

# Estrogenic response of wild roach from the Seine River (France)

by

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**ABSTRACT.** - The aquatic environment is the final destination for most chemicals released in the environment, as a consequence freshwater populations are inevitably exposed and may suffer from adverse effects. Fish have been widely used as models for determining the effect of environmental pollutants on vertebrate reproductive function. Several studies have demonstrated endocrine disrupting effects on fish living in rivers that receive treated sewage effluents. To investigate the estrogenic effects of effluents from the Seine River, plasmatic vitellogenin concentrations, a specific female protein, and gonadal histopathologies were studied in roach ( $n = 723$ ). We have identified a significant increase in plasmatic vitellogenin, as assessed in male fish from contaminated sites, indicating that they are exposed to xenoestrogens. Intersex fish, characterised by oocytes in the testes, represented 14% of the population. Severe intersexuality may decrease the fertility of the individual. The sex ratio was found to be significantly altered (30% of males), indicating feminisation of the roach population in the Seine River.

Key words. - *Rutilus rutilus* - Vitellogenin - Intersex - Estrogenicity.

## Introduction

Many environmental pollutants act in a similar fashion to 17- $\alpha$ -estradiol and may adversely affect individual health, especially with regards to the reproductive function. In order to evaluate the pollution of the Seine River in terms of estrogenic compounds, plasmatic vitellogenin (VTG) concentrations were measured in male, female and intersex fish and then compared to levels at the reference site. The occurrence of intersex fish was also determined.

## Methods

Mature fish (> 14 cm long) were sampled from the Seine River, which receives a large load of urban and industrial effluents, and also from the reference site (corresponding to a closed ecosystem without anthropogenic inputs). The fish were anaesthetised before collection of blood and gonad samples. The plasma collected after blood centrifugation was stored at -80°C until further processing. Plasmatic vitellogenin concentrations were assessed using immuno-assay methods. Gonads were embedded in paraffin and histological sections were stained with hematoxylin and eosin.

## Results and discussion

### 1. Gonad histology

613 fish were sampled from the reference site and no intersex fish were observed; however, in the Seine River 14% of fish were identified as being intersex ( $n = 110$ ). The intersex fish were characterised by the occurrence of oocytes within the testicular tissue. The oocyte development observed inside the testis corresponded to the primary oocyte stage, but no cases of the presence of a female ovarian cavity were noted. Finally, a significant decrease in the male fish ratio (including intersex fish) was observed in the Seine River, corresponding to a sex ratio of 30%, whilst in the ref-

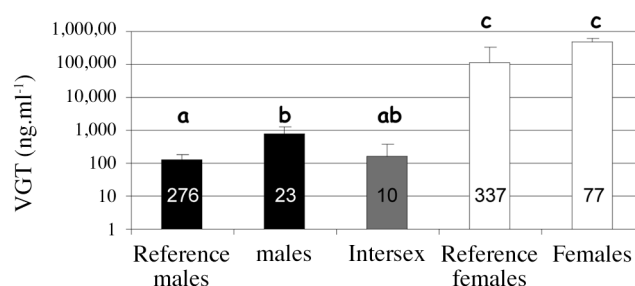


Figure 1. - Plasma vitellogenin concentrations in fish sampled from the Seine River and from the reference site. Results are given as mean  $\pm$  S.E. Different letters indicate statistically significant ( $p < 0.01$ ) differences between groups. The number of sampled fish is indicated for each group.

reference site 45% of the fish sampled were male.

### 2. Vitellogenin analysis

Plasmatic vitellogenin concentrations were recorded in both males and females from the Seine River and from the reference site. The highest VTG induction occurred downstream of the main sewage treatment plant, and differed significantly from the reference level (Fig. 1). A significant difference appeared between males and females but not between males and intersex fish.

## Conclusions

Evidence of endocrine disruption was observed in the Seine River and corresponded to a feminisation of male roach. High VTG levels were recorded in male fish, suggesting that the presence of xenoestrogens in the water could be linked to the sewage treatment plant.

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