Felis lynx Linnaeus, 1758

Lynx

Felis lynx Linnaeus, 1758:43. Type locality near Upsala, Sweden.

Lynx vulgaris Kerr, 1792:157. Type locality Sweden (=Felis lynx Linnaeus).

Lynx canadensis Kerr, 1792:157. Type locality eastern Canada (=Quebec).


Felis kattlo Schrank, 1798:52. Type locality Bohemia.


Felis cervalia Temminck, 1824:106. Type locality Asia.

Felis pardina Temminck, 1824:116. Type locality Lisbon, Portugal.

Felis lupinus Thunberg, 1825:189. Type locality North Scandinavia.

Felis vulpinus Thunberg, 1825:192. Type locality Upsala, Sweden.

Felis virgata Nilsson, 1829:pl. 3-4. Type locality Sweden.

Felis isabellina Blyth, 1847:1178. Type locality Tibet.

Lynx cervalia Fitzinger, 1870:108. Type locality Norway.

Lynx subsolansus Bangs, 1897:49. Type locality Codroy, Newfoundland.

Lynx pardella Miller, 1907:398. Type locality Coto Doñana, Huelva, Spain (new name for pardina Temminck thought to have been preoccupied by Lynx pardina Oken).

Lynx sardinae Molina, 1908:48. Type locality Nuoro, Sardinia.

CONTEXT AND CONTENT. Order Carnivora, Family Felidae, Subfamily Felinae, Genus Felis, Subgenus Lynx. Lynx is here recognized as a subgenus in compliance with taxonomic arguments by Van Gelder (1977), although Kratochvil (1975) believed subfamilial classification (Lyninae) might be justified. The number of genera, species, and subspecies is much debated. Matjuschnik (1978) and Werdelin (1981) suggested that lynx, canadensis, and pardina are specifically distinct under the generic designation Lynx. The context and content used herein is not definitive, but is a conservative view of lynx taxonomy, treating these forms as subspecies. The subgenus Lynx, then, includes two extant species: F. lynx and F. rufus. At least eight subspecies are recognized (Corbet, 1978):

F. l. canadensis (Kerr, 1792:157), see above (mollipilosus Stone is a synonym).

F. l. isabellina Blyth, 1847:1178, see above (tibetanus Gray, kumensis Satunin, and wardii Lydekker are synonyms).

F. l. kattlo (Fetisov, 1950:21). Type locality Barun-Burinkhan, Salangnisky region, Buryatskaya ASSR, USSR.

F. l. lynnaea, 1758:43, see above (vulgaris Kerr, borealis Thunberg, kattlo Schrank, lynxula Nilsson, cervalia Temminck, lupinus Thunberg, virgata Nilsson, orientalis Satunin, danniki Satunin, wrangelii Ognev, altus Kerr, melurus Kerr, baikalensis Dybowsky, and guttata Smirnov are synonyms).

F. l. pardina Temminck, 1824:116, see above (pardella Miller is a synonym).

F. l. sardinae (Molina, 1908:48), see above.

F. l. strogonovii Heptner, 1969:1260. Type locality Glazkovka, Supunisky reserve, Primorsky territory, Lake Baikal, USSR (new name for Lynx lynx neglectus Stroganov, preoccupied by Felis neglecta Gray).

F. l. subsolansus (Bangs, 1897:49), see above.

DIAGNOSIS. Lynxes are distinguished from other Felis by the slender nasal branch of the premaxilla, the thinner, less depressed, and sharper postorbital processes, shallower notching of the suborbital edge of the palate, and proximity to the canine and more forward setting of P3 (Pocock, 1917a). In the Nearctic, F. lynx differs from F. rufus in the following: black tip completely encircles tail; anterior condyloid foramen (hypoglossal canal) distinct from posterior lacerate (jugular) foramen; preponderant wider (>6 mm); upper carnassial longer (>16.6 mm); interorbital breadth greater (>30 mm); smaller postorbital processes; and tail shorter than one-half length of hind foot (Durrant, 1952; Hall, 1981; Mermann and Stock, 1932). Paleaeptic F. lynx can be distinguished from the caracal (Felis caracal) by the former having spots on the fur and a facial ruff (Werdelin, 1981), and distinction of the anterior condyloid from the posterior lacerate foramen (Van den Brink, 1970). F. l. pardina, however, also has confluence of these foramina in common with the caracal, but differs from the caracal (and F. l. lynx) in having no metacentroid on m1 (Van den Brink, 1970). The preponderant is wide in F. lynx but narrow in F. caracal (Ognev, 1935; Van den Brink, 1970).

