

Ectoparasitism by a fish louse on a stream-dwelling tadpole of *Buergeria buergeri* (Anura: Rhacophoridae) in Japan

AKIHIRO NODA

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record.

Please cite this article as:

Noda, A. (2026): Ectoparasitism by a fish louse on a stream-dwelling tadpole of *Buergeria buergeri* (Anura: Rhacophoridae) in Japan. *Acta Herpetol.* **21**. DOI: 10.36253/a_h-19686

**Ectoparasitism by a fish louse on a stream-dwelling tadpole of *Buergeria buergeri*
(Anura: Rhacophoridae) in Japan**

AKIHIRO NODA^{1,*}

¹ *Kyoto University, Division of Biological Science, Graduate School of Science, Oiwake-cho,
Sakyo-ku, Kyoto 606-8502, Japan.*

*Corresponding author. E-mail: noda.tadpole@gmail.com

Short running title: Fish louse parasitism in a stream-dwelling tadpole

Submitted on: 2026, 19th January; revised on: 2025, 7th July; accepted on: 2026, 13th July.

Editor: Maria Torres Sánchez

Abstract.

Stream-dwelling anuran larvae may be exposed to ectoparasites originating from sympatric fishes, yet such interactions are rarely documented. During laboratory rearing of tadpoles of the Kajika frog *Buergeria buergeri*, collected from a stream in central Japan, a fish louse was found attached to the dorsal body of a tadpole. The parasite was identified as a male *Argulus coregoni* based on diagnostic morphological characters. An attachment site was observed on the tadpole after removal of the parasite, but the individual subsequently completed metamorphosis without apparent abnormalities. *A. coregoni* is a widespread freshwater ectoparasite that primarily parasitizes salmonid fishes but is known to exhibit low host specificity. Although several species of *Argulus* have been reported as ectoparasites of amphibians, published field records have so far been limited to ranid and hylid hosts. The present observation appears to represent the first published record of *A. coregoni* parasitizing an anuran tadpole and extends the known amphibian host range of *Argulus* to a stream-dwelling rhacophorid species. Because salmonid fishes are frequently stocked in Japanese rivers, human-mediated introductions may increase opportunities for contact between fish-associated ectoparasites and non-fish hosts.

Keywords. Anura, Branchiura, fish stocking, Kajika Frog, lotic environment, opportunistic parasitism

The genus *Buergeria* Tschudi, 1838 is a small anuran clade restricted to East Asia, occurring only in Taiwan, Hainan Island (China), and the Ryukyu Islands to Honshu (Japan), and currently comprises six recognized species (Frost, 2025). Among them, the Kajika frog *Buergeria buergeri* (Temminck and Schlegel, 1838), which is distributed on the main island of Honshu, Japan, breeds in mountain streams. Its tadpoles live among pebbles on the streambed and graze on periphytic algae attached to rock surfaces (Matsui and Maeda, 2018). During laboratory rearing of stream-dwelling tadpoles collected in central Japan, I observed a fish louse, *Argulus coregoni* Thorell, 1864, attached to the dorsal body of a *B. buergeri* tadpole. This observation represents a previously undocumented case of ectoparasitism on a stream-dwelling rhacophorid tadpole in Japan.

On 16 July 2020, I collected tadpoles of *B. buergeri* using an aquarium fish net from the Kiyotaki River, Kyoto, Japan (35°03'19" N, 135°40'22" E). After collection, the tadpoles were reared in the laboratory at Kyoto University for use in a separate experiment. On 23 July 2020, I found a fish louse attached to the dorsal body of a tadpole at Gosner stage 39 (Gosner, 1960). During the rearing period, only tadpoles were kept in the tank, and tap water was used for water changes. In addition, the tank had been thoroughly cleaned and disinfected with a chlorine-based bleach prior to rearing. These conditions make post-collection contamination unlikely, suggesting that the ectoparasite was most likely introduced together with the tadpole at the time of capture. The parasite was carefully removed from the tadpole, preserved in 99%

ethanol, and subsequently photographed under a stereomicroscope (Fig. 1). After removal of the parasite, an attachment site on the body of the tadpole was observed (Fig. 2), but the individual subsequently completed metamorphosis without apparent abnormalities.

The parasite observed on the tadpole was identified as a male *Argulus coregoni*. In Japan, six species in the genus *Argulus* have been recorded from freshwater environments (Nagasawa, 2009; 2023; Nagasawa et al., 2022), allowing reliable identification based on diagnostic morphological characters. The specimen was identified as male based on the presence of paired testes and was assigned to *A. coregoni* by the presence of a digitiform process on the dorsoposterior margin of the second thoracopod and the number of plumose setae on the posterior margin of the coxa of the first leg (Tokioka, 1965; Neethling and Avenant-Oldewage, 2016; Nagasawa and Miyajima, 2025). The specimen measured approximately 3.9 mm in total body length using a ruler after preservation in 99% ethanol; therefore, this value may have been affected by shrinkage due to preservation. Identification was based on diagnostic morphological characters visible in photographs, but the specimen is no longer available for deposition in a permanent collection. The absence of a voucher specimen therefore limits future verification of this record.

