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Modern state of the pelagic ecosystem of the Large Aral Sea

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During the last five decades, zooplankton of the Aral Sea has been undergoing dramatic changes. Mineralization in the western Large Aral increased from 10 ppt in 1960 to 116 ppt and 211 ppt in the western and eastern basins, correspondingly, in 2008. Concurrently the crucial changes have been occurring in zooplankton community manifesting in the disappearance of most native species and significant decline of biodiversity of the pelagic community. During this period, the number of phytoplankton species dropped more than in order of magnitude. In June 2008, only 29 species were identified in the western basin of Aral Sea, Bacillariophyta - 17 species, Chlorophyta – 5 species, Cryptophyta, Dinophyta, and Cyanophyta – 2 species of each division, and one species of Flagellatae. The average concentration of phytoplankton in terms of number was 2.3*106 cells l-1, in terms of biomass 231 μg C l-1. In the eastern basin, 14 species of Bacillariophyta were found; the dominant species were Amphora coffeaeformis, Fragilaria brevistriata, and Navicula spp. Chlorophyta was presented by only unidentified species. The total number of phytoplankton was 0.9*106 cells l-1, biomass was 93 μg C l-1. Composition of phytoplankton community changed depending on the site and depth. In the eastern basin, where mineralization reached 211 ppt, the community was dominated by diatoms and green algae while in the western basin, with mineralization of 119 ppt, all divisions of algae were presented. The vertical distribution of phytoplankton reflected the light and temperature preferences of the different groups. Bacillariophyta, Chlorophyta, and Cryptophyta peaked at the 20 m depth with the temperature of about of 2°C and low irradiation. Warm-water and light-requiring Cyanophyta inhabited mainly the upper 5-m layer. The number of zooplankton species decreased from 42 species in 1971 to 1 species, the brine shrimp Artemia parthenogenetica, in 2008. Artemia, a typical resident of hypersaline lakes, was first found in the Large Aral Sea in 1998. Since 2002 onward, this species already absolutely dominated zooplankton community making up 99% of total biomass. In 2000-2002, in the western basin of Aral, abundance of Artemia increased by a factor of four while biomass varied from 0.2 to 0.3 g m-3. During 2002-2006, the population density has been progressively growing, in terms of number from 250 to 1260 ind. m-3 and in terms of biomass from 0.3 to 1.3 g m-3. In summer 2008, biomass of Artemia was higher in the eastern basin as compared with the western part, 4.7 g m-3 against 2.9 g m-3. Since the volume of the western basin is greater by a factor of five than that of the eastern basin, the total stock of Artemia population in the western basin exceeded that in the eastern one. A continued increase in Artemia abundance and biomass gives a good reason to wait for the rapid expansion of the population in the Large Aral. Artemia have two modes of reproduction: ovoviviparous (producing free-swimming nauplii released from egg sacs when conditions are stable) and oviparous (producing dormant cysts in diapause when conditions are unfavourable). The Aral Sea Artemia possess both reproduction modes and can switch from one mode to the other in a response to changing environment conditions. In early summer, all the Aral Artemia females produced ovoviviparously. In mid-summer, they switched to oviparous reproduction, and by August, only a small proportion of reproducing females (<2%) produced nauplii. In autumn, all females produced only dormant cysts. There was a positive correlation between clutch size and the body length of female for both reproduction modes. In ovoviviparous reproduction, the number of offspring was much higher (109$\pm$22 naupl. per female) than in oviparous reproduction (33$\pm$13 cysts per female). The temperature and salinity were shown to affect strongly the reproduction potential in Artemia. In the eastern basin where mineralization exceeded 200 ppt, both reproduction characteristics, the clutch size and percent of reproducing females, decreased significantly as compared with the eastern basin.