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Temporal trends in southern California coastal fish populations relative to 30-year trends in oceanic conditions

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ABSTRACT

Changes in the abundance of southern California marine fish populations during the past 30-years have raised concerns that these populations are at risk. These changes have been attributed to changes in oceanic conditions, overfishing, pollution, and habitat alteration. The objective of this study was to assess the relationship of changes in southern California fish populations to trends in different environmental variables. Fish population trends were determined from long-term (20- to 30- year) fish databases (e.g., power generating station fish impingement and trawl monitoring, recreational fishing, and publicly owned treatment work (POTW) trawl monitoring). Combined, these databases provided information on 298 species of fish. A number of long-term environmental databases (e.g., CalCOFI oceanographic data, shoreline temperature, coastal runoff, and POTW effluent contaminant mass emissions) were used to identify several important independent environmental variables (e.g., Pacific Decadal Oscillation (PDO); El Niño-Southern Oscillation (ENSO); offshore temperature; upwelling in the north, Southern California Bight (SCB), and south; coastal runoff; and contaminant mass emissions). Relationships of fish population trends to these environmental trends were determined using stepwise multiple regression analysis. The analysis sequentially assessed the relative importance of temperature, upwelling, and "other" variables in describing fish population trends. Most southern California fish populations had population trends that followed trends in natural oceanic variables. The most important of these were PDO (positive and negative responses), upwelling in the SCB, offshore temperature, and ENSO. The PDO was the dominant influence for most species in these databases, with the presence or absence of upwelling in the SCB during the warm regime having an important influence on others. The reduced abundance of cold-water species during the regime shift at the end of the 1970s was compensated only in part by increased abundances of warm-water species. Trends in surface runoff and mass emissions were difficult to distinguish from positive and negative PDO trends, respectively. While many species showed positive or negative responses to the environmental variables, catch trends for several important fished species showed weak or no relationships with any of the environmental variables examined, perhaps due in part to fishing or other influences.

Full Text

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