

Records of Intra-guild Predation by Eurasian Lynx, *Lynx lynx*

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A total of eight Red Foxes (*Vulpes vulpes*), and one Pine Marten (*Martes martes*) were killed and consumed by radio-collared Eurasian Lynx (*Lynx lynx*). These observations and those from the literature, suggest that intra-guild predation by Lynx may be common. Such predation may be cause for concern because of the risk of transfer of scabies from Red Fox to Lynx.

Key Words: Eurasian Lynx, *Lynx lynx*, Red Fox, *Vulpes vulpes*, Pine Marten, *Martes martes*, intra-guild predation.

Although it has long been known that carnivores kill, and sometimes eat, other carnivores, the full extent of intra-guild predation has often been ignored (Polis et al. 1989). Recent research has demonstrated that such predation may effect species distribution and conservation (e.g., Hersteinsson and Macdonald 1992; Creel and Creel 1996; Durant 1988). While many cases of intra-guild predation have been documented among North American carnivores (e.g., Stephenson et al. 1991), there has been little study of it in Europe.

From 1995 until 1998 the predation behaviour of Eurasian Lynx (*Lynx lynx*) was studied by snow-tracking and radio-telemetry in a site in southeastern Norway (Hedmark), and during winters 1996 and 1997 in northern Sweden (Sarek). The Hedmark study site consists of a hilly landscape covered with Scots Pine (*Pinus sylvestris*) and Norwegian Spruce (*Picea abies*) forest. The Sarek study site is more mountainous, with forested valleys, pine and birch (*Betula* sp.) covered slopes, and alpine peaks. Both sites have relatively continental climates, with cold winters and warm summers. Snow lies from October

until April (June in Sarek). Roe Deer (*Capreolus capreolus*) and semi-domestic Reindeer (*Rangifer tarandus*) were the main prey species for lynx in the Hedmark and Sarek sites, respectively (Haglund 1966; Dunker 1988).

During the study period, a total of eight carcasses of Red Foxes were found by following lynx tracks in snow, or by searching in areas where radio-monitored lynx were believed to have made kills. In each case it was possible to determine from tracks or observation that the lynx had killed the foxes, and had not simply found them dead. The Pine Marten was found when a radio-monitored lynx was observed making the kill. In five of the six cases where the identity of the lynx killing the fox was known, it was an adult female lynx. The other case was by an adult male. The Pine Marten was also killed by an adult female lynx. Sex could be determined for five of the killed foxes; four of these were male. The marten, and seven of the eight foxes killed were all fully grown. Between 75 and 100% of the available meat was consumed on six of the eight foxes and on the Pine Marten. The two foxes that

TABLE 1. The occurrence of Red Fox and Pine Marten remains as lynx prey from various studies in Europe.

Site	Occurrence (%)	n	Method	Reference
<i>Red Fox</i>				
Finland	1	88	Stomach contents	Pullianinen 1981
Sweden	4	46	Stomach contents	Haglund 1966
Sweden	7	46	Stomach contents	Liberg 1997
Sweden	2	65	Kills — snow tracking	Gløersen 1996
Norway	8	66	Kills — snow tracking	Sunde and Kvam 1997
Norway	2	134	Kills — snow tracking	Dunker 1988
Switzerland	13	194	Kills — telemetry	Capt et al. 1992
<i>Pine Marten</i>				
Norway	2	134	Kills — snow tracking	Dunker 1988
Poland	1	172	Kills — telemetry	Okarma et al. 1997
Poland	1	127	Scat analysis	Okarma et al. 1997

were only partially consumed (5%, 50%) were cases where the lynx were scared away from the kills before they could finish feeding.

Red Foxes have often been reported in other studies of the diet of lynx in Scandinavia and Europe (Table 1). Although foxes usually constitute a low proportion of the lynx diet, that their remains are detectable at all in diet studies indicates that the phenomena of intra-guild predation on foxes is widespread. Unfortunately we do not have precise estimates of Red Fox density so that the effect on their population dynamics cannot be estimated. As lynx occur at very low density (0.3–5 per 100 km²) it is unlikely that they could have the same effect on foxes as do Coyotes (*Canis latrans*) (Peterson 1995). Pine Martens are less often reported as lynx prey (Table 1), which may be due to their ability to utilise trees to escape (Lindström et al. 1995). Although the records of foxes and martens from stomach contents and scats could be due to scavenging, lynx so rarely eat prey that they have not killed themselves (own observations) that the chances of this are low. Other carnivores reported to have been killed by, or appearing in the diet of, lynx include otter (*Lutra lutra*) and Raccoon Dog (*Nyctereutes procyonoides*) (Liberg 1997; Okarma et al. 1997). The fact that all lynx that were not disturbed on their kills consumed most of the available meat on the fox carcasses indicates that foxes are regarded as prey. The consumption of other carnivores killed is not universal among cases of intra-guild predation (Peterson 1995).

Predation on foxes could have negative effects on lynx. Since the mid 1980s there has been an epidemic of sarcoptic mange in the Norwegian Red Fox population (Lindström et al. 1995). Lynx have been recorded to die of mange (two radio-collared and at least four unmarked lynx were infected in the Hedmark study site during this study, five of which died as a result of the infestation). Although the exact mode of infection has not been determined, it seems likely that contact with a freshly killed fox would carry a high risk of exposure. This possibility for parasite/disease transfer following intra-guild predation deserves further research.

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