

total extent of leopard predation on cranes that winter in Phobjikha Valley.

Although total deaths from predation could not be determined on our study site, we feel that predation may not be too severe because of the apparent abandonment of roosts after predation events, which probably prevented excessive killing of cranes by leopards. Also, other factors such as habitat loss and suitability probably have a bigger impact on crane populations than predation. If predation by leopards is determined to be excessive for the crane population, preventative measures could include trapping and relocating the offending leopards, as is done with bobcats in Florida to reduce predation on cranes (Urbanek *et al.* 2010).

Predation by leopards might be an important mortality factor for Black-necked Cranes wintering in Phobjikha Valley, and other areas of central Asia, at least where roosts are adjacent to forests containing leopards. We recommend future research that investigates the spatial and temporal extent of predation on wintering cranes in Bhutan, and the behavioural responses of flocks toward predation events. We caution other crane biologists that some predation events are not easily detected if leopards or other predators are killing at night and carrying carcasses far from roosts before feeding on them.

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### References

- Bergeson, D. G., Johns, B. W. & Holroyd, G. L. (2001) Mortality of Whooping Crane colts in Wood Buffalo National Park, Canada, 1997–99. *Proc. North Amer. Crane Workshop* 8: 6–10.
- BirdLife International (2001) *Threatened birds of Asia: the BirdLife International Red Data Book*. Cambridge: BirdLife International.
- BirdLife International (2009) *Grus nigricollis*. In IUCN 2010. *IUCN red list of threatened species*. Version 2010.4 <[www.iucnredlist.org](http://www.iucnredlist.org)>
- Cole, G. A., Thomas, N. J., Spalding, M., Stroud, R., Urbanek, R. P. & Hartup, B. K. (2009) Postmortem evaluation of reintroduced migratory Whooping Cranes in eastern North America. *J. Wildl. Dis.* 45: 29–40.
- Desroberts, K. J. (1997) Survival and habitat use of greater Sandhill Crane colts on Modoc National Wildlife Refuge, California. *Proc. North Amer. Crane Workshop* 7: 18–23.
- Dorji, P. J. (1987) Bhutan's Black-necked Cranes. *Oryx* 21: 71–72.
- Dwyer, N. C., Bishop, M. A., Harkness, J. S. & Zhong, Z. Y. (1992) Black-necked Cranes nesting in Tibet Autonomous Region, China. *Proc. North Amer. Crane Workshop* 6: 75–80.
- Ellis, D. H., Clegg, K. R., Lewis, J. C. & Spauldign, E. (1999) Golden Eagle predation on experimental Sandhill and Whooping Cranes. *Condor* 101: 664–666.
- Hayward, M. W., Henschel, P., O'Brien, J., Hofmeyr, M., Balme, G. & Kerley, G. I. H. (2006) Prey preferences of the leopard (*Panthera pardus*). *J. Zool. (Lond.)* 270: 298–313.
- Ivey, G. L. & Scheuering, E. J. (1997) Mortality of radio-equipped Sandhill Crane colts at Malheur National Wildlife Refuge, Oregon. *Proc. North Amer. Crane Workshop* 7: 14–17.
- Lhendup, P. & Webb, E. L. (2009) Black-necked Cranes *Grus nigricollis* in Bhutan: migration routes, threats and conservation prospects. *Forktail* 25: 125–129.
- Liu, Q., Yang, J., Yang, X., Zhao, J. & Yu, H. (2010) Foraging habitats and utilization distributions of Black-necked Cranes wintering at the Napahai Wetland, China. *J. Field Orn.* 81: 21–30.
- Munoz-Pulido, R., Alonso, J. C. & Alonso, J. A. (1993) Common Crane (*Grus grus*) killed by Golden Eagle (*Aquila chrysaetos*). *Vogelwarte* 37: 78–79.
- Nesbitt, S. A., Folk, M. J., Spalding, M. G., Schmidt, J. A., Schwikert, S. T., Nicolich, J. M., Wellington, M., Lewis, J. C. & Logan, T. H. (1997) An experimental release of Whooping Cranes in Florida—the first three years. *Proc. North Amer. Crane Workshop* 7: 79–85.
- Nesbitt, S. A., Folk, M. J., Sullivan, K. A., Schwikert, J. A. & Spalding, M. G. (2001) An update of the Florida Whooping Crane release project through June 2000. *Proc. North Amer. Crane Workshop* 8: 62–73.
- Thiollay, J.-M. (1979) La migration des grues à travers l'Himalaya et le prédation par les aigles royaux. *Alauda* 47: 83–92.
- Urbanek, R. P., Fondow, L. E. A., Zimorski, S. E., Wellington, M. A. & Nipper, M. A. (2010) Winter release and management of reintroduced migratory Whooping Cranes *Grus americana*. *Bird Conserv. Internatn.* 20: 43–54.

