Global Re-introduction Perspectives: 2010

Additional case-studies from around the globe

Edited by Pritpal S. Soorae

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Supportive breeding of the Tokyo bitterling in Tochigi Prefecture, Japan

Hitoshi Kubota[1], Katsutoshi Watanabe[2], Tadayuki Sakai[3] & Takeo Takahashi[4]

[1]- Senior Researcher, Tochigi Prefectural Fisheries Experimental Station, Ohtawara, Tochigi 324-0404, Japan (kubotah01@pref.tochigi.lg.jp)
[2]- Associate Professor, Department of Zoology, Graduate School of Science, Kyoto University, Sakyo, Kyoto 606-8502, Japan (watanak@terra.zool.kyoto-u.ac.jp)
[3]- Technical Staff, Tochigi Prefectural Fisheries Experimental Station, Ohtawara, Tochigi 324-0404, Japan (sakait01@pref.tochigi.lg.jp)
[4]- Senior Officer, Nature Preservation Division, Department of Environment and Forestry, Tochigi Prefectural Government, Utsunomiya 320-8501, Japan (takahashit10@pref.tochigi.lg.jp)

Introduction

The Tokyo bitterling (*Tanakia tanago*) is a threatened cyprinid species endemic to the Kanto region of central Honshu, Japan. This species primarily inhabits small brooks and swamps originating from springs scattered along hilly lowlands and alluvial fans, and its past range is thought to have extended throughout the lowlands and hilly lowlands of the Kanto Plain. In recent decades, most of its habitat has been destroyed by human activities, such as urbanization and the improvement of paddy fields. Because this species lays its eggs in the gill chambers of freshwater mussels (commonly Unionidae), declines in mussel populations also critically affect the persistence of bitterling populations. Wild populations are now found only in a few localities in Tochigi and Chiba Prefectures. Due to its drastic habitat loss, this species was designated as a natural monument of Japan in 1974 and listed as an endangered species under the Law for the Conservation of Endangered Species of Wild Fauna and Flora of Japan in 1994. This species was also catalogued as “Critically Endangered” in the Red Data Book of the Environment Agency of Japan and as “Vulnerable” in the IUCN Red List. An on-going supportive breeding program aims to reinforce a wild population in the Tone River, which inhabits a single irrigation ditch (~900 m long, 84 cm mean width) and has declined rapidly in recent years.

This project has been funded by the Environment Agency and the Fisheries Research Agency of Japan.

Tokyo bitterling (*Tanakia tanago*)

Goals

- Goal 1: To increase the number of individuals in the population.
- Goal 2: To produce genetically managed juveniles using information on the genetic relatedness of parent fish.
- Goal 3: To enable the breeding of released individuals in the wild.
- Goal 4: To avoid inbreeding in a small headwater habitat isolated by small weirs.

Success Indicators

- Indicator 1: Population size increases throughout the habitat.
- Indicator 2: The captive breeding is successful, producing juveniles that retain suitable genetic diversity.
- Indicator 3: The genetic diversity of the wild population is maintained or increased, particularly within the upper reach of weirs.

Project Summary

Feasibility: Since 2006, extensive field surveys, including estimations of population size and genetic diversity using microsatellite analyses, have examined the single remaining natural population within the Tone River system. The estimated population size was 104 (± 37 SD) individuals, and the wild population had lower genetic diversity than a captive population founded in 1994 with eight founders (four males and four females) from the natural habitat. The population was fragmented by small weirs within the ditch, and high genetic relatedness was found among individuals within fragments (mean r_{xy}=0.322; half-sibling relation in general). All the available data suggested that this population had been declining recently and that immediate reinforcement of this population was needed. Consequently, we conducted a novel supportive breeding program using wild fish as founders. We did not choose to re-introduce the existing captive population, which had been in captivity for a long period, because it might be adapted to captivity. Mussels for laying eggs are relatively abundant in the ditch, so the increase in breeding fish was believed to have helped to reinforce the population. Facilities and techniques for captive breeding had already been available at Tochigi Prefectural Fisheries Experimental Station.

Typical habitat of the Tokyo bitterling

Implementation: In the autumn of 2007, after the spawning season in the wild, 42 individuals were caught from the habitat and were re-matured using a long photoperiod and warm water temperature treatments. As

field surveys had demonstrated that pairs of fish caught some distance apart had lower genetic relatedness, mates were chosen from more distant sampling sites to avoid mating close relatives. Fifteen pairs were bred in separate aquaria from January to March 2008, and a total of 1,415 (20-150 from each pair) offspring were obtained. Twenty offspring from each family were chosen randomly for re-introduction to equalize family sizes. Ultimately, 296 (four died before release) offspring and parent fish were released throughout the natural habitat in the summer of 2008. No differences in allele frequencies or genetic diversity (heterozygosities) were observed between the re-introduced offspring and the wild population in 2006.

Post-release monitoring in the field

Post-release monitoring: The population has been monitored biannually. In the autumn of 2009, 132 under yearlings and yearlings that newly emerged in the wild (this species lives for 1-2 years) were caught, and the estimated population size was >200 individuals based on catch–mark–recapture data. The average genetic relatedness among individuals isolated above weirs had decreased to an unrelated level (mean r_{xy}=–0.002). These results suggest that natural reproduction was enhanced by the re-introduction and that short-term reinforcement of this population has been achieved. To ensure the long-term persistence of the population, habitat improvement to eliminate factors affecting the recent bottleneck is required.

Major difficulties faced

- The lack of sufficient habitat space to maintain the population: Suitable habitat for the reproduction of this population is restricted to a single 900 m long ditch. Improvement of this habitat is planned to improve the carrying capacity for long -term persistence.
- Difficulties in breeding while maintaining genetic diversity: Although breeding techniques for this species are well established, the breeding method using a large number of mates in separate aquaria was costly and required much manpower. Accordingly, it is difficult to perform this method repeatedly for reinforcing the population, especially with a limited staff.
- Illegal poaching: Poaching of the Tokyo bitterling by aquarists and traders still continues in this habitat. Surveillance of the habitat by the neighborhood association and the police has been conducted to stop poaching.

Aquaria for captive-breeding

- Anonymity of the habitat: Because this habitat has not been disclosed for conservation purposes, it is impossible to attract media interest and to raise public attention.

Major lessons learned

- Advanced scientific field data are essential for making management decisions and planning captive breeding. In particular, genetic data are important for improving the program.
- Using genetic information and advanced breeding techniques, we can provide juveniles that are genetically suitable for release.
- Re-introduction also helps to temporarily resolve the influence of habitat fragmentation on the population.
- Further ecological research should be carried out for future habitat improvement.

Success of project

Highly Successful	**Successful**	Partially Successful	Failure
	√		

Reason(s) for success/failure:

- Reinforcement through the reproduction of released individuals was confirmed.
- Practical genetic management of the captive breeding program was planned and conducted successfully.
- Habitat has not been improved to assure the long-term persistence of the population.