Effects of environmental conditions and jellyfish blooms on small pelagic fish and fisheries from the Western Mediterranean Sea

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Abstract
Sardine and anchovy have shown important changes in landings, biomass, abundance and body condition with time in the Western Mediterranean Sea. Several hypotheses have been proposed to explain these changes, including the negative interaction with jellyfish blooms. Increases in jellyfish blooms may be one of the reasons for a decline in these fish stocks because several jellyfish species have been shown to feed on fish larvae and juveniles. The main aim of the present study was to test the plausible relationship between jellyfish blooms and stock dynamics (abundance, biomass, and fitness) of anchovy and sardine, and its fisheries within an ecological context of the western Mediterranean Sea. Our main hypothesis was that jellyfish blooms, in combination with other environmental drivers, could have negative effects due to their predation on early stages of small pelagic fish (direct mortality) or due to predation on zooplankton, which is also prey of the small pelagic fish at different ontogenetic stages (direct competition). To test our hypothesis, we developed Bayesian Generalized Linear Mixed Models to compare landings, biomass, abundance, and Kn condition factor of both species with several climatic indices, oceanographic variables, and the occurrences of jellyfish blooms. Our results revealed that the jellyfish bloom occurrence had a high probability of negatively and broadly affecting both species in addition to changes in environmental conditions. This suggests that jellyfish blooms should be added to the likely causes of change when analyzing small pelagic fish change.

Author keywords
Anchovy; Climate change; Climate oscillation; Clupeids; Sardine