

***Nerocila japonica* (Isopoda: Cymothoidae) parasitic on
a Japanese seabass, *Lateolabrax japonicus* (Lateolabracidae),
from the Pacific coast of central Japan,
with a review of the geographical distribution
of the isopod in Japan and East Asia**

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■ **Abstract**

An ovigerous female of *Nerocila japonica* Schioedte and Meinert, 1881, was found to parasitize the pectoral fin of a Japanese seabass, *Lateolabrax japonicus* (Cuvier, 1828), caught on the Pacific coast of Shizuoka Prefecture, central Japan. This represents the third record of *N. japonica* from the Pacific coast of central Japan. This paper also reviews the geographical distribution of *N. japonica* in East Asia including Japan and reveals that the species occurs in coastal tropical to temperate waters in this region and its distribution along the coast of Japan is strongly affected by a warm current, the Kuroshio and its branch, the Tsushima Current.

■ **Introduction**

Isopods of the cymothoid genus *Nerocila* are skin parasites of marine fishes (Bruce, 1987). To date, two valid species of the genus are known to occur in Japanese waters: *N. japonica* Schioedte and Meinert, 1881 (see Yamauchi and Nagasawa, 2012) and *N. phaiopleura* Bleeker, 1857 (see Nagasawa and Isozaki, 2017). *Nerocila japonica* was originally described by Schioedte and Meinert (1881) based on material from Japan. The species was recently redescribed by Yamauchi and Nagasawa (2012) using the holotype

and many specimens from Japan. It has also been reported from China (Yu and Li, 2003) and Malaysia (Nierstrasz, 1918).

Nerocila japonica uses a variety of actinopterygian fishes as hosts. In Japan, the species has been found from 19 species of coastal and brackish-water wild fishes belonging to the following 12 families and 4 orders: 1 sp. in the Cyprinidae (Cypriniformes); 3 spp. in the Mugilidae (Mugiliformes); 1 sp. in the Triglidae, 1 sp. in the Latidae, 2 spp. in the Lateolabracidae, 2 spp. in the Sparidae, 1 sp. in the Terapontidae, 2 spp. in the Embiotocidae, 3 spp. in the Gobiidae, 1 sp. in the Labridae (Perciformes); 1 sp. in the Monacanthidae and 1 sp. in the Molidae (Tetraodontiformes) (Momoyama and Tensha, 2006; Hashimoto, 2007; Yamauchi and Nagasawa, 2012; Hata et al., 2017; Nagasawa and Kawai, 2018). The species is also known to parasitize farmed Kuromejina, *Girella leonina* (Richardson, 1846) (Kyphosidae: Perciformes), in Japan (Nagasawa et al., 2018).

The two lateolabracid hosts of *N. japonica* are Japanese seabass, *Lateolabrax japonicus* (Cuvier, 1828), and blackfin seabass, *Lateolabrax latus* Katayama, 1957 (Yamauchi and Nagasawa, 2012). Since the 2000s, we have conducted a parasitological survey of these lateolabracids in coastal waters of Japan and have so far found, in addition to *N. japonica*, three species of dactylogyrid monogeneans (Nitta and Nagasawa, 2014, 2015) and one species of piscicolid leech (Nagasawa et al., 2009) from Japanese seabass. Recently, we collected *N. japonica* from a Japanese seabass in coastal Pacific waters of Shizuoka Prefecture, central Japan. This paper reports on this collection

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Fig. 1. A, Right pectoral fin of *Lateolabrax japonicus* infected by an ovigerous female of *Nerocila japonica*, fresh specimen; B, *N. japonica*, ovigerous female, dorsal view, ethanol-fixed specimen. Note a slightly hemorrhagic wound (arrow) near the cephalon of *N. japonica* on the pectoral fin. Scale bars: A, 10 mm; B, 5 mm.

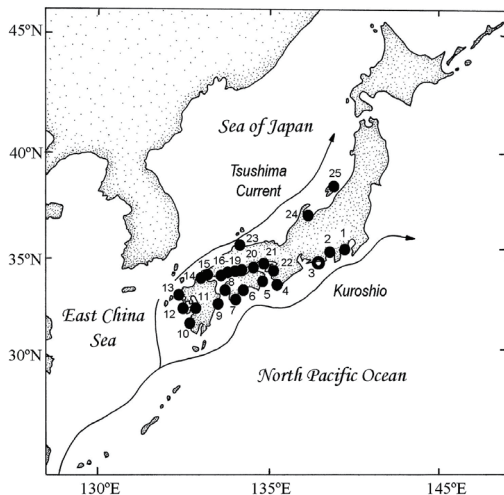


Fig. 2. Map of the Japanese Archipelago, showing the localities (1–25) where *Nerocila japonica* was collected in the previous (closed circles) and present (open circle) studies. 1, Unspecified locality, Kanagawa; 2, Mouth of Hatauchi River, Shizuoka; 3, Outlet of Lake Hamana, Shizuoka; 4, Shirahama, Wakayama; 5, Nasa Bay, Tokushima; 6, Kochi, Kochi; 7, Iburu, Kochi; 8, Uwa Sea, Ehime; 9, Mongawa Bay, Miyazaki; 10, Kasasa and Minamisatsuma, Kagoshima; 11, Yatsushiro, Kumamoto; 12, Tomioka, Kumamoto; 13, Mouth of Saza River, Nagasaki; 14, Kanda Port, Fukuoka; 15, Unspecified locality, Yamaguchi; 16, Hiroshima Bay, Hiroshima; 17, Shimo-kamagari Island and Kawajiri, Hiroshima; 18, Okurokami Island, Hiroshima; 19, Onomichi Fish Market, Hiroshima; 20, Tamano, Okayama; 21, Himeji, Hyogo; 22, Sakai and Misaki, Osaka; 23, Lake Nakaumi, Shimane; 24, Uozu, Namerikawa, and Himi, Toyama; 25, Sado Island, Niigata. Localities data are based on Honma et al. (1974), Nunomura (1981), Sato (2001), Momoyama and Tensha (2006), Hashimoto (2007), Yamauchi and Nagasawa (2012), Hata et al. (2017), Nagasawa and Kawai (2018), and this paper. The routes of the Kuroshio and its branch, the Tsushima Current, are also shown.

