HCS025 - Ecosystem Indicators and Integrated Conceptual Model: Fisheries Managements Perspective in the South-East Pacific

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Keywords: pelagic fisheries, northern Chile, variability, conceptual model, indicators.

The Chile-Peru Eastern Boundary ecosystem is one of the most productive systems of the planet. This richness takes place mainly by coastal upwelling induced by winds blowing predominantly towards the Equator and by the advection towards the Pole of rich nutrients water. In this ecosystem El Niño events correspond to those of most importance in the interannual variability. Nevertheless, after El Niño 1972-73 a regime shift was observed, and associated to a clear decrease of anchovy fishery after the mid 80's. In as much, from mid 70's a remarkable increase of sardine landings and in lesser quantity of jack mackerel and horse mackerel landings was observed. A second regime shift was observed after 1985, associated mainly by anchovy recovery and sardine decrease.
We develop an integrated conceptual model of different local and large scale phenomena that affects the marine environment and the distribution and abundance of the main pelagic resources of northern Chile (Fig. 1). This model is based on the analyses at different scales of environmental, biological and fishery data. The model describes the inter-decadal (associated to regime shifts) and inter-annual (associated to El Niño events) fluctuations developed in the Equatorial Pacific Ocean, South-East Pacific and northern Chile spatial scales, and the effects in annual cycle, planetary waves dynamics and coastal upwelling . In this framework, the interdecadal fluctuations would be playing an important roll in the sequence of alternating anchovy-sardine-anchovy regimes. An identification and develop of ecosystem indicators proxies is also proposed, in order to support the fisheries management decision making process.

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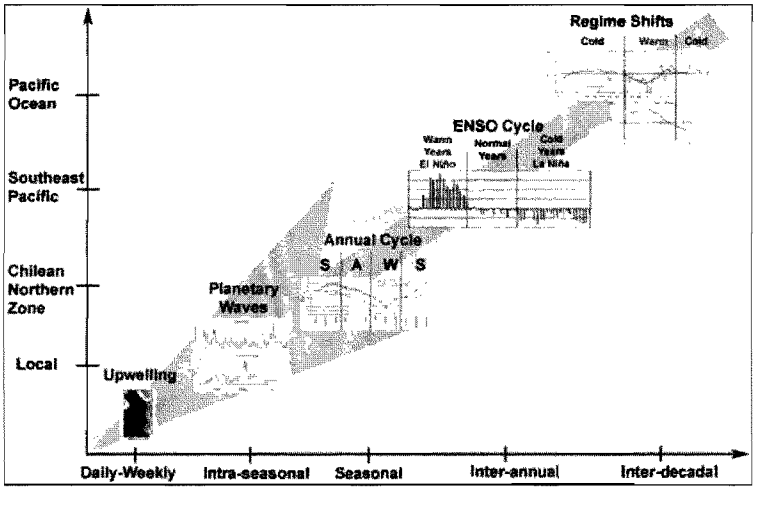

Figure 1. Northern Chile ecosystem integrated conceptual model relates local and large scale events affecting the pelagic resources.

HCS044 - Rule-based approaches to modelling long-term changes in the southern Benguela ecosystem

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Keywords: Benguela, change, ecosystem, model, rule-based

This paper describes how two rule-based approaches are used for detecting and predicting long-term ecosystem changes in the pelagic ecosystem of the southern Benguela region off South Africa. The two approaches are "frame-based modelling", which represents changes between ecosystem states on a decadal time scale, and "expert system modelling", which detects changes within a given ecosystem state (or frame). To implement these approaches, major ecosystem states in the southern Benguela are identified over the period of the past 50 years (mid-1950s to present), based on species compositions and hypothesised ecosystem processes. In the frame-based model, transition rules are defined and are used to change the ecosystem from one state to another. This model is executed to test scenarios of climate change in combination with different management strategies. The expert system model aims to improve our ability to detect real long-term ecosystem change in the short- to medium- term. This model synthesizes our best understanding of signals provided by ecosystem indicators, to provide an early warning of large-scale changes occurring in the ecosystem. The rule-based models rely to a large extent on expert opinion garnered from varied sources, in contrast to fully quantitative approaches, which are data-driven. We argue that the rule-based approaches allow multidisciplinary syntheses of ecosystem information in the absence of extensive data sets, and that the process of developing and maintaining such models allows trans-disciplinary teams to communicate effectively in implementing an ecosystem approach to fisheries management.

HCS055 - Expert systems as decisions support tools in an Ecosystem Approach to Fisheries: Comparing a fuzzy-logic and a rule-based approach

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Keywords :Benguela, decision support, EAF, fuzzy, rule-based

Management for an ecosystem approach to fisheries (EAF) must draw on information of widely different types, and information addressing various scales. Decision support tools, which have evolved considerably during the past two decades, assist in the decision-making process by summarizing this information in a logical, transparent and reproducible fashion. They generally consist of (i) a structured knowledge base storing the underlying information, (ii) an information system accessing and retrieving this information, (iii) a model predicting the outcome of a problem posed, and (iv) a framework that facilitates communication between the users, the decision support system, and the knowledge base. With regard to the modeling component, both rule-based Boolean and fuzzy logic models have been used successfully in such decision support tools, but the relative merits of these two approaches often remain unclear.
Three prototype decision support tools relevant to fisheries management in an EAF have been developed for the southern Benguela. The first is a rule-based expert system for the prediction of anchovy recruitment (Miller and Field 2002, Miller et al. this conference). The second is a fuzzy-logic decision support tool to monitor the implementation process of EAF in the sardine pelagic fishery (Paterson et al. this conference). This study is based on the construction of a fuzzy-logic counterpart for the rule-based model, and a rule-based counterpart to the fuzzy-logic model. We summarize the knowledge gained in this process with specific reference to the third tool, an expert system for predicting long-term ecosystem change (Moloney et al. this conference). We demonstrate the potential merits of both the rule-based Boolean and fuzzy logic models in supporting decision-making in an EAF.

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HCS056 - A fuzzy spin on fishy problems: Development of a fuzzy-logic tool to assist in multicriteria decision-making for an ecosystem approach to fisheries in the Southern Benguela

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