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NRP Endocrine Disruptors

Intermediate Summary

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| Endocrine disruption in Switzerland: assessment of fish exposure and effects on population level (SAFE I) |
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English Summary

Endocrine disruption in brown trout of Swiss rivers

Estrogenic contamination of rivers and associated developmental and reproductive alterations of exposed fish populations have been shown for a number of European countries. This project examines the potential hazard of environmental estrogens to brown trout in Swiss rivers.

Project description:

Research questions

This project aims at determining if disturbances of the estrogenic system of fish do occur in wild fish populations in Switzerland. To approach this aim, it has to be asked whether aquatic wildlife in our rivers is exposed to estrogen disruptors, and at which concentrations. Secondly, does this concentration cause disturbances in the reproductive functions of the wild brown trout? Further, it is explored whether the brown trout population of a selected river with known exposure is disturbed, in respect to the fertility, the age structure or the size of the population. For reasons of comparison, critical life stages, such as hatchlings or mature fish will be studied in respect to their response on estrogens in laboratory experiments as well.

Results

18 midland rivers were investigated in respect to their estrogen exposure. In general it appears that concentrations of environmental estrogens in Swiss midland rivers are low (< 1ng estradiol equivalents/L). By measuring the induced vitellogenin in male brown trout - which is a specific indicator for exposure to estrogen disruptors - it was shown that environmental estrogens pose a local problem to the aquatic ecosystem at 5 rivers. To assess the population dynamics, six 200m-long stretches representative of the river Luetzelmurg - three upstream and three downstream of the waste water treatment plant - are being surveyed regularly to calculate individual growth rates, age and age at maturity.

The species composition is typical for a Swiss river, with bullhead and brown trout dominating. Except for one stretch, the trout density (abundance and biomass) is low to intermediate and most reaches have an altered population structure with a rather small proportion of 0+ fish. Besides estrogen disruption, other stress factors include lack of habitat structures and heterogeneity, other pollution factors and a moderate fishing pressure may contribute to the population characteristics. An elaborated analysis of the population data will follow. In laboratory experiments, it was tested whether hatched embryos exposed to estradiol are disturbed in their reproductive functions and gonadal development. Vitellogenin induction was measured and histological analysis of the gonads revealed that the treatment did not induce a significant increase of female fish in the population, but 10.2% of the exposed fishes showed intersex status of the gonad.

Perspectives

The described data from wild populations must be completed by prolongation of our field studies. In addition, data on how estrogens affect development, hatchability, fecundity, fertility and other parameters of relevance for the reproduction will be raised. Therefore, hatchlings and mature fish will be studied in respect to their response on estrogens in laboratory experiments as well. The following project SAFE II will focuss on the development and use of a population model. Such a model, specifically developed for brown trout is at our disposal and can be extended for the question if and how estrogenic exposure affects populations. Finally, the model results have to be compared to the field data to assess the impact of estrogens in the field.