

Molecular-, Organ-, and Organism-Level Responses of Crucian Carp (*Carassius auratus*) in a Stream Influenced by a Municipal Sewage Treatment Plant

Soon-Ae Lee, Jinwon Seo¹, Hong-Gil Yun, Sung-Kyu Lee

Ecotoxicology Research Team, Korea Institute of Toxicology, Daejeon, 305-600

¹Ecological Research Team, Environmental Research Center, KIWE, Daejeon, 305-730

(Corresponding author: jinwonseo91@kowaco.or.kr)

Freshwater ecosystems at sewage and industrial waste treatment plants are exposed to complex mixture of various unknown pollutants which can cause adverse effects on fish population. For assessing a freshwater ecosystem, biological parameters, which are called as biomarker or bioindicator, have been proposed to complement the information given by chemical analysis. To examine the possible influence on fish in downstream of a municipal sewage treatment plant (MSTP), crucian carp (*Carassius auratus*) was selected to examine molecular-, organ-, and organism-level responses, and were caught at an upstream and a downstream of MSTP in the Gap stream in spring 2003. Three condition-based indicators, hepato- and gonadosomatic index (HSI and GSI), and condition factor (CF), were calculated for organ- and organism-level responses. Significant increases in HSI and CF were observed in females caught from downstream. Necropsy-based assessment using external and internal anomalies in fish revealed that there were many fish having abnormalities in the downstream of MSTP. Molecular-level responses measured with two biomarkers, DNA single strand breaks and 7-ethoxyresorufin-*O*-deethylase (EROD), were revealed that DNA damage as well as EROD activity found to be higher in the downstream fish compared to the upstream one. The results meant that confirmation of inhabitation in fish did not indicate that they did not have any problem at all on their life. Therefore monitoring of multi-level responses in fish assemblage could play an important role in ecological risk assessment, and further would be required for protecting streams and rivers "ecologically healthy".

Key words: Crucian carp, Biomarkers, Multi-level responses, Ecological risk assessment