

Anthropogenic Impacts on Sex Differentiation and Vitellogenesis of Roach and Perch in German Surface Waters



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Sex ratio and vitellogenesis of roach (*Rutilus rutilus*) and perch (*Perca fluviatilis*) were investigated at 8 sampling sites showing different degrees of anthropogenic impact. From winter 2000/2001 – 2002/2003 spot checks of 40 individuals per sampling site were caught twice a year in summer and fall to examine early and late stages of gonadal differentiation/ gonadal recrudescence.

Vitellogenin in juvenile male roach

Regardless of sex and origin, vitellogenin induction occurred occasionally (< 20%) in juvenile (0+) roach during the winter month (but not in summer) (Fig.1).

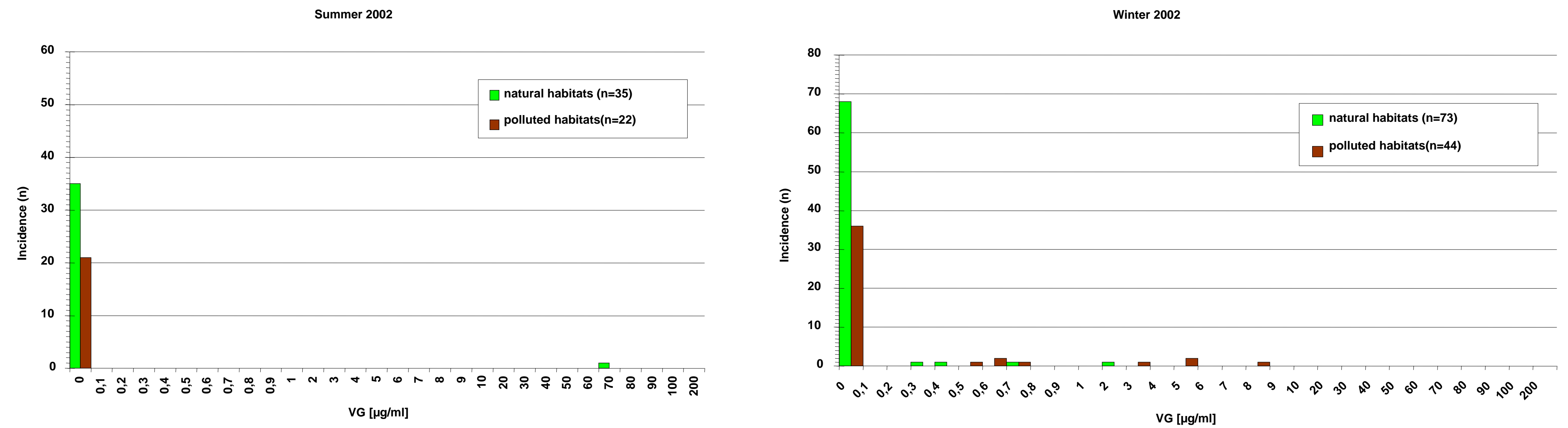


Fig. 1: Seasonal incidence of paradoxical induction of vitellogenin in juvenile roach

Vitellogenin in adult male roach

A significant elevated number of one year old males showing paradoxical vitellogenin synthesis was observed in polluted habitats (small river with high supply of sewage and a marina contaminated by tinorganic compounds) (Fig. 2).

