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Winter diet of *Felis lynx* L. in SE Finland as compared with the nutrition of other northern lynxes

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Abstract

Studied the contents of 88 stomachs and 45 intestines of *Felis lynx* L. killed in winter in SE Finland, where no roe deer (*Capreolus capreolus* L.) were available. Four out of every five digestive tracts contained remains of hare, which accounted for 86 % of the weight of the stomach contents, the rest consisting of domestic and ranch animals, a red fox, small rodents, tetraonids and a redpoll. No significant dietary difference was found between the sexes.

Support was noted for the theory that female lynx are small because of their low total energy requirements and their ability to channel large amounts of excess energy into reproduction, and the males are large as a result of sexual selection.

A literature review shows that *F. lynx* hunts roe deer when available, and its large body size may thus be an adaptation to the use of roe deer as a food, while the reduced body size of *F. pardina* Oken, would be an adaptation to the use of rabbit-sized prey in warm climates. In northern North America, where there are no mammals of the size of the roe deer available, *F. canadensis* Kerr, similar in size to *F. pardina*, feeds mainly on snowshoe hares.

Introduction

At the very beginning of the Villafranchian, the Issoire lynx (*Felis issiodorensis* Croizet and Jobert) crossed along the Bering Bridge from North America into Eurasia and reached Europe, where it has been recorded at numerous sites dating from later in that era (Kurtén

1968). The dentition of this Issoire lynx, which resembled a small puma, was of the lynx type, and Kurtén (1968) regards the evolution of the nothern species of lynx (*F. lynx* L., *F. pardina* Oken and *F. canadensis* Kerr) as an adaptation to the use of hare as the main prey.

F. lynx is the biggest of the three lynx species (Sládek et al. 1963; Pulliainen 1974; Burt and Grossenheider 1976). Usually large predators have potentially better chances of accepting larger prey than do smaller ones (e. g. Moors 1980), and predators also tend to optimize their food intake by maximizing the energy gained in relation to feeding effort (Griffiths 1975).

Fluctuations in the populations of the North American *F. canadensis* have been held to reflect cycles in the abundance of the snowshoe hare (*Lepus americanus* Erxleben) (Elton and Nicholson 1942; Keith 1963). *F. pardina*, similar in size to *F. canadensis*, is known as a small game hunter (e. g. Delibes et al. 1975), but the Eurasian northern lynx, *F. lynx*, is known to kill a variety of animals from small rodents to ungulates (Dulkeit 1953; Haglund 1966; Suminski 1973; Pulliainen 1974; Pulliainen and Hyypiä 1975; Hell 1978; Birkeland and Myrberget 1980; Jonsson 1980).

The males of the lynx are larger in size than the females (e. g. Stollmann 1963). A great attention has been paid recently to this kind of sexual dimorphism in carnivorous mammals (e. g. Ralls 1977; Erlinge 1979; Powell 1979; Simms 1979; Moors 1980; Pulliainen 1980c), and several theories have been presented, but little has been said of the lynx in this respect.

The purpose of the present paper is to provide sex-specific records on the winter nutrition of *F. lynx* in SE Finland, and to compare these results with the diet of *F. lynx, F. pardina* and *F. canadensis* in other parts of the northern hemisphere.

Material and methods

The stomach contents of 88 (50 males, 34 females and 4 unknown) lynx killed in the southeastern quarter of Finland in the winters of 1967/68–1979/80 were studied. The lengths of 55 intestines (from pylorus to anus) and the contents of 45 intestines were recorded. Usually there was similar food matter in the stomach and the duodenum, but if there was fresh food in the stomach, no material in the intestinum tenue and material again in the intestinum crassum, the latter was regarded as originating from a different source from that in the stomach. Hairs and feathers from the various prey animals were used for identification, these being washed before examination.

