



DISTRIBUTION, STATUS, AND CONSERVATION OF WILD YAK *Bos grunniens*

George B. Schaller

Wildlife Conservation Society, Bronx, NY 10460–1099, USA

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Liu Wulin

Tibet Forest Bureau, 22 Linguo North Road, Lhasa, Tibet Autonomous Region 850000, PR China

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Abstract

Wild yaks *Bos grunniens* survive only on the Tibetan Plateau where they have declined greatly in range and numbers during the past century because of excessive hunting. Wildlife surveys on the Plateau between 1984 and 1994 revealed that yaks persist in several small populations and in one large tract of alpine steppe and alpine desert, mostly above 4500 m in elevation, which extends over about 400,000 km² primarily in the Tibet Autonomous Region. The Chang Tang Reserve, 284,000 km² in size, covers a substantial part of this area and contains an estimated 7000–7500 yaks, a third of these in two relatively small areas. The number of wild yaks probably totals around 15,000. Meat hunting, encroachment by pastoralists into the last strongholds, and hybridization between domestic and wild yaks are among the dangers confronting the animals. Only large protected tracts of wilderness as in the northern Chang Tang Reserve can provide wild yaks with a future.

Keywords: wild yak, Tibetan Plateau, conservation, wildlife, habitat.

INTRODUCTION

The yak *Bos* (= *Poephagus*) *grunniens* has been domesticated for an unknown period (Olsen, 1990). Millions of domesticated animals now occupy the frigid uplands of Central Asia where their meat, milk products, wool, droppings for fuel, and strength in pulling plows and transporting loads have a crucial role in the economy of local peoples. Domesticated yaks have been well studied (Anon., 1976; Zhang, 1989; Zhang *et al.*, 1994), whereas little is yet known about their wild progenitor. Wild yaks occur only on the Tibetan Plateau, their range comprising the western edge of Gansu Province, Qinghai Province, the southern rim of the Xinjiang Autonomous Region, and the Tibet Autonomous

Region. There they occupy or once occupied plains, hills, and mountains from as low as 3200 m in elevation to the limit of vegetation at 5300–5400 m (Fig. 1). Early western explorers commented on the large number of yaks and hunted them for meat and sport (Przewalski, 1888; Rockhill, 1891; Hedin, 1903). In more recent decades, Schäfer (1937a), Feng *et al.* (1986), and Achuff and Petocz (1988) published some data on wild yaks, but it has only been in the 1990s that detailed information is becoming available (Schaller & Gu, 1994; Miller *et al.*, 1994).

A comparison of the accounts of early travellers with conditions in the same areas today indicates that yaks have greatly declined in range and number during this century. The wild yak is listed as endangered by the Convention on International Trade in Endangered Species and also by China which has given it the protection of its highest category (Class I). However, published data on the animal's actual status remain scanty and are based on limited field work. Numerical estimates range from 500 (Larrick & Burck, 1986) and 15,000 (Miller *et al.*, 1994) to 35,000 (Feng, 1991a) and 20,000–40,000 (Lu *et al.*, 1993). One of us (L.W.) surveyed wildlife throughout Tibet, especially in the western part during 1987–88. The other (G.B.S.) made 14 trips to the Tibetan Plateau between 1984 and 1994 and these included 6.1 months of work in the field in Qinghai (1984–86, 1993), 1.2 in Xinjiang (1987–88), and 12.6 in Tibet (1988–94). We have combined our findings to present this overview of the status and distribution of wild yaks.

THE TIBETAN PLATEAU

About 2.5 million km² in size and with 50% of its land area above 4500 m, the Tibetan Plateau is the most imposing such feature on earth. The Plateau consists of several distinct topographic regions determined by drainage patterns and the parallel high mountains that fringe and dissect it. Only the eastern and southern parts have outlets to the ocean with such rivers as the

Correspondence to: George B. Schaller 90 Sentry Hill Road, Roxbury, CT 06783, USA



Fig. 1. A large mixed herd of wild yak forages and rests in hills adjoining glacier of the Aru range; inset—a solitary wild yak male.

Yellow, Yangtze, Mekong, and Yarlung Tsangpo. Much of the Plateau comprises lake basins of varying size with internal drainage surrounded by hills and mountains that may rise to 5500–6000 m or more in elevation. Some basins are dry and others have lakes with saline or brackish but occasionally fresh water. The northwestern part of the Plateau, an area over 900 km long and 700 km wide, most of it 4500–5100 m in elevation, is known as the Chang Tang ('northern plain' in Tibetan), and this area was the focus of our surveys.

