SPACC/IDYLE/ENVIFISH Working Group meeting on "SPATIAL APPROACHES TO THE DYNAMICS OF COASTAL PELAGIC RESOURCES AND THEIR ENVIRONMENT IN UPWELLING AREAS", Cape Town, 6th – 8th September 2001

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Fifty-five scientists from fifteen countries participated in a meeting aimed at synthesizing the state of the art concerning recent theoretical achievements, analysis techniques and modeling tools used for the integration of spatial structures in the study of the dynamics of marine populations and their environments. The "Spatial approaches of the dynamics of coastal pelagic resources and their environment in upwelling areas" meeting was held in Cape Town, South Africa, from 6th – 8th September 2001, under the auspices of GLOBEC-SPACC, IDYLE1 and ENVIFISH2 . Sponsors of the meeting were: GLOBEC International, IRD, JRC, MCM, UCT and SCOR. Participants hailed from Angola, Canada, Chile, France, Germany, Japan, Mexico, Morocco, Namibia, Norway, Peru, Portugal, South Africa, the United Kingdom and the USA. Whilst many presentations described research from the Benguela and Humboldt current systems, the Canary and California current systems were represented as was research from the Bay of Biscay and Iberian Peninsula. The Spatial Approaches meeting continued existing collaboration between ENVIFISH and IDYLE (the two programmes had co-hosted a Workshop in October 2000), and was also the first formal meeting of SPACC Theme 3: Reproductive Habitat Dynamics. This theme groups the activities of the various Process Studies Working Groups of SPACC, including WG6 – Daily growth and zooplankton, WG7 – Spawning habitat quality and dynamics, and WG8 – Spawning habitat dimensions and location.

Three scientific topics were selected for the Spatial Approaches meeting, including:

• quantification and modeling of the spatial dynamic of the environment and the development of new tools and techniques to do this;

•description of the spatial dynamic of pelagic fish resources and their interaction with the environment; and

• characterisation of the spatial dynamic of spawning and nursery grounds, coupling between spawning and the environment, and linkages between recruitment and the environment.

To address these topics, the Spatial Approaches meeting was divided into four sessions, with the first three sessions comprising presentations and the last a synthesis. Session 1 was entitled Monitoring, Models and Techniques, and contained presentations ranging from a

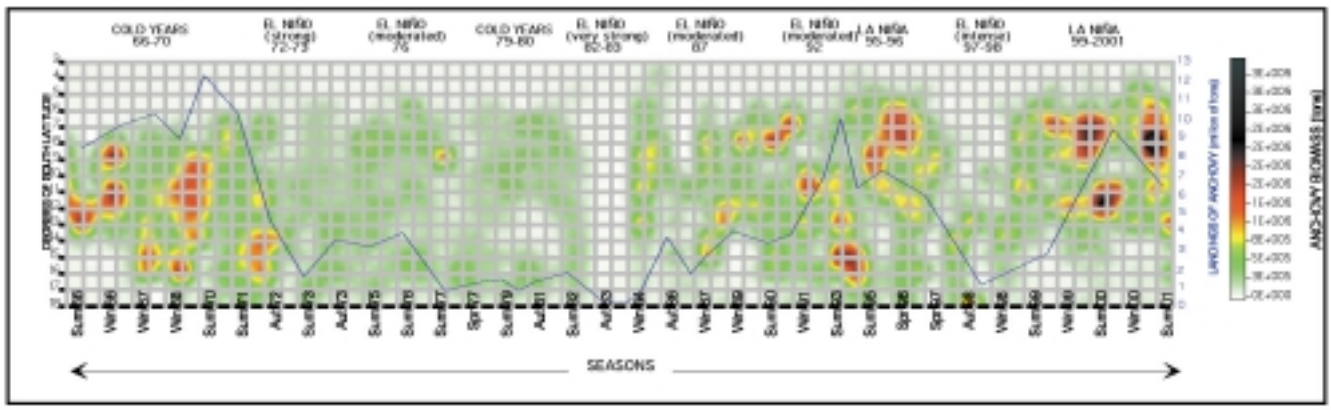

Figure 1. Time-series (by season) of the latitudinal distribution of biomass and landings of Peruvian anchovy (Engraulis ringens) over the period 1966-2001. A southward shift in anchovy distribution is apparent during periods preceding an El Niño event. Figure from M. Gutierrez, IMARPE, Peru.

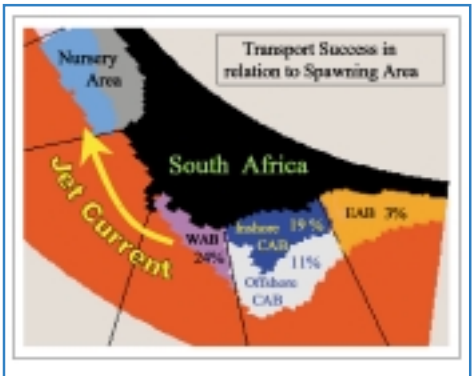

Figure 2. Results from IBM simulations showing variability of mean transport success (%) of particles released over different parts of the Agulhas Bank spawning area. WAB = western Agulhas Bank, CAB = central Agulhas Bank, and EAB = eastern Agulhas Bank. Successful transport means that the particles remain in the nursery area (off the west coast of South Africa) for at least 4 days within the time interval of 18 to 60 days after release. Figure from J. Hugget, C. Mullon, and P. Fréon, IDYLE, Cape Town.

proposed comparative retrospective analysis to reveal adaptive time-scales of fish populations, a description of an hydrodynamic model implemented in the southern Benguela, the use of artificial neural networks and self organizing maps (SOM) in environmental data analysis, a description of satellite identification of hydrogen sulphide outbreaks off Namibia, and descriptions of pelagic fish monitoring programmes in the Benguela and Humboldt current systems and the Bay of Biscay. One of the latter presentations illustrated how the latitudinal abundance and aggregative behaviour of Peruvian anchovy (Engraulis ringens) has showed marked changes related to stock size and the occurrence of El Niño events over the period 1966-2001 (Fig. 1).

