

Chinese Alligator *Alligator sinensis*

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Common Names: Chinese alligator, Yangtze alligator, tulong, yow lung

Range: Formerly widespread in Lower Yangtze River drainage, now appears restricted to southeastern Anhui Province of China. Possibly very low numbers in Zhejiang and Jiangsu Provinces.

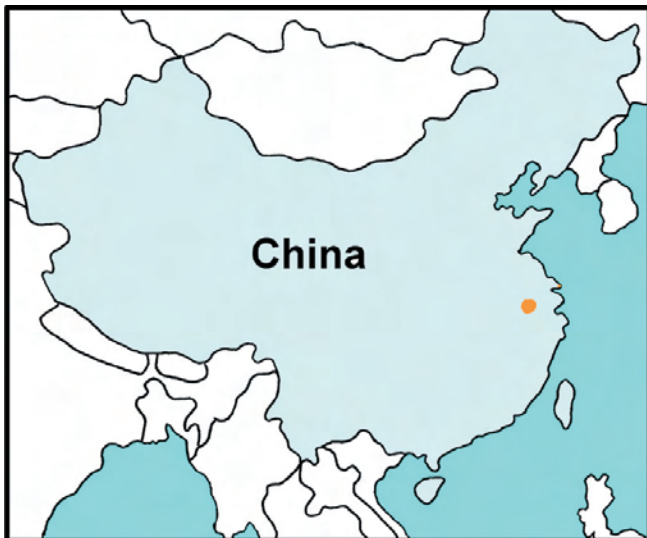


Figure 1. Distribution of *Alligator sinensis*.

Conservation Overview

CITES: Appendix I

2009 IUCN Red List: CR (Critically Endangered. Criteria: A1c. A decline of >80% in 3 generations in area of occupancy, area of occupancy >10 km², D1. Possibly fewer than 50 wild adults) (IUCN 2009) (last assessed in 1996).

CSG Action Plan:

Availability of Survey Data: Adequate
Need for Wild Population Recovery: Highest
Potential for Sustainable Management: Moderate

Principal threats: Habitat fragmentation and degradation, natural disasters (floods and drought), limited distribution, low productivity and pollution

Ecology and Natural History

The Chinese alligator is a relatively small crocodylian with a maximum length of approximately 2 m (Brazaitis 1973). Historically more widely distributed in the lower Changjiang (also known as Yangtze) River system in southeastern China (Huang 1982; Chen *et al.* 1985), *Alligator sinensis* is currently only known from a small region in southeastern Anhui Province, a fraction of its former distribution (Thorbjarnarson *et al.* 2002). Reports of very low numbers of wild *A. sinensis* in Zhejiang and Jiangsu Provinces (Manolis 2002; Webb 2002) have not been confirmed in recent years, and certainly no breeding populations occur outside Anhui Province.

The three principal habitat types where *A. sinensis* can now be found are:

- remnant wetlands in low, broad, fertile valleys along main river courses, dominated by paddy fields;
- intermediate ponds in low hill valleys (<100 m) but with significant agriculture in the valley above the pond; and,
- ponds situated in low hill valleys (<100 m) at the upper edge of rice cultivation and the low edge of tree plantations (Ding *et al.* 2001; Thorbjarnarson *et al.* 2002).

These habitat classifications are similar to those published by Watanabe *et al.* (1982).

Because they occur at relatively high northern latitude, Chinese alligators spend a large portion of the year hibernating in subterranean burrows (Huang 1982; Huang and Watanabe 1986). The burrows can be complex, with above and below-ground pools, and numerous air holes (Chen *et al.* 1985). The extensive use of these burrows and their very secretive behavior has allowed *A. sinensis* to inhabit wetland habitats in areas with dense human populations.

Chinese alligators usually begin to emerge from their dens to bask in May. In June, with warming temperatures, they will begin to make nocturnal sorties. Nesting occurs from early July to late August (Huang 1982), with 10-40 eggs being laid in a mound nest of decaying vegetation (Chen *et al.* 1985).

Conservation and Status

The Chinese alligator is considered one of the world's most endangered crocodylians. In 1972 the Chinese Government listed *A. sinensis* as a Class I endangered species, providing

it with the highest degree of legal protection (Wan *et al.* 1998). Enforcement of regulations prohibiting the capture or killing of wild alligators, however, was not entirely effective, particularly during the 1970s and early 1980s (Watanabe 1982).

