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# A survey for the Chinese giant salamander (*Andrias davidianus*; Blanchard, 1871) in the Qinghai Province

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***Abstract.*—The Chinese giant salamander (*Andrias davidianus*) was once common, but it has declined precipitously in the past several decades. An enigmatic specimen collected in 1966 represents the only historical record of the species from the Qinghai-Tibetan Plateau. From June–July 2012, we conducted opportunistic community inquiries and field surveys in Qinghai to attempt to locate *Andrias*. We received anecdotal evidence that additional *Andrias* have been found in recent years, but we failed to discover any *Andrias* during our field surveys. We suspect that relict populations persist in Qinghai, but the significant degradation of stream quality in the region likely threatens the long-term survival of any remaining *Andrias*. Here, we provide a brief overview of *Andrias* conservation, a summary of our surveys, and emphasize the importance of continued searches for this geographically disjunct population.**

**Key words.** Cryptobranchidae, Qinghai-Tibetan Plateau, conservation

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## Introduction

The Chinese Giant Salamander (*Andrias davidianus*) was once widely distributed throughout the Yangtze, Yellow, and Pearl River drainages. However, dramatic declines since 1950 have restricted the species to twelve fragmented regions across seventeen provinces (Zhang et al. 2002). These declines are due largely to habitat degradation and harvest for food (Dai et al. 2009). In response to these declines in the wild, the 2004 International Union for Conservation of Nature Red List evaluated *A. davidianus* as Critically Endangered, and the recognition of the conservation needs of the species has attracted national and international attention. Additionally, at least thirty preserves have been established in China to conserve *A. davidianus*, and captive breeding for human consumption has increased in prevalence and success (Dai et al. 2009; Zhang et al. 2002). One challenge for the conservation of *A. davidianus* is the preservation of genetic diversity, and several studies have examined variation between and among populations of *A. davidianus*. Significant substructuring exists among populations (Murphy et al. 2000; Tao et al. 2006), although results may be confounded by translocations of animals through the food trade. However, the overall genetic diversity of *A. davidianus* is relatively low compared to other salamanders (Tao et al. 2005; Yang et al. 2011).

A single specimen of *A. davidianus* was collected in the headwaters of the Yangtze River in the Qinghai Province in August 1966 (33.898 96.522; Fig. 1; Trap Location 9, Figure 2; Fig. 3). The specimen was a gravid female caught on hook-and-line near the town of Bagan at approximately 4,200 m, representing the highest known distribution record of *A. davidianus* by more than 2,000 m and a greatly disjunct population (Chen 1989). The geography and the geological history of this region (Yin 2010) suggest the possibility that the gap between this Qinghai record and other known localities for *A. davidianus* represents a true biogeographical break, and this population may be important for conservation purposes.

From 6 June to 2 July 2012, we used a variety of methods to survey Qinghai for *A. davidianus*. We were unsuccessful in locating any *Andrias*, but here we report the environmental conditions of the historic locality and others, anecdotal reports of *Andrias* from locals, and suggestions for future efforts to locate *Andrias* in Qinghai.

## Methods

Throughout our stay in Qinghai, we frequently talked to officials from the Bureau of Forestry to obtain permission to search for *Andrias*. During this process, we also inquired about anecdotal *Andrias* sightings from fishermen. This amounted to discussions with approximately

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fifteen government officials and five local fishermen. After talking with government officials and locals of Qinghai, we selected sites to survey based on historical and anecdotal records. We trapped in three general regions—Bagan, Zhiduo, and Yushu (Table 1; Fig. 2)—including the exact locality of the collection of the 1966 specimen from Bagan (Trap Location 9, Figure 2).

Browne et al. (2011) reviewed and evaluated survey techniques for cryptobranchid salamanders. Because of religious and cultural beliefs about the sanctity of fish, local people in Qinghai are overwhelmingly unsupportive of any attempts by biologists to survey aquatic organisms. Due to these limitations, some methods (e.g., electroshocking) were not possible, and our field surveys were conducted primarily through trapping, which has been shown to be reasonably effective for surveying for *Cryptobranchus a. alleganiensis* and *A. japonicus* (Foster et al. 2008; Briggler et al. 2013). Even so, we were restricted to trapping discretely, had several traps stolen, and were actively discouraged from actually entering the streams by both locals and governmental officials. These practical challenges significantly limited our trapping efforts. We primarily used two sizes of custom-made, mesh-net rectangular crab traps (approximately 81 × 61 × 28 cm; 61 × 46 × 20 cm) designed to catch *Andrias* of varying sizes. The traps were baited alternatingly with sardines, fishmeal, liver, and sponges soaked in fish oil held in bait containers. Traps were weighted with stones, anchored to shore, and entirely submerged in 0.3 – >5 m of water in suitable habitat. Typically, the traps were placed in still pools along rocky bluffs at the edge of the river and checked after approximately 24 hours. Additionally, baited hook-and-line and manual searches of rocky habitat were used opportunistically when the habitat was suitable.

