

Waterbird numbers at high altitude lakes in eastern Ladakh, India

TSEWANG NAMGAIL^{1,2*}, DIVYA MUDAPPA¹ &
T. R. SHANKAR RAMAN¹

¹Nature Conservation Foundation, 3076/5, IV Cross, Gokulam Park, Mysore 570002, Karnataka, India.

²Resource Ecology Group, Department of Environmental Sciences, Wageningen University, Droevendaalsesteeg 3a, Lumen-100, 6708 PB Wageningen, The Netherlands.

*Correspondence author. E-mail: namgail@ncf-india.org

Abstract

The unique high altitude (> 3,500 m a.s.l.) brackish and freshwater lakes of the Ladakh region, India, are used as breeding grounds and staging sites by migratory waterfowl and waders. A survey of the abundance and diversity of birds at four lakes in eastern Ladakh in July 2007 found that the diversity of birds in these lakes (Tsokar, Statsapuk Tso, Thasangkaru Tso and Tsomoriri) was relatively low. Eleven species were identified, ranging from the widespread Common Redshank *Tringa totanus* (590 individuals) to the highly endangered Black-necked Crane *Grus nigricollis* (three individuals). Among the four lakes, bird abundance and diversity was highest in Statsapuk Tso and Tsokar, respectively, and lowest in Thasangkaru. The importance of the lakes for waterbird conservation in Ladakh is discussed in relation to environmental changes in the area.

Key words: Avifauna, Changthang, Tsokar, waterfowl, wetland.

Ladakh, enclosed by the Karakoram mountain range to the north and the Greater Himalaya to the south, is a region of cold desert characterised by low primary production, with flora and fauna adapted to the high altitudes (Kachroo *et al.* 1977; Pfister 2004). Owing to its location in an area where the Palearctic meets the Orient and also to the great altitudinal gradients in the region, Ladakh harbours a diverse range

of > 270 bird species from 41 families (Pfister 2004). The wetlands of eastern Ladakh, especially the high altitude lakes, have been identified as important habitats for breeding and non-breeding migratory birds (Pfister 2004; Chandan *et al.* 2006). The marshlands around these lakes are used as staging sites by birds migrating between central and southern Asia (Ali & Ripley 1978; Williams & Delany 1985, 1986).

Additionally, birds such as the Bar-headed Goose *Anser indicus*, Ruddy Shelduck *Tadorna ferruginea* and Brown-headed Gull *Larus brunnicephalus*, which breed on the high altitude lakes of Ladakh, migrate to winter in the plains of India to the south. The region supports several resident species that are adapted to the cold and arid conditions of Ladakh (Mallon 1987; Namgail 2005; Namgail & Yom-Tov 2009). There are also several regular winter visitors, such as the Dark-throated Thrush *Turdus ruficollis atrogularis* which migrates to Ladakh from central Asia and the Tibetan plateau (Pfister 2004).

Few studies have been carried out hitherto on the birds of Ladakh, due largely to its poor accessibility, high altitude, and difficult climatic conditions (Osmaston 1925; Mallon 1987; Mishra & Humbert-Droz 1998; Pfister 2004; Prins & van Wieren 2004; Namgail 2005). Ali & Ripley's (1978) handbook was the most reliable source of information on the birds of Ladakh until Pfister's (2004) study. Most of the earlier observations were confined to general surveys except for a small number of species-specific or ecological studies (Narayan *et al.* 1987; Gole 1992; Pfister 2004; Namgail & Yom-Tov 2009). Although numerous comprehensive studies on waterbirds are available for other parts of India (Kumar *et al.* 2005), information on the status, distribution, and abundance of the waterbird assemblages of Ladakh remains rudimentary. The observations presented here were carried out to start to fill this gap in knowledge. As India is a signatory to the Ramsar Convention, comprehensive surveys are required to

determine the conservation status of waterbird populations and wetland habitats in the country (Kumar *et al.* 2005).