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## Nesting notes of the White-browed Tit *Parus superciliosus* in alpine scrub habitats in Qinghai and Tibet, China

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The White-browed Tit *Parus superciliosus* is endemic to alpine scrub and edges of adjacent treeline forest of south-western China. Most of its range falls in the Tibetan plateau, in at least three provinces. The birds were thought to breed in alpine shrub forests at 3,200–4,235 m altitude, placing their nests in rock crevices or old rodent burrows (Harrap & Quinn 1996, Gosler & Clement 2007) based on Martens & Gebauer (1993). This is the only information described in the species account of Gosler & Clement (2007).

For a long time the species was believed to build closed nests with a side entrance, presumed to reflect its occupation of treeless habitat. Although Pleske (1890) had already reported that the Russian explorer N. Przewalski saw birds entering holes in the ground, the view of a free-nest breeder was maintained for about a century. Field researchers of the last century working in central

Asia, e.g. Hugo Weigold, Walter Beick and Ernst Schäfer, supported this view (details in Martens & Gebauer 1993). However, an active nest was never found, so the breeding behaviour of *P. superciliosus* remained open to question. Doubts that the species really did build its nests in open *Caragana jubata* or *Berberis* bushes were expressed by Martens & Gebauer (1993), who reported *P. superciliosus* carrying nesting material (sheep wool and feathers) into old small-mammal holes south of Qinghai lake (Koko Nor; east Qinghai). These holes were situated in loess cliffs partly opened by erosion. Observed early in the breeding season, these sites were not investigated in detail.

Here we describe the first nests of this species ever found. These were in alpine scrub close to Qinghai lake, east Qinghai, and in the Lhasa mountains, south Tibet: they span nearly the northern- and southernmost parts of the species's range.

In the south Koko Nor mountains of Qinghai, Nan Shan lies c.5 km south of the southern shore of Qinghai lake (Koko Nor), near the village of Heimahe (36°42'N 99°46'E; 3,280–3,600 m in altitude). Fieldwork was carried out during 11–23 June 1996 on the southern lake shore, the plains between the shore and Heimahe, and further south in the Nan Shan to about 3,700 m. The whole area is treeless today, but high-stem *Juniperus* trees certainly occurred there in ancient times as they still do today in a few remote side valleys south-west of the study site at similar altitude. The area is heavily grazed, in parts even overgrazed, by yaks.

The first nest, found on 15 June 1996, was situated at 3,350 m, in loess above a steep 2–3 m high rock slope. Below this rocky slope was a creek, with bushes nearby of willow *Salix*, barberry *Berberis* and peashrub *Caragana jubata*. On 19 June, the nest contained seven chicks, with feather quills just started to open. The nest was 50 cm deep in this hole, its entrance c.15 cm wide, the tube diameter c.5 cm wide, the cavity with the nest c.20 cm wide; the voluminous nest was entirely built of animal wool (present at the locality were Woolly Hare *Lepus oiostolus*, marmot *Marmota*, pika *Ochotona* and various livestock). In the underside of the nest a few fruit parts from the plant family Compositae were built in, but there was no grass, moss or blades.

The second nest, in the same area, was up another side valley at 3,300 m, found on 17 June 1996. It was in a steep loess slope, the slope c.2.5 m high, with the nest entrance 20 cm below the upper edge of the slope. A creek ran at the base of the slope. Adults were feeding young in the nest. We did not examine the nest directly.

The third nest, in the same side valley, at 3,280 m, was also found on 17 June 1996. It was in the fissure of a rockface 70 cm above the ground, close by a small watercourse. The rockface at this place was c.100–150 m high. The adults were feeding young in the nest. The pair's foraging area was c.100–200 m upstream in *Salix* and *Caragana* bushes.

