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Source: Wildlife Biology, 16(2) : 221-224

Published By: Nordic Board for Wildlife Research

URL: https://doi.org/10.2981/08-008

Wildl. Biol. 16: 221-224 (2010)
DOI: 10.2981/08-008

www.wildlifebiology.com

Short communication

More female red foxes *Vulpes vulpes* on bait sites in spring

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The red fox *Vulpes vulpes* has traditionally been subjected to control efforts throughout much of its range. In this article, we present data on the sex and age composition of red foxes culled at bait sites in an area of southeastern Norway. While an excess of males were shot in early and mid-winter, equal proportions of males and females were shot in early spring. Apparently, females are more nutritionally stressed in March due to pregnancy and therefore visit bait sites more frequently. Culling earlier in winter will predominantly remove males and will bias the sex composition in the population towards females.

Key words: control, female behaviour, sex/age ratio, Vulpes vulpes

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Received 28 January 2008, accepted 22 March 2010

Associate Editor: Graeme Coulson

Due to its impact on game and livestock, and also because it is an important vector of rabies, the red fox *Vulpes vulpes* is subjected to control attempts throughout much of its range (Macdonald 1980, Saunders & McLeod 2007). Culling methods include trapping, poisoning, hunting with dogs for adults and for pups at den sites and hunting at night, either by searching an area by car and spotlight or by lying in wait near a bait site.

While culling will reduce fox populations at some temporal and spatial scales, the various methods differ in their effectiveness as population control methods (Hewson 1986, Gortázar et al. 2003, Virgós & Travaini 2005, Saunders & McLeod 2007). This is related partly to the ability of the red fox to compensate for hunting mortality and decreasing population density through increased production of pups and partly to its migratory and social behaviour (Storm et al. 1976, Caughley 1977, Hewson 1986, Newsome et al. 1989). Red fox populations usually consist of resident adults which, to varying degrees, defend their territories against other foxes, and of young 'floaters' without a territory (Schantz 1981, 1984, Corbet & Harris 1991). While most subadult males disperse, a varying proportion of females may stay in their mothers' territories (Jensen 1973, Macdonald 1979, Englund 1980).

The effect of hunting on a red fox population will depend both on the sex and age groups removed and on the time of the year during which the hunting takes place. If mostly young 'floaters' are shot, the effect of hunting will probably be low. On the other hand, removal of adult, resident foxes, especially pregnant females in late winter, will probably have a higher impact on the population.

In agricultural areas of Scandinavia, one of the most popular hunting methods for red fox is shooting at bait sites at night. The bait is placed in an open area where foxes commonly travel at night and is maintained from early fall and throughout the winter. The hunter hides in a barn or a specially constructed shelter. Hunting at night requires snow-covered ground or artificial light for good visibility.

In this article, we compare the age and sex of red foxes shot at bait sites in late winter with those shot earlier in the season in an area of southeastern Norway. We also present data on subsequent bags of red foxes following one year of intensive local sport hunting. The hunting was carried out by local hunters within the regular hunting season.

Material and methods

We collected red foxes shot at bait stations during the hunting seasons of 2004/05 and 2005/06 from an area of approximately 500 km^2 in southeastern Norway (59°15'N). This area is later referred to as the coastal area. We compared the sex and age composition of foxes shot in late winter with that of foxes shot earlier in the season. Hunting was particularly intensive at three neighbouring bait stations, which were located on a transect with approximately 0.6 km between the first and second and 1 km between the second and third stations, and which are later referred to as the core stations. We compared the sex and age composition of foxes shot at these stations during the season of 2005/06 with those shot during the previous season of 2004/05.

The coastal area is a typical lowland, agricultural area of southeastern Norway, located 5-10 km from the coast and dominated by fields, fragmented forests and scattered farms. The coastal area is located in the region which has the highest fox density in Norway, estimated at 20 animals/10 km^2 in early fall (Hjeljord 2008; Norwegian Bureau of Hunting Statistics, unpubl. data). Foxes have always been hunted in the area, but hunting was intensified during the 2004/05 and 2005/06 hunting seasons, particularly at the core stations. Hunting effort (i.e. number of hunting nights) did not differ substantially between the two seasons.

We also collected some foxes from an inland location 300 km farther to the north. This location, later referred to as the interior, is dominated by forest. At this location, most foxes were hunted using dogs and only a few were shot at bait sites.

We determined the sex and age of the foxes by counting the cementum layers on the roots of canine teeth (Harris 1978). The first cementum layer usually becomes visible during the fox's second summer (Harris 1978). Thus, if the microscopic counting revealed no cementum layers, the fox's age was set at 0, meaning that the fox was born last spring and still in its first year. We dissected uteri from females shot in March, counted the number of foetuses, and if possible, determined the sex of the foetuses.

We analysed data using contingency tables and Fisher's exact test together with simple t-tests and χ^2-tests. We used the SAS R version 9.2 (SAS Institute Inc. Cary, North Carolina, USA), the FREQ procedure and EXACT statement due to small sample sizes.