GENERAL CHARACTERS. Prime winter pelage consists of long, thick fur that is yellowish gray to grayish brown; summer pelage is shorter, more ragged, pale, and brownish (Durrant, 1952; Jackson, 1961; Saunders, 1961). Lynx fur is spotted to varying degree, depending on the subspecies. The ears are brown with a central silvery-gray spot, and terminate in long (approximately 4-5 cm) black ear tufts (Ognev, 1935). The eyelids, chin, inside of ears, underparts, and throat are white. A flared facial ruff, short tail, and short body with long legs are characteristic (Fig. 1). Digitigrade posture is supported by large, spreading, well-furred paws possessing five toes on the forepaw and four on the hind (McCord and Cardona, 1982). The digits are joined by a web (No.

Fig. 1. Photograph of Canada lynx, F. l. canadensis (upper), by Tom J. Ulrich, and of European lynx, F. l. lynx (lower) from the Carpathian Mountains of Czechoslovakia by Josef Stehlík.
and Alaska (Nawa, 1970), respectively, as follows: total length, 825 to 954, 910 to 1,545, 820 to 1,050 (saws tail), 740 to 1,170, 730 to 1,050, 670 to 830, tail length, 95 to 125, 110 to 208, 200 to 310, 50 to 130, 80 to 120, 70 to 130; length of hind foot, 203 to 250, no data, no data, 190 to 260, 210 to 250, 180 to 250.

The permanent dental formula for F. lynx is \( i 3/3, c 1/1, p 2/2, m 1/1, total 28; \) for deciduous dentition \( i 3/3, c 1/1, p 2/2, m 0/0, total 24 \) (Saunders, 1961, 1964). The skull of F. l. canadensis (Fig. 2) was described by Durrant (1952) as being large with small postorbital processes on the frontals, and having a transversely wide presphenoid constricted anteroposteriorly. The posterior palatine foramina are situated near the orbital rim of the palate, the anterior margin of the interparietal fossa is semicircular, and the anterior condyloid foramen is separate from the posterior lacrimate foramen. The rostrum is abbreviated. Hall (1981) provided skull measurements (in mm) for North American lynx as follows: greatest length, 120 to 136; zygomatic breadth, 82 to 93; alveolar length of maxillary toothrow, 38.1 to 41.6. Cranial measurements for F. l. lynx include: greatest length, 131 to 153; zygomatic breadth, 91 to 106.2; length of upper tooth row, 45.7 to 51.9 (Ognev, 1935).

**DISTRIBUTION.** The lynx has a Holarctic distribution (Fig. 3). Primary habitats in the Nearctic include boreal forests with openings, rugged outcrops, bogs, and thickets (Berrie, 1973; Koehler et al., 1979; Nellis, 1971; Saunders, 1961). Palaearctic habitats include old-growth taiga, mixed or deciduous forests, and wooded steppe up to an elevation of 2,500 m (Jurgenson, 1955; Kratochvil, 1968a; Novikov, 1956; Ognev, 1935).

In North America, the range (Fig. 3) of F. l. canadensis includes Labrador, Quebec to central British Columbia and the Yukon, Alaska (with the exception of the panhandle and Seward Peninsula) to tree line, northern New England, portions of the Lake States, the Pacific Northwest, and the Rocky Mountains south to Utah, but F. l. subsalutus is restricted to Newfoundland (Hall, 1981; McCord and Cardoza, 1982).

Distribution of Palaeartic F. lynx has changed appreciably during the last 2,000 years largely because of hunting and changes in land use (Ehbrecht, 1972; Kratochvíl, 1968b; Matheson, 1948; Pulliamen, 1964; Van den Brink, 1970). The range (Fig. 3) includes the entire taiga forest from Scandinavia to eastern Siberia, the Iberian peninsula, the Balkan peninsula (Mifric, 1974), the Carpathians, Caucasus, and Asia minor, south to Iran and the Kurdish Mountains of northern Iraq, and east through the Siberian forest to the island of Sakhalin, including Mongolia, Manchuria, Chinese Turkestan, the Kopet Dagh of Turkmenistan, southeastern Tibet, the Gilst, Ladak, and Kashmir regions of northern India, Korea, northern China, and Kanchatka (Corbet, 1978; Ellerman and Morrison-Scott, 1966; Guggisberg, 1975; Matsukhikin, 1978; Novikov, 1956; Ognev, 1935).

