Influence of communal waste waters discharge on local sea ecosystem

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Abstract

Discharge of communal waste waters frequently is the main pollution source of coastal waters, as its recipient. Much more bigger amount of waste waters, also related pollution, has discharged by Trašte outfall. Waste waters are non treated. In regular conditions and correct operation of submarine infrastructure, emitted pollution would be most probabely distributed at savefull way, without significant impact to the sea ecosystem, because high depth, direct contact with open sea waters and capture and transport of pollution by dominant sea currants. Determined damage of the pipe at cca 1500m, conditions discharge of waste waters much more closer to the coast and at lower depth (20m), practicaly in the middle of the bay, so the pollution has transformed under quite other circumstances. In these circumstances, pollutants distribute around the bay, where concentrated and transformed in accordance with phisical and biochemical egularities.

Keywords: waste water, pollution, sea ecosystem

Introduction

The influence of untreated communal waters can affect a negative effects on fishes and the other sea organisms, depletion of the oxygen content, pollution of bathing waters with closure of beaches, also other limitations of water use for recreation, limitations in catch of fish and use of waters for food of fishes and shelfishes etc. Some polluters can have the hazardous or potentially hazardous effects on ecosystem and human helath (Cheremisinoff, 2002; Marković *et all*, 1996).

Discharge of communal waste waters by outfall Trašte (Tivat and Kotor), is the main pollution source of coastal waters, as its recipient. In the same time, contribution to emmision from the tourism, has a sinergetic influence and multiply the effects of communal waters discharge during the touristic season.

Because that, it is designed the task on comprehensive investigation of sea ecosystem quality due to valid assessment of communal waters discharge effects near outfall Trašte as a prevention of the sea pollution.

Material and Methods

Sewage system Trašte covers the main theritory of municipalities Kotor and Tivat. Through outgoing units, aeration tower and outfall, water discharges into sea at Trašte bay, without any treatment. Considering to urban indented, for a small border

settlements (Risan, Morinj and others) will be build local facilities for waste waters treatment.

There is not any big industrial objects- pollution sources at the coast. Because that, the most valuable touristic offer is a high quality of the coastal sea waters, dedicated to bathing. High quality of sea waters is good base for another activities, mariculture and fishery. In this constelation, the main land-based pollution source is discharge of the communal waste waters, that are multiply own quantity during the touristic season.

In accordance with the such situation it is designed the sea water ecosystem monitoring program near end-of-pipe of Trašte. The Program is obtained the purposeful hydrographical and oceanographical measurements, including CTD probe and current profiler measurements, scaning by remote operated vehicle, as well as physical, chemical and microbiological measurements of waters in three depth layers, measurements of sediment and macrozoobentos analysis (APHA-AWWA-WEF, 2005).

Measuring network at Trašte consisted of 6 stations: 3 points at transect close the end-of-pipe - T0, T1 and T2, control station toward Croatian coast - R1, control station toward Budva - R2, coastal station - R3 (Figure 1, Table 1).

Figure 1. Network around outfall Trašte.

Results

Investigation of physical state of outfall pipe Trašte are shown an important damage of the submarine pipe at about 1500m from the coast line, at 20m depth. It is determined a missing of over 100m of the pipe. The damage is probabely a consequence of improper anchoring of a boat.

Table 1. Data of depth of water and sampling depth, Trašte

Measuring station	Depth of water, m	Sampling depth, m
T0	44	1 18 42
T1	45	1 18 40
T2	43	1 20 38
R1	46	1 18 40
R2	40	1 18 35
R3	14	1 7 12

On base of sort of damage, it can be conclude that the communal waters do not come to end of pipe, but they are discharge at the site of damage.

By CTD measurements (in summer) it is determined a termohaline (Table 2). Termohaline begin at 10m depth, and the depth of its layer is 30m. Temperature difference in termohaline layer is 10°C. The water with higher salinity and density is in depth layer at all station sites, but picnohaline is practicaly overlaped with termohaline. All these factors are appropriate to stop the pollution difusion toward the surface. By CTD measurement is identified a layer of fresh water, at 10-15m depth, at all stations except R3. It can be a conseuence of collection of waste waters which is concentrated in the layer, determined by stratification of density and temperature.

Table 2. CTD probe data average values.

Measuring station	T, °C	Sal, psu	Density, kg/m^3
T0	20.75	38.41	27.20
T1	20.96	38.39	27.12
T2	20.86	38.38	27.14
R1	20.96	38.37	27.10
R2	21.39	38.19	26.84
R3	25.84	38.06	25.42

Table 3. Results of physical and chemical parameters, nutrients, chlorophyl-a and TRIX in water column.

