Acta Ecologica Sinica xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Acta Ecologica Sinica

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

Seasonal pattern of zooplankton communities and their environmental response in subtropical maritime channels systems in the Bay of Bengal, Bangladesh

Mamun Abdullah Al [a,b], Aysha Akhtar [b], Abu Hena Mustafa Kamal [c], Md. Shafiqul Islam [b], M. Muslem Uddin [b], Md. Didarul Alam [b], Henglong Xu [a,*]

[a] Laboratory of Microbial Ecology, Ocean University of China, Qingdao 266003, China
[b] Faculty of Marine Sciences and Fisheries, University of Chittagong, 4331, Bangladesh
[c] Faculty of Agriculture and Food Sciences, Universiti Putra, Bintulu, Sarawak, Malaysia

ARTICLE INFO

Article history:
Received 9 April 2017
Received in revised form 7 November 2017
Accepted 13 November 2017
Available online xxxx

Keywords:
Zooplankton
Seasonal shift
Tropical channel
Community structure
Multivariate approach

ABSTRACT

Zooplankton are a primary component of aquatic food chain and play an important role in the functioning of aquatic food webs. Seasonal variation in community structures of zooplankton and potential environmental drivers were studied, during a 1-year cycle (summer 2015 – spring 2016) in subtropical maritime channels systems in the Bay of Bengal, coastal waters in Bangladesh. A total of 32 species representing 25 families, 13 orders and 15 taxonomic groups were identified. Of these species, 23 distributed in all four season of which 8 were dominant species with high contributions of the total communities. Species number was peaked in autumn and fell in summer while maximum abundance was in the winter and minimum in summer. Multivariate analyses showed that there was a clear seasonal shift in zooplankton community structures in relation with environmental conditions. Species diversity and evenness peaked in summer while the high value of species richness was found in autumn. Multivariate correlation (RELATE) and BIO-ENV analysis demonstrated that seasonal variation in community patterns was significantly correlated with temporal shift of environmental conditions and that variation mainly driven by water transparency, salinity, DO, TSS and nutrients. Thus, this finding implies that the zooplankton community represented a clear seasonal shift shaped by environmental drivers in subtropical channels systems.

1. Introduction

Zooplankton are heterotrophic and weak swimming aquatic organisms living in all types of water bodies including fresh, coastal and marine [1–3]. They are primary components in the biotopes and play an important role in functioning of the tropical food webs by mediating the flux of organic matter and energy from phytoplankton to fishes in the aquatic ecosystems [4–6]. For examples, they treat as intermediate nexus for flux of energy from primary producers to subsequent consumer levels of food chain, and the energy direction is; phytoplankton → microbes → benthos → fishes [7,8]. Furthermore, they provide essential indication about the trophic status of secondary production in the ecosystems [9]. Despite of having great significant in the food chain, recently they have widely been used as bio-indicators for discriminating environmental stress due to short life cycle and quick response against certain environmental changes either natural or anthropogenic pollutants [1,10–12].

Up to date, several studies have been reported about zooplankton and related environmental parameters in the coastal waters of the Bay of Bengal. As regards, their seasonal variation and environmental relationship in the Bangladesh coastal waters, however, few studies have been reported. According these previous reports seasonality and community patterns of zooplankton are significantly governed by hydrological parameters (e.g., transparency, salinity, temperature and nutrients) of the Bay of Bengal and adjacent water tributaries [7,13–16]. It has been reported seasonal variation and community patterns of zooplankton relation with physiochemical parameters directly related to monsoonal activity of the Bay of Bengal water circulation especially monsoon period May to July/June to September when effective rainfall and nutrients input from upland [17–20].

Bangladesh has the greatest significant for available aquatic resources both fauna and flora due to deltaic position in the world [17,21]. Several rivers and open maritime channel systems (Moheshkhali, Kutubdia and Kohelia) have been contributed in regional and global scale for the fisheries sectors and coastal carbon sequestration by massive growth of aquatic vegetation. These fisheries species are fond of zooplankton as their basic food during early life stages even some graze them in whole life [13]. Thus, it has been acquainted

* Corresponding author at: College of Marine Life Sciences, Ocean University of China, Qingdao 266003, China.
E-mail address: xuhl@ouc.edu.cn (H. Xu).

https://doi.org/10.1016/j.chnaes.2017.11.001
1872-2032/

that world richest fisheries completely depended on zooplankton availabilities [16,22]. For example, fisheries sustainability of a region based on zooplankton diversity because it leads the displacement of organisms that depended on it (e.g., fish migration) [13,23,24]. Being as important wetland and aquatic ecosystems, the research on zooplankton along with limnology are still scarce which is prime necessary for monitoring ecosystem health status.

In the present study, a 1-year baseline survey was carried out from summer 2015 to spring 2016 in subtropical coastal channels systems in Bangladesh, in the Bay of Bengal. Our objectives of this study were: (a) to document the compositional structure and community pattern of zooplankton; (b) to reveal the seasonal variation in zooplankton community structures; and (c) to summarize the seasonal environmental response of zooplankton communities in such subtropical channels systems.

2. Materials and methods

2.1. Study area and dataset collection

Three sampling stations were selected in south eastern coastal waters in Bangladesh, Bay of Bengal where station 1 & 2 were located in the Kohelia channel (station 1 was in the mouth part of the channel connected to the Bay of Bengal; station 2 was in the middle part of the channel) and station 3 was in the Kutubdia channel in north Materbari (Fig. 1). Samples were seasonally collected in summer (April 2015), autumn (August 2015), winter (December 2015) and spring (February 2016) respectively.

