

Capra sibirica. By Alexander K. Fedosenko and David A. Blank

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***Capra sibirica* (Pallas, 1776)**

Siberian Ibex

Ibex alpium sibiricarum Pallas, 1766:31. Vernacular name, invalid; not binomial (Heptner et al. 1988:774, footnote 161).

Capra (Ibex) sibiricus Pallas, 1776:52. Type locality “Munku-Sardyk range in Eastern Sayan Mountains, west of Lake Baikal,” Siberia, Russia.

Capra sibirica Meyer, 1794:397. Agreement in gender of Pallas, 1776.

Capra pallasii Schinz, 1838:9. Synonym of *sibirica*.

Capra himalayanus Hodgson, 1841:414. Type locality “Nepal” (vide Ellerman and Morrison-Scott 1951:406).

Capra sakeen Blyth, in Hodgson, 1842:283. Nomen nudum.

Aegoceros skyn Wagner, 1844:491. Type locality “the mountains of Kashmir and especially in small Tibet.”

Ibex sakin Hodgson, 1847:700. Nomen nudum.

Capra skyn Severtsov, 1876:334. Preoccupied by *Aegoceros skyn* Wagner, 1844.

Capra dauvergnei Sterndale, 1886:24. Type locality “probably somewhere to the west of Kashmir” (vide Lydekker 1913:150).

Capra sakin Blanford, 1891:504. Emendation of *C. sakeen* Blyth, 1843.

Capra sibirica typica Lydekker, 1898:281. Type locality “Tian Shan.”

Capra sibirica sacin Lydekker, 1898:284. Substitute name for *Aegoceros skyn* Wagner, 1844.

Capra sibirica wardi Lydekker, 1900:101. Type locality “Braldu, Baltistan, in the neighbourhood of the Baltoro Glacier” (vide Lydekker, 1913:148).

Capra sibirica lydekkeri Rothschild, 1900:277. Type locality “Kattutay district of Irtysh Altai” (vide Lydekker, 1913:145).

Capra altaica Noack, 1902:623. Type locality “Altai near Irtysh River” Russia.

Capra fasciata Noack, 1902:623. Type locality “North-east Altai, or Bia Altai, in the neighbourhood of Lake Telezko” (vide Lydekker, 1913:144).

Capra alaiana Noack, 1902:624. Type locality “central Alai range” (vide Heptner et al. 1988).

Capra sibirica hagenbecki Noack, 1903:384. Type locality “Kobdo, Gobi . . . Mongolia” (vide Lydekker 1913:145).

Capra sibirica lorensi Satunin, 1905:26. Type locality “320 versts south of Nizhneudinsk (Sayans)” (vide Heptner et al. 1988:775).

Capra sibirica typica Lorenz, 1906:95. Type locality “Tunkin alps, Sayans” (vide Heptner et al. 1988:775). Preoccupied by *typica* Lydekker, 1898.

Capra almasyi Lorenz, 1906:89, 98. Type locality “Tian Shan, including Kulja district” (vide Lydekker 1913:146).

Capra sibirica transalaiana Lorenz, 1906:90, 103. Type locality “Saryk-Mogul, southern slope of Trans-Alai Range” (vide Heptner et al. 1988:775).

Capra sibirica pedri Lorenz, 1906:94. Type locality “Gilgit” (vide Lydekker 1913:151).

Ibex sibirica mersbacheri Leisewitz, 1906:654–655. Type locality “central Tian Shan, inclusive of the Naryn district” (vide Lydekker 1913:147; but see Heptner et al. 1988:775).

Capra sibirica filippii Camerano, 1911:209. Type locality “Lahul” (vide Lydekker 1913:152).

Capra sibirica formozovi Tsalkin, 1949:20. Type locality “Aleksandrov range, Kyyamattu gorge 26 km southwest of Novo-Dimitriev station” (vide Heptner et al. 1988:775).

CONTEXT AND CONTENT. Order Artiodactyla, suborder Ruminantia, infraorder Pecora, family Bovidae, subfamily Capri-

nae, tribe Caprini, genus *Capra*, subgenus *Capra* (Baryshnikov 1981). Four subspecies are recognized (Heptner et al. 1961).

C. s. alaiana Noack, 1902:629, see above (*almasyi* Lorenz, *formozovi* Zalkin, *merzbacheri* Leisewitz, *transalaiana* Lorenz, and *typica* Lydekker are synonyms).

C. s. hagenbecki Noack, 1903:384. Type locality “Kobdo, Gobi.”

C. s. sakeen Blyth, 1842:283, see above (*dauvergnei* Lydekker, *dementievi* Zalkin, *filippii* Lydekker, *himalayanus* Hodgson, *pedri* Lorenz, *sacin* Lydekker, *sakin* Blanford, *skyn* Severtsov, *skyn* Wagner, and *wardi* Lydekker are synonyms).

C. s. sibirica (Pallas, 1776:52), see above (*altaica* Noack, *fasciata* Noack, *lorenzi* Satunin, *lydekkeri* Rothschild, and *pallasii* Schinz are synonyms).

DIAGNOSIS. *Capra sibirica* (Fig. 1) is the largest and heaviest-built species in the genus. Total length of adult males reaches 171 cm, height at withers is 110 cm, and body mass is 130 kg, compared with 170 cm, 115 cm, and 109 kg in *C. falconeri* and 165 cm, 109 cm, and 96 kg in *C. caucasica*. *C. ibex* and *C. aegagrus* are considerably smaller: 150 cm, 93 cm, 65–117 kg and 150 cm, 95 cm, and 70–80 kg, respectively (Heptner et al. 1961; Schaller 1977). Skull (Fig. 2) of *C. sibirica* is similar to that of *C. aegagrus* but differs from other *Capra* by having longer nasals. Compared to *C. aegagrus*, forehead of *C. sibirica* is broader and less bulging; width between eyes is longer than length between front edge of choana and lower edge of occipital foramen (basion) and covers 53% of total length of skull. Length of maxillary premolars



FIG. 1. Adult male *Capra sibirica* at San Diego Zoo. Photograph by Ron Gordon Garrison, Zoological Society of San Diego (used with permission).

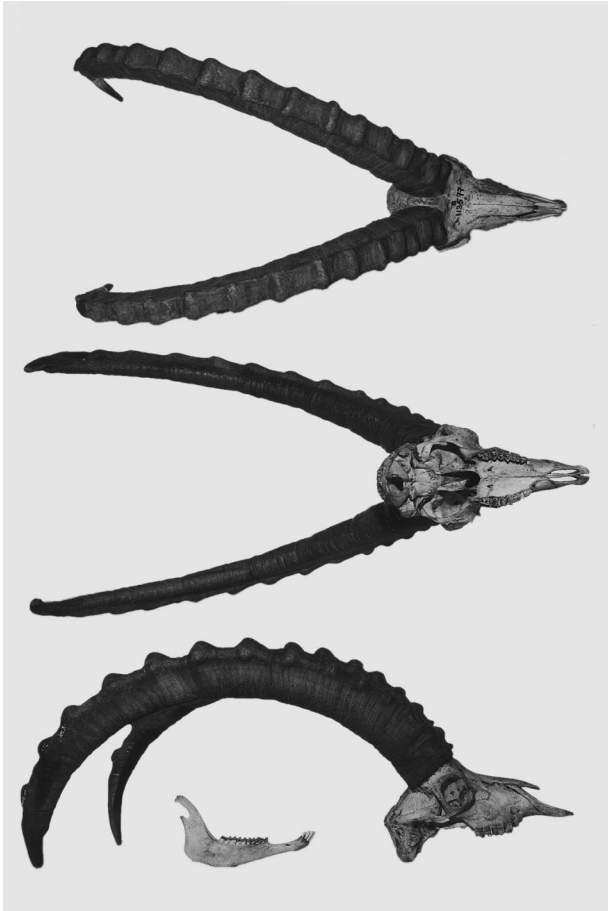


FIG. 2. Dorsal, ventral, and lateral views of skull and lateral view of mandible of *Capra sibirica* (9-year-old male; Moscow University Zoological Museum S-113577) from Shamsi, Kirgizskiy Alatau Range, Tien Shan. Greatest length of skull is 295 mm and biorbital width is 90 mm. Photographs by A. V. Antropov.

(P2–4) is <33% length of molars (P2–M3). Horn cores of females are displaced backwards. Horns of males are longest in genus; generally, their length is 100–148 cm, compared with 55–161 cm in *C. falconeri*, 140 cm in *C. aegagrus*, 48–118 cm in *C. caucasica*, and 75 cm in *C. ibex*. Horn shape of *C. sibirica* is most like that of *C. nubiana* and *C. ibex*, in that it is sabrelike, contracted from sides, and has transverse ridges on front surface. In contrast to *C. nubiana* and *C. ibex*, horns of *C. sibirica* have 2 marked edges with a broad flat surface between them frontally and index of their bend is nearly twice as large. Cross section of horn is tetrahedral at base and more triangular towards top. Body of *C. sibirica* is more gray and gray-brown than that of *C. aegagrus*, which has red-brown and ginger tints. Compared to other ibexes, *C. sibirica* has more geographical, seasonal, sexual, and age variability. Horny callus on back of carpal joint, which is characteristic of *C. aegagrus*, is seen only in natural populations of *C. sibirica* from Siberia (Fedosenko and Savinov 1983; Roberts 1977; Schaller 1977; Sokolov 1959; Weinberg 1993).

GENERAL CHARACTERS. Males have a massive long body with a big chest and short, heavy legs. Height at sacrum is 3–5 cm more than at withers. Nose profile is straight, and neck is short and thick in males but much thinner in females. Line of back is straight or slightly bulging at loins. Beard is large, long, and thick. Tail is short, flat, and hairless underneath. Hooves are long and massive, but they are low and have blunt rounded tops. Lengths of hooves are 70–80 mm on front legs and 60–70 mm on rear legs, heights of hooves are 37–45 mm and 36–42 mm, respectively (Heptner et al. 1961; Sokolov 1959).

Color of Siberian ibexes varies throughout their range. During winter, males in southern Siberia (Altai, Sayan) and adjoining parts of Mongolia are very light in color, with yellow-white tints on the

neck and body. A dark-brown stripe stretches from withers to tail. Head, shoulders, scapula, front part of legs, chest, and lower part of neck are brown. Beard and tail are dark. Belly, groin, and perineum are pale and generally do not have a contrasting border with darker upper parts, as is usual for individuals from Siberia. Lips are white. Siberian ibexes are darker in Central Asia (Tien Shan, Pamir). Some animals have white saddlelike spots on back and neck with a dark spine stripe in middle; the rest of upper parts is dark brown. During summer, males are more uniformly gray-brown and saddlelike spots disappear, but belly, groin, and perineum keep their light color. Only dark stripe on back remains as noticeable during winter. Individual differences in color occur. In Pamir dark, reddish, and pale animals may occur in the same herd. Light-gray individuals live in the Tien Shan Mountains. Some Siberian ibexes have white legs below carpus and/or knee joint. Compared to males, females have a homogeneous color; even the dark stripe on the back is not always noticeable. Females are gray-brown with a ginger-yellow tint, which is especially noticeable during summer. Young have more yellow-tinger tint to their pelage, but as they mature their color resembles that of adult females. Males have their adult colors by 4–5 years of age (Demin 1947; Egorov 1955; Sokolov 1959).