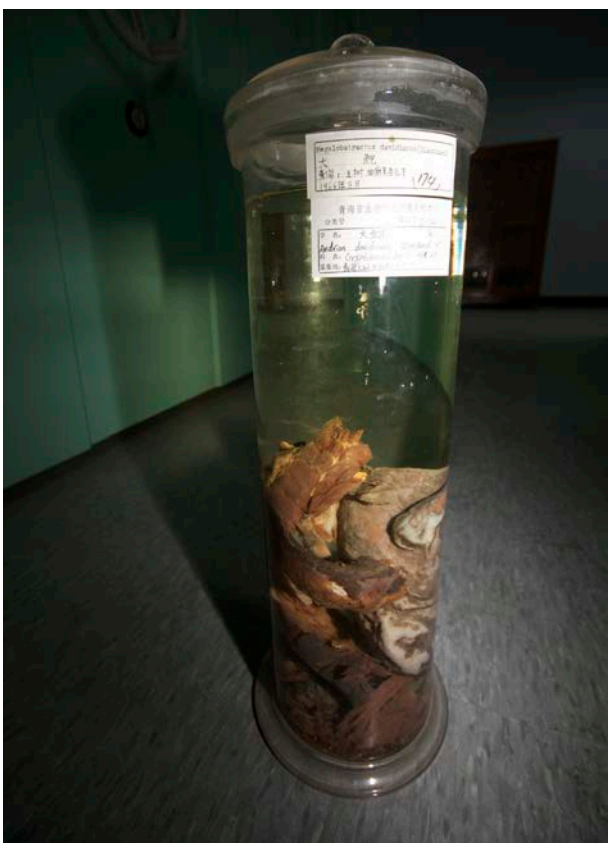

**Fig. 1.** The adult female *Andrias* captured in Qinghai, China in 1966. This specimen now resides at the Northwest Plateau Institute of Biology in Xining.

## Results and Discussion

During our discussions with local people and government officials, we heard several anecdotal reports of *Andrias* being caught in recent years. Local Bureau of Forestry officials and one layman in Qumalai told of an adult *Andrias* that had been caught and thrown back by a fisherman at the same locality as the original record (Trap Locality 9, Figure 2) around 1992. The same officials in Qumalai and several officials in Zhiduo told of an *Andrias* that had been caught in the Nieqia River at its confluence with the Tongtian River in Qumalai (34.016, 95.817) between 1996–1997. This individual was reportedly sent to Xian and sold for food. An official from Zhiduo also reported that this fisherman's brother had caught an *Andrias* in a slow part of the Tongtian River between Zhiduo and Yushu earlier in 2012. Finally, two residents of Yushu reported seeing dead *Andrias* in the Tongtian River after the earthquake of 2010. Only one other species of caudate (*Batrachuperus tibetanus*) is

**Table 1.** Trapping effort in Qinghai. Numbers to right of the location indicate the corresponding points on Fig. 2.

| Date Placed | Traps | Location |
|---|---|---|
| 13 June | 12 | Four tributaries of De Qu River near Bagan (1–4) |
| 13 June | 4 | De Qu River on the road to Bagan (5) |
| 14 June | 5 | Bo Qu River near Bagan (6–8) |
| 14 June | 4 | De Qu River at the bridge in Bagan (9) |
| 15 June | 12 | Four tributaries of De Qu River near Bagan (1–4) |
| 15 June | 1 | De Qu River on the road to Bagan (5) |
| 16 June | 12 | Four tributaries of De Qu River near Bagan (1–4) |
| 16 June | 5 | Upper De Qu River outside of Bagan |
| 17 June | 5 | De Qu River at the bridge in Bagan (9) |
| 19 June | 4 | Tribuatries of Hie Qu River near Zhiduo (10–11) |
| 20 June | 14 | Tribuatries of Hie Qu River near Zhiduo (10–11) |
| 21 June | 14 | Tribuatries of Hie Qu River near Zhiduo (10–11) |
| 26 June | 10 | Tributaries of Tongtian River near Yushu (12) |
| 28 June | 14 | Tributaries of Tongtian River near Yushu (12) |
| **TOTAL** | 116 | |

