



Changes in Nitrogen to Phosphorus ratio in the Inner Saronikos Gulf (West Aegean Sea) in relation to the operation of the Sewage Treatment Plant of Athens, Greece

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In this work we provide an overview of nitrogen (N) to phosphorus (P) ratio in the inner Saronikos gulf as it has changed over the last twenty five (25) years in relation to the sewage discharges from the Sewage Treatment Plant of Athens in Psittalia Island.

Saronikos gulf receives effluents from Athens Metropolitan area (population over 5 million). Until 1994, domestic and industrial sewage of Athens was discharged untreated into the surface water layer of Keratsini and Elefsis bay, whereas, after 1994, the sewage of the Athens Metropolitan area were primarily treated in Psittalia Sewage Treatment Plant and discharged in the inner Saronikos Gulf. Additionally, the secondary stage of the Psittalia Sewage Plant operated in the end of 2004 affecting the nitrogen to phosphorus (DIN:P) ratio (DIN stands for nitrate+nitrite+ammonium).

The treated effluent plume from Psittalia Sewage Treatment Plant is trapped within the seasonal pycnocline developed during May-November, whereas, during the mixing period (December-April) it reaches the sea-surface.

During the last 25 years, significant temporal variation of nutrient concentrations has been observed which has revealed an increase of the DIN:P ratio near the Psittalia Sewage Treatment Plant.

In the vicinity of the sewage outfall in Psittalia, DIN:P ratio in the deep layer (30m-bottom) did not show significant variation between the two periods: before and after the operation of the Sewage Treatment Plant (12.9 before the operation of the sewage treatment and 13.3 after the operation of the sewage treatment) showing that inorganic nitrogen and phosphate changed almost with the same rate. However, the limiting factor for phytoplankton growth remains nitrogen. On the contrary, significant increase of DIN:P ratio was observed in the surface layer between the two periods, during summer (stratified period). DIN:P increased from 5.9 for the period 1987-1995 (before the Sewage Treatment Plant operation) to 19.6 for the period 1995-2010. This remarkable increase of DIN:P ratio is due mainly to the significant decrease of phosphate in the surface layer after the discharge of the sewage effluents at 63m depth, whereas, DIN concentrations remained constant. The shift of the surface layer from N-limitation to P-limitation indicates a change in the trophic status in the inner Saronikos gulf, very close to the sewage outfall.