Common trends in catch per unit efforts of three kilka species and environmental variables time series in the southern Caspian Sea

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Abstract

In the present study, the time series (1996-2019) seasonal catch per unit effort (CPUE) of the most three pelagic fish species in two fishing regions in the southern Caspian Sea were analyzed using non-metric multidimensional scaling (MDS), min/max autocorrelation factor analysis (MAFA) and dynamic factor analysis (DFA). The main objective was to identify trends and explore the relationships between the CPUE and explanatory variables such as sea surface level (SSL), sea surface temperature (SST), East Atlantic/West Russia Pattern (EA/WR), global temperature anomaly (GTA) and fishing effort. CPUE in two regions (Babolsar and Anzaly) were highly correlated with environmental variables. In the MDS-ordination of all data, the samples were mainly clustered according to years and seasons, although the years 1996-2001 seemed somewhat different from the others. Both techniques of MAFA and DFA gave coherent results, indicating that the two most important trends in the response variables are: (i) a decrease in CPUE during the firth two-third of the time-series, and (ii) a fairly stable pattern in the last one-third. The main common trends obtained by MAFA and DFA were positive for anchovy and big-eye kilka and negative for common kilka in both regions. A DFA model with SST, SSL, and effort as the explanatory variable and two common trends gave good fits for main species, anchovy and common kilka. Based on these results on the environmental data, these variables and impacts of human activities should be taken into account when managing coastal environments for the conservation of these species in the Caspian basin.

Keywords: Min/max autocorrelation factor analysis, Dynamic factor analysis, Catch per unit effort, Kilka, Environmental parameters, Caspian Sea