Physicochemical properties of aquatic habitats from ecology and civil engineering perspectives

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Aquatic environments are usually represented by physicochemical properties, including flow regime on riverbed configurations, sediment size and stability, and water quality. This monograph focuses on the habitat of submerged macrophytes. Recent changes to the aforementioned physicochemical properties because of human activities have altered the aquatic habitats for submerged macrophytes, resulting in increases in the number of invasive species and extinction of native species. The expansion of invasive species into new environments often changes the physicochemical properties of these environments through accumulation of fine materials or changes in water quality. This is especially true in stable water areas—such as spring-fed rivers, rivers from lakes, lakes, and lagoons—where the submerged macrophytes are often found. In these locations, sufficient natural discharge and floods sizeable enough to renew the aquatic environment cannot be expected. In this case, increases in underwater invasive species tend to have further negative impacts on the natural environment, as they create conditions that are more suitable to themselves. These areas are considered to be among the most sensitive environments to human influences.

In order to overcome this issue, it is necessary to understand the factors that limit the growth of both invasive and native endangered species. With this knowledge, it may be possible to predict future changes to physicochemical properties—focusing on limiting factors with and

without the use of some countermeasures—in order to find effective management strategies. Thus, the cooperation of ecologists and civil engineers is essential in order to integrate their knowledge. To that end, all studies introduced here were presented and discussed at the annual meeting of the Ecology and Civil Engineering Society held in Saitama Prefecture, Japan, in 2009. The essential contributions made by several researchers to this issue are summarized here.

Shinohara et al. (2013) point out the importance of carbon dioxide (CO₂) and light availability to the distribution of submerged macrophytes. Takahashi and Asaeda (2012) clarify that low pH spring water increases the growth rate of *Egeria densa* by affecting free CO₂ concentration in water. It is known that submerged macrophytes play an important role in the ecosystems of shallow lakes and stable streams by changing water quality, creating a refuge for other creatures, reducing bottom shear stress by stabilizing the substrate, and reducing the presence of suspended particles. Submerged macrophytes, however, have been disappearing, and the cause is purported to be a limited supply of photosynthetically active radiation (PAR) because of phytoplankton blooms. Therefore, studies showing the importance of free CO₂ are of interest to those who seek to develop the above-mentioned management strategies.

Matsui (2012) presents his study on the distribution and habitat of submerged macrophytes in the Seta River as it flows out of Lake Biwa, Shiga Prefecture, Japan. He introduces the clear relationship between sediment type and submerged macrophytes. The study by Gunaratne et al. (2012) addresses changes in lagoon morphology, specifically inlet morphology and flushing properties of Koggala Lagoon, Sri Lanka. According to this study, the flushing half-life, which is the time needed to replace half

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of the water volume in the lagoon, suggests that the exchange rate between the lagoon and the ocean is controlled by the balance between freshwater and seawater inflow.

As evident by the issues introduced in these submitted studies, free CO₂ concentration, light availability, and sediment dynamics have considerable impact on submerged macrophytes. Predictions regarding substrate and morphological changes are still difficult to make, but several scenarios considering several morphological types can be examined.

I appreciate all the valuable contributions and efforts of the authors. I hope that this special issue becomes a stepping stone for future studies in this field.

References

- Gunaratne GL, Tanaka N, Amarasekara P, Priyadarshana T, Manatunge J (2012) Effect of inlet morphometry changes on natural sensitivity and flushing time of the Koggala lagoon, Sri Lanka. *Landscape Ecol Eng*. doi:[10.1007/s11355-012-0189-0](https://doi.org/10.1007/s11355-012-0189-0)
- Matsui A (2012) Relationship between the distribution and bottom sediment of submerged macrophytes in the Seta River, Shiga Prefecture, Japan. *Landscape Ecol Eng*. doi:[10.1007/s11355-012-0192-5](https://doi.org/10.1007/s11355-012-0192-5)
- Shinohara R, Asaeda T, Isobe M (2013) Effects of phytoplankton on the distribution of submerged macrophytes in a small canal. *Landscape Ecol Eng*. doi:[10.1007/s11355-013-0227-6](https://doi.org/10.1007/s11355-013-0227-6)
- Takahashi K, Asaeda T (2012) The effect of spring water on the growth of a submerged macrophyte *Egeria densa*. *Landscape Ecol Eng*. doi:[10.1007/s11355-012-0191-6](https://doi.org/10.1007/s11355-012-0191-6)