

A new prefecture record in Japan for a freshwater fish ectoparasite *Argulus coregoni* (Crustacea: Branchiura: Argulidae)

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Abstract

Male and female specimens of *Argulus coregoni* Thorell, 1864 were collected from the body surface of rainbow trout *Oncorhynchus mykiss* (Walbaum, 1792) cultured at a trout farm in Aomori Prefecture, the northernmost prefecture in Honshu, the largest island of Japan. This represents a new prefecture record for *A. coregoni* in Japan. The specimens of *A. coregoni* are characterized by five or six plumose setae near the posterior margin of the first leg coxa and 59–65 supporting rods in the marginal membrane of the first maxilla in both sexes; two protrusions adorned with small spines and one digitiform projection on the ventro- and dorsoposterior margins of the second leg coxa, respectively, in male; and one plumose seta on the posterior margin of that coxa in female. Aomori Prefecture is one of the six prefectures in the Tohoku Region, and the present collection of *A. coregoni* also represents its second record from captive fishes in this region, where it previously infected masu salmon *O. masou masou* (Brevoort, 1856) farmed in Akita Prefecture.

Introduction

Argulus coregoni Thorell, 1864 is an ectoparasite of various freshwater fishes in East Asia and Europe (Nagasawa et al., 2024a). In Japan, since 1936 (Tokiooka, 1936), this species has been reported from various localities on three main islands (Honshu, Shikoku, and Kyushu) (Fig. 1). Recently, specimens of *A. coregoni* were collected from rainbow trout *Oncorhynchus mykiss* (Walbaum, 1792) (Salmoniformes: Salmonidae) cultured at a trout farm in Aomori Prefecture, the northernmost prefecture in Honshu, the largest island of Japan (Fig. 1). So far,

there is no record of *A. coregoni* from this prefecture. Here, the present collection of *A. coregoni* is reported as its new prefecture record in Japan.

Materials and Methods

Two frozen rainbow trout were transported by a fish culturist from a trout farm in Aomori Prefecture to the Aquaparasitology Laboratory, Shizuoka Prefecture, because these fish were found to have skin crustacean parasites. The infected fish were collected on 11 October 2025 and deeply frozen immediately after capture. After they were thawed and measured for their total length (TL, to the nearest 0.1 cm, from the tip of the snout to the extended tip of the caudal fin) at the laboratory, parasites were carefully removed using forceps from the body surface of the fish and fixed in 70% ethanol. These specimens were observed with an Olympus SZX10 stereo microscope and an Olympus BX51 phase-contrast compound microscope. They were recorded for their sex and TL (to the nearest 0.1 mm, from the anterior tip of the carapace to the posterior tip of the abdomen). Two (one male and one female) specimens were cleared in lactophenol and examined using the wooden slide procedure (Humes and Gooding, 1964; Benz and Otting, 1996). Drawings were made with the aid of a drawing tube attached to the compound microscope. Morphological terminology follows Benz et al. (1995) and Benz and Otting (1996). The scientific names of fishes mentioned in this paper follow Motomura (2025), and the order and family of fishes are based on Froese and Pauly (2025). The specimens of *A. coregoni* (12 males and 33 females) have been deposited in the Crustacea collection of the National Museum of Nature and Science, Tsukuba, Ibaraki Prefecture, Japan (NSMT-Cr 33246).

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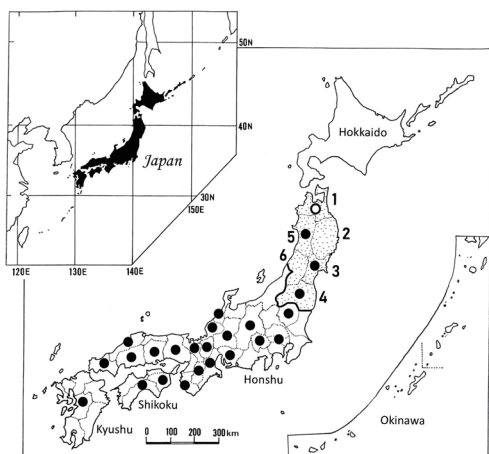


