Seasonal shift in zooplankton communities in two sub-tropical urban wetlands, Southern China

Songlu Liu [a], Xinlu Shi [a,*], Henglong Xu [b,*], Guijie Liu [a], Cuicui Hou [a], Xiaowen Zhu [a]

[a] Hangzhou Key Laboratory for Animal Adaptation and Evolution, Hangzhou Normal University, Hangzhou 310036, China
[b] Laboratory of Microbial Ecology, College of Marine Life Science, Ocean University of China, Qingdao 266003, China

ARTICLE INFO

ABSTRACT

The seasonal shift in the community pattern of zooplankton was studied in two typical urban landscape wetland systems (West Lake and Xixi Wetland) during four.
seasons (June 2013 to May 2014). Samples were monthly collected at six sampling stations within a gradient of environmental stress in West Lake and Xixi Wetland, respectively. A total of 119 zooplankton species were identified, comprising 75 rotifers, 23 cladocerans and 21 copepods. Multivariate analysis revealed that: (1) the species compositions represented significant differences between two biotopes, with Rotifera assemblage as the primary contributor to the difference; (2) the community structures showed dissimilar seasonal variation in both wetlands, and 14 rotifer species were the main contributors to this dissimilarity; (3) the temporal variations in zooplankton community structures were significantly correlation with the environmental variables in both systems, especially NO_2-N and NO_3-N in West Lake, pH, DO, T, COD in Xixi Wetland; (4) the species diversity indices (Margalef, Pielou and Shannon-Wiener) showed higher values in Xixi Wetland than that in West Lake. Based on the above results, we suggest that zooplankton community structures are significantly shaped by environmental drivers, and thus may be used as potential bioindicators of water quality in sub-tropical urban landscape wetland ecosystems.

© 2015 Published by Elsevier B.V. on behalf of Ecological Society of China.

Contents

1. Introduction

Zooplankton plays a significant role as the primary link in the local trophic food chain, transferring the energy from bacteria/phytoplankton to other invertebrates and fish in aquatic ecosystems [28,33]. Because of short life cycle and quick response to the environment changes, their
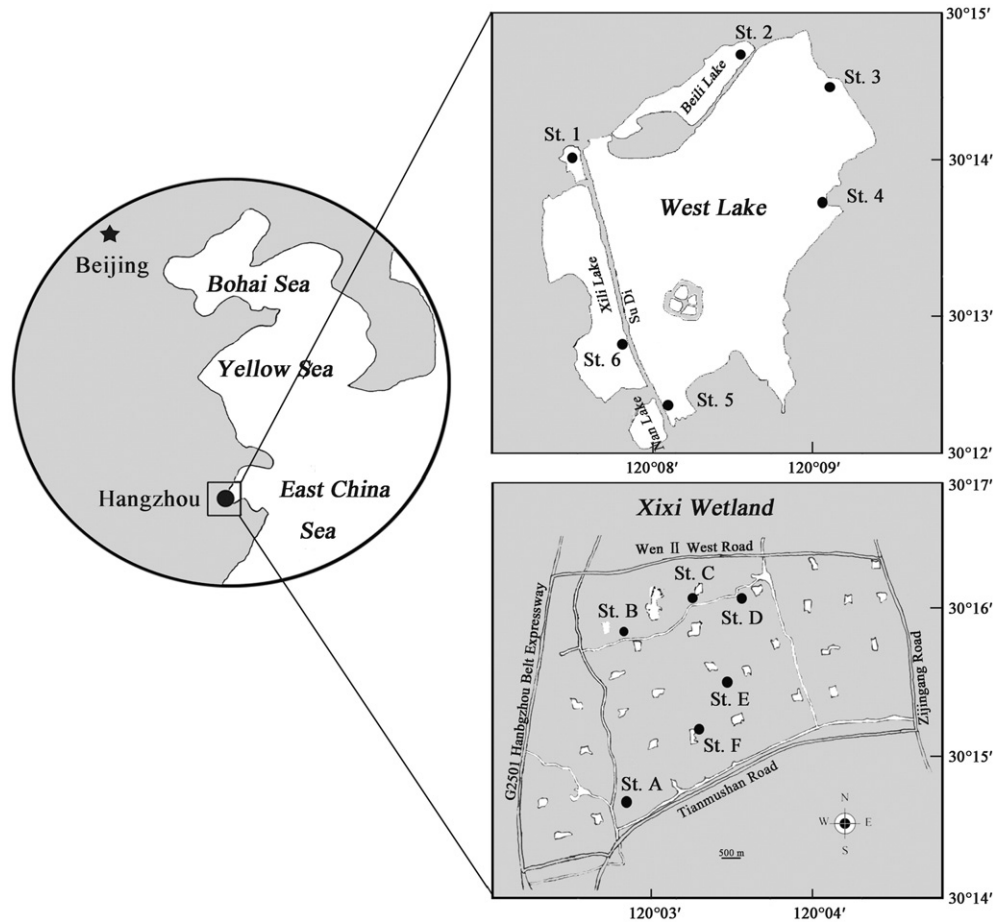
Fig. 1. Map showing the sampling stations in West Lake and Xixi Wetland, Hangzhou, China.

