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Status and trends of Tibetan plateau mammalian fauna, Yeniugou, China

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Abstract

We conducted surveys focusing on the unique and vulnerable ungulate species in Yeniugou, Qinghai province, China, during September 1997 to compare population estimates with those from the early 1990s. The status of two ungulate species appeared essentially unchanged since 1990–1992: wild yak *Bos grunniens* (about 1200 to 1300 animals) and Tibetan gazelle *Procapra picticaudata*. The status of one ungulate species, the white-lipped deer *Cervus albirostris*, appeared to improve, from a very few to close to 100. We are unsure how the status of the Tibetan wild ass *Equus kiang* compares with that of the early 1990s. The status of three species declined during the period: blue sheep *Pseudois nayaur* and argali *Ovis ammon* declined slightly (possibly due to a weather event), and the Tibetan antelope *Pantholops hodgsoni* declined dramatically (probably due primarily to poaching), from over 2000 estimated in 1991 to only two seen during 1997. Poaching of antelope has become a serious problem throughout the Tibetan plateau in recent years, and this survey provides evidence that an entire subpopulation can disappear (either through mortality, movement away from human disturbance or a combination) within a relatively short time-frame. That some species (e.g. wild yak, white-lipped deer) continue to thrive in Yeniugou is heartening, but even they remain vulnerable to market-driven poaching.

Keywords: Argali; Blue sheep; China; Conservation; Qinghai; Survey; Tibetan antelope; Tibetan gazelle; Tibetan wild ass; White-lipped deer; Wild yak; Yeniugou

1. Introduction

The mammalian fauna inhabiting the Tibetan plateau (referred to as the Qinghai–Tibet plateau in China) is unique and little studied. Pastoralists living on the plateau have always had some impact on wildlife populations, although their subsistence economy and relative isolation until the 1950s allowed most species to persist in relative security. In recent years, these species have become increasingly vulnerable to poaching and habitat alteration as human populations in nearby areas have increased (Cai et al., 1990), and as improved access and increased wealth generally have allowed incursions from agriculturalists and entrepreneurs from eastern Qinghai province.

The area of Golmud County in Qinghai province colloquially referred to as Yeniugou (Wild Yak Valley) has been considered by Chinese scientists to contain one of the best-preserved aggregations of these Tibetan plateau species (Cai, 1997). Despite the recent establishment of huge areas on the plateau as nature reserves [Arjin Shan (Achuff and Petocz, 1988), Qiangtang (Stevens, 1990; Schaller, 1993), Kekexili (Feng, 1993; Harris, 1993)], Yeniugou is still considered important for the future persistence of this faunal assemblage (Schaller and Liu, 1996; Cai, 1997) because of its relatively high productivity and diversity.

Our surveys in Yeniugou during the early 1990s resulted in a general description of the status of its wildlife (Harris et al., 1996), census estimates for wild ungulates (Harris, 1993), an investigation of dietary overlap and potential competition of wild ungulate with domestic livestock during summer (Harris and Miller, 1995), an assessment of the status of wild yaks (Miller et al., 1994), an examination of the potential for international funding to aid in conservation (Harris, 1995) and a proposed management framework together with its justification (Harris, 1993). However, all of this work was, of necessity, limited in perspective by the

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snap-shot-like time duration. Assessment of trends in wildlife populations and human impacts is difficult in only three seasons (1990–1992). This 1997 follow-up survey allowed comparison of selected condition indices over a seven year time-frame. Such repeated surveys, allowing the assessment of population trend, have not often been conducted in China but must become more common if it is to successfully manage its wildlife.

2. Study area

2.1. Geography and environment

Yeniugou is an interior valley within the Kunlun Mountains in Haixi Mongolian People's Autonomous Prefecture, Qinghai Province at approximately 35° 50′ N, 91 to 93° E (Fig. 1). Elevations on the valley floor vary from roughly 3800 to 4200 m. The main Kunlun range (elevations up to 5933 m) lies to the south of Yeniugou River, and isolated massifs of up to 5498 m rise up to the north. The entire area totals approximately 3900 km², although studies were conducted only within a smaller core area of approximately 1050 km². Yeniugou is characterized by high elevations, low annual precipitation and shallow soils. Vegetation consists predominately of graminoids (notably *Stipa, Kobresia* and *Carex* spp.) and forbs; there are no trees. Vegetation ground cover tends to be low (5–25 cm; Zhou, 1990; Harris and Miller, 1995) and portions of the area at higher elevations are devoid of all vegetation. Further information on vegetation in Yeniugou can be found in Harris (1993) and Miller and Bedunah (1994).

