

Safeguarding the Last Breeding Population of River Tern *Sterna aurantia* in China

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Introduction

River Tern *Sterna aurantia* occurs widely across South and Southeast Asia, having been recorded in Pakistan, India, Nepal, Bhutan, Bangladesh, Myanmar, Thailand, Laos, Cambodia, Vietnam and southern China (del Hoyo *et al.* 1996). IUCN Red List classified the species as Near Threatened (BirdLife International 2016), but this does not accurately reflect the dire conservation status of this species in Southeast Asia. While India supports a healthy population of more than 50,000 individuals, precipitous population declines have been reported across Southeast Asia: in Thailand, it is now considered very rare; in Laos, the species is very close to being extirpated from the country; in Cambodia, the species has declined by more than 75% in the past 15 years and the population is now likely to be fewer than 50 individuals; in Nepal, the species is now rare and very local, with an estimated maximum population of 20 individuals in 2016; in China, the species is restricted to the Dayingjiang River of south-western Yunnan, with occasional records from Southeastern Tibet (BirdLife International 2016).

The last stronghold of River Tern in China

Sitting at the crossroad of the Palearctic and Indo-Malayan Realms, and as the only tropical region of the Irrawaddy drainage basin in China along the Sino-Burmese border, Dehong Dai and Jingpo Autonomous Prefecture (hereinafter Dehong, 24.433° N 98.585° E) of Yunnan Province supports rich and unique biodiversity. With the recent surge of biodiversity research, a plethora of new species and national records have been discovered (Gong *et al.* 2018; Wang *et al.* 2018; Xue *et al.* 2017; Yang *et al.* 2018a; b; Yang & Chan 2018; Yang & Zheng 2018). Dehong is part of WWF's Northern Indochina subtropical forests ecoregion (IM0137), CI's Indo-Burma Biodiversity Hotspot (CHN66) and Birdlife's Important Bird and Biodiversity Area (CN245). Dehong is extraordinarily rich in avifauna; 710 bird species have been recorded within its 11,526 km² land area (Yingjiang Bird Watching Society 2019), which is the highest among China's administrative unit and has long been a popular birding destination. Yingjiang County has the best forest cover in Dehong, which is home to the largest patch of *Shorea*-dominated dipterocarp rainforest in China and the only area with three breeding hornbill species (Yang & Du 2006).

The Dayingjiang River, also known as Taiping River, is a tributary of the Irrawaddy which flows through Yingjiang County before entering the Irrawaddy near Bhamo of Myanmar's Kachin State. River Tern was once described as common in western and southern Yunnan, along the Xishuangbanna section of the Mekong, the Ruili River (Shweli River in Myanmar) and Dayingjiang River of the Irrawaddy drainage basin in Dehong (Yang *et al.* 1995). However, the species sank into oblivion until Yingjiang becomes a popular birding destination in the early 2000s. Every year, River Terns visit and breed along the Yingjiang section of Dayingjiang River in dry season, which is currently the only known River Tern breeding site in China. However, the riverine habitat where River Terns occur has been deteriorating, and continuous

population decline has been noted in the last few years, as elsewhere in the region. Amongst the various anthropogenic pressures, hydropower development is probably the biggest threats as it alters the hydromorphology of the river and destroy critical sandbar habitat where River Tern nests. Certain sections of the river where River Terns nested are also subject to intensive sand mining activities, further exacerbate habitat disturbances. The breeding population along the Dayingjiang River declined from 13 individuals in 2014 to seven in 2017, and only five birds were recorded in 2018 (X. Zeng pers. comm.). These anthropogenic threats also affect other declining riverine bird species found in the same river, such as River Lapwing *Vanellus duvaucelii* (NT) and Little Pratincole *Glareola lactea*.

Field surveys to understand River Tern's current status

River Tern has received minimal research and conservation attention in China despite being a highly threatened Class II nationally-protected species. A systematic survey is urgently needed to understand its current distribution and status in China. Kadoorie Farm and Botanic Garden (KFBG), together with Dehong Forestry Bureau (DFB) and other partners, launched the nation's first River Tern population survey during 11-13 March 2019. The joint team simultaneously searched potential habitats along the trunk and major tributaries of three rivers in Dehong (Dayingjiang River, Ruili River and Nanwan River), which drain into the Irrawaddy after leaving China (Figure 1).

