

## A review of the Swedish population of Eurasian lynx, *Lynx lynx*

### *General characteristics of the species*

The Lynx is a medium-sized wild cat belonging to the family Felidae, and in Sweden this usually refers to the species found within the country, the Eurasian lynx, *Lynx lynx*. These animals reach a height of 60-75 centimeters, and are roughly one meter in length. The normal weight for an adult male ranges from 20-25 kg and for an adult female from 16-20 kg. They have a short tail and usually long tufts of black hair on the tip of the ears. The hind limbs are longer than the front limbs, they have large paws padded for walking on snow and long whiskers on the face.

The colour of the coat varies with season; from light yellow brown to red brown with darker spots in the summer, to a significantly lighter and greyer colour in winter. The general behavioural traits resemble that of the domesticated cat. Lynx are usually solitary, although a small group can travel and hunt together. Mating takes place in the late winter, with a gestation time of around 70 days, and the litter size is two to four kittens. The young stay with the mother over the next winter and then go on to live by themselves.

The lynx feed on a wide range of prey like reindeer, roe deer and also birds, small mammals like hares, and sheep and goat. In Sweden the major prey of lynx in the north, is reindeer *Rangifer tarandus*, (the reindeer husbandry area covers the northern 40% of the country) and south of the reindeer area, the roe deer, *Capreolus capreolus*. They also prey on hare and forest fowl such as capercaillie and black grouse.

The lynx is listed in the Bern convention (Convention on the conservation of European Wildlife and Habitat, 1979) as a vulnerable species.

### *Brief History of the Swedish Lynx*

Based on hunting records, the population of lynx in Scandinavia in the 19<sup>th</sup> century was probably comparable to the current one, see details below. Then in the early 20<sup>th</sup> century there was a major decline in the population. This is believed to have been the result of unregulated hunting and high bounty payments from the government, and could also be further influenced by the declining populations of small game during that time (Andren *et al.*, 2002). The lynx was then protected in 1924 and the population started to recover. It should be mentioned that the lynx have managed to recover in both Norway and Sweden, and in Sweden lynx families are found throughout the country, except for the southern-most part (Götaland). And based on the annual counts (snow tracking), the estimated Swedish lynx population in 2005 was about 265 family groups, which is equivalent to around 1200 individuals (the Swedish National minimum goal for lynx is 300 family groups).

### *Habitat and home range*

It was concluded by Lindell *et al.* (2001) that large carnivore predator management needs the rapid establishment of effective wildlife management and enforcement structures. This is to ensure an effective protection or regulate harvest of both carnivores and prey. One of the most important parameters required for effective conservation and management is the variation in size of home range of a species. The density of lynx in Sweden is low with a range of 0.2-2.0 per 100 km<sup>2</sup>. However these animals move over large distances and according to European studies the individual home ranges of lynx vary by a factor of 10, thus ranging from 100-1000 km<sup>2</sup> (Andren *et al.*, 2006).

So what are the factors affecting the home range? Studies show that the variations are linked to indices of prey density and environmental productivity of the area. The sex also emerged as a significant explanatory variable with males having larger home ranges than females. In addition, the size of the male home-range increased faster with the decreasing prey density than that of the females. But overall there was the negative correlation between the harvested roe deer and lynx of both sexes (Herfindal *et al.*, 2005). Since the boreal forests in Sweden (Scandinavia) are amongst the most intensively exploited forests in the world, there is less than 5% virgin forest left, this means there are few wilderness areas large enough to maintain the lynx. Additionally the designated protected areas in Sweden are also smaller than the home ranges (Andren *et al.*, 2006). This ultimately means lynx will be found in human dominated multi use landscapes and the conservation work and strategies have been based upon these factors.

### *Hunting, Competition and Intraguild Predation*

As mentioned the major prey of lynx is the reindeer, roe deer and also hare and forest fowl. Sunde and Kvam (1997) performed a study on the effect on body weight and size of the lynx compared to prey choice. They did not find any significant difference in prey choice and suggested the differences seen in killing rates between the sexes to be the effect of habitat selection. The males tend to have larger home ranges than females, and therefore potentially have a different encounter rate of prey. From a study done three years later it was found that, as an average, two families of lynx, tracked during a period over the winter months, killed 0.2 ungulates per day (Sunde *et al.*, 2000). So lynx show relatively high kill rates, which on low density roe deer populations can result in potentially heavy predation impacts.