Fig. 1. Map of the Japanese Archipelago, showing the prefectures where *Argulus coregoni* was collected in the previous (closed circles) and present (open circle) studies. The Tohoku Region lies in the northeastern part of Honshu (stippled area) and consists of six prefectures: Aomori, Iwate, Miyagi, Fukushima, Akita, and Yamagata (indicated by numbers 1–6, respectively). A thick line shows the southern boundary of the Tohoku Region. Data on the geographical distribution of *A. coregoni* in Japan are based on Nagasawa et al. (2024a).

Results and Discussion

Two rainbow trout (50.2 and 46.2 cm TL) were each infected with five and 40 crustacean parasites on their body surface. These parasites consisted of 12 adult males [2.7–7.1 (mean, 5.5) mm TL] and 32 adult females [3.2–9.6 (5.7) mm TL].

Description (Figs. 2, 3). *Body* dorsoventrally flattened. *Carapace* nearly circular and covering frontal and lateral portions of thorax. Frontal region of carapace delimited by anterolateral indentations and protruding anteriorly. Paired compound eyes located at level of anterolateral indentations of carapace. Naupliar eye present dorsally at midline of anterior surface of carapace. Posterolateral lobes of carapace separated by sinus and ending in rounded margin. Paired respiratory areas, each consisting of anterior small and posterior large portions, located in lateral regions of carapace. *Thorax* four-segmented; each segment issuing a pair of biramous legs. *Abdomen* bilobed, longer than wide; each lobe slenderer in male than in female. Paired testes and spermathecae located in anterior region of male and female abdomen, respectively.

First leg coxae each with six and six plumose setae near posterior margin in male (Fig. 2C) and five and six setae in female (Fig. 3C). *Second leg coxae* each with two protrusions adorned with small spines and one digitiform projection on ventro- and dorsoposterior margins, respectively, in male (Fig. 2C) and with one

plumose seta on posterior margin in female (Fig. 3C).

First maxillae forming well developed cup-like suckers; marginal membranes of suckers each with 59 and 60 supporting rods in male and 59 and 65 rods in female.

Color in 70% ethanol. Carapace, abdomen, and legs white or yellowish white; compound eyes black; nauplius eye scarcely visible; female thorax yellow, with irregularly shaped dark brown spots unevenly scattered on dorsal surface; respiratory areas fringed by continuous black pigment; testes pale yellow, with small dark brown dots scattered on dorsal and ventral surfaces.

Remarks. The specimens of crustacean parasite collected in this study agree in their morphology with *A. coregoni* reported from Japan (Tokioka, 1936; Yamaguti, 1937; Hoshina, 1950; Nagasawa and Taniguchi, 2021; Nagasawa et al., 2024a; Nagasawa and Nishimura, 2025; Nagasawa and Miyajima, 2025; Nagasawa and Obata, 2025). In particular, the specimens have five or six plumose setae near the posterior margin of each coxa of the first leg and 59 to 65 supporting rods in the marginal membrane of the first maxilla. These numbers correspond to those recorded from *A. coregoni* [three to nine plumose setae (Nagasawa and Miyajima, 2025) and usually 60 and more supporting rods (Nagasawa et al., 2024a)]. Furthermore, the male of this species has been reported to have two protrusions adorned with small spines and one digitiform projection on the ventro- and dorsoposterior margins of the second leg coxa, respectively (Nagasawa et al., 2024a, 2025a; Nagasawa and Nishimura, 2025; Nagasawa and Obata, 2025), and the male specimen examined herein has similar protuberances (Fig. 2C). In contrast, the female specimen examined has one plumose seta on the posterior margin of the second leg coxa (Fig. 3C), and a similar seta has been observed in female *A. coregoni* (Nagasawa and Obata, 2025; Nagasawa et al., 2025b).

