Return of Chum Salmon with Latitude and Marine Environment in the Eastern Coast of Korea

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Chum salmon, *Oncorhynchus keta*, has the largest natural distribution range among salmon species inhabiting the North Pacific regions. River spawning sites of chum salmon in the Northwest Pacific are found throughout Russian, Japanese, and Korean rivers. The western coast of the East/Japan Sea (WEJS) is the southern limit of chum salmon distribution. However, the specific migration route of chum salmon in the WEJS from sea to river or vice versa is still unclear. This basic ecological knowledge including migration routes and distribution patterns is essential for effective management of salmon resources. In this study, we investigated whether arrival timing and movement patterns of chum salmon have been influenced by oceanic conditions around Korea waters. Results from our studies may be helpful in enhancing ecological knowledge and improving management of chum salmon and possibly connected to climate change.

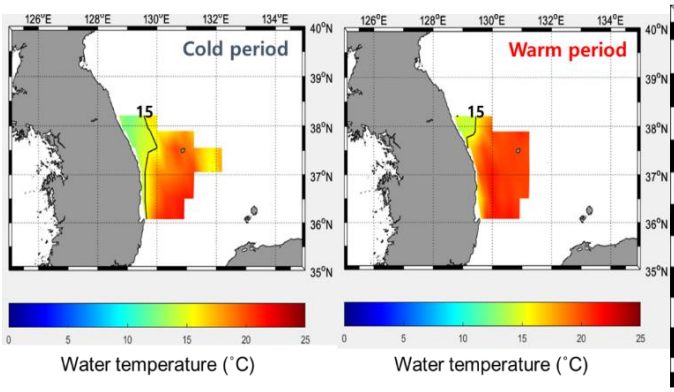

Fig. 1. Horizontal distribution of water temperature and 15˚C isothermal line at 30 m depth during cold and warm periods.

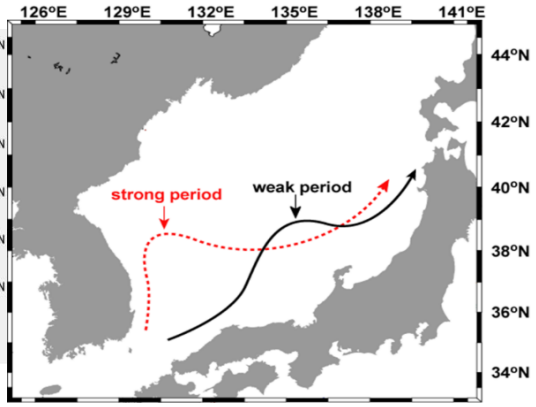

Fig. 2. Schematic diagram showing the two types of the main path of the Tsushima Warm current (Hong and Cho 1983; Lee 2003).

In the WEJS, horizontal distributions of water temperature in October, when the majority of chum salmon travel up rivers for spawning, are summarized as two types of periods (i.e., cold and warm oceanic conditions) (Fig. 1). During the warm period, water temperatures along the coast of the WEJS were higher than normal, while the water temperatures in this area were colder than normal during the cold period (Fig. 1). Such an alteration of cold and warm patterns was closely dependent on the strength of Tsushima Warm Current (TWC). In particular, strong volume transport of the TWC via the Korea Strait (KS) has pushed the main path of East Korea Warm Current (EKWC, branch of the TWC in the WEJS) northward along the eastern Korean coast resulting in changes to the water temperature structure in the WEJS (Fig 2). These oceanographic modifications in the WEJS probably control arrival timing and movement pattern of adult chum salmon.

