Camera trap monitoring of the carnivore community in late winter

Motivation

The resident carnivore community in the low Arctic tundra is composed by a mixture of endemic Arctic species, such as the arctic fox, wide-spread boreal and arctic species, such as wolverines or raven, and expanding boreal species such as red foxes. The relative abundance of these species is influenced by the proximity to the border to more productive ecosystems in the forest-tundra ecotone and the north boreal forest. Warmer winters and increased availability of subsidies resulting from anthropogenic activity promote the expansion of boreal generalist predators and provides them a competitive advantage over the arctic species, which are adapted to tolerate low temperatures and resource scarcity in winter. Thus red fox populations increase in the low Arctic, where subsidies from various human activities, including reindeer herding, are available and winter temperatures are not extremely low. Red foxes are a superior competitor to the endangered arctic fox, and competition with this larger species is one of the reasons for the slow recovery of arctic foxes in Fennoscandia. Anthropogenic subsidies also promote the increase of corvid populations, including crows and magpie in addition to raven in areas close to the forest border. Populations of both golden and sea eagles are growing in northern Norway.

Northern carnivore species are known to scavenge frequently, in particular in winter when resources are scarce. Moreover, competition between species is most important when resources are scarce. Localized resources such as ungulate carcasses attract carnivores and represent sites, where interspecific competition occurs as dominant species will exclude subordinate species from feeding on the carcasses. The importance of carcasses as a resource for low arctic carnivores can be used to monitor them using baited automatic camera stations.

State variables: This protocol describes data collection for the state variable V74, red fox, wolverine, raven, crow, white-tailed and golden eagle frequency and competition on carcasses in late winter, contributing to the monitoring target generalist predators (BT12) of the arctic fox module. The data inform also the state variable V80 presence of arctic foxes, movements and registering of released individuals, contributing to the monitoring target arctic fox (BT4) of the arctic fox module.

Reference to method: Hamel et al. (2012) evaluated the influence of sampling design on the detection of different species. Killengreen et al. (2012) showed how the proximity to more productive northern boreal habitats influenced the composition of the scavenger community.

Spatial study design

On Varanger Peninusla, red fox hunting is encouraged, and the Norwegian Nature Surveillance (Statens Naturoppsyn SNO) carries out extraordinary culling as an experimental management action to promote the recovery of arctic fox. Baited camera stations are established in this treatment area and in a control area further west, where no particular actions are taken to promote red fox hunting. The camera stations are placed on transects covering a gradient from the more productive coastal/forest area towards the less productive inland mountain tundra. Three such transects are located on Varanger Peninsula: Komagdalen, Vestre Jakobselv and Stjernevann; and two in the control area: Ifjordfjellet and Gaissane. The complete list of siteIDs included in the current data collection is:

Locality	Site ID	Red fox culling
komagdalen	k1, k2, k3, k4, k5, k6, k7, k8	yes
vestre_jakobselv	n2, n3, n4, n5, n6, n7, n8	yes
stjernevann	s1, s2, s3, s4, s5	yes
ifjordfjellet	i1, i2, i3, i4, i5, i6 , i7, i8	no
gaissane	g1, g2, g3, g4, g5, g6, g7, g8	no

The coordinates of the camera stations are in the file

Temporal study design

Observations with baited automatic cameras are carried out in late winter from the end of February to the beginning/middle of April for a period of 4-6 weeks.

Procedure:

Camera setup

The cameras are placed on a metal pole at 30-50 cm of the surface of the snow. The metal pole is permanently fixed into the ground. External batteries (12 V, 6 A) in an isolated plastic box are placed on the ground close to the pole, preferably under the snow, and connected with a cable to the camera. The cable is placed in a protective tube, as some animals bite them off. As baits, we buy blocks of frozen slaughtering remains of reindeer, which are sold as dog food. Each block weighs approximately 15 kg. Only meat approved by Mattilsynet can be used. The bait is placed at ca 2 m from the camera towards the north.

The Reconyx cameras are programmed to take time lapse pictures every 5 minutes at high resolution. The motion sensor function is turned off. Memory cards with a minimum capacity of 4GB (older large cameras) or 16 GB (newer cameras) are used. When setting up the cameras, it is important to check that date and time are correct.

