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Oncorhynchus mykiss (Walbaum, 1792) (Salmoniformes, Salmonidae), a newly introduced fish recorded in natural freshwaters of Jiuzhaigou Valley, Sichuan, China

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Abstract. The *Oncorhynchus mykiss* is native to areas of the Pacific Ocean in Asian and North America, which in relatively short time has been introduced into at least 45 countries and territories. In some regions, it has established breeding populations in natural habitats and significantly disrupted native ecosystems. The main reason of such a fast invasion is widely introduced as a farmed fish, but escapes from rearing ponds. The case of *O. mykiss* invasion demonstrates the risk of introduced fish, as well as urgent need of more caution and prevention in order to avoid further ecological problems.
Key Words: farmed species, biodiversity, invasive species, *Oncorhynchus mykiss.*

Short Communication. The spreads of invasive introduced species are globally recognized as the second greatest threat to the biodiversity after habitat destruction (Wilcove et al 1998; Pimentel 2002). The invasive introduced fishes in China have been one of the most worried ecological events to environmental threats (EPA 1998; Fang 2000). In the late 19th century, massive amounts of introduced species were introduced into China as farmed fish and aquarium fish. Some alien fishes have achieved remarkable successes in generating both economic and social benefits (e.g., *Oncorhynchus mykiss* and *Tilapia sp.*), while others are causing enormous damage to biodiversity (e.g., *Abbottina rivularis* and *Pseudorasbora parva*).

At the end of 2004, the statistics results of the Ministry of Agriculture The People's Republic of China showed that almost 400 invasive species had set home in mainland China that range from plants to reptiles and micro-organisms. Recent investigations indicate that the numbers of invasive species are increasing about 2 per year in latest 10 years (Wang et al 2009).

The Salmonids of the order Salmoniformes, are found in fresh, brackish and marine water, widely distributed in Northern Hemisphere. There are some 11 genera with about 66 species (Behnke 2002; Nelson 2006). In addition to China, some salmonid species have been widely introduced and are cultivated on all the continents for sports and aquaculture (Yuri et al 2000).

The genus *Oncorhynchus* with 17 species (Nelson 2006) is native to areas of the Pacific Ocean in Asian and North American. The rainbow trout, *O. mykiss*, is one of the most popular farmed fish species and has been introduced into at least 45 countries and territories. Since 1959, this specie has been introduced and is cultivated on many provinces (e.g., Sichuan, Heilongjiang) in China. This invasive fish is reported for the first time in the natural water bodies of Jiuzhaigou Valley, Sichuan, China.

The *O. mykiss* specimens were collected by hand-net in October 2010 during fieldwork on the Wujiao Reserve Survey in the Jiuzhaigou Valley of China. The habitat is located in Majia Township, close to the scenic area of Jiuzhaigou Valley (Sichuan Province), and is a small pool drawing into Bailong River, the headwaters of Jialing River. The specimens were preserved in 10% formalin, labeled individually and preserved at the

College of Life Science, Xihua Normal University in Nachong. *Schizopygopsis kialingensis* Tsao & Tun, 1962 and *Triplophysa robusta* (Kessler, 1876) were also collected from the Majia township. All of these sympatric species except *O. mykiss* are native. The results of this survey showed that *O. mykiss* specimens were abundant in winter.

