

## **The long-term variability of chemical structure of deep-water basins of the Caspian Sea**

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The Caspian Sea is a unique water object: the biggest lake on Earth, so large that it actually functions as a sea, but totally isolated from the World Ocean and extremely responsive to the climatic changes. The Caspian Sea is characterized by periodical large-scale sea level oscillations – it is one of the manifestations of multidecadal climatic fluctuations on East European Plain. In order to monitor the environmental conditions staff of the Laboratory of Hydrochemistry of Russian Federal Research Institution of Fisheries and Oceanography (FSBSI “VNIRO”) in collaboration with other Russian scientific institutions conducts annual research cruises to the Caspian Sea.

For the last 40 years natural and anthropogenic climatic changes caused a stable stratification of the water column in both Caspian basins and the nourishment depletion of the photic layer, created and annually aggravated by the biological pump. The data, collected in annual expeditions since 1995, shows the progressing hypoxia below the depth of 400 meters and the formation of hydrogen sulfidic contamination in bottom waters. The cumulative effect of natural variability and extremely intensive anthropogenic stress creates a very depressing environment for all the aquatics, from phytoplankton to unique commercial species.

In the last 20 years the level of the Caspian Sea has lowered for 2,5 meters. This is a result of changes in the water balance of the Caspian Sea, that includes the decrease of freshwater income. In long-term perspective this leads to an increase in surface water density and in winter convection depth. However up until 2016 the stratification of the water column stayed stable, so the deep waters were isolated from the atmosphere. Annual monitoring since 1995 has shown gradual oxygen depletion and intensive accumulation of biogenic elements. In 2016 concentrations of phosphate and nitrate were the highest ever registered for the Caspian Sea.

The analysis of the research conducted in last 4 years shows the increasing possibility of major change in the hydrological and chemical structure of the waters in both Caspian deep-water basins. In June 2016 oxygenated waters were registered at the bottom of the Middle Caspian Basin for the first time in the last 20 years. This allows us to conclude, that in winter 2015-2016 the environmental conditions created surface water, dense enough to reach the bottom of the basin cascading the continental slope.

Based on data, collected over the last century, the sea level, critical for the major winter convection to occur, was calculated, and in 2015 the level of the Caspian Sea has reached this mark. If the sea level lowering continues we can expect an intensive convective deep-water ventilation caused by winter cascading. This can lead to fundamental shift in nourishment enriching mechanisms of the photic layer that can boost the primary production and have positive repercussions throughout all the food chains in Caspian ecosystem.