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Long-term ecological research in a large river: hydrological influences on the plankton dynamics in the lower Nakdong River, S. Korea

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The river ecosystems are nowadays modified physically to satisfy human needs on the water resource management. We usually build dams or estuarine barrage in rivers, make levee to prevent floods, or change riparian zones. Among them, the flow regulation by dams is an important feature on the viewpoint of the changes of ecosystem dynamics in large rivers. The ecological components in rivers are quite influenced by the flow regime. The followings are some brief consequences of flow regulation: (1) serious eutrophication due to the elongation of retention time, (2) changes of community structure, (3) altered food-web functions and structures, etc. Those phenomena were often reported from European or American rivers which had relatively small levels of water level fluctuations. In the case of Asian rivers, however, the relationship between dam hydrology and river ecology should be considered in different way. Above features could also be observed, and the summer concentrated rainfall due to monsoon and typhoon events made the river ecology become more dynamic and unpredictable.

Long-term ecological data of the lower Nakdong River (total length: 525 Km), which is a good example of regulated river in Asia, shows this relationship clearly. This river has 5 multipurpose dams in upper part of the river and an estuary barrage in the mouth of the river. A twelve-year dataset (1993-2004) monitored on weekly-basis showed that dam hydrology (discharge and storage) had large impact on the plankton dynamics in the lower part of the river. In this river, 60% of total annual rainfall occurred in summer (Jun. to Aug.) due to monsoon and typhoons. However, occasional summer drought due to the short monsoon or no typhoons can cause a serious reduction of river flow. When the summer rainfall was enough, several peaks of discharge occurred and plankton communities were often flushed out. In this case, dams in the upper part of river stored enough volume of water and release water continuously to the lower part until next spring (Mar.-Apr.). In the case of summer drought, the lower river experienced severe cyanobacterial proliferations. During the winter of same year(Nov.-Feb.) diatom (*Stephanodiscus* sp.) blooms were regularly observed. In contrast, when the year had plenty of rainfall during the summer, both summer and winter phytoplankton blooms were not observed at the lower part of the river because of dam discharge. In the summer of next year following plenty of rainfall in previous year, the summer cyanobacteria did not increased as much as those of typical dry years.

The talk will provide case studies of ecological consequences of hydrology in a large river system with particular emphasis on the ecohydrology. Maintenance of minimum flow (Smart Flow) or flow regulation in Asian rivers should be considered more precisely to manage ecological integrity and water quality of the river ecosystems.