EFFECTS OF CLIMATE-DRIVEN CHANGES ON THE NORTH-CENTRAL ADRIATIC FOOD WEB: INSIGHTS FROM AN END-TO-END APPROACH

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Abstract
A biogeochemical model and an Ecopath with Ecosim food web model of the North-Central Adriatic Sea have been integrated for a comprehensive description of ecosystem dynamics. This End-to-End tool has been used to perform scenario analysis for evaluating the effects on high trophic level of potential climatic changes on precipitation and nutrient patterns (changes in timing and volume) in the region.
Keywords: Food Webs, Nutrients, Models, Adriatic Sea

Climatic changes are expected to produce variations that might substantially modify the structure and functioning of marine food webs with important consequences for exploited species. Important factors to be considered include modification of river run-off and water column stratification, which in turn cause modification in nutrient concentration within the euphotic layer with cascading effects on the upper part of the food web. Integration of biogeochemical processes and food web dynamics in an End-to-End approach is a possible way to tackle this issue. In this work, we analyse the potential cascading effects of climate-driven changes on the food web of the North Adriatic Sea ecosystem (Italy, Slovenia and Croatia) by using a hierarchy of linked models. Previous climatic scenario analysis for the North Adriatic region were obtained by comparing highly resolved meteorological outputs of a Regional Climate model (RegCM) for a reference situation (RF, 1961-1990) and two future IPCC scenarios (2071-2100). Results showed local change in the seasonality of precipitation pattern with increase of winter rainy events and a decrease of spring summer precipitation [1],[2]. These changes, observed in both market oriented (A2) and local sustainability policies (B2) scenarios, imply a change in the seasonality of nutrient inputs to the coastal areas whose effects on the food web are studied by using a hierarchy of models. An Ecopath with Ecosim (EwE) model representing the food web of the North-Central Adriatic Sea [3], [4] is forced by a biogeochemical (BGC; [5]) model of the system which, in turn, simulates two future scenarios, one with changes in the seasonality of nutrient inputs (equivalent to A2) and another that also include a general reduction of inputs of nutrient from the rivers due to the implementation of sustainability policies in the land use management (reduction of fertilizers; B2).
The biogeochemical and food web model are integrated through a two steps procedure [6]. In the first step the models are integrated by extending the EwE model for including the main biogeochemical processes thus accounting for all possible interactions among high and low trophic levels. In the second step the nutrient inputs are adjusted in the extended model in order to adjust to the BGC results in terms of nutrient dynamics. The adjustments are necessary for accounting differences in parameterization of the two models, including differences in the time and space scheme used [7]. The effects of climate-driven changes on higher trophic levels are analyzed by comparing the long term evolution of biomass for different trophic groups simulated under the different scenarios, with particular attention to species target of fishing activities (e.g. small pelagic species and demersal predators).

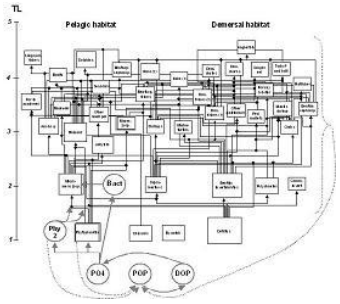

Fig. 1. Schematic representation of the End-to-End model for the North Adriatic Sea used in the climatic scenario analysis. The original food web model comprehend 40 functional groups (black boxes and arrows), that is extended to describe the biogeochemical processes (grey circles and arrows)

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