

## Correspondence

## Disappearance of endangered turtles within China's nature reserves

Shi-ping Gong<sup>1</sup>, Hai-tao Shi<sup>2,\*</sup>,  
Ai-wu Jiang<sup>3</sup>, Jonathan J. Fong<sup>4</sup>,  
Daniel Gaillard<sup>5</sup>, and Ji-chao Wang<sup>2</sup>

China ranks first among Northern hemisphere countries for species richness, but approximately 43% of its species are threatened [1], with harvesting being the major threat to vertebrates [2]. To protect its biodiversity, China has established about 2,700 nature reserves covering 1.46 million km<sup>2</sup> (about 15% of China's territory, a percentage higher than the world average [3]). With increasing habitat destruction and harvesting, nature reserves are the final refugia for threatened species. However, many Chinese nature reserves are poorly managed, leaving them vulnerable to poaching and other human encroachment [4]. In this study, we conducted a 12-year (2002–2013) case study on turtles to illustrate the damaging impacts China's nature reserves have on wildlife conservation. We discovered that poaching occurred in all of the 56 reserves surveyed, resulting in dramatically reduced turtle populations. In a majority of the reserves, the reserve staff themselves were involved in poaching. Although nature reserves were created to protect plants and animals, they have become part of the problem due to weak enforcement of rules.

We chose turtles as a model to evaluate the effectiveness of China's nature reserves because turtles are valued and targeted by hunters, occur in many of China's nature reserves and are banned from wild harvest by Chinese law. We investigated 56 nature reserves in Guangdong, Guangxi, and Hainan Provinces. Data were collected in three ways: field surveys, trade surveys and interviews. In field surveys of 11 nature reserves, we estimated turtle population density and looked for signs of poaching and habitat modification. In trade surveys, we collected information

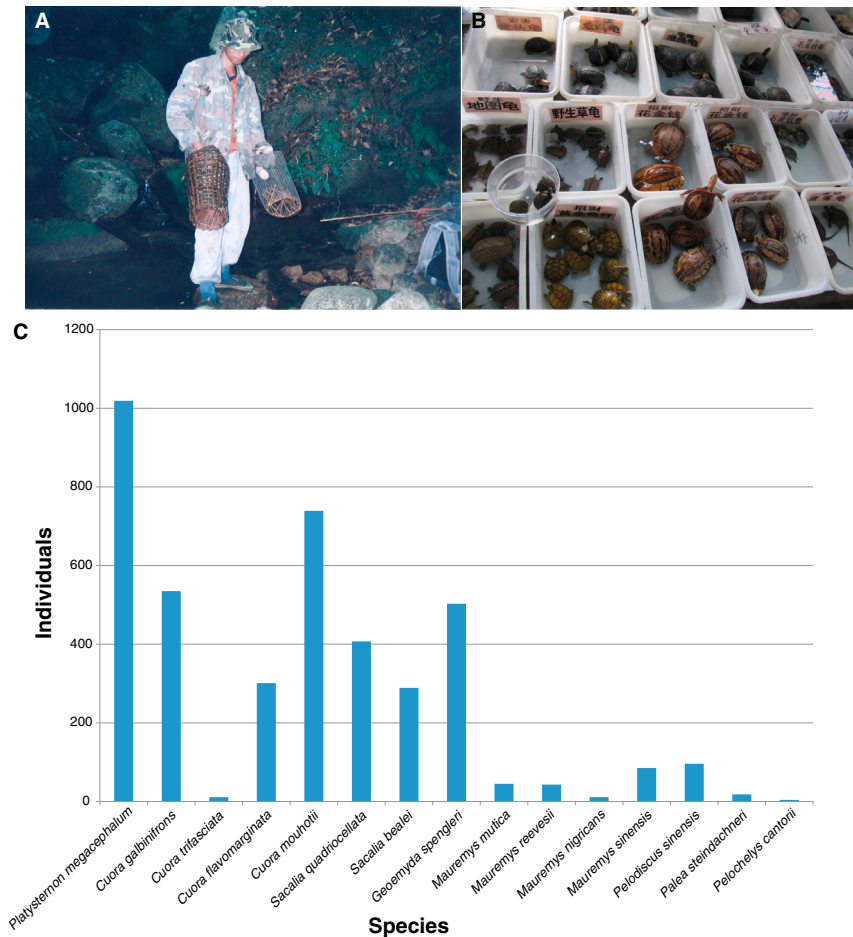
on the trade of wild-caught Chinese turtles found in the markets and local turtle collectors. For interviews in each of the 56 reserves, we talked to reserve managers, poachers and local villagers to collect information on poaching issues, conservation management, and trends of turtle populations.

