Continental-scale effects of phytoplankton and non-phytoplankton turbidity on macrophyte occurrence in shallow lakes

日期：2021年06月02日

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Submerged macrophytes are key components of shallow lake biological communities, and their presence has been associated with a predominantly clear-water state. Conversely, lakes lacking macrophytes are often turbid with elevated phytoplankton abundance. One main mechanism that influences the presence or absence of submerged macrophytes is turbidity that reduces the light available to macrophytes. Increases in turbidity can be caused by increased phytoplankton abundance and by increased concentrations of suspended inorganic sediment and understanding the relative contributions of these two factors can inform efforts to manage the

effects of increased turbidity on macrophyte occurrence. Here, a continental scale data set is analyzed to quantify the effects of macrophytes on turbidity that originates from phytoplankton and from non-phytoplankton sources (e.g., inorganic sediment). Effects of phytoplankton assemblage composition on turbidity are also estimated. Based on this model, illustrative examples of chlorophyll concentrations needed to maintain or restore macrophytes to shallow lakes are calculated, and the difference in the magnitude of these concentrations illustrates the stabilizing effect of macrophytes on lake condition.

（来源：AQUATIC SCIENCES 卷: 83 期: 1 出版年:2021 DOI: 10.1007/s00027-020-00769-1 ）

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