Temporal Changes in Physiological Condition of Juvenile Chum Salmon and Zooplankton Biomass in a Coastal Water of the Okhotsk Sea

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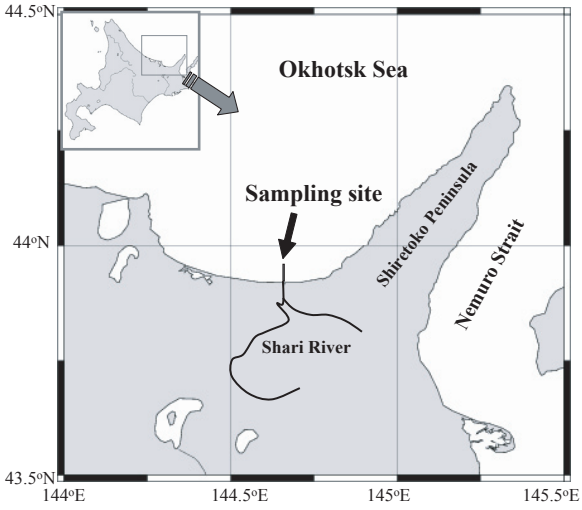
Japanese chum salmon (*Oncorhynchus keta*) are distributed along the coastal waters of Hokkaido for several weeks before their offshore migrations. Their survivals in the initial coastal life may be influenced by various factors. The aim of our research is to evaluate effects of coastal water temperature and zooplankton biomass on the physiological condition of juvenile chum salmon in a coastal water along the Okhotsk Sea.

Surveys were conducted in a coastal water near the Shari River, eastern Hokkaido (43°55'N, 144°38'E; Fig. 1) between May and July, 2004 and 2005. The sampling stations were set in 1, 2, 4, and 5 km offshore from the Shari River mouth. Zooplankton were collected with simultaneously multiple layer horizontal tow net (LH net; mesh size 1.0 mm; 1 m × 1 m mouth square; towed at 2 knots) at 3 and 15 m depths at 1 and 4 km offshore (stations 1 and 4) in 2005. The zooplankton samples were fixed with 10% seawater formaldehyde, and species compositions were determined at the laboratory.

Fig. 1. Sampling stations where juvenile chum salmon and zooplankton were collected.



A surface trawl net (4.5 m × 6.6 m) was towed at 2 knots for 30 min at all four stations in 2004 and 2005. Captured juvenile chum salmon were immediately deep frozen with dry ice and stored at -80°C. Fork length (FL) and body weight were measured for each fish, and the instant growth coefficient (IGC) was calculated by a formula: IGC = In (Lt) - In (L0) / T, where L0, FL (mm) at initial day; Lt, FL after t days; T, progress days. In addition, RNA/ DNA ratio in the white muscle of fish was determined using Schmit-Thanhauser-Schneider method.

Surface seawater temperature (SST) gradually increased during May and June in both years, but the initial SST

Fig. 2. Temporal changes in surface seawater temperature (SST) in the coastal water of Shari between May and July in 2004 and 2005.

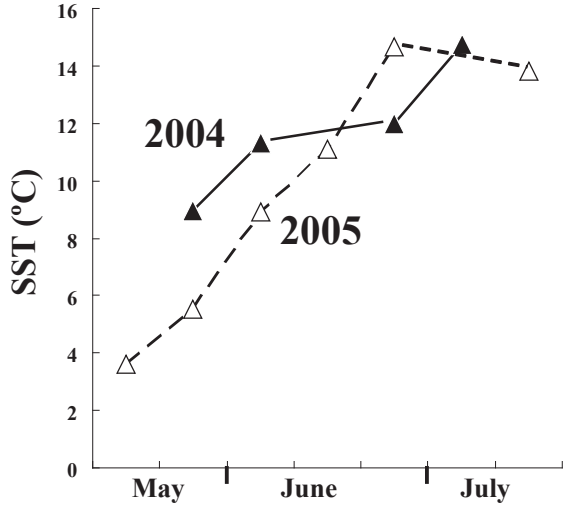


Fig. 3. Temporal changes in number of juvenile chum salmon captured by 30 min trawl in the coastal water of Shari between May and July in 2004 and 2005.

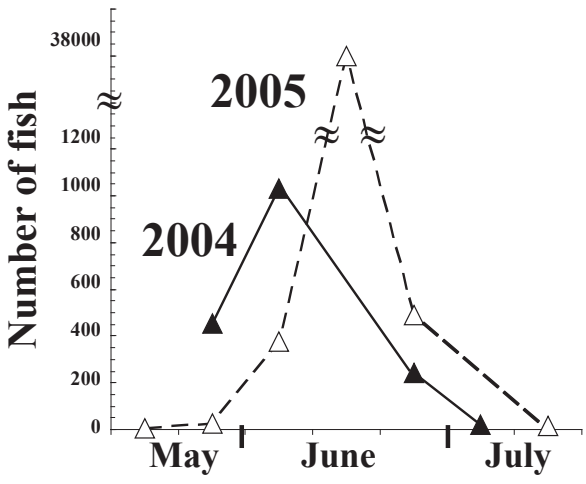


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Fig. 4. Temporal changes in fork length frequencies of juvenile chum salmon captured in the coastal water of Shari between May and June in 2004 and 2005.

