Detection of Renibacterium salmoninarum Antigen in Migrating Adult Chum Salmon (Oncorhynchus keta) in Japan

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Detection of *Renibacterium salmoninarum* Antigen in Migrating Adult Chum Salmon (*Oncorhynchus keta*) in Japan

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ABSTRACT: *Renibacterium salmoninarum* antigen was detected in the kidney of migrating chum salmon (*Oncorhynchus keta*) using the indirect dot blot assay and indirect fluorescent antibody test. The adult chum salmon had migrated into a bay in which cultured coho salmon infected with *R. salmoninarum* were present. Antigen was detected in 5% of the chum salmon although they did not have clinical signs of bacterial kidney disease (BKD). This report describes the first case of *R. salmoninarum* antigen detection among wild chum salmon populations in eastern Asia.

Key words: Chum salmon, *Renibacterium salmoninarum*, BKD, Coho salmon, case report.

Bacterial kidney disease (BKD) is an infection of salmonid fish caused by the gram-positive diplobacillus, *Renibacterium salmoninarum*. This disease was initially described in Scotland (1930) and by 1935 was reported in the United States (Fryer and Sanders, 1981). In Japan, the disease has been observed in cultured chum (*Oncorhynchus keta*), masu (*O. masou*) and chinook salmon (*O. tshawytscha*) from Hokkaido (Kimura and Awakura, 1977) and has spread to all parts of Japan where salmon are cultured. Kimura and Awakura (1977) suspected that BKD was introduced into Japan with eggs infected with *R. salmoninarum*. The occurrence of BKD has been limited to stocks of salmonid hatcheries associated with farms, and this disease has never been reported among populations of wild salmon.

Recently, coho salmon culture in Japan has increased and production reached about 23,000 tons in 1990. Coho salmon culture begins with eggs imported from the United States. After hatching, the fry are reared in fresh water for 10 mo and then transferred to net cages in sea water. BKD is one of the most prevalent diseases observed among cultured coho salmon in Japan (Sakai et al., 1989). Chum salmon are native to Japan, and this resource is a very important part of the fishing industry in the northern parts of the country. Chum salmon production was estimated to be about 150,000 tons in 1989. Chum fry are released into rivers or bays after hatching, and fish which come back 3 to 5 yr later are captured along the coast or in the rivers. No occurrence of BKD has been reported in captured or migrating chum salmon in Japan. However, in several bays into which chum salmon fry are released, coho salmon are cultured. The transmission of BKD from coho salmon to chum salmon may be possible. BKD had never been observed in wild or cultured fish in the Urahamagawa River prior to the introduction of coho salmon. In this study, *R. salmoninarum* antigen was detected in migrating chum salmon which returned to a bay culturing coho salmon. Fish were collected from the Urahamagawa River, Iwate prefecture, in 1989 and 1990. The locality of collection and release sites was 39°04′ to 39°07′N, 141°48′ to 141°53′E. In the Urahamagawa River, about 3,000 sexually mature adult chum salmon migrate annually, and the eggs from these fish are hatched in the chum salmon hatchery on the river and released into the Urahamagawa River. After 3 mo of rearing, fry were released into the river and entered the sea in Okkirai Bay, where coho salmon have been cultured in net pens since 1979. Coho salmon infected with BKD have been found in Okkirai Bay since 1985. The released chum salmon fry stay about 1 to 3 mo in Okkirai Bay, before offshore migration to the Pacific Ocean. Thus, chum salmon fry and coho salmon can be in con-

TABLE 1. Detection of *Renibacterium salmoninarum* antigen from wild chum salmon.

Year	Place	Number of samples	Clinical signs	The number of positive samples
1989	A	100	0	3 (3%)
	B	104	0	0
1990	A	211	0	11 (5%)
	B	150	0	0

tact in Okkirai Bay for more than 1 mo. After 3 to 5 yr in the ocean, the chum salmon return to the Urahamagawa River.

The kidney tissue of migrating fish was sampled, and smears prepared on non-fluorescent glass slides. The antigen from kidney tissue was prepared by heating (Sakai et al., 1989). The detection of *R. salmoninarum* antigen was examined by the indirect dot blot assay (IDBA) (Sakai et al., 1989) and the indirect fluorescent antibody test (IFAT) (Bullock and Stuckey, 1975) with *R. salmoninarum* polyclonal and monoclonal antibodies (Sakai et al., 1991a). All tissues were screened by IDAT and the positive samples confirmed by IFAT. For controls, 254 migrating chum salmon were collected from Miyako Bay where coho salmon are not cultured.

The results of our investigation are indicated in Table 1. In 100 fish collected from Okkirai Bay in 1989, *R. salmoninarum* antigen was detected in three fish. In 1990, 211 fish were obtained and 11 tested positive for the presence of *R. salmoninarum* antibody. In the test using monoclonal antibody, *R. salmoninarum* antigen also was detected from these 14 fish in IDBA and IFAT. In contrast, in 254 fish collected from Miyako Bay in 1989 and 1990, *R. salmoninarum* antigen was not detected. None of the *R. salmoninarum* antigen positive fish showed clinical signs of BKD (exophthalma, swollen abdomen, or abscesses in kidney).

In this study, *R. salmoninarum* antigen was detected in fish migrating to Okkirai Bay where coho salmon are cultured. However, no positive samples were found in fish migrating to Miyako Bay. In a preliminary examination, we attempted the detection of *R. salmoninarum* antigen from fry in the Urahamagawa Salmon Hatchery, using the same method, and the antigen was not detected. Although it is possible that *R. salmoninarum* antigen could not be detected with these techniques from the fry because of very little antigen presence, it is highly likely that migrating chum salmon were infected with *R. salmoninarum* from cultured coho salmon. We were not able to examine the chum salmon fry in Okkirai Bay, because their capture is prohibited. The possibility of *R. salmoninarum* infections in sea water has already been reported by Evelyn (1988). Chum salmon are sensitive to *R. salmoninarum*, and they experience high mortalities allowing experimental infection (Sakai et al., 1991b). This report describes the first known presence of *R. salmoninarum* antigen of wild chum salmon in eastern Asia. The presence of *R. salmoninarum* antigen is still at a low level and no diseased fish have been observed. However, the increase of coho salmon culture may cause spread of BKD infection among populations of wild chum salmon. To prevent BKD infections in chum salmon, it will be necessary to prevent the disease from occurring in the cultured coho salmon.

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