Measuring station	Water layer	pH	BOD_5, mg/l	Sat, %	TOC, mg/l	TN, mg/l	TP, µg/l	Chl-a µg/l	TRIX
	S	8.20	0.33	84	1.56	0.132	12	0.474	4.65
T0	M	8.16	1.56	93	1.52	0.193	15	0.206	2.25
	B	8.10	0.60	83	1.23	0.158	6	0.339	4.36
	S	8.21	0.44	86	1.74	0.143	8	0.306	4.27
T1	M	8.18	1.00	92	1.69	0.119	25	0.221	4.12
	B	8.15	1.97	87	1.31	0.113	2	0.220	3.43
	S	8.22	1.27	90	1.58	0.095	1	0.338	3.33
T2	M	8.18	1.07	93	1.43	0.082	6	0.205	3.62
	B	8.16	0.97	85	1.49	0.093	11	0.220	4.19
	S	8.21	0.47	86	1.59	0.146	17	0.267	4.55
R1	M	8.18	0.93	90	1.76	0.153	20	0.188	4.36
	B	8.17	0.85	83	1.40	0.077	6	0.221	3.93
	S	8.21	0.73	85	1.55	0.080	4	0.204	3.75
R2	M	8.20	0.93	94	1.64	0.089	11	0.220	3.86
	B	8.17	0.96	90	1.65	0.081	13	0.102	3.78
	S	8.20	1.00	86	2.25	0.097	7	0.203	3.97
R3	M	8.22	0.54	89	1.10	0.046	20	0.187	3.95
	B	8.22	1.57	91	1.08	0.087	20	0.102	3.85

Temperature difference in surface and bottom layers was 9-10 degrees. pH were the highest in surface layer, where phitoplancton activity is the highest (Table 3). The exceptance is site R3 near coast, where pH is increased with depth. Concentrations and saturation of oxygen were the highest in middle layer, except at R3, but here the water depth corresponds to depth of middle layer of the rest of stations. In surface and bottom layers saturation is 90% or smaller. All values of saturation were bellow 100% and indicate on prevaling organic substances destruction processes. BOD_5 was relatively low. TOC was over the prescribed A1 class. Total nitrogen (TN) was the highest at T0, than at T1 and R1. Concentrations of total phosphorus (TP) were increased in deeper layers, mainly in the middle. Chlorophyill-a was the highest at transect in surface layer, specially at T0. Index TRIX, as indicator of eutrophication, was the highest at T0, than at R1, T1. The values were not variable so much and indicate on developed eutrophication proces, that comes to moderate eutrophication level.

Number of bacteria, specially faecal originated bacteria was very low. The worst bacteriological state was at R3, first of all in bottom layer, where obviously direct influence of communal waste waters discharge at broken submarine pipe, was the highest.

Generally, water quality is good and by most of parameters corresponded to prescribed A1 class. Sometimes, ussualy in deeper layers, came to increased concentration of some parameters, which than exceedes the A1 class.

Discussion

Much more bigger amount of waste waters, also related pollution, has discharged by Trašte outfall. Waste waters are non treated. In regular conditions and correct operation of submarine infrastructure, emitted pollution would be most probabely distributed at savefull way, without significant impact to the sea ecosystem, because high depth, direct contact with open sea waters and capture and transport of pollution by dominant sea currants. Determined damage of the pipe at cca 1500m, conditions discharge of waste waters much more closer to the coast and at lower depth (20m), practicaly in the middle of the bay, so the pollution has transformed under quite other circumstances. In these circumstances, pollutatnts distribute around the bay, where concentrated and transformed in accordance with phisical and biochemical egularities. Bay-currants are much more worse and of opposite direction then general currants at open sea infront of the bay, so the pollution mainly stay captured in frame of badly mixed Bay waters. Obvious consequence of that is increasing of trophic level of waters to moderate eutrophy, the state which is stabile during almost all the year. Furthermore, the effects of waste waters emission are evidented in bentic biota. In aim to prevent eventual, first of all accidental pollution in this sence is recommended a establishment of permanent monitoring station near end of outfall Trašte.

Acknowledgement

The results presented in the paper were realized through the project ``Joint action on sea pollution prevention - JASPPer`` EU/IPA fonded project on cross-border cooperation, which one of the main tasks is a prevention of the sea pollution at cross-border area of Croatian and Montenegreen coast.

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