

Possibility of nutrients transportation from littoral slope for enhancement of phytoplankton growth in north basin of Lake Biwa

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Nutrient loading from non-point source in a lake ecosystem has not been well recognized yet. In Lake Biwa, total phosphorus (TP) does not decline to the level before eutrophication period, 1960s to 1970s, despite of decreasing the loading from point sources surrounding the lake after that. One of the reasons for no well lowering TP in the lake is attributed to agricultural runoff, in which suspended materials including phosphorus would be deposited to the littoral bottom. In our previous study, subsurface maximum of ammonium as a proxy of dissolved materials from anaerobic interstitial waters in the littoral bottom sediments was found along a transect from littoral to pelagic regions, implying horizontal transportation of nutrients from littoral sediments. There were no such evidences of soluble reactive phosphorus (SRP) yet due to always below the detection limit in the pelagic waters. Recently, we developed modified protocol using an ion chromatography for measuring orthophosphate concentration at nano-molar levels. In this presentation, we'd like to provide several evidences for horizontal transportation of dissolved nutrients including orthophosphate along a transect from littoral to pelagic sites in north basin of Lake Biwa.

Total of the 6 times transect surveys for determining vertical profiles of nutrients, methane and herbicides were made in 2010-2011. Additional two transect surveys for determining those of nutrients including orthophosphate were made in 16 May and 25 July of 2018. During the 2010-2011 campaigns, *in situ* phytoplankton primary production was measured during the stagnation period using light intensity and chlorophyll *a* concentration monitored by sensors attached to a mooring buoy situated at an offshore station in north basin of Lake Biwa and an equation of photosynthesis - light intensity (P-I) curve.

In 2010-2011 campaigns, we detected sub-surface maximum layer, 20-30 m, of ammonium and methane as a proxy of dissolved materials transported from interstitial water in the sediment of littoral slope. Herbicides, which were used in rice paddy during the rice planting and proxy of materials transported from terrestrial environments surrounding the lake, were also detected in 20-30 m even at the offshore regions in the lake. Primary production monitoring suggested that phytoplankton production depended on some environmental variables other than solar irradiance, e.g. nutrients, until summer months. These results suggested that nutrients for enhancing algal growth might be horizontally transported from sediment in the littoral slope, and that the source of the nutrients might be provided from the drainage of rice paddy.

In 2018 campaigns, sub-surface maximum of ammonium was clearly found along a transect from littoral to pelagic sites in both May and July, but no such sub-surface maximum of orthophosphate was found. Several reasons for failure to find sub-surface maximum of orthophosphate might be proposed. Phosphate would be used by both phytoplankton and bacteria, while ammonium would be used by phytoplankton alone in the euphotic layer. In phosphate limited environment, such as pelagic areas in north basin of Lake Biwa, sub-surface maximum could not be easily detected due to rapid absorption by both phytoplankton and bacteria. Or, a transportation of nutrients from the littoral sloop would sporadically occur, and then we simply missed to detect it. This is on-going research project, and then further studies will be conducted to clarify this issue.

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