Males are much larger and have longer and more massive horns than females. Means (with parenthetical ranges and sample sizes) of external measurements (in mm) of adult (5 years of age) males and females, respectively, are: total length, 1,593 (1,400–1,710; $n = 15$), 1,283 (1,150–1,400; $n = 34$); length of tail, 189 (180–200; $n = 17$), 163 (130–220; $n = 34$); length of ear, 149 (140–160; $n = 15$), 147 (130–180; $n = 34$); height at shoulder, 994 (880–1,100; $n = 15$), 830 (730–920; $n = 34$); height at sacrum, 1,061 (980–1,130; $n = 15$), 883 (820–1,000; $n = 34$); girth of chest, 1,185 (920–1,270; $n = 13$), 950 (740–1,000; $n = 14$); and body mass (kg), 90 (59.8–130; $n = 16$), 44.2 (34.4–56.2; $n = 34$)—Fedosenko and Savinov 1983; Roberts 1977; Savinov 1962).

Skulls of females have a horn core that is displaced slightly backwards: front edge of base is either behind rear edge of orbit or, rarely, even with it. Horn core of males in cross section is an isosceles triangle, and base is wide and slightly prominent at front. Males have a wide forehead that borders front side of horn core. Surface along sagittal seam of forehead is concave. In males, skull is rough anterior to base of horns and has a distinct border with smooth surface. Skin becomes thicker and horny at this site, and horn ridges form there. Maximum width of nasals is 28–40% of their length. Distance from front edge of nasals to that of prosthion is usually less than separation between prosthion and front edge of P2, and difference is always more than length of P2. Premolars are greatly reduced in size: their length on maxilla is <33% of row length of molars P2–M3 (Sokolov 1959).

Bow-shaped or sabrelike horns are curved backwards and diverge at an angle of 35–42°. Tips of horns are usually directed downwards and sometimes slightly inward or outward. Horn bases are ca. 2–2.5 cm apart. Horn surface is rugose from base to near top. Circular furrows border each section of annual horn growth; these sections are annual horn rings. Transverse ridges sharply protrude every 3–5 cm along front surface of horn and overlap side edges. Sections between adjacent annual horn rings usually have 2 transverse ridges, rarely 1 or 3. Horns are black in males and gray-brown in females. Length of horns of adult males (>5 years of age) is 1,151 mm (910–1,370 mm; $n = 43$) to 1,400–1,480 mm in record cases; their weight with cranium is 7 kg. Longitudinal horn diameter at the base is 75–80 mm, transverse diameter is 60–70 mm, and circumference is 247 mm (200–280 mm; $n = 29$). Horns have high individual variability, that is, in bend of horn (varies from nearly straight line to full semicircle), degree of separation, index of mass (i.e., relationship between horn length and thickness), and form and size of ridges on front surface. Horns of females are much thinner and shorter: length is 273 mm (190–390 mm; $n = 37$), or <1.5 times length of skull and circumference is 108 mm (90–140 mm; $n = 26$). Horns are further apart at base than in males. A cross section of a female's horn is elliptical. Circular rings are more evident in horns of females, but transverse ridges on front surface are absent (Fedosenko and Savinov 1983; Heptner et al. 1961; Roberts 1977; Schaller 1977; Sokolov 1959).

Capra s. sibirica is small: skull length is 256–293 mm for males and 239–260 mm for females; length of horn in males is 110–117 cm, girth at base is 24 cm, and body mass is up to 103 kg (Sobanskiy 1988). Nasals are short, absolute length is usually

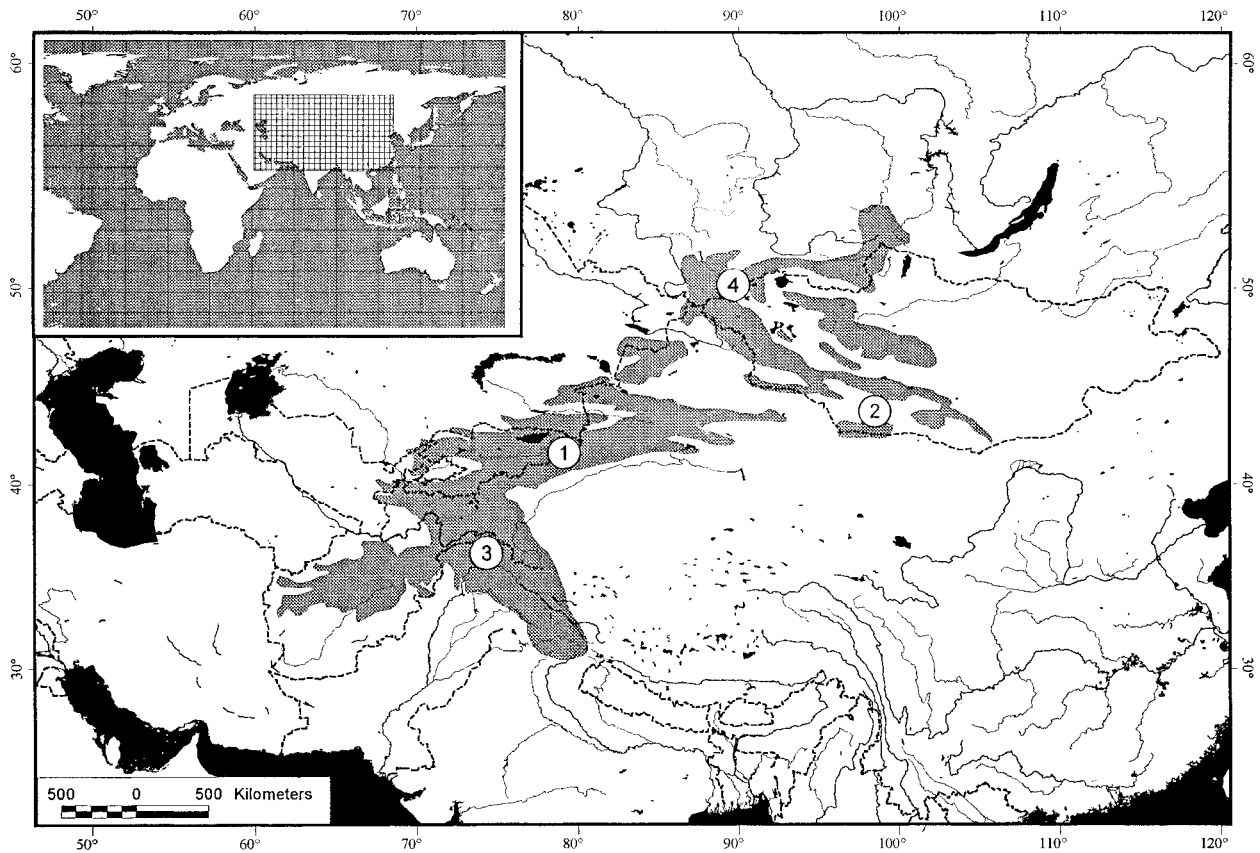


FIG. 3. Geographic distribution of *Capra sibirica* in central Asia and southern Siberia. Type localities of subspecies are: 1, *C. s. alaiana*; 2, *C. s. hagenbecki*; 3, *C. s. sakeen*; 4, *C. s. sibirica*. Adapted from Bannikov (1954), Fox and Johnsingh (1997), Heptner et al. (1961), Hess et al. (1997), Mallon et al. (1997), and Wang Sung et al. (1997).

<100 mm, and they comprise 28–37% of skull length for males and 32–42% for females. Suture between forehead and nose is situated anterior to leading edge of orbit or at same level. Horns of males are relatively short and not thick: length is <100 cm and girth at base is 18.5–24.0 cm. Color of males during winter is relatively light; back, sides, and upper part of neck are mainly dirty-white or yellowish white. Dark and light color patches are bright and have contrast borders (Sobanskiy 1988; Zalkin 1950).

Capra s. hagenbecki is quite close to *C. s. sibirica* in size and build, but it has relatively longer horns (74–139 cm for males and 16–38 cm for females) and ridges in middle portion of horns are larger. Color is more gray and pale brown without a light saddle, and old males may become nearly white (Bannikov 1954; Lydekker 1913).

Capra s. alaiana is bigger than other subspecies: skull length is 276–310 mm for males and 248–262 mm for females. Nasal bones are long: absolute length is >100 mm, and comprises 32–40% of skull length for males and 34–43% for females. Suture between forehead and nose is situated higher than leading edge of orbit. Horns of males are big and massive: usually >100 cm and up to 147 cm in length; girth at base is 20–28 cm. Body mass of males is up to 130 kg. Adult males during winter are relatively dark; body color is mainly dark brown-gray, and dark and light patches have less contrast than in *C. s. sibirica*. The light saddle-like spot on dorsum may vary in form and size (Heptner et al. 1961).

Morphologic characteristics of *C. s. sakeen* are close to those of *C. s. alaiana*, but horns of *C. s. sakeen* are relatively short (horn length of males is 102–140 cm) and more massive at base (base girth is up to 30 cm). Males also weight less (up to 90 kg). They are light in color: back and sides are pale brown or creamy white, dorsal stripe is pale brown, and other parts are light yellowish brown; beard and tail are black-brown (Heptner et al. 1961; Lydekker 1913; Roberts 1977; Schaller 1977).

DISTRIBUTION. Siberian ibexes occur throughout mountains of central and middle Asia, southern Siberia, and the north-

west Himalayas (Fig. 3). This species has an unbroken natural habitat in northeastern Tajikistan (Hissar and Pamir ranges). Siberian ibexes are most numerous in rocky ridges and in gorges of western Pamir; they avoid the smoother east ridges (Meklenburtsev 1949). The Siberian ibex population numbered 40,000 in Tajikistan during the 1980s, including 30,000 in the Pamir (Sokov 1993). In Kyrgyzstan they inhabit central and western Tien Shan and northern Pamir (Alai Range). Siberian ibexes are most numerous in the Terskei Alatau Range: ca. 80,000 ibexes were found during the middle 1980s (Klimova 1989). Now Siberian ibexes are most common in Kyrgyzstan and Tajikistan, where population size is ca. 70,000. In Uzbekistan, 2,400 individuals occur in west Tien Shan (Weinberg et al. 1997). They are numerous also in southeastern and eastern Kazakhstan (most ranges of the Tien Shan). Occasionally they travel into the isolated Tarbagatai-Saur Mountains of eastern Kazakhstan from China. They are not numerous in the southern Altai Mountains and the Narymskiy Range, and since the beginning of this century, they have almost disappeared from the Kalbinskiy Altai (Selevin 1937). Siberian ibexes apparently inhabited Tsentralniy Kazakhskiy Melkosopochnik (Central Kazakh Hillocky area) in central Kazakhstan during the last century. In Kazakhstan the number of Siberian ibexes was ca. 20,000 during the 1980s, with more than half living in the Dzhungarskiy Alatau (Fedosenko and Savinov 1983; Heptner et al. 1961). Current population is ca. 17,000 individuals (Weinberg et al. 1997).

In Russia, Siberian ibexes are distributed sporadically in southern Siberia, in Altai and Sayan ranges and the mountains of Tuva. They occur in central and southeastern Altai and are most numerous in the Katunskiy, Argut, and Chuiskiy ranges; nearly half of all Siberian ibexes living in Altai occur there. Lowest numbers are in the Beluha Mountain area, because of deep snow cover (Dmitriev 1938). The entire population in the Russian Altai was 4,500 at the end of 1980s (Sobanskiy 1988), and now is ca. 3,000–3,500 (Weinberg et al. 1997). The Tuva Mountains have ca. 15 small populations with a total of 3,000 Siberian ibexes (Smirnov and Tkachenko 1992). Ca. 2,100 animals are sporadically distributed

in the western Sayan Mountains (Zavatskiy 1990). In East Sayan, they numbered 800 at the beginning of the 1970s (Opryshko 1975). In 1997, the totals were 1,500 in western Sayan and 2,000–2,500 in eastern Sayan (Weinberg et al. 1997). The latter is the easternmost range of *C. sibirica*, and its intersection with Western Sayan represents the northernmost occurrence (Opryshko 1975; Sokolov 1959). Thus, 10,000–11,500 Siberian ibexes were in Siberia during the 1970s and 1980s, and >140,000 occurred in the former USSR (Klimova 1989). Present estimates are 8,000–9,000 and 100,000–110,000, respectively (Weinberg et al. 1997).

