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Linking a lower trophic ecosystem model with a bioenergetics model for European anchovy

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This contribution falls into the framework of the “Southern European Seas: Assessing and Modelling Ecosystem changes” (SESAME) project and synthetically presents the modelling efforts of a fish model in conjunction with a lower trophic level ecosystem model applied in the eastern Mediterranean.

Abstract: A fish bioenergetics model is implemented for European anchovy (Engraulis encrasicolus) and applied to northern-east Aegean Sea (eastern Mediterranean Sea). The model reproduces the growth of the European anchovy in a one-way linked with a lower trophic level ecosystem model (LTL), called POM-ERSEM (Princeton Ocean Model - European Regional Seas Ecosystem Model II) model. Three zooplankton group densities (flagellates, microzooplankton, mesozooplankton) derived from LTL are provided as the available energy intake for anchovy bioenergetics model. Following the basic structure of NEMURO.FISH type models (North Pacific Ecosystem Model for Understanding Regional Oceanography for Including Saury and Herring), certain model parameters concerning energy processes were imposed from related species’ energetics while others from field data and biological information specified for anchovy from the study area of northern-east Aegean Sea. Simulation results showed that the fastest growth is during spring and the slowest growth rate is noticed from October to January. The decrease of mesozooplankton consumption rate during

winter denotes a low energy intake causing an almost zero growth rate especially for age group +2 anchovy. Spawning activity did not a negative effect on the overall condition of anchovy's weight. Anchovy's weight began to increase before the start of spawning period and continued to increase during the all period, verifying the association of anchovy's reproduction with feeding rather than from energy reserves. The fit of the model to the data was satisfactory; an adjust state for anchovy is defined and adopted as a model assumption (reduction of swimming speed and partial feeding in smaller prey sizes) in order to avoid severe loss of weight during winter. Major sensitivities tests indicated the importance of feeding, adjust state assumption, water temperature and swimming speed of activity respiration to anchovy growth.