MINISTRY OF ECOLOGY AND NATURAL RESOURCES OF UKRAINE

STATE ECOLOGY INSPECTION OF THE BLACK SEA

UKRAINIAN SCIENTIFIC CENTER OF MARINE ECOLOGY

ODESSA BRANCH INSTITUTE OF BIOLOGY OF SOUTHERN SEAS OF NATIONAL ACADEMY OF SCIENCE OF UKRAINE

SHIPPING SAFETY INSPECTION OF MINISTRY OF TRANSPORT OF UKRAINE

EUROPEAN UNION FOR COASTAL CONSERVATION

ECOLOGICAL SAFETY DEPARTMENT OF THE CITY EXECUTIVE COMITTEE OF ODESSA

STATE CENTRE FOR SCIENTIFIC AND ECONOMIC INFORMATION OF ODESSA

International symposium

THE BLACK SEA ECOLOGICAL PROBLEMS

Black Sea Strategic Action Plan Implementations (1996 - 2000)

Odessa
SCSEIO
2000

ББК 26.221 (922.8)
Э40
УДК 551.46.9:628.5(262.5)

Друкується за рішенням **Редакційно-видавничої Ради** при Одеському ЦНТЕІ. Протокол № 6 від 24. 10. 2000 р.

Екологічні проблеми Чорного моря: 36. наук. ст. / ОЦНТЕІ; - Одеса: ОЦНТЕІ, 2000. - 405с.

Цей збірник наукових доповідей присвячень основним підсумкам виконання Стратегічного плану дій по реабілітації і охороні Чорного моря (1996-2000 рр.), підсумкового документа першого етапу виконання Міжнародної Чорноморської Екологічної Програми ООН. У цьому зв'язку надруковані матеріали відображають основні розділи Програми, а саме: швидке реагування при надзвичайних ситуаціях, моніторинг забруднення і стандарти якості навколишнього середовища, захист біологічної різноманітності, розробка загальної методології управління прибережною зоною моря, рибальство, освіта і громадська поінформованість в природоохоронній області. В статтях представлені результати раніше не надруковані результати наукових досліджень. Подані дані, їх інтерпретація і закінчення належать авторам повідомлень і ні в коєму разі не можуть бути приписані членам організаційного комітету, які склали даний збірник.
Збірник призначень для широкого кола спеціалістів у галузі біології і екології моря, океанографії, техногенної безпеки і охорони природи.

Відповідальні редактори: канд. біол. наук Б.Г. Олександров
канд. хім. наук Б.М. Кац
докт. геол.-мин. наук Т.А. Сафранов

The Black Sea ecological problems: Collected papers / SCSEIO, Odessa: SCSEIO, 2000.- 405 p.

Present issue is devoted to the main results of Strategic Action Plan for the Rehabilitation and Protection (SAPRP) of the Black Sea (1996-2000) implementation. The SAPRP is a resulting document of the Black Sea Environmental Program (GEF/UN/UNDP) first step. The published materials have been reflected by the main Program sections: emergency response, pollution monitoring and environmental quality standards, protection of biodiversity, integrated coastal zone management, fisheries, environmental education and public awareness. These papers are the results of scientific research haven't been unpublished earlier. The findings, interpretations and conclusions expressed in papers, are in own property of the authors and should not battributed in any manner to the members of organization committee, which prepared this issue.
The issue was design for specialists in the field of marine biology and ecology, oceanology, technogenic safety and environmental protection.

] БК 26.221(922.8)
' ДК 551.46.9:628.5(262.5)

ISBN 966-7635-08-2

THE ROLE OF THE GROUNDWATER IN THE ANTHROPOGENIC EUTROPHICATION OF THE COASTAL ZONE OF THE BLACK SEA

B.G. Alexandrov, Yu.I. Bogatova, G.P. Garkavaya, L.V. Vorobyova

Odessa Branch Institute of Biology of Southern Seas, National Academy of Sciences of Ukraine

Approximately 65% of the northwestern coast of the Black Sea from the Danube delta up to the Dnepr-Bug estuary is influenced to collapses and landslides. Due to that fact, in the vicinity of Odessa, in 1959-1975 was build a coast protecting system with the total length of 12,7 km between the capes Lanzheron and Bolshoy Fontan. The main aim of that project was abstraction of the groundwater into the sea to prevent the possible landslides.