In addition to *A. coregoni*, a congeneric species *A. japonicus* Thiele, 1900 also occurs in Aomori Prefecture (Nagasawa et al., 2024b). These two species are morphologically similar (Tokioka, 1965) but *A. japonicus* can be differentiated from *A. coregoni* by having a single plumose seta on the posterior margin of the first leg coxa (Nagasawa and Miyajima, 2025) and 40–52 supporting rods per first maxilla (Nagasawa et al., 2024a).

As stated in the Introduction, the present collection of *A. coregoni* in Aomori Prefecture represents its new prefecture record in Japan. This prefecture is one of the six prefectures (Aomori, Iwate, Miyagi, Fukushima, Akita, and Yamagata) in the Tohoku Region (stippled

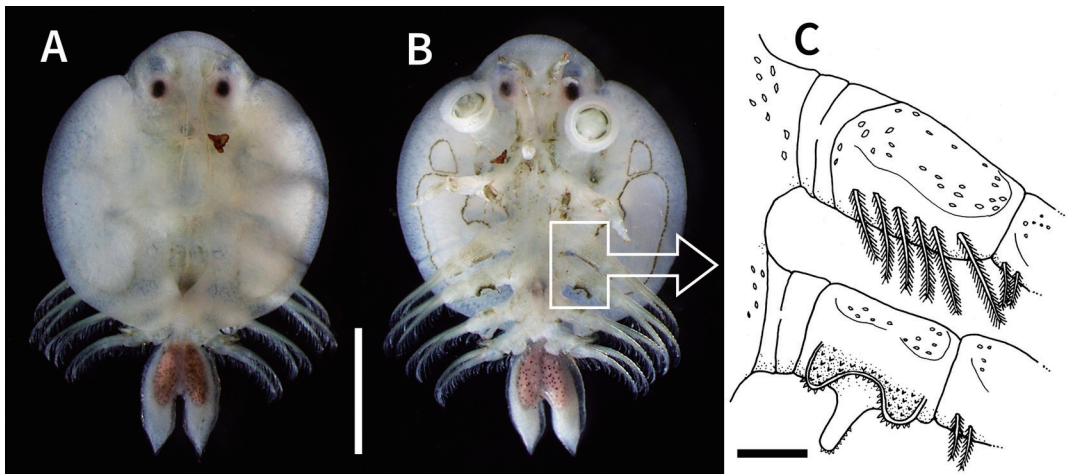


Fig. 2. *Argulus coregoni*, adult male (6.5 mm total length), NSMT-Cr 33246, collected from rainbow trout *Oncorhynchus mykiss* cultured at a trout farm in Aomori Prefecture, northern Japan, on 11 October 2025. A, habitus, dorsal view; B, habitus, ventral view; C, coxae of first and second legs, ventral view. After the specimen of *A. coregoni* was frozen on the day of collection, it was thawed and fixed in 70% ethanol on 13 October 2025, and photographed (A, B) on 21 November 2025. Scale bars: A, B, 2 mm; C, 0.2 mm.

