

Cyclic Climate Changes and Production of Pacific Salmon: The Possibility of Forecasting

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Long-term fluctuations of Pacific salmon production reflect the dynamics of climatic and ecological conditions over the North Pacific. The PDO and ALPI, the main climatic indices in the North Pacific, show synchronous 60- to 65-year fluctuations with clear maxima in the 1940s and early 2000s. The PDO is based on average annual North Pacific sea surface temperatures, which is a main ecological factor affecting biological productivity in the region. The 150-year sea surface temperature time series in the Gulf of Alaska shows the same dynamics as the PDO and ALPI, i.e., 60- to 65-year regular fluctuations. The total Pacific salmon catch in the 20th and early 21st century fluctuated in line with the PDO and ALPI dynamics: a clear maximum in the 1920-1940s followed by a depression in the 1950-1970s and a new maximum in the 1990-2000s. Three commercial salmon species, chum, sockeye and pink salmon, are known to provide approximately 95% of the total Pacific salmon production. Chum and sockeye production passed their maximum at the end of 20th century, whereas pink salmon production (both Asian and North American) still continues to increase slowly. The total Pacific salmon catch dynamics passed its maximum in the early 2000s, again in agreement with the dynamics of both the PDO and ALPI indices. We have reasons to expect the next descending trend in the PDO will likely start in the 2010-2020s and it will be accompanied by a corresponding decline in Pacific salmon. A simple stochastic model based on the 60- to 65-year cyclic climate oscillation can be used to foresee the main trends in Pacific salmon populations on a decadal scale. The model indicates a general decrease in Pacific salmon production is likely to take place in the 2010-2020s.