Table 1

Data on the stomach and/or intestine contents of 88 lynx killed in E and SE Finland in the winters of 1967/68–1979/80

Food item	Frequency %	Weight of stomach contents g	%
Lepus timidus and *L. europaeus*	79.5	20678	86.3
Domestic cat	4.1	2465	10.3
Domestic dog	0.8	124	0.5
Vulpes vulpes	0.8	+	+
Ranch arctic fox	0.8	+	+
Ranch rabbit	0.8	+	+
Microtus agrestis	0.8	+	+
Microtidae, sp.	0.8	+	+
Unidentified mammal	1.6	+	+
Lyrurus tetrix	2.5	400	1.7
Tetrao urogallus	2.5	277	1.2
Tetrastes bonasia	1.6	+	+
Acanthis flammea	0.8	+	+
Unidentified matter	1.6	20	0.1
Plant matter	3.2	+	

The amount of matter in the digestive tract varied from a few hairs to 1287 g (fresh weight) in the stomach. As pointed out by Birkeland and Myrberget (1980), hairs from certain food species may remain in the stomach for a longer time than those from other items. The composition of the diet of present lynx was so simple and clear, however, that this error must be minimal.

The majority of the present lynx were killed either as a result of hunting, with or without dog(s), or in traffic accidents, only a few being caught in traps set for red foxes. When a lynx is hunted for a long time, it seldom eats (Haglund 1966). Usually, however, the lynx has been hunting during the night and itself is hunted by man during the following daylight hours. Thus the present data can be regarded as generally representative of the winter diet of the species in southeastern Finland.

The great majority of the present lynx were killed in January–March, when there was snow on the ground. The available potential prey animals included the mammals *Sciurus vulgaris* L., *Vulpes vulpes* L., *Felis domestica* L., *Canis familiaris* L., *Lepus timidus* L., *Lepus europaeus* Pall., and *Alces alces* L., (but not *Cervus elaphus* L., *Odocoileus virginianus* Zimm., *Rangifer tarandus* L. and *Capreolus capreolus* L.), and the tetraonid birds *Lyrurus tetrix* L., *Tetrao urogallus* L. and *Tetrastes bonasia* L. Populations of hares, squirrels and tetraonids are known to vary markedly from year to year (see Siivonen 1948), thus affecting their availability. From the standpoint of the present study, it is significant that the lynx killings were distributed relatively evenly over the 13 winters, thus covering different availability levels of the potential food items.

Results

Felis lynx

Diet of Finnish lynx. Only one of the 45 digestive tracts studied was completely empty, and 13 of the 88 stomachs. The mean weight of fresh animal matter in 66 stomachs was 394,2 (SD = ± 371.9) g. Table 1 shows that hares were clearly the most important food item, confirming the result of a preliminary study by Pulliainen and Hyypiä (1975). Mammals comprised nine tenths of the diet. Remains of two ranch animals (an Arctic fox and a rabbit) were found among the stomach contents. The lynx in the settled areas of Finland also move around in the vicinity of farms and other houses, and succeed in killing cats and dogs now and then. Lingonblad (1952) notes that red foxes belong to the diet of the lynx (cf. Haglund 1966). It is notable that only two microtid voles were represented in the animal matter identified. Kills of red squirrels by lynx have also been recorded earlier in the present study area, as also has predation upon the semi-domestic reindeer in Lapland (Pulliainen 1974).

Table 2

Comparison of the winter diets of the 45 male and 31 female lynx killed in SE Finland

Food item	Proportion (%) of weight of stomach content	
	Female	Male
Hare	75.0	83.3
Domestic cat	0.0	7.6
Domestic dog	1.9	0.0
Red fox	0.0	1.5
Ranch arctic fox	0.0	1.5
Ranch rabbit	0.0	1.5
Field vole	1.9	0.0
Unidentified vole	1.9	0.0
Unidentified mammal	1.9	1.5
Hazel grouse	1.9	1.5
Black grouse	5.8	0.0
Capercaillie	1.9	1.5
Redpoll	1.9	0.0
Other items	5.7	0.0

Out of the 45 digestive tracts examined, 8 contained one prey species, 34 two and 3 three, while among the 88 stomachs, 69 contained one and 6 two prey species. There was no sex-related difference in the composition of the diet (Table 2), nor were there any differences between the diets of the adults, sub-adults and juveniles (proportions of hares 85.7, 100.0 and 83.3 % respectively). In all cases hares comprised at least two-thirds of the food taken in, the ratio of 3:1 for *L. timidus: L. europaeus* suggesting that the lynx had also hunted in the vicinity of fields (for resting sites of the hares, see Lind 1963).

Birkeland and Myrberget (1980) found that the male lynx had a relatively small volume of food in their stomach in February, which they assumed to be related to rutting. The same finding was recorded also here, the mean weight of food in the stomachs of the adult male lynx killed in February–March (370 ± 388 g, n = 21) being smaller than that recorded during the other winter months (588 ± 585 g, N = 7).

