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.
Environmental Variability and Small Pelagic Fisheries in the Mediterranean Sea

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