# IMPACT OF LOW OXYGEN ON THE LIFE CYCLES OF ZOOPLANKTON IN THE BENGUELA CURRENT UPWELLING REGION

## *IMPACTO DEL BAJO OXIGENO SOBRE LOS CICLOS DE VIDA DEL ZOOPLANKTON EN LA REGION DE SURGENCIAS DE LA CORRIENTE DE BENGUELA*

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The Benguela Current off southern Africa is one of the four major eastern boundary current systems of the world's oceans, characterized by coastal upwelling and high productivity supporting commercially valuable fisheries. Uniquely, it is bounded by warm-water frontal systems along its northern (the Angola-Benguela Front - ABF) and southern (the Agulhas Current Retroflection) borders, which both affect the living resources of the Benguela. Another feature of the Benguela is the extended area of oxygen-depleted water masses. In the north, there is an almost permanent hypoxic layer overlying the bottom. In some areas, oxygen concentrations <1 ml $L^{-1}$ are also found in the pelagial at depths of 50 to 100 m and thus may be a limiting factor for many pelagic species, particularly their early life-history stages. This may be even more important than currents, temperature gradients or food limitation caused by weak upwelling. Until recently, information on the effects of oxygen depletion on pelagic species, their recruitment or migration and distribution patterns, was scarce. Research initiatives to redress this were started under the umbrella of the BENEFIT (Benguela Environment Fisheries Interaction and Training) Programme and the Germany-South Africa Bi-lateral Scientific and Technological Cooperation. Data were collected during capacity building and training cruises onboard the South African FRS *Africana* (1999 and 2002) and the German RV *Alexander v. Humboldt* (2004). We present data on horizontal and vertical distribution patterns of low-oxygen water and how hypoxic conditions affect the distribution of life-history stages of populations of zooplankton (e.g., the dominant copepod *Calanoides carinatus*) and commercial fish (e.g., larvae of sardine *Sardinops sagax*, anchovy *Engraulis encrasicolus* and horse mackerel *Trachurus capensis*). The observed large-scale patterns in the hydrography and plankton distributions suggest that the Benguela system comprises a number of sub-systems, distinguishable based on water-mass characteristics, productivity patterns and plankton communities. Consideration of oxygen as an important environmental factor in the life history of zoo- and ichthyoplankton species and communities opens new perspectives for explaining their life-history strategies. Tight correlations exist between oxygen concentration and stratification as well as ecological adaptations of copepods and larval fish. For instance, *C. carinatus* did not inhabit the intermediate oxygen minimum layer (IOML; <1 ml $O_2$ $l^{-1}$). Experimental and physiological studies showed strong differences between active, lipid-poor individuals at the surface and diapausing, lipid-rich copepodids C5 below the IOML with severely reduced metabolism and respiration rates. Clearly, the role of the different zooplankton components interlinking primary production with pelagic fish stock dynamics under various seasonal and environmental influences, especially oxygen deficiency, is not fully understood, warranting further investigation.