Hunting is strictly forbidden in all nature reserves in China. From field surveys, however, we found over 1400 poaching devices (i.e. cage traps, hooks, pitfall traps) and encountered 69 hunters in 11 nature reserves (Figure 1A). This unexpected finding reflected the managers' inaction. Although historical records identified 15 species present in these areas, we found just nine species in the field. All species found were at low population densities, even for previously common species (e.g. *Platysternon megacephalum* [5]). Species in our study showed >89% reduction in population density when compared to historical data or nearby sites with minimal hunting pressures (Supplemental information). For example, *P. megacephalum* populations with low hunting pressure could be found at population densities of >120 individuals per stream kilometer [6], while in contrast, populations under heavy hunting pressures in nearby Guangdong and Hainan Provinces have 0–0.36 individuals/stream km (Supplemental information). From our own work and through discussions with others, we found no obvious temporal or geographic patterns in poaching pressure — poaching seems to be steady and intense in all areas with turtles.

During surveys of 64 markets in Guangdong, Guangxi, and Hainan Provinces, >4100 wild-caught turtles of 15 local turtle species were found, including some Endangered and Critically Endangered species on the IUCN Red List (e.g. *Cuora galbinifrons*, *Mauremys nigricans*; Figure 1C). We found that nature reserves were the important source of wild-caught turtles in markets. Turtles are first collected from nature reserves, gathered at small wildlife trade posts in nearby villages, then transported to large markets in cities (Figure 1B). Therefore, the huge demand in cities is a major driver of turtle poaching in reserves, while turtle farms are also a major factor [7].

From our interviews, we discovered poaching occurred in all of the 56 reserves surveyed and was common (>10 occurrences per year) in 61% of reserves (Supplemental information). In 89% of reserves, staff were involved in poaching to either consume themselves or to sell to supplement their income. Results from our questionnaire shed light on the causes of poaching (Table S2). Reserve rangers are unmotivated and do not feel responsible to perform conservation work (31% of those surveyed). A majority of nature reserve managers (62%) were more interested in commercial projects than nature conservation (Supplemental information). This situation arises from the nature reserve management system allowing managers to choose between two conflicting nature reserve roles: protect biodiversity and utilize natural resources. Managers are more interested in economic development, as seen by the 84% of reserves having commercial exploitation activities (i.e. hydroelectric power plants, ecotourism). Ecotourism, often promoted to generate conservation funds, may be hurting conservation. In order to attract tourists, the core zone of nature reserves, the most sensitive and biologically significant area, is even developed for tourism (i.e. hotels and restaurants) [8]. In our surveys, we found local villagers to be the main poachers, but hydropower plant staff and tourists opportunistically poached or purchased wildlife products. Thus, the management of nature reserves does not help protect, but instead contributes to the demise of wildlife.

Proper management practices (such as anti-poaching patrolling and enforcement) can be effective in reducing poaching by local villagers [9]. However, our study uncovered conflicting missions for nature reserves, resulting in managers focusing on exploiting natural resources for economic gain. China does have regulations for supervision and assessment of nature reserves [10]. Current assessment methods focus on changes to habitat (i.e. removal of trees and/or forest fires) as a proxy for ecosystem health because they are easily observed through field observations and remote sensing technology. Directly assessing the health



**Figure 1. Results of fieldwork, trade surveys and interviews during our 12-year (2002–2013) case study on turtles.**

(A) Poaching devices (cage traps) found in a national nature reserve during field surveys. (B) Turtles on sale in the Yuehe Pet Market, Guangzhou, including captive bred and wild turtles (e.g. *Cuora galbinifrons*, *Platysternon megacephalum*). (C) Species and numbers of wild-caught Chinese turtles found in markets in Guangdong, Guangxi, Hainan Provinces. Of the 15 species, one is listed as Vulnerable (*Pelodiscus sinensis*), two as Critically Endangered (*C. galbinifrons*, *C. trifasciata*), and the remaining 12 as Endangered on the IUCN Red List.

of animal populations through field observations is labor and time intensive, so nature reserve managers often ignore wildlife or even prepare fake records to deceive inspectors. Reluctance to patrol and enforce laws results in rampant poaching. The result is that seemingly healthy nature reserves of old growth forests are devoid of wildlife.