Six KFBG and 17 DFB personnel participated in the field survey, team members were divided into nine groups to cover all potential habitats in Dehong. In total, 129 kilometers of river courses were systematically surveyed in this three-day survey. During this survey, seven River Terns were recorded along the Yingjiang section of Dayingjiang River, with one active nest found. Our survey also identified several potential breeding sites where tern activities were high. Those sites were re-visited during a supplementary survey between 28-29 March 2019 and the joint team was able to discover two more active nests (Figure 2).

Nest Site Protection

Anthropogenic activities considered detrimental to River Tern survival were also documented during the surveys to identify the major threats causing its decline. Dedicated conservation measures were then implemented to mitigate a litany of threats that might devastate nesting successes of River Tern.

Regulating water discharge by hydropower dam

Water sporadically released by upstream hydropower dams causes a surge in water level and could flood the nests. Once staff of DFB received notice of a scheduled hydropower maintenance discharge in late March, they immediately contacted several relevant government departments and the hydropower company. After multiple negotiation meetings, a safe discharge volume was agreed upon to protect the nests. The joint team also monitored the water level continuously using a water level metre to ensure the safety of the nests.

Minimising human disturbances

Illegal fishing activities including electrofishing were found around the nest sites during the official fishing moratorium. Fishing activities not only disturb the River Terns' breeding but also reduces its food sources. This was reported to law enforcers and patrol effort was enhanced.

Additionally, three villagers from neighbouring communities were recruited to protect the nests, and each nest protector was assigned one nest for daily monitoring. With the help of local nest protectors, human-induced threats such as poaching and egg collection could be prevented. The nest protectors also monitored nesting bird behaviours, information collected will be analysed for future nest site management.

Minimising disturbances from livestock and wild animals

One of the nests, located on a sandbar connected to the river bank, was susceptible to predation by dogs and rodents, and grazing buffalo herds might crush well-camouflaged eggs or chicks. To mitigate the above threats, we adopted the field-proven Cambodian approach to fence off the nest once it was discovered (Claassen 2018). The study from Cambodia demonstrated that nest exclosures (fences) significantly increase the breeding success of River Tern during a five-year study (Claassen *et al.* 2017). To minimise disturbance to parent birds during installation, the fence was installed as swiftly as possible with a big team.

The fence inevitably made the nesting site more noticeable by casual observers. The nest protector was asked to closely monitor the nest from a safe distant, and was able to stop people from approaching the fence. Leaders from neighbouring communities were also mobilised to cut off access to the sandbar to ensure the birds breed in peace.

Successful breeding of all three nests

All three nests had three eggs in the beginning, but only two of the three eggs each clutch hatched. According to a previous study from Cambodia, the average incubation period of River Tern is 23.5 ± 2.6 days, the average chick period is 22.0 ± 1.3 days (Claassen *et al.* 2017). The incubation and chick periods of the three nests monitored in Yingjiang were in line with the Cambodia data (Table 1). The exact incubation period of Nest 3 is not available due to the late discovery of this nest. As the eggs were laid before Nest 3 were detected during the supplementary survey in late March, the recorded incubation period is therefore shorter.

	Nest 1	Nest 2	Nest 3
Date of egg detected	13 March 2019	28 March 2019	28 March 2019
Incubation period (days)	23-24	22-23	≥17-18
Date of chick detected	4 April 2019	18 April 2019	13 April 2019
Chick period (days)	22-23	26-27	25-26

Table 1. Nesting information of three River Tern nests monitored in Dayingjiang River, Yunnan Province, China.

With months of intensive conservation work, all six juveniles born this year fledged. They were flying very well with their long angular wings, and taught to fish by their parents. The terns started to leave the breeding site in Yingjiang since early June and the last juvenile left on 1 July 2019. With concerted efforts from the joint conservation team, the successful breeding of all three nests had double the number of this imperiled population from seven to 13 individuals.

Awareness raising and capacity building

To raise the awareness of local communities about this overlooked species, billboards were installed at major road and bridge crossings along the river to make sure the conservation message reach a wider audience. We printed 2000 leaflets for distribution in the surrounding communities to raise the awareness of River Tern conservation, wildlife protection laws and regulations. KFBG and DFB also hosted two educational fun fairs for the public on 21 June 2019 and 13 July 2019, which attracted 317 and 151 local residents, respectively.

