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专论与综述

湖泊水位变动对水生植被的影响机理及其调控方法

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摘要 水位的高低及其变动范围、频率、发生的时间、持续的时长和规律性等是影响湖泊水生植被的核心因子。水位变动有短期、年内季节性和年际变动3种，对湖泊水生植被有不同的影响机理。水位短期变动通过对水体中的悬浮物、透明度、光衰减系数等的影响而对水生植被产生作用；周期性的年内季节性和年际水位变动可对水生植被的生态适宜性产生影响，并进而改变其时空分布；长期的高水位和低水位以及非周期性的水位季节变动会破坏水生植被长期以来对水位周期性变化所产生的适应性，从而影响了植被的正常生长、繁衍和演替。植被的极端深度和物种多样性是水位调控的核心表征指标，可通过经验数据分析法、生态模型法和参照法等方法来确定湖泊的适宜水位变动范围和时间。研究对象选择、研究方法、管理中的应用以及重要环境变化所产生的影响等是今后相关研究的核心问题。

关键词 水位；水生植被；影响机理；水位调控；沉水植被

分类号 P343.3,Q14,Q178,Q948.8

Role of water level fluctuation on aquatic vegetation in lakes

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Abstract This paper analyzes the impact of lake water level fluctuation on aquatic ecological systems based upon studies documented in a wide range of literatures throughout the world. Lake water level fluctuation (LWLF) plays a significant role in ecological restoration and ecosystem management. The impact of LWLF on aquatic ecological systems has been widely studied in recent years, with some of the more recent studies focused on the relationship between LWLF and aquatic vegetations, particularly submerged plants.

It is important to maintain an ecologically suitable water level to sustain a healthy lake ecosystem. An ecologically suitable water level is in general characterized by the magnitude, frequency, timing and duration of water level fluctuation. As suggested by many studies, LWLF impacts aquatic ecosystems in both direct and indirect ways, and at various scales from the very small to the ecosystem level scales. LWLF demonstrates different patterns, including short- and long-term LWLF, as well as long-term high and low water levels. Winds and waves are the dominant factors causing short -term LWLF with associated increase in total suspended solid (TSS) concentration and light extinction, which would leads to changes in aquatic and near shore vegetations. Seasonal and long-time LWLF is responsible for more significant changes in lake ecosystems. Long-term high and low water levels, and some abnormal changes in water levels can cause low species diversity or declined biomass. It is considered an important management tool for shallow lake restoration to integrate the role of LWLF into the water-level management framework. The maximum bio-suitable water depth and species diversity index are taken as indictors for water level control. The magnitude, frequency, timing and duration of LWLF need to be adjusted for lake restoration. The main study methods, including statistical analysis of long-time historical data, ecological modelling approach and reference lake approach, are proposed in recent studies. The basic water level control measures include: (1) reducing frequency of flow variation; (2) increasing seasonal variation and avoid extreme conditions; (3) reintroducing seasonal flow peaks; (4) increasing seasonal hig

h flows; (5) reducing high flows, especially those badly timed; and (6) reducing intensity of water-l
evel change.
Several limitations in the past studies on this topic are identified as: (1) absence of studies on the e
ffects of LWLF on overall aquatic ecosystems; (2) lack of comprehensive ecological modeling stu
dies to quantify the impact of LWLF; (3) lack of sufficient attention to the role of water level contr
ol in lake management; and (4) lack of studies on the effects of global warming on LWLF and lak
e ecosystem. Based on the intensive literature review, this paper presents some potential researc
h directions and methods for water level control and lake ecosystem response.

Key words water level； _ aquatic vegetation； _ influence mechanism； _ wat
er level management； _ submerged vegetation

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