Methods

Study area

Surveys were made of four lakes in eastern Ladakh (Fig. 1): Tsokar (33°18'N, 78°00'E), Statsapuk Tso (33°15'N, 78°02'E), Thasangkaru Tso (also known as Kiagar Tso, 33°06'N, 78°18'E), and Tsomoriri (32°54'N, 78°18'E). Statsapuk Tso and Tsokar (4,590 m a.s.l.) are close to each other; the former is a small (*c.* 6 km²), freshwater lake whereas the latter is large (*c.* 19 km²) and brackish. Tsomoriri (4,520 m a.s.l., 143 km²), a fresh-brackish lake, is the largest of the four, whereas Thasangkaru Tso (4,730 m a.s.l., *c.* 5 km²) is brackish and the smallest (Gujja *et al.* 2003; Philip & Mathew 2005). There are permanent human settlements on the shores of Tsokar and Tsomoriri, but only herders' camps on Statsapuk Tso and Thasangkaru. All of the lakes have marshes of varying sizes along their shores. Thasangkaru has the smallest area of marshland, whilst Tsokar and Statsapuk Tso have the most extensive marshes. Over 70% of the marshlands are covered by lush vegetation during the summer months (Rawat & Adhikari 2005a). Marshland areas around the lakes are also grazed by domestic livestock, mainly yak, horse, sheep and goats, although grazing pressure is lighter during summer than at other times of year.

