Investigating Sardinella aurita seasonal migratory pattern off North-West Africa with a biophysical model

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Abstract

Sardinella aurita, or round sardinella, has been the main small pelagic fish species harvested off Senegal and Mauritania coasts over the last 4 decades and plays a central role for sub-regional food security and economic incomes. The landings of this species have strongly declined recently. Intense exploitation and climate change are acting together but population's dynamics are too poorly understood to disantangle the different drivers and to clearly evaluate the current state of *S. aurita*'s population. In the present study, we developed a bio-physical, individual based model for *S. aurita* population off North-West Africa. The hydrodynamic environment was simulated by a regional model ("ROMS") configuration covering the area 5°-40°N and 5°-30°W, with a 8km resolution and 32 sigma-levels in our area of interest. The biogeochemical compartments were simulated using the PISCES model coupled with ROMS. Fish schools of S. aurita were represented by active lagrangian markers affected with ad hoc larval, juvenile and adult fish swimming behavior. Individual's physiology was described following the local temperature and food availability by the Dynamic Energy Budget model "DEB". The extended kinesis algorithm ruled the horizontal fish movement and depends on food research, individual temperature preference and spawning migration, whereas fish vertical position in the water column was set for each stage according to scientific knowledge. We investigate the predicted seasonal migrations pattern of *S. aurita* off West Africa over the period 1980-2006. Then we also evaluate the fluctuations of fish biomass available for coastal fisheries (h$<$200m) in 4 distinct areas from the western Saharan bank (24°N) down to the Bijagos islands (11°N) and compare with the available fish landings data on this period. Finally, we calculate seasonal connectivity indices between the populations in the 4 areas selected as the percentage of fish present in an area that was born in another area.

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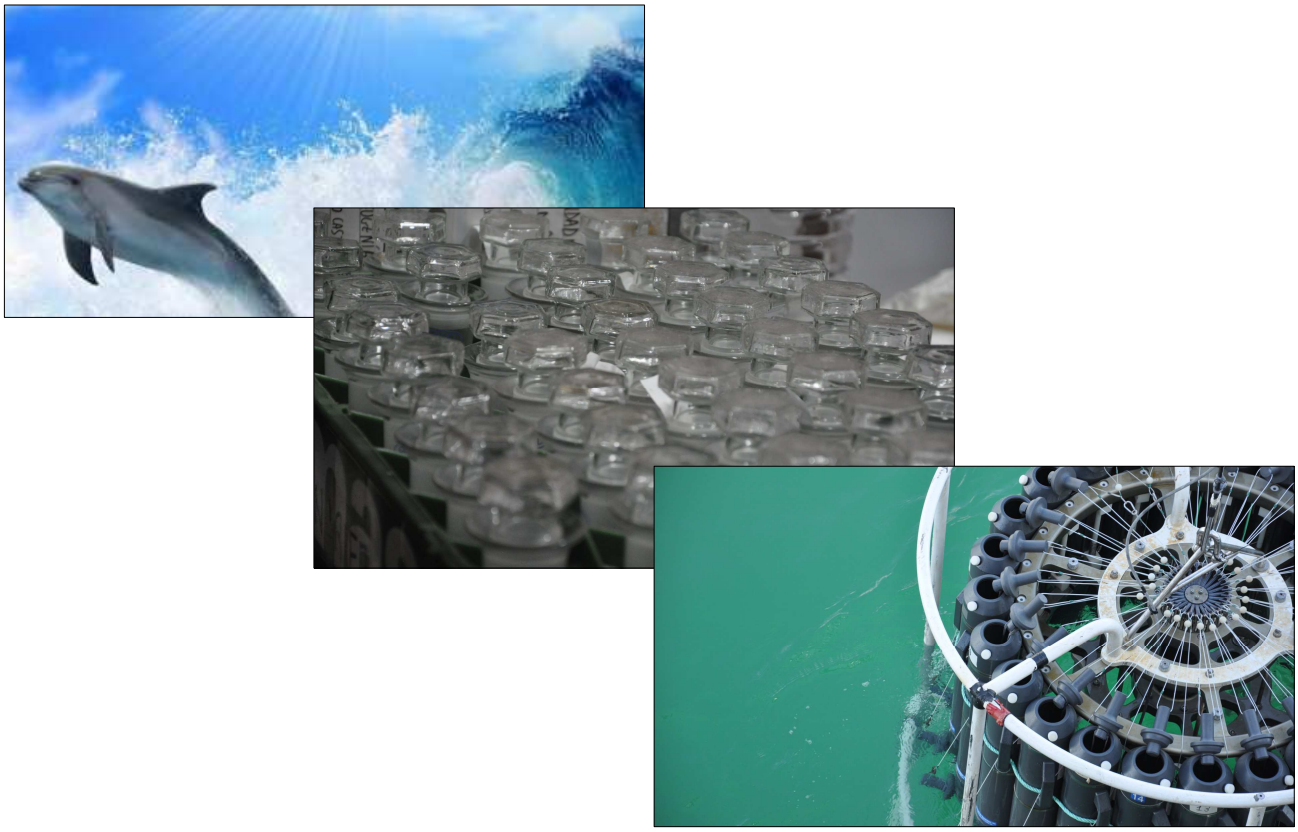

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