Table 3

Occurrence of depot fat around the kidneys of *F. lynx* killed in SE Finland in winter

Fattening rate	No. of cases	%
0	3	5.8
1	7	13.5
2	17	32.7
3	25	48.1
Total	52	100.1

Scale: 0 = 0–10 %, 1 = 11–40 %, 2 = 41–70 % and 3 = 71–100 % of the surface of the kidneys covered by fat.

The body condition of a lynx may be evaluated on the basis of the amount of depot fat around the kidneys. Less than 20 % of the present animals had under 40 % of the surface area of the kidneys covered by fat (Table 3), indicating that they were generally in good condition. Only abandoned juveniles younger than nine months were in very poor condition, or had even died of starvation (see also Haglund 1966; Pulliainen 1974).

Plant matter in the digestive tracts was represented only by a few pine and spruce needles and some small sticks.

According to a previous study (Pulliainen and Hyypiä 1975) 43 % of the lynx's attacks on hares and 9 % on black grouse were successful.

Diet of the Scandinavian lynx. Haglund (1966) studied the diet of lynx in areas of Sweden where reindeer, roe deer, or only small game were available. The following food items were identified in the contents of 46 stomachs: 6 reindeer, 7 roe deer, 6 hares, 2 tetraonids, 2 red foxes and 3 other items. Birkeland and Myrberget (1980) calculated that the diet of the Swedish lynx includes 25 % hares and 54 % cervids. Cervids were killed preferentially whenever available, otherwise small game. Trackings of lynx in the snow revealed that 45 out of 64 attacks on reindeer resulted in a kill, and 23 out of 35 attacks on roe deer. Correspondingly, 35 % of attacks on hares and 29 % on tetraonids were successful. Jonsson (1980) emphasizes the importance of the roe deer in the diet of lynx when available. A lynx was reported to kill a roe deer in Sweden every sixth day.

Cervids also appeared to be an important source of food for the lynx in Norway. According to Birkeland and Myrberget (1980), 164 of the 185 animals identified from 146 lynx stomachs, were mammals (89 %), mainly cervids (reindeer, roe deer and one moose calf). *Lepus timidus* constituted 19 %, and cervids 53 %. Among the other food items there was one cat, two red foxes and three mustelids. Surprisingly, 35 % of the stomachs contained various amounts of vegetable matter.

Diet of the lynx of NW European Soviet Union. In Soviet Karelia hares comprised 80 % of the diet of the lynx, tetraonids 16.3 % and other items 3.7 % (Danilov et al. 1979). There are very few roe deer available in this area (Danilov 1979). In the northern part there are wild forest reindeer, but they are very seldom killed by the few lynx present. In the south wild boar (*Sus scrofa* L.) and beavers (*Castor fiber* L.) are also killed by lynx now

and then. 28.7 % of the attacks on hares by lynx are successful, and 27.8 % of these on tetraonids. Danilov et al. (1979) have found lynx feeding on carcasses and moving about in the vicinity of houses and fur farms when there is scarcity of food in the forests.

Diet of lynx of eastern Central Europe. In the Western Carpathian mountains analysis of the contents of 88 lynx stomachs gave the following result (freq. –%): roe deer 52.3 %, red deer *(Cervus elaphus)* 12.3 %, small rodents 32,3 %, hares 3.1 %, tetraonids 4.6 %, red foxes 1.5 %, small birds 4.6 %, insects 4.6 % and sheep 1.5 % (Hell 1978). Another 38 stomachs of lynx killed in the Carpathians contained 14 % roe deer, 20 % wild boar, 20 % hares, 16 % tetraonids, 15 % rodents and 15 % other items (squirrels, martens, badgers, foxes, dogs and cats; Lindemann 1956).

Diet of the lynx in the Altai Mountains, Asia. According to Dulkeit (1953) the composition of the diet of the lynx is: roe deer 58.9 %, other deer 23.2 %, blue hares 7.1 %, capercaillie 2.0 %, carrion 5.3 % and domestic sheep 3.5 % (Stroganov 1969).

