], Róbert A. Stefánsson[2], Kirsten Liden[3], & David W. Macdonald[4]

1) Faculty of Life and Environmental Sciences, University of Iceland, 2) West Iceland Nature Research Centre, Stykkishólmur,

3) Archaeological Research Laboratory, Stockholm University, Sweden, 4) Wildlife Conservation Research Unit, University of Oxford, UK

Introduction

- The invasive American mink (*Neovison vison*) in Iceland is a generalist carnivore, considered to select prey mostly based on its frequency and availability.[1,2]
- Mink population size in Iceland seems to have peaked around 2003, but decreased dramatically after that (Fig. 1).[3]
- Stable isotopes in mink tissue can reveal information on the relative importance of prey of marine vs. terrestrial/freshwater origin.[4,5]

Aims

- To measure the proportion of mink prey of marine vs. terrestrial/freshwater origin.
- To explore if mink diet can shed some light on the dramatic decrease in mink numbers in recent years.

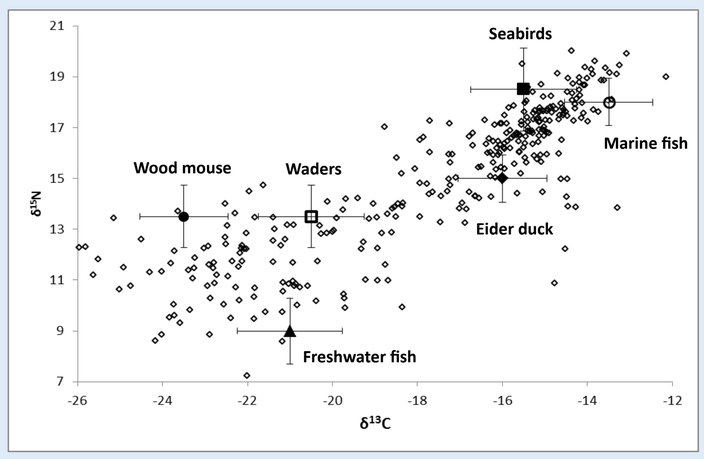

Figure 2. *Stable carbon and nitrogen isotope signatures for all mink and prey species (with standard deviation) in the Snæfellsnes Peninsula , W-Iceland, 2001-2009. High $\delta^{13}C$ values indicate marine diet, whereas low values indicate prey species of freshwater or terrestrial origin.*

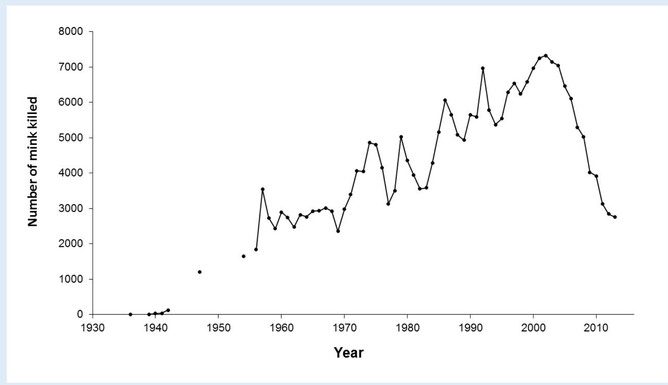

Figure 1. *The annual number of mink killed in Iceland in 1937-2014, indicating a drop in population size after 2003.*

Materials and methods

- Tissue samples were collected from 317 mink carcasses (165 males and 152 females) obtained from mink hunters in the Snæfellsnes Peninsula, W-Iceland, in the years from 2001-2009.
- Stable isotope analysis was conducted on the mink samples for $\delta^{13}C$ and $\delta^{15}N$ as well as on main prey species.

Results and discussion

Marine vs. terrestrial prey

The overall population was characterised by a continuous gradient between the two extremes (diet of terrestrial/freshwater vs. marine origin). However, the overwhelming importance of diet of marine origin to the majority of mink also came clear, as 72% of males and 64% of females had marine $\delta^{13}C$ values between -18 and -12 (figure 2 and 3).

Trophic cascade

The crash of the mink population occurred almost simultaneously with a severe breeding failure of many seabird species. Since seabirds only make up a small fraction of mink diet,[2,3] it seems likely that the difficulties of both mink and seabirds have a common explanation connected to changes in the marine environment, which may be associated with global climate change. Values of $\delta^{15}N$ in mink consuming marine diet indicated nutritional stress in the latter half of the study period, supporting this theory.

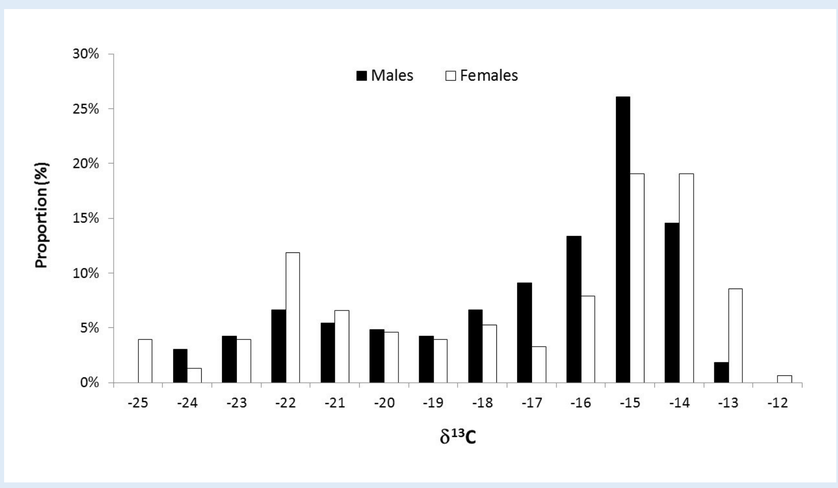

Figure 3. *Frequency of $\delta^{13}C$ values for female and male mink in the Snæfellsnes Peninsula. High $\delta^{13}C$ values indicate marine diet, whereas low values indicate prey species of freshwater or terrestrial origin.*

Conclusion

- **The mink in the Snæfellsnes Peninsula mostly depend on food sources with a marine signature.**
- **Recent changes in the marine environment might have contributed to the sharp decrease in mink population since 2003.**

Acknowledgements

This study would not have been possible without mink hunters providing their catch, of which we are grateful. Professor Pall Hersteinsson was a valuable part of our research team until his untimely death.

References

1) Dunstone, N. (1993). The Mink. T. & A.D. Poyser Ltd., London, 232 pp.
2) Magnusdottir, R., R.A. Stefansson, M. von Schmalensee, D.W. Macdonald & P. Hersteinsson (2012). Habitat- and sex-related differences in a small carnivore's diet in a competitor-free environment. European Journal of Wildlife Research Research 58:669–676.
3) Magnusdottir, R., M. von Schmalensee, R.A. Stefansson, D.W. Macdonald & P. Hersteinsson (2014). A foe in woe: American mink (*Neovison vison*) diet changes during a population decrease. Mammalian Biology, 79: 58-63.
4) Dalerum, F. & A. Angerbjorn (2005). Resolving temporal variation in vertebrate diets using naturally occurring stable isotopes. Oecologia, 144, 647.
5) Hobson, K. A. & L. I. Wassenaar (1999). Stable isotope ecology: an introduction. Oecologia, 120: 312.

Photos:

Left column: ©Sigrún Bjarnadóttir.

Right column: Unknown, ©Steven Holt/Stockpix.com and ©Sigrún Bjarnadóttir.

Lower corners: ©Jóhann Óli Hilmarsson.