

Advances in herpetological research emanating from China

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The warming of Earth owing to human activities is resulting in an episode of mass extinction. If global warming is not abated quickly, up to one-fourth of the species on our planet will face extinction in only 35 years. The loss of biodiversity is more than just many species disappearing. It could signal the beginning of the collapse of our ecosystems because the loss of one species can trigger a domino effect. Among vertebrates, the so-called cold blooded species—fishes, amphibians and reptiles—are the most threatened groups. According to International Union for Conservation of Nature (IUCN), as of 2009, 30% of amphibians are threatened with extinction and another 6% are considered to be Near Threatened. Regarding the world's reptiles, Simon Stuart, Chair of the IUCN's Species Survival Commission, believes their situation "may be much worse than it currently looks". Some 10% of Chinese and South East Asian species of snakes are Threatened with extinction and a whopping 43% are listed in the Endangered and Vulnerable categories. Turtles and tortoises are not doing any better.

The percentages of Threatened species are moving targets because of the discovery of many new cryptic species. Typically, new species await assessments of their status. The number of new species of amphibians and reptiles described each year continues to increase and, unlike for mammals and birds, no end is in sight. Take for example China. Zhao & Adler (1993) summarized China's diversity of amphibians and reptiles. They listed 274 species of amphibians among which 175 species were endemic (occurring only in China). More diverse, the reptiles accounted for 387 species, yet fewer, only 133, were endemic. A quick assessment of the past 22 years indicates we have a long road ahead before documenting the actual number of species, assuming we can reach the end of the road before the species become extinct.

According to AmphibiaWeb (2015), today China has 406 species of amphibians, yet AmphibiaChina (2015) lists 429 species. The latter assessment amounts to an increase of almost 57% since 1993. The vast majority of the increase in amphibian diversity owes to the discovery and description of new species. Based on data from AmphibiaWeb (2015) and Frost (2015), this involves 150 species descriptions and nine new records or resurrections of old species names. Figure 1 shows the number of new species of Chinese amphibians

described since 1994; the number of newly described species tends to increase annually. Every year has witnessed the description of at least one new species. A plot of the total number of amphibian species in China (not shown) shows no asymptote; no data indicate just how many species of amphibians occur in China.

The reptiles show a similar trend to amphibians of increasing diversity, but only by 33%. According to the Reptile Database (Uetz & Hošek, 2015), today China has 514 species of reptiles, which includes lizards, snakes, turtles and one species of alligator. However, unlike amphibians, the increase of 127 species involves the description of only 51 new species (Figure 2). The increase in diversity largely owes to the discovery and resurrection of previously described species. Historically, the diversity of reptiles in China may be better known than amphibians in part due to their broader use in Chinese culture and in traditional medicine. In 1596, the great pharmacologist Shi-Zhen LI of the Ming Dynasty published his book *Ben Cao Gang Mu* (The Great Pharmacopoeia). In it, LI listed three amphibians (Chinese giant salamander, tadpole and toad) as opposed to five reptiles (turtle, gecko, snake, 100 pace viper and alligator).

The increases in the numbers of species often owe to "less than comfortable" and sometimes outright dangerous fieldwork. Such is the essence of herpetology and the experience with the animals in nature yields invaluable insights into the lives, ecology and vulnerability of each species. The absence of such information hampers efforts to conserve the species. Historically, much of the work was carried out by foreign investigators. Today, Chinese researchers are largely responsible for such initiatives.

Nowadays, phylogenetics forms the philosophical and methodological basis for recognizing species and organizing them into genera and other hierarchical taxonomic categories. The development of affordable molecular genetic approaches

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also catapulted biodiversity assessments. For example, DNA barcoding, a method that uses the nucleotide sequence of a short fragment of mitochondrial DNA, plays a central role in this approach. The comparison of DNA barcodes from widespread taxa allows for the identification of likely cryptic species. Using this extremely fast and efficient approach, Scientists at the Kunming Institute of Zoology have successfully barcoded more

than 80% of all species of Chinese amphibians and from multiple localities. A large proportion of the species have samples from type localities. The approach has been so successful in China that the Kunming Institute of Zoology played the central role in forming ColdCode, the international initiative to DNA barcode all species of amphibians and reptiles (<http://coldcode.org/>) (Murphy et al., 2013).