Bird counts and treatment of the data

Birds were counted by two persons (DM and TRSR) from a good vantage point at

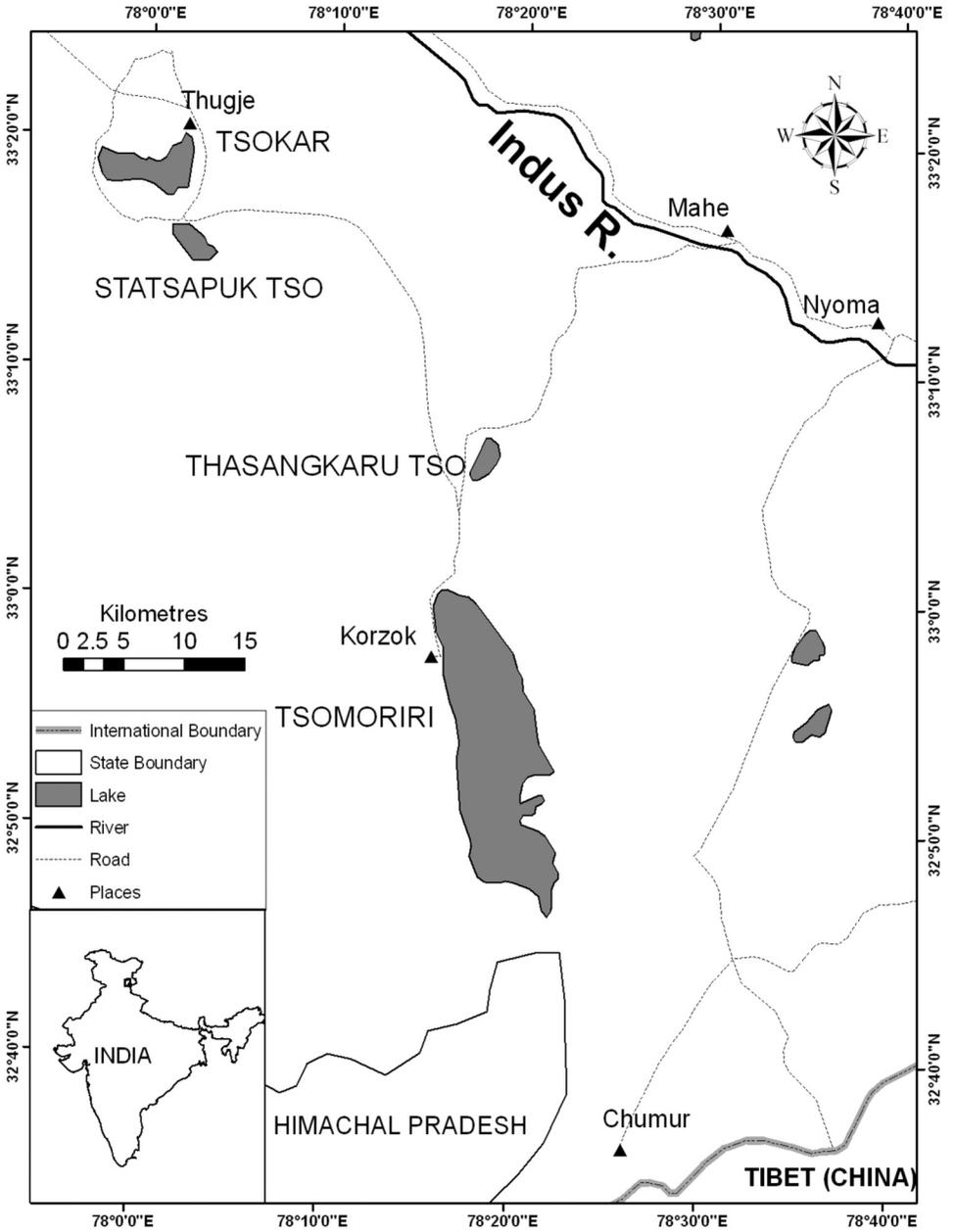


Figure 1. Map showing locations of the four high altitude lakes in eastern Ladakh.

each lake, using a spotting scope, in late July 2007 (*i.e.* during the breeding season; Pfister 2004). Observations were made in the morning between 07:00–09:00 or in the afternoon between 12:30–17:00, depending on the light conditions. We counted birds in the four lakes on three consecutive days, but each lake was counted only once. Thasangkaru and parts of Tsomoriri were counted on a single day. Birds were identified to the species level and care was taken not to double-count birds that flew from place to place. Individuals were considered to be in a different flock when they were > 50 m from the flock being counted.

Although counts of all birds present were made at the two smaller lakes, this was not possible at the larger lakes due to time and logistical constraints. Examination of maps of the area indicated that birds were counted for half of the area of Tsokar lake and approximately one-sixth of the area of Tsomoriri lake, although the middle portion of this lake is deep (> 40 m) and may not be crucial habitat for birds. The Shannon diversity index (H), which takes into account both the number of individuals and the number of species present (Magurran 1988), was used to describe the diversity of bird species on each lake.

Results

Eleven species of waterbirds were recorded in the four lakes, nine of which breed in the area (Table 1). The Black-necked Grebe *Podiceps nigricollis* is a summer visitor, whereas the Green Sandpiper *Tringa ochropus* is a passage migrant.

During the survey period, the highest number and species of birds were recorded in Statsapuk Tso (923 individuals, nine species) followed by Tsokar (775, seven species), Tsomoriri (204, six species), and Thasangkaru Tso (35, three species). On pooling data from all the lakes, Common Redshank was found to be the most abundant species (590 individuals) followed by Ruddy Shelduck (577) and Bar-headed Goose (450; Table 1). The mean flock size of Common Redshank was 25.7 (s.e. \pm 13.97, range = 1–322), Ruddy Shelduck 9.2 (\pm 2.04, range = 1–98), while that of the Bar-headed Goose was 18.7 (\pm 6.41, range = 1–154). Common Redshank was, however, concentrated in Statsapuk Tso (408 individuals) and Tsokar (181; Table 1). Thasangkaru Tso was the most species-poor lake, with just seven species recorded, whilst Statsapuk Tso was the richest with nine species observed. In terms both of the number of birds present and the number of species recorded, Tsokar (H = 1.34) and Statsapuk Tso (H = 1.27) had more individuals and a greater range of species than the other two lakes (H = 1.04 and H = 0.70 for Tsomoriri and Thasangkaru Tso, respectively; Table 1) during the surveys.

Discussion

The 11 species observed during this study represent 13% of the avian species recorded on lakes in the Ladakh area during summer (Pfister 2004). The high altitude lakes and the swamps along stream banks in eastern Ladakh are visited by more than 100 species of passage migrants, mostly in autumn when birds from the Palearctic region

Table 1. Total number of waterbirds counted at four high altitude lakes in the Ladakh trans-Himalaya (number of bird-days per site) and the mean flock sizes (\pm s.e.) recorded for each species.

