

Biomarker for Impairments of Reproductive Health in the Aquatic Environment



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The study was addressed to define biomarkers as early warning tool for a contamination of surface waters by endocrine modulating compounds.

Tab. 1: Study design

Indicator species	Perch (<i>Perca fluviatilis</i>) Roach (<i>Rutilus rutilus</i>)
Area under investigation	8 German surface waters, differing in terms of hydrogeology and anthropogenic impact
Sampling period	Dec. 2000 - Dec. 2002
Sampling mode	2 x annually (1 x Summer, 1 x Winter) 40 individuals of both species
Sampling method	Electro fishing
Parameters recorded	Age structure, growth/age, parasitization, sex ratio/gonadal development, gamete ripening, yolk protein (vitellogenin) synthesis

The “natural” sex ratio of both species was 1:1:f:m (Fig.1, Fig. 4). Independent of hydrological habitat condition the course of sex differentiation was synchronic in **roach**, indicating a stringent mostly endogenous control (Fig.2). Basing on these results we conclude that deviations from the normal pattern of sex differentiation in roach give a strong indication of an exogenous anthropogenic induced impact on reproductive health.

- Factors inhibiting the gonadal development in roach: 1. Infection by *Ligula intestinalis*
2. Sewage water burden (Schwarzbach, up to 80%)
- Intersexual gonads (Testis ova) were not found
- The “natural” sex ratio 1:1:f:m exists even at polluted sampling sites (Fig. 1)

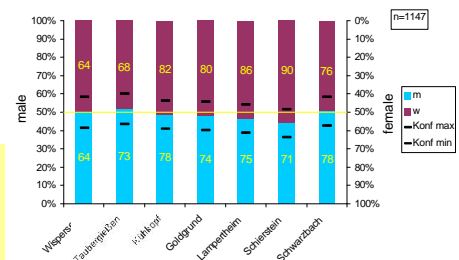


Fig 1: Sex ratio of roach; the black bars represent the 95% confidence level

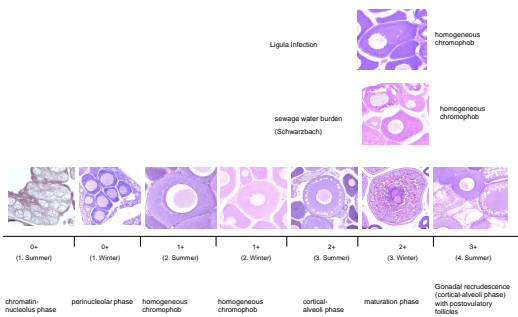


Fig. 2a: Sex differentiation in female roach

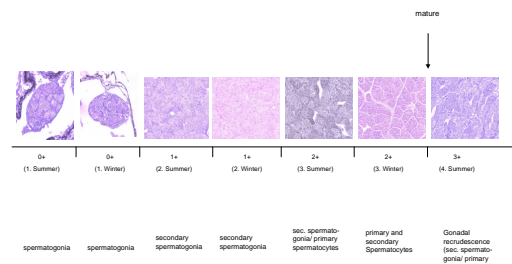


Fig. 2b: Sex differentiation in male roach

Perch showed several variants in sex differentiation even in unpolluted natural habitats regarding:

- the onset of sexual maturation (“pubertas praecox”)
- course of annual gonadal recrudescence (facultative biennial spawning period)
- occurrence of heterologous germ cells (testes ova) restricted to prematuring males, Fig. 4

Therefore, control of sex differentiation seems to be open for exogenous cues in this species. Thorough examination of more than 1800 perch from different sampling sites showed a significant elevated portion of male individuals (59.3%; $p=0.05$) in the area of a marina (Lampertheim) and suppression of gonadal ripening in a sewage polluted brook (Schwarzbach).

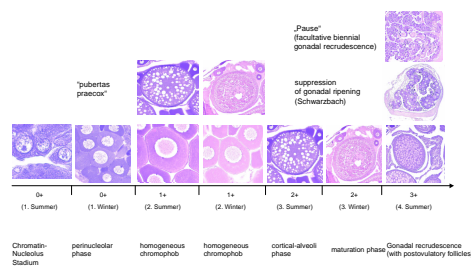


Fig. 4a: Sex differentiation in female perch

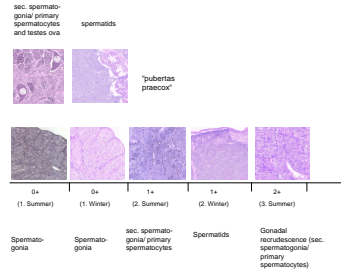


Fig. 4b: Sex differentiation in male perch

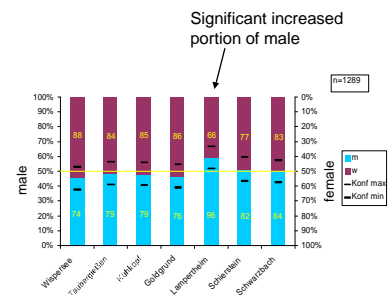


Fig. 3: Sex ratio of roach; the black bars represent the 95% confidence level.

A significant shift of sex ratio was observed at the TBT contaminated marina (Lampertheim).

Conclusion: These results indicate that perch is more sensitive for exogenous cues influencing reproductive functions than roach; however interpretation of the data requires detailed knowledge of the natural plasticity of sex differentiation in this species. Identification of reproductive health impairments requires different assessment schemes for perciform and cyprinid indicator species.