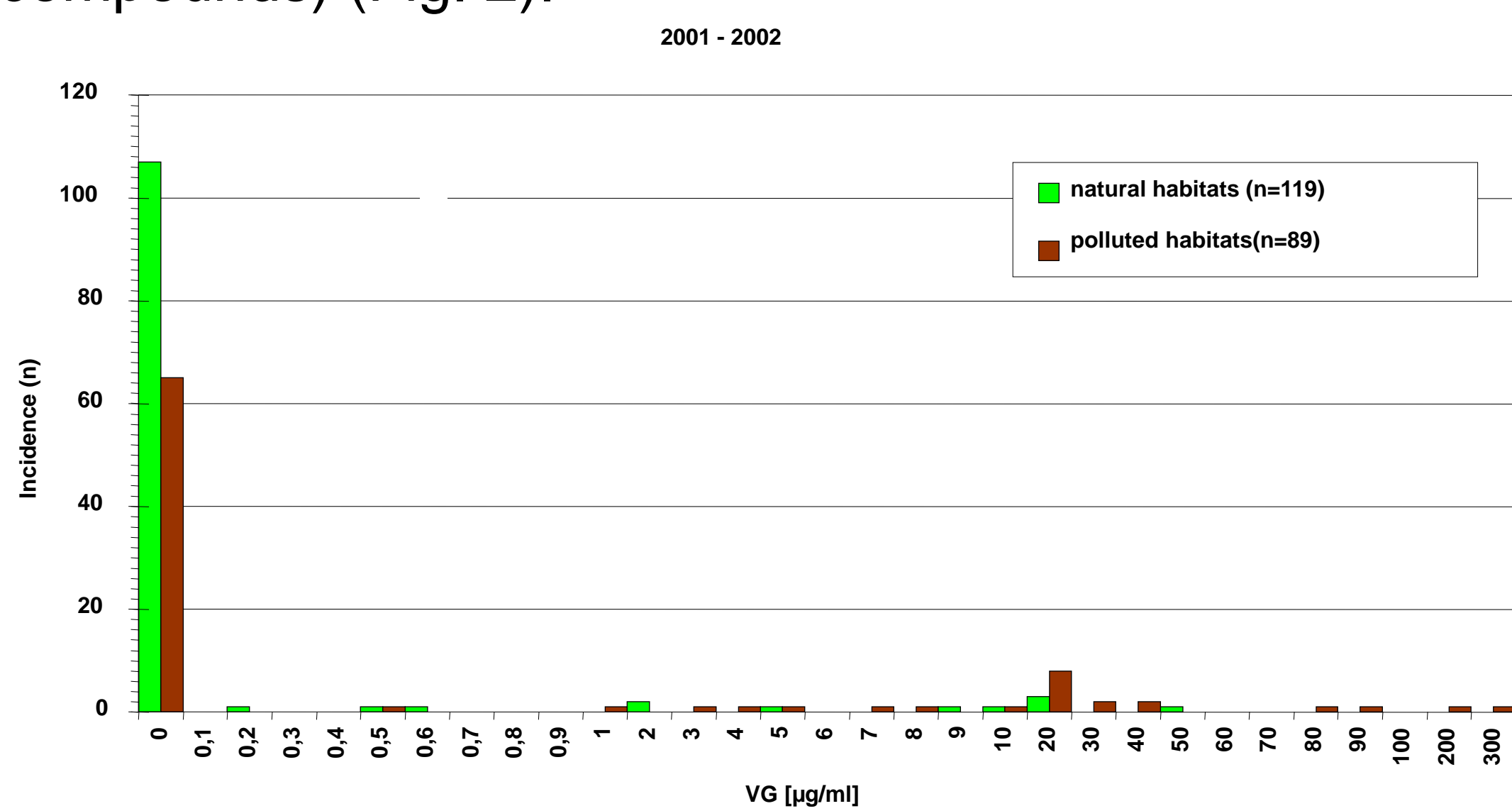


Fig. 2: Incidence of paradoxical induction of vitellogenin in adult male roach

Sexual heterogeneous gonadal features were not observed indicating that induction of vitellogenin and gonadal intersexuality are not caused by identical cues (Fig. 3).

