Climate changes and variability of small pelagic fish productivity in the Portuguese coast: The PO-SPACC project

A. Miguel P. Santos. Instituto de Investigação das Pescas e do Mar (IPIMAR), Portugal (amsantos@ipimar.pt)

The "Portuguese small pelagic fishes and climate change program: comparative retrospective analysis (PO-SPACC)" (FCT/PRAXIS/P/CTE/11281/1998) intends to be one of the contributions at the Portuguese national level for the GLOBEC-SPACC Programme. The main objective of the project is to build time series of atmospheric, oceanographic and fisheries data and use them to make a comparative analysis to investigate the interrelationships between small pelagic fish (SPF) and its environment (for more details see GLOBEC International Newsletter, Vol. 6 No.1, 15-17).

Sardine (*Sardina pilchardus*) is the main SPF species off Portugal, being of great socio-economical importance for the Portuguese fishing community and industry. Thus, the fluctuations in its productivity place important problems for fisheries' sustainability in the scope of fishery management and policies. For those reason that species is the main target of PO-SPACC Project.

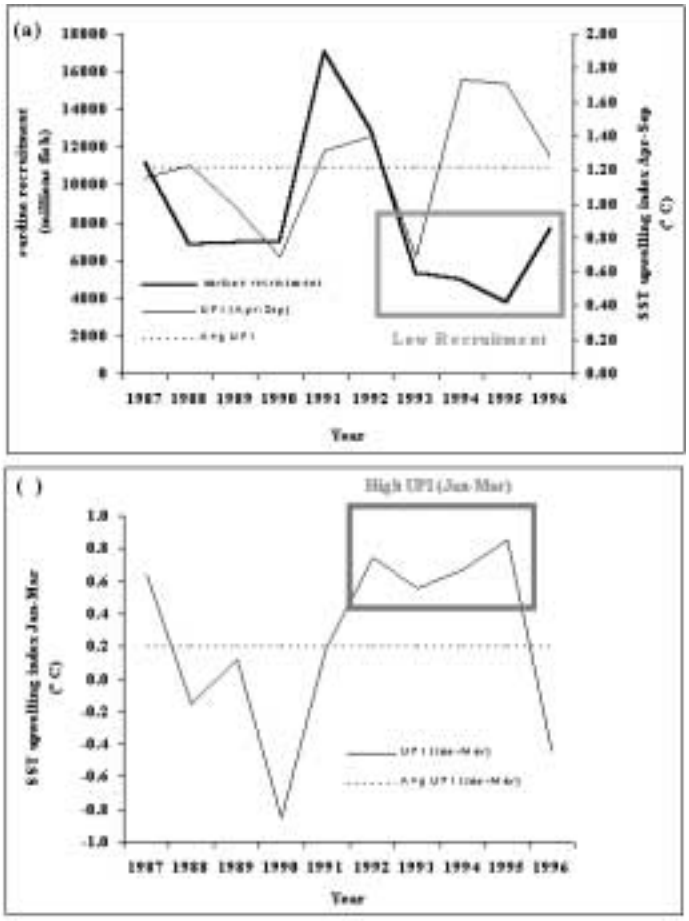

Figure 1: Annual upwelling indexes (UPI) for the typical upwelling season of the west coast of Portugal (April-September), produced from satellite-derived sea surface temperature (SST) anomalies between coastal and offshore areas, and sardine recruitment for the period 1987-1996 (a) and UPI during winter (January-March), the spawning season of these fish species (b). The long-term mean of the upwelling index series are indicated by the horizontal dot line (adapted from Santos *et al.*, 2001).

Until now the project have built the following time series:

- annual catch of sardine, 1896-1999
- sardine recruitment, 1976-1998
- annual catch of horse mackerel (*Trachurus trachurus*), 1915-1997
- horse mackerel recruitment, 1985-1998
- tuna catch, 1808-1835
- NAO index (Jan-Mar), 1864-1999
- Northerly wind frequency (Jan-Mar) from NCAR database, 1946-1991
- Mean northerly wind index (Jan-Mar) from NCAR database, 1946-1991
- Upwelling index from satellite-derived SST, 1987-1997

We (Santos *et al.*, 2001) showed that the decreasing trends in recruitment of sardine and horse mackerel off Portugal observed in the 1990's were caused by the increase of upwelling events during the spawning season (winter) of these SPF species (Fig. 1). We hypothesise that the increasing upwelling events in winter have had a negative impact on fish recruitment due to increasing larvae mortality, possibly through enhanced offshore transport to unfavourable feeding areas. Therefore these upwelling events during the spawning season of SPF off Portugal limit the success of spawning, contrary to the beneficial influence of upwelling events that occur later during summer.

We (Borges *et al.*, 2000) also observed decadal changes in the annual catch of sardine with a period of about 15 years (Fig. 2), as well as long-term periods of about 10-20 years and short-term ones of about 2-3 years of favourable winter upwelling conditions derived from the wind time series (Fig. 3). Furthermore, we detected two cycles in the annual catch of sardine: one high catch cycle in the period before the late 1960's and a low catch cycle from then on. These catch cycles coincide with a shift in the wind conditions which occurred in the beginning of the seventies which are in phase with the NAO index trends (data not shown).

The future work under PO-SPACC will be the continuation of the time series analysis on the effect of the environment on pelagic fish species (sardine, horse mackerel, tuna, anchovy, spinefish), and the investigation of how can we use environmental indices in the management of pelagic fish stocks.