Felis pardina

Delibes et al. (1975) analysed 16 digestive tracts and 37 scats of *F. pardina* in the Iberian Peninsula and found rabbits in 86.8 % of them. Of the 85 prey animals identified, 56.5 % were rabbits (*Oryctolagus cuniculus* L.), 26.9 % rodents, 11.7 % birds of the size of *Turdus* and *Alectoris* and 4.9 % other items. Delibes (1980) analysed 1537 droppings collected throughout two periods of one year in SW Spain. The main prey was the rabbit which amounted to 79 % of the prey captured and 85 % of the biomass consumed. The next in importance were the ducks (9 % and 7 % respectively) and the ungulates (mainly fawns of *Cervus elaphus* and *Dama dama*; 3 % and 5 % respectively). Predation on ungulates might be a kind of starvation-related mortality.

Felis canadensis

According to Saunders (1963a) snowshoe hare was the most important prey of *F. canadensis* in Newfoundland and occurred in 73 % of the stomachs and scats collected throughout the year. Birds occurred in 21 %, and the rest of the material consisted of carrion (moose and caribou), small rodents and plant matter. Bergerud (1971), however, concluded that the lynx was most likely responsible for the high losses of caribou calves on this island, since 84 out of 114 dead or dying calves found had been bitten by this predator.

The estimated winter diet of the lynx in Alberta, Canada, was 69 % hare, 17 % carrion, 11 % ruffed grouse (*Bonasa umbellus* L.), 2 % sharp-tailed grouse (*Pedioecétes phasianél-lus* L.), 1 % red squirrel (*Tamiasciurus hudsonicus* Erxleben), and a trace of chichadee (*Parus* sp.) (Nellis and Keith 1968). Later studies in Alberta, other parts of Canada and Alaska (Van Zyll de Jong 1966; Nava 1970; Nellis et al. 1972; Brand et al. 1976; Parker 1980) have confirmed the importance of hares in the diet of *F. canadensis*. A functional response by the lynx to declining densities of snowshoe hare (see also Elton and Nicholson 1942) was reflected in a shift in the occurrence of squirrels, ruffed grouse and other birds, and increased use of carrion when available (Brand et al. 1976). The dietary shift from snowshoe hares to alternative prey and carrion during hare lows did not compensate completely for the scarcity of this item, however, as a marked decrease in daily kill and consumption rates was observed from the winters with an abundance of hare to those marked by a scarcity (Brand et al. 1976).

Discussion

The present review shows that mammals are clearly the most important food of the lynx throughout their ranges, their minimum proportion in the diet being around 80 % and a more usual figure being about 90 %. The majority of these food items are herbivores (e. g. cervids, wild boars, beavers, hares, rabbits and small rodents), but carnivores are also accepted (e. g. dogs, cats, red foxes, badgers and other mustelids). Even cannibalism occurs in the lynx (e. g. ELSEY 1954; PULLIAINEN 1974; see also below).

Although small rodents would be available in vast numbers under snowless conditions, feeding on these alone would not be reasonable for the lynx, as at least 60 field voles would be required to equal the food biomass of one blue hare, or at least 25 ones to supply one meal for an individual of *F. lynx*. The same concerns red squirrels (see also BRAND et al. 1976), in addition to which the larger Eurasian red squirrel, which lives in a supranivean environment in winter (PULLIAINEN 1973), is more difficult to catch than the smaller North American red squirrel, which lives in both subnivean and supranivean environments (PRUITT and LUCIER 1957).

The daily food requirement of an adult *F. lynx* is at least 1.1 kg (EISFELD 1978), usually 1.2–1.5 kg (DANILOV et al. 1979), and that of the smaller *F. canadensis* 300–800 g less (SAUNDERS 1963a; BRAND et al. 1976). The largest amounts of food material found in the stomachs of Finnish *F. lynx* were 1240, 1268, 1286 and 1287 g. An adult Finnish blue hare *(L. timidus)* weighs at least twice this (SIIVONEN 1977), and a lynx in eastern Fennoscandia would usually eat a half of a hare at one time and hide the rest (DANILOV et al. 1979; PULLIAINEN and HYYPIÄ unpublished observations). An adult hare must be close to the optimum prey size for a northern lynx, which prefers to feed on fresh meat, since PULLIAINEN and HYYPIÄ (1975) found that when hares and tetraonids were available, *F. lynx* seldom returned to feed on carrion.