Our long-term case study of turtles highlights the damaging impact of poaching in nature reserves on wild populations. This situation is not unique to turtles, as we saw signs of poaching for all species valuable for food and trade. Currently in China, endangered species are facing a serious threat of extirpation due to poaching,

and we identify nature reserves as contributing to the problem due to poor management practices and lack of effective supervision. In order to improve the conservation of China's rich biodiversity, it is imperative for China's nature reserve system to make meaningful changes to its policies and procedures. We make the following recommendations to improve nature reserve management: first, commercial activities in reserves should be strictly restricted by national policy, especially avoiding reserve managers themselves from undertaking commercial activities in reserves. Conservation activities (e.g. anti-poaching patrolling, enforcement) should be their sole

focus; second, an effective evaluation system needs to be established to assess reserve effectiveness. Besides the indicators of habitat, the health of animal populations should be included as an evaluation index; third, strict supervision of nature reserve management. Such supervision should include participation from social media, academic institutes and NGOs.

#### SUPPLEMENTAL INFORMATION

Supplemental Information including acknowledgements, experimental procedures and two tables can be found with this article online at <http://dx.doi.org/10.1016/j.cub.2017.01.039>.

#### REFERENCES

- Jiang, Z.G. (2016). Assessing the surviving status of vertebrates in China. *Biodiversity Science* 24, 495–499.
- Li, Y.M., and Wilcove, D.S. (2005). Threats to vertebrate species in China and the United States. *BioScience* 55, 147–153.
- Wang, J., Sun, J.P., Shi, L., Li, N., Ma, Z., and Meng, X.X. (2016). Present situation, existing problems and prospects of the construction of nature reserves in China. *China Population Resources Environment* 5, 270–273.
- Xie, Y., Wang, S., and Schei, P. (2013). *China's Protected Areas*. (Beijing, China: Tsinghua University Press.)
- Gong, S.P., Xie, C.J., and Chen, C. (2004). A survey of freshwater turtles on Hainan Island, China. *Nature* 6, 48–49.
- Sung, Y.H., Nancy, E.K., and Billy, C.H.H. (2013). Demographic evidence of illegal harvesting of an endangered Asian turtle. *Conserv. Biol.* 27, 1421–1428.
- Shi, H.T., Parham, J.F., Lau, M., Chen, T.H. (2007). Farming endangered turtles to extinction in China. *Conserv. Biol.* 21, 5–6.
- Fang, G.Y., Li, J., and Ma, L. (2003). The countermeasures of ecotourism exploitation in Chinese nature reserve. *J. Northeast Forestry Univ.* 4, 56–57.
- Wan, J., Chan, B., Liao, C., Mi, H., Lau M, Li, F., Wang, H., and Sung, Y. (2015). Conservation status of freshwater turtles in Hainan Island, China: Interviews and field surveys at Yingling Nature Reserve. *Chelon. Conserv. Biol.* 7, 100–103.
- Ouyang, X.J., Ye, W.H., Hockings, M., Luk, C.L., and Huang, Z.L. (2013). Developing phase of China's system of nature reserves in perspective. *Forest Science Practice* 15, 340–348.

<sup>1</sup>Guangdong Key Laboratory of Animal Conservation and Resource Utilization, Guangdong Public Laboratory of Wild Animal Conservation and Utilization, Guangdong Institute of Applied Biological Resources, Guangzhou 510260, China.

<sup>2</sup>College of Life Science, Hainan Normal University, Haikou 571158, China. <sup>3</sup>College of Forestry, Guangxi University, Nanning 530004, China. <sup>4</sup>Science Unit, Lingnan University, Hong Kong, China. <sup>5</sup>School of Life Sciences of Peking University, Beijing 100871, China.

\*E-mail: [haitao-shi@263.net](mailto:haitao-shi@263.net)