2.2. History and current use

Yeniugou is situated in a zone of transition between traditionally Mongol and Tibetan areas. Superimposed on these two groups has been the addition of Kazaks, who arrived during the 1930s seeking refuge from persecution in Xinjiang. Yeniugou was originally inhabited by Tibetans, but they were removed in the early 1950s and their grazing rights revoked. From the early 1950s through to 1983 grazing rights belonged to a group of Kazaks who were based near Golmud. Then, in 1984, the area was officially handed over to a group of Mongol pastoralists when the majority of Kazaks moved back to Xinjiang (Qinghai Bianjizu, 1985). Nearby Tibetans began illegally grazing livestock in Yeniugou during the winter of 1986. The effective land tenure system since then has been that summer and winter

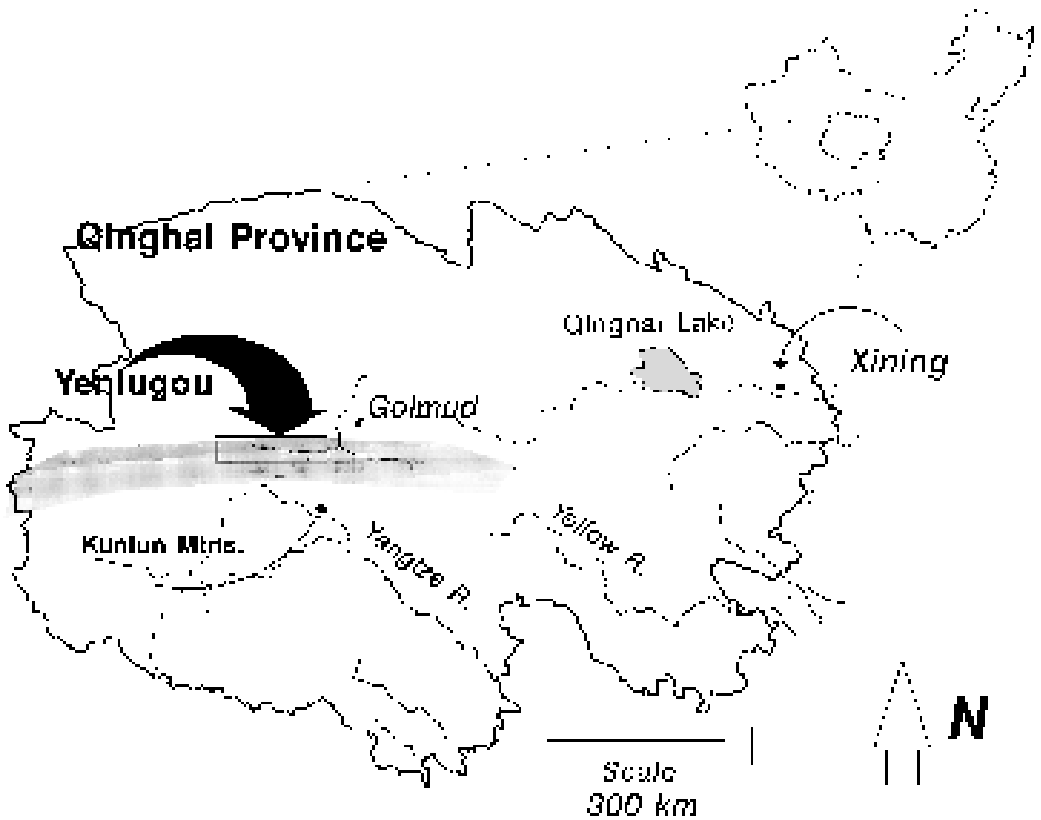

Fig. 1. Location of Yeniugou within Qinghai Province, China. The major cities of Xining and Golmud are indicated, as is the general location of the Kunlun Mountains chain. Solid lines indicate major river systems; the dashed line is the only highway in the province, connecting Xining with Lhasa in the Tibetan Autonomous Region. Inset shows the location of Qinghai within China.

