Journal of Marine Systems 76 (2009) 336–342

Contents lists available at ScienceDirect

Journal of Marine Systems

journal homepage: www.elsevier.com/locate/jmarsys

Quantitative distribution of the meiobenthos in the Large Aral Sea in 2003 and 2004

Vadim O. Mokievsky

P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, Nachimovsky prosp. 36, Moscow 117899, Russia

ARTICLE INFO

Article history:
Received 15 January 2007
Received in revised form 30 August 2007
Accepted 12 March 2008
Available online 8 August 2008

Keywords:
Aral Sea
Large Aral
Benthos
Meiobenthos
Meiofauna
Hypersaline biotopes

ABSTRACT

Living meiobenthos samples were collected in the Large Aral Sea in 2003 and 2004 from water depths ranging from 0 to 39 m. The near-bottom water salinity at the sampling sites varied from 88 to 109‰. Meiobenthos, which occurred at all stations, consisted of nematodes, harpacticoides, ostracods and turbellarians. Unicellular organisms (foraminifera) were also present. The density of meiobenthos showed a significant spatial variation. Nematodes predominated in most samples. The maximal abundance of free-living nematodes (1440 specimens/10 cm^2) was recorded in 2003 at a depth of 10 m, at a site with 88.9‰ salinity and a water temperature of 13.6 °C. The maximal abundance of nematodes in 2004 was 750 specimens/10 cm^2 at about the same depth and salinity, but with a considerably higher water temperature (24.5 °C). The highest value for the harpacticoid copepods density was 116 specimens/10 cm^2 at 1 m depth. The high spatial meiobenthos variation is to a considerable extent related to the sediment characteristics at the sampling stations.

1. Introduction

During the last two decades, a great number of studies had been undertaken to evaluate various aspects of ecosystem transformations both in the Aral Sea and along its shores (Glazovsky, 1995; Orlova, 1996; Létolle and Chesterikoff, 1999; the most recent bibliography: Nihoul et al., 2002). These studies were conducted in both parts of the Aral Sea: in the so-called Large (southern part) and in the Small Aral Seas (northern part). Recently, the Small Aral Sea has attracted more attention, mainly because of its current importance for local fisheries; however, less is known about the current state of the Large Aral Sea, although changes in its ecosystem are probably much more prominent. Great changes in the Aral Sea ecosystems occurring over the last decades mostly occurred because the freshwater input has decreased as much as 5-fold since the 1960s and the salinity has thus increased accordingly. The mean annual freshwater inflow was 56 km^3 up until the 1960s; it then gradually decreased to values between 0 to 10 km^3 per year. This resulted in a sea level drop of approximately 25 m. In 1988, the Aral Sea partition started. Progressively, the northern, shallow basin (Small Aral Sea) and the southern basin (Large Aral Sea) developed independently though, in the beginning, these two sections remained conjoined by the narrow Berg Strait (Fig. 1). The Syrdarya River mouth moved northward, and the river now discharges into the Small Aral Sea. As a result, salinity in the Small Aral Sea is still low; in 2002 it ranged from 14 to 18‰ (Friedrich and Oberhänsli, 2004). In the Large Aral Sea, salinity has increased continuously and approached 109‰ in 2004 (Zavialov et al., 2009-this issue). Today, the Large Aral Sea is completely cut off from the Small Aral Sea and consists of an eastern shallow (3 m) basin and a western, deep (40 m) basin, which are connected in the north by an 8 m deep channel.

The oceanographic and hydrological changes occurring in the Large Aral Sea over the last few years have been summarized in Zavialov (2005) and Zavialov et al. (2009-this issue). The authors highlighted the complexity of the hydrological structure of the two basins and demonstrated the dynamic interactions occurring between the eastern shallow and the western deep basin of the Large Aral Sea. The temperature and oxygen regime exhibits great seasonal and interannual changes. In the western part, the water is often stratified, at

E-mail address: vadim@ocean.ru.

0924-7963/$ – see front matter © 2008 Published by Elsevier B.V.
doi:10.1016/j.jmarsys.2008.03.014