changes in abundance, species diversity and community composition may provide important indications of environmental change or disturbance [6,31]. Compared with single species-based indicator, the community-based bioassessment has proved to be the more reliable [19].

In previous decades, many studies on freshwater zooplankton communities have been carried out in different bodies like rivers, streams, lakes and smaller aquatic habitats (e.g., [3,11,20,23]). However, as regards the differences in zooplankton community patterns and their relationships to water conditions between lake and wetland systems, little information is known [18,21,32,41].

West Lake, located near Hangzhou city, southern China, is one of the world cultural heritages, with an area of 6.5 km² and a mean depth of 2.7 m. In 1999, after the water diversion from Qiantang River and dredge project was finished, the water eutrophication of the lake had been improved [22,42]. Xixi Wetland, located in the same city, is the representative national wetland park with urban, farming and culture in China, and its water network belongs to the canal water system. It covers an area of 5.29 km², which was studded with network river and scaly pond with a mean depth of 2.13 m [16,17,27]. With the rapid development of social and economical conditions, both wetland systems as the urban landscape have been more vulnerable to suffer pollution from human activities [35].

In this study, the zooplankton community features and their relationship to changes of environmental conditions were comparatively studied in both wetland systems during a 1-year period (June 2013 to May 2014). The aims of this study were: (1) to document the zooplankton community composition and species diversity between the two different water bodies, (2) to show the difference in zooplankton community structures in response to environment variables between the two biotopes, and (3) to assess the environmental quality status of both urban landscapes based on zooplankton community.

2. Materials and methods

2.1. Study area and sampling sites

A total of twelve sampling stations (1–6, A–F) were selected in Xixi Wetland and West Lake (Fig. 1). Their characteristics were presented in Table 1.

2.2. Sampling and data collection

Samples were monthly collected from June 2013 to May 2014. At each sampling site, samples were taken from upper-mid-bottom layers mixed of the water using an organic glass hydrophore (2.5 l) [25]. The

Table 1
The location and character of the twelve sampling sites.

Sites	Location	Character
1	N30°15′23.61″, E120°08′27.04″	Water diversion corner, lotus, fish
2	N30°15′41.07″, E120°08′53.03″	Spacious, much more tourists
3	N30°15′28.23″, E120°09′08.71″	Near water outlet, restaurant
4	N30°14′57.04″, E120°09′20.63″	Located in outer lake
5	N30°13′56.41″, E120°08′20.92″	Near water inlet
6	N30°14′04.34″, E120°08′16.09″	Ornamental fish pond
A	N30°15′33.16″, E120°03′26.81″	Near water inlet, wharf
B	N30°15′58.53″, E120°03′33.19″	Farming, fishing
C	N30°16′16.59″, E120°03′19.60″	River intersection, market place
D	N30°16′20.15″, E120°03′20.15″	Natural riverway
E	N30°16′29.49″, E120°03′47.39″	Ornamental riverway, Near water outlet
F	N30°16′29.14″, E120°03′55.06″	Ornamental pond