However, lynx do not cause decline in the roe deer population alone. The red fox, *Vulpes vulpes*, share the same diet as the lynx, reindeer excluded, and this choice in diet is especially evident when the density of field-mice is low. So there is the competition between these species and several observations have been made on the predation of lynx upon foxes. Sunde *et al.* (1999) showed that the percentage of uneaten fox carcasses was significantly lower than that of other lynx prey, suggesting that interference competition between these species may be a factor for the intraguild predation.

There is also the potential for interspecific competition between wolf and lynx, who also share common diets in the ungulates, but with the wolf population being fairly low with 130-150 individuals (annual count 2005/2006, Swedish Environmental Protection Agency) this is something which has not, up until now, been widely studied.

### *Human interaction and current population status*

Due to human conflicts with reindeer farming, roe deer hunters and to some extent sheep farmers the conservation management of lynx is faced with the problem of poaching. Andren *et al.* (2006) examined the causes of mortality of 245 adult radio-marked lynx and found that the main causes were, by far, anthropogenic.

In Sweden the sheep population is fairly small and the predation of lynx is around 200 sheep per year. The predation on reindeer however is around 10 000 to 20 000 per year, and the recorded predation on roe deer was discussed earlier. To tackle the livestock loss there is a compensation payment system in force for the loss of reindeer, which is based on the number of lynx present within the grazing area. And over the last years the management actions have been to lower the lynx population within the reindeer husbandry area. There are set hunting quota for this region and in 2005 the lynx population within this area was around the management goal of circa 80 family groups.

In the south-central Sweden (Svealand) the current lynx population is not expected to increase due to resource limitation in the form of the roe deer densities. So to be able to reach the national management goal of 300 family groups, the current management strategies are to try and get the lynx established in the southernmost part of Sweden (Götaland).

To manage and conserve the current lynx population and to reach future management goals it therefore seems like an equally important conservation action is to put more emphasis on the problems of poaching, potentially through stricter law enforcements or alterations in the compensation system. Equal to this is the importance of the work dealing with the social aspects of lynx-human conflicts to, if possible, try and increase the human tolerance towards the lynx now being re-established within the country.

### References

Andren, H., Linnell, J.D.C., Liberg, O., Ahlqvist, P., Andersen, R., Danell, A., Franzén, R., Kvam, T., Odden, J., Segerstrom, P., (2002). Estimating total lynx (*Lynx lynx*) population size from censuses of family groups. *Wildlife Biology* 8, 299–306.

Andrén, H., Linnell, J.D.C., Liberg, O., Andersen, R., Danell, A., Karlsson, J., Odden, J., Moa, P.F., Ahlqvist, P., Kvam, T., Franzén, R. and Segerström, P. (2006). Survival rates and causes of mortality in Eurasian lynx (*Lynx lynx*) in multi-use landscapes. *Biological Conservation*, Volume 131, Issue 1, P 23-32

Herfindal, I., Linnell, J.D.C., Odden, J., Birkeland Nilsen, E., Andersen, R., (2005). Prey density, environmental productivity and home-range size in the Eurasian lynx (*Lynx lynx*). *Journal of the Zoological Society of London*. Vol. 265, 63–71

Linnell, J.D.C, Andersen R, Kvam T., Andren, H., Odden J, Moa P.F. (2001). Home range size and choice of management strategy for lynx in Scandinavia. *Environmental management* vol 27, no8, 869-879.

Sunde, P. and Kvam, T. (1997). Diet patterns of Eurasian lynx *lynx lynx*; what causes sexually determined prey size segregation. *Acta Theriologica*. Vol 42, 189-201

Sunde, P., Overskaug, K. and Kvam, T. (1999). Intraguild predation of lynxes on foxes: evidence for interference competition?. *Ecography*. Vol 22: 521-523

Sunde, P., Kvam, T., Bolstad, J.P., Bronndal, M., (2000). Foraging of lynxes in a human-exploited boreal alpine environment. *Ecography* 23, 291–298.

### Websites

The Swedish Environmental Protection Agency, [www.environ.se](http://www.environ.se)

The Research and Learning Centre for the 5 large predators, Järvsö, Sweden, [www.de5stora.com](http://www.de5stora.com)

The Swedish Agricultural University, Wildlife Section, [www.slu.se](http://www.slu.se)

The Bern Convention, [www.chm.org.uk](http://www.chm.org.uk)