grazing was done by two separate communities, with no communication or coordination between them. This cultural ebb and flow has had practical manifestations for conservation: three different groups have occupied Yeniugou in the past 45 years. The two disruptions in the identity of the local people interacting with Yeniugou's wildlife in recent times has severely compromised the development of traditional systems of resource husbandry.

According to Kazak informants who observed both periods, two phenomena occurred during these most recent years: (1) the movement of gold miners, based in eastern Qinghai, through Yeniugou to suspected deposits to the west and (2) commercial hunting of wildlife by outsiders, primarily of yaks and argali, and primarily in winter. Both of these activities were illegal; in practice, both were virtually uncontrolled. Wildlife evidently survived in good numbers during the Tibetan and Kazak periods, except during the early 1960s when famines associated with the Great Leap Forward resulted in widespread exploitation. Wildlife evidently began declining with the improvement of the road into Yeniugou during the Mongol period, particularly as poaching from itinerant gold-miners and market hunters increased during the 1980s. Further information on the cultural history of the area is reported in Harris (1993).

3. Methods

Two of us (RBH and COL) spent the period from 2 September through to 23 September 1997 in Yeniugou and interviewed local and provincial officials in the Chinese language. To maximize the validity of comparisons, we used the same methodology as during our 1990–1992 surveys whenever possible and surveyed exactly the same subdrainages (during the same season). We focused our attention on Yeniugou's wild ungulate fauna, particularly the three species deemed most susceptible to recent declines at the hand of humans: wild yak, Tibetan antelope and argali. Observations were obtained primarily on foot or horseback (vehicles were used to transport base-camps along the main river valley). Most observations were aided by 7 or 10× binoculars or 20–42× zoom spotting scopes. Time constraints did not allow us to conduct line-transect surveys for specified species as we had during 1991 (Harris, 1993; 1996), but we did record all sightings of these species. When appropriate, we estimated the probability that multiple sightings in the same general area represented duplicate counts and adjusted our counts accordingly (Harris, 1993; 1994). We make no claim that surveys of argali, blue sheep, or wild yaks from either time-period represented fully unbiased population censuses: we cannot account for animals that may never have been observed. Rather, by replicating counts under similar conditions, we believe that gross changes were detectable.

4. Results

4.1. Species of concern

4.1.1. Wild yak

Our best estimate of the number of wild yaks we observed during September 1997 was 1297. This is similar to the number estimated during 1991 (point estimate 1223; 95% CI 1014–1494) and higher than the 841 estimated in the valley during 1992 when yak distribution was particularly widespread (Harris, 1993). Yak bands often move among subdrainages, particularly during the transition from summer to autumn foraging (Harris and Miller, 1995), making assessment of possible duplicate counts difficult. Our travel itinerary during 1997 allowed us to double-check the location of most of our previously observed yak bands while searching for new ones. Thus, we were usually able to ensure that apparently new bands were not, in truth, previously counted bands that had moved ahead of us. Our estimate of 1297 is conservative in that we tended to assume that counts were indeed duplicates when such assurance was not possible (Harris, unpubl. data). Thus, we believe that yak numbers in Yeniugou remained relatively constant during the 1991–1997 period.

4.1.2. Tibetan antelope

A dramatic decline evidently occurred in the Tibetan antelope population resident in Yeniugou. In the early 1990s, Tibetan antelope were the most abundant ungulate (2076; 95% CI 927–3247) in Yeniugou (Harris, 1993). We did not replicate the line-transect work during 1992, but observed little visible change in antelope abundance. However, during 1997, despite considerable search effort, we observed only two Tibetan antelope within Yeniugou, both adult males. Although comparing results from a line-transect estimate (1991) with simple observations (1997) is imprecise, the magnitude of this decline argues against counting inconsistencies as a causative factor. During the early 1990s, we directly observed over 1000 antelope each season (i.e. direct observations supported the projections from line-transect density estimation). Additionally, we frequently found sign of antelope (e.g. tracks, fecal pellets), whereas in 1997 we observed no fresh sign of antelope and even old skulls were rarely encountered. In the subdrainage where female and young antelope congregated during 1991–1992 (and in which we observed directly no less than 745 antelope within a few days' time in 1991), we could not find a single, live Tibetan antelope. This same subdrainage continued to support Tibetan gazelles and Tibetan wild ass in numbers that

appeared similar to those seen during the early 1990s (see below).

