Abstract

Hanson, N. 2008. Does Fish Health Matter? The Utility of Biomarkers in Fish for Environmental Assessment. ISBN: 978-91-85529-23-0

Assessments of environmental pollution can be performed to evaluate the present status of the environment as well as to find explanations to observed biological effects. One possible strategy for environmental assessments in the aquatic environment is to examine sub-organism responses (biomarkers) in fish. Biomarkers include physiological and biochemical variables. There is, however, little evidence that link biomarker responses to effects at higher levels. In addition, confounding factors, such as migration and age, can complicate the interpretation of results.

In the thesis, which is based on six scientific papers, the utility of biomarkers in fish for assessing the environmental status was evaluated. Fish are suitable for environmental monitoring as they can be found in most aquatic environments and play a major ecological role in aquatic food webs. A methodology with farmed rainbow trout (*Oncorhynchus mykiss*), which were reared in net cages and/or plastic tanks, was used and evaluated. This was done as it was expected that caging would increase the precision of biomarker measurements by, e.g., preventing migration and thereby achieve a standardized exposure. Furthermore, biomarker responses from a 20-year data set on feral perch (*Perca fluviatilis*) from national reference areas on the Swedish Baltic coast were examined to evaluate potential explanations to an increasing trend in detoxification enzyme activity) in the liver and a reduction in gonad size.

The results showed that the methodology with caged fish was robust to differences in holding conditions but that differences in feeding can affect the responses for several variables. Furthermore, the methodology worked well in a water system with high anthropogenic impact, while the interpretation of results was more complicated in a water system with lower pollution levels. From the 20-year data set on feral perch, it was seen that the flow rate in a nearby river correlated with detoxification activity in the liver. It is, therefore, likely that contaminants are brought to the area by runoff from land. Furthermore, it was found that fish that lived during years with higher detoxification activity had smaller gonads. Analyses of frozen bile showed that PAHs is a likely contributor to increasing biomarker responses in Kvädöfjärden.

Biomarkers in fish can be a useful tool to evaluate environmental pollution in many, although not all, situations. The use of farmed fish can improve the precision in the measurements, but some ecological relevance will be lost and certain confounding factors may be introduced. The choice between farmed or feral fish depends on the situation and what questions that needs to be answered. The results from biomarker analyses are most useful when data from other kinds of environmental monitoring can be included in the interpretation. Future work should focus on how different kinds of environmental monitoring can be integrated to get an effective and more reliable assessment of environmental conditions.

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Does fish health matter?

The utility of biomarkers in fish for environmental assessment

Akademisk avhandling för avläggande av
Filosofie Doktorsexamen i Tillämpad Miljövetenskap
Som offentligt försvaras den 19 december 2008, kl. 10:00
Stora Föreläsningssalen, Botanhuset
Carl Skottbergs gata 22B, Göteborg

Avhandlingen försvaras på engelska.
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