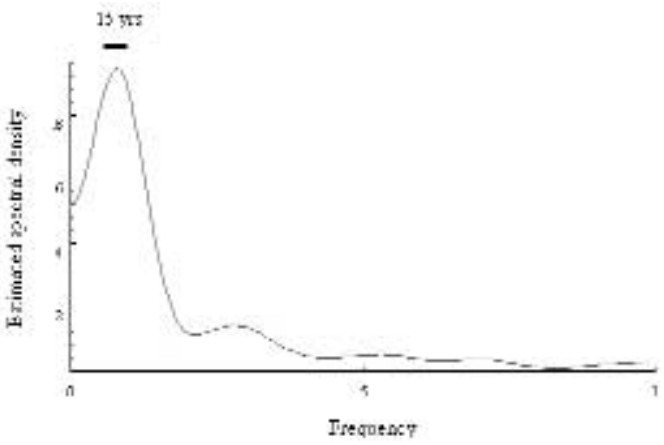

Figure 2: Smoothed periodogram of sardine catches obtained with a Parzen window (m = 25) (adapted from Borges *et al.*, 2000).

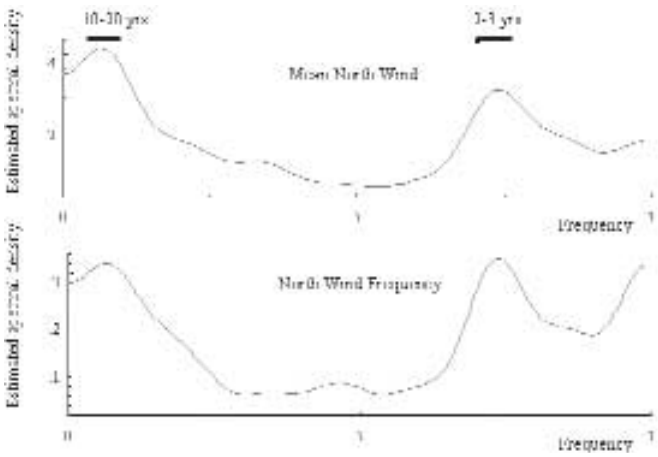

Fig. 3: Smoothed periodogram obtained with a Parzen window (m = 25) for the winter (January-March) wind conditions from 1947 to 1991: (a) mean northern wind (Mean_nw) index, and (b) northern wind frequency (Freq_nw) (adapted from Borges *et al.*, 2000).

References

Borges. M.F., A.M.P. Santos, N. Crato, H. Mendes and B. Mota (2000). North Atlantic Oscillation (NAO) and sardine population dynamics off Portugal. Submitted to Scientia Marina.

Santos, A.M.P., M.F. Borges and S. Groom (2001). Sardine and horse mackerel recruitment and upwelling off Portugal. ICES Journal of Marine Science (in press).

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Update on GLOBEC's Data Management strategies

Hester Willson, GLOBEC IPO, UK (HEW@wpo.nerc.ac.uk)

Data is an investment. We spend considerable amounts of time, money and energy collecting it and, like any investment, we have to take steps to insure that it doesn't lose value. When we receive our salary, we put it in the bank account, we keep records of where it is, what it's been spent on, we convert it to goods, savings, pensions – and we keep a record of all these things. To make the most of our money we must manage it actively and we must do the same for our data investments. Publishing our results is like banking the money – but what do we do with the data then?

The GLOBEC IPO is committed to helping GLOBEC scientists make the most of their data. It is our job to set up easy to use methods of recording and archiving GLOBEC data collected as part of the GLOBEC programme. In December, Hester Willson, the GLOBEC IPO Data Manager visited the Global Change Master Directory in Greenbelt, MD to discuss setting up a GLOBEC Metadata Inventory.

NASA's Global Change Master Directory (GCMD) is a comprehensive directory of descriptions of data sets of relevance to global change research. The GCMD database includes descriptions of data sets (DIFs) covering climate change, agriculture, the atmosphere, biosphere, hydrosphere & oceans, geology, geography, and human dimensions of global change. The user may search the GCMD database and the resulting metadata records provide information on the nature of the data (e.g., parameters measured, geographic location, time range) and where the data are stored.

The funding for the GCMD is long term, therefore storing metadata here is a secure way of preserving a record of the results and achievements of the GLOBEC programme. This will continue into the future when GLOBEC is completed and finished. To distinguish GLOBEC collected data, GLOBEC will have a specially set up portal into the GCMD. This will highlight the GLOBEC data available. The portal can be searched in two ways, by a simple free text search and by a detailed Keyword Search. Experts at the GCMD have proven that this is a more effective and efficient way of finding the data you are looking for. The keyword search also shows the number of records containing that particular keyword, which are available in the portal. The portal will be accessible via the GLOBEC International web pages. GLOBEC scientists will also have access to the GCMD, so that they can expand their searches beyond GLOBEC data if they so wish.

The GCMD uses a data format called a DIF (Directory Interchange Format), a de-facto standard used to create directory entries which describe a group of data. The DIF allows users of data to understand the contents of a data set. The DIF contains those fields that are necessary for users to decide whether a particular data set would be useful for their needs. Six fields are required in the DIF; the others expand upon and clarify the information. Some of the fields are text fields, others require the use of valid values. The 6 required fields are: