Supplementary Information
Numerical analysis on long-term shifts of mixing regime and nutrient status in Lake Biwa under climate change

Jinxin Zhou[1, *], Takero Yoshida[2] and Daisuke Kitazawa[1]

[1] Institute of Industrial Science, University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8574, Japan.

[2] Department of Ocean Sciences, Tokyo University of Marine Science and Technology, 4-5-7 Konan, Minato-ku, Tokyo 108-8477, Japan.

[*]**Corresponding author:** Jinxin Zhou. E-mail: jxzhou@iis.u-tokyo.ac.jp.
Institute of Industrial Science, University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8574, Japan.

Supplementary Figure S1

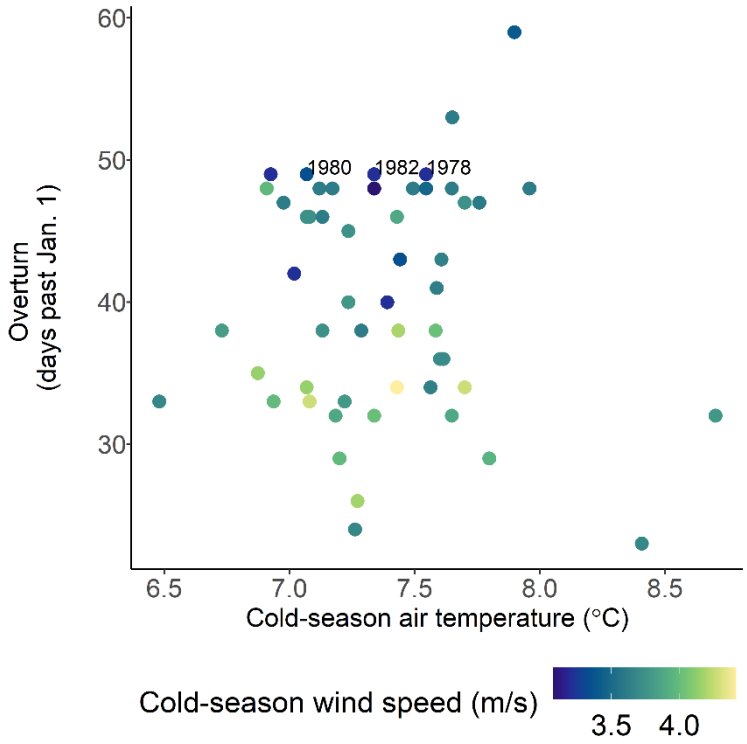

Figure S1. The relationship between the beginning date of overturn, the cold-season air temperature, and wind speed. Points show the averaged values of climate conditions for each year.