For the drainage of the groundwater in the area of the coastal slope was created an underground gallery; it collects water from the whole water-bearing horizon with the help of 195 drainage wells. From the gallery, the drainage waters enter 11 drainage galleries, emergent into the narrow coastal zone of the sea at a length of about 1 km. Main part of the drainage waters enters the coastal zone near the edge of the sea and only 17% from the total volume is discharged after the breakwaters line. Annual debit of the culverts is 0,012 km^3. During the last years, it was stated a tendency of increasing of the volumes of drainage waters discharge into the sea coastal zone.

The aim of studies was to determine quality of the drainage waters, entering the coastal zone, and to estimate their influence on the state of water ecosystem.

Basic data were received during the two-year hydrochemical investigations of the 11 culverts (264 samples), and during 6 complex ecological surveys in 2 defined areas of the sea coastal zone - receiving (basin "A") and not receiving (basin "B") drainage waters discharge. Both defined areas (volume "A"= 26400 m^3, "B"= 8000 m^3) were partly isolated from the open sea by traverses and breakwaters. Water quality was studied by 14 parameters (324 samples). Parallel were investigated functional characteristics of the plankton, benthos and fouling communities (640 samples).

Formation of the groundwater quality is determined by natural and anthropogenic factors. It was found out that chemical composition of the groundwater (drainage waters) discharged into the sea in Odessa region is unstable. Thus, total mineralization of groundwater is 0,5-3,3 g/dm^3. The range of nearly all characteristics varied within the vast limits (Tabl.l). That is caused by terms of their formation. Near Odessa coast it was found that the main factor of its pollution is the leakage of sewage flows. It was registered that in the region of old part of the city the drainage waters are mainly polluted with nitrogen compounds. The high values of the organic nitrogen (158,0-164,0 mg/1) and nitrates (120,0-160,0 mg/1) testify to pollution with sewage waters.

Table 1. Range of variability of the main quality indices of drainage waters discharged into the marine coastal zone near Odessa

Parameters	Period	
	1990-1992	1994-1995
0_2, mg/1	4,35-11,48	8,9-12,5
O2,% saturated	60,5-110,5	88,8-124,5
PH	7,30-8,55	6,77-8,49
$P0_4$, mg/1	0,010-0,210	0,009-0,047
Porg., mg/1	0,0-0,550	0,0-0,020
Ptotab mg/1	0,001-0,710	0,009-0,065
NH4, mg/1	0,001-0,140	0,004-0,100
$N0_2$, mg/1	0,0-0,008	0,0-0,010
$N0_3$, mg/1	2,62-160,72	14,05-20,57
N_{org}., mg/1	2,44-243,4	4,07-164,6
N,$_{o_1}$ai, mg/1	12,14-340,6	21,8-181,0
Labile organic matter (by permanganate oxi-dizability), mgO/1	0,12-2,88	1,73-4,19
BOD5, mg0_2/l	0,12-3,87	0,47-6,84

Drainage waters with the high nitrates concentrations, entering the sea are able to form carcinogenic compounds. It can happen during the interactions between the products of blue-green algae decomposition, rich with the albumin compounds with the amine and nitrates. Near Odessa coast, blue-green algae compose 55-73% of the phytoplankton. The highest quantities of the blue-green algae were mentioned in June and in November. It is connected with the fact that they enter this region with the transformed waters from the Dnepro-Bugskiy liman as well as they develop in the places of drainage waters

discharge. Phosphates, which have the high capacity to be absorbed by calcium compounds, poorly penetrate through lime layers into the drainage waters. That causes low phosphate concentrations in the drainage waters. In the city regions, with suburban settlements, groundwaters are notable for higher total phosphorus (P_{to}tai) concentrations (up to 0,710 mg/1). The latter was probably caused by intensive watering, usage of fertilizers and detergents on the homestead lands (tabl. 1).