4.1.3. Argali

Our best estimate of the number of argali we observed during September 1997 was 141, substantially below our estimate of 245 (95% CI 238–256) in 1991 and also lower than our 1992 estimate of 167 (Harris, 1993). We found only two skulls from recent argali mortalities in 1997, compared with 24 found in 1991. Argali are the most difficult ungulate species to census, yet we believe a real decline occurred during the 1992–1997 period, although it may have been more or less severe than the 43% suggested by these observations.

First, the lower number observed in 1992 relative to 1991 was probably a result of poor weather conditions during the 1992 field season. During August 1992, rain and snow, with accompanying low clouds, frequently obscured the mid- to higher slopes that argali generally prefer during summer. Second, of the estimated 167 observed during 1992, almost 41% were classified as adult males (4+ years old), a percentage that was unlikely to reflect the true population composition (suggesting that many females and young went unrecorded). Males were often more easily seen than females, particularly when poor visibility prevented us from observing the higher slopes. Third, we observed 67–68 adult male argali during 1992, compared to 43 adult males during 1991. It is unlikely that a substantial reduction in total numbers woul have been accompanied by an increase in the number of adult males. Thus, we believe that the apparent decline from 1991 to 1992 was largely, if not entirely, due to observation conditions, rather than a true reduction.

Observation conditions were excellent during 1997, however, and we had the additional advantage of knowing more about likely argali distribution than we did during 1991–1992. Finally, our lower counts during 1997 did not come from failing to find entire bands so much as they did from the smaller size of the same bands (i.e. those that evidently used the same summer foraging and resting areas as did analogous bands during the early 1990s). For example, we observed a nursery band (adult females, yearlings and lambs) which we termed the Hongshanbao band, during 1991, 1992 and 1997. We estimated the size of this band as 38 during 1991 and 42 in 1992, but we consistently saw a band numbering only 24 during 1997. Similarly, a nursery band occupying the A'nawari mountain numbered about 25 in both 1991 and 1992, but despite thorough searching we documented only a group of 6 females (with no young) on the mountain in 1997. On four separate occasions during 1997 we observed a relatively large nursery band, consisting of 31 argali; however, during 1991 we had observed two separate nursery bands of 43 and 19 (a total of 62) in this same area. Thus, we believe that lower counts in 1997 reflected a true reduction in abundance, rather than simply counting inconsistencies.

4.1.4. Other species

The status of one ungulate species, white-lipped deer, appeared to improve from the early 1990s. We observed 80–89 white-lipped deer during September 1997 (the range in numbers results from uncertainty about movement and possible duplicate counts). The most deer we could account for during the early 1990s was 16, and we guessed that no more than 50 occupied the entire valley. Our best estimate of the number of blue sheep observed during September 1997 was 839, slightly less than the 1137–1492 estimated during 1991 and the 1053–1077 estimated to have been observed during 1992. Blue sheep bands were found in most, but not all, of the previous locations, but, as with argali, most were smaller in size than during the early 1990s. We estimate that we observed 418 individual Tibetan wild ass during September 1997. This is less than our 1991 estimate of 843 wild ass (95% CI 618–1052), but more than we observed during 1992, when less than 100 were seen. However, survey techniques for wild ass differed between 1991 and 1997; group size and locations were similar to that in the early 1990s, but the wide variation in numbers observed between 1991 and 1992 made direct comparisons with the 1997 counts ambiguous. Similarly, lack of line-transect estimates during 1997 precluded us from quantifying Tibetan gazelle numbers. However, frequency of observation, group size and group distribution suggested that gazelle abundance was roughly similar to the 1511 (95% CI 1037–1985) estimated during 1991.

