

Climatic oscillations and tuna catch rates in the Indian Ocean: a wavelet approach to time series analysis

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ABSTRACT

We analysed the influence of climatic oscillations [based on the Indian Oscillation Index (IOI)] on monthly catch rates of two tropical tuna species in the equatorial Indian Ocean. We carried out wavelet analysis, an efficient method of time series analysis to study non-stationary data. Catch per unit of effort (CPUE) of bigeye tuna was computed from Japanese longline statistics from 1955 to 2002 in the equatorial Indian Ocean, and CPUE of yellowfin tuna was derived from industrial purse seine statistics from 1984 to 2003 in the Western Indian Ocean. Wavelet analyses allowed us to quantify both the pattern of variability in the time series and non-stationary associations between tuna and climatic signals. Phase analyses were carried out to investigate dependency between the two signals. We reported strong associations between tuna and climate series for the 4 and 5-yr periodic modes, *i.e.* the periodic band of the El Niño Southern Oscillation signal propagation in the Indian Ocean. These associations were non-stationary, evidenced from 1970 to 1990 for bigeye, and from 1984 to 1991 and then from 1993 to 2001 for yellowfin. Warm episodes (low negative IOI values) matched increases of longline catch rates of bigeye during the 1970-1990 time frame, whereas the strong 1997-1998 warm event matched a decrease of purse seine catch rates of yellowfin. We discussed these results in terms of changes in catchability for purse seine and longline.

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