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Sukyung Kang, Chae Sung Lee, Ki Baik Seong, and Cheul Ho Lee

Salmon Research Team, East Sea Fisheries Research Institute, NFRDI
424-1, Songhyun-ri, Sonyang-myeon, Yangyang-gun, Gangwon-do 215-821,
Republic of Korea

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Pacific salmon are the dominant fishes in the Pacific Ocean and the total catch of Pacific salmon has been at historical high levels recently. Especially, chum salmon populations have increased more than double during the past 20 years due to favorable ocean condition, improved population management policy and artificial enhancement programs in each country (Bigler et al. 1996). However, the survival rate (i.e., return rate) of Korean chum salmon has been quite low compare to other countries; about 1.5% in 1990s and 0.2% in 2000s.

For the last four decades, Korea's chum salmon program has focused on some routine activities on fertilizing eggs artificially, raising fingerlings, and releasing them. Return rate is one of the indicators that determine stock condition, and it would be controlled by survival condition of out-migration fingerlings. Since 1991, we have conducted investigations in river. Both biological and environmental data were collected in order to determine the behavior of fingerlings' out-migration and to investigate the source of early mortality during out-migration. Some preliminary results (i.e., duration and patterns of fingerlings' out-migration, stomach contents, and Namdae-cheon (river) environments) from those surveys are presented below.

Water temperature in Namdae-cheon increased with time and was above 15℃ since late April. High water temperature since late April would be inadequate for the survival of juvenile chum salmon. Mean water temperature for last 26 years (1980~2005) in the coastal waters near the mouth of Namdae-cheon was 9.8℃ in April and 12.9℃ in May. Negative correlations between return rate and mean water temperature of the coastal waters in April and May were observed (r=-0.485, p<0.05 in April; r=-0.599, p<0.01 in May) (Fig. 1). Zooplankton biomass in the coastal waters didn't show any significance with the return rate of Korean chum salmon. However, Seo et al. (2006) reported trends of zooplankton biomass corresponded with that of early growth of chum salmon. They reported that food availability was more important than seawater temperature in chum salmon growth in the North Pacific, although it is not easy to decouple the effects of these factors on fish growth.

Chum salmon fingerings were released into Namdae-cheon in mid Feb. and early Mar. in 2005.

All of fingerings, caught before 1st release were wild salmon. However, most salmon caught through the surveys were the released fingerlings from the Salmon Research Center. The proportion of wild salmon to total catch was 11.2%. Catch of juvenile salmon increased after salmon release, peaked the mid Mar., and gradually decreased. They seemed to stay in Namdae-cheon about 30 days and then move to the coastal area. Some salmon stayed persistently at upper stream and grew up to over 7 cm of body length.

Smoltification is a series of physiological, morphological and behavioral changes that takes place in juvenile salmon. Most salmon were smoltified since late April, which matched with water temperature increase (Fig 2). In addition, we analyzed stomach contents of chum salmon fingerings. The majority of prey eaten was clearly Diptera, which occupied 92% of number of prey items and 41 % of wet weight. The food items from stomach of juvenile salmon were matched with living organisms in the river. Therefore it seemed that there was no food selectivity of juvenile chum salmon in Namdae-cheon.

There is very little information about the coastal and ocean distribution to figure-out migration route of Korean chum salmon to the North Pacific Ocean. The surveys from coastal areas to offshore or along the coast of North Korea will be needed to improve our understanding on timing of out-migration, early mortality rate, and migration route near the coastal area.

References

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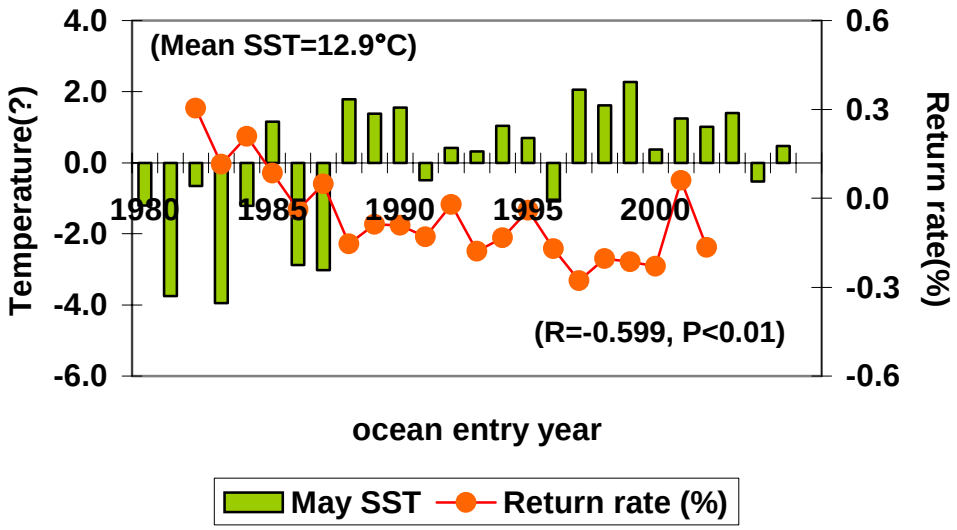

Fig. 1. Interannual variability in water temperature at river mouths and the return rate to Namdae-cheon.

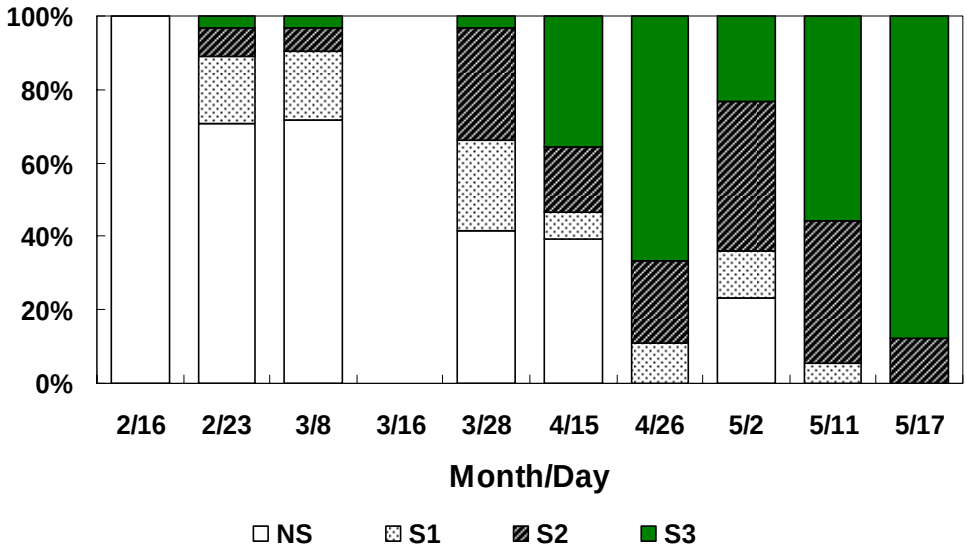

Fig. 2. Degree of smoltification of juvenile salmon. S1-S3 indicate parr mark, silvery apperance, and increase of caudal part and silvery, respectively.