Distribution and Growth of Juvenile Chum Salmon in the Abashiri Bay, Eastern Hokkaido, in Relation to Sea Surface Temperature

Yasuyuki Miyakoshi[1], Makoto Fujiwara[1], Daisei Ando[1], Hiroshi Shimada[2], Mayumi Sawada[2], Hiroki Asami[3], and **Mitsuhiro Nagata[1]**

[1]*Hokkaido Fish Hatchery, Kitakashiwagi 3-373, Eniwa, Hokkaido 061-1433, Japan*
[2]*Hokkaido Central Fisheries Experimental Station, 238 Hamanaka, Yoichi, Hokkaido 046-8555, Japan*
[3]*Hokkaido Wakkanai Fisheries Experimental Station, 4-5-15 Suehiro, Wakkanai, Hokkaido 097-0001, Japan*

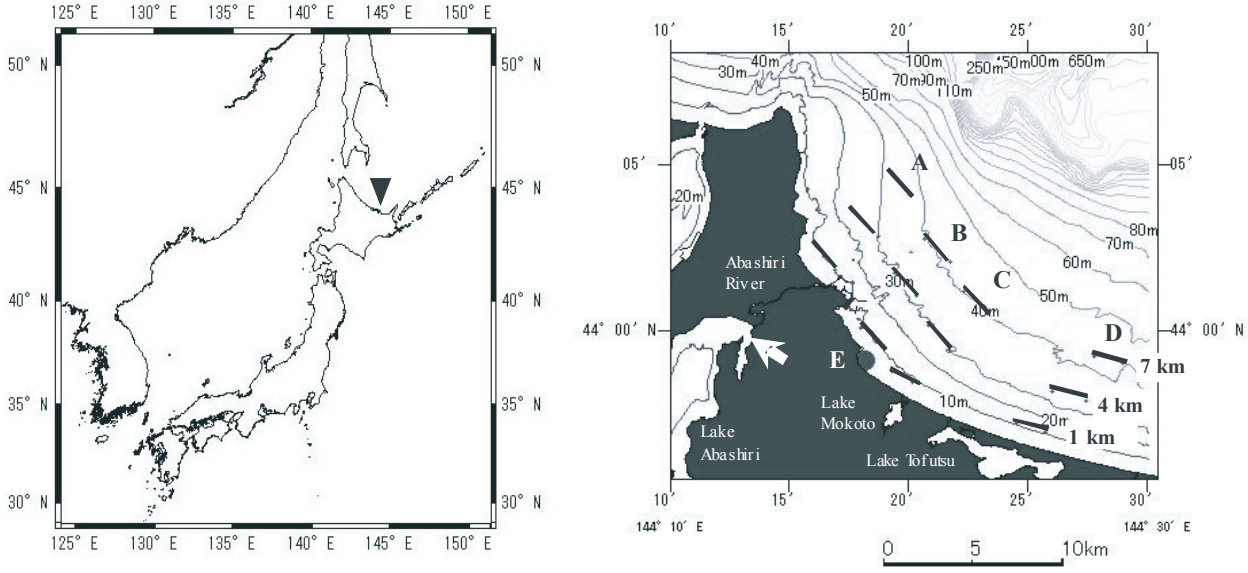
Keywords: Chum salmon, distribution, growth rate, stocking, timing

The number of chum salmon (*Oncorhynchus keta*) returns in Hokkaido, northern Japan, increased since 1970s. The recent high returns are supported by the improved stocking techniques and favorable oceanic conditions (Kaeriyama 1999). However, there are significant differences in the return rate of hatchery-released salmon depending on their spawning seasons or home regions within northern Japan.

To determine the optimal timing to stock hatchery-reared juveniles, we have conducted a research project along the Abashiri coast of the Okhotsk Sea since 2002 (Nagata et al. 2004; Nagata et al. 2005). A part of chum salmon juveniles were otolith-marked with alizarine complexone (ALC) before hatching, and were stocked in the Abashiri River in April or May 2002–2005. Several marked groups were stocked at different timings to examine the effects of stocking timing on distribution and growth of juveniles after ocean entry. In the Abashiri Bay, four transects were established (A–D; Fig.1) in the costal waters, and three sampling sites were set on each transect at 1 km, 4 km, and 7 km from the shore. Marked and unmarked juvenile chum salmon were captured at these sites by a surface trawl in 2002-2005. Also, a beach seine has been conducted to capture salmon juveniles inhabited in the littoral waters (within 100 m from the shore; St. E in Fig. 1) in 2003–2005. Sampling in the coastal and littoral waters was repeated every ten days from late April to mid-July in each year.

While relatively high juvenile abundances were observed in the coastal waters from late May to mid-June in 2002 and 2004 when sea surface temperature (SST) ranged from 8 to 13°C, this temperature zones occurred only in June in 2003 and 2005 in the coastal waters (Fig. 2). When SST was below 8°C, marked juvenile chum salmon stocked in late April 2003 were not distributed in the coastal waters, and they appeared widely in the coastal waters when SST exceeded 8°C in June, along with the other marked group stocked in mid-May (Fig. 3). When SST was less than 8°C in the coastal waters, juvenile chum salmon were abundant in the littoral waters where SST was relatively higher. Marked fish stocked in late May 2004 and 2005 were distributed in the coastal waters immediately after stocking, and never captured in the littoral waters (Fig. 3), because SST in the coastal waters were near or

Fig. 1. Locations of sampling sites by surface trawl net (A–D transects) and beach seine (E). The arrow indicates release site of marked chum salmon.