In Mongolia, *C. sibirica* is distributed along the whole Altai and Gobi Altai ranges southeast to ca. 109°E, on the main ridge of the Hangai Mountains of central Mongolia, on Turgen Uul and other ranges of northwest Mongolia, in the mountains west of Lake Khovsgol, and on many of the isolated mountains in the Transaltai Gobi. This species is most common in the Mongolian Altai and least common in the Gobi region. In the 1980s Siberian ibexes were released just south of Ulaanbaatar and well outside their traditional range. Ca. 80,000 were in Mongolia during the 1970s, but they have declined considerably since then (Bannikov 1954; Mallon et al. 1997).

In China, *C. sibirica* is restricted to the northwest, primarily in mountains surrounding Xinjiang, but this species also occurs in northern Gansu, Inner Mongolia, and extreme northwestern Tibet. In western Xinjiang, they are found along the border with Kazakhstan to the south of Mongolia border, in Altai, Saur-Tarbagatai, and Dzhungarskiy Alatau and throughout the Tien Shan ranges, through the Kok Shaal Tau Mountains along the border with Kyrgyzstan, and into the Pamir along the border with Tajikistan, Afghanistan, and Pakistan. They are noted in the Kuruk-Tag Mountains to the south from Bagrashkul Lake, in eastern Kashgaria and Karakoram, and in the western Kunlun Shan Range to 80°E. Populations occur along the Sino-Mongolian border in the Baytik (Xinjiang) and Bei Mountains (Gansu), and as far east as the Daqinshan of central Inner Mongolia. The Siberian ibex is most numerous in Tien Shan, where the population is estimated at ca. 40,000–50,000. Ca. 3,000–4,000 Siberian ibexes are in the Bei Mountains. Densities in other areas (Daqin Mountains, Altai) are low (Wang Sung et al. 1997).

Capra sibirica is the most common ungulate in northwestern Himalayas. In India, *C. sibirica* occurs in the Karakoram, Himalayan, and Transhimalayan regions of Jammu, Kashmir, and Himachal Pradesh, as far east as the Sutlej River. Siberian ibexes are found in the western half of Ladakh, in the Shyok Valley of northern Ladakh, along the Ladakh Range to 45 km southeast of Leh, and along both sides of the main Himalayan Range eastward to Shingo La Pass. Recent population estimates include >6,000 in Ladakh and 4,000 on the south side of the main Himalayas in Jammu, Kashmir, and Himachal Pradesh (Fox et al. 1992; Fox and Johnsingh 1997).

Capra sibirica is the most numerous species of Caprinae in Pakistan (Schaller 1977). It is restricted to relatively dry mountains of the inner Himalayas, Karakoram, and Hindu Kush. Siberian ibexes are fairly widespread throughout higher mountain ranges of the Gilgit, Diamir, and Baltistan districts, and northern part of the Chitral District. In Dir, Swat, Koshistan, and Mansehra districts, as well in the northern part of Azad Jammu and Kashmir, *C. sibirica* inhabits inner mountains range and southern slopes of the main Himalayan chain. In Gilgit, the species is still numerous in Ishkoman, Yasin, and Hunza. Further west it occurs in the Hindu Kush Range and throughout northern Chitral down to ca. 32 km north of Chitral Bazaar. Total number of *C. sibirica* in Azad Jammu and Kashmir was estimated at 375 individuals in 1986–1987, and for the northern areas (Gilgit, Diamir, and Baltistan districts) between 9,000 and 10,000 ibexes were estimated in 1993 (Hess et al. 1997; Roberts 1977).

West of the Karakoram, Siberian ibexes extend into the interior parts of Afghanistan. *C. sibirica* is found throughout the Hindu Kush, northeast as far as southern Badakhshan, and southward into the Hazarajat Mountains, in the Spinghar, and the Kohe Baba Range near Kabul. Siberian ibexes also occur in the Feroz Koh in the northeast; in northern Nuristan and mountains of Badakhshan Province, including Darwaz; throughout the Pamir Mountains; and in glaciated ranges south of the Wakhan River. Siberian ibexes penetrate farther west and north from these mountains to the borders with Iran and Turkmenistan. Siberian ibex was considered abundant throughout its range until the 1980s. Ca. 5,000 individuals were in the Ajar Valley Reserve and >4,000 inhabited Pamir

alone during 1970s. The present population is lower because of numerous wars (Habibi 1997; Heptner et al. 1961).

FOSSIL RECORD. The genus *Capra* is related to the Mongolian genus *Tossunnoria* from the lower Pliocene, combining signs of 2 genera, *Capra* and *Ovis*. Fossil remains of the first true goats appeared during Pleistocene (Sokolov 1959). The earliest finds, which are related to *Capra*, are known from Middle Pleistocene (Solihac, Hundshem, and Saint-Esteve). However, the documented history of *Capra* species in Europe begins with early part of 3-Riss (glacial terraces in Thuringia; Achenheim), when the apparently distinct species *Capra camburgensis* appeared. This species combined characters of various present species such as *C. pyrenaica*, *C. ibex*, and others. Possibly the Camburg ibex was ancestral to all modern forms, which diverged and differentiated since the 3-Riss glaciation. In the F-Eemian and 4-Würm, the Siberian ibex occurred in and around the Alps. In Spain it reached Gibraltar and was present in southern Italy, south of France, Belgium, Germany to the Hartz Mountains, in England as far north as Yorkshire, eastward to Austria, Moravia, Transsylvania, to the Crimea and Palestine (Kurtén 1968). The currently fragmented range of *Capra* is the remains of a distribution that stretched from the European coast of the Atlantic Ocean to India and from the Mediterranean Sea to Ireland (Sokolov 1959).

Earliest remains of *C. sibirica* were found from the Upper Pleistocene at the Mousterian site (Middle Palaeolithic) of Neanderthal man and in the Teshik-Tash Grotto of the Gissarskiy Range, Uzbekistan (Gromov 1948). Remains from the Middle Palaeolithic have also been found in Siberia (Kuzneckiy Alatau Mountains). More recent fossils are known from the Lower Neolithic in Tajikistan. Fossil remains of *C. sibirica* were found also on the Upper Palaeolithic sites near Krasnoyarsk and to the north along the Yenisey River in Siberia (Smirnov and Tkachenko 1992), and far to the east of its present range, around Lake Baikal and 250 km to the east, near the Chikoi River (Okladnikov and Kirillov 1980). Siberian ibex was also noted from the Middle and Upper Pleistocene in the southern Ural Mountains (Gromov 1948).

Distribution of *C. sibirica* was more extensive during the Upper Pleistocene, and in southern Asia and southern Europe it overlapped with natural habitat of *C. ibex*, which reached England and Ireland (Heptner et al. 1961). The eastern extent of its range during the Iron Age was ca. 250 km to the east of Lake Baikal (Okladnikov and Zaporozhskaia 1970). Later this border moved 350–400 km to the west, and separate patches of formerly unbroken range remained in southern Siberia. Thus, distribution of the Siberian ibex has decreased considerably during the last several thousand years. However, as a whole the species has not decreased its range during the last century (Fedosenko and Savinov 1983).

FORM AND FUNCTION. Pelage consists of slightly wavy and rather coarse guard hairs and thin kinked hairs of underfur that have a length up to 22 mm and a thickness to 55 μ m. During winter length of guard hairs is ca. 60–80 mm and thickness is 132–207 μ m. Some long (100- to 120-mm) hairs occur on upper part of the neck; these sometimes appear manelike. Hair core is 78–95% of hair thickness. The long (ca. 200-mm) and pointed beard of males occupies almost the entire lower part of the head. Females have either a thin bunch of long hairs or no beard hairs at all. Tail is covered by regular body hairs; only the top has longer (to 100–130 mm) and coarser hairs. Hairs of beard cover all of the bottom of head except the chin. During winter, hairs are ruffled, with thick underfur. In summer pelage is shorter with thin underfur, and it lies closer to body. Guard hair color varies along its length and is light brown at base, darker in the middle, then turns to yellow-ginger, and is topped by a thin, dark-brown tip. In contrast, underfur color is uniform, mostly light brown or smoke colored (Sokolov 1959; Sokolov et al. 1988; Zalkin 1950).

Molt occurs through spring and summer, from April to July; time and duration vary depending on local conditions and physiologic state of individuals. Males, barren females, and youths molt earlier and faster than pregnant females, sick animals, and those weakened by heavy parasite loads. Molt occurs earlier after warm winters with light snow cover and later after a snowy cold winter. In Tien Shan molt begins in April and ends during late May–early June. In the Pamir molt begins from mid-May and generally continues until mid-July, but isolated flocks of females and kids can be in molt until late August. At the beginning of molt, downy wool

falls out, followed by thick guard hairs and subsequently the intermediate hairs between downy wool and winter guard hairs. Molt in Siberian ibexes have many patches of hair hanging from their bodies; these patches are removed by rubbing against bushes and rock ledges. Molt begins on shoulders, neck, cheeks, thighs, and groin and then spreads to head and sides of body. Hairs are last replaced on belly, legs, and upper part of back and neck. Growth of summer pelage occurs simultaneously with molt. These hairs reach 2–3 cm in length by August. At the same time, downy wool begins to grow back, and slightly later winter guard hairs start to develop, but these grow more quickly, outstripping downy wool and summer hairs by October. Throughout winter, rust-colored hairs of summer remain among winter guard hairs. Pelage growth is completed by late November–early December (Egorov 1955; Shnarevich 1948; Sokolov 1959).

Capra sibirica has 2 types of cutaneous glands: simple, extended, baglike or two-part holocrine glands and simple, tubular, apocrine glands. Holocrine glands are large; those from withers of an adult female were 56 by 226 μm and those from chest were 45 by 113 μm . Holocrine glands (1 or 2) occur near both guard and wool hairs, but those near wool hairs are 2 times smaller. Tube of apocrine gland is variable in diameter (32–113 μm). Secretory tube lies deeper than hair bulb, but narrow excretory duct begins at level of half the hair root and flows into hair follicle 169–226 μm below surface of skin (Sokolov and Chernova 1988).

Skin of *C. sibirica* has several glandular, secretory fields: Meibom glands on eyelids, glands of lips and nostrils, secretory fields on upper part of nose, and glands around vagina of females and in prepuce of males. Meibom glands in the Siberian ibex are typical among ungulates in structure and location. They are large (1.2–1.4 by 2.8–3.1 mm) for females. Central duct is wide, up to 525 μm in diameter. Males have also rounded Meibom glands (1 by 1 mm), which lie on tarsal plate of eyelid. Diameter of excretory duct is 226 μm . The glands of the lips' cutis are enlarged to 113 by 621 μm in adult males. The large glands are numerous on the border between hairy and naked skin. Holocrine glands around nostrils are also large (525 by 875 μm in adult females), but skin glands of muzzle and around horns are of usual size (113–226 by 45–56 μm). A secretory field occurs on naked skin of upper part of nose; here, alveolar-tube glands have a typical structure. Thickness of secretory field there is 2.1 mm for an adult male, 2.8 mm for an adult female, and 1.1 mm for a young male, which is 56–79% of the skin's thickness. Diameter of excretory tube is 113 μm , but alveole are small (23 μm). Apocrine glands of the vagina are not large (339 by 339 μm with a diameter of secretory tube of 45 μm in adult females); holocrine glands are not enlarged. Males have small apocrine glands (113 by 226 μm) and large holocrine glands (0.3 by 1.4 μm) in prepuce's skin (Sokolov and Chernova 1988).

