

## ***Argulus coregoni* (Branchiura: Argulidae) parasitic on wild and cultured *Oncorhynchus masou ishikawae* (Salmonidae) in Yamaguchi Prefecture, western Honshu, Japan**

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**Abstract.** The argulid branchiuran *Argulus coregoni* Thorell, 1864 was collected from the body surface of wild anadromous and farmed fluvial individuals of *Oncorhynchus masou ishikawae* Jordan & McGregor, 1925 in Yamaguchi Prefecture, the westernmost prefecture of Honshu Island, Japan. These are the first records of *A. coregoni* from Yamaguchi Prefecture and extend its geographical distributional range in Japan from the neighboring Shimane and Hiroshima prefectures westward to Yamaguchi Prefecture. As fluvial individuals of *O. masou ishikawae* occur more widely and abundantly than anadromous ones in this prefecture, the former fish are considered to serve as the major host for *A. coregoni* in the rivers.

**Key words:** *Argulus coregoni*, Branchiura, distributional range extension, fish parasite, *Oncorhynchus masou ishikawae*, freshwater culture

The argulid branchiuran *Argulus coregoni* Thorell, 1864 is a skin parasite of freshwater fishes in the Northern Hemisphere (Yamaguti, 1963). In Japan, this parasite has been recorded from various species of the family Salmonidae and some species of other families including the families Cyprinidae, Plecoglossidae, Odontobutidae, and Amblycipitidae (e.g., Nagasawa, 2009, 2011; Nagasawa *et al.*, 2014; Nagasawa & Ishikawa, 2015). The geographical distribution of *A. coregoni* has not yet been studied well in Japan, especially in the western part of Honshu, the largest island of Japan. Recently, we collected *A. coregoni* from *Oncorhynchus masou ishikawae* Jordan & McGregor, 1925 (Salmonidae) in rivers (Fig. 1) and at a trout farm in Yamaguchi Prefecture, the westernmost prefecture of Honshu, Japan. These

represent the first records of *A. coregoni* from Yamaguchi Prefecture.

A total of 33 specimens of *A. coregoni* was collected from the body surface of *O. masou ishikawae* in this study. Of these, 18 specimens were taken from wild fish caught in three rivers of two river systems emptying into the Seto Inland Sea: three, one, and one specimens from each of three fish (390, 327, and 370 mm in standard length [SL]) in the Usa River, a tributary of the Nishiki River, at Usago (34°23'14"N, 132°01'35"E), Iwakuni, on 29 August 2013 (one fish) and 3 October 2014 (two fish), respectively; seven, two, two, and one specimens from each of four fish (390, 320, 291, and 270 mm SL) in the Negasa River, a tributary of the Nishiki River, at Hiura (34°10'13"N, 131°57'55"E), Iwakuni, on 18 September 2013 (one fish) and 3 October 2014 (three fish), respectively; and one specimen from one fish

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Fig. 1. Anadromous adult male of *Oncorhynchus masou ishikawae* (327 mm SL) infected with an adult female of *Argulus coregoni* (arrow, 13.0 mm long) on the body surface near the gill operculum. The fish was collected in the Usa River, a tributary of the Nishiki River, Yamaguchi Prefecture, on 3 October 2014. Scale bar: 75 mm.