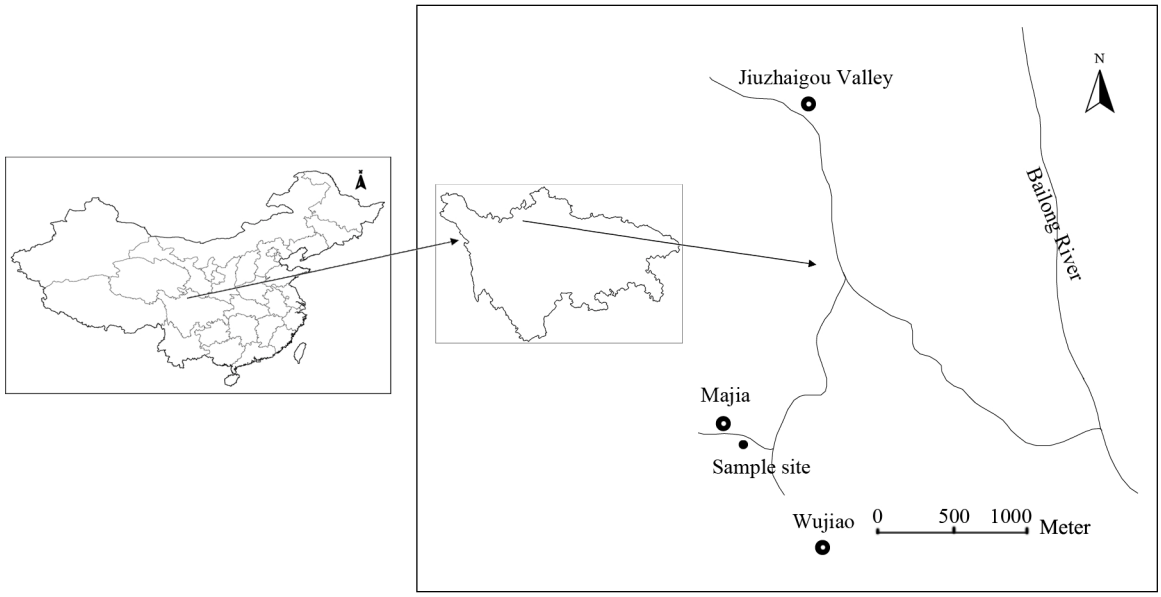

Figure 1. Drainage map of River Bailong with sampling location.

Adult *O. mykiss* has a pink band along the lateral line with small black spots on back, sides, head and fins, thus commonly called as rainbow trout. Body of this fish is fusiform and slightly compressed, with kinds of teeth in upper jaw. Some morphometric and meristic characteristics of the collected specimens are given in Table 1.

The *O. mykiss* was introduced into China as a farmed fish, but is now established breeding populations in natural habitats. The aquatic ecosystems of Jiuzhaigou Valley, climate and water quality offer excellent habitats to at least two indigenous (*S. kialingensis* and *T. robusta*) and one exotic fish species (*O. mykiss*). Now the high economic *O. mykiss* has established in natural habits as a consequence of escapes from rearing ponds.

The *O. mykiss* is easy to propagate, grows rapidly, and therefore has gained popularity amongst fish farmers. However, like the other introduced species, this species may cause irreparable harm to native fishes through disease transmission, predation and competition (Vitousek et al 1997; Taniguchi et al 2000; Helfman et al 2009). Our survey of fish diversity indicated that the reduction of two native fish populations (*S. kialingensis* and *T. robusta*) may be associated with the *O. mykiss* introduction, and the specify reason need more research. Given the increasing introduction of *O. mykiss* and its harm effects to native fish, state and local fisheries sector should focus on prevention, assessment, and management. In addition, it is also important to heighten public awareness of the biodiversity crisis, so as to ensure that they do not release exotic fish into local waters.

Table 1

Morphometrics and meristics of *O. mykiss* specimens collected from Majia township

Fish number	*Sex*	*Gill rakers*	*Lateral Line scales*	*Dorsal Fin rays*	*Anal Fin rays*	*Pelvic Fin rays*	*Pectoral Fin rays*	*Total Length (mm)*	*Standard Length (mm)*	*Head Length (mm)*	*Head Width (mm)*	*Head Depth (mm)*	*Max Body Depth (mm)*	*Min Body Depth (mm)*	*Weight (g)*
1	F	18	124	11	11	10	14	131	109	24	16	22	35	13	24.6
2	F	17	126	11	10	10	14	108	93	19	14.5	17.5	27	10.2	10.7
3	F	17	127	11	12	10	15	153	128	33	18	26	40	15	37.4
4	M	17	125	11	12	11	13	144	119	29	17	25.5	37.5	14	33.9
5	M	16	122	10	13	11	15	146	120	29.5	17.5	23	39	13	32.8
6	F	19	118	13	13	10	16	140	117	26	16.5	25.9	37	14.8	34.9
7	F	15	122	12	12	10	15	134	112	27	16.5	23	38	13	30.6

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