Short Communication

A small population and severe threats: status of the Critically Endangered Chinese crested tern *Sterna bernsteini*

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Abstract The Critically Endangered Chinese crested tern *Sterna bernsteini* is a poorly known species. From June 2003 to August 2007 we therefore surveyed the Zhejiang and Shandong coasts of eastern China for breeding colonies and to document any threats. Our results indicated that (1) the colonies at Matzu and Jiushan are the only two in the species' potential breeding range, (2) the total population is no more than 50, (3) numbers in the two extant breeding colonies fluctuate annually, and (4) threats to the breeding populations include habitat degradation, egg poaching, disturbance, overfishing and typhoons. Egg poaching is the greatest threat to the Chinese crested tern population and other breeding seabird populations along the coast of China. We make recommendations for the conservation of this species.

Keywords Breeding population, China, Chinese crested tern, coast, egg poaching, *Sterna bernsteini*, threats.

The Chinese crested tern *Sterna bernsteini* is a poorly known species. Since being described and named in 1863 it has been known only from a few pre-1938 specimens and unconfirmed sightings in the breeding season from Hebei and Shandong in northern China, and in the non-breeding season from Thailand, Philippines, Malaysia, Indonesia, Cambodia and Singapore (Collar et al., 2001). The literature concerning this species does not offer either detailed or exact information about population size, distribution, breeding and wintering range, ecology or any threats (Hsu & Melville, 1994; del Hoyo et al., 1996; Collar et al., 2001). Its population size was previously regarded as unknown but was presumed small given the paucity of recent records (IUCN, 2008) or estimated to be < 50 (BirdLife International, 2008). Its range is described as 'breeding along the coastal area of east China and wintering in Indonesia and Philippines' (Delany & Scott, 2006). It is categorized as Critically Endangered on the IUCN Red List (Collar et al., 1994; BirdLife International, 2008; IUCN, 2008). In June 2000 four breeding pairs discovered on the Matzu Islands off the coast of Fujian Province, eastern China, proved that the species was extant (Liang et al., 2000). Subsequently another small breeding population was found on the Jiushan Islands off the coastal Zhejiang Province, eastern China (Chen et al., 2005).

Following these discoveries we surveyed the potential breeding areas of the Chinese crested tern along the eastern coast of China during June–August of 2003–2007. We searched for breeding colonies to estimate the global population size, determine the breeding range, and document threats to the breeding population. Additionally, we have monitored the population at the two known breeding sites since they were located and investigated any potential threats there.

The 18,000 km coastline of China spans temperate, subtropical and tropical regions. It includes rocky coasts and islets, rapidly accreting soft shores, mangroves and coral reefs. There are c. 6,500 uninhabited islands along the coast within the Bohai, Yellow, East China and South China Seas, in 13 provinces or districts. Historical records of the Chinese crested tern and the two known breeding sites are along the coasts of Shandong, Zhejiang and Fujian Provinces, and we therefore regard these areas as the potential breeding range of the species. Unconfirmed sightings from Hebei in 1978 (Collar et al., 2001) and the Yellow River Delta in 1991 (Hsu & Melville, 1994) could indicate breeding in northern Shandong or Liaoning but recent surveys in these areas have not located the species (Fang, 2001; Zhang et al., 2006). Surveys along the coast of Fujian Province and adjacent areas have not located any new breeding sites (Sun et al., 2003; Jiang et al., 2005) and therefore we confined our surveys to coastal areas of Zhejiang and Shandong Provinces (Fig. 1).

We spent 13 days searching along the northern Zhejiang coast in 2003, 23 days along the northern and central Zhejiang coast in 2004, 18 days along the northern and