Specific cutaneous glands are usually formed as a skin pocket or crease. Occipital, inguinal, interdigital, and carpal glands are lacking in Siberian ibexes, although Schaffer (1940) asserted that these are usual for goats (*Capra hircus*). A subcaudal gland, located between base of tail and anus, occurs as an oval pocket 2.5 by 3.5 cm and has a light fatty secretion. The pocket's sides contain large holocrine glands, and under them are apocrine glands with secretory parts, which are formed into balls. Holocrine glands form a secretory sheet that covers 36–90% of the skin's thickness. Every gland consists of 4 or 5 lobes, separated from each other by a thick connective tissue. Alveoli of subcaudal glands are filled with secretory epithelium; each gland has a short narrow duct. Pigment granules and melanocytes do not occur in holocrine glands. Secretory tube of apocrine glands is thicker in surface layers (to 90–113 μm in adults) than in interior layer. These glands have the same structure in both sexes. Subcaudal secretory field stretches from subcaudal organ to anus, where it passes into the circumanal secretory field. The gland's structure there is the same, and apocrine and holocrine glands are also large (0.3 by 0.7 mm in adult females). Skin around anus is hairy and is separated from intestinal epithelium by a transitional zone (proctodeum), where glands are absent (Sokolov and Chernova 1988).

Teeth of goats are adapted to masticating rigid grasses. Dental formula is i 0/3, c 0/1, p 3/3, m 3/3, total 32. Horns of the Siberian ibex grow throughout its entire life, and growth begins soon after birth. Neonates have temporary horns that are gradually replaced by permanent horns towards winter. During winter, horn growth is interrupted, giving each year's growth a well-defined border on the horn. Area between the borders generally has 2 ridges on front horn

surface. Horns grow most intensively during the second year and reach 17 cm in length; later the growth is retarded. Horns of adult males (9–10 years of age) grow 4–9 cm/year (Zalkin 1950). Transverse horn ridges are apparently involved in helping to control length of lever arm, hence bending moment, thus helping to minimize bending stress and torque on the occiput (Alvarez 1990).

Rigidity of spinal column is very important for running in *C. sibirica*, and is assured through transverse and spinous processes of vertebrae as well as ligaments between and around them. Tops of spinous processes of lumbar vertebrae are expanded in a forward-backward direction; thus, ligaments are shorter and harder. Legs of *C. sibirica* are adapted to climbing on rocks, scree, and glaciers. They have a callus (ca. 3 cm in diameter) on knee or carpal joint of front legs for scrambling up steep inclines (Schaller 1977). Elastic tissues between digits are developed and consequently extend from hooves. This helps Siberian ibexes to stand on narrow ledges of vertical rocky walls and to traverse glaciers without problems (Razmahnin 1977). Weight load on hooves is considerable (\bar{X} = 850 g/cm²; range, 550–950 g/cm²). Siberian ibexes easily surmount friable snow up to 20 cm deep, but a snow depth of 30–40 cm impairs movements (Zimina 1964).

During fighting between males, *C. sibirica* has a slower closing velocity (up to 13.4 m/s) and a weaker force of impact (up to 0.29 Fi) than does *Ovis* (up to 26.9 m/s and 1.00 Fi, respectively). In contrast, Siberian ibexes have a larger lever arm (up to 20.6 cm) and relative torque during fighting (up to 1.00 Ts) as compared with other species of *Capra* (16.9 cm and 0.52 Ts, respectively, for *C. aegagrus*) and *Ovis* (up to 4.2 cm and 0.68 Ts, respectively). This difference is connected with a fighting style in which butting occurs with a sideways thrust of head. For compensation of torque force and prevention of rapid rotation of head during butting, Siberian ibexes have the most developed muscles of the neck; basioccipital area mass is 0.19 cm²/kg, in comparison with 0.16 cm²/kg in *C. aegagrus* and 0.10–0.14 cm²/kg in *Ovis* (Schaffer 1968).

Muscle of *C. sibirica* consists of 76–88% protein, 14% fat, and 4–7% of an extractive nitrogen-lacking substance. Ca. 65–70% of body mass of males and 58–62% of females is muscle tissue. Siberian ibexes are fat in autumn before rut. The main mass of fat is in the peritoneal cavity, around kidneys, omentum, and large intestine; subcutaneous fat is only slightly developed. In autumn, 8- to 9-year-old Siberian ibexes have ca. 4–5 kg of fat. Fat of ibexes is quite solid and contains more refractory palmitic and stearic acids as compared to wild sheep (Egorov 1955).

ONTOGENY AND REPRODUCTION. Complete spermatogenesis in *C. sibirica* first occurs at 1.5 years of age. Initially this process is neither intense nor reproductive. The reproductive stage begins at 2.5 years of age, when all canals are densely filled with spermatozoa (Tsapluk and Savinov 1973). However, males begin to mate later (Sokolov 1959). Testes of adult males increase in size and weight during rut, averaging 38 by 70 mm and 36.2 g in May–June (n = 8) and 51 by 84 mm and 93 g in October–November (n = 14). Yearling females do not reproduce, but 25% (n = 20) are pregnant at 2 years of age, as are nearly all females >3 years old. Only 1 out of 58 females was not pregnant by 15 years of age (Savinov 1962). Duration of estrus is 20 days. Females can have a second estrus during 1 reproductive period if impregnation and development of the corpus luteum does not occur during first estrus. A second estrus prolongs the duration of rut and lambing and increases reproductive success (Tsapluk and Savinov 1973). Females reproduce until 15 years of age, although 17% (n = 6) cease reproducing as early as 9 years of age (Savinov 1962).

Males and females have 2 annual peaks of the sexual activity. The first period of spermatogenesis is late March–May, and the second period begins in July and reaches its peak in October to mid-November. Testes are full of spermatozoa from September to January, although many degenerative spermatozoa are present at the first and the last months of this period. Spermatozoa are totally absent just 2 months during the year, March and June. Sexual activity during spring is unproductive; possibly, this is a faded peak in the sexual rhythm of *C. sibirica* from a period when conditions were favorable for it to reproduce twice a year (Tsapluk and Savinov 1973). Rutting season of the Siberian ibex takes place October–January, occurring earliest in the Dzhungarskiy Alatau, Tien Shan, Altai, and Sayan mountains and latest in the Pamir and Himalayas. Date of the rutting period depends mainly on elevation of home range but also on weather during the year. Estrus for adult females

occurs at the beginning of rut followed later by estrus for young females (Heptner et al. 1961; Roberts 1977; Savinov 1962; Sokolov 1959).

Gestation lasts 170–180 days (Heptner et al. 1961). Growth rate of embryos is uneven: they grow slowly during the first 4 months of pregnancy, when their weight reaches only 200–300 g by February, but they quickly increase in weight (by 2 to 3 times) during the last 60 days. External measurements (in mm) and body mass (g) for male embryos 5 and 6 months of age, respectively, are: total length, 444 ($n = 12$) and 535 ($n = 11$); height at shoulder, 265 ($n = 12$) and 336 ($n = 1$); and body mass (g), 153 ($n = 12$) and 318 ($n = 11$). The same measurements (in mm) and body mass (g) for female embryos 5 and 6 months of age, respectively, are: total length, 474 ($n = 8$) and 530 ($n = 7$); height at shoulder, 300 ($n = 8$) and 351 ($n = 7$); and body mass (g), 194 ($n = 8$) and 279 ($n = 7$). Parturition begins with the arrival of warm weather and appearance of green grass. In Dzhungarskiy Alatau, Altai, and western Sayan, young of the Siberian ibex are usually born during late April–early May, in Zailiiskiy and Talasskiy Alatau (Tien Shan) birth is during May (Dmitriev 1938), in the Himalayas and Central Tien Shan parturition occurs in late May–early June, and in the Pamir births occur during June (Roberts 1977; Sobanskiy 1988; Zavatskiy 1990). As a rule birth dates vary with elevation: in the Dzhungarskiy Alatau the first newborn was noted at 600 m above sea level on 15 April, at 1,000 m on 24 April, and at 1,200 m on 6 May. If possible, females descend to a lower elevation for lambing, where spring begins earlier (Savinov 1962).

Adult females (93%, $n = 86$) give birth every year; females =2 years of age (25%, $n = 20$) and =9 years of age (83%; $n = 6$) are more likely to remain barren each year. Pregnancy rates change every year; they may be <80% in Pamir. Some pregnant females abort during severe winters. Siberian ibexes usually have 1 kid (86% of pregnancies in Dzhungarskiy Alatau and 96% in the Central Tien Shan and Pamir, $n = 3$ and 56, respectively), 2 kids are rare (11–14% and 4%, respectively), and 3 kids occur in exceptional cases (Egorov 1955; Savinov 1962). In Kirgizia, a pregnant female had 4 embryos covered with hair. During favorable years, the number of females having twins is higher, up to 25% (Annenkov and Litun 1989). In Pakistan, twins are common, although singletons occur more frequently in some populations (Roberts 1977). Twinning occurs more frequently in older females, >5 years of age (Savinov 1962); however, in the Leningrad Zoo all females, including young ones, had twins (Egorov 1955). Proportion of newborn females is 45.8% and of males is 54.2% ($n = 59$ —Heptner et al. 1961).

Newborn Siberian ibexes weigh 3–4.5 kg in Zailiiskiy Alatau, 2.8 kg in the East Pamir, 3.4–4.8 kg in the Terskei Alatau, and 2.96 kg (2.4–3.7, $n = 18$) in the Dzhungarskiy Alatau. Birth weight depends on the grazing conditions during pregnancy, especially during the last stage. Growth rate after birth is most rapid during the 1st year. Linear size increases faster initially, followed by weight index to 3 months; then the relationship becomes more equal. In males, ratio between height at withers and weight is 12.6 at 1 day of age, 3.0 at 1 year, and 1.0 at 9 years; in females, the ratios are 12.5, 3.4, and 1.8, respectively. Development of twins is slower than that of single young of the same age. Males grow faster than females. Females have an even rate of growth at 1–3 years of age; then growth rate decreases abruptly, and stops by 5 years. Growth of males is not uniform after 3 years because of considerable fluctuation in their nutritional state before and after rut. Males grow continuously until 9 years old. External measurements (in cm) of males at 1 day ($n = 1$), 7 days ($n = 1$), 1 month ($n = 1$), 1 year ($n = 4$), and 2 years of age ($n = 8$) are, respectively: total length, 48, 61, 79, 106, 123; length of tail, 7, 10, 9, 13, 15; length of head, 19, 19, 24, 31, 37; length of hind foot, 24, 27, 27, 38, 46; length of ear, —, 6, 11, 13, 14; height at shoulder, 34, 49, 49, 70, 83; height at sacrum, 38, —, 55, 74, 87; girth of chest, 30, —, 46, 70, and 89; and body mass (kg), 2.7, 5.8, 9.1, 23.0, 38.3. The same measurements (in cm) of females at 1 day ($n = 4$), 2 days ($n = 1$), 7 days ($n = 2$), 1 year ($n = 4$), and at 2 years of age ($n = 18$), are: total length, 48, 94, 95, 102, 113; length of tail, —, 12, 10, 12, 14; length of head, —, 23, 28, 29, 33; length of hind foot, —, 59, 71, 71, 81, 86; length of ear, —, 12, 11, 14, 14; height at shoulder, 35, 57, 64, 64, 74; height at sacrum, —, 59, 71, 71, 81; girth of chest, —, 58, 68, 69, 79; and body mass (kg), 2.8, 13.0, 14.0, 18.8, 27.1. Horns begin to grow soon after birth and are noticeable in 3–4 weeks. During the 1st year in the wild horns

reach 10–12 cm in length; their growth is slowed or sometimes stopped during winter. Transverse cylinders appear during the 2nd year. In zoo conditions horns continue to grow even during winter, reaching 30 cm in length and having up to 5 ridges after the 1st year (Egorov 1955; Heptner et al. 1961; Savinov 1962; Shnarevich 1948).