Lynx distribution in northern Norway has remained about the same but expansion has occurred in southern Norway (Heggberget and Myrberget, 1980). Lynxes occur regularly between 66°N and 68°N in Norway and Sweden but the most northern distribution is unclear and much debated (Curry-Lindahl, 1969; Mazak, 1968, 1970). In France, lynxes were thought to be nearly extinct until some were found in the Pyrenees (Beaufort, 1965, 1966), and reintroductions have been attempted (Ferrex, 1977). Reintroductions also were attempted with some success in Yugoslavia (Cop 1977a, 1977b). Schauenberg (1969) believed lynxes were extinct in Switzerland and Italy. The southern boundary of the range in the western USSR crosses the Moscow, Ryzan, and Vladimir districts (Synyev, 1966). In Siberia, the southern limit of the constant range is in pine-birch forests but migrating individuals often travel further south (Azarov, 1976). Mitchell and Derksen (1976) recorded a specimen from Nepal, about 75 km south of the range reported by Ellerman and Morrison-Scott (1966). Hell (1972) believed that the lynx had become extinct in western Europe except in Spain, but since 1950 an increase in the populations of the Carpathian Mountains had occurred. In a symposium on lynx distribution in Europe, populations of lynxes in Norway, Sweden, Finland, Poland, Czechoslovakia, Rumania, and Yugoslavia were reported to be stable or increasing largely because of reduced hunting, immigration from areas of higher density, and increased food supply (Kratochvíl, 1968a).

**FOSSIL RECORD.** The assumed common ancestor of lynxes, E. fissidens, is believed to have originated in Africa in the

![Figure 2](image-url)
early to middle Pliocene. This ancestor had lynx-like dental features but skeletonally resembled other Felis. It is believed to have migrated throughout the northern hemisphere by the middle Villafranchian. Felis lynx developed in China and reached Europe from Asia during the Steinheim by land, and manual age of the Paleocene. It also migrated into North America and gave rise to the Canadian lynx (Werdelin, 1981).

Fossil remains of F. lynx in North America are recorded from the Sangamonian faunas and from the Wisconsinan of Alaska, Idaho, Wyoming, and the Yukon (Kurtén and Anderson, 1980). Records are more common in Europe, including specimens from the E-Eonian in the travertines near Weimar and records from the E-Ciurm of Italy and the Balkans (Kurtén, 1968a). Specimens are known from the Ipswichian and Devensian of England, the Weichselian of northern Europe, and the Pleistocene of England and Denmark (Werdelin, 1981). Fossil specimens have been reported from England (Matthe- son, 1948), France (Boule and de Villeneuve, 1927), Spain (Sos, 1932), and Greece (Symeonidis et al., 1977).

FORM. Moore et al. (1974) provided detailed descriptions of three forms of guard hair from F. l. canadensis. Maximum length of the coarsest hair was 61 mm, maximum diameter 118 μm. The basal medulla is continuous and vacuolated, usually more than one-half the shaft width. Melanin is usually confined to the distal tip and a midshaft band; pigment intensity varies with season and ontogeny (Saunders, 1961).

The hypodermal apparatus is held near the base of the skull and is not imbedded in the throat musculature (Pocock, 1916a), therefore the lynx can purr but not roar. In F. l. isabellina, the tympanic bulla is a large partition that does not reach the summit of the bull but terminates toward the inner angle of its anterior edge (Pocock, 1916b). The outer chamber extends more forward than the inner chamber. F. l. canadensis differs in that the partition does not advance so far in front so that the anterior part of the inner chamber is wider.

Some external characters of F. lynx differ from other lynxes (Pocock, 1917b). The ears are angular, pointed, and tipped with long hairs. The upper margin of the pinna is more convex than in other lynxes and the nostrils are somewhat larger, possibly an adaptation to life at higher altitudes. The intertrimal tuft of tactile vibrissae is absent but the mystacial and supralabial tufts are well developed. Genal tufts are obscured by the long facial ruff, and may consist of a single bristle. The feet of F. l. isabellina differ from F. rufus by having larger inner toes of the sheaths of the claws and the plantar pads are shorter compared with their width. The plantar pads are also more overgrown with hair in F. lynx.

The distal end of the baculum of F. lynx is conical to slightly compressed laterally and slightly curved (Kratovitch, 1975). The proximal end is bifurcated and the rami are concave on the inner surface. Dimensions (in mm) of the largest os penis were: length, 9.4; greatest width, 3.8; least width, 0.5.