Species of the genus *Argulus*, commonly known as fish lice, are branchiuran crustaceans of the family Argulidae and obligate aquatic ectoparasites that primarily parasitize fishes (Kabata, 1988; Poly, 2008). They attach to the host's body surface using specialized

appendages and feed on blood, tissue fluids, and surface mucus (Watermolen, 2019; Weng et al., 2025). Within the genus, *A. coregoni* is distributed in China, Eastern Russia, Europe, and Japan (Nagasawa and Kawai, 2008) and is most frequently reported from freshwater salmonids in Japan (Nagasawa, 2009), including ayu (*Plecoglossus altivelis*) and Japanese char (*Salvelinus leucomaenis*). Although this species primarily parasitizes fishes, previous studies have shown that *A. coregoni* exhibits low host specificity, particularly during early developmental stages (Mikheev et al., 2004; 2007; Neethling and Avenant-Oldewage, 2016), and it has occasionally been reported from non-salmonid fishes in Japan (Nagasawa et al., 2014; 2024; Nagasawa and Ishikawa, 2015; Nagasawa and Taniguchi, 2021; Nagasawa and Nishimura, 2025). In this context, the present observation demonstrates that stream-dwelling anuran larvae such as *B. buergeri* may also be exposed to opportunistic ectoparasitism in lotic environments.

Several species of the genus *Argulus* have previously been reported as ectoparasites of amphibians. Seven species (*A. americanus*, *A. diversus*, *A. hylae*, *A. japonicus*, *A. ventanensis*, *A. ambystoma*, and *A. foliaceus*) are known to parasitize amphibians, of which the first five species have been recorded from anuran larvae (Watermolen, 2019; dos Anjos et al., 2021). The present observation appears to represent the first published record of *Argulus coregoni* parasitizing an anuran tadpole. Published field records of *Argulus* parasitizing amphibians have so far involved hosts from the families Ranidae and Hylidae, and comparable observations from

rhacophorid tadpoles, including *B. buergeri*, have not been reported. This observation therefore extends the known amphibian host range of *Argulus* to a stream-dwelling rhacophorid species.

Because freshwater salmonids frequently inhabit the same lotic environments, *A. coregoni*, which primarily parasitizes salmonid fishes, may occasionally encounter and opportunistically utilize stream-dwelling tadpoles as hosts. The Kiyotaki River, where the tadpole was collected, is a tributary of the Hozu River, from which *A. coregoni* has previously been reported. A fish louse described from ayu in the Hozu River as *A. plecoglossi* by Yamaguchi (1937) was later regarded as a junior synonym of *A. coregoni* (Tokiooka, 1965; Nagasawa, 2009), suggesting that this parasite likely also occurs in the Kiyotaki River. In addition, ayu and amago trout (*Oncorhynchus masou ishikawae*), the principal hosts of this louse (Nagasawa and Yuasa, 2020), are frequently released into the river system through fish stocking (Kawamura et al., 2007; Hasegawa, 2020). Human-mediated movements of fish for stocking and fisheries management have long been considered a possible route for the dissemination of fish parasites, although their importance may vary among systems (Kennedy et al., 1991; Buchmann, 2022). Although the origin of the individual observed here cannot be determined without molecular data, stocking of suitable fish hosts may increase local opportunities for contact between fish-associated ectoparasites and non-fish hosts, including stream-dwelling tadpoles. Thus, regardless of whether the parasite was native to or introduced into the river system, the present observation suggests that interactions between fish-associated

ectoparasites and stream-dwelling amphibian larvae may occur in natural stream habitats but have been overlooked.

Further field studies are needed to evaluate how often *A. coregoni* infests tadpoles in natural stream environments and to assess the potential consequences of such infestations for larval growth, survival, and population dynamics. It also remains unclear whether tadpoles represent only incidental hosts or whether such host use can support any part of the parasite's life cycle. From a management perspective, monitoring ectoparasites on stocked and resident fishes may help clarify whether fish stocking alters opportunities for contact between fish-associated parasites and sympatric amphibian larvae in stream ecosystems.