Lactation lasts ca. 6 months and young stop nursing during October–November, although some may attempt to suckle into December. Young usually continue to stay with their mothers even after appearance of newborns the next year. Neonates begin to eat grass shoots 8–10 days after birth, although feeding on grass does not regularly occur until 1 month of age. By 1.5 months, the young graze for long periods, similar to adults. At 1 month, young also begin to eat soil and lick salt deposits (Fedosenko and Savinov, 1983).

Most males live 8–10 years in the wild, but in some cases they live 15 years. Males live longer in south Siberia than in Tien Shan and Dzhungarskiy Alatau. Females live up to 16–17 years. In the Leningrad Zoo Siberian ibexes have reached the age of 18–20 years. At London Zoo, a female lived 22 years, 3 months, and 19 days (Fedosenko et al. 1992; Heptner et al. 1961; Savinov 1962).

ECOLOGY. In the Himalayas, Siberian ibexes live at 3,700–6,700 m above sea level; in Pamir on the rocky slopes at 3,500–5,000 m; and in Tien Shan at 600–4,000 m. In northeastern Altai, Siberian ibexes are found at 500–3,000 m. In Sayan they inhabit ranges along rivers at 600–2,000 m. In Tuva, Siberian ibexes live in rocky tundra at 2,000–3,500 m during summer and descend to lower slopes during winter. In northern Mongolia, Siberian ibexes are found up to 4,000 m; however, in the Gobi Desert they live on low desert hills (at 700 m) and in hollows with cliff slopes (Egorov 1955; Heptner et al. 1961; Roberts 1977; Smirnov and Tkachenko 1992).

Siberian ibexes prefer rocky habitats from lowest mountain zones (semidesert) to highest areas (alpine zone and rocky tundra covered with lichen). They, like other species of the genus, are attracted to steep slopes of rocks and scree. Although Siberian ibexes cannot run quickly on plains, they can climb to sharp rocky slopes and cliffs more quickly than their predators. Therefore, Siberian ibexes do not go too far away from crags, which serve as protection from carnivores, humans, and midges as well as providing cover during hot periods in summer and during bad weather in winter. However, they must venture from crags to find enough food. Siberian ibexes live in a complex landscape, which apart from craggy mountains, consists of alpine meadows for grazing, streams for watering, and level areas with scree between rocks for resting. Females spend more time in crags than males, especially during birth and rearing of young. In areas with little human disturbance (e.g., the Aksu-Dzhabagly Reserve in Tien Shan), Siberian ibexes move a considerable distance away from rocks. They may stay on gently sloping grassy areas for long periods of time or even to descend to wet meadows of mountain rivers for grazing (the Sayano-Shushenskiy Reserve in south Siberia—Fedosenko and Savinov 1983; Zavatskiy 1990).

Siberian ibexes generally prefer firm soil, steppe vegetation, and regions with less snow cover during winter. Depth of snow cover is an important factor in the distribution of Siberian ibexes, and sometimes it is the single cause for their absence in some mountains or surrounding areas. In the Altai Mountains, Siberian ibexes stay in some forest zones year-round because steep slopes and strong winds do not allow deep snow to accumulate. In Tien Shan, Siberian ibexes occur on the forest slope occasionally, staying mainly in the alpine zone on open slopes, with high insolation and wind that blows away the snow, making food available all year. In contrast, in East Pamir, many alpine pastures are present, but Siberian ibexes are rarely there in summer and are absent in winter because of deep snow cover. Population density increases from periphery towards interior parts of mountains because of reduction in snow level in interior (Egorov 1955; Sokolov 1959). Thus, distribution and number of Siberian ibex depend on availability of sizable rocky areas and an absence of deep snow. Siberian ibexes occur from the deserts of Middle Asia and Mongolia to highest ridges of the Himalayas and the Pamir. Siberian ibexes avoid gentle slopes far from rocks, thick coniferous taiga, tall grass, and damp marshy areas (Fedosenko and Savinov 1983; Sokolov 1959).

Capra sibirica feeds on ca. 140 plant species, including 26

bushes and trees. During spring and summer ibexes eat mainly green grasses, especially in the alpine zone, where bushes and trees are absent. A considerable portion of their diet is comprised of rigid cereal grasses and sedges. Apart from Poaceae and Cyperaceae, ibexes eat Liliaceae, Papilionaceae, Asteraceae, and Rosaceae. In the forest they also eat leaves, shoots, flowers, and fruits of the currant bush (*Ribes*), dogrose (*Rosa*), *Cotoneaster uniflora*, *Spiraea*, *Evonymus*, and rowan (*Sorbus*); in Altai, they prefer fruits of *Prunus padus*, *Ribes rubrum*, *R. nigrum*, and *Sorbus* in forest, and lichens, including *Cladonia*, in tundra. Sometimes *Allium* species form the basis of their diet in Mongolia, up to 60–63% of stomach contents. In the Himalayas, they graze mainly on grass tussocks that clothe the higher mountain slopes, and in Gilgit, they eat *Enneapogon persicum* (Bannikov 1954; Dmitriev 1938; Egorov 1955; Fedosenko and Savinov 1983; Roberts 1977; Sobanskiy 1988).

During autumn Siberian ibexes pasture in moist and shady places where plants thrive. Diet at this season consists of Poaceae species and various other grasses. Often Siberian ibexes graze on slopes covered by steppe vegetation. *C. sibirica* has a poorer selection of fodder in drier mountains, such as the Pamir, where stomach contents consist of 2 plant species: seeds and stems of *Prangos* (Umbelliferae) and *Polygonum* (Egorov 1955). During autumn, importance of bushes and trees, such as leaves and shoots of *Ribes* and *Salix* and fruits of *Rosa* and *Sorbus*, to the foraging Siberian ibex increases considerably (85% of stomach contents). In the Zailiiskiy Alatau, shrubs comprise 85% of stomach contents; 50% of these consist of needles, twigs, buds, and bark of *Juniperus turkestanica* and *Ephedra equisetina* (Shnarevich 1948).

During winter Siberian ibexes graze on slopes, where snow cover is not deep and friable; they avoid snowy slopes and flat plots, where snow is usually crusty because of sun and wind. They prefer areas that are cleared of snow by avalanches. During snowy winters Siberian ibexes eat all plants that show above snow, generally trees and bushes. They eat needles, buds, and twigs of *Picea schrenkiana*, *Juniperus*, and *Ephedra*; shoots and leaves of *Evonymus*, *Cotoneaster*, *Rosa*, *Lonicera*, *Spiraea*, *Ribes*, and *Rubus*; and branches of young trees of *Populus tremula* and *Salix himalayensis*. Perennial plants that reach above snow are also eaten, such as *Artemisia*, *Equisetum*, *Heracleum*, *Phlomis*, *Urtica*, and tall cereals. Moreover, Siberian ibexes can reach forage by digging through snow, if the depth is <30–40 cm; plants eaten include *Alchemilla*, *Allium*, *Artemisia*, *Carex*, *Dactylis*, *Equisetum*, *Festuca*, *Geranium*, *Heracleum*, *Pedicularis*, *Phleum*, *Phlomis*, *Poa*, *Polygonum*, *Rhodiola*, *Stipa*, and *Urtica*. The stomach of 1 female contained 70% cereals, 15% *Euonymus semenovii*, 10% willow (*Salix*) leaves, and 5% *Sedum hybridum*. A male's stomach contained needles and twigs of *Picea* (60%), stems of *Equisetum hiemale* (20%), cereals (10%), shoots of *Populus tremula*, and leaves and branches of *Euonymus semenovii* (10%). In east Pamir, snow cover during winter is not substantial and the diet consists of *Carex*, *Eurotia ceratoides* (Chenopodiaceae), and *Artemisia skorniakovii* (Asteraceae). Siberian ibexes may eat lichens. Females eat 8–10 kg of green food/day, and big males eat up to 16 kg. During snowy winters, they eat only twigs of bushes and trees. They eat desert vegetation in low dry mountains and only mesophillous grasses in the alpine zone. They are adapted to different foraging conditions, making them less vulnerable to food shortages (Egorov 1955; Fedosenko and Savinov 1983; Heptner et al. 1961; Roberts 1977; Sokolov 1959). In Tien Shan, Siberian ibexes usually do not lose much mass or nutritional condition by the end of winter. In southeastern Kazakhstan, mortality due to starvation did not occur during severe winters (Fedosenko and Savinov 1983), although in other ranges such cases are known (Heptner et al. 1961; Roberts 1977).

Siberian ibexes do not drink every day. If the liquid content in vegetation is high and dew is present, Siberian ibexes will not drink for long intervals. They eat snow for water in winter. During the warm time of year (April–September), Siberian ibexes regularly visit salt licks, and they are known to eat salty soil in November and December (Fedosenko and Savinov 1983). During this time ibexes mainly eat grasses, which are rich in potassium, but poor in sodium, forcing them to eat salty soil (Shaposhnikov 1953). They feed on soil and sand and lick the thin coating of salt on stones near mineral springs or incidentally graze the salt coating that is usual for slopes of the East Pamir. *C. sibirica* gnaws dry salt clay at outcroppings, resulting in the formation of pits (1 m in width and

60–70 cm in depth), sometimes with a great variety of grottos and niches, where several adult ibexes can be present. Salt points are usually situated on south slopes, sometimes on east and west exposures, and rarely on the north. Siberian ibexes visit them in the morning (0800–1000 h), and sometimes at mid-day (1400 h), or even during the night (2400–0200 h). Duration of their stays is 15–85 min (mean = 49 min, $n = 9$). Siberian ibexes go to salt licks in mixed groups of 5 to 7 individuals, sometimes groups of 20–34 goats, and rarely 50 animals. During July females with their young begin to visit these sites and feed on salty soil (Egorov 1955; Fedosenko and Savinov 1983; Grachev 1988). Lack of sodium is a characteristic of mountain biotopes, and its absence in the diet of *C. sibirica* may be a cause of migration. However, clays (silicates) without sodium play an important role in compensating for the sodium deficiency by retaining the small amount in the body, while maintaining the consistency of feces during transition from dry winter food to green grasses (Panichev 1990; Shaposhnikov 1953).

In Tien Shan, Dzhungarskiy Alatau, and the Himalayas ratios of females to males after birth are 1.09:1 ($n = 1454$), 1.21:1 ($n = 92$), and 1.11:1 ($n = 312$), respectively (Fedosenko and Savinov 1983; Fox et al. 1992). The female bias is greater for populations of Mongolia and west Sajany: 2.13:1 ($n = 1,000$) and 1.87:1 ($n = 9,600$), respectively (Dzieciolowski et al. 1980; Zavatskiy 1989). Ratio of females to males after birth can change depending on nutrition; females produce more male offspring during unfavorable range conditions (Hoefs and Nowlan 1994). However, mortality of males in any age usually is higher than that of females. Young males die more often than do females, and adult males are weaker after rut and primarily die in winter. Snow leopards (*Uncia uncia*) and wolves (*Canis lupus*) catch males twice as often as females. In some regions, trophy hunting also decreases the number of males (Fedosenko and Savinov 1983; Heptner et al. 1961; Savinov 1962).

Population structure varies geographically. The Himalayas have 33.1% adult females, 30.1% adult males, 10.9% yearlings, and 25.8% young ($n = 312$). Populations consist of 52.5%, 21.9%, and 25.6% adult females, adult males, and young ($n = 1,067$), respectively, in Tien Shan (Zailiiskiy Alatau); 48.0%, 32.1%, and 19.9% (n unknown) in Altai; 48.1%, 27.4%, and 24.5% ($n = 9,600$) in west Sayan; and 45%, 21%, and 34% ($n = 1,000$) in Mongolian Altai. Seasonal changes occur. In May–September (in Tien Shan) the population comprises 32–42% females, 15–18% adult males, 12–22% yearlings, and 27–33% young ($n = 920$). In autumn–winter, when males return to female herds, the population consists of 46.1% females, 38.8% males, and 15.1% young ($n = 484$)—Dzieciolowski et al. 1980; Fedosenko and Savinov 1983; Fox et al. 1992; Sobanskiy 1988; Zavatskiy 1989).