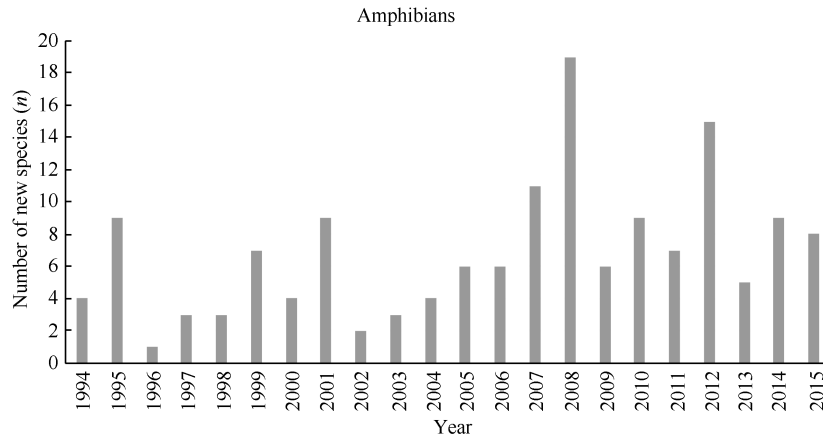


Figure 1 Histogram showing the number of newly described species of amphibians per year occurring in China (data from AmphibiaWeb (2015) and Frost (2015))

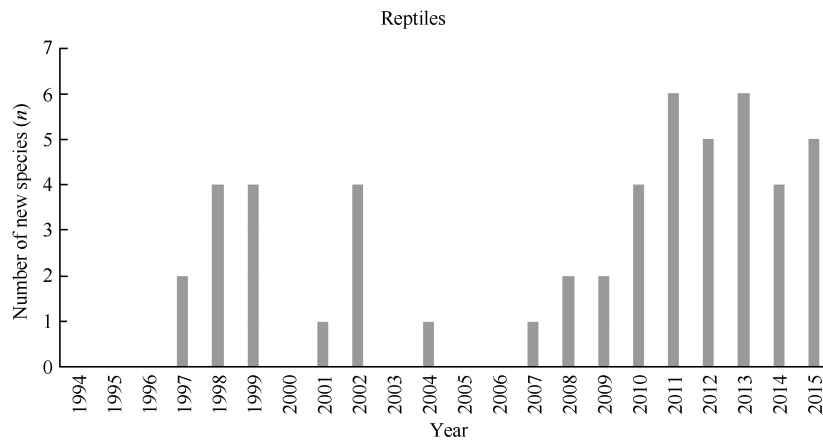


Figure 2 Histogram showing the number of newly described species of reptiles per year occurring in China (data from Reptile Database (Uetz & Hošek, 2015))

Given the biodiversity crisis, conservation is of utmost importance. Conservation usually involves named species and bad taxonomy kills because no species can be protected until it is named (May, 1990). Naming requires discovery and the documentation that a potential new species is on its own evolutionary trajectory. The synergy of fieldwork, documentation, naming and protection requires much effort and commitment. To the surprise of many, *Zoological Research* now documents that the biodiversity of the Qinghai-Tibetan plateau (QTP) is deserving of much further exploration and work. In this special issue, one research team from the Laboratory of Herpetological Diversity and Evolution, KIZ, CAS is invited to report their recent work on the QTP.

