Geophysical Research Abstracts
Vol. 18, EGU2016-16019, 2016
EGU General Assembly 2016

Primary production of phytoplankton in the estuaries of different types (by the example of the Curonian and Vistula Lagoons of the Baltic Sea and the Volga delta)

Sergei Aleksandrov (1) and Julia Gorbunova (2)

(1) Atlantic Research Institute of Marine Fisheries and Oceanography, Kaliningrad, Russian Federation (hydrobio@mail.ru),
(2) Atlantic Branch of P.P. Shirshov Institute of Oceanology RAS, Kaliningrad, Russian Federation (julia_gorbunova@mail.ru)

The aim was to analyze the long-term change of the primary production in large estuaries of different types (Volga delta, Curonian and Vistula Lagoons) under the impact of environmental factors (e.g. climate changes, algal blooms, invasion mollusk). The researches (primary production, chlorophyll, nutrients and others) were carried out monthly from March-April to November in the Vistula and Curonian Lagoons since 1991 to 2015, and in the Lower part of the Volga Delta and fore-delta since 1996 to 2007.

The Volga River is the largest river in Europe that flows into the Caspian Sea and it forms a great delta. According to the analysis of long-term data (from the 1960s), the maximum eutrophication and primary production (85-100 gC·m^{-2}·year-^{1}) in the Volga Delta was observed in the 1980s. In the 1990s, fertilizers use and the input of nutrients into the Volga Delta decreased significantly. Due of the high-flow exchange in the delta, especially during high-water years, observed in the 1980s - early 2000s, this led to a significant decrease in the concentration of nutrients in the water in the Volga Delta. As a result, in the 1990-2000s, the primary production has decreased to the level of 1960s-1970s (40-60 gC·m^{-2}·year-^{1}) and the process of eutrophication was replaced by de-eutrophication. At present, the trophic status of the Volga delta assessed as mesotrophic. The future trend of phytoplankton primary production of the Volga delta will greatly depend on the scenario of nutrients loading and river runoff.

The Curonian Lagoon and Vistula Lagoon are the largest coastal lagoons of the Baltic Sea, relating to the most highly productive water bodies of Europe. The Curonian Lagoon is choke mostly freshwater lagoon, while the Vistula Lagoon is restricted brackish water lagoon. In the last decades the nutrients loading changes, warming trend and biological invasions are observed.

The Curonian Lagoon may be characterized as hypertrophic water body. The local climate warming combined with other factors (freshwater, slow-flow exchange, high nutrients concentrations) creates conditions for ongoing eutrophication and harmful algae blooms despite of significant reduction of nutrients loading in 1990s-2000s. Mean annual primary production in 2000s and 2010s (490 and 570 gC·m^{-2}·year^{-1}) is considerable higher, than in the middle of 1970s (300 gC·m^{-2}·year^{-1}). Harmful algal blooms in July-October (chlorophyll to 700-3400 μg/l) result in deterioration of the water chemical parameters, death of fish in the coastal zone and pollution with toxins.

The climate warming was cause of algal blooms in restricted Vistula Lagoon in 1990-2010. Mean annual primary production in 2000s and 2010s (415 and 450 gC·m^{-2}·year^{-1}) is considerable higher, than in the middle of 1970s (300 gC·m^{-2}·year^{-1}). After the invasion of the filter-feeding bivalve *Rangia* the benthic biomass increased by 17 times (to 500 g/m^2 in 2011-2014), and chlorophyll “a” decreased by 2 times (to 20 g/m^3 in 2011-2014). The phytoplankton assimilation numbers increased by 2-3 times (to 300-400 mgC·mgChl^{-1}·day^{-1}) in 2012-2015 which are discover in aquatic ecosystems and primary production remained at previous level. Therefore mollusc invasion improved water quality, but Vistula lagoon ecosystem remained at eutrophic-hypertrophic level.