Two Species of *Caligus* (Copepoda: Caligididae) from Amberjacks (*Seriola* spp.) Cultured in Oita Prefecture, Kyushu, Western Japan

Kazuya NAGAWA and Yutaka FUKUDA

1) Graduate School of Biosphere Science, Hiroshima University, 1-4-4 Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8528 Japan

2) Fisheries Research Division, Oita Prefectural Agriculture, Forestry and Fisheries Research Center, 194-6 Tsuiura, Kamiura, Saiki, Oita 879-2602 Japan

Abstract Two species of copepods of the caligid genus *Caligus* were found parasitic on amberjacks cultured in the Bungo Channel off the coast of Oita Prefecture, Kyushu, western Japan. They are *Caligus spinosus* Yamaguti, 1939 from the gills of yellowtail amberjack (*Seriola lalandi*), and *Caligus lalandei* Barnard, 1948 from the body surface of Japanese amberjack (*Seriola quinqueradiata*). This is the first confirmed record of *C. spinosus* from *S. lalandi* in Japan.

Key words: aquaculture, *Caligus lalandei*, *Caligus spinosus*, Copepoda, fish parasite, *Seriola lalandi*, *Seriola quinqueradiata*

INTRODUCTION

Three species of amberjacks (*Seriola* spp., Perciformes: Carangidae) are cultured in coastal waters of Japan: Japanese amberjacks (*S. quinqueradiata* Temminck and Schlegel), greater amberjack (*S. dumerili* Risso), and yellowtail amberjack (*S. lalandi* Valenciennes). Since only several works have been conducted on the parasitic copepods of *S. quinqueradiata* farmed in Japan (e.g., Fujita et al., 1968; Izawa, 1969; Ho et al., 2001; Cruz-Laciera et al., 2011), our knowledge on such parasites of amberjacks is very limited. This note reports on two species of *Caligus* found on amberjacks cultured in Oita Prefecture, Kyushu, western Japan.

MATERIALS AND METHODS

A single *S. lalandi* (5,200g body weight) was collected on 6 March 2009 from a floating cage off Tsuiura (33°2'47"N, 131°56'10"E) in Kamiura, Saiki, Oita Prefecture. Also, 10 age-0 *S. quinqueradiata* [15.4-18.0 (mean 16.6) cm fork length] were sampled on 13 July 2009 from a floating cage in Inokushi Cove (32°46'25"N, 131°53'52"E), Kamae, Saeki. Both sampling sites are located in the Bungo Channel. The fishes were brought to the laboratory, where copepods were removed from them and fixed in 70% ethanol. Later, the copepods were soaked in lactophenol and examined using the wooden slide procedure of Humes and Gooding (1964). Voucher specimens are deposited in the crustacean collection at the National Museum of Nature and Science, Tokyo (NSMT-Cr 21850 for *C. spinosus*; NSMT-Cr 21851 for *C. lalandei*). The scientific and common names of fishes follow Froese and Pauly (2011).
RESULTS AND DISCUSSION

Twenty-four (18 adult female and 6 adult male) specimens of *Caligus spinosus* Yamaguti, 1939 (Fig. 1) were found on the gills of a single *S. lalandi* cultured off Tsuiura in Kamiura, Saiki. The morphology of the specimens agrees to the description of the species given by Yamaguti (1939), Yamaguti and Yamasu (1960) and Choe and Kim (2010). Shiino (1960) reported “*Caligus spinosus*” from *S. lalandi* (recorded as *Seriola aureovittata* Temminck and Schlegel) and an unidentified fish from Japan, but his caligid specimens are currently regarded by Choe and Kim (2010) as *Caligus aesopus* Wilson, 1921. While *C. spinosus* is known to infect both *S. quinqueradiata* and *S. lalandi* in Korean waters (Choe and Kim, 2010), it was reported only from *S. quinqueradiata* in Japan (Yamaguti, 1939; Yamaguti and Yamasu, 1960; Fujita et al., 1968; Izawa, 1969; Ho et al., 2001; Nagasawa et al., 2010; Cruz-Lacierda et al., 2011). Fukuda (1999: 56) stated *C. spinosus* parasitized *S. lalandei* farmed in Oita Prefecture, but he did not provide any morphological characters of the caligids collected. The present collection of *C. spinosus* represents the first confirmed record of this parasite from *S. lalandi* in Japan.