It was estimated that annually, due to the drainage waters 330 tons of nitrates, 600 tons of organic nitrogen in average enters into the Odessa beach area, which is comparable with monthly input of these matters with the Dnestr run-off into the Black Sea.

Investigations on estimation of the drainage waters influence on the coastal zone showed that basin "A" prevailed over "B" in content of all forms of the mineral and organic nitrogen compounds (tabl. 2); mussel's total quantity *(Mytilus galloprovincialis)* in the component of the structure of the fouling community, in meiobenthos biomass in bottom sediments. It was characterized by predominance of such mass deitritophagous as Nematode and Polychaeta *(Neanthes succinea).* In "A" region due to the higher contents of dissolved organic matter was stated high quantities of saprophyte bacterium. Basin "B" was characterized by high ammonia concentrations and seston of 10-50 um fraction, which indicates development of the destruction processes. Quantitative mussels predominance in the overgrowth "A" explains reduction of dredge concentrations of the above mentioned size composition because of its active grazing.

Table 2. Range of changing (I) and average value (II) of hydrochemical parameters in the basin «A» (receiving drainage run-off) and in the basin «B» (absence of drainage run-off) in the coastal zone

Parameters	**Basin « A »**		**Basin «B»**	
	I	**II**	**I**	**II**
S, ‰	7,27-15,97	12,29	9,95-16,40	13,51
0_2, % saturated	34,6-144,9	102,85	58,9-95,8	94,49
Ptotai, mg/1	0,030-0,110	0,062	0,035-0,172	0,071
$N0_3$, -//-	0,014-4,161	0,614	0,002-0,188	0,060
N_{org}. -//-	0,210-12,330	1,562	0,020-1,325	0,511
Ntotal *-II-*	0,540-14,24	2,204	0,140-1,325	0,728

Average annual food allowance of the overgrowth per day, determined mainly by mussels, in "A" was 1,8 times higher than in "B" and was 9,518±2,920 kJ-mf^3.

High concentrations of nitrogen in the drainage flow, along with the sufficient amount of the phosphates, cause intensification of macrophytes primary production. Their average annual production in specific volume of the basins "A" and "B" was 1,748±0,178 and 1,212±0,127 kJ-м"^{3} accordingly. Dissolved organic matter and detritus that are forming during vegetation period serve as feeding substrates for the saprophyte bacterium and worms.

Meiofauna of the «A» basin is significantly richer than in the «B» by number of the large taxons. For example, in the basin «A» harpacticoids density was 14,7-62,0 ind./m^2, which was two times more than in the basin «B». Presence of the drainage waters disturbs the seasonal development of meiobenthos, when during the spring time in comparison with summer there was stated exceeding of its total biomass in 1,5-2 times.

The main reasons of intensification of production and destruction processes in the "A" water area are connected with the run-off of groundwater. That is the influence of physical factors - hydrodynamics and temperature as well as chemical factors- exceeding of the N_{to}tai abundance more than 3 times. Intensification of the water exchange in «A» was determined by exceeding of the current velocity in 2,3 times in comparison with «B» and was recorded even in cases of dead calm (Vaverage$^=$ 4-8 m/sec). Total water exchange in "A" was realized in average every 4 hours taking into account consumption of the entering drainage waters. Entrance of the groundwater provides basin's aeration and improves oxygen regime. Groundwater promoted stable exceeding of the water temperature on 1° C in the region of influence (basin "A").

Thus, influence of the drainage waters on the coastal zone is different. There is possible negative influence (ability to worsen balneological water qualities) as well as it is also stated a positive influence on the ecosystem (aeration, improvement of water exchange and as the result - organic matter is carried out beyond the basin's borders). Question regarding the influence of the groundwater (in their modern condition) on the coastal ecosystems needs more detailed investigation with attraction of the wide range of specialists.