Since 1979, Chinese alligator management focused on captive breeding, and centers were established in Anhui and Zhejiang Provinces (Wan *et al.* 1998). The Anhui Research Center for Chinese Alligator Reproduction (ARCCAR) is the largest facility, housing over 10,000 *A. sinensis* and serving as the administrative center for alligator management in Anhui Province. A 43,300 ha reserve for *A. sinensis* was established in Anhui Province in 1982 and promoted as the national nature reserve in 1986. From then on, the reserve, named the Anhui National Nature Reserve for Chinese Alligator (ANNRCA), covered a 5-county region and includes 13 protected sites that contained virtually all the remaining areas with wild Chinese alligators.



Figure 2. Captive *A. sinensis*. Photograph: Grahame Webb.

Once widely distributed throughout the eastern Yangtze River system, the current distribution of the species is restricted to extremely small fragments of its former range in southeastern Anhui Province (Thorbjarnarson *et al.* 2002). By the late 1980s, wild *A. sinensis* remained only in Anhui Province, principally in small ponds in agricultural valleys and hills in 5 counties (Nanling, Jinxiang, Guangde, Langxi, Xuancheng), which together comprise the ANNRCA.

Outside the ANNRCA, including all sites where alligators were previously found bordering the Yangtze River (Wuhu, Ningguo and Dongtu counties), ARCCAR staff report alligators were extirpated during the past 20 years. A survey in late July to early August 2005 indicated that *A. sinensis* were distributed among 19 fragmented habitats (ponds) (see Table 1 in Jiang *et al.* 2006). Within the ANNRCA, only 32 alligators were observed in 7 of 13 designated sites, 2 old sites and 2 new sites, and an additional 8 sites with tracks. The largest groups contained a maximum of 10-11 animals and one adult female. In some cases these are small or remnant populations with little or no breeding known (Jiang *et al.* 2006; Wu *et al.* 2008).

Despite establishment of the ANNRCA, the wild population has continued to decline, and current population estimates are <25% of 1980s levels. Results of population surveys can be summarized as:

- In the early 1980s, surveys in Anhui Province estimated the wild *A. sinensis* population to be at least 300 individuals, comprised mostly of juveniles or sub-adults [Watanabe, cited in Groombridge (1982)].
- In 1985 and 1987, a more extensive survey of 129 villages (423 bodies of water) in the ANNRCA was organized by ARCCAR, and the population was estimated at 735 animals. Based on this estimate, and that between 1979 and 1983, 212 wild *A. sinensis* were collected to stock the ARCCAR, it is likely that around 1000 wild *A. sinensis* were in Anhui Province during the late 1970s.
- Zhou (1997) provided population estimates of 378-747 for the ANNRCA from 1985 to 1994. However, it is unclear how these population estimates were derived.
- In 1994, the total population was estimated to be 667-740 individuals, based on the assumption that only one-third of the sites within the ANNRCA were surveyed (Li *et al.* 1996). But because the key locations actually known to have Chinese alligators were visited, the validity of this extrapolation is questionable and the population figure is most likely to be an overestimate.
- In 1997 the population was estimated to have been reduced to approximately 400 animals (Wan *et al.* 1998), but no details were provided.
- Thorbjarnarson *et al.* (2002) provided data indicating the total wild population had declined from approximately 1000 alligators in the late 1970s to the current estimate of ≥ 130 .
- Only 23, 22, 20 and 32 Chinese alligators were observed during spotlight count surveys in the ANNRCA in 1999, 2002, 2003 and 2005 respectively (Thorbjarnarson *et al.* 2002; Ding *et al.* 2004; Wu *et al.* 2008). The most recent survey in 2005 indicated the total number to be around 92-114 individuals (Jiang *et al.* 2006; Wu *et al.* 2008), and that the wild population was stable in most sites and increasing in Hongxing, Zhucun, Zhuangtou and Heyi.
- The population appeared to have stabilized between 1998 and 2003 (Ding *et al.* 2004), and increased slightly between 2003 and the present (Wu *et al.* 2008).

