FINE-TUNING PREDICTION MECHANISM FOR SMART ANCHOVY FISHING - SCIENTIFIC BASELINE

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Abstract
With future monitoring and modelling efforts, based on scientific research that revealed autumnal environmental conditions inducing specific winter ones, which showed impacts on annual Adriatic anchovy catch, a fine-tuning prediction mechanism for smart anchovy fishing could be developed.

Keywords: North Adriatic Sea, Circulation, Fisheries, Phytoplankton, Zooplankton

February anticyclonic circulation (FAC) in the northern Adriatic (NA) favours nutrient enriched freshwater spreading from the Po River delta towards the eastern coast (Fig. 1.a). Freshwater remains restricted in the NA favouring high phytoplankton abundance, which is positively correlated to annual catch of one of the most important commercial Adriatic fish species, *Engraulis encrasicolus* (L.) - anchovy [1]. Annual zero- and one-year-old anchovy correlate with FAC of the same year, and with both winter and annual microzooplankton [1], thus indicating the importance of favourable pre-spawning environmental conditions for juvenile anchovy (in February to April period [2]).

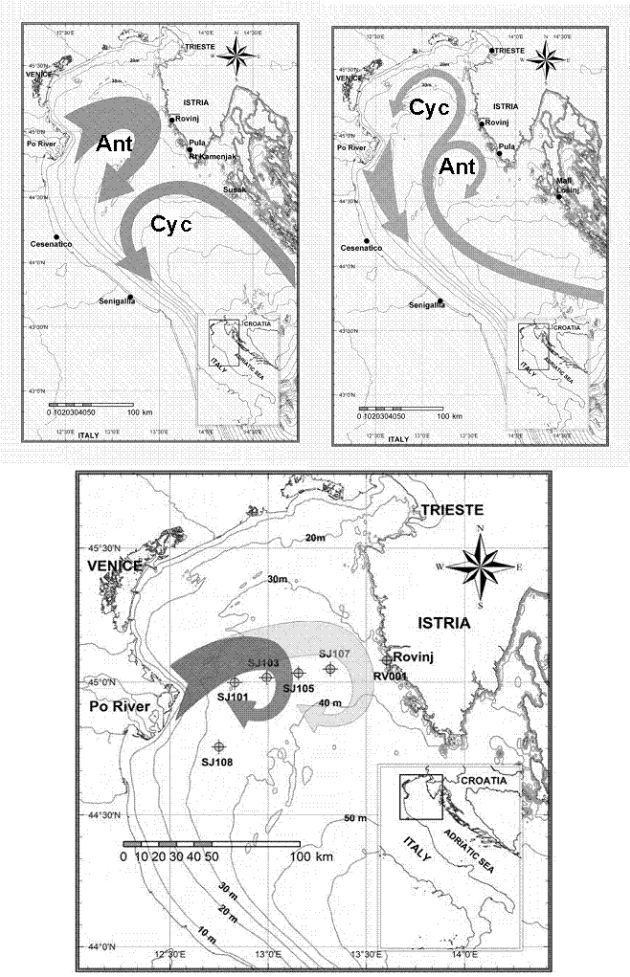

Fig. 1. Circulation patterns in the NA: (a) winter type A with large anticyclonic (Ant) and cyclonic (Cyc) gyres, (b) winter type B with large cyclonic and anticyclonic gyres and (c) winter type A of small intensity (dark grey arrow) and of large intensity (light grey arrow) with sampling stations along the Po River delta - Rovinj profile.

Annual microzooplankton (at SJ101 and SJ107) is highly impacted by March fraction, indicating this month environmental conditions as important for the annual anchovy stock [3]. Depending on the circulation intensity (Fig. 1.c) phytoplankton production is high (dark grey arrow) or extremely high (light grey arrow) [1, 3].

In 2004, a year of an exceptionally intense FAC, winter spreading with extremely high concentration of total inorganic nitrogen and orthophosphate at the eastern part [4] resulted with extremely high annual anchovy catch. Continuing effects of this favourable year for anchovies were observed throughout high generational catch: zero-year-old catch in 2004, one-year-old catch in 2005, two-year-old in 2006, as well as three-year-old in 2007 [3]. While correlations of anchovy to circulation pattern in the western NA are stable [5], correlations to the central NA disappear upon removal of outstanding values. However, as the case of 2004 shows, outliers are highly important as the stock increases (or decreases) highly in extreme environmental situations [3]. This is further supported by the fact that February microzooplankton at SJ101 seems to be irrelevant for the annual microzooplankton, contrary to the one at SJ107, which proves to be highly correlated. This is in line with observation that intense freshwater spreading from western to the eastern coast results with exceptionally high phytoplankton production [1].

The idea of possible prediction of anchovy stock was developed as impacts of autumnal meteorological conditions favour development of specific NA winter type; moderate cooling and *sirocco* (SSE wind) in autumn, and, more specifically, low evaporation rates in November, favour winter type A (Fig. 1. a [6, 7]). Afterwards, followed the idea of *smart fishing*. Namely, continuous anchovy stock monitoring along with the autumn and winter conditions could prove as worthwhile efforts in planning fishery activities in the Adriatic for a sustainable and responsible economical development. We anticipate a novel approach to monetary stimulation that could be beneficial for the environment and economy: *a fine-tuning prediction mechanism*. In the case of Adriatic, we would suggest that the anchovy fishery should be monetary stimulated in the favourable years, not stimulated in average ones, and in the poor years stimulated for non-fishing [3]!

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