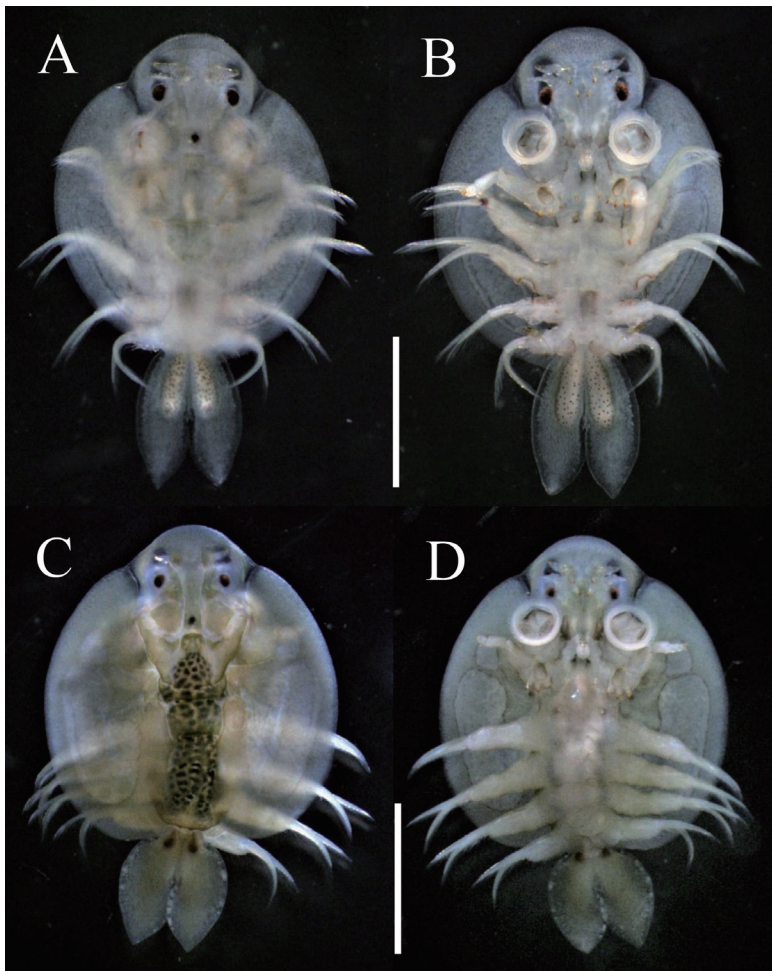


Fig. 2. *Argulus coregoni*, adult male (A and B, 7.1 mm long) and adult female (C and D, 8.3 mm long), NSMT-Cr 25567, from the body surface of *Oncorhynchus masou ishikawae* at a trout farm in Yamaguchi Prefecture on 3 September 2012. A and C, dorsal view; B and D, ventral view. Scale bars: 2 mm in A and B; 3 mm in C and D.

(385 mm SL) in the Shimaji River, a tributary of the Saba River, at Suyama (34°12'02"N, 131°46'30"E), Yamaguchi, on 9 October 2014. Also, 15 specimens of *A. coregoni* were collected from two fish (SL not measured) at a trout farm (34°12'35"N, 131°40'38"E) in Tokuji-Fukadani, Yamaguchi, on 3 September 2012. All these specimens were fixed and preserved in 70% ethanol. Voucher specimens (n=15, from the trout farm) are deposited in the Crustacea (Cr) collection of the National Museum of Nature and Science, Tsukuba, Ibaraki Prefecture (NSMT-Cr 25567). The remaining specimens are retained by the senior author (KN) for future taxonomic work of freshwater *Argulus* spp. from Japan. The scientific names of fishes used in this paper follow those recommended by Nakabo (2013).

The specimens of *A. coregoni* (Fig. 2) examined from the trout farm are 5.0–7.1 (mean 6.2) mm long × 3.0–5.1 (4.1) mm wide in males (n=7) and 3.6–10.8 (8.3) mm long × 2.4–8.2 (5.5) mm wide in females (n=8). Their morphology is in accordance with the descriptions of the species from Japanese freshwater fishes (Tokioka, 1936; Yamaguti, 1937; Hoshina, 1950).

Only four records of *A. coregoni* are available from western Honshu in Japan: three from Shimane Prefecture (Nagasawa & Kawai, 2008, 2016; Nagasawa *et al.*, 2014) and one from Hiroshima Prefecture (Nagasawa *et al.*, 2009). The present collections of *A. coregoni* extend its distributional range from these prefectures westward to Yamaguchi Prefecture. The known hosts in western Honshu are *O. masou ishikawae* (Nagasawa *et al.*, 2009; Nagasawa & Kawai, 2016; this paper), *Oncorhynchus masou masou* (Brevoort, 1856) (Nagasawa & Kawai, 2016), *Salvelinus leucomaenis imbrius* Jordan & McGregor, 1925 (Nagasawa & Kawai, 2008) (all Salmonidae), and *Odontobutis hikimius* Iwata & Sakai, 2002 (Odontobutidae) (Nagasawa *et al.*, 2014). *Argulus coregoni* is also known to infect farmed

salmonids in other regions of Japan (Hoshina, 1950; Shimura, 1983; Nagasawa & Ohya, 1996; Nagasawa *et al.*, 2015).

In Yamaguchi Prefecture, the river populations of *O. masou ishikawae* are composed of two ecologically different individuals, which are anadromous (=sea-migrating) and fluvial (=river-resident) fish, called “satsukimasu” and “amago”, respectively (Fujimura, 1970; Hatama & Ohashi, 2009). The farmed individuals of *O. masou ishikawae* examined in this study were fluvial fish, while, based on their body size, the wild individuals examined are regarded as anadromous adults that returned from the sea or lakes to the rivers in the spring and early summer and stayed there during the following seasons (see Fujimura, 1970; Umino *et al.*, 2001). In Yamaguchi Prefecture, fluvial individuals of *O. masou ishikawae* occur more widely and abundantly than anadromous adults (Katayama & Fujioka, 1966; Hatama & Ohashi, 2009), and those river-resident fish are likely to serve as the major host for *A. coregoni* and sustain the populations of the parasite in the rivers.

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