Siberian ibexes exhibit fidelity to their home range; animals disturbed by hunters return to their home territory within several days. However, snow cover and absence of food in snowy areas force them to seasonally change their home ranges or even migrate. In the Altai Mountains, most Siberian ibexes are found in stony tundra during summer, grazing in alpine meadows. During winter, Siberian ibexes leave the tundra and descend to steep grass slopes, forest edges, or other areas with a southern exposure, where sun and wind hinder accumulation of snow. *C. sibirica* also goes into interior forest during snowy and calm winters. In the Zailiiskiy Alatau (north Tien Shan), Siberian ibexes move from north- to south-facing slopes for winter. They descend as far as the lowest forest belt during unusually heavy winters. In central Tien Shan and in Pamir during autumn, Siberian ibexes move from the upper rocky zone, where they stay all summer, to sunny slopes or forests. Siberian ibexes may inhabit cultivated areas during winter (Horog town area in Pamir). Seasonal movements and migrations are 20–30 km in distance with a 700- to 800-m change in elevation (Pamir, central Tien Shan, and Altai) or 40–50 km with an elevation drop of 1,500–2,000 m (Gissar Range, Talasskiy, and Zailiiskiy Alatau); maximum migrations cover 50–100 km (Dzhungarskiy Alatau). Time of migration depends on local conditions. Migration begins in late September to early October and peaks after appearance of deep snow. Initially, females with kids and young individuals migrate to their winter range and adult males descend later. Return migrations begin during March–April to June. Old males are the first to climb, and they may reach the glaciers by early June. Females and young linger at middle elevations before climbing higher. Climatic factors, livestock movements, poaching, midges, and gadflies influence seasonal migrations (Dmitriev 1938; Egorov 1955; Heptner et al. 1961; Savinov 1964; Sobanskiy 1988; Sokolov 1959).

Capra sibirica is sympatric with *Ovis ammon* in many places, but the latter avoids rockier habitats, so the 2 species usually do not graze or rest together. *C. sibirica* may share habitat with *C. falconeri* (Hindu Kush in Afghanistan), but where the 2 species coexist only *C. sibirica* lives in the highest areas; *C. falconeri* prefers lower ridges. *C. sibirica* rarely encounters *Capreolus capreolus* and *Cervus elaphus* at pastures and salt licks. Although *C. sibirica* does not have much competition with other wild ungulates, domestic sheep (*Ovis aries*), goats (*C. hircus*), horses (*Equus caballus*), and yaks (*Bos mutus*) provide serious competition and a source of disease (Heptner et al. 1961).

The main predator of the Siberian ibex is the snow leopard (*U. uncia*), which is common in the Pamir, Tien Shan, and Dzhungarskiy Alatau mountains. In regions where the number of snow leopards is increasing, the number of ibexes is decreasing. Population loss to snow leopards often involves older males. In west Pamir remains of 30 ibexes (22 males and 8 females) were found after a snow leopard's hunt along a 14-km route. Most (64%) of the males killed were >5 years old, although this group accounts for 29% of the population (Egorov 1955; Fedosenko and Savinov 1983; Schaller 1977). In Tien Shan, and Dzhungarskiy Alatau, 6.3–27% of lynx (*Lynx lynx*) feces contains remains of ibex (Zhiriakov 1995), and in west Sayan 66.7% of lynx feces contains ibex remains (Zavatskiy and Guschin 1980).

Wolves successfully hunt Siberian ibexes by cutting off retreat to the safety of rocks. Siberian ibex remains account for 13.4% ($n = 82$) of wolf feces in the Aksu-Dzhabagly Reserve (west Tien Shan), 5.3% (4.4–6.6%, $n = 549$) in the Zailiiskiy Alatau, and 11.5% (4.1–18.7%, $n = 57$) in the Dzhungarskiy Alatau; 20% of the Siberian ibex population of Altai is preyed on by wolves. Wolves take Siberian ibexes more often in regions with little human disturbance where Siberian ibex graze in pastures at a considerable distance from rocks. Wolves prey on males more than on females; 74 males and 30 females were captured from 104 successful hunts. Mortality of *C. sibirica* to wolves is greatest during winter, particularly among males >4–5 years old that are weak after rutting (Fedosenko and Savinov 1983; Heptner et al. 1961; Sobanskiy 1988; Zavatskiy 1989). In the Altai Mountains, 70.5% males, 27.4% females, and 2.1% subadults ($n = 149$) were prey of wolves (Zavatskiy 1990). During early spring brown bears (*Ursus arctos*) occasionally eat dead Siberian ibexes that perish in avalanches, and they prey on live young. Hairs of *C. sibirica* occur in 0.3–0.8% of bear feces (Grachev 1981; Grachev and Fedosenko 1977; Zhiriakov 1980).

Asiatic wild dogs (*Cuon alpinus*), wolverines (*Gulo gulo*), and foxes (*Vulpes vulpes*) rarely attack newborns. Siberian ibexes suffer little loss from predators because climbing rocks provides a reliable defense. Among birds of prey only golden eagles (*Aquila chrysaetos*) attack ibex kids in some areas of Tien Shan and west Sayan (Heptner et al. 1961; Fedosenko and Savinov 1983). In Zailiiskiy Alatau (Tien Shan), a pair of eagles alternately attacked a kid 6 times during 35 min without success (Dzhanyspaev 1986). Such assaults also are known in other places, but the number of successful hunts is unknown. Bones of young ibexes occur near nests of golden eagles. Vultures (*Aegypius monachus*, *Gypaetus barbatus*, and *Gyps fulvus*) eat the remains of Siberian ibexes, including their placentas (Egorov 1955; Savinov 1962; Zavatskiy 1989).

Siberian ibex are prone to scabies infection, produced by the itch-mite *Acarus siro* var. *caprae*. During years of heavy snow many ibexes die from scabies, resulting in a population decrease over a considerable part of their range. Epizootics have occurred in northeastern Dzhungarskiy Alatau, the Aksu-Dzhabagly Reserve in west Tien Shan (ca. 80% of the population was infected in 1968–1971), in the Chatkal Range of Uzbekistan, and in Kirgizia (Fedosenko and Savinov 1983; Vyrypaev 1973; Yanushevich et al. 1972). Initially, the infection affects legs and lower part of neck and head, then belly, and later back and withers. Often large bald patches are noted, and the sickest Siberian ibexes are alone, at a lower elevation than the rest of the herd, and usually near water; some animals become blind. Such afflicted individuals are emaciated, move little, and have empty stomachs and bowels. Scabies may be the result of *Sarcoptes ovis* in the Tien Shan (Koshkarev and Nesterov 1989). In zoos, necrobacillosis, pasteurellosis, and catarrhal fever have occurred; necrobacillosis has also been documented in wild populations. An epizootic of goats' infectious pleuropneumonia resulted in the deaths of many Siberian ibexes in Pamir during the late 1940s (Fedosenko and Savinov 1983; Heptner et al. 1961).

Ectoparasites infecting Siberian ibexes include nasopharyngeal flies (Oestridae), mainly the breeze fly (*Oestrus caucasicus*), whose larvae parasitize the nasal cavity, frontal sinuses, and even horn cores. *Oestrus ovis* has infected Siberian ibexes in Kirgystan; 65.7% of animals were infected in April, 17.9% in May, 11.3% in June, 2.5% in July, 20% in August, 26% in September, and 71% in October. Larvae emerge during April–June, new infections occur during July–August, and larval infections peak during winter (Fedosenko and Savinov 1983). Hypodermic gadflies (*Hypoderma*) do not normally parasitize Siberian ibexes, although 1 case is known from Pakistan (Roberts 1977). Louse flies (*Melophagus dispoetus*) parasitize Siberian ibexes during warm periods of the year (Doshzanov 1980). Lice (*Linognathoides*) and fleas (*Vermipsylla alacurt* and *Xenopsylla*) also parasitize Siberian ibexes (Shnarevich 1948). Ca. 1,000 *V. alacurt* may occur on every Siberian ibex in Kirgizia, usually on sacrum, hind legs, and chest. Ticks (Ixodoidea) hosted by Siberian ibex include *Dermacentor marginatus*, *Haemophysalis numidiana*, *H. punctata*, *H. warburtoni*, *Hyalomma plumbeum*, and *Rhipicephalus pumilio* (Egorov 1955; Fedosenko and Savinov 1983; Ushakova et al. 1976).

Endoparasites of *C. sibirica* are represented by 28 species of helminths from internal organs; 75% were Nematoda and others were Cestoidea and Trematoda. These parasites are mainly from the alimentary canal (15 of 28 species) and lungs (9 of 28 species). Two species (*Nematodirus sugatini* and *Protostrongylus dikmani*) are endemic to *C. sibirica*. The most pathogenic species is the pulmonary nematode (*Cystocaulus veseolodovi*), which is widely spread throughout the Zailiiskiy Alatau Range. Coccidians infecting ibexes include *Eimeria arloingi*, *E. faurei*, *E. ninae*, and *E. parva*. In the Talasskiy Alatau, 85.4% ($n = 62$) of ibexes were infected with *E. ninae-kohl-jakimovi* and *E. arloingi*. Coccidiosis can cause death (Boev et al. 1962; Fedosenko and Savinov 1983; Nukerbaeva 1982).

Magpies (*Pica pica*) often examine Siberian ibexes and peck off ticks from ears, around eyes, and around base of horns. They check some individuals for up to an hour. Siberian ibexes remain still during this treatment, which may facilitate healing of an open wound (Fedosenko and Savinov 1983). Choughs (*Pyrhocorax pyrrhocorax* and *P. graculus*) also clean Siberian ibexes of various ectoparasites (Roberts 1977; Sulpin 1948). Partridges (*Alectoris kakehik*), snowcocks (*Tetraogallus*), and marmots (*Marmota*) that reside in the same areas as ibexes can warn of approaching dangers by their alarm cries (Egorov 1955; Shnarevich 1948).

Although 86% of Siberian ibex females give birth each year, only 30–40% still have young later in the summer, and only 25–33% of the young survive to the summer of the following year (Annenkov and Litun 1989; Egorov 1955; Fox et al. 1992; Savinov 1962). Many adult Siberian ibexes die during epizootic events, and some herds disappear completely, as with cases of epizootic pneumonia in populations of the Pamir (Meklenburtsev 1949). Mortality during winters with heavy snow is quite high, and whole groups of animals may die under avalanches. Oldest individuals die first during winters, especially adult males, who are too weak after rut or have too worn teeth; trees are often the only food available to them. Of 87 male skulls found in the Dzungarskiy Alatau, 53% were 6–8 years old (Fedosenko and Savinov 1983; Roberts 1977).

The natural habitat of Siberian ibexes has been considerably reduced in south Siberia since the Middle Paleolithic. Long ago they were found in mountain ranges, foothills, and low mountains. In accessible areas, Siberian ibexes began to disappear more than 2,000 years ago: around Baikal Lake, western East Sayan Range, and Minusinskay Hallow (southern Siberia) during the Mesolithic and in Tuva and the northern foothills of Altai during the early Middle Ages. In Siberia, natural habitat of Siberian ibexes decreased >5-fold and their numbers decreased by >10-fold during the historic period (Smirnov and Tkachenko 1992). Human activity in conjunction with livestock pasturing has changed the numbers, distribution, and movements of Siberian ibexes. They were forced off the steppes, forest-steppes, and floodlands to less favorable parts of the mountains (rocks, rocky deserts, and mountain tundra). The continuity of their natural habitat was broken for several populations (Fil' 1977; Smirnov and Tkachenko 1992). Poaching during the 1960–1970s considerably reduced populations. Siberian ibexes disappeared from some regions, especially in low mountains and spurs, because of poaching. Their numbers have become stable, but poaching is still common throughout their range (Fedosenko

and Savinov 1983; Habibi 1997; Mallon et al. 1997; Weinberg et al. 1997).

