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FULL LENGTH ARTICLE

Spatio-temporal variations of macrobenthic fauna in Lake Nasser khors, Egypt

Hesham R. Abdel Mola *, **Soad S. Abdel Gawad**

National Institute of Oceanography and Fisheries, 101, Kasr El-Einy St., Cairo, Egypt

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KEYWORDS

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Abstract Spatial and temporal variations of macrobenthic fauna in Lake Nasser khors, were studied at four subsequent seasons during 2013. Khor Tushka West recorded the highest average number (597 Org./m^2). It was decreased at khor Kursku (112 Org./m^2) and Kalabsha (105 Org./m^2) while it reached the lowest at khor Wadi Abyad (65 Org./m^2). The highest average number was recorded during spring (447 Org./m^2). It decreased during winter (174 Org./m^2) and summer (151 Org./m^2), then reached the lowest during autumn (107 Org./m^2). Annelida, Arthropoda and Mollusca were the most dominant groups in the lake during the study being 72.65%, 26.09% and 1.35%, respectively. The highest number of species (16) was observed at khor Kalabsha. This may be due to its nature of sandy bottom. Biological indices showed high richness values of all the studies khors except khor Tushka West.

These low values of indices may be due to the dominance of Annelids species especially, *Limnodrilus* spp. and *Branchiura sowerbyi*. There is a positive correlation between these species and total annelids with all physico-chemical parameters. The analysis of variance between the different khors based on the main macrobenthic groups showed a highly significant value ($p < 0.001$).

Introduction

Benthic macroinvertebrates are animals inhabiting the substratum of lakes, streams, estuaries, and marine waters. In Lake Nasser, benthic organisms are represented by 5 major groups, namely, Annelida (oligochaetes), Arthropoda (Insecta and Crustacea), Mollusca, Cnidaria (Hydrozoa) and Bryozoa (Abdel Gawad et al., 2014). Freshwater benthic macroinvertebrates include representatives of many oligochaetes, insects, crustaceans, gastropods and bivalves (Merritt et al., 2008). They contribute in many important ecological functions, such as decomposition, nutrient recycling, as well as serve an important role in aquatic food webs as both consumers and prey (Covicch et al., 1999; Vanni, 2002; Moore, 2006). Benthic macroinvertebrate assemblages are structured according to physical and chemical parameters that define habitat and other biological parameters that influence their reproductive success (Abdelsalam and Tanida, 2013). In addition, they provide a more accurate understanding of changing in aquatic conditions than chemical and microbiological data, which at least give short-term fluctuations (Ravera, 1998, 2000). Moreover, the Water Framework Directive (WFD, 2006) demands the establishment of biomonitoring programmes for European aquatic ecosystems and includes macroinvertebrates as one of the biological elements to be monitored.

* Corresponding author.

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The different groups of benthos serve as an important food for various fish species in Lake Nasser (Latif, 1974; Iskaros, 1993). These authors found that chironomid larvae form the major food items for *Mormyrus kannume*, *Mormyrus caschive* and *Chrysichthys auratus* throughout the different seasons. *Synodontis schall* and *Synodontis serratus* feed mainly on gastropods, *Bulinus truncatus* and *Physa acuta*. Furthermore, they report that nymphs of Odonata and Ephemeroptera, larvae of Trichoptera, Corixidae are also infrequently recorded in the guts of the above 5 fish species. *Hydrocynus* spp., particularly *Hydrocynus forskalii*, subsists mainly on insect larvae (Iskaros, 1993; Mola, 2009). The changing of macrobenthic fauna in the main channel was studied by many authors (Entz, 1978; Latif et al., 1979; Latif, 1974; Fishar, 1995) while at Lake Nasser khors was not studied for a long time on a wide scale except Iskaros (1993) and El-Tantawy et al. (2003) who studied the bottom fauna in khor Kalabsha only. Hence, the aim of the present work is to study the abundance, species composition and seasonal population dynamics of macrobenthic fauna in different khors of Lake Nasser and its relation to some environmental parameters.