Supplementary Figure S2

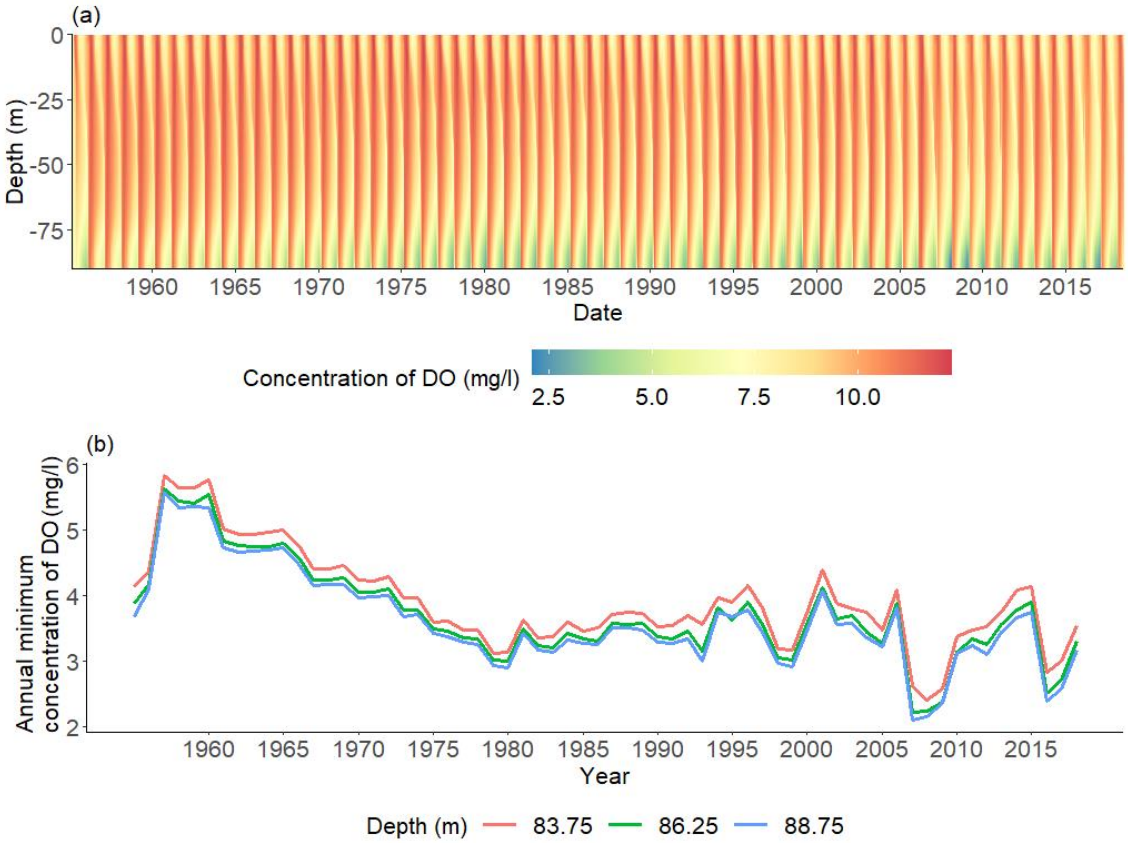

Figure S2. The fluctuation of DO concentration across all depths at monitoring station over the simulation period: (a) raw data shown in contour plot, and (b) annual minimum value for three bottom depths.

Supplementary Figure S3

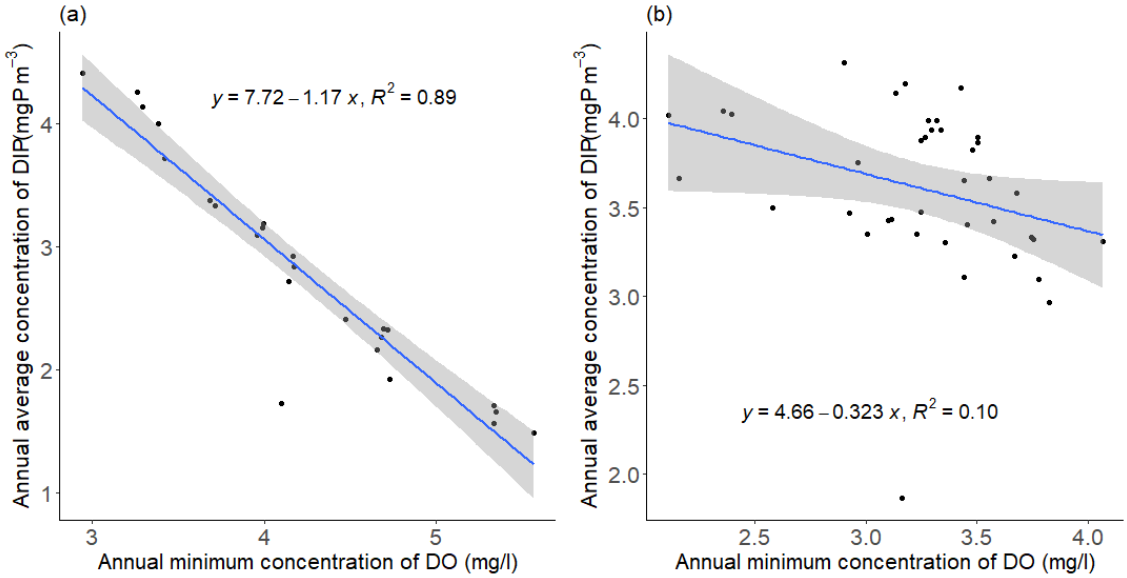

Figure S3. Relationship between annual minimum concentration of dissolved oxygen and dissolved inorganic phosphorus in Lake Biwa: (a) with data before 1980 during which eutrophication progressed, and (b) with data after 1980 during which climate change becomes the dominant stressor.