From 7 *C. sibirica* from Kirgizia released on the Krym Peninsula in 1947, ca. 20 individuals were present in 1957 (Lyalitskaya 1958), but they became extinct within a few years (Heptner et al. 1961). Of 27 Siberian ibexes released in North Kazakhstan (Kokchetavskiy plateau, Sinuha Mountain) during 1963–1965, only 2 animals were present in 1973 (Fedosenko and Savinov 1983). From 40 Siberian ibexes released in the Canadian River Canyon of New Mexico (United States) in 1978, ca. 50–60 animals were present in 1979 (Poglayen-Neuwall 1984). In the 1980s, ca. 20 Siberian ibexes were released in the Bogd Han Uul Reserve, to south of Ulaanbaatar (Mallon et al. 1997).

Meat is the most important product from the Siberian ibex, and it plays a large role in the diet of people in the most mountainous areas. Meat of adult ibexes is tough, even after it is boiled for a long time, because of abundant connective tissue in muscle. Skin of Siberian ibexes is quite thick during winter and suitable for manufacture of box calf; it is firmer than sheepskin. Fur coats are produced from skins of young ibexes. Skin is also used to make carpets, sturdy boots called “chokoi,” and water-skins for fermented horses’ milk. Horns become wall decorations and other articles. Cleansed and dried stomachs sometimes are employed for storing butter, fats, and other liquids (Egorov 1955; Heptner et al. 1961).

Siberian ibex was main quarry for aboriginal people of the south Siberian mountains during the 12,000–15,000 years before end of the 19th century and for Mesolithic hunters of middle Asia (Smirnov and Tkachenko 1992). According to petroglyphic drawings, Siberian ibexes were driven by horsemen to an ambush by hunters with bows and crossbows. Dogs were used to drive ibexes toward arches and hole-traps dug along the path. On the Yenisey River, people hunted using boats and rafts to drift along rocks near the river’s edge. Siberian ibexes are popular for sport hunting. Usually hunters conceal themselves in pastures, near salt licks, or along paths of the animals. Animals may be chased near the hidden hunters. Sometimes dogs are used to chase and find wounded Siberian ibexes. In Pamir, hunting is done using yaks, which ibexes do not perceive as dangerous; hunters hide behind yaks until within range. Animals are captured with nets, traps, arbalests, or crossbows in Altai and Sayan Mountains (Dmitriev 1938; Egorov 1955; Heptner et al. 1961; Sokolov 1959). Siberian ibexes live without difficulty in captivity (Bulavin 1934).

BEHAVIOR. Siberian ibex are gregarious. Herd size depends on population size: the larger the population, the larger the herds. In the Altai, Siberian ibexes form herds of <30 individuals, but in some regions of Pamir groups of up to 70 individuals may occur during July and in west Sajany, south Siberia, as many as 150 Siberian ibexes may congregate during the November rut (Sokolov 1959; Zavatskiy 1989). Herd size averages 5.4 (range 1–35, $n = 109$) in Tuva Mountains, 7.5–11.2 (range 2–27, $n = 82$) in Sayan Mountains (south Siberia), 7.4–9.5 (range 1–60, $n = 173$) in Altai, 14.0–24.2 (range 1–51, $n = 244$) in Tien Shan, and 29 (range 1–111, $n = 36$) in Mongolia; median group size in the Himalayas is 11 (range 1–40, $n = 80$). Age and sex composition of herds varies daily as well as seasonally. Male herds contain 5.5 individuals (2–19, $n = 53$) in Tien Shan and 6.5 animals (1–39, $n = 17$) in Mongolia. In the Himalayas, age distribution in male herds is 23% 2–3 years of age, 34% 4–6 years, and 43% =7 years. Female groups contain 8.1 individuals (2–29, $n = 138$) in Tian Shan and 19.5 animals (3–73, $n = 29$) in Mongolia. Mixed groups have 15.7 animals (2–60, $n = 117$) in Tian Shan and 60 (3–111, $n = 14$) in Mongolia. During summer, 58.6% of Siberian ibexes are in mixed herds, but in autumn percentage increases to 80–96%. During spring and summer the number of Siberian ibexes in mixed herds decreases from 22.3% in May to a minimum of 17.8% in July–August. Usually the number of males in mixed groups during summer is 2 or 3 or fewer individuals, and as a rule they are ≤ 5 years of age. During rut, 2 to 6 males occur in every group. Groups of males are usually formed in May–June but in the alpine zone groups of males do not form until July. These herds consist mainly of adults, often of the same age (Dziedziolowski et al. 1980; Fedosenko and Savinov 1983; Fox et al. 1992; Koshkarev and Nesterov 1989; Sobanskiy 1992; Zavatskiy 1989).

Rut begins in late October, but males may appear in female herds earlier, and some, especially younger individuals, stay with females throughout summer. Other males descend from the alpine

zone, where they stay during warm seasons, and join mixed herds. During rut males court females intensively. A male approaches a female in a low-stretch pose. The male then sniffs the female’s vulva or stands still behind her, and then he starts to lick her side and shoulders, rotating his head around its axis (the pattern twist—Rice 1995). The male utters a low scream at this point. The female moves or runs away or takes threatening pose and sometimes strikes the male with her horns, or more rarely, she squats and urinates. If she urinates, the male places his muzzle in the stream of urine or sniffs it on the ground, and then performs flehmen. During flehmen the male raises his muzzle, opens his mouth, baring his gums, and moves his head from side to side. If several males see a urinating female, they all go to her in turn, according to their place in the hierarchy, to smell her urine on the ground. In some cases the male will stand still behind the female in a low-stretch pose; his tail is raised, his tongue is out, and sometimes 1 of his front legs is lifted. He then twitches and shifts from 1 foot to the other. At that point the male runs to the female and licks her side or lower part of her belly. Such courtship is performed for >30 min. Before copulation the male intensively licks the female’s legs, belly, and sides and mounts her. The female moves away while the male follows her, walking on his hind legs, and making pushing movements with his pelvis. The male mounts 2 or more times, and copulation lasts 5–7 s. After copulation the male continues to chase the female. During rut males graze significantly less than females. They grow thin and become emaciated, and some are forced to leave the herd. Males return to all-male herds only after December, when the rut ends (Fedosenko and Orlov 1977; Fedosenko and Savinov 1983).

Although serious conflicts among males are rare, sometimes they fight during rut to determine their position in the dominance hierarchy and for access to females. Combatants stand on their hind legs, take 2 or 3 steps forward, and then with necks arched down, they bring their horns together with a resounding crash. Opponents are oriented side by side, and they butt each other with a sideways thrust of head; upon impact, their horns are crossed (Schaffer 1968).

Some intrasexual interactions occur. Males chase other males in the low-stretch pose, mount them, and even thrust their pelvis. Females also chase other females in the low-stretch pose and mount each other (Fedosenko and Savinov 1983). Adult males masturbate often during rut; a male moves his pelvis forward, turns his head backward, and takes his penis in his mouth. After masturbation he chews several times or sometimes performs flehmen. Masturbation also occurs at times other than rut, particularly during May–June (Tsapluk and Savinov 1973).

Several days before parturition, females become solitary on slopes under cover of thick bushes and scree. In the Tien Shan births occur on open slopes during warm, dry weather but under concealment (rocky niche or cave) during cold, wet periods. When pregnant females isolate themselves, their yearling offspring remain solitary or group with other yearlings; they are separated from their mother the week before and the week after birth. Before giving birth the female spins around and attempts to reach her genitals. She lays and stands several times, but delivers in the laying position. The neonate begins to move immediately and raises its head from time to time. Its entire body, including its eyes is covered with thick mucus; the umbilical cord is 20 cm long and it bleeds slightly. The kid is completely dry and clean within 1.5 h, after being licked clean by its mother. The hooves of the kid are light and soft. The newborn kid bleats repeatedly and attempts to stand several times, but it generally does not succeed until at least 2 h after birth. The following day the kid may have moved up to 10 m from its birth-place (Fedosenko and Savinov 1983). At 1 day old kids are so active that they are nearly impossible to catch (Savinov 1962).

Females leave their young for long periods during the first few days after birth, and they travel great distances to join their herds. In a dangerous situation a mother runs away, while her kid hides. When caught by humans the young bleats loudly, and if the mother hears this, she returns and runs to within 5–7 m of her offspring. When released the kid runs to its mother, and after she sniffs it, both walk away (Savinov 1962). After 5–6 days several females with young join together. If a vulture or eagle appears, young run to the nearest female, which directs her horns toward the bird; other females immediately join. During the first days after birth a mother recognizes her kid by the smell of its anus, so in May she sniffs the young’s hindquarters ca. 80% of the time ($n = 15$) before nurs-

ing. Later she distinguishes her kid visually, and olfaction becomes less important: mothers sniff their kids 63% of the time ($n = 25$) before nursing in late June, and just 25–33% of the time ($n = 19$) in July–August (Fedosenko and Blank 1982). During their first days kids suckle 57 s (range 50–68 s, $n = 5$), and mothers do not limit feeding. Females begin to restrict suckling at the end of May in 76% of cases ($n = 42$) and in 94–100% of cases ($n = 60$) by the end of June. Duration of nursing bouts decreases gradually from 34.1 s (range 11–68 s, $n = 42$) in May, to 23.1 s (range 9–62 s, $n = 71$) in June, 22.0 s (range 13–40 s, $n = 46$) in July, 20.3 s (range 17–24 s, $n = 10$) in August, and to 8 s (range 7–9 s, $n = 2$) in November. Intervals between nursing increase from 40.3 min (range 35–50 min, $n = 3$) in May and 60.5 min (range 35–96 min, $n = 19$) in June to 110 min (range 87–131, $n = 11$) in July–August. Duration of nursing by twins is considerably shorter (16 s) than for a single kid of the same age (26.6 s); 1 of the twins suckles less than its sibling, because it begins to feed 8–10 s later (Fedosenko and Blank 1982). Young Siberian ibexes generally feed during daylight, so they are more active at this time. Duration of nursing varies annually and among different populations. Young are weaned in November–December, but they stay with their mothers throughout the next year (Fedosenko and Savinov 1983).

A female stands to feed her young; as she approaches and calls, the kid runs to its mother and usually suckles. Twins generally suckle on opposite sides, and rarely with both on the same side. The mother sniffs and licks her young's hindquarters during feeding. Sometimes she slightly bends her hindquarters to the ground for a more comfortable position for her young during nursing. When the udder is too low for the kid, it kneels on its front legs. If a female stands in a position that is uncomfortable for the kid, it rises on its hind legs and strikes her sides with its front legs until she changes her position. Kids may stand and walk on their mother or even roll down from her back in play. If a kid approaches its mother too early for suckling, she moves forward or backward and either jerks her hind leg or threatens the kid with her horns. During the first hours and days of their lives young rest for long periods of time and move only to suckle. After a week, when mothers rejoin their herds, the kids are more active. Young stay together, sometimes slightly apart from adults or around a single female (Fedosenko and Savinov 1983).