The deciduous carnassial pair is formed by dp3/3/dp4, but the adult pair is composed of P4/4 (Saunders, 1961). Greatest sector of dp3 = dp3 and P4 is seen in the paracorons and metacorons, respectively, of dp4 and M1. The dp4 and M1 are small and molariform, but m1 has practically lost the entire talonid. However, Kurtén (1963) suggested an evolutionary return of the metacoronal-talonid complex of m1 and the possible return of m2. Supernumerary teeth have been reported (Kratovitch, 1965; Miric, 1973; Vereschagin, 1979). Manville (1959) records a large amount bone in the only one lynx cranium (0.62%) from the Yukon territory of Canada, although bobcats possessed these bones in about 15% of the crania examined.

FUNCTION. Under experimental conditions, lynx guard hair had the lowest transmittance of solar radiation among Arctic mammals (Heitsland and Ronald, 1978), indicating that solar heating does not contribute significantly to energy conservation in the species. Thick fur and large, well-furred paws are thermoregulatory and structural adaptations to the Arctic environment (McCord and Cardoza, 1982). Lynxes maintain thermoneutrality but do not change respiratory frequency or minute volume (lung ventilation) at low temperatures, as do other Arctic mammals whose higher winter metabolic rates require greater oxygen consumption. Maximum minute volume is realized at 20°C with a respiratory frequency of 30/min (Casey et al., 1979).

Yearling lynxes have less bone-marrow fat than adults, suggesting greater energetic needs and undeveloped hunting skills (Stewart, 1973). Frey abundance affected renal and subcutaneous fat levels; also renal levels were affected by age, and subcutaneous fat by sex (Brand and Keith, 1979).

Scapino (1981) found that a stifled mandibular symphysis functions to transfer muscle force from the balancing side of the head to the teeth in the working jaw. Claw retraction is a function of the dorsal elastic ligaments but co-contraction of both forearm flexor and extensor muscles is necessary for claw protrusion (Goyena and Ashworth, 1975). A comparative study of the appendicular skeleton of the caracal and lynx (Mandal and Talukder, 1975) indicated that lynxes had a longer presacral but shorter postosacral ilium and an elongated ischia, and concluded this modification was related to their springing behavior. Auditory, visual, tactile, and taste senses are highly developed, but olfaction is poor (Lindemann, 1955; Saunders, 1963c). Vision in the lynx is predominantly scotopic and is especially suited for perception of fine differences in brightness (Rager and Festetics, 1982).

ONTGENY AND REPRODUCTION. The breeding season of lynxes varies geographically. In Newfoundland, mating occurs between early March and early April, peaking about the third week of March (Saunders, 1961); in Alaska, from March through April (Nava, 1970); in Alberta in April and May (Nellis et al., 1972). Lynxes in the Paleartic breed in February and March (Haglund, 1966; Novikov, 1956), and as early as January in southern Spain (Guggisberg, 1975). Saunders (1961) estimated that 10% of the ova were lost before implantation, and at least another 13% were lost between implantation and capture. In Alberta, Brand and Keith (1979) found that 73% of adult females conceived in years of snowshoe hare (Lepus americanus) abundance, but only 33% when hares were scarce. Gestation period for wild lynxes was estimated at 63 to 70 days (Saunders, 1961) and 67 to 74 days (Matjuschkina, 1978); Haglund (1966) determined a gestation period
of 63 to 73 days for captive European lynxes. Parturition occurs in late May to early June in Newfoundland (Saunders, 1961), and late May in Russia (Matjuschkin, 1978).

Litter sizes in lynxes may range from one to six, but are usually three to four in North America (Brand and Keith, 1979; Nava, 1970; Saunders, 1961) and two to three in the Old World (Novikov, 1956). Younger females tend to have smaller litters (Brand and Keith, 1979). Commonly, there is a prepartum breeding season; however, individuals in some populations may have litters only in alternate years (Ognev, 1935; Saunders, 1961).

Newborn lynxes have closed eyes, folded ears, no teeth, poorly developed ear tufts, and well-developed pelage with dark longitudinal stripes on back and limbs but dark less on the flanks (Merriam, 1886; Saunders, 1964). Lengths and body masses of two neonates in Newfoundland were 163 and 158 mm, and 197 and 211 g (Saunders, 1964). Guggisberg (1975) reported an average body mass of neonates as 70 g, but Steblík (1983a) reported an average of 289 g (range 250 to 360).