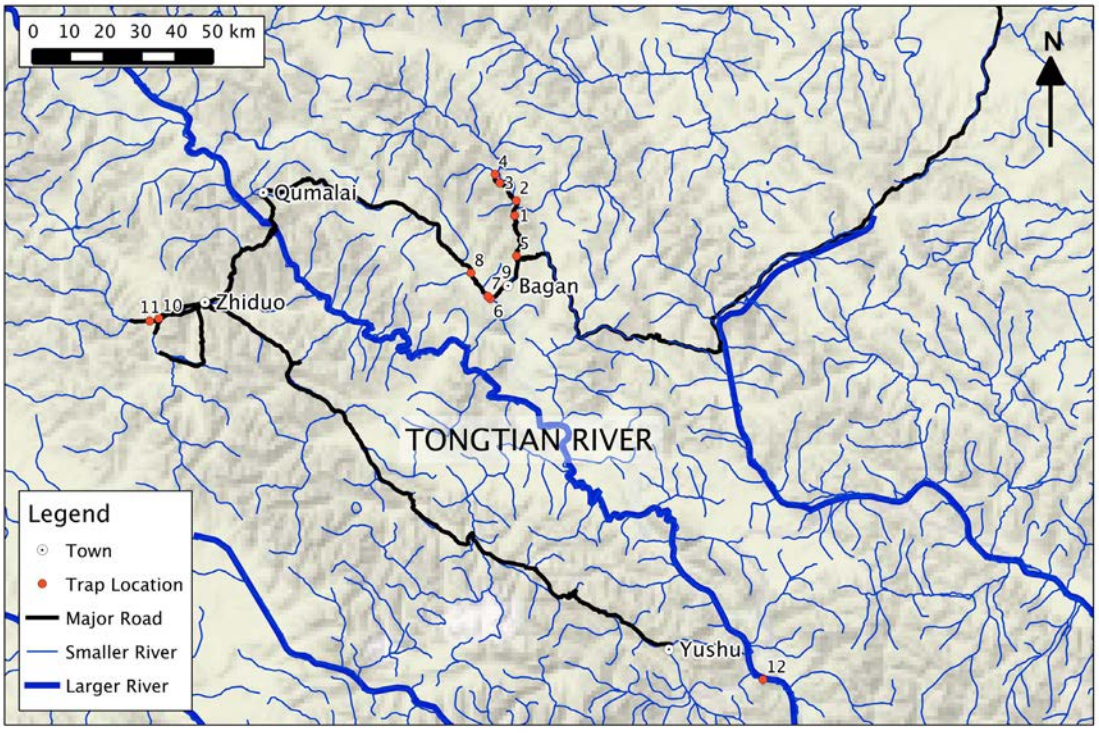


**Fig. 2.** Map of trapping localities and nearby towns in Qinghai.

present in the region, but its limited distribution in Qinghai and small size make it unlikely to have been misidentified as *Andrias* in locals' reports. Although there is no hard evidence to substantiate the reports we heard, when taken in aggregate, they seem credible.

We trapped for 106 trap-nights (Table 1) and were not able to discover any *Andrias* during our field survey of Qinghai. Foster et al. (2008) used a similar trapping protocol and caught *Cryptobranchus a. alleganiensis* at a rate of 0.01–0.10 captures/trap-night. Briggler et al. (2013) trapped for *C. a. alleganiensis* in deeper and more turbid water and reported an average capture rate of 0.042 captures/trap-night with net-mesh traps. We acknowledge that our limited number of trap-nights prevents us from making definitive conclusions about the presence or absence of *A. davidianus* at our trapping sites.

Virtually all of the streams in which we trapped were turbid and swollen with silted water (Fig. 3), which is a major threat to *Andrias* conservation. While it is possible that some of this turbidity was due to seasonal snowmelt, it is more likely that anthropogenic causes are primarily responsible. Since the collection of the lone specimen in 1966, mining for gold and other valuable commodities has become prevalent throughout the Qinghai-Tibetan Plateau. Furthermore, dozens of active sand and gravel mining operations were stationed throughout the rivers we sampled (Fig. 4). Locals in Yushu reported an increase in mining activity in response to construction and reparation needs following the major earthquake of 2010. Additionally, some streamside microhabitats for *Andrias* have been degraded due to road and bridge construction (Fig. 5). Another contributor to the siltation of Qinghai streams may be grassland degradation and desertification driven by climate change that has been demonstrated in the region (Cui and Graf 2009).

## Conclusion

Despite our inability to locate *Andrias* in Qinghai, anecdotal reports suggest that relict populations may still exist throughout the former range of the species. However, the apparent dramatic declines in stream quality in the region probably threaten the persistence of these populations. Although more remote regions further west of Bagan have fewer roads and present more practical challenges to fieldwork, they hold large headwaters of the Yangtze upstream of significant mining activity and may represent the most suitable remaining habitat. While we were not able to survey these regions during our expedition, they should be prioritized in future searches. Because Qinghai is at such a high elevation, suitable conditions for searching occur in a small window each year. We recommend that efforts be focused in August or September, after seasonal flooding from snowmelt has passed, but before winter has returned. In addition to the continued use of trapping, hook-and-line, and manual searches, we recommend the possibility of using environmental DNA, which has been demonstrated to be an effective tool for detecting populations of other cryptobranchids (e.g., Olson et al. 2012; S. Spear, pers. comm.).

Because of the potential importance of this geographically isolated population of *Andrias* in Qinghai, its redis-

**Fig. 3.** The locality where the first and only *Andrias* was collected from Bagan, Qinghai in 1966. Today, the water is turbid and appears largely unsuitable for *Andrias*.

**Fig. 4.** A mining operation on the banks of the Tongtian River, near Qumalai, Qinghai.

**Fig. 5.** Stream bank degradation caused by road construction along the Tongtian River.

covery should continue to be a top priority for *Andrias* conservation.

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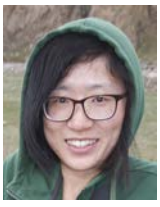

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