Results

In the coastal area, a total of 58 and 65 foxes were shot at bait sites in 2004/05 and 2005/06, respectively. There was an excess of males among foxes shot during fall and winter (October through February); the male:female ratio was 27:13 in 2004/05 ($\chi^2 = 1.86$, df = 1, P = 0.17) and 39:13 in 2005/06 ($\chi^2 = 5.91$, df = 1, P = 0.02). However, in early spring (March) 2005 and 2006, the male:female ratio was 7:11 and 6:7, respectively, which did not differ significantly from a 50:50 ratio (χ^2=0.113, df = 1, P = 0.74 and $\chi^2 = 0.0434$, df = 1, P = 0.84, respectively; Fig. 1).

Of the foxes shot in the coastal area, 36 and 32

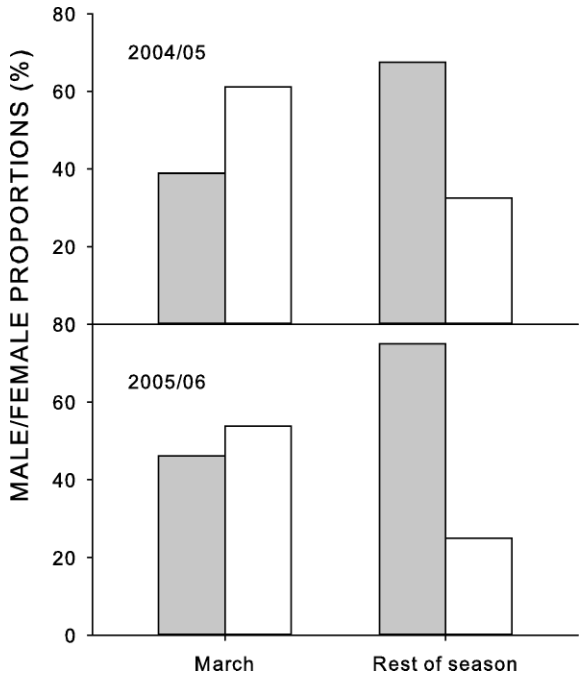

Figure 1. Male (grey) and female (open) proportions of red foxes shot at bait sites in southeastern Norway during the hunting seasons of 2004/05 and 2005/06.

were shot at the core stations during 2004/05 and 2005/06, respectively. Although the number of animals shot during the two seasons was similar, more young of the year were shot during the 2005/06 (75%) than during the 2004/05 hunting season (47%; $\chi^2 = 5.92$, df = 1, P = 0.0215). The proportion of females in the bag decreased from 2004/05 (male:female ratio of 24:12) to 2005/06 (male:female ratio of 27:5), and while five females $\geq$ 1 years old were shot in 2004/05, only one was shot in 2005/06. The difference in the proportion of the sexes between seasons was, however, not significant (Fisher's exact test: P = 0.16). All of the four females shot at the core stations in March 2005 were pregnant.

The male:female ratio of 44 foxes hunted using dogs and shot in the interior area was 21:23. Only 17 foxes were shot at bait sites in this area and of these, 11 were males and six were females. We could not test for difference in the sex ratio between the two hunting methods due to small sample sizes.

We dissected 19 female foxes shot during March. Of these, two shot in late March showed signs of already having given birth, and therefore they were excluded from further analysis. Of the remaining 17 females, 10 were young of the year and eight of these were pregnant with an average of 3.8 foetuses. Of the seven females $\geq$ 1 years old, six were pregnant with an average of 4.3 foetuses. The difference in number of foetuses was not significant ($t = 0.419$, df = 15, P = 0.68). Of the 31 foetuses old enough for sex determination, 16 were male and 15 were female.

Discussion

The sex ratio of foxes shot at bait sites during early and mid-winter was skewed towards males. The even sex ratio of foetuses and the difference in sex ratio among foxes shot at bait sites and those hunted with dogs in the interior area, clearly indicate that there is a male bias among foxes shot at bait sites during this time of the year, even if the sex composition of the population is even. We see three possible reasons for the male bias:

- most subadult males leave their natal home ranges, whereas subadult females emigrate less frequently (Jensen 1973, Englund 1980). This may also imply that female foxes are more stationary at a smaller scale and are less likely to roam far enough to encounter baits.
- It is a common assumption among fox hunters that male foxes are less shy than female foxes (Kraabøl 2003). Thus the male foxes may expose themselves more frequently by readily accepting bait close to farmhouses.
- Late winter is the mating season of the red fox in Scandinavia (Lindström 1984). Male foxes increase their activity during this period (Cavallini 1996), which may increase their chances of finding a bait.

The male:female ratio of foxes shot in early spring (March) showed a different and actually opposite trend to the ratio of foxes shot during the rest of the year, with more females being shot during March. The most likely reason for this difference is that although females may generally be shyer than males, they become nutritionally stressed and less cautious during this month due to pregnancy. This conclusion may be supported by similar observations of other animal species. An excess of pregnant female beavers *Castor fiber* were shot during spring hunting (Parker et al. 2002). Female beavers are usually the first to appear in the evening and venture more frequently onto land than do the rest of the animals in a colony. Also collared pikas *Ochotona collaris* forage farther from the talus when pregnant (Holmes 1991), and bighorn sheep *Ovis canadensis* trade safety for access to more nutritious food during the last month of pregnancy (Berger 1991).

