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Nerocila phaiopleura (Isopoda: Cymothoidae) parasitic on Japanese Spanish mackerel *Scomberomorus niphonius* in the Seto Inland Sea, Japan

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Abstract. Ovigerous females of *Nerocila phaiopleura* Bleeker, 1857, were collected from the body surface of Japanese Spanish mackerel *Scomberomorus niphonius* (Cuvier, 1832) commercially caught in the Seto Inland Sea off Yamaguchi Prefecture, western Japan. This collection represents a new host record for *N. phaiopleura* and the first documented record of the species in the Seto Inland Sea. A hemorrhage skin lesion was found at attachment site.

Key words: *Nerocila phaiopleura,* Isopoda, Cymothoidae, fish parasite, *Scomberomorus niphonius,* new host record, Seto Inland Sea

The cymothoid isopod, *Nerocila phaiopleura* Bleeker, 1857, is a skin parasite of marine fishes in the Indo-West Pacific (Bowman & Tareen, 1983; Bruce, 1987). This species has been reported from various countries and areas of the region, ranging from Japan in the northeast through Hong Kong, Singapore, Indonesia, Thailand, India, and Kuwait to South Africa in the southwest (Bowman & Tareen, 1983; Bruce, 1987; Bruce & Harrison-Nelson, 1988).

In Japan, Mitani (1982) first reported *N. phaiopleura* (as *N. phaeopleura*) and studied its effects on the condition of Japanese sardine *Sardinopsis melanostictus* (Temminck & Schlegel, 1846) (as *S. melanosticta*) (Clupeidae) from Kaneda Bay and Tokyo Bay, Kanagawa Prefecture. He also found this parasite on three other coastal fishes, *viz*., Japanese anchovy *Engraulis japonica* Temminck & Schlegel, 1846 (Engraulidae), Japanese sardinella *Sardinella zunasi* (Bleeker, 1854) (Clupeidae), and dotted gizzard shad *Konosirus punctatus* (Temminck & Schlegel, 1846) (Clupeidae). His specimens of *N. phaiopleura* from *S. melanostictus* (as *S. melanosticta*) and aegathoids from *E. japonica* were reported by Bruce & Harrison-Nelson (1988). Subsequently, Saito & Hayase (2000) found *N. phaiopleura* infecting *S. melanostictus* in Suruga Bay, Shizuoka Prefecture, and described an aegathoid of *N. phaiopleura* stranded on the coast of the bay. All of these reports were based on the collections of *N. phaiopleura* in the western North Pacific off central Japan (localities 1–3 in Fig. 1), but the occurrence of the species in other Japanese waters is poorly understood. Without any detailed information, Saito & Hayase (2000) mentioned that *N. phaiopleura* is

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a common parasite of *S. melanostictus* in Hiroshima Bay, the Seto Inland Sea, Hiroshima Prefecture, western Japan, but Yamauchi *et al*. (2004) stated that the cymothoids infecting *S. melanostictus* from this bay should be carefully identified because two undescribed species of the same genus occur in the sea. Recently, we collected two ovigerous females of *N. phaiopleura* from Japanese Spanish mackerel *Scomberomorus niphonius* (Cuvier, 1832) (Scombridae) in the Seto Inland Sea (locality 4 in Fig. 1). This collection represents a new host record for *N. phaiopleura* and the first documented record of the species in the Seto Inland Sea.

The two females of *N. phaiopleura* were taken individually from the body surface near the ventral finlets of two *S. niphonius* (ca. 70–80 cm fork length) commercially caught off Tabuse, Yamaguchi Prefecture, on 7 October 2015. As these females were accidentally found, no data were taken on prevalence of infection. They were removed from the fish, fixed in 70% ethanol at Yamaguchi Prefectural Fisheries Research Center, Yamaguchi, and later sent to the laboratory at Hiroshima University, Higashi-Hiroshima, for identification. Voucher specimens of *N. phaiopleura* are deposited in the Crustacea (Cr) collection of the National Museum of Nature and Science, Tsukuba, Ibaraki Prefecture, Japan (NSMT-Cr 24611). The scientific and common names of fishes used in this paper follow Froese & Pauly (2016), except *S. melanostictus* which follows Nakabo (2013).