Moisture from the southwest monsoon comes up the gorges from the east and south. Consequently precipitation decreases from east to west and from south to north. Eastern Tibet and southeastern Qinghai have a rugged topography with a temperate and relatively humid climate that supports forests in some areas up to an elevation of 4400 m, a habitat not favored by yaks. Instead the animals frequent the cold, treeless uplands where average annual temperatures vary from 0 to -6°C , winter cold may drop to -40°C and below, and summer precipitation is often in the form of snow (Feng *et al.*, 1986).

The vegetation on these uplands consists primarily of perennial graminoids and forbs, low-growing to procumbent shrubs, and cushion plants. However, most of the yak's range encompasses three broad plant formations.

- (1) Alpine meadow is extensive where annual precipitation exceeds 350–400 mm, as on the plains of eastern Qinghai and in Tibet along the Lhasa–Golmud highway and west almost to Siling Co

('co', 'caka', and 'coring' are terms for 'lake' in Tibetan). To the north and west of this area, alpine meadow becomes largely riparian along streams, seepages, and swamps (Cincotta *et al.*, 1991). It has a sod layer 10–40 cm thick and is densely covered with short sedges (*Kobresia* spp.) and various forbs.

- (2) Alpine steppe lies generally between 4300 and 5100 m in elevation, is cold and windy and its soils are poor, consisting of sand, gravel, or silt without a sod layer. Precipitation is only 100–350 mm annually. Plant coverage is sparse, seldom more than 30%. *Stipa* spp. are the dominant grasses but other such graminoids as *Poa*, *Kobresia*, and *Carex moorcroftii* are also locally common. Dwarf shrubs, usually no more than 30 cm tall, include *Ajania* and *Ceratoides*. Herbaceous plants, especially legumes of the genera *Astragalus* and *Oxytropis*, and cushion plants such as *Leontopodium* are also prominent. Alpine steppe extends into the hills to 5200–5300 m, but plant dominance shifts with, for instance, *Kobresia* replacing *Stipa* as principal graminoid.
- (3) Desert steppe replaces alpine steppe in Tibet between about $34^{\circ}30'$ and 35°N and this plant formation then extends north into Xinjiang. Its annual precipitation is only 50–100 mm. Most plant species here are the same as in alpine steppe but coverage is much more sparse. Large tracts are almost devoid of vegetation except for patches of the coarse *Carex moorcroftii* and an occasional cluster of *Ceratoides compacta*. Desert steppe remains largely uninhabited by pastoralists.