Training and experience from the project proved to be a great capacity building opportunity for local forestry officials and volunteers. Training workshop was organised by KFBG before the field survey and educational funfairs. All field surveys, conservation interventions and community outreach activities were conducted by the joint team to ensure local participants received adequate training and on-site guidance. The veteran surveyors and local nest protectors trained in the project will also be an invaluable resource for future conservation work targeting this highly endangered species and other bird conservation projects.

Future conservation plan

River Tern is reported to be a sedentary species with some short nomadic movements (del Hoyo *et al.* 1996). However, the whereabouts of the Yingjiang River Terns between July and December is currently unknown. It is our hope to investigate the migration routes of our River Terns with the help of tracking device, so that we can expand our conservation network to ensure their safety throughout an annual cycle.

The breeding sites of River Tern discovered this year were located upstream of the extensive Yingjiang National Wetland Park (Figure 2), which covers 20 kilometers of the Dayingjiang River and its floodplain. KFBG and DFB will discuss with relevant government authorities and explore the possibility of expanding the wetland park to include river section of the known breeding sites.

We also plan to continue working on the monitoring and conservation of other riverine species sharing the same Dayingjiang habitat, especially the healthy populations of River Lapwing and Little Pratincole *Glareola lactea*, which are also in decline in Southeast Asia. The conservation measures taken to protect River Terns will also benefit these species.

Acknowledgements

The project was conceptualised and funded by KFBG, field surveys and in-situ conservation measures were partially funded by Oriental Bird Club and aec Ltd. We are grateful to the Forestry and Grassland Bureau of Dehong Dai and Jingpo Autonomous Prefecture and Yunnan Tongbiguan Provincial Nature Reserve, for their support in field surveys and conservation interventions. We thank all participants of the field survey, especially our colleagues from Kadoorie Farm and Botanic Garden and staff from Yingjiang National Wetland Park and Yingjiang Birdwatching Society. We thank our interns, Twinky WONG and Natalie CHUNG, for their assistance in community outreach programmes. We are also thankful for the dedication of three community nest protectors, Xiao-Er YUE, Genbohuhuan and Shaoboshangliang.

References

- BirdLife International (2016) *Sterna aurantia*. *The IUCN Red List of Threatened Species 2016*, e.T22694537A93456605. Available from: <http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22694537A93456605.en>. (July 26, 2019).
- Claassen, A.H. (2018) *Ten-year species action plan for the Cambodian population of River Tern Sterna aurantia, 2018-2028*. Phnom Penh, Cambodia
- Claassen, A.H., Sok, K., Arnold, T.W. & Cuthbert, F.J. (2017) Effectiveness of direct payments to increase reproductive success of sandbar-nesting river birds in Cambodia. *Bird Conservation International*, 1–17.
- Gong, Q.-B., Landerin, S., Xi, H.-C., Ma, X.-D., Yang, Z.-H., He, K.-W. & Shen, J.-Y. (2018) *Aristolochia tongbiguanensis*, a new species of Aristolochiaceae from Yunnan, China. *Taiwania* 63, 183–187.
- del Hoyo, J., Elliott, A. & Sargatal, J. (1996) Lynx Edicions *Handbook of the Birds of the World, vol. 3: Hoatzin to Auks*. Barcelona, Spain.
- Wang, L., Wang, Z., Chen, L.I., Zhao, F.E.I. & Li, R. (2018) *Sadiria longistyla* (Myrsinoideae, Primulaceae), a new species from Yunnan, China. *Phytotaxa* 345, 293–297.
- Xue, B., Ye, D.-P., Shao, Y.-Y. & Tan, Y.-H. (2017) *Polyalthia yingjiangensis* sp. nov (Annonaceae) from the China/Myanmar border. *Nordic Journal of Botany* 35, 476–481.
- Yang, J.-H. & Zheng, X. (2018) A New Species of the Genus *Calamaria* (Squamata: Colubridae) from Yunnan Province, China. *Copeia* 106, 485–491.
- Yang, J. & Chan, B.P.L. (2018) A new phytotelm-breeding treefrog of the genus *Nasutixalus* (Rhacophoridae) from western Yunnan of China. *Zootaxa* 4388, 191–206.
- Yang, J., Wang, J. & Wang, Y. (2018a) A new species of the genus *Megophrys* (Anura: Megophryidae) from Yunnan Province, China. *Zootaxa* 4413, 325–338.
- Yang, J., Zeng, Z.-C. & Wang, Y. (2018b) Description of two new sympatric species of the genus *Leptolalax* (Anura: Megophryidae) from western Yunnan of China. *PeerJ* 6, e4586.
- Yang, L., Wen, X., Han, L., Yang, X., Shi, W. & Wang, S. (1995) *The Avifauna of Yunnan China, vol. 1: Non-Passerines*. Yunnan Science and Technology Press, Kunming.

