ASSESSING HABITAT PREFERENCE OF INVASIVE AMERICAN MINKS (*NEOVISON VISON*) USING TRAP-CAMERAS IN NAVARINO ISLAND, CHILE

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Introduction

- Invasive species are a significant component of global change, affecting native species, communities and ecosystems around the world (Vitousek *et al.* 1997). Among the most vulnerable regions are islands, where the introduction and establishment of mammalian predators are considered a major threat to native species (Courchamp *et al.* 2003).
- The American mink (*Neovison vison*) is a small-size semi-aquatic mustelid, native to North America (Lariviere 1999). Minks were first introduced in South America in 1930 and since then they dispersed, reaching Navarino Island probably in mid 90s (Rozzi & Sherriffs 2003).
- On Navarino Island mink are considered a threat for birds that nest along the coast (Schüttler *et al.* 2010) and previous research has focused on coastal and riverine habitats. However given their ecological plasticity we hypothesized that they can expand their niche into the forest where they will hunt and threaten native forest bird species.

Objective

- **Investigate habitat preferences of invasive minks in Navarino Island using camera traps**

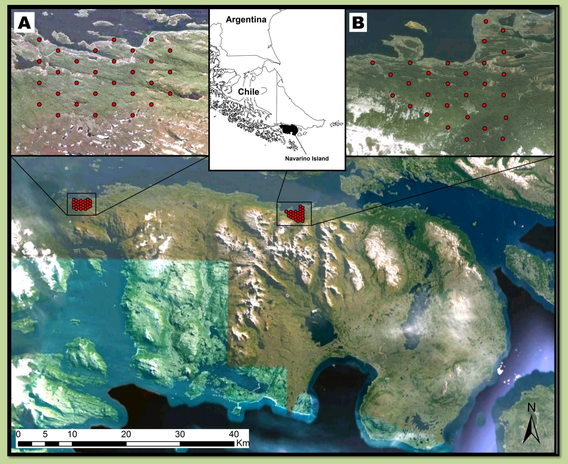

Fig 1. Trap-camera locations in Navarino Island, Chile. A- Navarino Port ; B- Omora Park

Study Area

- Navarino Island, Chile (68°W, 55°S, 2,500 km^2) (Fig 1) belongs to the Cape Horn Biosphere Reserve, which is recognized among the most pristine areas of the world (Rozzi *et al.* 2006).
- The region corresponds to the Magellanic Sub-Antartic Forest Biome and it includes evergreen forests of *Nothofagus betuloides and Drimys winteri*, deciduous forests of *Nothofagus pumilio and Nothofagus antarctica*, wetlands, shrubs, grasslands and high-Andean vegetation (Rozzi *et al.* 2006).
- The climate is oceanic and cold, with a mean annual temperature of 6°C and a mean annual precipitation of 467.3 mm.

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Methods

- We examined mink presence during February and March of 2013 by setting 2 sets of 30 fish-baited trap-camera stations, operated for 16 days and spaced out 500m from each other (Fig 1). We discarded 4 cameras from the analysis because they did not work properly.
- At each camera station, we measured:
  - Altitude: with a hand held GPS unit
  - Canopy cover
  - Main habitat types:
    - Mature forest
    - Secondary forest
    - Shrub and grasses
  - Distance to coast and beaver dams: using ruler tool in Google Earth.
  - Visual obstruction at ground level: a frame of 46 x 15 cm divided in 8 equal sections was located at 5m from the camera in 4 cardinal directions. An observer from the camera location counted the amount of sections covered by ground vegetation. Final value was the mean of 4 measures (Fig 2).

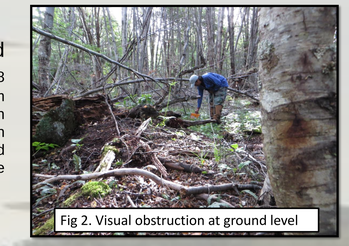

Fig 2. Visual obstruction at ground level

- We fitted generalized linear models with negative binomial distribution to relate mink detections with habitat characteristics. To select the most competitive models we used the Akaike's Information Criterion corrected for small sample sizes (AICc). We performed model average within models of ΔAIC_c <2. For all analysis we used R software (Version: 2.14.1, R Development Core Team 2011) with the packages MASS and MuMin.

Results

- We detected mink presence in 46% of operative-camera stations: 44% (12/27) in Navarino Port and 48% (14/29) in Omora Ethnobotanical Park (Fig 3).