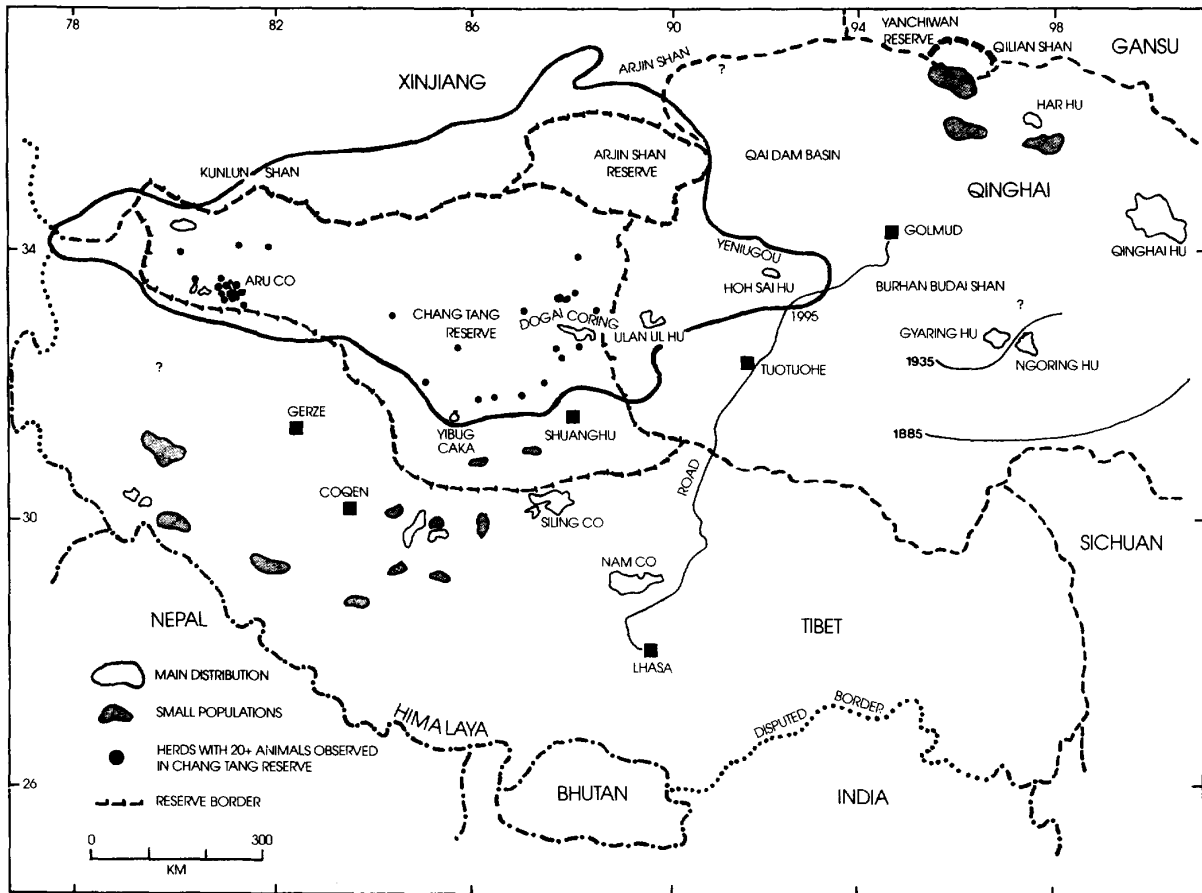


Fig. 2. The current distribution of wild yak. The easternmost yak limits in 1885 and 1935 are based on information in Schäfer (1937b). The question marks indicate areas where yaks may still survive. Approximate limits of distribution are shown by the dated lines 1885, 1935 and 1995 (heavy line).

METHODS

Most parts of the yak's range were visited (for G.B.S.'s routes see Schaller *et al.*, 1988, 1991; Schaller, 1993), but for logistic and other reasons we could not survey all potential areas. Our major effort was devoted to the Chang Tang Reserve, established in 1993 and comprising 284,000 km² (Fig. 2). We did most work with vehicles, driving along tracks and cross-country. In rugged terrain we went on foot, and in one instance, in Xinjiang, for 350 km by camel. The bulky, black forms of yak are readily seen in open terrain from as far as 10 km with binoculars. At first we attempted to determine average yak density by counting all yaks within 1 km on each side of our travel route. However, yak distribution was characteristically clumped with most animals in a few large herds. To sample such herds adequately it would be necessary to transect an area systematically, something that was often not feasible. Instead we tried to obtain total counts by criss-crossing selected large blocks of terrain. This provided minimum figures with which other areas could be compared. Local people also provided information about the status of yak within their areas.

Attempts were made to count all herd members and to determine their age (adult, yearling, young) and sex. However, yaks were usually so shy that they bunched up and fled far as soon as they perceived person or car. We were seldom able to do more than count the total number of individuals and number of young in a large herd before it vanished from view.

Wild yaks can be distinguished from domestic yaks by their shyness, larger size, and color. Wild animals are typically black with rust-brown overtones except for gray on the muzzle. (However, a wild mutant in the Aru Co region, comprising 1.6% of that population, is golden instead of black.) By contrast, in a sample of 1518 domestic yaks, 48% had white patches and other colors. We considered any 'wild' yak with such aberrant colors as feral or hybrid.

Yak fecal samples were collected for later food habit analyses, as described in Schaller and Gu (1994).

DISTRIBUTION AND STATUS

Although Pleistocene fossils of yaks have been found in eastern Russia (Olsen, 1990), there is little evidence that

other than domestic yaks have occurred there in historic times (Heptner *et al.*, 1966). A fossil yak is also known from Tibet and a probable one from Nepal (Olsen, 1990). At present wild yaks are confined to the Tibetan Plateau within China except that a few may seasonally enter the Changchenmo valley of Ladak in India (Fox *et al.*, 1991) and until recent decades some penetrated northern Nepal (Miller *et al.*, 1994).

