

INTERACTIONS BETWEEN KAMCHIA RIVER AND COASTAL WATERS (BULGARIAN BLACK SEA)

Galina Shtereva *, Anton Krastev , Boryana Dzhurova and Ogniana Hristova
Institute of Oceanology - BAS, Bulgaria, Varna 9000, P.O.Box 152 - chem@io-bas.bg

Abstract

Understanding the connection between Water Quality (WQ) in the coastal zone (CZ) and river catchment is important in order to better assess the CZ processes. One of the main sources of pollution in CZ is certainly that one produced by human activities in the associated river basin. The goal of the paper is to estimate the river impacted zone during the high flow period of the largest Bulgarian Black Sea river. The analysis of data reveals the presence of fresh water low transparency layer with thickness of 3 - 5 m. Vertical distribution of the chemical parameters confirms the location of the impacted area at <1 mile. There is a good correlation between nutrient content and salinity.

Keywords : Black Sea, River Input, Coastal Waters.

The coastal zone is a dynamic area of natural changes and increasing human use. One of the main sources of pollution in CZ is certainly the human activity in the associated river basin. Understanding the connection between WQ in CZ and river catchment is important in order to better assess CZ processes and to evaluate various management options leading to improvement of the status of the coastal ecosystem. The largest national Black Sea rivers, Kamchia River, is the main source of fresh water for the Bulgarian part of the Black Sea (19.25 m³/s). Kamchia River length is 245 km with a catchment area of 5358 km², which covers 40 % of the Black Sea watershed. The catchment of Kamchia River includes some industrial and urban areas as well as regions with agricultural activity [1, 2]. In this regard WQ of the river is affected by human activities (industry, urbanization and agriculture). The river water transports pollutants to the sea and the magnitude of pollutants discharge is often related to watershed changes, utilization and river basin management. There is a lack of knowledge about Kamchia River influence on the coastal waters. Few publications provide information on this subject [3, 4].

The goal of the paper is to estimate the extent of the coastal zone impacted by the river during the high flow period (spring). The study of the interaction between Kamchia River and the related CZ focuses on nutrient emissions and eutrophication.

The study is based on monthly monitoring of Kamchia River, during the period 2005-2006 on the following parameters: BOD₅, nutrients as dissolved phosphorus (P), nitrogen (N) and silica (Si). The investigation of water column in the coastal zone in front of the river mouth was carried out during the high flow period by *in situ* measurements of temperature, salinity, transparency, pH and oxygen. The collected samples were analyzed for nutrients and suspended matter by standard methods [5].

The results for the river show a nutrient content, exceeding the allowed concentration maximums established by Bulgarian WQ standards (more frequently for nitrites). The analysis of data for coastal waters during high flow period reveals a significant influence of the river discharge on the 1 n.m. coastal zone. Several parameters (nutrients and salinity) are used to define the impacted area which spreads in the South and East due to the current circulation along the coast. As a consequence of river discharge the WQ of close coastal zone does not correspond to the Bulgarian standards.

The size of this area, related to the advection of the river plume, depends on the amount of Kamchia River waters discharged into the sea, as well as on the winds and current system in this part of the Western Black Sea. The vertical distribution of the observed parameters confirms the location of the impacted area (Fig. 1 and 2). The main features of the river which influenced the waters in the coastal area are the lower salinity, higher nutrients and suspended matter content. The analysis of the data recorded reveals a presence of fresh water low transparency layer with thickness of 3-5 m. High Si content leads to significant increase of Si:P and Si:N ratios. There is a good correlation between the nutrients and salinity distribution in the coastal area ($r^2=0.57$ for N and $r^2=0.81$ for P and $r^2=0.70$ for Si). The river directly influences the brackish waters in the immediate proximity of the river mouth. Due to the current circulation along the coast the transformed river waters at near mouth stations are characterized by low transparency (0.5-1.5 m), pH values 8.09-8.25, salinity <8.3 psu. The farthest two stations on transect in front of river mouth with distance >1 n.m., have similar vertical distribution of the biogeochemical parameters, showing that the river has no impact in this area.

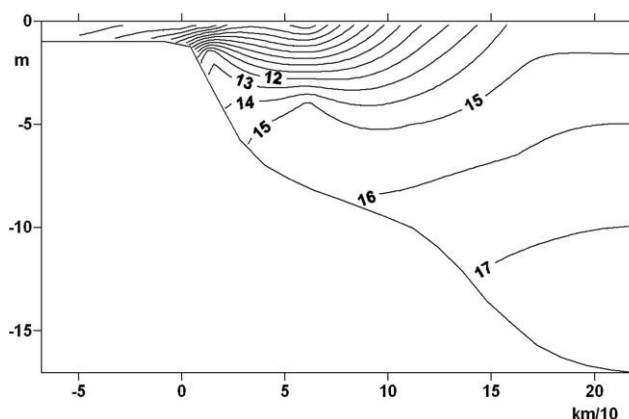


Fig. 1. Vertical distribution of salinity (psu) a front of Kamchia River.

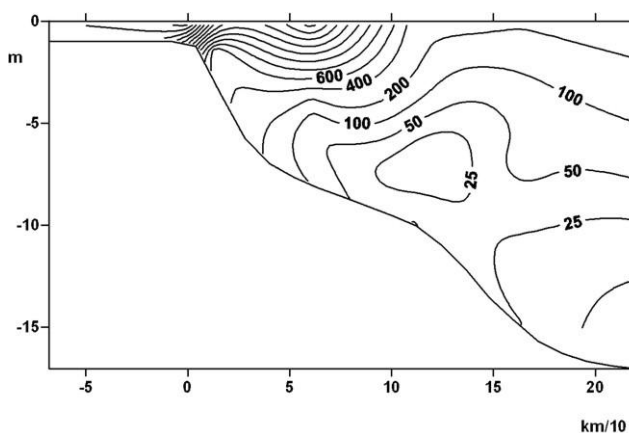


Fig. 2. Vertical distribution of nitrates (Îµg/l) a front of Kamchia River.

References

- 1 - Mihajlov G., Simeonov V., Nikolov N. and Mirinchev G., 2002. Environmental approaches to estimate pollution impacts on a coastal area by sediment and river water studies. *Water Science and Technology*, Vol 46, No 8, 45-52.5.
- 2 - Shtereva G. and Hristova O., 2006. Nutrients in Water of Kamchia River, Bulgaria, *J. of Balkan Ecology*, Vol. 9, 2, 183-189.
- 3 - Rozhdstvensky A., 1980. Influence of Kamchia River on the chemistry of the Black Sea waters. In: Belberov Z.K. et. al. (eds), *Interaction of the atmosphere, hydrosphere and lithosphere in the nearshore zone*, BAS, Sofia, 285-291.
- 4 - Shtereva G. and Hristova O., 2005. Dissolved silica in coastal Black Sea waters and Bulgarian Black Sea Rivers, *Proc. of IO*, Vol. 5, 121-125.
- 5 - Grasshoff K., Ehrhard M. and Kremling K., 1983. *Methods of sea water analyses*. 419.