



Stable nitrogen isotopes of plankton as an indicator of urban waste sources on marine ecosystems (Central and Northern Adriatic)

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The stable isotopic composition of nitrogen in plankton were used to assess the impact of nutrients deriving from human sewage impacts into the marine coastal ecosystems of Central and Northern Adriatic Sea. The sampling areas were the Murter Sea and sea around fish farms at Vrgada Island, semi enclosed Pirovac Bay, around the Korčula Island, the unaffected offshore location at the Lumbarda ReefFlat, Kornati Island (Central Adriatic) and in northern Istra peninsula (Northern Adriatic). Samples were collected with plankton net at the beginning and in the main tourist season 2007 (July, August).

The results indicated that the $\delta^{15}\text{N}$ values were significantly higher in impacted areas of Istra peninsula and Pirovac Bay, compared to the unaffected locations. The highest $\delta^{15}\text{N}$ values were observed in Pirovac Bay as 6.8 ‰ and northern Istra peninsula as 7.0 ‰ affected by faecal organic matter from septic systems. Nitrogen in Murter Sea as well as around Vrgada Island reached equal values (4.7 ‰) which disprove any impact of aquaculture activity (organic faecal material and feed wastage) on plankton. These values are the result of human pollution south of this area (marines, tourist settlements, towns). Previous researches on benthic sessile organisms (i.e. *Anemonia sulcata*, *Aplysina aerophoba*, *Posidonia oceanica*, *Balanus perforatus*) showed significant lower values in Lumbarda ReefFlat compared with impacted areas. Contrary, $\delta^{15}\text{N}$ values in plankton sampled in Lumbarda ReefFlat are only negligibly lower (4.1 ‰). The lowest nitrogen values were measured in samples around Korčula Island (up to 3.8 ‰) that is positioned in the open sea, away from biggest pollution sources.

The distribution pattern of the $\delta^{15}\text{N}$ values of plankton organisms is due to its mobility different like sessile organisms. It was recognized that the nitrogen increase in north and northwest direction, respectively. This transport pattern is consequence of the main water currents (southeast-northwest direction) and wind-driven current regime. Every pollutant source along the coast also contributes to the pollution. Elevated nitrogen values are locally the result of untreated municipal, industrial and agricultural pollution like in semi enclosed Pirovac Bay with sea water poor circulation. The difference in nitrogen values between plankton and sessile organisms around fish farms indicates that the aquaculture activity has prominent negative impact on surrounding ecosystems whereas its contribution to the general sea water pollution is negligible.