and, based on the literature published between 1918 and 2019, reviews the geographical distribution of *N. japonica* in Japanese and East Asian waters.

Materials and Methods

Five Japanese seabass were caught using rod and line on the Pacific coast ($34^{\circ}41'39.0''\text{N}$, $137^{\circ}35'12.9''\text{E}$, locality 3 in Fig. 2) at the outlet of the brackish-water Lake Hamana, Hamamatsu, Shizuoka Prefecture, on 6 June 2019. The fish were immediately transferred in an ice box to the National Research Institute of Far Seas Fisheries, Shimizu, Shizuoka Prefecture, where they were examined by the naked eye for macroparasites on the body surface and fins. One isopod was found, removed carefully from attachment site, and fixed in 70% ethanol. Later, at the Aquaparasitology Laboratory, this isopod was examined for its morphology and identified as *N. japonica*. The isopod specimen is retained by the first author (KN) for a taxonomic study of cymothoid isopods from Japanese fishes but will be deposited in the Crustacea collection of the National Museum of Nature and Science, Tsukuba, Ibaraki Prefecture. The scientific and common names of fishes mentioned in this paper follow Froese and Pauly (2019).

Results and Discussion

One (70 cm in total length) of the five Japanese seabass examined was found to be parasitized by an ovigerous female of *N. japonica* (26.5 mm in total length, 13.8 mm in greatest width) on the inner side of the right pectoral fin (Fig. 1). The dorsal surface of the female was black when fresh and in alcohol. While the

central posterior portion of the pleotelson was damaged and lost, morphological features of the female are in accordance with those of *N. japonica* redescribed by Yamauchi and Nagasawa (2012).

A slightly hemorrhagic wound was found near the cephalon of *N. japonica* (Fig. 1A, arrow). Similar wounds were observed at attachment sites of *N. japonica* on the caudal fin of eastern keelback mullet, *Planiliza affinis* (Günther, 1861) (reported as *Liza affinis*) (Mugilidae), from Nagasaki Prefecture (Yamauchi and Nagasawa, 2012), and on the dorsal fin of big-scaled redfin, *Tribolodon hakonensis* (Günther, 1877) (Cyprinidae), Hiroshima Prefecture (Nagasawa and Kawai, 2019). The wounds in the present and previous cases were, most probably, formed by the feeding activity of *N. japonica* and insertion of its pereopod dactyli.

The collection localities of *N. japonica* in Japanese waters are shown in Fig. 2 based on the literature published between 1974 and 2019 (see the figure caption). The species is distributed in coastal waters of the western North Pacific Ocean along central and western Japan (localities 1–9 in Fig. 2), those of the East China Sea along western Kyushu (localities 10–13 in Fig. 2), and those of the Sea of Japan along western and central Japan (localities 23–25 in Fig. 2). It is also found in the Seto Inland Sea (localities 14–22 in Fig. 2). A warm current, the Kuroshio, and its branch, the Tsushima Current, flow off western and central Japan (Fig. 2), and part of the waters of these currents intrudes into the Seto Inland Sea through two channels open to the western North Pacific and one strait to the Sea of Japan (Hayami and Unoki, 1970). This indicates that the geographical distribution of *N. japonica* along the Japanese coast is strongly affected by the two currents. There is no record of the species from the coast of Hokkaido and northeastern Honshu, northern Japan, affected by a cold current, the Oyashio. The species has not been reported from subtropical waters off the Ryukyu Islands, southern Japan (Williams et al., 1996; Nagasawa and Fujimoto, 2018), but it is known in subtropical waters off Fujian Province, China (Yu and Li, 2003) and tropical waters at Penang, Malaysia (Nierstrasz, 1918). Thus, based on its known distributional records, *N. japonica* is regarded as a species occurring in coastal tropical to temperate waters of East Asia.

The present collection of *N. japonica* (locality 3 in Fig. 2) represents its third record from the Pacific coast of central Japan, where it was previously reported from blackhead seabream, *Acanthopagrus schlegelii*

(Bleeker, 1854) (Sparidae), in Kanagawa Prefecture (Hata et al., 2017, locality 1 in Fig. 2) and from yellowfin goby, *Acanthogobius flavimanus* (Temminck and Schlegel, 1845) (Gobiidae), in Shizuoka Prefecture (Yamauchi and Nagasawa, 2012, locality 2 in Fig. 2). The northernmost locality of the species in the Sea of Japan is Sado Island (locality 25 in Fig. 2), where it was reported as *Nerocila acuminata* Schioedte and Meinert, 1881 (Honma et al., 1974; Nunomura, 1981). While Yamauchi and Nagasawa (2012) were unsuccessful to find the specimens reported as *N. acuminata*, they considered that the specimens were likely *N. japonica*.

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