Qinghai

Wild yaks were once abundant on the vast alpine meadows around the headwaters of the Yellow River near Gyaring and Ngoring lakes. Prezewalski (1888) found them there 'in herds of several hundreds, and sometimes even more than a thousand animals', and Wellby (1898) noted that 'on one green hill we could see hundreds upon hundreds of yak grazing; there was, I believe, more yak visible than hill'. By the mid-1930s Schäfer (1937b) found yaks scarce or absent in that part of Qinghai (Fig. 2). In 1949, Clark (1954) saw few animals 'due to the importation of repeating rifles... We had already seen hundreds if not thousands of the enormous white skulls of wild yaks'. The construction of a highway south from Qinghai Hu ('hu' = 'lake' in Chinese) during the 1950s opened the region to casual hunting, and this, together with a widespread famine in China between 1958 and 1961, during which many animals were killed, greatly decimated all wildlife. The last wild yak was observed near Gyaring Hu in 1983 according to local informants (Kaji *et al.*, 1993). Today the eastern limit of wild yak lies near the Lhasa-Golmud highway; during surveys east of the highway in 1985 and 1986 we saw only a few solitary males. The highway roughly marks the transition zone between the alpine meadow in the east and alpine steppe in the west. From here the yak's range extends westward over a block of terrain of about 400,000 km² (Fig. 2).

The part of this block in Qinghai has been surveyed for wildlife in several localities. In 1991, the Yeniugou, a valley in the Burhan Budai Shan ('shan' = 'mountain' in Chinese) had a population of about 1223 yaks in 1051 km² and in 1992 there were 841 (Miller *et al.*, 1994). In 1986, Schaller *et al.* (1991) transected 20,000 km² on each side of the highway from the southern edge of the Burhan Budai Shan to the town of Tuotuohe, but only 9 yaks, all males, were seen. In 1993, we made a trip far up the Tuotuo River and found no yaks. In 1990, Feng (1991b) drove west from the highway to Ulan Ul Hu, north to the Burhan Budai Shan, and then east past Hoh Sai Hu. A total of 805 yaks were tallied, almost all in two concentrations. One concentration with 363 animals was found at Xijir Ulan Hu, just north of Ulan Ul Hu, and a second with 435 animals was at Hoh Sai Hu, but we suspect that these were part of the nearby Yeniugou population censused by Miller *et al.* (1994).

North of the Burhan Budai Shan is the Qaidam basin, 2600–3000 m in elevation, whose salt flats and desert scrub are not yak habitat. But toward the northern rim of the Plateau, along the Arjin Shan and Qilian

Shan with its associated ranges, yaks persist in fragmented populations of unknown size. P. Kozloff saw 'traces of wild yak' in the Arjin Shan and farther east found the animals 'extremely numerous' (Anon., 1896). We do not know if yak persist in that part of the Arjin Shan, but they occur farther west in the same range. Zheng *et al.* (1989) observed 51 yak in the Yanchiwan Nature Reserve of Gansu close to the Qinghai border. Local people told us that yak enter the reserve only seasonally from the south. We censused a 610-km² area along the northern slopes of the Shule Nanshan just east of the Yanchiwan Reserve without finding fresh evidence of yak (Schaller *et al.*, 1988). To our knowledge at least three populations persist in that part of Qinghai.

Xinjiang

We made two surveys in Xinjiang. The first traversed an area of about 6000 km² from the northern flanks of the Kunlun Shan across a portion of the Plateau just west of the Arjin Shan Reserve. A total of 26 yaks were tallied (Schaller *et al.*, 1991). The second survey was in the Yusupalik Tag, a spur of the Arjin Shan, north of the Arjin Shan Reserve. Only 23 yaks were seen, but according to local people many animals come to that area from the reserve in winter. The Arjin Shan Reserve, established as a national reserve in 1985, encompasses 45,000 km². Sheng (1986) gave its yak population as about 10,000, and Butler *et al.* (1986) quoted a similar figure. Based on transects during which 420 yaks were seen, Gu *et al.* (1984) calculated a total population of 5625 yaks on the assumption that density was similar throughout the reserve. In 1988, Achuff and Petocz (1988) conducted a survey of 18,000 km², covering the western half of the reserve; they saw 219 yaks and estimated fewer than 1000 in that part. No reliable estimate is available for the whole reserve, but we consider it unlikely that there were more than 3000 at that time. During the early 1990s illegal hunting by gold miners and others greatly reduced wildlife populations (H. Wong, pers. comm.).