Species	Statsapuk		Thasangkaru		Tsokar	Tsomoriri	Total	Mean flock size (\pm s.e.)
	Tso		Tso					
Bar-headed Goose <i>Anser indicus</i>	281	4	30	135	450	18.7 (6.41)		
Brown-headed Gull <i>Larus brunicephalus</i>	7	1	144	31	183	11.1 (3.53)		
Black-necked Crane <i>Grus nigricollis</i>	3	0	0	0	3	3.0		
Black-necked Grebe <i>Podiceps nigricollis</i>	18	0	0	0	18	2.6 (0.48)		
Common Redshank <i>Tringa tetanus</i>	408	0	181	1	590	25.7 (14.0)		
Common Sandpiper <i>Actitis hypoleucos</i>	0	0	1	0	1	1.0		
Common Tern <i>Sterna birundo</i>	2	0	0	3	5	2.5 (0.50)		
Great-Crested Grebe <i>Podiceps cristatus</i>	17	1	0	8	26	1.7 (0.25)		
Green Sandpiper <i>Tringa ochropus</i>	0	0	2	0	2	2.0		
Lesser Sand Plover <i>Charadrius mongolus</i>	1	0	47	0	48	6.0 (2.80)		
Ruddy Shelduck <i>Tadorna ferruginea</i>	179	22	350	26	577	9.2 (2.04)		
Unidentified duck	6	0	0	0	6	3.0 (1.0)		
Unidentified wader	1	7	20	0	28	3.5 (1.44)		
Total	923	35	775	204	1937	11.4 (2.35)		

migrating to wintering grounds in southern India stop at these wetlands to rest and replenish their fat reserves (Pfister 2004). These wetlands have consequently been described as the most important habitats for migratory waterfowls in Ladakh, with Tsomoriri designated as a Ramsar Site (Kumar *et al.* 2005), the only such site in India north of the Himalayan range. The Statsapuk Tso and Tsokar lakes have been recognised as important breeding habitats for the highly endangered Black-necked Crane *Grus nigricollis* (Chandan *et al.* 2006). During the present study, we observed two pairs of crane with one young each and also two solitary individuals. These eight cranes included the three birds recorded in Statsapuk Tso.

Common Redshank was found mainly in Statsapuk Tso and Tsokar. This may perhaps be related to its carnivorous diet and the availability of a greater expanse of shallow water and mudflats (*c.* 1 km²) with high abundance of molluscs, aquatic insects, and worms at these sites compared with Tsomoriri (estimated marshland of *c.* 0.3 km² within the surveyed area; T. Namgail unpubl. data). The high abundance of the Bar-headed Goose in Statsapuk Tso and Tsomoriri could be related to the high availability of herbs and tender grasses along the shores of these fresh and fresh-brackish water lakes, respectively, which the birds may select in preference to the less palatable, salt-tolerant plants of the brackish lakes (Rawat & Adhikari 2005b). Indeed, the overall abundance and range of species at Statsapuk Tso, which included the Black-necked Crane, may be related to the availability of vegetation on its shore, fish in

its shallow waters and invertebrates in its mud-flats. The Ruddy Shelduck is an omnivore, so would be expected to inhabit areas with abundant palatable plants as well as aquatic invertebrates. Its high abundance at both Statsapuk Tso (freshwater) and Tsokar (brackish), which together provide these resources, could reflect this varied diet, though a detailed study of the birds' feeding ecology in the area would be needed to confirm or reject this hypothesis.

The Bar-headed Goose, Ruddy Shelduck, and Common Redshank were the most abundant species recorded during the survey, with the Bar-headed Goose seen most frequently at Statsapuk Tso and Tsomoriri, whereas Ruddy Shelduck and Common Redshank occurred largely in Tsokar and Statsapuk Tso. Overall, Statsapuk Tso attracted more species and thus may be an important lake for birds in mid-summer, although more years' data are required to determine whether this is consistent across years. Although Tsokar and Statsapuk Tso have been recognised as Important Bird Areas (Islam & Rahmani 2004), we suggest that they together should be considered as a candidate Ramsar Site. Given our spatially and temporally limited sampling effort, however, we urge for more intensive sampling to assess the relative importance of these lakes in conserving waterbirds in Ladakh. In particular, it should be noted that the study was made over a short period, and that longer-term monitoring is required to describe and investigate changes in the distribution of birds within the region, both within and between years. Additionally, given the potential for long-term habitat changes in

the area resulting from glacial melt associated with climate change (De Terra & Hutchinson 1934; Philip & Mathew 2005), more detailed ecological studies are required to assess the association between habitat variables and the population dynamics of waterbirds breeding and staging in the region.

Acknowledgements

This study was supported by the Rufford Small Grants Foundation and the Wildlife Conservation Society. We thank the Department of Wildlife Protection, Jammu and Kashmir, for granting permission to work in the Changthang Wildlife Sanctuary. We also thank Karma Sonam for his assistance in the field.