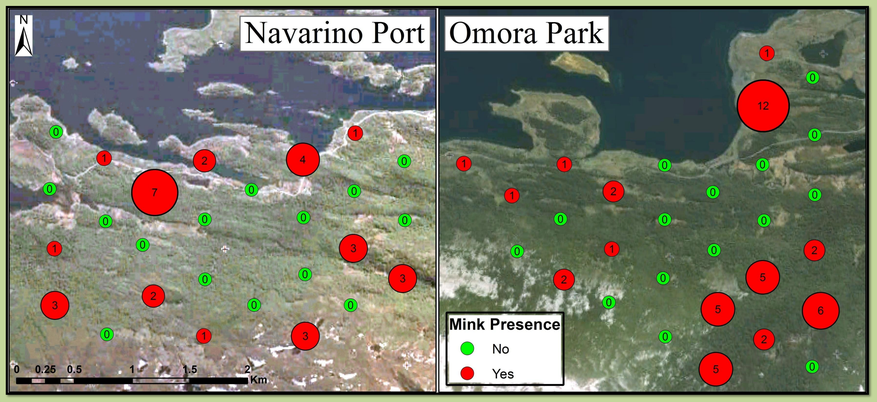

Fig 3. Presence/absence of mink in 56 operative-trap cameras. The red circles indicate the number of mink detections per station in 16 survey days. We considered two detections independent from each other at the same station if there was >60 min apart.

- We obtained five best-supported models (Table 1). Competitive models included the variables: vegetation density at ground level, type of macro-habitat, and distance to beaver dams. The other variables did not seem to be affecting mink detections.
- On the basis of model-averaged coefficients, only shrub and grass habitat presented a significant negative effect on mink detections (Table 2).

Table 1. Model selection results of the most competitive models (ΔAICc <2) used for modeling-average to investigate habitat preferences of mink in Navarino Island.

Model	df	AICc	ΔAICc	Weight
Habitat Type	4	178.97	0.00	0.26
Veg Density + Habitat Type	5	179.16	0.19	0.24
Dist Beaver Dam + Habitat Type	5	180.04	0.98	0.15
Null model	2	180.25	1.29	0.14
Veg Density + Dist Beaver Dam + Habitat Type	6	180.63	1.66	0.11

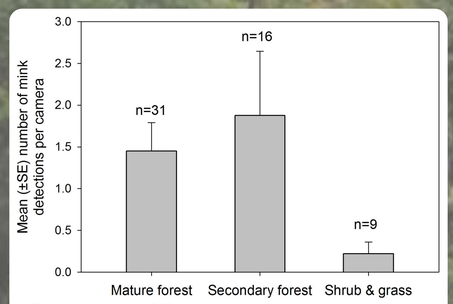

Fig 4. Mean (±SE) number of mink detections in each habitat type.

Box 1. We documented a male of Magellanic woodpecker (*Campephilus magellanicus*) at one camera station (A) and a pair of Magellanic woodpeckers at another camera station (B; red arrows), where several individuals of minks were also detected. These figures show how likely mink predation is on this charismatic species. Moreover, mink predation on this species was confirmed by another study in Navarino.

Table 2. Model averaged coefficients, adjusted standard errors (SE), *p* values, and importance from best models explaining habitat preferences of mink in Navarino Island. Variables of habitat type are compared to the base factor, mature forest.

Variable	Coefficient	Adjusted SE	*p*	Importance
Habitat Type: Secondary forest	0.299	0.488	0.539	0.85
Habitat Type: Grass and shrubs	-2.068	0.932	0.026*	0.85
Vegetation Density	1.675	1.134	0.134	0.39
Dist Beaver Dam	0.001	0.001	0.257	0.30

* α= 0.05

Discussion

- Our results suggest that minks did not prefer any particular habitat characteristic that we evaluated. However, they seemed to be avoiding open areas dominated by grasses and shrubs compared to forest habitat (Fig 4). Prey abundance and distribution has a major effect on mink habitat selection (Zabala *et al.* 2007), and we need future research to test this and better understand habitat selection in Navarino Island.
- This is the first time that the use of forests by mink was documented in the area.
- Similar to Schüttler *et al.* (2010) we found no association between minks and beavers.
- Given that birds and small mammals represent >60% of mink's diet in Navarino Island (Schüttler *et al.* 2008) and that fresh-water food is scarce, we believe that minks have expanded their niche moving away from water sources to hunt in the forest. This may have a significant impact on native bird species that evolved without mammalian predators on this island (Box 1). We will to evaluate this hypothesis in the future.

Acknowledgments

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