REFERENCES

- Buchmann, K. (2022): Control of parasitic diseases in aquaculture. *Parasitology* **149**: 1985–1997.
- dos Anjos, C.S., de Souza, F.C., Costa, G.N., de Oliveira Malta, J.C., Zuanon, J.A.S. (2021): Tadpoles of *Boana geographica* (Spix, 1824) (Anura: Hylidae) parasitized by *Argulus* sp. (Branchiura: Argulidae) in a Central Amazonia forest stream. *Herpetol. Notes* **14**: 335-339.
- Frost, D.R. (2025): Amphibian Species of the World: an Online Reference. Version 6.2 (18 December 2025). Electronic Database accessible at <https://amphibiansoftheworld.amnh.org/index.php>. American Museum of Natural History, New York, USA. Captured on 18 December 2025.
- Gosner, K.L. (1960): A simplified table for staging anuran embryos and larvae with notes on identification. *Herpetologica* **16**: 183-190.
- Hasegawa, K. (2020): Invasions of rainbow trout and brown trout in Japan: A comparison of invasiveness and impact on native species. *Ecol. Freshw. Fish* **29**: 419-428.
- Kabata, Z. (1988): Copepoda and Branchiura. In: Guide to the parasites of fishes of Canada. Part II—Crustacea, pp. 3-127. Margolis L., Kabata Z., Eds.
- Kawamura, K., Kubota, M., Furukawa, M., Harada, Y. (2007): The genetic structure of endangered indigenous populations of the amago salmon, *Oncorhynchus masou ishikawae*, in Japan. *Conserv. Genet.* **8**: 1163-1176.

123 Kennedy, C.R., Hartvigsen, R., Halvorsen, O. (1991): The importance of fish stocking in the
 124 dissemination of parasites throughout a group of reservoirs. *J. Fish Biol.* **38**: 541-552.
 125 Matsui, M., Maeda, N. (2018): Encyclopedia of Japanese frogs. Shinjuku, Tokyo. Bun-ichi Co.,
 126 Ltd.
 127 Mikheev, V.N., Pasternak, A.F., Valtonen, E.T. (2004): Tuning host specificity during the
 128 ontogeny of a fish ectoparasite: Behavioural responses to host-induced cues. *Parasitol. Res.*
 129 **92**: 220-224.
 130 Mikheev, V.N., Pasternak, A.F., Valtonen, E.T. (2007): Host specificity of *Argulus coregoni*
 131 (Crustacea: Branchiura) increases at maturation. *Parasitology* **134**: 1767-1774.
 132 Nagasawa, K. (2009): Synopsis of branchiurans of the genus *Argulus* (Crustacea, Argulidae),
 133 ectoparasites of freshwater and marine fishes, in Japan (1900-2009). *Bull. Biogeogr. Soc.*
 134 *Jpn.* **64**: 135-148.
 135 Nagasawa, K. (2023): First Japanese record of *Argulus nobilis* (Crustacea: Branchiura:
 136 Argulidae), an ectoparasite of gars of North American origin. *Species Divers.* **28**: 205-215.
 137 Nagasawa, K., Asayama, T., Fujimoto, Y. (2022): Redescription of *Argulus mongolianus*
 138 (Crustacea: Branchiura: Argulidae), an ectoparasite of freshwater fishes in East Asia, with
 139 its first record from Japan. *Species Divers.* **27**: 167-179.
 140 Nagasawa, K., Ishikawa, T. (2015): *Argulus coregoni* (Branchiura: Argulidae) parasitic on the
 141 torrent catfish *Liobagrus reini* in Japan. *Biogeogr.* **17**: 99-102.

142 Nagasawa, K., Kawai, K. (2008): New host record for *Argulus coregoni* (Crustacea:
 143 Branchiura: Argulidae), with discussion on its natural distribution in Japan. Biosphere
 144 Science **47**: 23-28.

145 Nagasawa, K., Kuwabara, T., Nakano, H. (2014): *Odontobutis hikimius* (Perciformes:
 146 Odontobutidae), a new host for *Argulus coregoni* (Crustacea: Branchiura: Argulidae).
 147 Biosphere Science **53**: 33-36.

148 Nagasawa, K., Miyajima, N. (2025): *Argulus coregoni* (Crustacea: Branchiura: Argulidae)
 149 parasitic on a freshwater minnow *Opsariichthys platypus* (Cypriniformes: Xenocyprididae)
 150 in a low-elevation stream in Kyushu, Western Japan. Species Divers. **30**: 147-154.

151 Nagasawa, K., Nishimura, H. (2025): Infection of cypriniform fishes with *Argulus coregoni*
 152 (Crustacea: Branchiura: Argulidae) in a low-elevation stream, central Japan. Species Divers.
 153 **30**: 1-9.

154 Nagasawa, K., Taniguchi, R. (2021): Second record of *Argulus coregoni* (Branchiura:
 155 Argulidae) from acheilognathine fish (Cyprinidae): Its infection of an oily bitterling *Tanakia*
 156 *limbata* in central Japan. Taxa, Proc. Japan. Soc. Syst. Zool. **51**: 29-37.

