Climate Change Effects on Aquatic Ecosystems and the Challenge for Fishery Management: Pink Shrimp of the Southern Gulf of Mexico

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Ecosystems that change through time impose new scientific challenges for fisheries management advice. We present a case study to illustrate our view on how to face such challenges. The Pink Shrimp fishery in the Southern Gulf of Mexico has collapsed. Annual yields were about 24,000 metric tons during the mid-1950s to early 1970s; currently, they are about 1,200 metric tons. Overfishing was assumed as the main cause, but single-species models failed to provide the advice necessary for recovery. An inverse relationship between stock abundance and temperature was demonstrated, and a decline in recruitment and primary production (since 1970s) was observed. We constructed a trophic model for the ecosystem using Ecopath with Ecosim, incorporating the annual mean anomaly of the Atlantic Multidecadal Oscillation as a climate change index to force primary production. Signals were propagated throughout the food web, and biomasses were simulated for the period of 1956 to 2011. Ecosystem changes were estimated with the highest carrying capacity by the mid-1970s then declining with time; Pink Shrimp follows such a decline. Balanced harvesting was simulated and the “ecosystem reference level” was identified as a maximum harvesting of 40% (catch/biomass ratio) for all resources for a sustainable ecosystem. Conventional single-species management resulted in population crashes. by Francisco Arreguín-Sánchez, Pablo del Monte-Luna, and Manuel J. Zetina-Rejón