Long-Term and Spatial Correlations Between Survival Rates of Pink Salmon *(Oncorhynchus gorbuscha)* and Sea Surface Temperatures in the North Pacific Ocean

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Pink salmon*(Oncorhynchus gorbuscha)* are the most abundant salmon species in the North Pacific Ocean (Fig. 1). Year-to-year changes in abundance of pink salmon showed a similar trend in both odd- (solid line) and even-year (broken line) classes. Abundance began to increase in 1976, although it remained at low levels in the early 1960s to mid 1970s. Pink salmon abundance is controlled by spawner abundance and environmental factors. However, little is known about what, when, and where environmental factors affect pink salmon in the North Pacific Ocean.

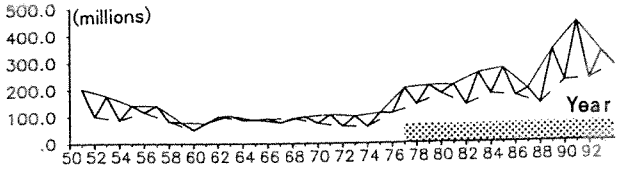

Fig. 1. Interannual change in abundance of pink salmon (*Oncorhynchus gorbuscha*) in North Paific Ocean. Solid line shows odd-year class and broken line shows even-year class.

Figure 2 shows the time series of the survival rate of pink salmon in the North Pacific. Changes in the survival rate were different between Russian (bold line) and Alaskan (thin line) pink salmon. Figures 3(a) and (b) show the spatial correlations between survival rates of Russian and Alaskan pink salmon and sea surface temperature in August in North Pacific Ocean. Relatively high positive correlation coefficients were found between survival rates of Russian pink salmon and the SST in the Sea of Okhotsk and the waters off the East Kamchatka in August. On the other hand, the survival rates of pink salmon from Alaska were related to SSTs in the waters along the west coast of North America in August. These seasons correspond to the period when mortality rate is the highest in the ocean life of pink salmon. This suggests that the survival rates of pink salmon are affected by SST changes at a local level.

As an index of survival rate of year-t class, the ratio of catch in year t+2 to year t was calculated for Russian and Alaskan pink salmon. This index of survival rate includes both freshwater and ocean mortality, including fishing mortality. Correlations between survival rates of pink salmon and sea surface temperature (SSTs) were investigated by monthly and 2°×2° area using data from 1977 to 1993. Pink salmon run sizes in Russia and Alaska, estimated by Rogers (1995), and the monthly mean gridded SST data set (GLBSST) in the North Pacific, provided by the Japan Meteorological Agency, were used in this study.

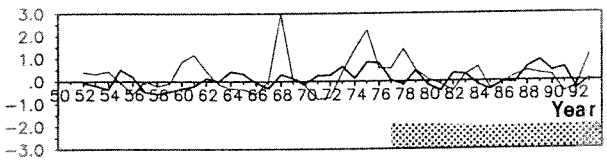

Fig. 2. Time series of the survival rate of Russian (bold line) and Alaskan (thin line) pink salmon.

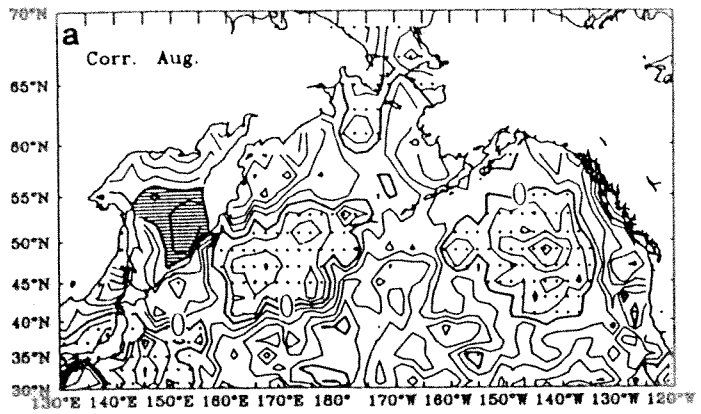

Fig. 3(a). Spatial distribution of correlation coefficients between the survival rate of Russian pink salmon and sea surface temperature in August. Hatch indicates the area of correlation coefficients more than 0.5. Dots indicate the area of negative correlation coefficients.

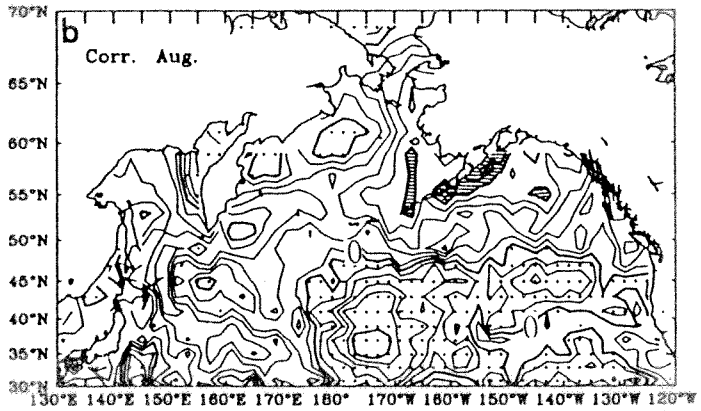

Fig. 3(b). Spatial distribution of correlation coefficients between the survival rate of Alaskan pink salmon and sea surface temperature in August. Hatch indicates the area of correlation coefficients more than 0.5. Dots indicate the area of negative correlation coefficients.

REFERENCES

Rogers, D.E. 1995. Estimates of annual salmon runs from the North Pacific, 1951-1994. Fisheries Research Institute, University of Washington, Seattle, January 13, 1995.