References

- Ali, S. & Ripley, S. D. 1978. *Handbook of the Birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka*. Oxford University Press, Delhi, India.
- Chandan, P., Gautam, P. & Chatterjee, A. 2006. Nesting sites and breeding success of Black-necked Crane *Grus nigricollis* in Ladakh, India. In G.C. Boere, C.A. Galbraith and D.A. Stroud (eds.), *Waterbirds around the World*, pp. 311–314. The Stationery Office, Edinburgh, UK.
- De Terra, H. & Hutchinson, G.E. 1934. Evidence of recent climatic changes shown by Tibetan Highland Lakes. *The Geographical Journal* 84: 311–320.
- Gole, P. 1992. On the tract of wintering Black-necked Cranes in India. *Journal of Ecological Society* 6: 7–22.
- Gujja, B., Chatterjee, A., Gautam, P. & Chandan, P. 2003. Wetlands and lakes at the top of the world. *Mountain Research and Development* 23: 219–221.
- Islam, M.Z. & Rahmani, A.R. 2004. *Important Bird Areas in India: Priority Sites for Conservation*. Indian Bird Conservation Network: Bombay Natural History Society, India and BirdLife International, UK.
- Kachroo, P., Sapru, B.L. & Dhar, U. 1977. *Flora of Ladakh*. Bishen Singh Mahendra Pal Singh, Dehradun, India.
- Kumar, A., Sati, J.P., Tak, P.C. & Alfred, J.R.B. 2005. *Handbook on Indian Wetland Birds and their Conservation*. Zoological Survey of India, Calcutta, India.
- Magurran, A.E. 1988. *Ecological Diversity and its Measurement*. Princeton University Press, Princeton, USA.
- Mallon, D.P. 1987. The winter birds of Ladakh. *Forktail* 3: 27–41.
- Mishra, C. & Humbert-Droz, B. 1998. Avifaunal survey of Tsomoriri Lake and adjoining Nuro Sumdo Wetland in Ladakh, Indian trans-Himalaya. *Forktail* 14: 65–68.
- Namgail, T. 2005. Winter birds of the Gya-Miru Wildlife Sanctuary, Ladakh, Jammu and Kashmir, India. *Indian Birds* 1: 26–28.
- Namgail, T. & Yom-Tov, Y. 2009. Elevational range and timing of breeding in the birds of Ladakh: the effects of body mass, status and diet. *Journal of Ornithology* 150: 505–510.
- Narayan, G., Akhtar, A., Lima, R. & D’Cunha, E. 1987. Black-necked Crane (*Grus nigricollis*) in Ladakh. *Journal of Bombay Natural History Society* 83: 180–195.
- Osmaston, B.B. 1925. The birds of Ladakh. *Ibis* 12: 663–719.
- Pfister, O. 2004. *Birds and Mammals of Ladakh*. Oxford University Press, New Delhi, India.
- Philip, G. & Mathew, J. 2005. Climato-tectonic impression on trans Himalayan lakes: A case study of Kyun Tso basin of the Indus Suture Zone in NW Himalaya using remote sensing techniques. *Current Science* 89: 1941–1947.
- Poole, R.W. 1974. *An introduction to quantitative ecology*. McGraw-Hill, New York, USA.

- Prins, H.H.T. & van Wieren, S.E. 2004. Number, population structure and habitat of bar-headed geese *Anser indicus* in Ladakh (India) during the brood-rearing period. *Acta Zoologica Sinica* 50: 738–744.
- Rawat, G.S. & Adhikari, B.S. 2005a. Floristics and distribution of plant communities across moisture and topographic gradients in Tso Kar basin, Changthang plateau, eastern Ladakh. *Arctic Antarctic and Alpine Research* 37: 539–544.
- Rawat, G.S. & Adhikari, B.S. 2005b. Millenia of grazing history in eastern Ladakh, India, reflected in rangeland vegetation. *In* Proceedings of the second global mountain biodiversity assessment, La Paz, Bolivia, pp. 201–212. CRC Press, Boca Raton, Florida, USA.
- Williams, C. & Delany, S. 1985. Migration through the Northwest Himalaya – some results of the Southampton University Ladakh Expeditions, Part 1. *Bulletin of the Oriental Bird Club* 2: 10–14.
- Williams C. & Delany, S. 1986. Migration through the Northwest Himalaya – some results of the Southampton University Ladakh Expeditions, Part 2. *Bulletin of the Oriental Bird Club* 3: 11–16.