Eyes open between 10 and 17 days after birth (Kune, 1970; Lindemann, 1955; Novikov, 1956; Wayne, 1969). Young lynxes begin to walk at 24 to 30 days (Lindemann, 1955; Steblík, 1983a). The pelage of a 2-month-old kit had lost the natal pattern on the body, but the bars on the inner side of the forelegs were more distinct than in newborns. All lacteal teeth had erupted. Lacteal canines possessed an accessory cusp located immediately above the incisors (Saunders, 1961). Eruption of lacteal teeth begins with the canines at about 17 days of age, then continues with the incisors at about 20 days, then premolars at about 30 days (Lindemann, 1955; Steblík, 1983a; van Zyll de Jong, 1963). Lacteal dentition begins replacement at about 4 months of age (Lindemann, 1955; Saunders, 1961). Young European lynxes reportedly possess dp2 which is not replaced in the adult (Lindemann, 1955), however, van Zyll de Jong (1963) noted that this observation may represent misidentification of dp3 and dp4 as dp2 and dp3. Two-month-old lynxes in Europe had fully developed the ability to groom their body surface (Lindemann, 1955).

Litters begin at 10 days of age with stretching of the hind legs while lying on the back (Steblík, 1975). This stretch is accomplished while standing at 14 days, and stretching of the forepaws occurs at 15 days. Stretching of the back appears by the 34th day, and simultaneous stretching of opposite fore and hind limbs is seen at 35 days. Yawning begins at 10 days. Reaction to optic stimuli was observed at 15 to 20 days and to acoustic stimuli at 18 to 20 days (Steblík, 1983a).

The temporal ridges of the pelliaries are leaf-shaped but the lyre width decreases with age and joins in later life to form the same degree of a unipartite (transverse) (Saunders, 1964). The mesodermal ridge also becomes more prominent with age. Epiphyses of long bones of the forelimb remain unossified up to 9 months of age (van Zyll de Jong, 1963). The distal epiphysis of the humerus and proximal epiphysis of the radius are ossified by 18 months, the proximal epiphysis of the ulna is ossified by 30 months, complete ossification of all epiphyses occurs by the age of 3 months (van Zyll de Jong, 1963).

The duration of the suckling period is over 6 months (Lindemann, 1955) but young take meat from 30 days of age (Guggisberg, 1975). At about 40 days, young begin playful motions of walking prey (Guggisberg, 1975). During ontogeny, litter mates lose their need for kinship and become more "envious" of prey caught by litter mates (Lindemann, 1955).

The litter remains with the mother until the next mating season, and young of late litters have not attained adult size at this time (Lindemann, 1955; Novikov, 1956). Ognev (1935) emphasized that some litters may remain with their mothers after 1 year, which may mean that some lynxes reproduce only in alternate years.

Female lynxes can breed during their first reproductive season, that is, at about 10 months of age (Nava, 1970) but may not breed until 22–23 months (Saunders, 1961; van Zyll de Jong, 1963). Sexual maturity may be delayed during periods of prey scarcity (Brand and Keith, 1979; Nava, 1970) and overall breeding declines during such periods. Parker et al. (1983) reported that reduced prey affected reproductive success in yearling females more than in older females.

Luteal bodies are large and persistent, and increase in number with age (Brand and Keith, 1979; Nellis et al., 1972). Largest Graafian follicles appeared in early March as oestrus-like promi-

nences on the ovaries (Saunders, 1961). Testicular size also increases with age (Nava, 1970). Males apparently do not breed until their third year (Saunders, 1961; Stewart, 1973); gametogenesis may decline during summer and fall (Saunders, 1961; van Zyll de Jong, 1963).

Lynxes have lived almost 22 years in captivity (James, 1977) but seldom surpass 15 years in the wild (Nava, 1970). The primary mortality factors seen in the wild are prey scarcity (Brand et al., 1976; Nava, 1970), which affects kittens and yearlings most, and man (de Vos and Matel, 1952; Mech, 1980).

ECOLOGY. Population irruptions or habitat disruptions sometimes force dispersal of lynxes (Guggisberg, 1975; Mech, 1980). Reported long-range dispersal distances for lynxes have increased from 165 km (Nells and Whetmore, 1969) to 483 km (Mech, 1977). Average daily cruising distance ranges from 5.0 km (Saunders, 1963a) to 19.2 km (Baglund, 1966). Differences in cruising distances are thought to be related to hunting conditions.

Home ranges in lynxes differ by sex, age, prey density, and survey method, from approximately 11 to 50 km² (Berrie, 1973; Brand et al., 1976; Novikov, 1965; Saunders, 1963a). However, a colonizing population of lynxes in Minnesota had home ranges of 51 to 243 km² (Mech, 1980) and lynxes in Riding Mountain National Park, Manitoba, had ranges of 118 to 221 km² (Carbyn and Patrignian, 1983). Larger home-range size could be related to low density of lynxes or low prey density, although Brand et al. (1976) found that lynx home ranges were unrelated to either. Females usually have smaller home ranges than males, and home ranges sometimes overlap (Brand et al., 1976; Mech, 1980; Nells et al., 1972).