The set net fishery landing data show that there were some latitudinal differences in chum salmon arrival timing (Fig. 3). Adult salmon return to their natal rivers between September and December; however, the horizontal distribution pattern of adult salmon arrivals was different by latitude. In the R-4 site (around 38˚N), the adult salmon first appeared in early September, whereas arrival timing in the other regions has been later than in the R-4 region (Fig. 3). The results indicated that adult chum salmon first arrived at the R-4 site, and in turn moved north and/or southward to their natal rivers. Because the coastal area around R-4 region also is known as the eastern tip of the subpolar front in EJS, adult chum salmon have been expected to use the subpolar front as one of the river migration routes. In addition, there also were somewhat south-northern variations in the catch of coastally arrived adult chum salmon according to the path of the EKWC and the extent of TWC volume transport via the KS in the

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WEJS (Fig. 4; see also Fig. 1). During the warm period, the catch ratio of adult chum salmon tended to be higher in the northern areas (R-1 and R-2 sites), while the opposite trend was evident during the cold periods (Fig. 4).

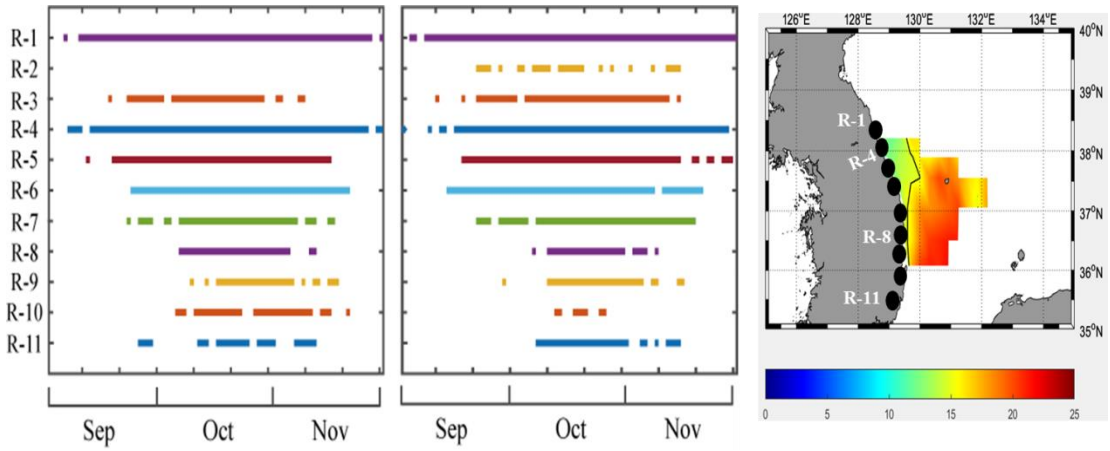

Fig. 3. Horizontal distribution of arrival timing of adult chum salmon during warm and cold periods. Left panel = warm period, middle panel = cold period, right panel = station maps from R-1 to R-11.

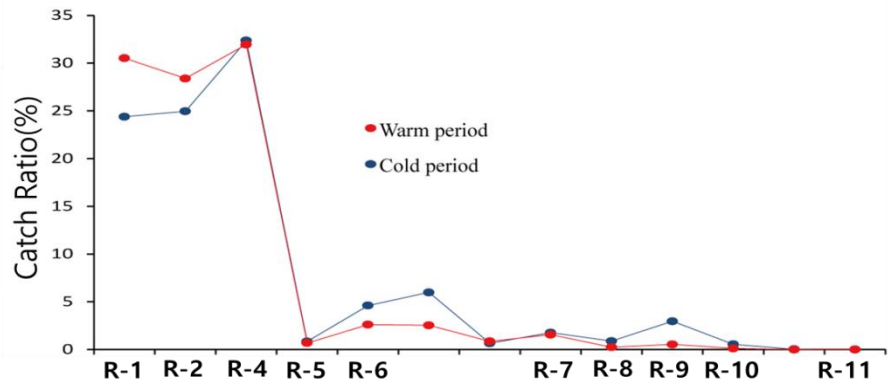

Fig. 4. Catch ratio of chum salmon between warm and cold period in each of the 11 regions on the eastern coast of Korea.

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