

## Winter flooding provides a habitat for threatened fish and amphibians in a hilly area paddy field

Satoyo Ono & Taisuke Ohtsuka

In 2008, an NGO called Nippon International Co-operation for Community (NICCO) started a program of untilled organic rice farming with winter flooding in a paddy field in a hilly area of Ryuo Town, southeast of Lake Biwa in Japan. This paddy is part of the Lake Biwa Model Farm for sustainable agriculture. It is about 500 m<sup>2</sup> in area, faces a secondary woodland, and is irrigated by a spring-fed stream: such rice paddies are nowadays vulnerable to abandonment of farming.

Together with local residents, we have been observing the organisms in this paddy field continuously since the start of farming. So far, we have found 14 threatened species (13 animals and one plant) designated in the national red list of the Environment Ministry or in the local red list for Shiga Prefecture. Those appearing in the national red list are as follows:

1. *Lefua echigonia*; Japanese eight-barbel loach, endangered.
2. *Hynobius nebulosus*; clouded salamander, vulnerable.
3. *Appasus japonicas*; ferocious water bug, near threatened.
4. *Cipangopaludina chinensis laeta*; mud snail, near threatened.
5. *Ardea intermedia*; intermediate egret, near threatened.
6. *Ricciocarpos natans*; fringed heartwort, near threatened.
7. *Amphiesma vibakari*; Japanese keelback, data deficient.

Those appearing in Shiga Prefecture's red list but not in the national list are:

8. *Rana ornativentris*; montane brown frog, rare.
9. *Sphaerium japonicum*; Japanese fingernail clam, notable.
10. *Rana japonica*; Japanese brown frog, notable.

11. *Pelophylax nigromaculatus*; black-spotted pond frog, notable.

12. *Rhacophorus schlegelii*; Schlegel's green tree frog, notable.

13. *Buergeria buergeri*; kajika frog, notable.

14. *Bambusicola thoracicus*; Chinese bamboo partridge, otherwise important.



*Hynobius nebulosus*; clouded salamander

Upper: An adult in spawning season.

Middle: Egg masses.

Lower: A larva grown in a paddy field.



*Rana japonica*; Japanese brown frog. Left: An adult. Right: An egg mass spawned in a paddy field.

Among these threatened species, the clouded salamander, montane brown frog, Japanese brown frog, and Schlegel's green tree frog usually live in woodlands and use paddy fields for spawning and as nurseries. Their spawning seasons differ depending on species: the two brown frog species usually in February, the clouded salamander in March, and Schlegel's green tree frog in May. Winter flooding of paddy fields adjacent to woodlands, therefore, ensures spawning site for these forest amphibians, especially for brown frogs.

Japanese eight-barbel loaches are frequently found in this paddy field especially after flooding in



*Lefua echigonia*, Japanese eight-barbel loach, associated with juveniles of *Zacco* sp. and *Misgurnus anguillicaudatus* caught in the paddy field after flooding in November.

late autumn. This species mainly inhabit spring-fed wetlands in valleys among hills. Because such places have been mostly destroyed or compromised by land development, the remaining paddy fields irrigated by spring have become a particularly important component of the habitat. While these fish usually use paddy fields for spawning (Kaji & Nagura 2010) and juvenile growth (Mitsuo et al. 2010), our case shows that winter flooding enables adults to overwinter in paddy field as well.

The contribution of winter flooding for biological conservation in our case differs substantially from those of certain lowland paddy fields in the Tohoku region of Japan in the contents; in the latter region, the winter flooding chiefly intends to restore habitats of water birds (cf. Kurechi 2007). Different regional characteristics bring about different results even if is adopted the same approach.

### References

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