The major food of Nearctic lynxes is snowshoe hares, accounting for as much as 83% (frequency of occurrence) of the diet (More, 1976; Nells et al., 1972; Saunders, 1963b; van Zyll de Jong, 1966a). These studies also indicate utilization of squirrels (Tamiasciurus hudsonicus, Spermophilus sp.), small mammals (Muridae), beaver (Castor canadensis), deer (Odocoileus sp.), moose (Alces alces), muskrats (Ondatra zibethicus), and birds (Galiformes and Passeriformes); some is taken as carrion. Brand (1976) is the first to believe that lynxes use rodents (Lepus sp.) as long as 8 months of age (Fig. 9). Asymmetrical epiphyses of the radius and ulna are ossified by 32 months (Delibes, 1980), rabbits (Oryctolagus cuniculus) were used most from July through October, bucks (Anas sp.) from March to June, and crows (Certhia alpacia, Dama dama) from November to January. All lynxes except Brand et al. (1976) estimated daily food requirements for lynxes at 660 to 750 g. Consumption of the range lynx at 591 g/day (Delibes, 1980) and 960 g/day (Brand et al., 1976); rates vary according to prey abundance (Brand et al., 1976). Hunting success improves with practice and group size (Parker et al., 1983), and has been estimated at 26% in Nova Scotia (Parker et al., 1983) and 36% in Alberta (Brand et al., 1976).

Two hundred years of trapping records from the Hudson Bay Company have shown cyclical fluctuations in L. canadensis harvests. These records show a regular periodicity of about 9.6 years but an irregular amplitude of oscillations of trapped lynxes (Elton and Nichol-son, 1942). Elton and Nicholson (1942) believed lynx cycles to be geographically synchronous, but more recent investigation indicates that peak collection is first reached in the central provinces, and the western and eastern regions peak later and with less amplitude (Bunger, 1974; Butler, 1955).

Several attempts have been made to analyze the lynx data by use of autoregressive models. Moran (1953a) used logarithms of the numbers trapped, Bunger (1974) included a strictly periodic term, Campbell and Walker (1977) used a modified periodic term, Strong et al. (1977) used a periodic term and Bhanasal (1979) considered harmonic components. These statistical treatments are attempts to explain the cyclic fluctuation in lynx populations in mathematical terms, which can aid in prediction of population status.

The sunspot and lynx cycles are not correlated (Moran, 1949), but lynx trapping is correlated with temperature and precipitation (Ardis, 1979; Fox, 1978; Moran, 1953a). Moran (1953a) suggested that the effect of weather on snowshoe hares was responsible
for synchronization of hare-lycyn cycles through predator-prey in-
teraction. Fox (1978) believed that forest fires caused plant success-
sion favoring hares, that snowfall accounted for the variation in
interactions, and that oscillation was forced through these
events. Ardito (1979) found that a few linear combinations of 3 or
4 months of temperature and precipitation variables fit the lynx
population index, with the critical variable occurring between sum-
mer and winter.

By use of a predator-prey model, Gilpin (1973) found that
hare must "prey" on lynx. He interpreted this to mean that hare
abundance could indirectly kill lynx by vectoring a disease, but also
suggested that man, by trapping more heavily for lynx and having
harvested artificially caused the lynx oscillation. Wunderberg (1977)
commented that trapping records may reflect short-
term changes in hunting strategy related to hare abundance. Finerty
(1979) noted that the phenomenon might be an artifact created by
comparing data that are not comparable. Gilpin's (1973) data ap-
parently compared harves of hares in eastern Canada to that of
lynxes in western Canada.

Van Zyll de Jong (1966b) summarized the known occurrence
of ectoparasites of lynx, including eight species of fleas. Most fleas
encountered were found commonly on rodents and lagomorphs so that
are accidental records for the lynx. Van Zyll de Jong (1966b)
noted that the scarcity of fleas on lynxes is linked to their
habit of bedding on the trail and a lack of regularly used dens
or burrows (with the exception of the nursing female). Hopkins
(1912) isolated a species of Ixodes from a lynx in British
Columbia. In North America, seven cestodes (Adams, 1966; Barley
and Burt, 1970; Fyvie and Addison, 1979; Loewen, 1929; van
Zyll de Jong, 1966b), two trematodes (Pearson, 1956; van Zyll de
Jong, 1966b), seven nematodes (Pence et al., 1978; Rausch et al.,
1956; van Zyll de Jong, 1966b), and one acanthocephalan (Schmidt,
1968) have been reported. Sudikov (1952) described the nematode
Troglostrongylus asiadou from F. lynx in Azerbaijan, USSR.
Faganski (1961) reported the nematode Toxocara canis and the
estode Taenia solium from the lynx in Poland, but van Zyll de Jong
(1966b) differed to find this species. The cestode Pseudocestode
Matuzevich (1970) reported the cestodes Taenia crassiceps, T.
krabbei, T. pisiformis, and Hydatigera taeniaeformis, and the
nematode Toxocara mystax from the lynx in Lithuania. Diseases
known to infect lynxes include panleucopenia, rabies, coccidiosis,
and mycoplasmosis (Amplegova and Sokov, 1975; Langford, 1974;
Lewis, 1975; Povey and Davis, 1977; Matjuschkin, 1978).

