EVOLUTIONARY INDIVIDUAL-BASED MODEL FOR THE RECRUITMENT OF THE ANCHOVY IN THE SOUTHERN BENGUELA: TOWARDS A METHODOLOGY FOR UNDERSTANDING SPAWNING PATTERNS?

(This presentation is based on a paper submitted to CJAS, by C. Mullon, P. Cury and P. Penven)

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Evolutionary simulations are developed to explore environmental constraints that select observed spatial and temporal spawning patterns for the anchovy in the southern Benguela. They couple a realistic 3-D hydrodynamic model with an individual-based model in which an evolutionary-based reproductive strategy for adult fish and a passive transport for early-life stages are implemented. The evolutionary success of spawning is quantified when patterns at the population level emerge after many generations from constraints at the individual level through a selective process. Simulated patterns match observed spawning patterns when two selective environmental constraints are associated: a threshold temperature of 14°C, above which the development of early-life stages is insured, and the avoidance of offshore currents that constitutes a loss of spawning products. Other spawning patterns are observed under different selective constraints, indicating the possible existence of several coexisting self-sustaining populations with different recruitment patterns. A differential exploitation of these populations will have a strong incidence on patterns of variability for recruitment. A general methodology is proposed for identifying sets of environmental factors important for self-sustaining populations and fish recruitment.

The French south-African Idyle project, within which this modelling experiment was performed, is then presented in order to document several different activities that are currently developed on "Ecosystem Modelling" in the Benguela.

Keywords: Recruitment, reproductive strategy, pelagic fish, anchovy, upwelling, southern Benguela, hydrodynamical 3D model, IBM, evolutionary simulations, viability, self-sustaining populations.

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