

Role of Climatic Conditions on Pacific Bluefin Tuna *Thunnus orientalis* Stock Structure

Authors : Ashneel Ajay Singh, Kazumi Sakuramoto, Naoki Suzuki, Kalla Alok, Nath Paras

Abstract : Bluefin (*Thunnus orientalis*) tuna is one of the most economically valuable tuna species in the world. In recent years the stock has been observed to decline. It is suspected that the stock-recruitment relationship and population structure is influenced by environmental and climatic variables. This study was aimed at investigating the influence of environmental and climatic conditions on the trajectory of the different life stages of the North Pacific bluefin tuna. Exploratory analysis was performed for the North Pacific sea surface temperature (SST) and Pacific Decadal Oscillation (PDO) on the time series of the bluefin tuna cohorts (age-0, 1, 2,...,9, 10+). General Additive Modeling (GAM) was used to reconstruct the recruitment (R) trajectory. The spatial movement of the SST was also monitored from 1953 to 2012 in the distribution area of the bluefin tuna. Exploratory analysis showed significance influence of the North Pacific Sea Surface temperature (SST) and Pacific Decadal Oscillation (PDO) on the time series of the age-0 group. Other age group (1, 2,...,9, 10+) time series did not exhibit any significant correlations. PDO showed most significant relationship in the months of October to December. Although the stock-recruitment relationship is of biological significance, the recruits (age-0) showed poor correlation with the Spawning Stock Biomass (SSB). Indeed the most significant model incorporated the SSB, SST and PDO. The results show that the stock-recruitment relationship of the North Pacific bluefin tuna is multi-dimensional and cannot be adequately explained by the SSB alone. SST and PDO forcing of the population structure is of significant importance and needs to be accounted for when making harvesting plans for bluefin tuna in the North Pacific.

Keywords : pacific bluefin tuna, *Thunnus orientalis*, cohorts, recruitment, spawning stock biomass, sea surface temperature, pacific decadal oscillation, general additive model

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