Yan et al. (2016) document the occurrence of the family

Ceratobatrachidae in Himalaya region of China and Southeast Asia for the first time. They confirm a new subfamily to accommodate three Chinese species, which they assign to genus *Liurana*. This paper demarks a significant to the origin and diversification of a large radiation of frogs. Jiang et al. (2016c) report the discovery of a new species of treefrog from southeastern Tibet and they erect a new genus for it. This too makes an important contribution to the diversity of frogs within China. Further, Jiang et al. (2016a, b) describe new species of frogs in the genera *Amolops* and *Scutiger*, respectively, also from Tibet. Finally, Wang et al. (2016) describe two new species of lizards in the genus *Japalura* from valley habitats in the Hengduan Mountain Range on eastern Qinghai-Tibetan plateau, highlighting the underestimated diversity of the region and the

importance of valley habitat conservation in the Three-Parallel-Rivers.

Overall, one of the most important contributions to this issue of *Zoological Research* is the announcement of AmphibiaChina (Che & Wang, 2016). The project, which is modeled after AmphibiaWeb (2015), will serve to catapult and coordinate amphibian research in China. It will prove to be invaluable for governmental officers, wildlife managers, academics, and the public audience alike. As Wake (2016) notes, it is destined to become THE place for updated information of the diversity of amphibians in China. Surely it will serve to stimulate similar efforts on a global basis. My only question is where is ReptiliaChina?

REFERENCES

- AmphibiaChina. 2015. The database of Chinese amphibians. Electronic Database accessible at <http://www.amphibiachina.org/>. Kunming Institute of Zoology (CAS), Kunming, Yunnan, China. (in Chinese)
- AmphibiaWeb. 2015. Information on amphibian biology and conservation. Electronic Database accessible at <http://amphibiaweb.org/>. Berkeley, California.
- Che J, Wang K, 2016. AmphibiaChina: an online database of Chinese Amphibians. *Zoological Research*, **37** (1): 57-59.
- Frost DR. 2015. Amphibian Species of the World: an Online Reference. Version 6.0 (Nov 26, 2015). Electronic Database accessible at <http://research.amnh.org/herpetology/amphibia/index.html>. American Museum of Natural History, New York, USA.
- Jiang K, Wang K, Yan F, Xie J, Zou DH, Liu WL, Jiang JP, Li C, Che J. 2016a. A new species of the genus *Amolops* (Amphibia: Ranidae) from southeastern Tibet, China. *Zoological Research*, **37** (1): 31-40.
- Jiang K, Wang K, Zou DH, Yan F, Li PP, Che J. 2016b. A new species of the genus *Scutigera* (Anura: Megophryidae) from Medog of southeastern Tibet, China. *Zoological Research*, **37** (1): 21-30.
- Jiang K, Yan F, Wang K, Zou DH, Li C, Che J. 2016c. A new genus and species of treefrog from Medog, southeastern Tibet, China (Anura, Rhacophoridae). *Zoological Research*, **37** (1): 15-20.
- May RM, 1990. Taxonomy as destiny. *Nature*, **347** (1990): 129-130.
- Murphy RW, Crawford AJ, Bauer AM, Che J, Donnellan SC, Fritz U, Haddad CFB, Nagy ZT, Poyarkov NA, Vences M, Wang WZ, Zhang YP. 2013. Cold Code: the global initiative to DNA barcode amphibians and nonavian reptiles. *Molecular Ecology Resources*, **13** (2): 161-167.
- Uetz P, Hošek J. 2015. The reptile database. Electronic Database accessible at <http://www.reptile-database.org/>.
- Wake DB. 2016. A new resource for China. *Zoological Research*, **37** (1):2-3.
- Wang K, Jiang K, Zou DH, Yan F, Siler CD, Che J. 2016. Two new species of *Japalura* (Squamata: Sauria: Agamidae) from the Hengduan Mountain Range, China. *Zoological Research*, **37** (1): 41-56.
- Yan F, Jiang K, Wang K, Jin JQ, Suwannapoom C, Li C, Vindum JV, Brown RM, Che J. 2016. The Australasian frog family Ceratobatrachidae in China, Myanmar and Thailand: discovery of a new Himalayan forest frog clade. *Zoological Research*, **37** (1): 7-14.
- Zhao EM, Adler K. 1993. Herpetology of China. Oxford, Ohio: Society for the Study of Amphibians and Reptiles. Contributions to Herpetology, **10**: 522.