A caribou calf seems to be the largest size of prey for *F. canadensis* and a female fallow deer for *F. pardina* (DELIBES 1980). The large-sized *F. lynx,* on the other hand, may succeed in killing a moose calf (BIRKELAND and MYRBERGET 1980). Is is highly significant that the roe deer plays an important role in the nutrition of *F. lynx* wherever this prey is available in sufficient numbers (cf. BIRKELAND and MYRBERGET 1980). A lynx will only eat a small portion of this prey at a time, of course, and thus its significance in the food economy of the lynx depends on the predator's returning to feed on the carrion. Under cold winter conditions the carcass will freeze, but its short, strong jaws enable the lynx to feed on it all the same. Here the large-sized *F. lynx* is better placed than its small-sized counterpart *F. canadensis* living under similar winter conditions. Lynx which are having difficulties in obtaining food in Finland, have been seen feeding on a frozen cow carcass for weeks, for instance. Similarly predation by *F. lynx* on ungulates may be so frequent in the

Table 4

Intestine/body length ratio in *Felis lynx, Canis lupus* L. and *Gulo gulo* L.

All the specimens were killed in Finland and studied at the Department of Zoology, University of Oulu

Species	Number of specimens	Mean length of intestine (A) in metres	Mean length of body (B) in metres	Ratio A/B
Felis lynx	55	2.89	0.92	3.14
Canis lupus	39	5.40	1.17	4.62
Gulo gulo	4	5.26	0.84	6.26

Scandinavian Peninsula that carrion-feeders such a *Gulo gulo* L. may learn to follow the trails of lynx in order to feed on the carcasses remaining (HAGLUND 1966).

The three hunting methods used by the lynx which are easily detectable in snow, namely 1. following well-used prey runways, 2. concentrating movements in small areas of prey activity, and 3. using short-term "waiting beds", usually on ridges overlooking areas of prey activity or beside well-used prey runways, are apparently well-suited for encountering and securing hares (BRAND et al. 1976), and also roe deer and other relatively small ungulates in snow, since the latter also use specific runways, especially in relatively deep snow, and their winter activities may be concentrated in somewhat restricted areas (e. g. those of the roe deer on the slopes of river valleys and in the vicinity of hay barns, see MARKGREN 1966; PULLIAINEN 1980a). Interestingly DANILOV et al. (1979) describe how lynx use the same technique for hunting beavers; a lynx waited at a distance of 3–5 m from a beaver trail and 7–10 m from the waterline, from which point it succeeded in catching a beaver before it reached the water.

The stalking technique typical of hunting cats is used by the lynx when hunting tetraonids resting in snow cavities. These relatively large birds of the north, which are the most important avian prey of *F. lynx* and *F. canadensis*, are active during the daylight and/or twilight hours and rest during the hours of darkness, often in the snow, thus being vulnerable to predation by lynx, which are out hunting when these birds are resting. A lynx can eat a tetraonid of the size of the black grouse at one time, but an adult female capercaillie is enough for two *F. lynx* and a male capercaillie for three.

Whereas BIRKELAND and MYRBERGET (1980) found vegetable matter in many stomachs, the present specimens contained very little plant matter, and this must have been taken in unintentionally. The structure of the digestive tract and the relative shortness of the intestine (Table 4) indicate that such vegetable matter cannot be of any significance for the nutrition of the lynx.

Sexual dimorphism in body size is a characteristic feature of northern lynxes. The male of *F. lynx*, for example, is found to weigh on average 2.8–7.2 kg more than the female in different parts of Europe (according to reviews by SUMINSKI 1973; PULLIAINEN 1974, unpublished data). As in other carnivorous mammals, at least two theories can be advanced to account for this sexual dimorphism. Firstly, it may be a strategy for avoiding intraspecific competition by enabling the sexes to exploit different food resources (see also the review by MOORS 1980), while according to the other explanation, the females are small because of their low total energy requirements and their ability to channel larger amounts of excess energy into reproduction, and males are large primarily as a result of sexual selection (see also the review by MOORS 1980).