All correspondence should be addressed to Y. Miyakoshi.
e-mail: miyakoshiy@fishexp.pref.hokkaido.jp

Fig. 2. Sea surface temperature at 1 km, 4 km, and 7 km off the Abashiri coast, 2002–2005.

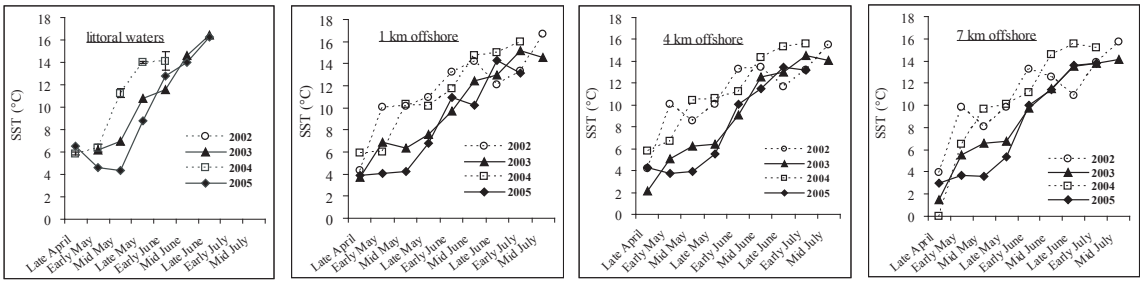
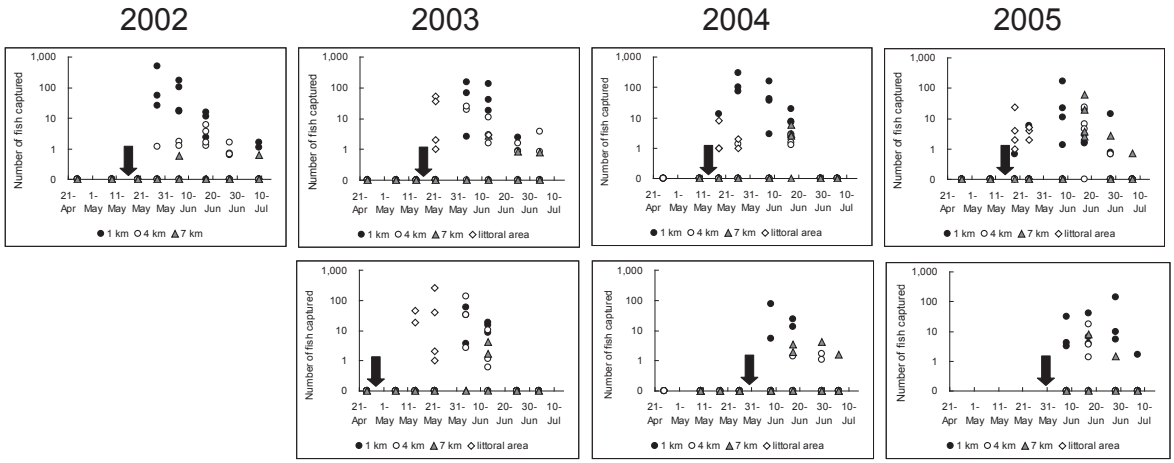


Fig. 3. Number of marked chum salmon captured by surface trawl (number of fish per 2 km towing) at 1 km, 4 km, and 7 km off the coast and beach seine (number of fish per 100 m towing) in the littoral waters, 2002–2005. The arrows indicate release dates for each marked group.



exceeded 8°C when they entered the ocean. These differences indicated that spatial distribution of juvenile chum salmon immediately after ocean entry was strongly affected by seawater temperature.

The specific growth rates (SGR) of marked juveniles released in mid-May was not correlated with SST. Also, SGR fluctuated within a season, and the trend was different from year to year. Seawater temperature might not be the critical factor to determine the growth rate of juvenile chum salmon in the coastal waters. High SST in May seems an advantageous condition for juvenile chum salmon, because it allowed fish to feed in the wide nursery areas. However, growth rates of juveniles should be related to abundance and structure of zooplankton community (Asami et al. 2005).

REFERENCES

Asami, H., H. Sato, H. Shimada, M. Sawada, Y. Miyakoshi, D. Ando, and M. Nagata. 2005. Fluctuations of the zooplankton community during early ocean life of chum salmon in the coastal waters of eastern Hokkaido, Okhotsk Sea. N. Pac. Anadr. Fish Comm. Tech. Rep. 5: 54−56.

Kaeriyama, M. 1999. Hatchery programmes and stock management of salmonid populations in Japan. *In* Stock Enhancement and Sea Ranching. *Edited by* B.R. Howell, E. Moksness and T. Svåsand. Blackwell Science, Oxford, UK. pp. 153−167.

Nagata, M., H. Asami, Y. Miyakoshi, and D. Ando. 2004. Spatial distributions of juvenile chum salmon in the coastal waters of eastern Hokkaido determined with otolith-marking in relation to zooplankton community. N. Pac. Anadr. Fish Comm. Tech. Rep. 5: 24−26.

Nagata, M., Y. Miyakoshi, D. Ando, and H. Asami. 2005. Relationship between the distribution of juvenile chum salmon in the coastal waters of eastern Hokkaido and water temperature as determined by experimental releases of otolith-marked juveniles. N. Pac. Anadr. Fish Comm. Tech. Rep. 6: 74−77.