The second session, entitled Spatial Dynamics, consisted primarily of presentations illustrating the distributions of small pelagic species off Angola, California, Chile, Morocco, Peru, Portugal and South Africa. Seasonal and annual variations in fish distribution and the effect of different biomass levels or different environmental conditions on distribution patterns were described. The possibility of non-stationarity in the adaptation of pelagic fish to their environment, evidenced by an eastward shift in Cape anchovy (Engraulis capensis) spawning habitat off South Africa, was described and discussed. Presentations describing spatial variations in anchovy spawning habitat along the Chilean coast, and spatial and temporal variability in the diet of top predators (seabirds and fur seals) in the northern Benguela, were also part of this session. Unusual oceanographic events in the southern Benguela thought to have resulted in the exceptionally high recruitment strength of Cape anchovy during 2000 were described, and used to construct an empirical model for predicting anchovy recruitment in the southern Benguela.

The third session included updates on international and regional programmes such as GLOBEC-SPACC, BENEFIT3 , and BCLME4. An overview of SPACC-related research in the Humboldt current system was given, and case-studies considered characteristic of the ENVIFISH and IDYLE programmes were presented. The ENVIFISH case-study related pelagic fish abundance in the southern Benguela (as indexed by catch-per-set) to environmental variables (e.g. SST and standard deviation of SST) through generalized additive models (GAMs). The functional forms suggested by the GAMs were then used to construct predictive equations using general linear models (GLMs). The IDYLE case-study described individual based models (IBMs) used to test hypotheses regarding the variability of anchovy recruitment success in the southern Benguela. In these IBMs, experimental simulations that involved thousands of individual particles representing eggs, larvae or juveniles released in the 3-dimensional hydrodynamic model of the region (known as PLUME) were run (Fig. 2). Pattern orientated analysis (POA) was used to compare simulation outputs with observed distribution patterns, and general linear modeling was carried out to establish the relative importance of the model parameters and their contribution to explaining the variance of the model outputs.

The final session consisted of a general discussion in which the future of collaborative work within SPACC was considered, with special focus placed on possible Benguela-Humboldt collaboration. As evidenced from the presentations, research in both of these systems is strong and has resulted in improving the knowledge of their respective dynamics. Similarities in problems, and in approaches to solve these problems in both systems were highlighted and it became clear that there is a unique potential to develop comparative studies between the two regions within the framework of GLOBEC-SPACC. However, whilst comparative analysis of the ecosystems was considered useful, it was emphasized that such analyses should be based on a scientific framework that would direct the collaborative research to answer specific scientific questions, to strengthen capacity building in areas where it is much needed, and to share expertise in relevant areas. Exactly what this framework should be received limited discussion, and at the end of the session participants felt that the meeting had set a solid basis for further discussion on collaborative work between the Benguela and the Humboldt systems.

A workshop report including extended abstracts from the meeting and summaries of the discussions will soon be published in the GLOBEC Report series. Overall, participants considered the meeting to have been informative, productive and useful in terms of creating links between scientists and identifying potential collaborators.

[1] *IDYLE (Interactions and Spatial DYnamics of Renewable Resources in UpweLling Ecosystems) is a multilateral programme involving scientists from South Africa, France, Namibia, and Angola. This GLOBEC-SPACC affiliated project aims to understand the dynamics of the interactions between pelagic fish and both the physical and biotic environment. Whilst studies are focused on the Benguela ecosystem, generic tools that can be applied to other upwelling ecosystems will be developed. See Fréon (2000), GLOBEC International Newsletter 6.1: 12.*

[2] *ENVIFISH (Environmental Conditions and Fluctuations in Recruitment and Distribution of Small Pelagic Fish Stocks) is a European Commission-funded project that aims to develop appropriate methodologies for improving the sustainable management of small pelagic fishes in the Benguela Current region. ENVIFISH is formally affiliated to GLOBEC-SPACC. See Nykjaer (2000), GLOBEC International Newsletter 6.1: 11, and Hardman-Mountford (2001), GLOBEC International Newsletter 7.1: 28-29.*

[3] *BENEFIT (BENguela Environment Fisheries Interactions and Training) is a regional research programme involving countries bordering the Benguela ecosystem (Angola, Namibia and South Africa). It aims to improve knowledge and understanding of the Benguela ecosystem and to provide training for young scientists in the region, so as to develop the enhanced scientific capacity required for the optimal and sustainable utilisation of living resources in the Benguela ecosystem. Both IDYLE and ENVIFISH are affiliated to BENEFIT.*

4 BCLME (Benguela Current Large Marine Ecosystem) is a Global Environment Facility-funded programme that aims to develop institutional capacity within the region for rational management of living and non-living resources of the Benguela Current Ecosystem.

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