As in the sexually dimorphic mustelids (see POWELL 1979a, b; SIMMS 1979; ERLINGE 1979; MOORS 1980; PULLIAINEN 1980c), this body-size characteristic of the lynx is maintained by conflicting selective pressures, a large size enabling an animal to exploit a wider size range in its prey, and a small size serving to keep daily energy expenditure low. The larger male lynxes usually have larger home ranges than the smaller females, which move about with their kittens (SAUNDERS 1963b; HAGLUND 1966; BRAND et al. 1976; MECH 1980). The home range of a female with kittens usually overlaps with that of a male, but those of two males usually do not even partly overlap (SAUNDERS 1963b; HAGLUND 1966; BRAND et al. 1976; MECH 1980). Thus it would be reasonable that a male and a female should exploit different prey and not be in competition for food. BIRKELAND and MYRBERGET (1980) found no difference in the occurrence of cervids (roe deer and reindeer) in the diet of adult male lynx between the periods May–November and December–April (65 and 67 % respectively), while the difference was marked in the adult females (39 % and 67 %). In the present study area there were no roe deer or reindeer available, nor was there any significant sex-specific difference in the diet (Table 2).

The food requirements of the smaller-sized lynx are certainly smaller than those of the

larger one (cf. the principle of BERGMANN's Rule). The females can be thought to be subject to selection for small size in order to reduce maintenance energy requirements during gestation, lactation and weaning, when energy is required for raising the kittens. Lynx kittens, usually born in May, develop very slowly and travel with their mother until February or March (HAGLUND 1966; PULLIAINEN 1974), and may still suckle in December (HAGLUND 1966). Young Fennoscandian individuals of *F. lynx* weigh 9–11 kg in December–January (HAGLUND 1966; PULLIAINEN 1974) and their food consumption can be estimated at 600–700 g/day (see also DANILOV et al. 1979). The mother eats first (BRAND et al. 1976), and thus in order that an adult hare should also provide enough food for the two young ones as well, it is reasonable that the food requirements of the mother should be as small as possible. As shown by the number of prey animals found in the stomachs of *F. lynx* (BIRKELAND and MYRBERGET 1980; the present data) an adult lynx or a litter may be obliged to kill more than one prey individual per night.

In the lynx, as in the mustelids, the males give no assistance with raising the litters, and thus there is no energy premium for reduced size. The adult males live alone in their own home ranges, but congregate in certain places during the rut. Such gathering of four adults on 14–15 March is described by HAGLUND (1966). A large body size would certainly be an advantage for a male in the bitter rutting fights, and this is consequently favoured through selection. HAGLUND (1966) records the killing of one male lynx by another on 20 March, and in another case in Sweden a strong male killed on old, weaker male (ANONYMOUS 1977).

There has been no size reduction in *F. lynx* as in the two smaller lynx species since the Pleistocene (KURTÉN 1968). In the Villafranchian there was no true hare in Europe, but only *Oryctolagus* rabbits and a *Hypolagus* species, an intermediate between the hares and rabbits. Hares of the genus *Lepus* entered Europe in the early Middle Pleistocene, and KURTÉN (1968) assumes that the typical hunting method of the northern lynx began to evolve at that time. His review shows that conjectures on the food habits of the Issoire lynx range from leopard-style arboreal stalking to rabbit hunting with *Oryctolagus* and *Hypolagus* as their staple food.

Against this background, the history of the lynx in Europe is interesting. *F. pardina* is one of the few endemic mammal species in Europe. *F. issiodorensis*, which crossed from North America to Eurasia at the beginning of the Villafranchian and spread even to the Iberian Peninsula during that period, is regarded as the ancestor of both the European lynx species. Even in the Late Pleistocene *F. pardina* was still nearly as large as *F. lynx* in the north (KURTÉN 1968), its body size being assumed to have diminished since the Ice Age, while that of *F. lynx* has not. *F. pardina* was not confined only to the Iberian Peninsula in the Late Pelistocene, but was also found in Central Europe, where its range overlapped with that of *F. lynx* (KURTÉN 1968), but the two species remained distinct and there is no evidence of interbreeding.

Since the same hunting technique can be used by the lynx to catch hares, rabbits and roe deer with about equal efficiencies in snow, it may be thought that the large body size of *F. lynx* is an adaptation to the use of roe deer under conditions in which the depth of snow does not exceed 50 cm (FORMOZOV 1946; PULLIAINEN 1980a), while the reduced body size of *F. pardina* is an adaptation to the obtaining of rabbit-sized prey under relatively warm climatic conditions (see also DELIBES 1980). The climate of the Iberian Peninsula during the Ice Age must have been colder than at present.