Lynxes have been harvested for fur for over 2 centuries, but
significant value (therefore trapping pressure) has developed more
recently. The average price of lynx pelts in Canada rose from $38
(Canadian dollars) to $210 between 1970 and 1975 to 760 in
1973 (Brand and Keith, 1979). Increased harvest has been caused by price
increases, but improved access to remote areas and the use of
snowmobiles have increased trapping efficiency as well (Berrie, 1973).
Other studies show that this is the only way lynx have been conducted by trapping
the snow, telemetry on tagged individuals, and analysis of
data obtained from carcasses. Berrie (1973) found lynxes were trapped most easily with a bait
combination of grouse forms and beaver castor, producing one lynx per 74 trap nights. Leg-hold traps of various sizes commonly are used for capture (Berrie, 1973; Nellis et al., 1972; Saunders, 1963a). Immobilization has been accomplished with succinylcholine chloride at a dosage of 0.66 mg/
kg of body mass, ketamine hydrochloride at a dosage of 15 mg/
kg (Parker et al., 1983), and a phenacyclidine hydrochloride called Sernylan (Berrie, 1973; Mech, 1980; Nellis et al., 1972). Berrie (1972) showed that males were more susceptible than females to comparable dosages, males being immobilized with 0.25 mg/kg Sernylan and females with 0.6 mg/kg. Mech (1980) immobilized lynxes with a combination of about 1 mg of phenacyclidine hydro-
chloride and 0.5 mg of promazine hydrochloride per kg of body
mass.

Harvest data may show a preponderance of males in younger age
classes (Stewart, 1973), presumably because of dispersal, but sex
ratios often reflect the environment and will vary over time (Brand
and Keith, 1979; Parker et al., 1983). Yearly fluctuations in sex
ratios reflect differential survivorship, phase of the cycle, and trap-
ing sample biases. Kittens may be underrepresented in harvest
samples (Berrie, 1973; Brand and Keith, 1979; Parker et al., 1983); possibly because of poor survival of kittens, trapping biases, and
lack of maternal protection of young kittens.

Age can be estimated by examining ossification of epiphyseal
plates of longbones (Nava, 1970; van Zyll de Jong, 1963), tooth
replacement and cranial characteristics (Saunders, 1964), or ce-
mentum annuli (Nellis et al., 1972). Presence of an apical root
foramen in canines of lynx less than 19 months of age is an
important distinguishing kittens (Saunders, 1963b). Keith (1979)
indicated that the first incremental line appeared in lynx canines
between February and March of the second year.

Lynx populations should benefit from forest management
favoring hares (Parker et al., 1983). Eucalyptus plantations in op-
timal habitat in Spain may be detrimental to lynxes (Valverde,
1957). Harvest during periods of low recruitment delays or sup-
presses natural increases in lynxes by leaving fewer lynxes in the
breeding population. Suspending harvest for 3 to 4 years during
low population; the identification of greater overall harvest during har-
population increases and higher numbers at the peak (Berrie, 1973;
Brand and Keith, 1979). Shortened seasons would change the age
structure of the harvest, because the proportion of kittens in the
harvest increases through the season, whereas the proportion of
yearlings decreases (Parker et al., 1983). When recruitment is high,
a delayed season (January-February) would insure higher harvest of
yearlings and lower harvest of kittens; orphaned kittens in the
later season have increased chances of survival (Parker et al., 1983).

BEHAVIOR. Lynxes usually are solitary animals except for
females with litters (Parker et al., 1983). They exhibit a strong
reaction to the smell of the feces of conspecifics, to the sexual smell,
and other strange olfactory and taste stimuli (Lindemann, 1955).
Mutual avoidance may be effected through this mechanism, but
during periods of prey scarcity mutual avoidance may cease to
function as a spacing behavior (Brand et al., 1979).

