Research on the Early Life History of Chum Salmon in Korea

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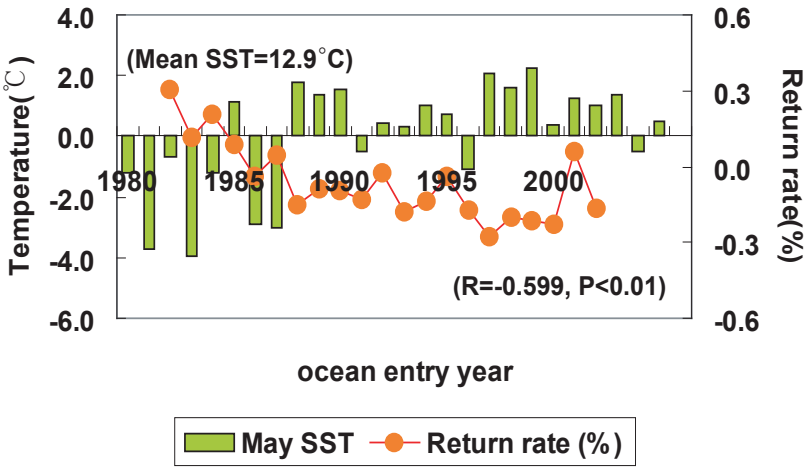
Pacific salmon are dominant fishes in the North Pacific Ocean and recent catches of salmon have been at historical high levels. Chum salmon have more than doubled during the past 20 years due to favorable ocean conditions, population management policies and artificial enhancement programs (Bigler et al. 1996). However, the marine survival rate of Korean chum salmon is quite low compared to other countries: ~1.5% in the 1990s and ~0.2% since 2000.

For the last four decades, Korea's chum salmon enhancement program has focused on improving the conditions of salmon stocks by artificially fertilizing eggs, raising fingerlings, and releasing them. We studied factors controlling the out-migration mortality of fingerlings with a view to improving return rates and consequently the status of Korean salmon. Since 1991, we have conducted follow-up 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. Here we provide some preliminary results from these surveys, mostly from 2005, which summarizes duration and patterns of fingerlings' out-migration, stomach contents, and physical characteristics of the Namdae-cheon (river).

Water temperature in Namdae-cheon increased with time and exceeded 15˚C after late April. These high temperatures may be unfavorable for the survival of juvenile chum salmon. Mean water temperatures (1980–2005) in the coastal waters near the mouth of Namdae-cheon were 9.8˚C in April and 12.9˚C in May. Return rates were negatively correlated with mean water temperatures of the coastal waters in April and May ($r = -0.485$, $p < 0.05$ in April; $r = -0.599$, $p < 0.01$ in May) (Fig. 1). Zooplankton biomass in the coastal waters was not correlated with return rates of Korean chum salmon. However, Seo et al. (2006) reported trends of zooplankton biomass were correlated with early growth of chum salmon. They concluded that food availability is more important than seawater temperature in determining chum salmon growth in the North Pacific, although it is not easy to decouple the effects of these factors.

Chum salmon fingerings were released into Namdae-cheon in mid February and early March in 2005. Fingerings caught before the first release were wild salmon. However most salmon caught originated from the Salmon Research Center. Wild salmon constituted 11.2% of the total catch. Catches of juvenile salmon increased after salmon release, peaked in mid-March, and gradually decreased. Salmon seemed to stay in Namdae-cheon about 30 days and then moved to the coastal area. Some salmon remained in the upper stream and grew up to over 7 cm body length.

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



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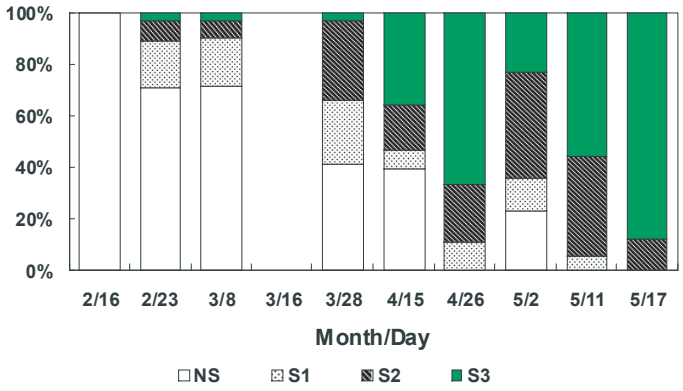
Smoltification is a series of physiological, morphological and behavioral changes that take place in juvenile salmon. Almost all salmon had smolted by late April, which corresponded with water temperature increases (Fig. 2). In addition, we analyzed stomach contents of chum salmon fingerings. The majority of prey eaten were Diptera, which represented 92% of prey items by number and 41% by wet weight. Food items from the stomachs of juvenile salmon were compared with living organisms in the river. Juvenile chum salmon in Namdae-cheon do not appear to feed selectively.

There is very little information about the coastal and ocean distribution and migration of Korean chum salmon in the North Pacific Ocean. Coastal surveys are needed to improve our understanding of timing of out-migrations, early mortality rates, and coastal migration routes.

Fig. 2. Degree of smoltification of juvenile salmon.



NS: no smoltification
S1: parr mark
S2: silvery appearance
S3: increase of caudal part, silvery

REFERENCES

Bigler, B.S., D.W. Welch, and J.H. Helle. 1996. A review of size trends among North Pacific salmon (*Oncorhynchus* spp.). Can. J. Fish. Aquat. Sci. 53: 455–465.

Seo, H., S. Kim, K. Seong, and S. Kang. 2006. Variability in scale growth rates of chum salmon (*Oncorhynchus keta*) in relation to climate changes in the late 1980s. Prog. Oceanogr. 68: 205–216.