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# DISTRIBUTION OF POLLUTANTS IN THE RUSSIAN SECTOR OF THE BLACK SEA COASTAL ZONE

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For the latest 30-40 years the Black Sea pollution by various pollutants is observed. It is the result of economical activity intensification on the shore and of slow growth of cleaning system capacity.

In the coastal zone concentration of pollutants depends on the pollutant amount brought from the source and the process of their distribution and transport to the open sea. Within the Krasnodar region towns of Novorossiisk, Gelendzhik, Tuapse, Sochi and the ports of Novorossiisk and Tuapse are the main sources of pollutants.

On the basis of many years of research we may state that near the Krasnodar region coast there is a general longitudinal current directed from the south-east to the north-west, i.e. from Sochi towards Anapa. Velocity of this current sometimes reaches 1 m/s. This general stream is rather pronounced one during autumn-winter-spring period. In this period its mean monthly velocity is from 10 to 35 days. In summer months it is feebly marked. In different years mean monthly velocity was from 4 to 25 days. Due to a weak water circulation in summer there occur stagnant effects in the coastal zone provoked by the accumulation of pollutants in water. Sizeable areas of polluted water are formed near the sources of pollutants. Not far from the outlets of badly purified sewage waters clouds of muddy water with sharp boundaries are formed.

The research has shown also that in the shelf zone periodically 5-6 times a week there are formed anticydone eddies against a background of a general longitudinal current. When they pass the near shore zone, there occurs streams directed against a general longitudinal water shifting. Near the shore, beginning from the depth of 10-25 m, those streams become weak owing to the bottom friction. Anticyclone eddies are distinguished not only by the direction and by temperature field too. Special investigations have shown that the radius of vortexes can be 10-12 miles, i.e.- they cover the shelf and continental slope. one, streams of opposite direction are less probable. The second component is caused by anticydone eddies. Anticydone eddy is the basic mechanism of the pollutant cai-rying out of the coastal zone and of their spreading in the open sea. Basically pollutants get into the sea coastal zone from the land and ships. They are pesticides, petroleum hydrocarbons, heavy metals, organic matter, and polycyclical aromatic hydrocarbons (PAH). The largest part of them is brought to sea (or firstly to river and then to sea) by storm runoff. Smaller parts are brought to sea by wind (eolian transport). A part of pollutants gets to sea through deep sewers. It is non-cleaned wastewaters from littoral cities. On the Black Sea shore pesticides are used for spraying of vineyards, fruit gardens, tea plantations. They get to sea during the rains together with storm runoff. Early in 90's in the near shore regions about 1000 tons of pesticides were used. After 1993 their amount began to reduce And the concentration of pesticides in seawater became less one too. The main sources of pollution of natural environment by petroleum and oil-products are the following: oil fields, oil pipelines, oil-refining factories, oil storage tanks, land and water transport. Oil-products mainly get into the coastal zone from the ships, which are based in the pons of Tuapse, Novorossiisk, and Gelendzhik. That's why the port of Tuapse and Tsemess Bay are the most polluted with oil areas. In Gelendzhik Bay the highest oil-product concentration is observed at the area near the port. Oil-products can be brought to sea by storm flows as well. Mainly, it is benzine, masout, oil and other products used by transport and in private life. Organic matters, polycydic aromatic hydrocarbons (PAH), heavy metals, benzopyrene, benzoperylene, bacteria and some other pollutants are

washed out from the area of littoral towns and their environs during the rain. In this period their concentration in seawater increases greatly. Thus, coli-index of seawater increases in tens. Often a high concentration of bacteria and their species composition turn to be the main reason of imposing a ban to use a beach. Heavy metals get into seawater as a result of natural processes and economical activity on the shore. Rains wash out compounds of copper, zinc, iron and other metals from littoral urban areas and arable lands. It will be presented diagrams of distribution of copper, iron, cadmium, nickel concentration in seawater As it was mentioned above, pollutants from the land get into sea coastal zone. There they are accumulated until the beginning of storm, or winds of the northern and northeastern direction. In the course of storm polluted water is carried to the open sea in the near bottom layer. When northern and northeastern winds are blowing - in surface water layer. In the open sea polluted water is captured by the stream of a general longitudinal flow directed to the northwest, or gets into anticydone eddy, which is shifting to the southeast within the coastal zone. In the last case this water is finally carried away to the open sea and dispersed. It should be noted that there is no longitudinal pollutant fluxes in the Black Sea coastal zone within the Russian section but general water transportation from the southeast to the northwest is pronounced very clearly. We can explain this phenomenon by the fact that anticyclone eddies appear periodically in the coastal zone (several times in a month). These eddies disturb a longitudinal flow and direct polluted water to the open sea, there polluted water disperses. Owing to this polluted water at the areas close to the land pollutant source is quickly and effectively replaced by clean water from the open sea. The problems concerning the increase of pollution are the urgent ones in summer during a calm water period when the current velocity reduces down the first cm/s, and in the closed bays, as well, such as the Gelendzhik Bay and the northern pan of the Tsemess Bay.

Littoral towns and the Kerch Strait are the main sources of pollution containing the Black Sea water within the Russian section. The pons of Novorossiisk and Tuapse supply a certain amount of oil-products. Since the periodical presence of the anticydone eddies, polluted water is transported to the open sea there are no longitudinal pollutant fluxes in the sea. This is why the pollutant concentration in water becomes sufficiently low one when going along the shore away from the pollutant source. The conclusion can be made that there are local centres of pollution in the Russian section of the Black Sea.