Neither the hunting effort nor the number of foxes shot at the core stations differed substantially between the hunting seasons of 2004/05 and 2005/06. However, there were changes in the age composition of the bag. The increased proportion of subadults shot during the intensified hunting of the 2004/05 season follows a general trend in heavily hunted fox populations (Storm et al. 1976, Hewson 1986, Gortázar et al. 2003). It is, however, surprising that hunting restricted to a small local area (the three core stations), apparently has an effect at the population level. This may be explained by foxes from a larger area making excursions outside their territory to search for spots with good food supplies (Cavallini 1996).

Conclusion

Since attempts to control the red fox are carried out in many regions of the world, there is a need for knowledge on how culling can be carried out in the

most efficient way. Our studies show that when hunting at bait sites is applied, reproductive females are most effectively removed in March. Culling earlier in winter will predominantly remove males and bias the sex composition in the population towards females.

Acknowledgements - we thank the many hunters who participated in the project, in particular Gunnar Andersen, who shot 94 of 167 the foxes used in our study. We thank Katrine Eldegard for assistance in data analysis. We received financial support from the Norwegian Directorate for Nature Management.

References

Berger, J. 1991: Pregnancy incentives, predation constraints and habitat shifts: Experimental and field evidence for wild bighorn sheep. - Animal Behaviour 41: 61-77.

Caughley, G. 1977: Analysis of vertebrate populations. - John Wiley and Sons Ltd, New York, New York, USA, 234 pp.

Cavallini, P. 1996: Variation in the social system of the red fox. - Ethology, Ecology & Evolution 8: 323-342.

Corbet, G.B. & Harris, S. 1991: The handbook of British mammals. 3rd edition. - Blackwell Scientific Publications, Oxford, UK, 588 pp.

Englund, J. 1980: Yearly variations of recovery and dispersal rates of fox cubs tagged in Swedish coniferous forests. - In: Zimen, E. (Ed.); The red fox. Biogeographica 18: 195-207.

Gortázar, C., Ferreras, P., Villafuerte, R., Martín, M. & Blanco, J.C. 2003: Habitat related differences in age structure and reproductive parameters of red foxes. - Acta Theriologica 48: 93-100.

Harris, S. 1978: Age determination in the red fox (*Vulpes vulpes*) - an evaluation of technique efficiency as applied to a sample of suburban foxes. - Journal of Zoology (London) 184: 91-117.

Hewson, R. 1986: Distribution and density of fox breeding dens and the effects of management. - Journal of Applied Ecology 23: 531-538.

Hjeljord, O. 2008: Viltet - biologi og forvaltning. - Tun forlag, Oslo, Norway, 352 pp. (In Norwegian).

Holmes, W.G. 1991: Predator risk affects foraging behaviour of pikas: Observational and experimental evidence. - Animal Behaviour 42: 111-119.

Jensen, B. 1973: Movements of the red fox (*Vulpes vulpes* L.) in Denmark, investigated by marking and recovery. - Danish Review of Game Biology 8, 20 pp.

Kraabøl, M. 2003: Rev og revejakt. - Friluftsforlaget, Arendal, Norway, 152 pp. (In Norwegian).

Lindström, E.R. 1984: Rävens år. - In: Markgren, L. (Ed.); Skogsvilt. Grimsö Viltforskningsstation, Naturvårdsverket, Stockholm, Sweden, pp. 116-119. (In Swedish).

Macdonald, D.W. 1979: Helpers in fox society. - Nature 282: 69-71.

Macdonald, D.W. 1980: Rabies and wildlife: a biologist's perspective. - Oxford University, New York, New York, USA, 151 pp.

Newsome, A.E., Parer, I. & Catling, P.C. 1989: Prolonged suppression by carnivores - predator removal experiments. - Oecologia 78: 458-467.

Parker, H., Rosell, F., Hermansen, T.A., Sørløkk, G. & Stærk, M. 2002: Sex and age composition of spring-hunted Eurasian beaver in Norway. - Journal of Wildlife Management 66: 1164-1170.

Saunders, G. & McLeod, L. 2007: Improving fox management strategies in Australia. - Bureau of Rural Sciences, Canberra, Australia, 206 pp.

Schantz, T. von 1981: Female cooperation, male competition, and dispersal in the red fox *Vulpes vulpes*. - Oikos 37: 63-68.

Schantz, T. von 1984: "Non-breeders" in the red fox *Vulpes vulpes*: a case of resource surplus. - Oikos 42: 59-65.

Storm, G.L., Andrews, R.D., Phillips, R.L., Bishop, R.A., Siniff, D.B. & Tester, J.R. 1976: Morphology, reproduction, dispersal and mortality of mid-western red fox populations. - Wildlife Monographs 49, 82 pp.

Virgós, E. & Travaini, A. 2005: Relationship between small-game hunting and carnivore diversity in central Spain. - Biodiversity and Conservation 14: 3475-3486.