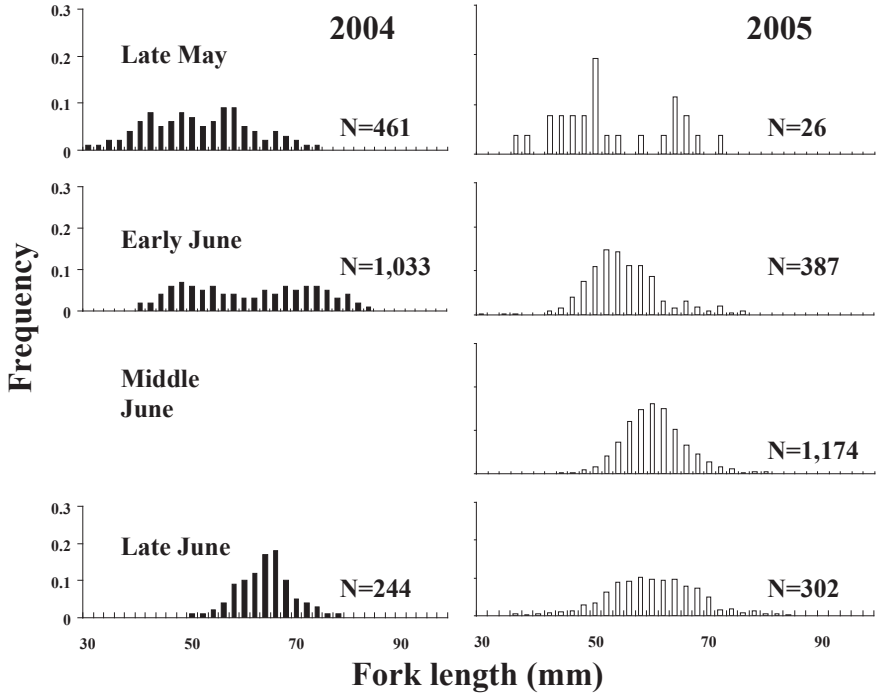


Fig. 5. Temporal changes in mean RNA/DNA ratios in the white muscle of juvenile chum salmon captured in the coastal water of Shari between May and July in 2004 and 2005. Vertical Bars, one standard deviation; *significant difference compared with same period at $p < 0.05$; ** significant difference at $p < 0.01$.

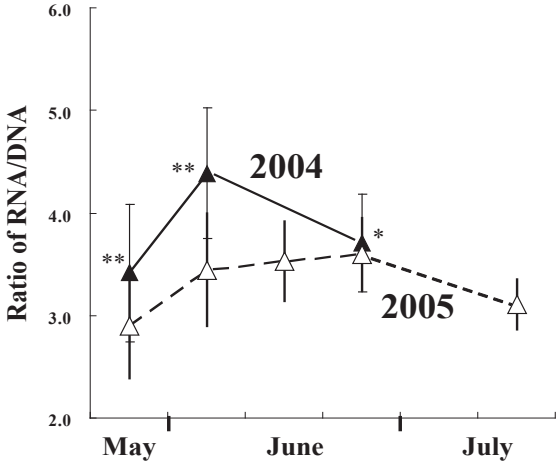
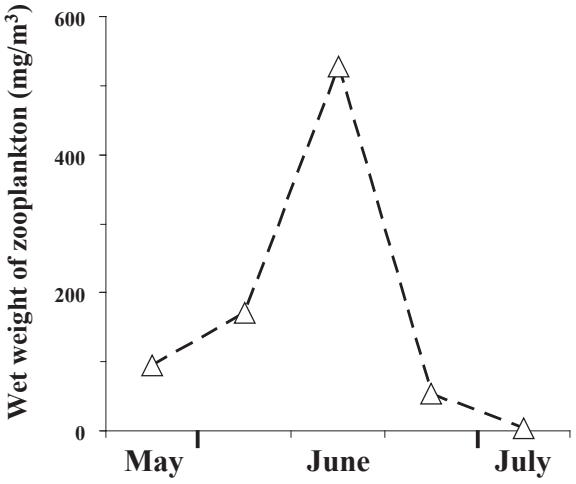


Fig. 6. Temporal changes in mean wet weight (mg/m^3) of zooplankton collected with LH net at 3 m deep in the coastal water of Shari between May and July in 2005.



was higher in 2004 than in 2005 (Fig. 2). Most chum salmon juveniles were captured near the shore when SST was 8-11ºC. The number of captured fish was low in May, peaked in June and decreased to zero by mid July when SST was over 14ºC (Fig. 3). The peak of fish abundance looked a slightly different in timing between 2004 and 2005, but it was uncertain because of no survey in the mid June of 2004. The fork length of captured fish varied depending on the sampling date (Fig. 4). The instant growth coefficient of fish was higher in 2004 (0.0098) than in 2005 (0.0042). The mean RNA/DNA ratio in the muscle of fish captured between May and early June was also significantly higher in 2004 than in 2005 (Fig. 5). The mean wet weight (mg/m3) of zooplankton in the surface water showed a peak in the mid June of 2005 (Fig. 6), coincidenting with a peak of fish abundance. The results suggest that seawater temperature might affect the growth and physiological condition of juvenile chum salmon as well as zooplankton production in the coastal water.