

MODELLING OF ECOSYSTEM DYNAMICS IN THE BLACK SEA

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ABSTRACT

The objective of the basic model studies is to understand the dynamical behaviour of the lower trophic levels of the Black Sea ecosystem, as affected by first order physical processes within the mixed layer. A zero-dimensional simple ecosystem model is used to solve the time dependent coupled equations for the system biological and chemical elements.

The strategy, necessitated by the low order approach, and based on a synthesis of satellite and in-situ pool of information, is to divide the Black Sea into some characteristic areas where the input parameters differ by the nature of their physical, chemical environments.

Simple models at different levels of sophistication are considered. For this purpose, a series of models with increasing numbers of trophic levels are constructed, including 4, 7, 8, 9, and 11 levels. The lowest order system is based on phytoplankton, zooplankton, nutrients and detritus. The most complex system includes bacteria, DON, ammonia, as well as two classes of phyto- and zooplankton, as well as Mnemiopsis and mucus compartments. Sensitivity to choice of parameters, and food rationing is investigated. The reducability of the more complex systems to lower order systems without major losses in the representation of dynamical behaviour is investigated.

Mixed layer properties are extracted from historical and recent data. Average mixed layer nutrient distributions in the Black Sea and the ratios of nutrients with respect to different regions and circulation features are investigated. Changes in these distributions over the last decades are evaluated. The possible changes in the primitive ecosystem due to eutrophication are investigated, based on changes in nutrients and invasion of new carnivore species. In particular, the effects of ctenophores on the lower trophic levels, and possible interannual fluctuations are examined.



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MODELLING HYDRODYNAMICALLY DOMINATED
MARINE ECOSYSTEMS
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