

Transportation of the Coastal Marine Leech *Limnotrachelobdella okae* (Hirudinida, Piscicolidae) to a River by Adult Sockeye Salmon *Oncorhynchus nerka*

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Abstract. Live specimens of the piscicolid leech *Limnotrachelobdella okae* (Moore, 1924) were found in October 2003 and 2007 on sockeye salmon *Oncorhynchus nerka* kept at an aquarium in Hokkaido, northern Japan. These salmon returned as adults for spawning from the North Pacific Ocean to a river in Hokkaido in the summer of these years and were provided to the aquarium after they were kept for a few months in a springwater pond. The leeches are considered to have been carried by *O. nerka* from the sea to the river and since have survived in fresh water. *Oncorhynchus nerka* is a new host of *L. okae*.

Key words: *Limnotrachelobdella okae*, leech, fish parasite, new host, *Oncorhynchus nerka*

Introduction

In Japan, the piscicolid leech *Limnotrachelobdella okae* (Moore, 1924) had been believed to be a parasite infesting both marine and freshwater fishes (*e.g.*, Oka & Nagano, 1965). Currently, however, based on the past and current literature, Nagasawa *et al.* (2008a) discussed the freshwater or marine origin of this leech species and concluded that it is not a freshwater species but a coastal marine and/or brackish-water species. The authors suggested that anadromous fishes, such as salmonids, carry *L. okae* from the sea to fresh water. In October 2003 and 2007, we found live individuals of *L. okae* on adult sockeye salmon *Oncorhynchus nerka* (Walbaum) kept in a freshwater tank at the Chitose Salmon Aquarium in Chitose, Hokkaido, northern Japan. We herein report that these salmon most likely transported the leeches from the sea to a river to which the fish returned for spawning.

Materials and Methods

Three leech specimens were collected in mid-October 2003 from the skin of adult sockeye salmon *Oncorhynchus nerka* kept in a tank (water temperature [WT]=11.0°C) of the Chitose Salmon Aquarium at Hanazono in Chitose, Hokkaido. These sockeye salmon were captured in the middle reach of the Bibi River, a tributary of the Abira River, at Misawa in Tomakomai, Hokkaido, in the summer of 2003 and then kept for a few months in a springwater pond (WT=8.8°C) at Rankoshi in Chitose. The fish were provided to the Chitose Salmon Aquarium for exhibition in late September 2003. The leeches were fixed in 10% formalin and later brought to the laboratory of Hiroshima University, where they were identified and preserved in 5% formalin. In October 2007, leeches were again found on adult sockeye salmon of the Bibi River origin kept at the aquarium, and the attachment sites of the leeches were recorded. The leech specimens are deposited in the annelid (An) collection at the National Museum of Nature and Science, Tokyo (NS-

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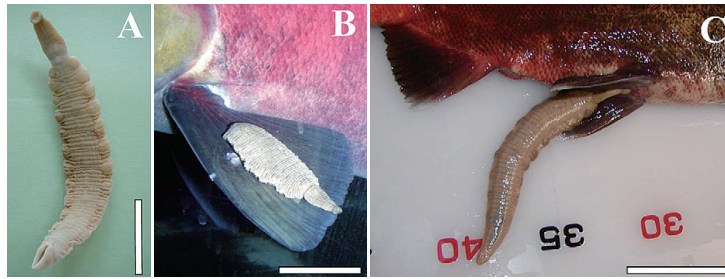


Fig. 1. *Limnotrachelobdella okae*. A, a fixed specimen (collected in October 2003), ventral view; B and C, *Oncorhynchus nerka* infested by *L. okae* on the pectoral fin (B) and the abdomen (C), respectively (collected in October 2007). Scale bars: 30 mm in A and B; 50 mm in C.

MT-An 409). The English and scientific names of fishes follow Froese & Pauly (2010).