157 Nagasawa, K., Uchiyama, R., Tomikawa, K. (2024): *Argulus coregoni* (Crustacea: Branchiura:
 158 Argulidae) parasitic on a dark chub *Nipponocypris temminckii* (Cypriniformes:
 159 Xenocyprididae) in a stream, central Japan, with a list of its known hosts in East Asia.
 160 Species Divers. **29**: 181-197.

161 Nagasawa, K., Yuasa, A. (2020): The fish louse *Argulus coregoni* from *Oncorhynchus masou*
162 *ishikawae* (Salmonidae) cultured in Shikoku, western Japan, with a list of occurrence
163 records of *A. coregoni* from fishes reared in Japan. Crustacean Research **49**: 1-8.

164 Neethling, L.A.M., Avenant-Oldewage, A. (2016): Branchiura - a compendium of the
165 geographical distribution and a summary of their biology. Crustaceana **89**: 1243-1446.

166 Poly, W.J. (2008): Global diversity of fishlice (Crustacea: Branchiura: Argulidae) in Freshwater.
167 Hydrobiologia **595**: 209-212.

168 Tokioka, T. (1965): *Argulus coregoni* Thorell. In: New illustrated encyclopedia of the fauna of
169 Japan, Part I, pp. 503–504. Okada, Y., Uchida, S., Eds, Uchida, T.

170 Watermolen, D.J. (2019): Crustacean ectoparasites of amphibians. Bull. Chic. Herpetol. Soc.
171 **54**: 85-91.

172 Weng, M., Liu, X., Zhang, C., Shu, R., Wang, A., Zhang, H., Wang, X., Yang, H., Zhang, J.
173 (2025): A global review of the zoonotic potential and disease risks of amphibian parasites
174 in bullfrog aquaculture. Rev. Aquac. **17**: e70030.

175 **Fig. 1.** Ventral view of a male *Argulus coregoni* collected on a tadpole of the Kajika frog
176 *Buergeria buergeri*. Scale bar = 1.0 mm. The approximate scale bar was added based on the
177 measured total body length of the specimen after preservation in 99% ethanol (3.9 mm).

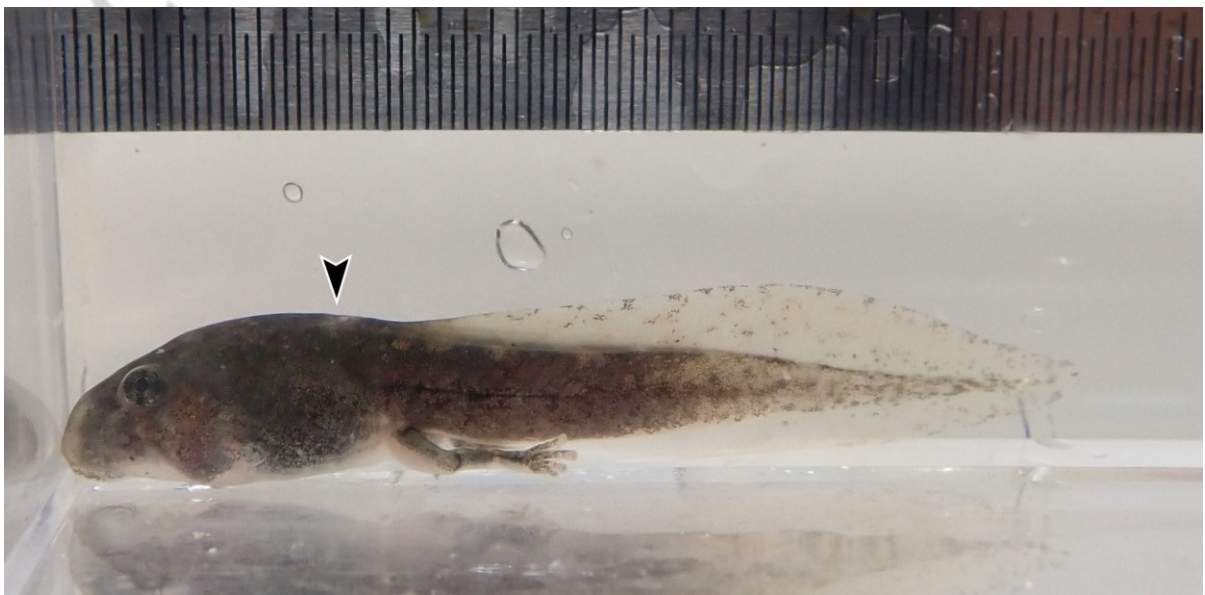
178

179 **Fig. 2.** Attachment site (arrow) on the dorsal side of a tadpole of *Buergeria buergeri* after
180 removal of *Argulus coregoni*.

181



182



183