Material and methods

Area of study

The lake shoreline is very irregular, with numerous embayments which are called khors (inundated valleys) the total number of important khors are 85 of which 48 lie on the eastern side and 37 on the western one (Entz, 1974). The investigation includes selection for the study khors (Kalabsha, Wadi Abyad, Kurusku and Tushka West). On the bases of quantitative and qualitative analysis, the benthic fauna were sampled at many stations of each khor (Table 1 and Fig. 1) during the study period to elucidate the changing in macrobenthos distribution. Field work was conducted seasonally during the period from February, 2013 to November, 2013.

Collection and analysis of samples

Some physico-chemical parameters e.g. temperature, Electrical conductivity (EC), pH were measured immediately by multiprob Hydrolab (Model CRISON-Spain). Transparency was measured by Secchi disk and dissolved Oxygen was measured according to APHA (2005). The bottom fauna was collected by the Ekman Grab bottom sampler, covering an area of about 0.03 m^2. After collection the bottom fauna was washed thoroughly in a small hand net of bolting silk (0.5 mm mesh size) and picked in and preserved immediately in 10% neutral formalin solution in polyethylene jars. In the laboratory, samples were washed again. However, each species was counted separately. The bottom fauna was identified and sorted into groups and species according to Edmondson (1966), Brown (1980, 2001), and Bishai et al. (2000).

Statistical analysis

Biological indices and similarity index were conducted with PRIMER 5 (version 5.2.0) software. The correlation coefficient between different Physico-chemical parameters and the dominant zooplankton groups was carried out by SPSS (version 16) software. ANOVA two-way was conducted between the different khors and the dominant macrobenthic groups by SAS, 2004 program.

Results

Physico-chemical parameters

The average pH values fluctuated between 8.21 during spring and 8.65 during autumn. Temperature ranged between 18.2 °C during winter and 28.7 °C during summer. Transparency ranged between 185 cm during spring and 257 cm during winter while Electrical conductivity ranged between 189 and 228 μS/cm (Fig. 2). Dissolved oxygen was measured at the bottom water layer of each khor. It was fluctuated between 2 mg/l at khor Kursku during summer and 7.8 mg/l at khor Tushka West during autumn (Fig. 3). The data of physic-chemical were cited from Tawfeek and Koriem (2014).

Abundance and distribution of the macrobenthic fauna

The maximum number (1421 Org./m^2) of macrobenthic invertebrates was recorded at khor Tushka West during spring while the lowest number (36 Org./m^2) was recorded at khor Wadi Abyad during autumn (Fig. 4). The highest average abundance was recorded at khor Tushka West (597 Org./m^2), followed by khor Kalabsha (105 Org./m^2) and Kursku (112 Org./m^2) while the lowest abundance was recorded at khor Wadi Abyad (65 Org./m^2). At all seasons, the highest average number was recorded during spring (447 Org./m^2). It decreased during winter (174 Org./m^2) and summer (151 Org./m^2), then reached the lowest during autumn (107 Org./m^2). Annelida, Arthropoda and Mollusca were the most dominant groups in the lake during the study being 72.56%, 26.09% and 1.35% respectively.

Species composition of the macrobenthic fauna in the Lake khors

The highest number of taxa and species was recorded at khor Kalabsha (16 species). It decreased at khor Kursku and

Table 1 Latitudes, longitudes average depths and nature of the bottom (some morphometry) for the studied khors.

Khor name	Kalabsha	Wadi Abyad	Kurusku	Tushka West
Latitude	32°51′25″E–32°32′4″E	32°57′47″E–33°4′56″E	32°19′3″E–32°20′29″E	31°45′53″E–31°33′27″E
Longitude	23°41′13″N–23°26′32″N	23°24′34″N–23°20′47″N	22°32′45″N–22°33′26″N	22°37′42″N–22°35′8″N
Average depth	29 m	17 m	32 m	22 m
Nature of the bottom	Sandy	Sandy gravel	Rocky	Sandy mud