Two-three weeks after the deployment of the cameras, baits and memory cards are replaced. After a second period of 2-3 weeks, the cameras are collected. The work with the automatic cameras is carried out by snow scooter. It is important to obtain the necessary permits for driving off tracks and in the national park.

Equipment needed:

- Automatic cameras
- Batteries (make sure they are charged)
- Battery box isolated with isolating mat
- Connecting cables and protective tubes
- Memory cards
- Bait meat
- GPS

Picture processing

After collecting the memory cards, the pictures are loaded up to the COAT server to xxx. The file structure is as follows: one folder for each year, containing a folder for each transect, containing a folder for each camera station, with two folders for the two different periods.

At present, the pictures are processed manually in the Reconyx Software MapView Professional. The software can be downloaded from:

http://www.reconyx.com/software/mapview

- Start MapView
- Under *View/Load New Pics & Vids ->* Choose *From another folder* and navigate to the folder with the pictures.
- *Load New Images Wizard* opens, click on *Check all*, afterwards click *Next>*
- In *Choose Marker Location*, click on *Add a new location* and use the site ID of the camera station as location names, afterwards click *Next>*, and *Next>* again
- The picture files are now loaded into MapView, this can take some time
- click on *Finnish*

When you use start to analyse a set of cameras

- go to *Tools, Setup Keywords*
- Enter the variables you will use and possible values for these.
  In the datafile produced by the software there will be one line per picture and one column for each keyword. Make the following keywords:
    - newbait: 1 on the picture when a new bait was brought, and empty otherwise
    - baitvisible: 0 when the bait is not visible, ie it is not possible to see whether it is there or not, otherwise leave empty
    - quality: 0 when visibility is so bad that you are not sure whether you would see a raven or a red fox in a radius of 2 m around the bait.
    - comment: a text field where you can write everything important to know
    - human
    - arcticfox
    - redfox
    - foxsp
    - wolverine
    - raven
    - crow
    - magpie
    - corvidsp
    - seaeagle
    - goldeneagle
    - eaglesp
    - reindeer
    - gull
    - snowyowl
    - mammalsp

  For each of the animals make a numerical keyword and enter the number of animals seen, and if none, leave empty

- If there is an unexpected animal on the picture, register it in the comments.

Now you are ready to start registering.

Under *Marker locations*, click on the right Camera location in the list, then click on *View Pics & Vids*

- When you start a new folder or a new camera, set a value in all keyword fields for the first picture – then all the columns will be included in the resulting table file. Use 0 for all animals, 1 for quality and bait visible, x for comment and 1 for new bait. In general the card is changed at the same time as the bait, therefore, write newbait = 1 every time you start a new folder. Sometimes the bait is covered with snow when it is deployed.
- Click on *Start slide show* and regulate the speed to be able to look at each picture attentively
- *Stop slide show* when there is an animal on the picture
- Click on *Image data*, and the list of keywords will appear to the right of the picture. Set in the number of the species observed in the corresponding box.
- You can select several pictures in the list of pictures on the left side of the screen, and enter the same value for all of them at the same time.
- While scoring, use an additional log file. When there were longer periods of bad visibility, this can be recorded there with from date time, to date time.
- Record when you see that an animal removes the bait either in the comments in MapView or in the log file.

- **When you have gone through all the pictures from one camera, select all pictures in the list on the left side of the screen. Then click on *Image*, *Export Image Data* and give the file a name (use site ID and 1 or 2 for the period). The file will be saved in .csv format. Exporting takes some time.**

To distinguish arctic foxes from red foxes during the night, look at the shape of the ears. Arctic foxes have smaller and rounder ears. Make a folder to where you copy pictures for which you are not sure – then several people can have a look at them.

For arctic foxes record in the comments, whether they had earmarks, and whether they were dark morph individuals. If they have ear marks, try to note the colour (not always easy to see, and not possible at night)

To distinguish golden eagles from sea eagles, look at the feathers on the feet. Sea eagles have feathers only at the top of the leg, whereas golden eagles have feathers along the leg down to their feet. Make a folder to where you copy pictures for which you are not sure – then several people can have a look at them. I

For gulls, which are very little numerous, write the species in the comments.

The .csv files are loaded onto the COAT server under xx .

Training requirements and specialized skills

People deploying the cameras and the baits should have experience with driving snow scooters and carrying out field work in winter in the Arctic.

No specific training is required to process the pictures.