PRESENT WATER QUALITY OF KASTELA BAY (ADRIATIC SEA) AND SOME PROPOSALS FOR ITS PROTECTION AND IMPROVEMENT

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Abstract
The research of the physical-chemical properties of the Kastela Bay waters carried up to now (1952-2002) showed it to be a highly eutrophic area and one among the most polluted along the eastern Adriatic coast. Frequent anoxia in the bottom layer along with microbiological pollution often cause mass mortality of marine organisms in its eastern part of the Bay.

Key words: Kastela Bay, nutrients, eutrophication, pollution, remedial measures.

Introduction

The number of urban inhabitans in cities is rapidly growing, producing further increase of amount of waste: bacterial/viral pollutants acting as potential disease pointer, and nutrient generating severe eutrophication of coastal waters. The eutrophication has become an acute environmental problem especially in semi-enclosed areas and gulfs with small exchanges of water with surrounded areas, like the Kastela Bay (Split area). The excessive level of organic matter and nutrients (P and N-salts) affects water quality by contributing to algal bloom every summer, in eastern part of the Bay (1). Unfortunately, there is no federal agency (in the town or in the country) with overriding responsibility for nonpoint source pollution control.

Study area

The Kastela Bay is 14.8 km long, about 6 km wide and, on the average, 23 m deep. The eastern part of the bay also receives large quantities of untreated municipal and industrial effluents. Water exchange and changes in the current field are mostly induced by local winds related to the passing of mid-latitude cyclones over the area. The Bay is particularly threatened by the organic matter and nutrients input causing an extreme phytoplankton bloom each summer.

Results and discussion

The long-term studies of chemical and biological parameters in the Kastela Bay area point to the fact that, during the past decade, an increase in the eutrophication level has persisted in all the areas of the eastern Adriatic coast (2). Different types of pollution produce different forms of water degradation. The source of water pollution provides the key to its control. Most people still believe that the industry-big industry-is the problem. They come into the Bay ecosystem from diffuse or "non-point" source such as runoff from stormwater and from atmosphere (Fig. 1). Stormwater runoff also delivers a certain quantity of nutrients, motor oils, cleaning fluids and assorted contaminants from roadways and parking lots. Nonpoint sources of pollution include all other discharges and involve urban and agricultural runoff, leaches and runoff from individual disposal systems such as septic tanks and marine sanitation device, runoff from construction sites and forest harvest areas. These sources of contaminants are becoming more important all over the Bay, and these sources remain more difficult to quantify as well as to control.

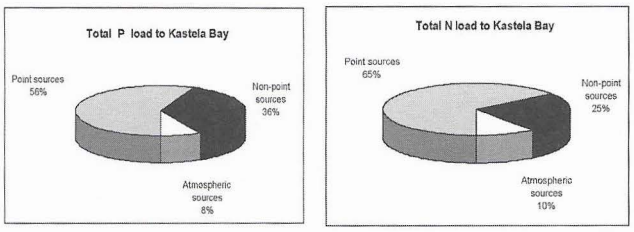

Fig. 1. Source of nutrients in the Kastela Bay

Statistical analyses of 20-50 years trends of selected water quality parameters showed declining water quality conditions in the all areas of the Bay. Nutrients, suspended matter, pesticides, heavy metals and bacteria are the five major causes of severe water quality problems in the Kastela Bay (3, 4).

Long-term studies of heavy metal concentrations (Zn, Cu, Cd and Hg) in seawater, sediments and some marine organisms in coastal area of the middle Adriatic have shown that the Kastela Bay is one of the most threatened areas along the eastern coast, as shown in Table 1(5). Nowadays we know a fear amount about inputs of toxic metals into the Bay, we are still just learning how to measure the effect of those contaminants on the Bay organisms, and on the Bay ecosystem itself. Exposure to trace metals and other contaminants can effect on phytoplankton population, for example, causing shifts in species composition, and these changes could have significant impact throughout the ecosystem (6).

Table 1. Mean values of heavy metals in water (ng dm^{-3}) sediments (mg kg^{-1} DW) and marine organisms (*Mytilus galloprovincialis*, (mg kg^{-1} FW) in the open sea stations (*a*) and in the Kastela Bay (*b*). b* Station just near CAP (chlor-alkali plant)

	Seawater		Sediments		*M.galloprovincialis*	
Metal	(a)	(b)	(a)	(b)	(b)	(b*)
Zn	234	2170	29	342	16.5	29.4
Cu	112	196	8.6	27.6	0.66	1.65
Cd	21	48	0.1	0.37	0.08	0.15
Hg	10	52	0.02	1.86	0.3	3.32

Conclusion

The following points are among the significant conclusions resulting from this paper in order to minimizing pollutant fluxes from land-based sources:

- Many existing industries represent pollution hot spots in coast of the Bay. Old and abandoned industrial plant have had in the past contamined land and water of the Bay.
- To reduce the flux of water-polluting elements and compounds from point and non-points sources, as well as from agricultural sources and deposits of urban sludges.
- Reducing the emission from trafic sources, (especially in summer period), mining activities and cement industry.
- The planing of waste water treatment plants needs to include many low-cost plant serving large population, to reduce their discharges of toxic materials to a minimum level.
- " Environmental education "program for young people and adults. These program can prepare better tomorrow's generation as informed stewards for our threatened coastal seas and their irreplaceable living resources.
- Monitoring program. These programs include monitor level of conventional pollutants and some toxic elements and compounds in water, sediments and marine organisms as well. Monitoring program also include the bacterial quality of waters phitoplankton communities, as well as, monitoring of benthic macroinvertebrate and fisheries assessments.

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