Egyptian Journal of Aquatic Research xxx (2017) xxx–xxx

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Egyptian Journal of Aquatic Research

journal homepage: www.sciencedirect.com/locate/ejar

Full length article

Ecological assessment of the macrophytes and phytoplankton in El-Rayah Al-Behery, River Nile, Egypt

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ARTICLE INFO

Article history:
Received 6 May 2017
Revised 2 August 2017
Accepted 2 August 2017
Available online xxxx

Keywords:
Ecological assessment
Phytoplankton
Macrophytes

ABSTRACT

The present study aimed to assess the effect of ecological factors on distribution and species composition of macrophytes and phytoplankton communities at El-Rayah Al-Behery. Changes in the quantitative and qualitative composition of the macrophytes and phytoplankton communities were detected in relation to season and sampling site. A total of eleven macrophytes and 100 phytoplankton species were identified. Among the macrophytes, the emergent species *Echinochloa stagnina* was the most dominant and widely distributed. Phytoplankton community is fairly diverse, related to 7 classes, which contains 3 main classes: Bacillariophyceae (28 taxa), Chlorophyceae (33 taxa) and Cyanophyceae (23 taxa). According to statistical analysis, occurrence of most macrophytes species were reversely affected by DO, COD, BOD and $PO_{4;}$ and closely correlated with NO_2, NO_3, Temp. and pH values. However, nitrogen and phosphorus are considered as limiting factors for bacillariohyceae growth (r = 0.7). Both temperature and pH have a positive effect on the growth of chlorophyceae (r = 0.9 and 0.8, respectively); while dissolved oxygen is an important parameter that affects on the growth of cyanphyceae (r = 0.8). In addition, existence of *Myriophyllium spicatum* was associated with increasing of bacillariohyceae and total phytoplankton density (r = 0.7). However, the presence of *Polygonum tomentosum* was intensely related with chlorophyceae (r = 0.9) and *Potamogeton nodosus* and *Polygonum tomentosum* were positively correlated with cyanphyceae. In conclusion, the investigated area was characterized by different taxonomic composition of macrophytes and phytoplankton communities, which varied as a result of changing in water physiochemical characteristics as well as the interaction between different species.

Introduction

Over the coming decades, climate change will has a potential effect on many sectors in which water resource managers play an active role. The major drivers are changing temperature and precipitation regimes and the associated impacts as growth of aquatic plants (Short et al., 2016). These aquatic plants are growing so rapidly and densely representing an acute problem causing tremendous loss of water from water bodies, decrease the flow capacity of irrigation canals, causing oxygen depletion, reducing phytoplankton production and increasing water pollution. On the other hand, aquatic plants are essential in promoting the diversity and function of aquatic systems (Carpenter and Lodge, 1986), and can provide a source of animal feed, paper pulp, fiber, bio-energy and bioactive materials (Fareed et al., 2008; Haroon, 2010; Daboor and Haroon, 2012).

The algae are an essential component of all aquatic systems where they serve as the base of the food chain for all other aquatic organisms (Napiórkowska-Krzebietke et al., 2016). Scientists use algae in bioassay tests for vitamins and as tools for investigations into plant physiology. In addition they play a primary role in oxygenation and filtration. In some countries, it plays an important part in their economy by extraction of many useful substances (Vernon and Vandiver, 2002). Microalgae also act as a useful indicator of water quality (Abuzer and Okan, 2007), and can be used in making assessment of ecological variations (Hamed, 2008). Algal biomass (Chl. *a*) is long-accepted methods for estimating the amount of algae in aquatic environment (Hussian et al., 2015), primary productivity indicator, one of the most effective variables on the trophic status of aquatic ecosystem (Horne and Goldman, 1994) and regards as a very good estimate for monitoring and assessing the eutrophication status of the aquatic environment (Heinonen et al., 2000).

The cultivated lands in Egypt are almost irrigated permanently by the river Nile water through a huge network of drains and canals with approximately total length 4700 km (Van der Bliek et al., 1982). The two water systems are subject to be infested by different aquatic plants, which varied in their degree of infestation

Peer review under responsibility of National Institute of Oceanography and Fisheries.

