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Pelagic ecosystem functioning in the vicinity of the Kerguelen Islands (Southern Ocean): a state of the art

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Results acquired over more than two decades now make it possible to outline the functioning of the pelagic ecosystem off the Kerguelen Islands. Although the structuring role of natural iron fertilization has been demonstrated both in terms of productivity and the structuring of pelagic communities, recent results raise questions about the paradigm of the coupling between carbon and silicon biogeochemical cycles in naturally iron-fertilized environments of the Southern Ocean. Similarly, new, recently published results highlight the role of biological processes, e.g. the partitioning of grazing between micro- and mesozooplankton, or the life cycles of primary producers (including senescence and resting spore formation) in the operation of the biological carbon pump. At the same time, several conceptual models have been developed to better describe the functioning of pelagic ecosystems with regards to the limiting nutritional factors of the first trophic levels. The synthesis of current data lays the foundation for the current functioning of the pelagic ecosystems surrounding the Kerguelen Archipelago and guides implementation of the strategies to observe the changes that will affect this region in the coming years in response to global warming. The partitioning of the Southern Ocean into large meridional subsystems was a step towards a modern understanding of its biogeochemical functioning, with emphasis on the structuring role of the seasonal pack ice zone, the Antarctic circumpolar current, and geostrophic frontal systems. The most recent studies now highlight the need to consider the zonal variability of the Southern Ocean, which should lead to the development of multiple models combining physical, geomorphological, biogeochemical, and ecological characteristics at regional scales.