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Management application of an empirical model of sardine–climate regime shifts

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Abstract

In previous work, we show that accumulated anomalies of physical indices are proportional to California sardine landings and that the accumulated anomaly curves change the sign of their slope, showing maxima (minima) when climate is favorable (unfavorable) to successful completion of the sardine life cycle change. Here, we find unique time series characteristics of the periods when the climate changed for sardines in the 1930–2004 period. Only one 50–70 year cycle is examined but the consistency of the dominant signals in measurements taken independently within the sardine's environment at locations separated by thousands of kilometers, supports the argument that the events affecting the ocean-climate of the California Current region and consequently sardine life-cycle are large-scale and persist over multi-decadal periods. Year-to-year monitoring of the climate regime-state in the physical environment and its accumulating effects on sardine populations is also described. The ability to analyze climate shifts and monitor their effects on the sardine populations can reduce uncertainty in making resource management, social and business decisions. Possible effects of management decisions affecting transboundary fisheries issues within United States (US) and between the US and its Pacific neighbors are clarified. The methods presented will add an analysis of low-frequency events to the current management oriented analyses of interannual events, which are part of the existing Pacific Fishery Management Council sardine management plan.