Carnivores were occasionally seen during both time periods, but observations were too few to base any assessment of trends. Our 1997 observations provided no basis to believe major changes had occurred in the abundance of wolves (*Canis lupus*), bears (*Ursus arctos*), foxes (*Vulpes vulpes, V. ferrilata*) or weasels (*Mustela altaica*). Numbers of Himalayan marmots (*Marmota himalayana*), Tibetan hares (*Lepus oiostolus*) and plateau pikas (*Ochotona curzoniae*) similarly appeared unchanged from the early 1990s.

4.2. Management

The number of summer pastoralists observed during 1997 was 19 (compared to 15 observed in 1991 and 29 in 1992), and none were camped further up the valley (i.e. west) than in 1992 (Harris, 1993). We were informed that the average size of sheep herds had remained constant at the early 1990s number (about 600). Thus, it appeared that neither domestic livestock numbers nor their summer distribution had increased since that time. Evidence of winter camps suggested that Tibetans

summering south of Yeniugou continued to use it for winter pasture in similar numbers as observed during the early 1990s. Livestock management practices appeared to be generally similar to those encountered during the early 1990s (Harris, 1993), except that we observed no domestic cattle (*Bos taurus*) in 1997, but did observe domestic yaks (*B. grunniens*), which were absent during the earlier period. Few Mongols maintain domestic yaks generally, but one encampment, which had remained in Yeniugou year-round since 1994, had begun keeping a group of 25. This mostly female group of domestic animals elicited great interest among a number of solitary, male wild yaks in September 1997 (mating season for wild yaks), raising the specter of potential hybridization. In general, hunting of wildlife by local herders appeared to have stabilized, or perhaps declined slightly, during the period. Hunting by local pastoralists, uncontrolled as it continued to be, was considered a lesser threat to ungulate populations than was poaching by outsiders by Harris (1993).

Gold-miners from eastern Qinghai province, who first began entering the valley in the late 1980s, were still using it as a transportation corridor to mining sites in 1997. The impact of a new jade mine, near the valley's entrance, appeared to be limited to its immediate environs. During 1997 we observed small groups of outsiders who had arrived specifically to capture marmots, an activity we had not previously recorded in Yeniugou. Again, their impact appeared to be local and relatively minor. However, as we discuss below, market-hunting of ungulates by outsiders—the largest threat to Yeniugou's wildlife according to Harris (1993)—appears to have continued largely unchecked since the early 1990s.

Very little organized effort to conserve or manage Yeniugou's wildlife resources had evidently occurred during the period from the early 1990s to 1997. The Golmud Agriculture and Animal Husbandry Bureau, formally entrusted with the task, had conducted no surveys or patrols, nor initiated any new programs. There were no personnel at the Bureau who appeared to have made wildlife conservation a priority, nor was any funding available to begin wildlife-oriented programs. The guard station at the valley's main entrance, a temporary (i.e. seasonal) structure during the early 1990s, had been improved by 1997 to allow year-round occupance, but personnel there had been authorized only to monitor the newly established jade mine nearby; they did not control access to the valley, nor did they monitor wildlife law violations. Law enforcement (entrusted to the police; there are no game wardens per se) has apparently had little success in apprehending violators. Yeniugou may, however, receive some enforcement assistance from officials in adjacent Zhiduo and Qumalai Counties, where police occasionally conduct patrols looking for poachers (they can confiscate and keep vehicles of convicted poachers).

5. Discussion

Poaching of yaks by organized gangs, a concern during the early 1990s, appeared not to have occurred in Yeniugou during recent years. Poaching by local pastoralists was evidently still occurring—we found carcasses at a number of winter herding camps—but appeared limited by the relatively small number of winter encampments.