The two females collected (Fig. 2) agree in their general morphology with *N. phaiopleura* redescribed by Bowman & Tareen (1983) and Bruce (1987). Their morphological features are also in accordance with the illustration and photographs of *N. phaiopleura* collected from *S. melanostictus* in

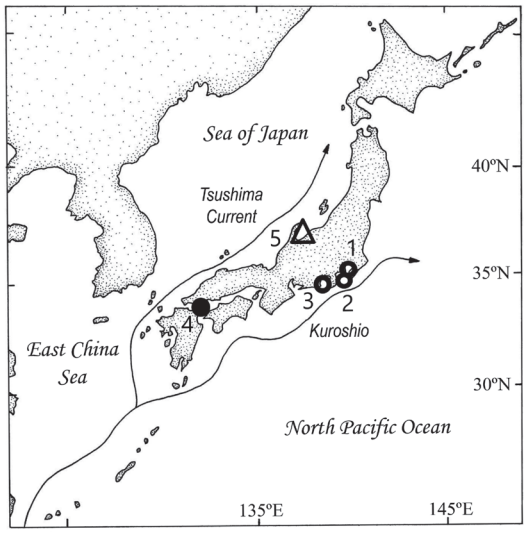

Fig. 1. Map of the Japanese Archipelago, showing the localities where *Nerocila phaiopleura* was collected in the previous (open circles) and present (closed circle) studies. Localities 1, 2, and 3 are Tokyo Bay (Mitani, 1982; Bruce & Harrison-Nelson, 1988), Kaneda Bay (Mitani, 1982; Bruce & Harrison-Nelson, 1988), and Suruga Bay (Saito & Hayase, 2000), respectively. Locality 4 is the Seto Inland Sea off Yamaguchi Prefecture (present study). Locality 5 (open triangle) is Toyama Bay, in which the occurrence of the species was suggested by Saito & Hayase (2000).

Fig. 2. Two ovigerous females of *Nerocila phaiopleura*, NSMT-Cr 24611, from *Scomberomorus niphonius* in the Seto Inland Sea. Dorsal view. A, female, 20.5 mm long, with normal uropods; B, female, 21.1 mm long, with a shorter exopod of the left uropod. Scale bars: 5 mm in A and B.

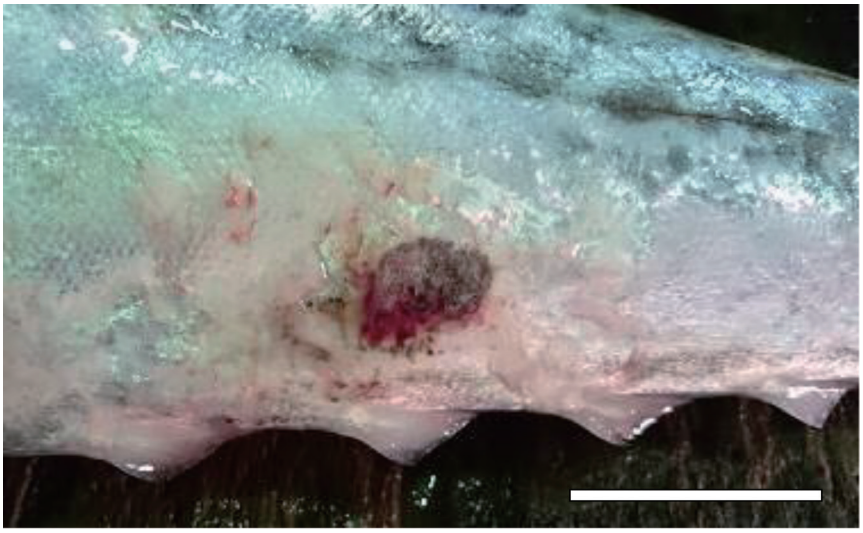

Fig. 3. Caudal peduncle of *Scomberomorus niphonius* from the Seto Inland Sea, showing a hemorrhage skin lesion caused by *Nerocila phaiopleura*. Scale bar: 20 mm.