In Tibet, fieldwork was carried out in the Xiongse valley near Lhasa (29°27'N 91°40'E; 3,900–5,600 m in altitude). Because the study area is located inside the valley, natural scrub vegetation is well developed. Predominant species include roses *Rosa sericea*, barberries *Berberis hemleyana* and Wilson's Juniper *Sabina pingi* on the south-facing slopes, and spiraces *Spirace alpina*, willows *Salix sclerophylla* and rhododendrons *Rhododendron nivale* on the north-facing slopes. No forests are present. The study area is described in detail in Lu (2008): in its alpine habitats, White-browed Tits are present throughout the year, but uncommon (Lu *et al.* 2007).

During long-term ornithological survey in the Xiongse valley, only three White-browed Tit nests were found. They were all in cliff holes between 4,200 and 4,650 m altitude, on south-facing slopes. The nesting holes were 17–25 cm long. Nest materials consisted almost entirely of hair of Woolly Hare; a few bird feathers and moss were also incorporated. External diameter of the nests was 121–125 mm, internal diameter 65–73 mm, depth 40–43 mm, height 62–68 mm, and weight 19–20 g. When found, one nest contained four eggs (4 June 2001) and the remaining two each had four nestlings (12 and 15 June 2001). The four eggs, which were white with light brown spots, were measured as 17.3 (SD ± 0.9, 16.1–18.0) × 12.9 (SD ± 0.1, 12.8–13.0) mm. One nestling weighed 12 g, having a body length of 66.0 mm, tail 15.1 mm, wing 27.6 mm, tarsus 17.0, and bill 5.1 mm.

Additionally, on 23 June 2002 a White-browed Tit was watched delivering food to its nest at 4,100 m, and on 13 July 2003 the parents of a White-browed Tit family attracted fledged young to feed from their bill by lowering and flapping their wings. Based on these observations, the first-egg dates were estimated to fall in mid–late May.

The birds preferred to forage in bushes during the breeding season. After fledging, family flocks were frequently seen to exploit the Lepidoptera larvae developing within leaf buds of *Berberis hemleyana*, as did Great Tit *Parus major*, Streaked Rosefinch *Carpodacus rubicilloides* and Pink-rumped Rosefinch *C. eos*. No interspecific aggression was observed, even when more than one species fed at the same bush.

In conclusion, *Parus superciliosus* is definitely a hole breeder, like other congeneric tits. The few nests found so far were located between 3,280 m (Qinghai) and 4,650 m (Tibet) altitude. Rock cliff fissures and old mammal burrows in loess cliffs seem to be the preferred nesting sites. The breeding season is May–June, with young leaving the nest in late June and/or early July, probably independently from altitude of nesting site.

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### References

- Gosler, A. G. & Clement, P. (2007) Family Paridae (tits and chickadees). Pp.662–750 in J. del Hoyo, A. Elliott & D. A. Christie, eds. *Handbook of birds of the world*, 12. Barcelona: Lynx Edicions.
- Harrap, S. & Quinn, D. (1996) *Tits, nuthatches & treecreepers*. London: Christopher Helm / A & C Black.
- Lu X. (2008) Breeding ecology of an Old World high-altitude warbler, *Phylloscopus affinis*. *J. Orn.* 149: 41–47.
- Lu X., Zhang L. Y. & Zeng X. H. (2007) Comparisons of the alpine bird communities across habitats and between autumn and winter in the mid-Yalong Zangbo River valley, Tibet. *J. Nat. Hist.* 41: 2511–2527.
- Martens, J. & Gebauer, A. (1993) Bemerkungen zur Biologie, Stimme und Verwandtschaft der Weißbrauenmeise (*Parus superciliosus*). *Zool. Abh., Staatl. Mus. Tierk. Dresden* 47: 213–222.
- Pleske, T. (1890) *Wissenschaftliche Resultate der von N.M. Przewalski nach Central-Asien unternommenen Reisen auf Kosten einer von seiner Kaiserlichen Hoheit dem Grossfürsten Thronfolger Nikolai Alexandrowitsch. Zoologischer Theil., Band II. Vögel* 81–144, pll. II, IV–VI. St. Petersburg: Commissionaires de l'Académie Impériale des Sciences.

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