Tibet

Western Tibet has long had a large pastoral population south of about 32°N. There wild yaks have been hunted so intensively for meat, horns (used as milk pails), and other products that the animals have been exterminated or reduced to small local populations (Fig. 2). We probably overlooked a few scattered sites, and some populations may have vanished since we recorded them. And at least some of the animals in this part of Tibet are either feral domestic yaks or hybrids.

Wild yaks once occurred throughout the northern Chang Tang, an area that is now within the Chang Tang Reserve. In 1891, Bower (1894) noted that they 'are to be seen all over the Chang. Sometimes as many as a hundred were seen in a day, and for days together some were always in sight'. But, as the observations of Hedin (1903, 1922), Deasy (1901), and others make clear, yak herds were usually encountered at intervals, droppings and trails indicating that they ranged widely.

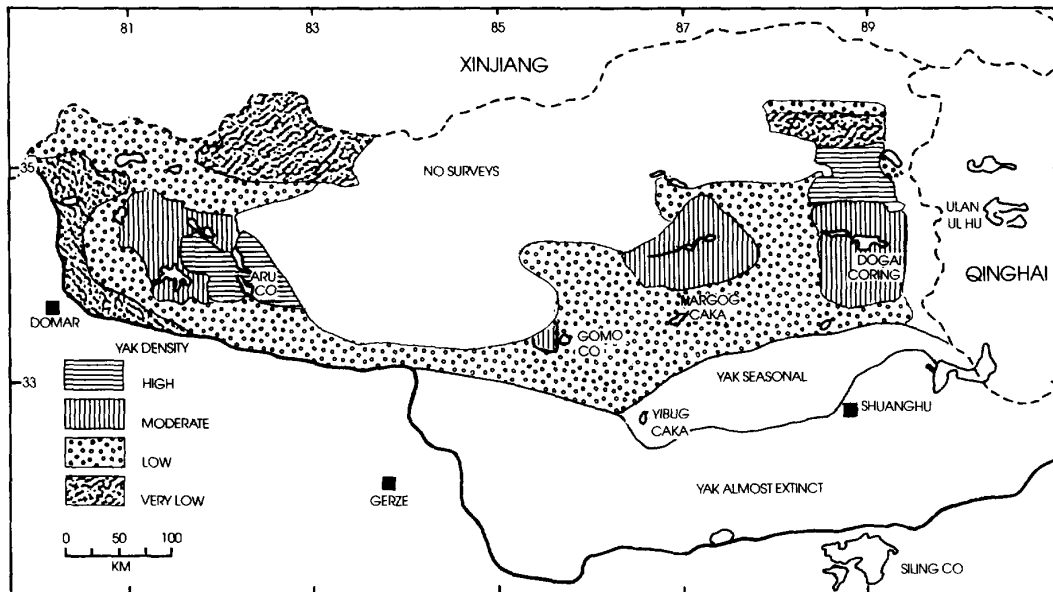


Fig. 3. Relative density of wild yaks in Tibet's Chang Tang Reserve.

Today the Chang Tang Reserve can be divided into three zones with respect to yak distribution (Fig. 3).

The yaks in the southern quarter (24%) have in recent years been almost exterminated. Few pastoralists inhabited the steppes north of Siling Co and the town of Gerze before the 1960s, but at present about 3500 families with 1.5 million head of livestock live within the reserve, or use it seasonally, as far as 33°40'N in places such as Gomo Co.

In the eastern part, between Shuanghu and Yibug Caka, an area comprising about 5% of the reserve, yaks are now mainly seasonal visitors. In December 1991 we surveyed 17,500 km², including a major part of this area, and tallied 13 yaks, all bulls. According to local informants, yaks from the north visit briefly in autumn; in confirmation of this, we saw herds with 20 members or more four times there only in September. The usual distribution of yaks suggests that some of these herds had traveled south for 50 km or more.

Yaks occupied the rest of the reserve (71%) at varying densities. Males were often solitary or in male herds with 2–5 members but with as many as 12 and 19, to note the two largest such herds seen. Males were widely scattered, sometimes with or in the vicinity of females, and at other times far removed even during the July–September rut. Herds with females were often small, comprising 6–20 animals, but at times they contained over 100 individuals (Fig. 4).

The large population in the Aru basin differed somewhat from others. Solitary individuals and herds with 2–5 animals, almost all of them males, were relatively scarce, and more animals were in herds with over 80 individuals. Excluding solitary animals, the average size of 64 herds in the Aru basin was 24.5; elsewhere in the reserve the average of 109 herds was 11.3.