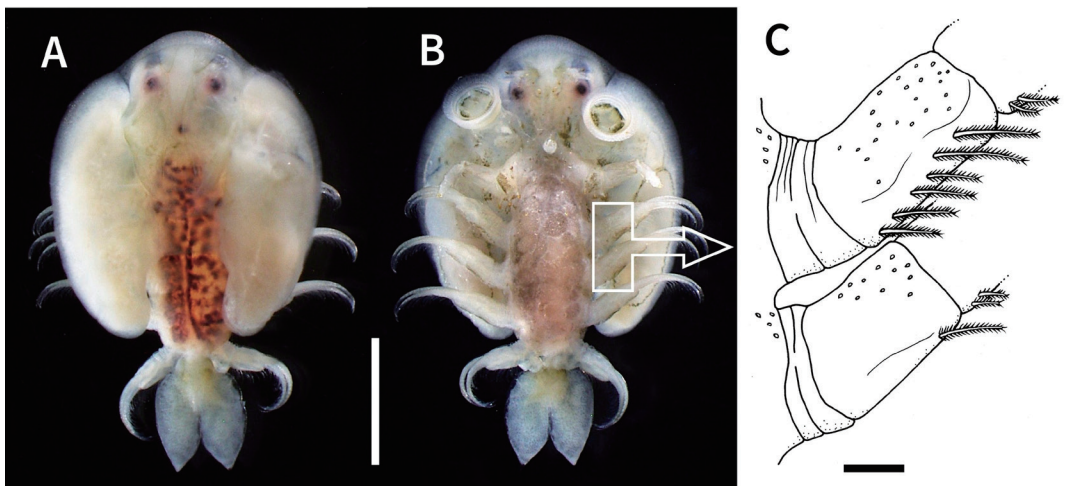


Fig. 3. *Argulus coregoni*, adult female (7.0 mm total length), NSMT-Cr 33246, collected from rainbow trout *Oncorhynchus mykiss* cultured at a trout farm in Aomori Prefecture, northern Japan, on 11 October 2025. A, habitus, dorsal view; B, habitus, ventral view; C, coxae of first and second legs, ventral view. After the specimen of *A. coregoni* was frozen on the day of collection, it was thawed and fixed in 70% ethanol on 13 October 2025, and photographed (A, B) on 21 November 2025. Scale bars: A, B, 2 mm; C, 0.2 mm.

area in Fig. 1). There is one record of *A. coregoni* from captive fishes in this region, where the parasite was previously found to infect masu salmon *Oncorhynchus masou masou* (Brevoort, 1856) (Salmoniformes: Salmonidae) farmed in Akita Prefecture (Nagasawa et al., 2020). Thus, the finding of *A. coregoni* from cultured rainbow trout in this study represents its second record from captive fishes in the Tohoku Region as well. As reviewed by Nagasawa and Yuasa (2020), this parasite is known to infect salmonids and ayu *Plecoglossus altivelis altivelis* (Temminck and Schlegel, 1846) (Salmoniformes: Plecoglossidae)

reared at various localities in central and western Japan.

Argulus coregoni also has so far been collected from wild fishes in three prefectures of the Tohoku Region, i.e., Akita (Nagasawa et al., 2019, 2020; Nagasawa and Sato, 2023, 2025), Fukushima (Nagasawa and Ishikawa, 2015), and Miyagi (Nagasawa et al., 2023). The hosts reported from Akita and Fukushima Prefectures are five species, consisting of ayu, torrent catfish *Liobagrus reinii* Hilgendorf, 1878 (Siluriformes: Amblycipitidae), whitespotted charr *Salvelinus leucomaenis leucomaenis* (Pallas, 1814),

masu salmon (Salmoniformes: Salmonidae), and Sakhalin redfin *Pseudaspius sachalinensis* (Nikolskii, 1889) (Cypriniformes: Leuciscidae) (Nagasawa and Ishikawa, 2015; Nagasawa et al., 2019, 2020; Nagasawa and Sato, 2023, 2025). In Miyagi Prefecture, a specimen of *A. coregoni* was found on a Japanese barbel *Hemibarbus barbus* (Temminck and Schlegel, 1846) (Cypriniformes: Gobionidae) kept in a tank containing over 170 individuals of six fish species collected from a river, but it was impossible to determine a true wild host of the parasite (Nagasawa et al., 2023). Although as many as 59 species of freshwater fishes are found in Aomori Prefecture (Takeuchi et al., 1985), nothing is known about wild fish hosts of *A. coregoni* in this prefecture, and it is desirable to examine various freshwater fishes for the occurrence of the parasite in order to understand its host utilization in the wild.

To date, *A. coregoni* has not been recorded from Hokkaido, which is one of the four main islands and the northernmost prefecture of Japan (Fig. 1). Nevertheless, this parasite is likely to occur in Hokkaido because it was recorded from Sakhalin, an island of the Russian Far East north of Hokkaido (Sokolov et al., 2012).

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