Play among kids consists of running, jumping, butting, and mounting each other. They run back and forth or around in circles for 5–40 min at a time. When jumping they twitch back and forth with their legs while in the air. Yearlings and adult females sometimes join kids in play (Fedosenko and Savinov 1983), but kids play mostly with similarly aged partners. Male kids usually play among themselves, significantly more with related than with non-related males, and their play involves more motor patterns than that of female kids. Female kids do not have a preference for the sex of their play partners. Male kids start ca. 20% of play bouts using the pattern mount, which females almost never use (Byers 1980).

During spring, Siberian ibexes in Tien Shan forage from morning to evening for 11 h; during this time, they take several rest breaks (ca. 4 h), visit salt licks (ca. 1 h), play 30–40 min, and engage in other activities for ca. 10 min (Grachev 1988). Grazing periods are 88.5 min (range 50–120, $n = 6$) in March and 66.4 min (range 10–110 min, $n = 7$) in April; resting time is 41.8 min (range 7–120 min, $n = 8$). Rumination lasts 34.1 min (range 15–60 min, $n = 6$). Proportions of a day for usual pasturing time and rest periods, respectively, are 67.8% and 32.3% in March and 66% and 34% in April. In May, grazing decreases to 56 min (range 40–106 min, $n = 5$) and in June to 46 min (range 22–91 min, $n = 9$); resting increases to 53 min (range 16–84 min, $n = 10$). The portion of resting and pasturing is 49.6% and 50.4% in May and 53.1% and 46.9% in June. By end of June the resting period is longer at midday, and individuals are significantly more active in the mornings and evenings. In July–August this schedule becomes even more marked; Siberian ibexes pasture at the beginning and end of the day and rest in the shade of rocks and trees, or on high windy places, from 0900 until 1700 h. Only females interrupt their rest to feed young for 5–10 min, sometimes for up to 25 min. During cloudy summer days Siberian ibexes are also active at midday. Siberian ibexes eat before sunrise, after sunset, and during the night. In September they still take a grazing break from 1000 to 1600 h, but in November they graze all day. Duration of grazing bouts increases from 46 min in June to 102 min in November (range

70–155 min, $n = 4$), and during the same period resting bouts increased from 52 to 88 min (range 52–145 min, $n = 7$). Proportion of resting and grazing during November is 46.3% and 53.7%. Later, grazing time increases by 67% because accessibility and nutritional value of food declines; resting decreases by 33%. In the Himalayas during November–December Siberian ibexes have a noticeable midday period of rest; only 20–25% of animals are active during 1100–1430 h. In the warmer mountains of Talasskiy Alatau, daytime activity is different. Midday breaks start in April and are quite long by June, lasting from 0800 to 1600–1900 h. Ca. 83–100% of individuals are active in mornings and evenings, and only 32–40% are active from 0900 to 1500 h. During summer in the low spurs of Tian Shan, Siberian ibexes forage mainly at night (Egorov 1955; Fedosenko and Savinov 1983; Fox et al. 1992; Grachev 1988; Heptner et al. 1961; Savinov 1964).

During summer, Siberian ibexes eat shrub leaves and grass shoots. They take either a bunch of grass or a single plant and pull it up, tearing it out sometimes with root and soil, then chewing, drawing it into the mouth little by little. If the grass is tall, and the Siberian ibexes cannot reach the flowers, they take the stem at the highest point they can reach and bend it so they can move their mouth along the plant to its top. Young and yearlings stand on their hind legs in this case. Grazing females take 30.0–51.5 bites/min, whereas males take 66 bites/min on average. Males chewed the cud 55.5 times/min or 45.3 times on average for 3, 49-s chewing cycles. Chewing frequency for 10-month-old Siberian ibexes is 81.6 times/min, or 56 times during a 41-s cycle.

Siberian ibexes graze unhurriedly and stay up to an hour at a single location. Activity during summer depends on food supply, temperature, and abundance of midges. In poor pastures, Siberian ibexes graze longer, whereas hot weather and midges shorten feeding. Livestock in the mountain pastures also change feeding activity; Siberian ibexes do not go into pastures during daytime, stay in rocks until nightfall, and graze only after livestock have left. Young animals graze longer than adult females, which in turn graze longer than adult males. Males rest longer than females and young. Before and after bad weather Siberian ibexes graze more actively and for longer periods. Siberian ibexes also lick soil to obtain salt, making quick movements with their tongues; they may scratch the ground with their front legs and then eat the soil in a kneeling position (Fedosenko and Savinov 1983; Heptner et al. 1961).

In winter, adults eat shoots from bushes and the tops of grasses above the snow cover. They often strike a bush with their front legs to shake off snow. If snow cover is not heavy, they can graze by shoving their muzzles through the snow. If snow cover is solid, adults and young alike dig and scratch with their front legs to get to the vegetation underneath. Siberian ibexes prefer to graze under bushes or trees, where snow cover is absent or at least not deep. During long snowfalls, they also prefer rocks, forests, or large bushes, where they stay throughout the inclement weather, leaving their refuge only for short grazing bouts (10–30 min). Siberian ibexes can lie a long time under a partial covering of snow (Fedosenko and Savinov 1983). During a blizzard, Siberian ibexes stay protected under rocks or descend far into gorges; on open slopes, they lie during bad weather, sometimes being buried in snow up to their horns. Siberian ibexes are good swimmers, capable of crossing through dense slush ice of the 300-m-wide Yenisey River. They have good senses of hearing, smell, and especially sight (Heptner et al. 1961).

In summer, Siberian ibexes rest in the shade of rocks and bushes, on patches of snow or ice, or in humid caves near waterfalls (Grachev 1988). They also sleep during the hottest part of day, sometimes very deeply (Antipin 1941). Young sleep more often than adults. Sleep lasts from several seconds to 10 min. A male slept 22 min 25 s out of an 80-min rest period. During light rain, Siberian ibexes graze, but they stop grazing during hard rain. Females with kids run from pasture to the nearest rocks, where they stay under overhangs. After the rain, they return to pasture and graze more actively because midges are absent. Kids attempt to avoid contact with tall wet grass either by jumping by staying on rocks near their grazing mothers (Fedosenko and Savinov 1983).

During tick infestations, Siberian ibexes scratch their back, sides, and base of tail with their horns; scratch their muzzle and neck with their leg; and scratch their shoulders and sides with their muzzle, lips, teeth, and tongue. They use bushes for scratching their muzzle and base of their horns, and they lie on the ground and move their hind legs to scratch their sides. Against flies, gnats, and

mosquitoes Siberian ibexes must constantly move, stay in windy regions, rest in snowy areas, or scratch and shake their tails and muzzles. Often they scratch their belly and udder with their hind legs, or sometimes females fall abruptly to the grass to rub their bellies and sides (Fedosenko and Savinov 1983).

To avoid predation, Siberian ibexes often look around, especially before grazing. Females with young are most watchful; males and young can be careless. When at rest, they lie facing different directions. Adult individuals stay on edges or prominent points with good fields of view. If danger is close, a Siberian ibex emits a shrill whistle 'chiv-v' and shakes its raised tail from side to side. The herd then begins to look for danger, and some females may urinate. The herd leader runs off first, followed by the others; as a rule they run upwards or to the nearest rocks, where they can climb to the most inaccessible places of the cliffs. In areas undisturbed by poaching and hunting, Siberian ibexes react quietly to humans. If they do not smell a person's scent, a human can approach to within 60–80 m, and possibly to within 15 m. Siberian ibexes of different ages react differently to danger. Younger always run away, whereas older animals stay put if they are far enough from the threat; otherwise, they also run. For example, young will run away from hunting dogs immediately, but adults will keep a safe distance, moving slightly ahead of these predators. However, adults leave the pasture for rocks as soon as a brown bear (*U. arctos*) moves into the area. Proximity to a snow leopard provokes panic in Siberian ibexes: they immediately stop grazing, leave the pasture, and move to the rocks. Siberian ibexes will leave their home range for several days after the appearance of a snow leopard. After the attack of a lynx, Siberian ibexes remain vigilant by watching all nearby slopes for up to 1.5 h. Airplane noise does not alarm Siberian ibexes, but they will run downhill or to the forests from a low-flying helicopter. Young begin to run after hearing thunder, but adults do not react at all. Avalanches cause alarm, and Siberian ibexes bunch together and watch the moving snow. Sometimes they even initiate an avalanche; if snow begins to move they run immediately to the nearest rocks or another safe place. They do not react to stones that fall as result of their own movements on the rocks, but they run if stones fall from above (Fedosenko and Savinov 1983).

GENETICS. *Capra sibirica* has $2n = 60$ chromosomes (Schmitt and Ulbrich 1968). Natural hybridization between *C. sibirica* and domestic *C. hircus* has occurred in the Kishtwar region of north Kashmir and in the Pamir. In Kazakhstan, male Siberian ibexes were bred with female domestic goats to produce animals with the high wool productivity of domestic goats and the fitness of the wild alpine stock (Butarin 1947; Egorov 1955; Roberts 1977). Both sexes of *C. sibirica* × *C. hircus* hybrids are fertile. Many hybrids between *C. sibirica* and *C. caucasica* (*C. cylindricornis*, see Remarks) were born in the London Zoo; some lived 14–19 years. Two hybrids (a female and a male) of *C. ibex severtzowi* (*C. caucasica*) and *C. sibirica* were born in captivity at Novosibirsk (Gray 1972).

REMARKS. The author and date of the description of the Siberian ibex are confused. The first description by Pallas was not binominal (*Capra alpium sibiricarum*—Spicilegia, 2, 1766:31). Later, Pallas renamed the Siberian ibex as *Ibex sibiricus* (Spicilegia, 11, 1776:52). Meyer (1794:397) emended Pallas' name to *Capra sibirica* and provided a new description. Both Meyer's name and description were subsequently used in the Russian literature (Bannikov 1954; Sokolov 1959).

The taxonomy of genus *Capra* has problems. Ellerman and Morrison-Scott (1951) considered *C. sibirica* a subspecies of *C. ibex*; therefore some authors (Fox et al. 1992; Roberts 1977) named this species *C. ibex sibirica* and others referred to it as *Capra ibex* Linnaeus 1758:68 (Pavlinov and Rossolimo 1987).

Color, body size, and horn shape are highly variable, and use of these characteristics for taxonomy has resulted in nearly 20 synonyms for *C. sibirica* (Heptner et al. 1961), and anywhere from 1 to 13 subspecies have been recognized (Ellerman and Morrison-Scott 1951; Lydekker 1913). Most authorities now recognize 4 subspecies (Heptner et al. 1961). Because the taxonomic position of Caucasian *Capra* is unclear (Heptner et al. 1961), we propose that hybrids *C. sibirica* × *C. caucasica* and *C. sibirica* × *C. ibex severtzowi* (described by Gray 1972) actually represent *C. sibirica* × *C. cylindricornis* and *C. sibirica* × *C. caucasica*. The taxonomy

of *C. s. sakeen*, which shares many morphologic characteristics with *C. s. alaiana*, is unclear (Heptner et al. 1961).

The Siberian ibex from the Himalayas is called the Asiatic ibex (Fox et al. 1992; Schaller 1977) or Himalayan ibex (Roberts 1977). Russian names for the Siberian ibex include Sibirskiy gorniy or kamenniy kozel (Siberian mountain goat or rock goat), kozel (male goat), kozerog or Sibirskiy kozerog, and Tsentralnoasiatskiy kozel (Central Asiatic goat from Russia—Heptner et al. 1961). Other names for the Siberian ibex include Turkic names (Kazakhstan, Kyrgyzstan, and Uzbekistan), tek, teke, tau-teke, and tau-eshek (female); kiik (Uzbekistan); bun (Altai); djim (Sayan), and yangir (Mongolia); in the northwest Himalayas (Ladakh), it is known as skyin (male) and idanmo (female—Antipin 1941; Bannikov 1954; Fedosenko and Savinov 1983; Heptner et al. 1961; Ishunin 1961).

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