Zooplankton samples were collected using a conical zooplankton net with a mesh size of 100 μm. A digital flow meter was set up at the mouth of the net to record the amount of water filtered through the net during sampling. Samples were collected at three sampling stations from the surface water 1 m depth for 10 to 15 min. After collection, all samples were preserved in 5% formalin solution [25]. For effective sorting, the samples were stained with Rose-bangle (4,5,6,7-tetrachloro-2′,4′,5′,7′-tetraiodofluorescein) and left for 24 h in the laboratory for attaining pink color which helping to sorted out easily and identify using fine brush, needles, forceps and microscope. The sorted zooplankton species were brought under the microscope and identified morphologically according to the previous studies such as [2,3,26–32] and preserved in 70% ethanol solution. Enumeration was done according to Goswami [25], zooplankton concentration was expressed as individuals per cubic meters (individual/m^3).

Environmental parameters such as water temperature (°C), salinity (psu), pH, and water transparency (cm) were estimated *insitu* using centigrade thermometer, refractometer (TANAKA New S-100, Japan), digital pen pH meter (HANNA instruments, model HI 98107) and secchi disk, respectively. Subsurface water samples (≈50 cm) were collected for measuring dissolved oxygen (DO), total dissolved solid (TDS), total suspended solid (TSS), nitrite nitrogen (NO_2-N) and soluble reactive

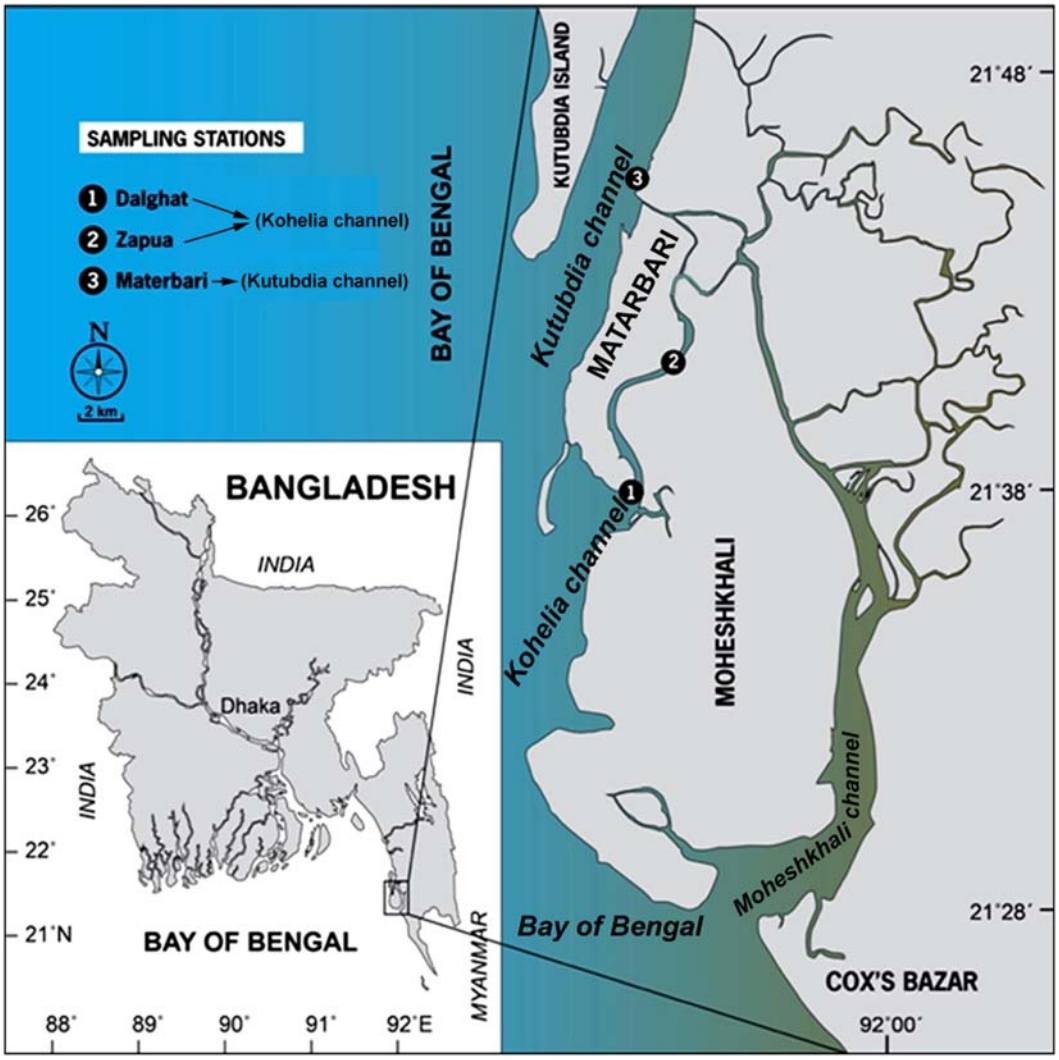

Fig. 1. Sampling stations (1–3) in subtropical maritime channels systems in the Bay of Bengal, coastal waters of Bangladesh.

Please cite this article as: M. Abdullah Al, et al., Seasonal pattern of zooplankton communities and their environmental response in subtropical maritime channels systems in the Bay o..., Acta Ecologica Sinica (2017), https://doi.org/10.1016/j.chnaes.2017.11.001