THE SOUTHERN SEAS (ARAL, CASPIAN, AZOV AND BLACK) UNDER ANTHROPOGENIC STRESS CONDITIONS

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The fact that for the last several decades the regime of the Aral, Caspian, Azov and Black seas has undergone considerable changes causes no doubt today. Human economic activity in the sea water areas and especially in sea basins has played the most important role here. The observed unfavorable changes are connected mainly with the decrease in the river water inflow, disturbances in its intrannual dynamics, sea water pollution with drainage, sewage, and waste waters. At the same time, degradation of aquatic ecosystems take place, which is usually accompanied by significant reduction in their biological productivity; recreation and sanitary conditions in the coastal zones become deteriorated. Climate in the regions adjoining the seas changes too, and in some cases negative socio-economic effects begin to manifest themselves.

Observed decrease in river water inflow to the seas (10-13% reduction for the Black and Caspian seas, 25% - for the Azov Sea, and nearly 100% reduction for the Aral Sea, as compared to the normal inflow values), even if it is caused entirely by human impact, make (as we see it) only a certain part of its total value. In this case, it is hardly possible to speak about the direct impact of river runoff losses on the main parameters of the whole water body regime such as the average currents. This conclusion turns out to be true for certain areas in the seas under review as well, for example for some areas in the north-western part of the Black Sea and in the northern part of the Caspian Sea, which are, to some extent, independent. In these areas, the pattern of sea water properties distribution is subject to comparatively inconsiderable spatial and temporal variations under the effect of fluctuations in the volume of continental water inflow, with the exception of regions subject to the direct impact of river runoff, such as brackish lagoons and water areas adjoining large river deltas. In any case, human-induced reduction in the river runoff, as well as changes in the seasonal runoff dynamics affect primarily peculiarities of vertical and horizontal distribution of sea water salinity - both in shallow and deep-water zones of southern seas. Disturbances in historically established water stratification result mainly from the transformation of southern seas regime under the conditions of anthropogenic stress. It is this stress that modifies the gas regime (at present, anoxia and mass destruction have become typical for shelf areas and continental slope) and in the biogenic substance balance. Human economic activity, as a rule, leads to the decrease in the river runoff and, at the same time, to the increase in the input of pollutants, finding their way into the seas with river waters.

The scale of "undesirable changes" in the aquatic ecosystems of southern seas varies. For example, a historically established ecosystem of the Aral Sea has totally degraded. It is impossible to restore the Aral Sea as it was 30 years ago. It is impossible to save the sea as it is even for lower level marks. Under the conditions of the deficit of uncontaminated fresh water, which cannot be made up for, we can only speak about preventing the further reduction in the surface area of this water body (which, at present, has nothing in common with the sea), where intensified pollution (mainly with chemical weed- and pest-killers contained in collector-drainage waters) can destroy the life itself.

On the contrary, the Black Sea ecosystem is subject to human impact to a less extent. Here, changes in the abiotic and biotic components of the environment manifest themselves mainly in the shelf area. Their manifestations are less pronounced in the open part of the sea, which is explained by the peculiarities of its water circulation. Today, it is still impossible to carry out observations (monitoring) of the Black Sea ecosystem as an integral wholesome object, which introduces uncertainty in revealing consequences of human impact against the background of natural variations in its ecosystem. Most probably, this is the main reason for contrary estimates of one and the same phenomena, when some specialists proclaim ecological disaster of the Black Sea ecosystem, while others, being sure of the fact that most of the revealed facts of disturbances in this ecosystem are connected with natural fluctuations, accuse the first ones of "ecological hysteria". As always, the truth is in between the two extremities: it is yet early to speak about the ecological catastrophe, but the state of the Black Sea ecosystems has already become a matter of serious concern.

As for the degree of disturbance in their ecosystems, the Caspian and Azov seas fall between the Black Sea and the Aral Sea. Before the 1980s, fluctuation of the Caspian Sea level, its water salinization and intensification of circulation processes in the water column of its deep-water part, as well as decrease in the input of biogenic substances with river water caused the decrease in biological productivity at all the levels, as well as the deterioration of fish food basis (primarily in the North Caspian). However, the observed changes in the processes of biological production cannot be considered irreversible. It can be assumed that human-induced disturbances in the Azov Sea ecosystem have not become disastrous. Most probably, to a certain extent they can be compensated for under the conditions of favorable spatial and temporal variability in the characteristics of hydrophysical and hydrochemical regime of the sea. At the same time, appreciable water level rise in the Caspian Sea and decrease in the Azov Sea water salinity, observed for the last years, which were caused by the increase in natural rate of streamflow, most probably, did not entail the restoration of historically established ecosystems of these water bodies. For example, the opinion that it is only the water level of the Caspian Sea that has returned to the "norm" is being aggressively advocated.

We should bear in mind actually uncontrollable export of poisonous substances from agricultural fields, especially from rice check-plots, to say nothing about a "traditional set" of industrial and domestic wastes. Information about the latter has just begun to find its way in reference-books and scientific papers, as well as in the mass media. Now we know much about the ecological catastrophe in the Aral Sea region. Consequences of a similar event, should it occur in the Azov Sea basin, would be of no less disastrous for the one reason: dozens of thousand people inhabit the Aral Sea coast, while the population of the Azov Sea coastal zone makes dozens of millions.

On the whole, the degradation of the southern seas conditions continues with insignificant fluctuations. Probably, the general industrial decay in the former USSR can exercise its certain positive effect. Seemingly, the increase in the natural rate of streamflow (or decrease in consumptive river water withdrawal for the needs of economy) cannot guarantee the restoration of biological productivity and recreational potential of southern seas. Such a problem can only be solved under the conditions of significant reduction in the input of pollutants in the water bodies.

Today, it is no use finding out who is to blame for what has happened in the southern seas. Who will dare to argue seriously the necessity in constructing dams,

developing irrigated farming and applying fertilizers to agricultural fields? It is hardly possible to stop the process of river runoff regulation. Can we be sure that in the near future the scale of sea water pollution will be decreased due to more efficient application, careful storage and transportation of fertilizers, that water treatment processes will be improved? We can hardly expect to get positive answers to these questions quickly. Nevertheless, it is high time to proceed from passive statement to active implementation of nature conservation measures in the Aral, Caspian, Azov and Black sea basin. The success of such measures largely (if not totally) depends on the degree of their scientific substantiation.

However, at present the quantity and especially quality of the available observation data restrict the use of modern methods, (in particular, mathematical modeling) for the estimation and prediction of the water bodies' response to the intensified anthropogenic press. Available observation data, especially that of sea water pollution, does not ensure the solution of this problem either. All this must be taken into account while planning research activities in the southern sea regions, organization of monitoring and especially in giving scientifically substantiated recommendations for the mitigation of negative consequences, both for the seas themselves and for their coastal areas.

It goes without saying that any impact on the life of seas should be based not only on our knowledge of their regime peculiarities, but also on the comprehension of the mechanism, maintaining the balanced state of such complicated dynamic systems. The information on the nature of the Black Sea, accumulated for almost 100 years, seems to give us the right to produce and utilize its resources (fish, recreational, mineral, etc.). As is known, the result turned out to be deplorable.