Yang, Y. & Du, F. (2006) *Integrated Scientific Studies of Yunnan Tongbiguan Nature Reserve*. Y. Yang and F. Du (Eds). Yunnan Science and Technology Press, Kunming.

Yingjiang Bird Watching Society (2019) *The Checklist of Birds of Dehong Dai and Jingpo Autonomous Prefecture (2019 edition)*.

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Figures

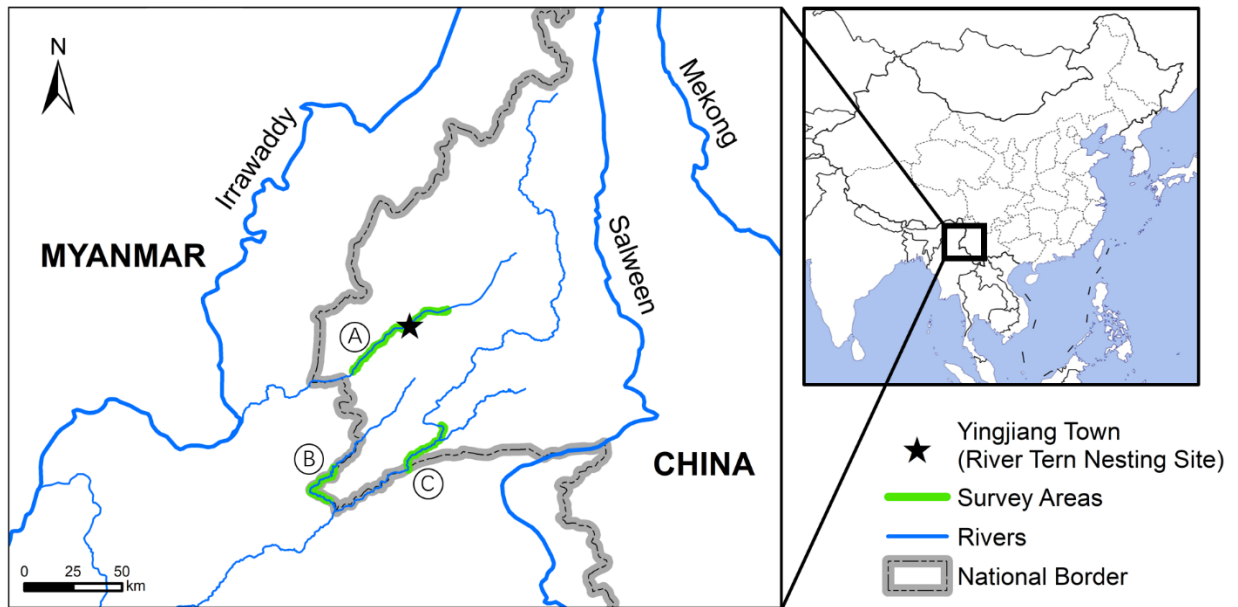


Figure 1. River Tern surveys conducted in March 2019 covered potential habitats along three rivers in western Yunnan. A = Dayingjiang River, B = Ruili River, C = Nanwan River.

