RELATIONSHIPS BETWEEN OCTOPUS VULGARIS LANDINGS AND ENVIRONMENTAL FACTORS IN THE NORTHERN ALBORAN SEA: AN ATTEMPT TO DEVELOP A PREDICTIVE MODEL

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Abstract
The stock abundance of short life-cycle species is very sensitive to the strength of annual recruitment, and the latter is influenced by environmental factors [1]. One of the aims of the present work is to accurately delimit the spawning period of *O. vulgaris* in the northern Alboran Sea, using maturity data, and the fishing season (from landing data). Finally we develop a predictive model which relates landings during the fishing season to environmental variables some months on advance. We show that environmental monitoring programs provide information that is extremely valuable to understand the factors that affect the abundance variability of this species, as well as for predicting and managing this resource
Keywords: Alboran Sea, Cephalopods, Models, Monitoring, Time Series

Introduction
Numerous environmental variables influence recruitment strength and stock abundances of fish species [1], [2]. This fact is more important in short life-cycle species because the stock abundance is very sensitive to the strength of annual recruitment. *O.vulgaris* is especially susceptible because annual recruitment is responsible for the entire stock biomass. In this work we have obtained environmental variables-abundance relationships in order to develop a predictive model for the northern Alboran Sea (fig. 1).
Maturity data have been used to delimit the spawning season, helping to choose the months when environmental variables should be used as predictors of the fishing season landings. Finally, the environmental factors-landings relationships found are used for developing a predictive model.

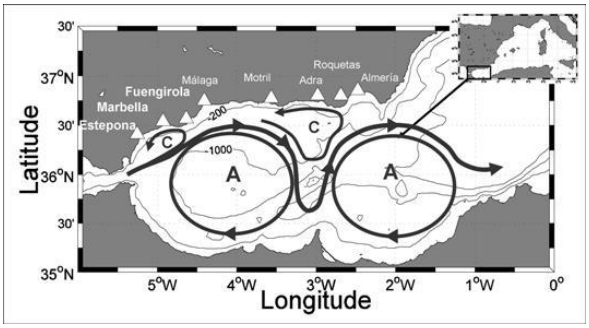

Fig. 1. Alboran Sea

Material and Methods
Monthly octopus landings from 1987 to 2008 in the northern Alboran Sea were used. Monthly environmental data were collected for the same period from ICOADS, NOAA, the Mediterranen Group on Climate Change from Instituto Español de Oceanografía (www.ma.ieo.es/gcc), from the project RADMED ("Series Temporales de datos Oceanográficos") funded by IEO, and also from the NCEP. Octopus landings and environmental variables time series were de-trended. Resultant time series were tested for normality and Pearson correlation coefficients between landing anomalies and environmental variables were calculated. Selected variables were used in a stepwise linear regression in order to select a set of candidate models. Akaike Information Criterion AICc and Cross Validation tests were used to select the best model.

Results and Discussion
The best predictive model was a linear combination of the mean Alboran Sea SST and the local temperature in Fuengirola beach. Our results show that an increase of octopus landings is related with negative temperature anomalies. Using the model, we have predicted octopus landings one year ahead (fig. 2) using natural years for defining the predictors and the landings. In the future, octopus maturity data will allow us to define accurately the spawning season and then select the months in which environmental factors will be considered. In this way, we would construct a model that would be more adjusted to the reality. This work has demonstrated that environmental monitoring an extremely valuable tool for the management of this resource.

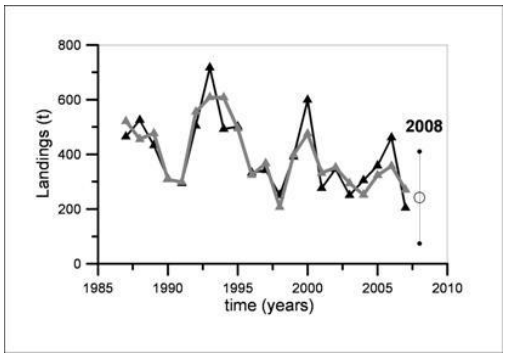

Fig. 2. Dark line: annual octopus landings. Grey line: landings predictive by a linear model

References
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