Results

The three leech specimens collected in October 2003 were all identified as *Limnotrachelobdella okae* (Fig. 1A). Their body is divided into the subcylindrical trachelosome and the dorsoventrally flattened urosome. The body surface is wrinkled. Eleven pairs of pulsatile pairs are recognized. The caudal sucker is larger than the oral sucker. The specimens are whitish yellow in formalin, ranging from 68.5–94.8 (mean 80.0) mm in total length (TL, including the suckers) and from 12.0–16.6 (14.5) mm in maximum body width.

Two adult sockeye salmon examined in October 2007 were individually infected by a single *L. okae* (Fig. 1B–C). The two leeches (*ca* 60 and 139 mm TL) were each attached to the left pectoral fin (by the caudal sucker) and the abdomen between the ventral fins of the fish (by the oral sucker). Their body was gray or fawn in color.

Discussion

Limnotrachelobdella okae is a coastal marine/brackish-water species and can survive in fresh water for a certain period (Nagasawa *et al.*, 2008a). Adult sockeye salmon make their spawning run into the Bibi River from the North Pacific between late June and early September with a peak in July (Kaeriyama, 1993; Urawa & Kaeriyama, 1999). After trapped in the river,

the fish are usually transported to springwater ponds, where they are kept without feeding for three or four months for full maturity. Among these fish, some are provided every September or October to the Chitose Salmon Aquarium, at which we found the leeches infesting the salmon kept in a freshwater tank. Based on the up-stream migration and freshwater-rearing periods of Bibi River sockeye salmon and the freshwater tolerance ability of *L. okae*, it is most likely that the leeches found were first transported by returning adult salmon from the coastal area of the North Pacific Ocean to the river and then survived in fresh water for a considerably long period (about 1.5 month [early September to mid-October] to 3 months [late June to mid-October]).

The present finding of *L. okae* is the second record of the species from Hokkaido. Previously, Furiness *et al.* (2007) recorded it from Japanese huchen *Hucho perryi* caught near the mouth of the Sarufutsu River in Hokkaido. Like sockeye salmon, *H. perryi* is an anadromous salmonid to return to fresh water after its marine life (Edo *et al.*, 2005).

The external morphology of our leech specimens is more or less identical with that of *L. okae* reported from Japanese waters (Nagasawa *et al.*, 2008a; Nagasawa & Fukuda, 2008; Nagasawa & Hirai, 2009). The body color of our specimens was, however, gray or fawn (Fig. 1B–C), which was different from that (black or greenish black) of the species infesting marine fishes. Since leeches blanch when exposed to darkness (Sawyer, 1986: 144–148), the specimens may have changed their coloration in the darkened, indoor tank at the

aquarium.

The sockeye salmon *Oncorhynchus nerka* is a new host of *L. okae*. As pointed out by Nagasawa *et al.* (2009), this leech shows no strict host specificity. Twelve species of fishes within seven families so far have been recorded as its hosts (Nagasawa *et al.*, 2008b, 2009; Nagasawa & Hirai, 2009): kaluga *Huso dauricus* (Acipenseridae); Pacific redbfin *Tribolodon brandtii* (Cyprinidae); Japanese huchen *Hucho perryi*, pink salmon *Oncorhynchus gorbuscha*, chum salmon *O. keta*, masu salmon *O. masou masou* (Salmonidae); Japanese seabass *Lateolabrax japonicus* (Lateolabracidae); Japanese amberjack *Seriola quinqueradiata*, greater amberjack *S. dumerili* (Carangidae); bastard halibut *Paralichthys olivaceus* (Paralichthyidae); 'kusafugu' *Takifugu niphobles*, and Japanese pufferfish *T. rubripes* (Tetraodontidae).

Oncorhynchus nerka is a migratory fish, and its occurrence is seasonal in the coastal North Pacific Ocean off central Hokkaido (Kaeriyama, 1993; Urawa & Kaeriyama, 1999), into which the river where we collected the *L. okae* specimens empties. It is thus likely that *O. nerka* is an occasional host but coastal marine fishes serve as stable hosts for *L. okae* there.

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