Before 2000, the efforts for conservation of alligators in China mainly focused on the development of a number of rearing centers. ARCCAR was established in 1979 and stocked in 1981-82 with 212 wild individuals. Of these, 160-170 were still alive in 1990. Wild eggs (787 in total) were also collected between 1982 and 1985. Captive breeding has been very successful, with the first F2 produced in 1988 and the first F3 produced in 1998. By 2001, total stocks held had reached 10,000 alligators with 700-1000 hatchlings produced annually (Jiang *et al.* 2004).

A much smaller farm at Yinjiaban (Zhejiang Province), operated by the local cooperative, held 118 alligators (2:2:114) in 1998. Since 2001, the center has been managed by the Changxing Forestry Bureau and named the Changxing

Breeding and Research Center for Chinese Alligator (CBRCCA). By 2007, total stocks exceeded 630 alligators, with 100-200 hatchlings produced annually.

Additional breeding centers have been established at Qiongsan City (Hainan Island), National Forest Park of Qiandaohu (Thousand Island Lake, Zhejiang Province) (Zhang 1994a,b), Doumen County (Guangdong Province) and Jiangying City (Jiangsu Province). In addition, some small-scale safari parks, museums and captive-breeding farms also rear *A. sinensis* (eg Chongqing and Shanghai Municipalities).

Captive breeding of Chinese alligators has also been achieved at the Bronx Zoo (New York), St. Augustine Alligator Farm (Florida), and Rockefeller Refuge (Louisiana) in the United States. Specimens are held in zoos and private holdings outside of China, and studbooks are maintained for the USA and Europe (Jensch 2008).

Following a review of management and conservation of *A. sinensis* (Webb and Vernon 1992), in 1992 the ARCCAR facility was registered with CITES as a captive breeding operation. The primary intentions expressed at the time of registration were to provide alligators for local meat consumption and live animals for the European pet market. Income from the trade of captive-bred alligators was mainly used to maintain and continue captive breeding and conservation activities.



Figure 3. *Alligator sinensis*. Photograph: Grahame Webb.

To strengthen captive breeding and commerce management of crocodylians in China, the Guangzhou Advocacy was issued at the International Workshop on Captive Breeding and Commerce Management in Crocodylia (Guangzhou, Guangdong Province, China; 30 August-3 September 2001). This workshop also considered the deliberations of the International Workshop on Conservation and Reintroduction of Chinese Alligator (Hefei City, Anhui Province, China; 25-28 August 2001) (SFA 2002).

To mitigate the pressure of the large captive population, the State Forestry Administration (SFA) of China funded \$US1.2 million and the Anhui Provincial Government co-financed

about \$US0.74 million in 2003, which were provided for ARCCAR to construct two new breeding areas with the area of 1.6 ha, and reinforce the existing fence (length of 3500 m to be more than 3 m high). All of these measures ensure good conditions for captive-bred alligators. Meanwhile, in 2003 the SFA provided \$US0.6 million and the Changxing Government co-financed \$US0.9 million for CBRCCA to facilitate infrastructure and wetland restoration. The Construction Programme for Releasing Chinese alligators in Zhejiang Province was approved by the SFA in October 2006.

The factors most responsible for the population decline have varied over the last 50 years, but have included habitat fragmentation and degradation, hunting, natural disasters (floods and drought), geographic separation, low productivity and pollution. From the 1950s to 1990s, habitat loss and the killing of alligators were the most significant factors. Presently, killing of alligators is less of an issue but the loss of habitat has been virtually complete. Therefore, the highest priority for the conservation of *A. sinensis* is habitat restoration as the first step towards reintroduction of captive-bred individuals. In addition, the potential consequences of environmental pollution and reduced genetic diversity of the wild population must be addressed (Ding *et al.* 2004).

To effectively protect and manage the current wild Chinese alligators and their habitats in Anhui Province, the State Council of China approved the range adjustment of the current ANNRC to 18,565 ha, to benefit control of habitat destruction/alteration, reinforce the wild population, create habitat corridors for isolated sites, and mitigation of conflicts between natural protection and community development.

The Chinese alligator is a good candidate for reintroduction because wild populations are at dangerously low levels and a large captive population exists. The release of captive-reared crocodylians has been successfully used as a means of restocking or reintroducing wild populations of crocodylians in a number of countries, including India and Venezuela. In these and similar projects, reintroductions were made possible by the existence of protected areas containing suitable habitat.

