

Workshop Contribution #12

A mesoscale index to describe the regional ocean circulation around the Balearic Islands. Its impact on the population dynamics of demersal fishery resources.

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Historical oceanographic surveys carried out around the Balearic Islands (western Mediterranean) suggest two different scenarios for the regional ocean circulation. In one scenario, occurring during cold winters, cool water is formed at intermediate layers (150-500 m) in the Gulf of Lions. This Winter Intermediate Water (WIW) usually moves southward reaching the Balearic channels, deflecting the warmer Levantine Intermediate Water (LIW) coming from the eastern Mediterranean, and even stalling the Ibiza channel. On the other hand, during mild winters, less WIW is formed and then LIW flows through the channels, appearing at their characteristic depths. It has been hypothesized that the observed changes in the trends of catches and population dynamics parameters of some demersal species could be related to this inter-annual variability.

The oceanographic surveys around the Balearic Islands (1986–2004) have provided a qualitative index, indicating the presence or not of WIW in the Ibiza channel, based on the analyses of TS diagrams. In order to quantitatively relate oceanographic data and biological parameters, a better index for the WIW presence is advisable.

A quantitative index based on mean water temperature between 100 and 300 meters depth in the channels may also be defined. Both indexes, the qualitative and the quantitative, are well correlated for the period 1985-2004, however, both are short in time and gapped.

In order to obtain a longer and continuous index of presence of WIW and then of regional ocean circulation around the Balearic Islands, some atmospheric variables from the meteorological data base ERA-40 for the period 1970–2002 have been analysed. Mainly, the surface temperature (at 1000 hPa, the closest level to the surface) in 5 points (N, S, E, O and centre of the Western Mediterranean); and the magnitude of O-E and N-S low level fluxes from geo-potential height at 925 hPa.

The air temperature anomalies at 1000 hPa in the Gulf of Lions during winter (January-March) has been shown to be the best indicator of absence/presence of WIW in the Balearic Islands channels in late spring. Values over 0.4°C of the temperature anomaly would indicate absence of WIW in the Ibiza channel. The high correlation obtained allows using this index as an indicator of presence of WIW backwards in time and in those years for which the oceanographic data are missing.

The WIW index has been compared with the abundance of hake at sea (number of individuals and biomass at sea by year class and year) obtained from Virtual Population Analysis (VPA) and with catch per unit effort indexes (CPUE) for those years when VPA is not applicable.

As a result, a high correlation between hake dynamics and the WIW index in the Balearic Islands since 1980 is found, suggesting that a clear presence of WIW in the Balearic channel is an environmental favourable scenario for hake abundance in the area.