During the breeding season, vocalizations become common.
Purring and meowing is performed especially at dawn and twilight,
but the loud bellowing of the male may be given throughout the
night (Ognev, 1935). The call of the female is more of a vibrating
whine (Guggisberg, 1973). Male lynxes display a characteristic
singing scent or scenting of urine of the female followed by a
siffrid facial expression, to determine the reproductive condition
of the female (Lindemann, 1955; Stehlik, 1979). The period of
receptivity lasts 1-2 days but preceding that time there is an in-
crease in urine marking by both sexes (Stehlik, 1983b). Males hold
on to the skin of the neck of the female during copulation (Stehlik,
1983b).

By tracking lynxes in snow, Saunders (1963a) found that
kittens buried their faces and covered urination sites except when
the crust of the snow was too hard. By late April, kittens had
abandoned the habitat. Adults commonly urinated and defecated along
trails, sometimes in the same location (latrines), presumably to scent
mark territories.

When several lynxes travel together (most commonly family
groups), they follow in the footsteps of the leader. Although lynxes
generally avoid water, they can swim across large stretches if nec-

ecessary (Ognev, 1935). Familiar features of the surroundings are
strongly imprinted on the lynx. Orientation and homing abilities are
affected primarily by visual means, and an excellent memory allows
the lynx to locate pre-established hiding places (Lindemann, 1955).

Lynxes may feed at any time of day, but they are most active
during dusk and dawn, and hide in rest areas during the day
(Ognev, 1935; Saunders, 1963a). Lynxes stalk as close as possible
to prey, then pounce on it in one or two bounds, or less commonly
they leap down from a branch onto larger prey (Guggisberg, 1975).

Prey are usually pursued 20-50 m, but chases have reached 100
m (Stehlik, 1979a). Tracking an adult female with two offspring
in the snow, Saunders (1963a) found that the kittens often flanked
the adult 15 to 40 paces when hunting through wooded areas. Upon
entering clearings, they rejoined the female and frequently followed
in her footsteps. Lynxes often made hunting or resting beds in the
proximity of recent hare activity. Kills were sometimes made from
such beds. Barach (1971), Parker et al. (1983), and Saunders
(1963a) noted instances of cooperative hunting.

When food is less limiting, lynxes may cache food for later
use. Nellis and Keith (1968) trailed lynxes through snow and found
that at least portions of 6 of 11 hares killed were cached, and six
old caches were revisited. Berrie (1973), Haghind (1966), and
Matjuschkin (1978) also reported caching by lynxes.

Hancock et al. (1976) reported an attack on a trapper car-
rying 12 hares. Usually attacks on humans are during periods of
prey scarcity or when the human wears animal-hide clothing.

GENETICS. The diploid number is 38 chromosomes. The
autosomal complement includes two graded series (ranging from large to small) of eight pairs of metacentrics and eight pairs of the submetacentrics, and two pairs of medium-sized acrocentrics (Heu and Benirschke, 1974). The X is a large submetacentric and the Y is a small submetacentric.

Kurtén (1966b) believed that the Scandinavian lynx population had a dual origin, from the south across Denmark and from the east through Finland. Merging of immigrants from these origins resulted in gradients of character gradients in tooth size. Lynxes of southern Sweden seemingly were isolated at some time, indicated by a more narrow postorbital constriction than in other forms. Dilute mutation was observed in a lynx from Alaska (Schwartz, 1938). Jones (1923) described color phases, including "drab blue," "tabby," "light brown," and "fawn yellow." Ognev (1935) described an "ocher-orange" specimen.

REMARKS. Phylogenetic relationships within the Felidae are unclear. Kurtén and Rausch (1959) tentatively attributed differences between lynx crania from Alaska and Fennoscandia to clinal variation, initiating a move to consider these lynxes conspecific. Van den Brink (1970) concurred, but showed that the confluence of the anterior cingulum foramen with the posterior lacerate foramen, used to distinguish holocats from lynxes in the Nearctic, also was present in F. l. pardina in the Palearctic, and referred the latter to Lynx pardina. Kratovil (1975) suggested that bacilar morphology could justify subfamilial classification of the lynx group and later (Kratovil, 1982) added mathematical evaluation of karyotype support. Van Gelder (1977) argued that the ability to hybridize negated generic distinction of Lynx and Felis. Herring (1983) examined the Felidae with cluster, principal component, and cladistic analyses, and concluded that the genus Lynx was a valid category within the Felidae. Strebl (1975) believed that behavioral differences justified Lynx as a genus. The current tendency in original research papers appears to be to accept Lynx as a genus, but acceptance is still not widespread. Should Lynx become the accepted generic designation, it is likely that the forms lynx, canadensis, and pardina will be elevated to species rank.

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