We considered three hypotheses regarding the dramatic decline of Tibetan antelope: (i) natural losses, perhaps resulting in part from the severe snowstorms that occurred in Qinghai province during 1996 (ii) a wholesale movement to an alternate area and (iii) poaching, primarily to take advantage of the high prices for shahtoosh, the fine quality antelope wool (Schaller, 1993; Wright and Kumar, 1997). Although considerable losses of antelope to severe snowstorms have been documented (Schaller and Ren, 1988; Schaller et al., 1991), we believe the first hypothesis to be unlikely. We found fewer antelope skeletons, carcasses and skulls in 1997 than during the earlier period. We would have expected to find more, not fewer, if a recent snowstorm had killed so many animals. Additionally, we did not observe population reductions of nearly this magnitude with any of the other species that would have been affected. While it is likely that the severe winter of 1996 may have taken a toll on antelope, it seems unlikely that this alone caused such a dramatic decline. The second hypothesis, large-scale movement, is possible, but also seems unlikely to have occurred under normal conditions. According to local guides, antelope have been resident in Yeniugou every year since at least the mid 1950s, and a small lake in the subdrainage of highest antelope concentration was locally termed Antelope Lake. The relative similarity in numbers and distribution of the other ungulate species throughout the period suggests that environmental conditions were roughly similar.

The third hypothesis is supported by qualitative information from nearby areas suggesting a recent upsurge in antelope poaching (Wright and Kumar, 1997; Wong, unpubl. data; G. Schaller, pers. commun.), although we found less evidence of poachers' activities in Yeniugou than we would have expected had such a large-scale operation taken place. The local pastoralist, who had served as our guide during the early 1990s, informed us that he had witnessed winter-time antelope poaching by residents of eastern Qinghai beginning in 1993, and that spot-lighting at night was the preferred hunting method. Had poaching occurred during winter and had entire carcasses been removed (which seems likely, given the value of heads and horns as well as pelts), we could well have failed to observe much evidence of poaching. We believe a combination of the second and third hypotheses is the most likely explanation.

That is, a large increase in poaching, beginning in the early 1990s, may have eventually caused the surviving animals to search out more secure areas. We do not know how many survived or where survivors may have moved.

We are less certain about the cause of the argali decline. This reduction was of a magnitude that could have been caused by the snowstorms of 1996, but poaching may also have been a factor. Although precipitation records for the closest meteorological stations provide inconclusive evidence of snow depths in Yeniugou (Golmud Meteorological Station, unpubl. data; National Climatic Data Center, 1997), a Mongol pastoralist who had been present in Yeniugou at the time indicated that they were abnormally high and that he lost many domestic animals at the time. The decline in argali numbers was of a similar magnitude to that of blue sheep, which would similarly be affected by a severe winter, but which are usually less preferred targets for subsistence poachers. Yeniugou lacks low-elevation areas that could have provided a refuge from deep snows. However, our understanding of mortality causes is confounded by the lack of carcasses and skulls during 1997. We believe that there is a new market in decorated sheep skulls [both domestic and wild; argali skulls were being advertised in Golmud for 1200–1400 yuan (about $146–170)], providing an incentive for traders to pick up skulls (and possibly also to poach argali to create them more quickly).

As of 1997, no incentive system had been established in Yeniugou to aid in wildlife conservation. Hunting of all ungulate species was forbidden by law, but law enforcement efforts appeared unequal to the task of preventing poaching. When armed gangs arrive with a specific commercial focus (as they have recently, focused on Tibetan antelope), it is probably too much to expect even the most efficient incentive system or law-enforcement entity to stop them; assistance from the national level is needed. In the case of antelope poaching, which is feeding an international demand for its shahtoosh (cashmere-type wool; see Wright and Kumar, 1997), an educational effort to stem such demand (by making consumers aware that their purchases are contributing to the demise of a species) is also needed. Currently, none of these options has been initiated.

As a result, the status of wildlife populations in Yeniugou appears to be a function of external market forces and accessibility. The area's wildlife remains vulnerable to the intentions of commercial (albeit illegal) poaching operations, primarily from outside the local area. In recent years, focus has shifted away from wild yaks (and the yak population appears stable) and toward Tibetan antelope (which has been essentially eliminated). Failing the establishment of effective conservation incentives, other species could suffer a similar fate as the antelope should strong market forces continue to produce incentives for non-locals to engage in extensive poaching.

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