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FULL LENGTH ARTICLE

Ecological factors affecting the distribution of the zooplankton community in the Tigris River at Baghdad region, Iraq

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Abstract Biodiversity of zooplankton in the Tigris River running in Baghdad City, central Iraq, was investigated. Fourteen physical and chemical parameters, were analyzed, these parameters include water and air temperature, pH, EC, turbidity, TDS, DO, BOD_5, total hardness, Ca^{+2}, Mg^{+2}, chloride, nitrate and reactive phosphate. Most of these values were within of the Iraqi and international standard limits. In all, 106 taxonomy units of zooplankton were identified, including 65 taxa belonging to rotifers, 25 taxa to copepod and 16 taxa to Cladocera. Values of species richness index of rotifers varied from 1.051 to 12.98, for Cladocera from 1.285 to 3.41 and for copepod from 1.5 to 7.2. The Shannon–Weiner index of Rotifera varied from 0.67 to 3, 0.50–1.72 for Cladocera and from 0.91 to 2.51 for Copepoda. The uniformity index of zooplankton varied from 0.41 to 0.93 for rotifer, 0.33–1 for Cladocera and 0.36–1 for Copepoda. According to statistical analysis, temperature, EC, TDS and dissolved oxygen were observed as major factors which restrict the abundance and diversity of the zooplankton communities in the Tigris River.
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Introduction

Freshwater zooplankton is an important component in aquatic ecosystems, whose main function is to act as primary and secondary links in the food chain. The physical and chemical environment shapes affect community structure. T hese communities are also influenced by biological interactions, predation and their specific competition for food resources (Neves et al., 2003). Plankton has been used as a bioindicator for monitoring aquatic ecosystems and the integrity of water. Zooplankton assemblages may be considered bioindicators of eutrophication, as they are coupled to environmental conditions, responding more rapidly to changes than do fishes, and are easier to identify than phytoplankton. Therefore, they are of considerable potential value' as water quality indicators (Sládecek, 1983; Murugan et al., 1998). Zooplankton offer several advantages as indicators of environmental quality in both lakes and rivers: as a group, they have worldwide distribution and the species composition and community structure are sensitive for changes in environmental conditions, nutrient enrichment (Jha and Barat, 2003) and different levels of pollution (El-Bassat, 2007).

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Materials and methods

Study area

The study area (Tigris River within Baghdad City) is located in the mesopotamia alluvial plain between latitudes 33°14′–33°25′ N and longitudes 44°31′–44°17′ E. Tigris River enters Baghdad City at a distance of 5 km north of the Al-Muthana Bridge, a point of exit, about 3 km south of estuary of the Diyala River, and at a length between those two points about 58 km, the river divides Baghdad City into right (Karkh) and left (Rusafa) sections with a flow direction from north to south (AL-Adili, 1998). It has numerous river twists due to the decrease in speed and precipitation (Toma, 1983).

In the present study four stations were chosen from the Tigris River in Baghdad City (Fig. 1). The longitudes and latitudes of the studied stations are mentioned in Table 1.

Sampling procedures

Samples were collected from all sites mentioned above on a monthly basis (from December 2012 to November 2013).

For chemical analysis water samples were collected in polyethylene containers in volumes of 10 l under the water surface about 20–30 cm after punning the container with water samples, then kept in a refrigerator at 15 °C, while water samples for dissolved oxygen (DO) and biological oxygen demand (BOD_5) were collected in sterile dark Winkler bottles. Water temperature was measured in the field with a mercury thermometer (0–50 °C) graduated up to 0.1 intervals, at the depth of 20 cm. pH value and electrical conductivity were measured directly in the field by using a portable pH-meter model (WTW pH 720). Other water quality parameters were determined separately for all the samples in the laboratory by following standard methods (APHA, 1998).

Table 1 Latitudes and longitudes of study stations in the Tigris River within Baghdad City.

Stations	Latitudes (North)	Longitudes (East)
Station one (S.1)	33°25′16.61″N	44°20′10.57″E
Station two (S.2)	33°20′51.56″N	44°23′58.98″E
Station three (S.3)	33°16′27.59″N	44°24′20.94″E
Station four (S.4)	33°13′45.23″N	44°30′14.18″E

For collecting zooplanktons a net was used with a mesh size 53 μm, and formalin 4% is added for fixation.

Measuring of diversity indices

Margalef diversity index (D^*)

This index is calculated monthly according to Clifford and Stephenson (1975).

$$D^* = \frac{(S-1)}{\log N}$$

where S = the number of species, N = the total number of individuals.

Shannon–Weiner diversity index (H)

Values of this indicator were calculated monthly for all groups of invertebrates by using the equation of Shannon and Weiner according to Pielou (1969).

$$H = -\sum \frac{ni}{N} \ln \frac{ni}{N}$$

where ni = The number of individual species, N = The total number of individuals. Values less than 1 bit/ind. are little diversified, while the values more than 3 bit/ind. are most highly diversified (Proto- Neto, 2003).

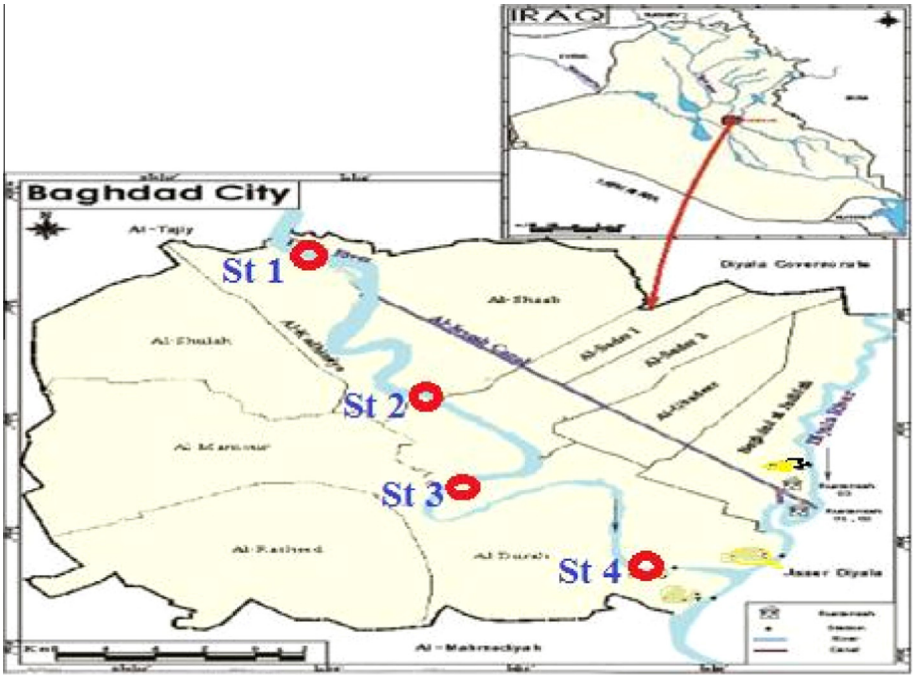

Figure 1 Tigris River along Baghdad city with the sampling stations.

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