Supplementary Figure S4

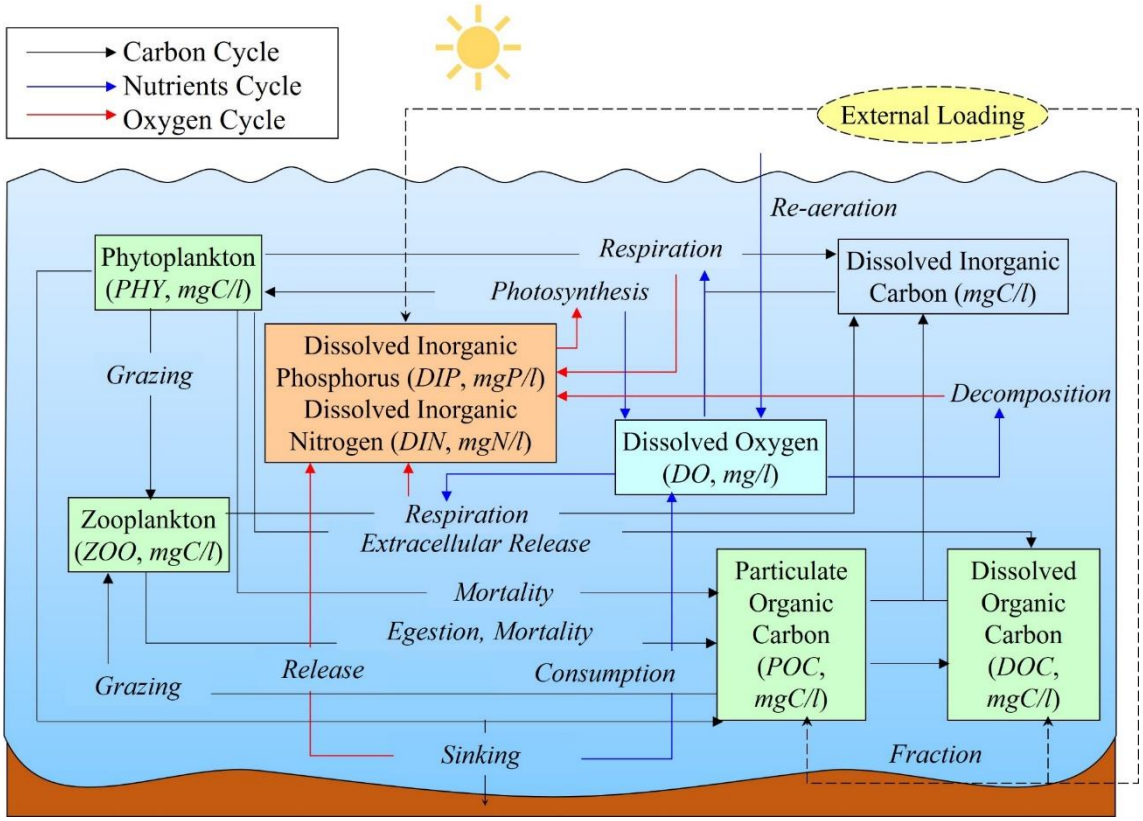

Figure S4. The conceptual structure of pelagic ecosystem submodel. State variables include phytoplankton (PHY), zooplankton (ZOO), dissolved inorganic phosphorus (DIP), dissolved inorganic nitrogen (DIN), dissolved oxygen (DO), particulate organic carbon (POC), and dissolved organic carbon (DOC).