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https://doi.org/10.1016/j.ejar.2017.08.002
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depending on the environmental factors (El-Gharably et al., 1982). The study of aquatic vegetation of irrigation and drain canal in the Nile Delta region have received the attention of many authors, like study of Shaltout et al., 1994; Serag and Khedr, 1996; Abu Ziada et al., 2008; Mashaly et al., 2009. Al-Behery canal is a fresh waterway, which is vital for irrigation, navigation, fishing and other domestic uses in Egypt. We failed to find any publication concerning macrophytes distribution at this waterway. So, the present study aims to assessment the effects of ecological factors on the distribution and species composition of macrophytes and phytoplankton communities in El-Rayah Al-Behery. The relationships between different macrophytes species and phytoplankton classes was described. In addition, algal biomass (Chl. *a*) was also estimated to assess the eutrophic status of water.

Materials and methods

Study area

El-Rayah Al-Behery is a fresh waterway, starts from the Rosetta branch at El-Kanater El- Khayria city and extends into the West of Delta, heading the north-west parallel to Rosetta branch and west of Giza Governorate of approximately 220 km with average width 40–50 m and its average depth 2-3 m. It was connected with Mahmudiyah canal after Damanhor city. The canal is characterized by existence of many water and power giant plants especially on Mahmudiyah canal. Eight sampling sites distributed along El-Rayah Al-Behery were chosen for sampling (B1: B8, Fig. 1) along four seasons from spring to winter. Details of the sampling locations with their longitude and latitude are presented in Table 1.

Macrophytes collection and identification

At each station, macrophytes were handly collected. After collection, emergent macrophytes were placed in polyethylene bags without water. However, submerged and free floating species were stored in river water before taking to the laboratory. The macrophytes did not weight but just kept for later ID in the laboratory, where they were separated into different taxa and identified based on Täckholm (1974) and Boulos (1999). The species presence was expressed as percent of sites with taxa

Phytoplankton composition

For phytoplankton examination, subsurface water sampling was collected from the different stations. In each station, one litter water sample was preserved with formalin 4% and Lugols iodine immediately. In the laboratory, these samples are transported into a glass cylinder and stay 5 days for settle down. Approximately, 90% of the supernatant siphoned off by plastic tubes protected with plankton mesh (5μ), and adjusted to a stable volume. Sub-samples were prepared for species identification and account using inverted microscope. Each sample was examined and enumerated via a drop method (APHA, 1995). The main references used in phytoplankton identification were Starmach (1974), Httl and Gartner (1988), Tikkanen (1986) and Deskachary (1959).

Seasonal average of physico- chemical characteristics at the different stations of El-Rayah Al-Behery were obtained from Goher (2015)

Fig. 1. Map of the study area showing different sampling locations (Goher, 2015).

Table 1
Details, longitude and latitude of the sampling locations.

St. No.	Name	Latitude	Longitude	St. No.	Name	Latitude	Longitude
B1	El Qanater	30 °10′47.36″	31 ° 6′18.69″	B6	El Mahmodeia	31°10′25.9″	30 °31′42.1″
B2	Abo Ghaleb	30 °14′46.90″	30 °56′33.68″	B7	Connection of El Behairy with El Mahmodeia	31° 5′16.85″	30 °25′16.79″
B3	Kafr Dawood	30 °27′3.75″	30 °49′41.35″	B8	Kafr El dawar		
B4	Al Tawfekeih	30 °48′36.91″	30 °45′21.65″				
B5	Damanhor	31 °00′46.5″	30 °28′52.8″				

*After Goher (2015).

Please cite this article in press as: Haroon, A.M., Hussian, A.-E.M. Ecological assessment of the macrophytes and phytoplankton in El-Rayah Al-Behery, River Nile, Egypt. Egyptian Journal of Aquatic Research (2017), https://doi.org/10.1016/j.ejar.2017.08.002