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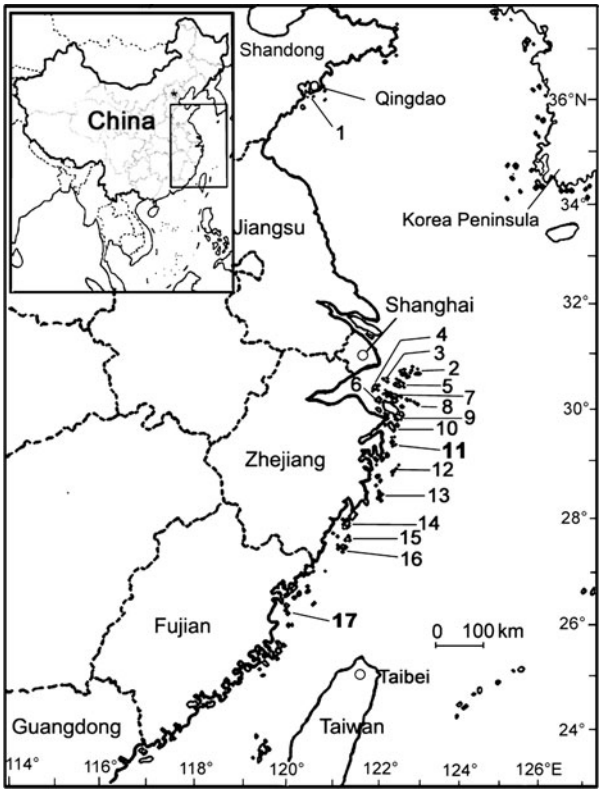

FIG. 1 The areas surveyed for the Chinese crested tern along the eastern coast of China in 2003–2007. 1, islands adjacent to Qingdao; 2, Shengsi Archipelago; 3, Qiqu Archipelago; 4, Huoshan Archipelago; 5, Qushan Archipelago; 6, Wuzhishan Archipelago; 7, Changtu Archipelago; 8, Zhongjieshan Archipelago; 9, Putuo and adjacent islands; 10, Meisan Archipelago; 11, Jiushan Archipelago; 12, Yushan Archipelago; 13, Taizhou Archipelago; 14, Dongtou Archipelago; 15, Beiji Archipelago; 16, Nanji Archipelago; 17, Matzu Archipelago. The two sites where the species was found (11 and 17) are in bold. The inset indicates the location of the main figure in China.

central Zhejiang coast in 2005, 22 days along the central and southern Zhejiang coast and 15 days along the Shandong coast in 2006, and 12 days along the central Zhejiang coast in 2007. Each survey team consisted of 3–5 members. We hired fishing boats for the surveys, visiting all uninhabited islands within the chosen area, and in total visited c. 95% of the uninhabited islands within the survey area. When a seabird breeding colony was found we took pictures and landed on the island to confirm the species present, population sizes and breeding status.

During the surveys we observed five species of terns (*Sterna sumatrana, Sterna dougallii, Sterna annethetus, Sterna bergii* and *Sterna bernsteini*) in a total of 39 colonies breeding on 20 islands or islets along the coast of Zhejiang province. No breeding terns were found along the Shandong coast, where a total of 21 specimens were collected in 1937 and where it was then presumably breeding (Shaw, 1938). Other than the colonies at Matzu and Jiushan we did not find any further breeding colonies of the Chinese crested tern. Our results and surveys in Liaoning (Zhang et al., 2006), Fujian (Jiang et al., 2005) and Guangdong (Sun et al., 2003) indicate that the colonies at Matzu and Jiushan are probably the only two extant breeding populations of the Chinese crested tern. The dynamics of these colonies during 2000–2007 are summarized in Table 1. Both colonies fluctuated annually. All of the breeding Chinese crested terns occur as a small colony within a large breeding colony ($>$1,000 pairs) of greater crested tern *S. bergii*. In 2004 and 2007 the Chinese crested terns were observed to breed at both Matzu and Jiushan; the total number (including adults and fledglings) in 2004 was no more than 29, and in 2007 no more 23. If these two colonies are the only extant breeding populations the species is at a critical level, with $<$50 individuals. Although no further breeding sites were found, several other breeding colonies ($<$ 20 pairs) of greater crested tern have been recorded along the coast of Zhejiang and Fujian (Jiang et al., 2005) and these areas could therefore be within the potential breeding range of the Chinese crested tern and thus warrant further surveys.

Habitat degradation, egg poaching, disturbance, overfishing and typhoons all threaten, to varying degrees, the survival of the Chinese crested tern. In addition, red tides frequently break out around the mouth of the Changjiang river and along the coast of Zhejiang (Zhao et al. 2004), generally in May–June, the start of the seabird breeding in this area. Red tides are associated with the production of

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Table 1 Numbers of Chinese crested terns recorded in the two known populations.