After the International Workshop on Conservation and Reintroduction of Chinese Alligator (SFA 2002), the SFA issued the “China Action Plan for Conservation and Introduction of Chinese Alligator” in 2002. Meanwhile, *A. sinensis* was also listed as the one of 15 prior species of National Wildlife Conservation Project in the Tenth-Five Year Plan. Since then, the Chinese Government has paid more attention to the protection and management of wild populations and their habitats, as well as speed up release projects.

The ANNRC initiated reintroductions in 2001. In 2003, three captive-reared alligators were released at one of the protected sites - Hongxing Reservoir. Monitoring results indicated successful breeding in 2004 and 2005 (Jiang *et al.* 2006). An additional reintroduction site, Gaojingmiao Forest Farm (GFF), was evaluated and identified as a reintroduction

site by international and national crocodile experts in 2001 (Matsuda and Jenkins 2002). Over the last few years, a total of 50 ha of habitat has been reconstructed and restored. Since 2006, a total of 21 captive-reared alligators (6, 6 and 9 alligators in 2006, 2007 and 2008 separately) were released into different ponds at this site. On 22 July 2008, one *A. sinensis* nest containing 19 eggs (17 of which were fertile) was discovered at GFF as ANNRCA staff were conducting regular patrols (Jiang 2008).

In addition, the Wildlife Conservation Society cooperated with the Shanghai Forestry Bureau, Chongming Dongtan Wetlands Company, to release 6 captive-reared alligators into the Chongming wetlands in June 2007. In September 2008 a group of ≥ 15 hatchlings was discovered from a nest laid by one of the released females.

All of these cases indicate that captive-reared *A. sinensis* can adapt to restored habitats quickly and recover breeding capacity in the wild very smoothly.

Priority Projects

High priority

1. **Conservation strategy:** Although conservation efforts for this species in China began in 1979, efforts have focused on the wild population only since 2000. A master plan for guiding future conservation and management is considered an urgent priority for *A. sinensis*, in order to establish short-, medium- and long-term actions that need to be taken.
2. **Conservation and restoration of breeding groups in areas of natural habitat:** In the current distribution range in Anhui Province, measures are needed to improve and maintain ecosystem integrity. In the historical distribution range, some potential habitats owned by forestry organizations should be recognized as the highest priority to restore and ensure the ecological requirements for released alligators. New populations in existing or restored areas of suitable wetlands habitat in Anhui and other areas within the historical range of the species should be established.
3. **Establishment of the GIS-based habitat management system:** Applying RS, GPS and GIS techniques to develop a habitat management system for Chinese alligators, which can be used to monitor habitat changes and evaluate potentially suitable habitats. An important function of this system would be to help identify suitable alligator habitats that could be used for reintroduction or restocking programs.
4. **Population monitoring:** Regular, systematic monitoring (eg surveys) of the known wild populations is required to assess status and effectiveness of reintroduction efforts.
5. **Public education:** Given that many of the surviving alligator populations are located in human-made habitats

in close proximity to dense human populations, the role of public education is an important one. Efforts are needed, through public education, to emphasize the protected status of the alligator and enforce existing protective legislation. Emphasis on how to live with alligators successfully is vital to this program, and developing a respect for the alligators.

Moderate priority

6. **Maintenance and management of captive populations:** Captive populations, both within and outside China, are the current repository of most of the individuals and most of the genetic diversity of this species. These populations should be managed in a manner that ensures maximum genetic diversity and the maintenance of an adequate founder base for the future. To this end the managers of the various captive collections should communicate and cooperate in matters of information and studbook maintenance, exchange of captive specimens and husbandry technology, etc.
7. **Evaluation of current reintroduction projects:** To date, captive-bred Chinese alligators have been released at three different habitats in Hongxing Reservoir, Gaojingmiao Forest Farm (Anhui) and Chongming Island (Shanghai) in different years. At Gaojingmiao Forest Farm, monitoring of released alligators using radio-telemetry has continued, but at the other two sites it was discontinued due to lack of funding. Analysis of the results from these experimental releasing projects can provide a good understanding of the ecological requirements for future releases of captive-bred animals.

Acknowledgements

John Thorbjarnarson, J. Perran Ross, Terry Cullen and Charlie Manolis provided valuable input into this plan.

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