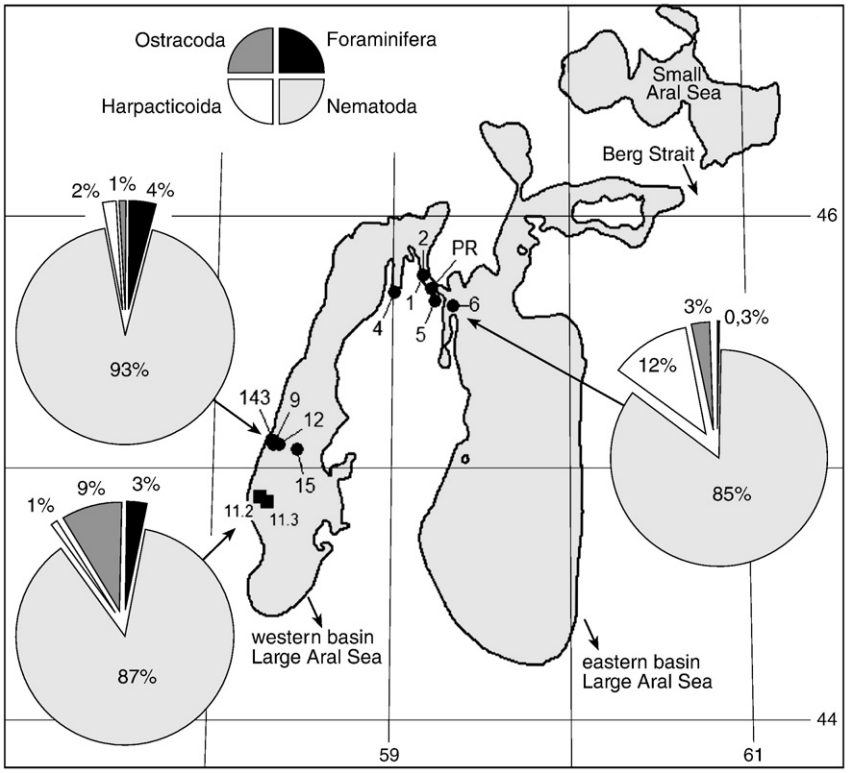

Fig. 1. Schematic map of the Small and the Large Aral Seas, with sampling stations in the Large Aral Sea (dots — stations sampled 2004, squares — station sampled 2003; numbers — corresponding station numbers reported in Tables 1 and 2). The coastline is shown according to the satellite image from September 2004. The pie charts represent the relative abundance of the main meiobenthos taxonomic groups. The three pie charts show the mean values for the W basin stations sampled in 2003 (mean values of two stations 11.2, 11.3), channel stations sampled in 2004 (mean values of six stations 1,2, 4, 5, 6, PR) and W basin stations sampled in 2004 (mean values of four stations 143, 9, 12,15).

least during summer and autumn; as a result, oxygen depletion occurred near the bottom in 2002 and 2003 (Zavialov, 2005; Zavialov et al., 2009-this issue). During the survey from 2002 through 2006, the salinity was continuously rising. For a period in 2004, salinity approached 91‰ in the western basin and reached up to 109‰ in the eastern basin (for further details see Zavialov et al., 2009-this issue).

Within the wide range of research topics addressing the ecology of the Aral Sea, little attention has been paid to one of the most abundant benthic groups — the small-sized biota, or meiobenthos. Not only meiobenthos as a whole, but also the individual species of the most abundant taxonomic groups, such as nematodes, harpacticoides, oligochaetes, are known to be stable and resistant elements of benthic communities (Raffaelli and Mason, 1981; Giere, 1993) since they can survive in highly saline and poorly oxygenated water. Overall, they are much better adapted to conditions that are no longer favourable for the macrobenthos (Jensen, 1986; Olafsson et al., 2000; Warwick et al., 2002). Recently, Mokievsky et al. (2004) documented that standing stocks of meiobenthos vary significantly and they may reach densities as high as 10^5–10^6 individuals/m^2 (2004), and a diversity of 100 species may be attained at specific sites (Mokievsky and Azovsky, 2002; Finlay and Fenchel, 2004; Gerlach, 2004). However, the meiobenthos of the Aral Sea remain poorly characterized. Species inventories documenting conditions before 1960 are restricted to harpacticoid copepods, turbellarians, and ostracods (Shornikov, 1973; Morduchai-Boltovskoi, 1974); whereas the most diverse and abundant group of the meiobenthos, the free-living nematodes, were not studied at all prior to the ecosystem changes. As to the spatial distribution of major meiobenthos taxa, to date, very little information is available. Filippov et al. (1993), were the first to report on benthic assemblages, which were investigated in a more quantitative way in 1992. These authors sampled nine stations off the Syrdarya River mouth and in the Berg Strait, which previously connected the southern and northern parts of the Aral Sea. The salinity of the water in the strait was 20–25‰ at the time of sampling.

Since 2002, oceanographic studies have been conducted during several expeditions on the Large Aral Sea by the P.P. Shirshov Institute of Oceanology RAS, led by P.O. Zavialov et al. (2004). During these expeditions, plankton and benthos were also regularly sampled. Here, we report data from a meiobenthos assemblage study of samples collected in 2003 and 2004 from three hydrographically well-documented areas. These samples permit, for the first time, more spatial insight into the diversity and abundance patterns of bottom dwellers. We present the quantitative distributions and diversity changes along depth profiles and document specific meiobenthos assemblages from sites with various hydrographic properties; these sites seem to be close to a critical salinity state for marine invertebrates (see also Arashkevich et al., 2009-this issue; Sapozhnikov et al., 2009-this issue).