

POSSIBLE LINK BETWEEN THE BASIC SCIENCE AND NATIONAL ECONOMIC STRATEGY: A FISHY HYPOTHESIS FROM THE NORTHERN ADRIATIC

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Abstract

Long-term analysis of oceanographic conditions leading to extreme phytoplankton blooms in the northern Adriatic revealed that specific February conditions in the region might play a key role in the entire Adriatic anchovy stock. Even the preconditioning of the February conditions might be feasible. These findings could be a valuable input in the national economic strategy for a sustainable development *via* monetary stimulation grants that Croatia provides for fishery.

Keywords: North Adriatic Sea, Phytoplankton, Blooms, Fishes, Circulation

Introduction

One of the most productive regions of the generally oligotrophic Mediterranean Sea is the northern Adriatic. The Po River freshets induce high production rates in this region, which are especially pronounced in the western part, close to the delta (Fig. 1). Consequently, a west-to-east descending phytoplankton abundance gradient usually forms. However, the area affected by large blooms sometimes enlarges and, in extreme cases, large phytoplankton blooms occur over large areas with a pronounced southward current near the eastern coast between stations SJ107 and RV001 (the Istrian Coastal Countercurrent; ICCC). To broaden our knowledge about factors which induce and/or spread large blooms in the region, we have related the phytoplankton abundance to basic oceanographical and atmospheric parameters and to the Po River discharge rates. In order to investigate possible effects of large blooms on the bio-production in the Adriatic, we compared our data to the Adriatic anchovy catch, *Engraulis encrasicolus* (L.), one of the most important commercial fish species in the Adriatic [1]. We have also investigated surface fluxes and Po River discharge rates for several months preceding a bloom.

on: Po section): monthly/seasonally collected oceanographic data, including components of geostrophic currents relative to 30 dbar surface between stations, monthly averages of surface fluxes and Po River rates, and yearly averages of fish catch data. Correlations were determined with a simple linear regression analysis.

Results with discussion

The highest seasonal phytoplankton blooms are the February ones. The largest February bloom at SJ107, SJ108 and SJ101 occurred in 2004. At the time the ICCC was very pronounced, while cold, low salinity, low density and nutrient rich waters from the vicinity of the Po River delta spread in a thick layer over the northern Adriatic and broadened phytoplankton from the western region over to the eastern one. Large February blooms at these three stations were preceded by an intense Po River influx during the previous June-August, by an intense evaporation in the preceding November and, interestingly, by low Po River rates in November and December. A large phytoplankton abundance at SJ101 and SJ107 in February along with specific distribution of geostrophic currents across the Po section in the same month highly correlated with the anchovy catch of the same year. The obtained correlations were highly dependent on the year 2004, when ICCC, phytoplankton and yearly anchovy catch were of outstanding values. However, a very high bloom at SJ101, which occurred in February 2000, when freshened waters occupied only the western part of the northern Adriatic, preceded another large anchovy catch in 2000. An excess feeding of the anchovy in the pre-spawning period (February) can lead to a higher than usual amount of anchovy eggs, two months later. As the anchovy obtains the commercial length of around 9 cm in about four and a half months, the April generation might significantly contribute to the total amount of the fish catch in the same year (anchovy season lasts throughout the year, with an exceptionally high maximum in September). Based on the obtained results we hypothesize that a February circulation type is basic for the increment of anchovy stock in the same year (Fig. 1). We would like to validate our hypothesis in an international, multidisciplinary study of a larger scope with field data and modelling expertise, as we believe that our insights should be vital in moderating grants for stimulation of anchovy fishing and ultimately could preserve anchovy stock from overfishing in the Adriatic.

References

1 - Kraus, R. and Supic, N., 2011. Impact of circulation on high phytoplankton blooms and fish catch in the northern Adriatic (1990-2004). *Est. Coast. Shelf Sci.*, 91: 198-210.

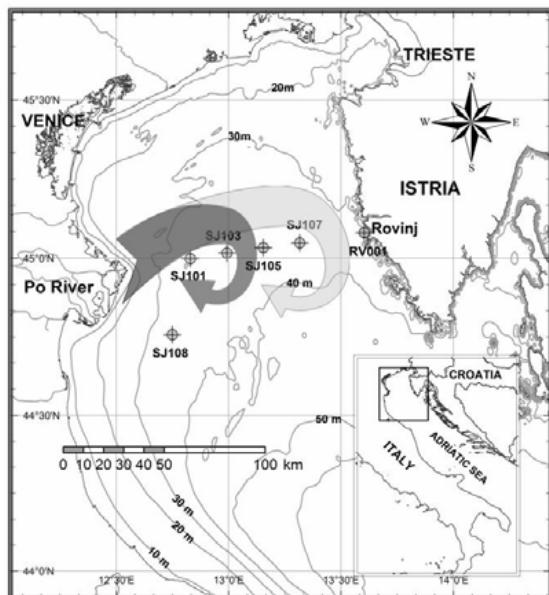


Fig. 1. Northern Adriatic map with sampling stations, along with hypothetical February paths of freshened Po River waters which favour large (dark grey) or extremely large (light grey) anchovy catch in the subsequent year.

Data and methods

We analysed three types of data obtained in the northern Adriatic (Fig. 1) during the period 1990-2004 at 6 stations at the Po River delta-Rovinj section (further