Suruga Bay by Saito & Hayase (2000). The females in this study are 20.5–21.1 mm long and 9.3–9.5 mm wide. The exopod of the left uropod in one of the two females is shorter than that of the right uropod (Fig. 2B). Dark brown or black stripe is present on the uropod exopod and lateral sides of the pleon and the posterior pereonites (Fig. 2). Black spots are widely scattered on the dorsal side of the pereonites, the pleon, and the anterior pleotelson. The present collection has confirmed that *N. phaiopleura* occurs in the Seto Inland Sea, as briefly stated by Saito & Hayase (2000).

The major hosts of *N. phaiopleura* are species of the families Engraulidae and Clupeidae (Bruce, 1987; Aneesh *et al*., 2013), but species of other families, such as the Ariidae, Carangidae, Chirocentridae, Dussumieriidae, Istiophoridae, Leiognathidae, Scombridae, and Sphyraenidae, also have been reported as the hosts (*e.g*., Morton, 1974, as *N. phaeopleura*; Bowman & Tareen, 1983; Bruce & Harrison-Nelson, 1988; Trilles *et al*., 2011, 2013). As for the Scombridae, in which *S. niphonius* is placed, only two species, Indian mackerel *Rastrelliger kanagurta* (Cuvier, 1816) and Indo-Pacific king mackerel *Scomberomorus guttatus* (Bloch & Schneider, 1801), are known to serve as hosts for *N. phaiopleura* off India (Rameshkumar & Ravichandran, 2010; Trilles *et al*., 2011). *Scomberomorus niphonius* is added herein as a new host of *N. phaiopleura*.

A hemorrhage skin lesion was found at attachment site (Fig. 3). Similar lesions or wounds caused by *N. phaiopleura* also have been reported in two other fishes, *viz*., goldstripe sardinella *Sardinella gibbosa* (Bleeker, 1849) from Hong Kong (Morton, 1974) and Japanese sardine *Sardinopsis melanostictus* from Japan (Mitani, 1982). In the latter species, the mean condition factor of fish declined with increasing the severity of wounds, from 13.4 (without wound) through 12.9 (with scratch wound) and 12.7 (with slight wound) to 12.4 (with serious wound) (Mitani, 1982). In our observation, there was no emaciation in the fish examined, but the commercial value of the fish with a hemorrhage skin lesion was low in fish market auctions.

No data were taken in this study on the preva-

lence of infection by *N. phaiopleura*, but according to the fishermen engaged in commercial fisheries of *S. niphonius* in the study area, isopod infections are constantly found throughout the year and there is a seasonal change in prevalence, which is high (up to *ca*. 30%) but remains low (*ca*. 10%) in summer and winter, respectively. They also say that large-sized isopods are found in summer. If these fishermen's observations are correct, *N. phaiopleura* may demonstrate seasonal fluctuations in population size and reproduction there.

Sixteen species of clupeids and nine species of engraulids occur in coastal waters of Japan (Nakabo, 2013), and most of them are commercially caught. As our knowledge on *N. phaiopleura* in Japanese waters is limited, it is important to clarify various aspects of the biology of the species, including the geographical distribution, host utilization, seasonal occurrence, reproduction, and pathogenicity by examining various clupeids and engraulids from different locations and/or a fixed location. In addition, Saito & Hayase (2000) stated that "*Aegathoa* sp." reported by Nunomura (1985, 1999) from Toyama Bay (locality 5 in Fig. 1) is *N. phaiopleura*, which suggests that this isopod occurs in the southern Sea of Japan as well.

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