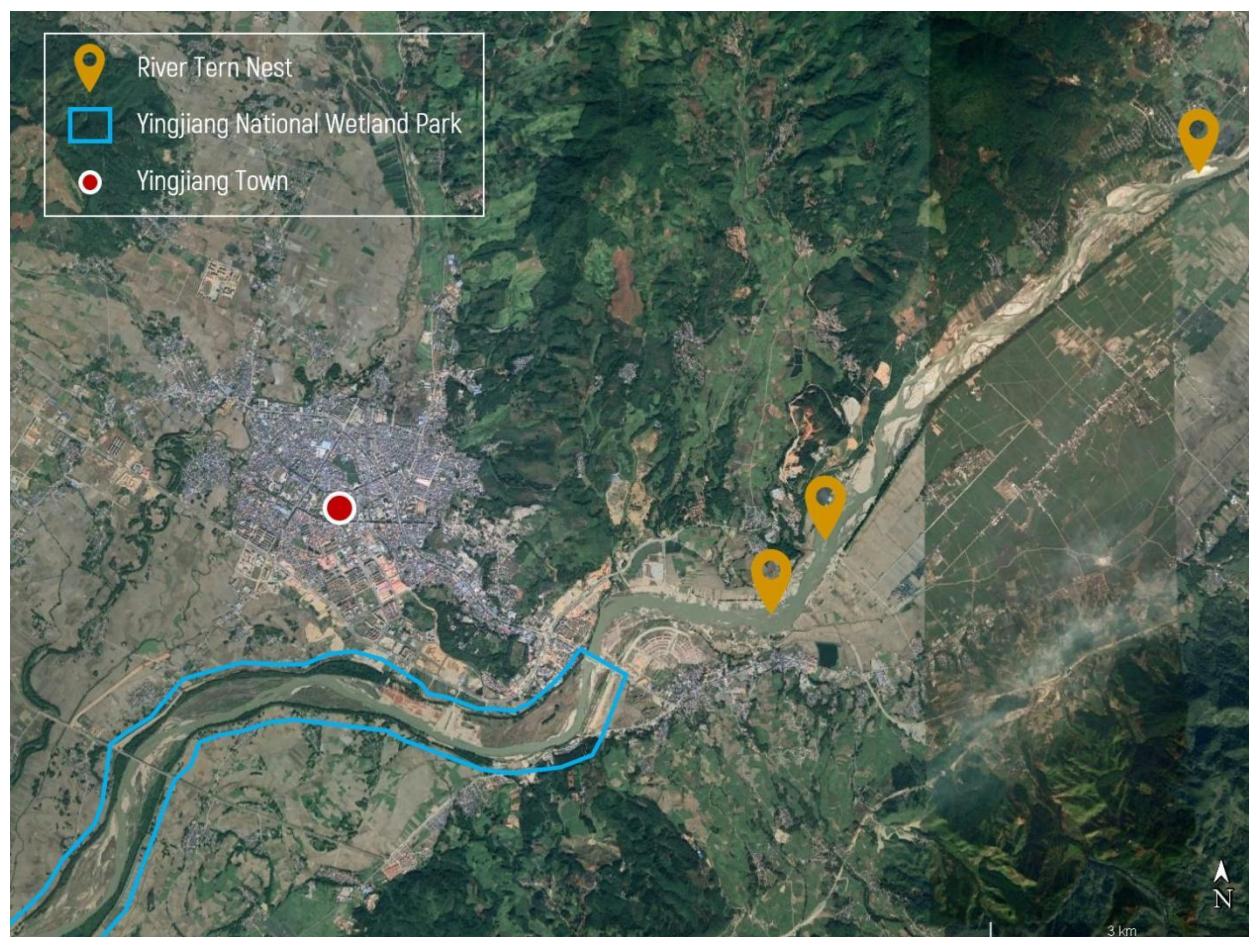


Figure 2. Nest sites discovered during the River Tern surveys in March 2019, Dayingjiang River, Yunnan Province, China.

Photos



Landscape of Dayingjiang River, Yunnan Province, China where the third nest was found.



One of the breeding River Terns from Dayingjiang River, Yunnan Province, China.



River Lapwing sharing the same habitat with River Tern in Dayingjiang River, Yunnan Province, China.



Little Pratincole sharing the same habitat with River Tern in Dayingjiang River, Yunnan Province, China.



One of the three nests found along Dayingjiang River in Yunnan Province in March 2019.



Immature River Terns born in China's Yingjiang in 2019.



Our team race against time to fence off the nest to keep predators at bay and increase breeding success, Dayingjiang River, Yunnan Province, China.



Billboard erected near River Tern nesting site to raise awareness. Dayingjiang River, Yunnan Province, China.



Children learned about the ecology and conservation of waterbirds of their home, including the River Terns, at educational fun fairs organised by KFBG and DFB in Yingjiang Town, Yunnan Province, China.