F. canadensis inhabits areas of North America which are even colder than southern Fennoscandia (BANFIELD 1974), but it is equal in size to *F. pardina* and very much smaller than *F. lynx*. This situation can be explained by the fact that there have not been any roe deer or deer of that size available in North America, so that the *F. canadensis* populations are dependent on local hare populations (see ELTON and NICHOLSON 1942; BRAND et al. 1976). *F. lynx* occurs in Finland in areas where no roe deer are available, but human land

use activities (forestry measures and hunting practices) serve to maintain rather dense hare populations. JONSSON (1980) emphasizes the dependance of the *F. lynx* population on the roe deer population in Sweden.

F. lynx has expanded its range to the north in Fennoscandia during the past two decades, even into areas where the species has not previously occurred (CURRY-LINDAHL 1969; MYRBERGET 1970; PULLIAINEN 1974, 1979; JONSSON 1978; HEGGBERGET and MYRBERGET 1980). The reasons for this trend are obviously manifold. Protection activities on the part of human agencies, the lack of wolves (see also PALMÉN 1913; PULLIAINEN 1980b), expansion of the roe deer to the north (see PULLIAINEN 1980a) and especially the availability of degenerated, overcrowded semi-domestic reindeer populations (e. g. HELLE 1980; PULLIAINEN and HAVAS 1980) have each for their own part promoted this development.

Zusammenfassung

Zur Winterernährung von Felis lynx L. im südöstlichen Finnland im Vergleich mit der Nahrung von anderen nördlichen Luchsen

Zur Untersuchung kamen Mägen (n = 88) und Därme (n = 45) von *Felis lynx* L., die im Winter im südöstlichen Finnland erlegt wurden. In dieser Region sind keine Rehe *(Capreolus capreolus)* als mögliche Beutetiere vorhanden. 4 von 5 Verdauungstrakten enthielten vorwiegend Reste von Hasen: insgesamt 86 % des Gewichts der Magenfüllungen. Der übrige Teil bestand aus Haustieren, Pelztieren von Farmen, Rotfüchsen, kleinen Nagetieren, Tetraoniden und Birkenzeisigen. In der Zusammensetzung der Nahrung wurde zwischen beiden Geschlechtern kein wesentlicher Unterschied festgestellt.

Es wurde die Theorie bekräftigt, nach der weibliche Luchse klein sind, weil sie ein geringeres Bedürfnis an Totalenergie haben, und weil sie darüber hinaus größere Mengen überschüssiger Energie in die Aktivitäten der Fortpflanzung und Jungenaufzucht kanalisieren können. Die männlichen Luchse sind groß als Resultat sexueller Selektion.

Eine Literaturdurchsicht zeigt, daß *F. lynx* Rehe jagt, sofern sie vorhanden sind. Die größere Körpergestalt von Luchsen könnte deswegen als eine Adaptation an das größere Beuteobjekt Reh gedeutet werden. Demgegenüber kann die geringere Größe von *F. pardina* Oken in warmen Klimaten ebenfalls als Adaptation verstanden werden, jedoch an das kleinere Beuteobjekt Kaninchen. Im nördlichen Nordamerika, wo keine Säugetiere von der Größe des Rehes auftreten, jagt *F. canadensis* Kerr, der von gleicher Größe ist wie *F. pardina,* hauptsächlich Hasen.

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Die Rolle des Prolaktins bei der Trächtigkeit des Rehes
(*Capreolus c. capreolus*)

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Abstract

The importance of prolactin in the gestation of the roe deer (Capreolus c. capreolus)

Studied was the question whether prolactin is important for the gestation of roe deer *(Capreolus c. capreolus)*. In a first part of the study we have analysed prolactin and gestagen concentrations in 103 females of roe deer (radio-immunoassay). In a second part bromocriptin (a prolactin antagonist) was administered to a group of three roes (one roebuck and two does).

The serum analysis showed a prolactin-like substance (PRL). This substance had a higher serum concentration in pregnant animals than in nonpregnant controls. Each of the two does having been subject to administration of 2.5 mg bromocriptin, daily from september 1 to december 31, 1978, aborted spontaneously. Results suggest that a prolactin-like substance is important to maintain pregnancy in roe deer.