The distribution of large herds provided a better idea of relative yak abundance than the mere presence of solitary males and small herds. A total of 33 herds with 20 or more yaks were observed in the reserve. Three visits were made to the Aru basin but only the 1990 data are shown in Fig. 2. Excluding the yaks in the Aru basin, the remaining 21 herds comprised 1008 yaks or 73% of the total of 1373 animals tallied.

Our sightings of large herds indicated two areas of high density (Fig. 3). These two sites had several characteristics that made them attractive to yaks. There were high mountains, the Aru Range and Rola Kangri, partially glaciated, that provided freshwater streams and slopes with alpine meadow or luxuriant alpine steppe. The terrain enabled yaks to shift seasonally up and down slopes to select the best available forage. In 1994, the volcanic hills east of Rola Kangri had greened by early June some 2–3 weeks before the plains. With plants dormant from September to May, the availability of early high-quality forage may be critical to wildlife in that region and yaks, Tibetan antelope or chiru *Pantholops hodgsoni* and kiang *Equus kiang* concentrated there.

In 1990, 681 yaks were counted in the 1800 km² Aru basin and 114 more in the small Yalung basin on the west slopes of the Aru range; in 1992, only 315 were counted in the Aru basin. Probably at least 1000 yaks inhabited the 5000 km² in and around the Aru basin (Schaller & Gu, 1994). We did little work west of the Aru area. Fifty-four yaks were seen there during one survey. Information from local people indicated a population of moderate size. However, some of these animals possibly moved in and out of the Aru basin. At the time of the surveys perhaps 1500 yaks were in that western area of concentration.

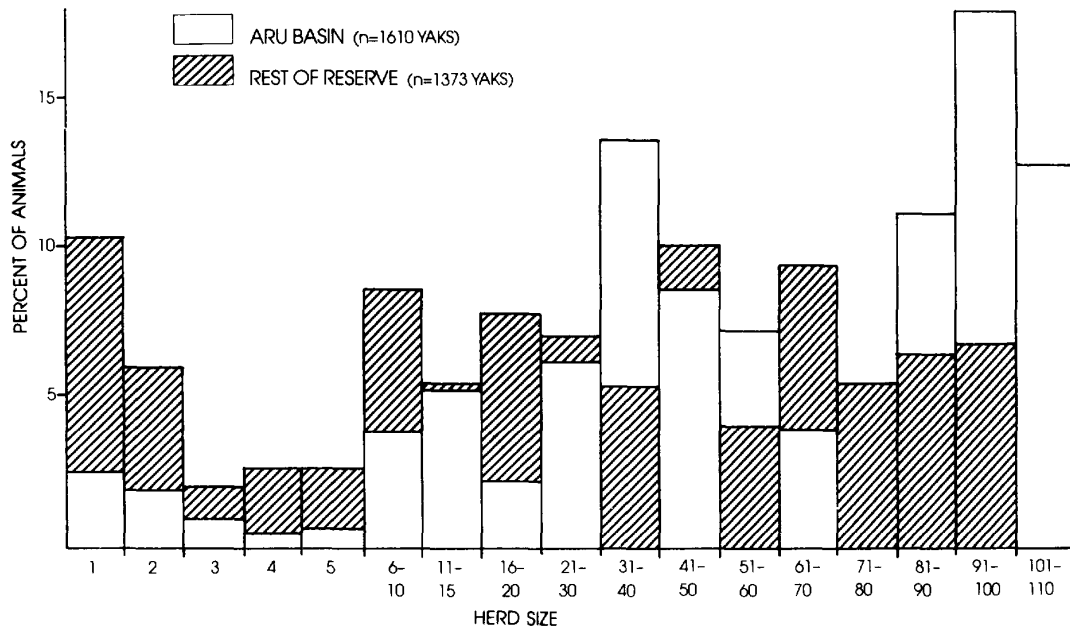


Fig. 4. Percent of wild yaks in herds of various sizes, Chang Tang Reserve. The Aru basin area includes our combined data for 1990 and 1992.

At the other end of the reserve, between the lakes Dogai Coring and Dogai Coring Qangco, we counted 437 yaks in about 4000 km² during a June 1994 survey. To the south between Dogai Coring and the glaciated massif Purog Kangri was an area of moderate density in which we tallied 146 yaks. However, as in the Aru region, herds probably shifted seasonally, some moving south toward Shuanghu in autumn. Good yak habitat extended east to the Qinghai border as well. This eastern concentration area may contain 1000 yaks.