Breeding season	Matzu islands	Jiushan islands
2000	8 adults & 4 fledglings on Zhongdao islet	
2001	1 adult non-breeding	
2002	6 adults & 3 fledglings on Sheshan islet	
2003	1 adult on Liuquanjiao islet, breeding status unknown; 1 adult on Jinyu islet, breeding status unknown	
2004	6 adults & 3 fledglings on Baimiao & Tiejian islets	10–20 adults breeding amongst c. 4,000 greater crested terns on Jiangjunmao islet, no fledlgings
2005	2 adults on Sanlianyu islet, breeding status unknown	No individuals recorded
2006	6 adults & 3 fledglings on Sanlianyu islet	No individuals recorded
2007	10 adults & 5 fledglings on Sheshan & other islets	8 adults breeding amongst c. 2,000 greater crested terns on Jiangjunmao islet, no fledglings

toxins and depletion of dissolved oxygen, causing the death of fish and thus reduction in food available to breeding seabirds.

Collection of seabird eggs is widespread and common along the coastal regions surveyed. Eggs are usually collected by local fishermen, who believe wild eggs have greater nutritional value than poultry eggs. At Matzu fishermen from nearby villages frequently collect seabird eggs; this could have resulted in the breeding failure of Chinese crested terns in 2001, 2003 and 2005. At Jiushan the mixed breeding colony re-laid in 2004 after the first clutches were taken in June but were devastated by two strong typhoons in August. In the 2007 breeding season, although patrolling around the breeding islet was reinforced, the breeding colony still suffered egg poaching.

Fishery activities at or near the breeding grounds, such as shellfish collection, can deter breeding birds from their feeding grounds and, although landing is prohibited at Matzu, tourism sometimes interferes with seabird breeding there. The Fishing-prohibited Period Policy of the Chinese government restricts fishing from 15 June to 15 September but illegal fishing still occurs. During the fishing ban most large fishing boats remain in harbour but smaller craft are generally less restricted. Strong typhoons occur frequently along the Fujian and Zhejiang coasts in summer.

Of these threats egg poaching has the greatest effect on the Chinese crested tern and other seabirds breeding along the eastern China coast. The consumption of seabird eggs was traditionally common in these areas. With rapid economic development, tourism and cuisine have also been developing and large numbers of snack booths have emerged in the coastal areas of Zhejiang and Fujian. Seabird eggs are sometimes the recommended food during the breeding season.

The Chinese crested tern has been categorized as Critically Endangered on the IUCN Red List since 1994, currently on the basis of criteria B1ab(iii), C2a(ii) and D4 (IUCN, 2001), i.e. relating to its range, decline and population size, respectively. The results of our surveys do not indicate that any change in this assessment is warranted. In the short-term urgent measures need to be taken to halt egg poaching. These measures should include: (1) education programmes to promote the concept of conservation of the Chinese crested tern and other seabirds to the fishery communities along the coasts of Fujian and Zhejiang, (2) prohibition of the sale and consumption of seabird eggs, (3) continued monitoring of the Chinese crested tern at existent breeding sites and further surveys in potential breeding areas, and (4) enforcement of the landing ban for all uninhabited islands and islets during the seabird breeding season. In the long-term an action plan for the conservation of the Chinese crested tern is required.

Based on our findings we have made conservation recommendations for the Chinese crested tern to the relevant state and local authorities, including the China State Forestry Administration, China State Oceanic Administration, and China Wildlife Conservation Association. Guarding of the breeding seabirds at Jiushan Islands has since been reinforced. Simba Chan and Shuihua Chen are now involved in the drafting of an action plan for the conservation of the Chinese crested tern.

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Biographical sketches

Shuihua Chen's main research interests are bird ecology and conservation biology. Since 2002 he has studied breeding seabirds along the coast of China. Shou-hua Chang, the Director of the Wild Bird Society of Matzu, has been monitoring birds at Matzu Islands Tern Refuge annually. Yang Liu focuses on the mechanisms that maintain phenotypic and genetic diversity in birds. Simba Chan is working on bird conservation in Asia, especially on conservation of threatened species such as the Chinese crested tern. Zhongyong Fan is interested in bird ecology, conservation biology and bird photography. Cangsong Chen has conducted field research in animal ecology, especially that of birds and amphibians. Chung-wei Yen's main research interests are bird ecology and evolution. Dongsheng Guo is interested in ornithology and biodiversity science.