

Development of the Indicator to Assess Ecosystem Health for Eutrophic Lakes by Using Wakasagi Smelt (*Hypomesus nipponensis*)

Principal Investigator: Megumu FUJIBAYASHI

Institution: Kyushu University

E-mail: m.fujibayashi@civil.kyushu-u.ac.jp

[Abstract]

Key Words: Lake ecosystems, Ecosystem health, Fatty acids, Food web, Stable isotope ratios, Pond smelt, Lake Hachiro, Carbon transfer efficiency, Diet availability

Aquatic animals need to intake highly unsaturated fatty acids (HUFA) such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) from dietary sources, which are important compounds for the normal growth, reproduction, and survival. Moreover, high species richness of benthic animals was observed where HUFA are supplied adequately from sedimentary organic matters in inner bay ecosystems. Thus, supply of HUFA can be considered as an important role of aquatic ecosystems, and monitoring of HUFA supply in lake ecosystems can be a new viewpoint for lake managements. Since fatty acid profiles of consumers reflects those of dietary sources, aquatic animals can be used as indicators of HUFA supplies in lake ecosystems.

Here, to test this hypothesis, pond smelts, *Hypomesus nipponensis* and basal dietary sources (i.e. suspended solids) were collected every month during June to November from 2019 to 2021 in Lake Hachiro, Japan. Correlation analysis between the HUFA contents of *H. nipponensis* and suspended solids showed significant positive relationship in EPA and DHA. This finding has also validated in other lakes, Lake Kasumigaura and Hokuzan Reservoir. These findings suggest that *H. nipponensis* can be used as the indicator of the EPA and DHA supplies in lake ecosystems.

We also found the significant positive relationships between the annual average of EPA contents of *H. nipponensis* and proportion of carnivorous fish to annual total fishery catch in Lake Hachiro. This can be explained that sufficient EPA supply from basal dietary sources enhance the carbon transfer efficiency through the food chain, and consequently relative abundance of carnivorous fish increased. Similarly, we also observed longer food-chain length when higher EPA contents of *H. nipponensis* was detected. These findings imply that EPA contents in *H. nipponensis* can be a useful monitoring tool for carbon transfer efficiency.