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Fig. 1. Female (A) and male (B) specimens of *Caligus spinosus* Yamaguti, 1939 from the gills of yellowtail amberjack (*Seriola lalandi*) cultured off Tsuiura in Kamiura, Saiki, Oita Prefecture. Alcohol-preserved specimens. Dorsal view. Scale bar: 2 mm.
Twenty-seven (19 adult female and 8 adult male) specimens of *Caligus lalandei* Barnard, 1948 (Fig. 2) were taken from the body surface of eight of 10 *S. quinqueradiata* cultured in Inokushi Cove, Kamae. No data were taken on the number of copepods per fish. The specimens correspond to the recent redescription of *C. lalandei* given by Ho *et al.* (2001). The fish examined were transported in June 2009 from nearby Nyudu Cove, where they had been temporarily kept in a floating cage after caught as juveniles at sea between April and May of the same year. Previously, Fukuda (2008) also found *C. lalandei* on *S. quinqueradiata* farmed in Oita Prefecture, where this copepod species is known to parasitize farmed *S. lalandi* as well (Ho *et al.*, 2001). In Japan, *C. lalandei* has so far been reported only from coastal waters of Kyushu.

Ho *et al.* (2001) reported that juvenile *S. quinqueradiata* caught in the western North Pacific off Kyushu, Shikoku and central Honshu, Japan, were infected with *C. spinosus* and *C. lalandei*. Because wild-caught juvenile *S. quinqueradiata* are used as seeds for aquaculture conducted in coastal seas of Japan, both caligid species are considered to be introduced into farming sites with the juveniles. Moreover, once these parasites arrive at the farming sites, they appear to easily establish there by utilizing two species of amberjacks (*S. quinqueradiata* and *S. lalandi*) reared at high densities in sea-cages. Mortalities caused by *C. spinosus* are known for farmed *S. quinqueradiata* (Fujita *et al.*, 1968), but there has been no report about *C. lalandei* as a pathogen of farmed amberjacks.

Fig. 2. Female (A) and male (B) specimens of *Caligus lalandei* Barnard, 1948 from the body surface of Japanese amberjack (*Seriola quinqueradiata*) cultured in Inokushi Cove, Kamae, Saiki, Oita Prefecture. Alcohol-preserved specimens. Dorsal view. Scale bar: 2 mm.
Yamaguti (1936) described *Caligus seriolae* based on a single female specimen from the gills of *S. quinqueradiata* caught in the Seto Inland Sea, Japan. This caligid species has not been found from wild or farmed *S. quinqueradiata* since its original description.

**REFERENCES**


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大分県で養殖されていたブリ属魚類から得られたウオジラミ属カイアシ類2種

長澤和也1)・福田 穗2)

1) 広島大学大学院生物圈科学研究科，〒739-8528 東広島市鏡山1-4-4
2) 大分県農林水産研究指導センター水産研究部，〒879-2602 佐伯市上浦大字津井浦194-6

要 旨　大分県豊後水道沿岸域で養殖されていたヒラマサ Seriola lalandi の鰭からブリウオジラミ Caligus spinosus Yamaguti, 1939。ブリ S. quinqueradiata の体表からモジャコウオジラミ Caligus lalandei Barnard, 1948 を採集した。ブリウオジラミの寄生がわが国のヒラマサに初めて確認された。

キーワード：カイアシ類，魚類寄生虫，水産養殖，Caligus lalandei, Caligus spinosus, Seriola lalandi, Seriola quinqueradiata