West of Dogai Coring are extensive arid flats and hills with little wildlife, but there are areas with moderate yak numbers around the Tian Shui river and the Yako Hu basin, the latter also known as Pamachungtsong. Grazing is quite good in these two areas, good enough that the government twice tried to settle pastoralists there in recent decades but the people soon returned south, in part because of the isolation. People from Shuanghu drove there by truck to hunt yak for meat in October 1991 and saw 300–400. The Pamachungtsong area, we were told, was used mainly by male yaks. We confirmed this 3 years later by observing only males there—a total of 30—and counting 55 skulls, of which 50 were males. Possibly 500 yaks inhabited that region. Areas of moderate to high yak density comprised about 12% of the reserve and contained an estimated 3000 yaks or an average of 16.5 km² per yak.

About 59% of the reserve is presumed to have low to very low densities. We were unable to visit all parts, but based on our knowledge of terrain and vegetation, as well as on information from other sources, we doubt that large yak concentrations occur there. Few wild yaks and little spoor were encountered in low-density areas. For example, driving north past Margog Caka

we saw 3 yaks in 143 km; and going west from Dogai Coring no yaks were seen in 101 km, but then a herd of 39 was encountered. If such low-density areas averaged about 30 km² per yak, half the number in areas of moderate to high density, the total would be about 3666 yaks, or roughly 3500–4000.

In 1990, we made an intensive survey over about 8000 km² of desert steppe north of the Aru basin between the Toze Kangri massif and Heishi Beihu. A total of 73 yaks were tallied or 110 km² per yak. Similar habitat extends eastward along the northern edge of the reserve as well as north into Xinjiang. The western edge of the reserve also has few yaks because there is a major highway near which truck drivers hunt. An estimated 100 km² per yak in very low-density areas extrapolates to about 580 yaks. Judging by the accounts of Hedin (1903), Bower (1894) and other early travelers, desert steppe had low densities even a century ago.

Overall current status

The yak's last major refuge is in the remote northwestern part of the Tibetan Plateau. An estimated 7000–7500 animals were in the Chang Tang Reserve. Contiguously to the east in Qinghai, there were about 1200 in the Yeniu-gou and surrounding areas (Miller *et al.*, 1994) and perhaps 1000–1500 more, judging by Feng's (1991b) survey. The Arjin Shan Reserve still had a substantial population in the late 1980s but hunting in the past few years has decimated it. The desert steppe west of that reserve had few animals. Possibly 2000–2500 yaks persist in Xinjiang. These figures total 11,200–12,700 within a block of about 400,000 km², an estimate based on fragmentary data, but, we believe, of the correct order of magnitude.

We have no information upon which to judge numbers elsewhere except to suspect on the basis of local

interviews that populations are small. In Tibet, possibly 1000 yaks persist outside the Chang Tang Reserve. If so, Tibet's wild yak population would be about 8000–8500, similar to the estimate of 7156–8758 given by Liu and Yin (1993). The size of the yak populations in northern and northeastern Qinghai also remains unknown. We arbitrarily assume that 1000 survive there.

Based on these rough estimates and assumptions, the total number of wild yak on the Tibetan Plateau is approximately 13,200–14,700. Until further surveys elucidate the status of the species, an estimate of around 15,000 seems appropriate.

PROBLEMS AND ACTIONS FOR CONSERVATION

Over a century ago, Prejevalsky (1876) noted that 'in the midst of a desolate nature, yet far removed from pitiless man, the famous long-haired ox roams in unrestricted freedom'.

'Pitiless man' has now intruded. The range of the species has been reduced by more than a half since Prejevalsky wrote these words. Except for scattered populations with a tenuous future, yaks are now confined to one large tract. They have lost most of their best habitat, the alpine meadow and steppe, to pastoralists. Their decrease is not due to habitat degradation or destruction, as with many endangered species, but to hunting. As Rockhill (1894) noted in Qinghai, locals 'hunt them a great deal, their flesh being the only meat a great part of these people use during winter', and the same was true in Tibet. Western travelers also contributed to the decline. 'We left the greater number of those we shot untouched, having no use for the meat in Tibet' (Prejevalsky, 1876). Gold diggers past and present killed much wildlife (Hedin, 1991; Feng, 1991*b*), in 1980 a geological survey team shot 250 yaks mainly for the market (Feng, 1991*a*), and early in 1992 a poaching gang shot at least 143 yaks in the Arjin Shan Reserve (H. Wong, pers. comm.).

Traveling through what is now the Shuanghu area in 1901, Hedin (1903) found that 'yaks and kulans [kiangs] were remarkably numerous. Occasionally we counted them by the hundreds'. Shuanghu was established as an administrative centre in the 1960s. Yaks were still there in number during the early 1970s (Li Bosheng, pers. comm.), but by the late 1980s herds no longer frequented the vicinity. In the early 1990s, trucks from town went as far as 250 km north and northwest to kill yaks. Hunters from the town of Gerze drove north for a similar distance to the Aru basin. Within 30 years the yak in the southern part of what is now the Chang Tang Reserve had been virtually eliminated, the decline hastened by motorized hunters who in winter can drive almost anywhere. Discarded yak heads litter all but the most remote parts. The Tibet Forest Bureau, which is responsible for wildlife, is making a major effort to protect yaks and other species. The fine for killing a yak is the equivalent of US\$600. In 1994, three hunters were apprehended after killing a yak and nine chirus; their penalty was US\$1765 and the loss of two rifles.

Most surviving yaks are in the Chang Tang and Arjin Shan Reserves, and a few frequent Gansu's Yanchiwan Reserve. Qinghai offers yaks no reserve protection. Even though two of the reserves are huge, yaks remain under threat within them. Hunting is difficult to suppress in such remote areas without a mobile patrol force, as the recent decimation of wildlife in the Arjin Shan Reserve has shown. Wild yaks, perhaps more than other wild ungulates in the Chang Tang, must have large tracts of wilderness in which pastoralists are sparse or absent. Domestic and wild yaks readily hybridize and the pure wild strain will vanish with frequent contact.

Transmission of disease, such as brucellosis, from domestic to wild yaks is also a possibility when the two occupy the same ranges. In 1992, young comprised 1% of the population ($n = 315$) in the Aru basin and only one yearling was seen (Schaller & Gu, 1994), virtual reproductive failure for 2 years. An adult female yak raises at most one offspring every 2 years (Zhang, 1989), young being generally born in May and June. With such a recruitment rate one would expect about 10–15% of a population to be comprised of young. In June 1994 we tallied 690 yaks in the eastern part of the reserve, of which 2.5% were young—but the birth season was not yet over. In August 1990, 5.7% of the population ($n = 700$) consisted of young in and around the Aru basin, whereas it was 12.7% ($n = 267$) elsewhere in the reserve.

Currently the last undisturbed good grazing grounds are under threat from intrusion by pastoralists in the northern part of the Chang Tang Reserve. Pastoralists began to move seasonally from Qinghai west to Dogai Coring during the 1990s; in 1991 five families with their livestock moved permanently into the Aru basin; and the government is considering plans to move pastoralists northward even though previous attempts had failed. Furthermore, the traditional patterns of life of the nomadic pastoralists are changing. The government promotes livestock development and a market economy. People are becoming more sedentary as they build huts and enclose pastures with fences — which wild yaks break on occasion. Domestic and wild yaks have the same diet (Table 1), the animals

Table 1. Mean percent relative density of plant fragments in feces of wild and domestic yaks in the Chang Tang Reserve^a

	Wild yak 21 samples	Domestic yak 11 samples
Graminoids		
<i>Carex moorcroftii</i>	14	7
<i>Kobresia</i> spp.	4	5
<i>Stipa</i> spp.	52	77
Other graminoids	4	3
Forbs	12	8
Shrubs		
<i>Ceratoides compacta</i>	10	Trace
Other shrubs	1	—
Seeds	3	—

^aEach sample consists of a mix of material from 10 fresh fecal piles.

being predominantly grazers, a source of potential competition for pasture assuming that any wild ungulates can survive in numbers.

The decline of wild yaks during this century has shown that the animals do not persist for long in areas with many people and much livestock. We believe that the Chang Tang Reserve north of about 34°N and from the Qinghai border west to and including the Aru basin should be closed to pastoralism. That area is marginal for livestock production and remains essentially uninhabited. In Xinjiang, the National Environmental Protection Agency which has jurisdiction over the Arjin Shan Reserve must regain control over that area, and in Qinghai critical yak sites such as the Yeniugou and its surroundings should receive full protection. The wild yak is a totem of this high and lonesome realm and it will survive there in its last stronghold only if it can roam, in Prejevalsky's (1876) words, with 'unrestricted freedom'.

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