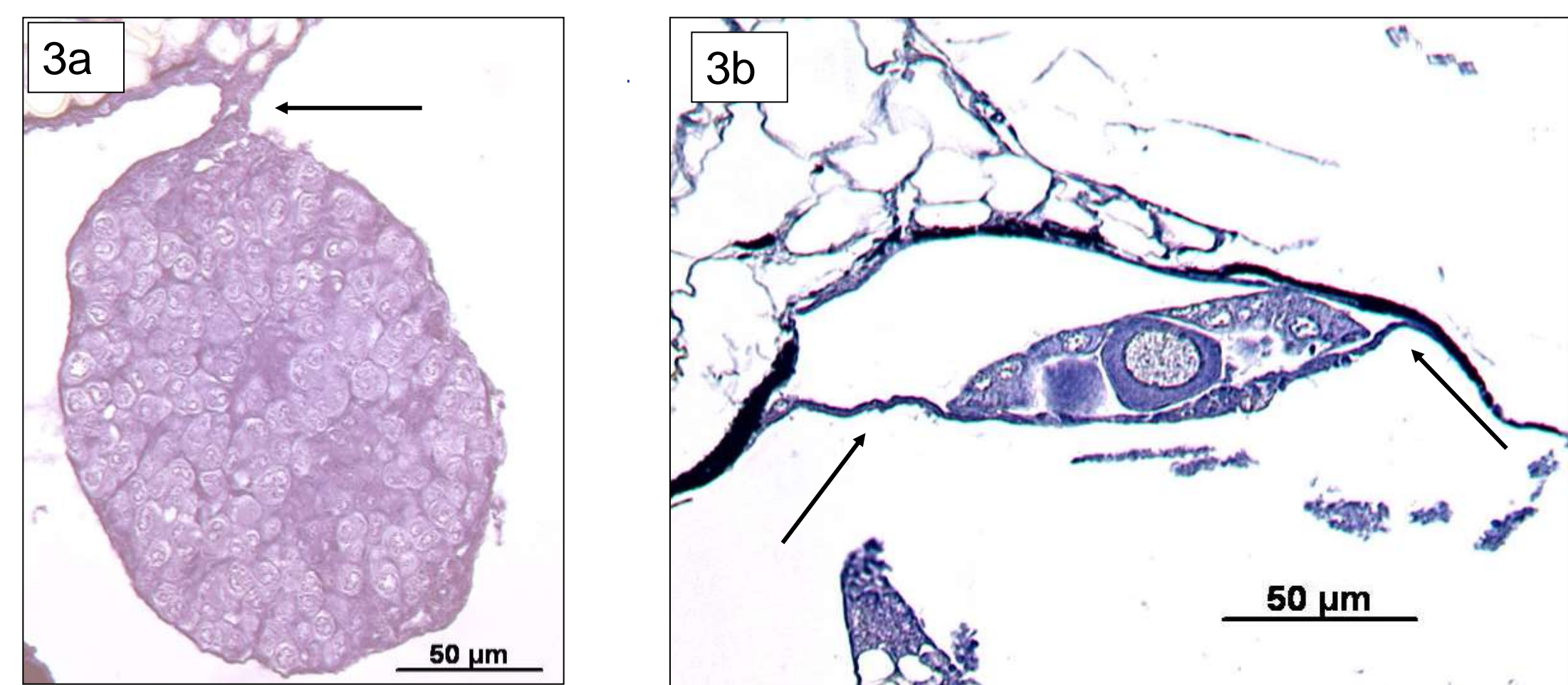


Fig. 3: Gonadal male (a) and female (b) secondary sex characteristics (one and two attachment sites respectively) occurred exclusively in combination with the corresponding gender of germ cells spermatogonia and oocytes respectively.



In **perch** vitellogenin was not detectable in blood of juveniles and females during the early vitellogenic phases of oocyte differentiation, although histological features of yolk formation were clearly visible. Only in blood of females showing the latest stages of oocyte ripening vitellogenin was detectable (< 45 µg/ml).

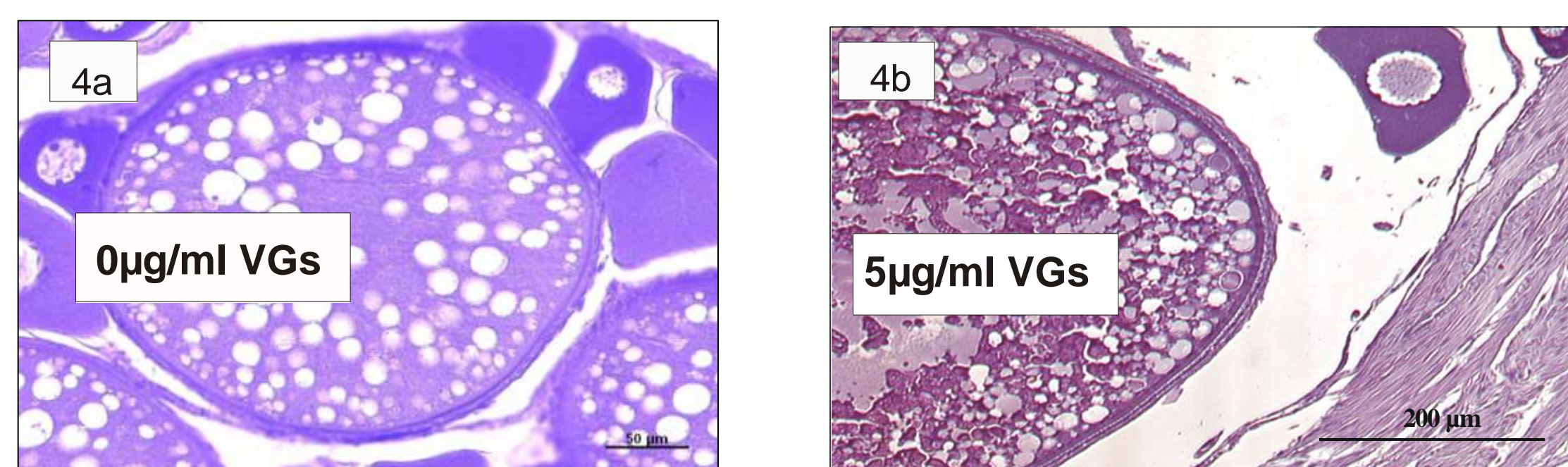


Fig. 4: Cross section of oocytes during early (a, cortical-alveoli phase) and late phase (b, maturation phase) of oogenesis resp. VGs: Vitellogenin serum titer.



Vitellogenin was detectable in blood of juveniles and maturing female **roach** already during the early vitellogenic phases of oocyte differentiation.

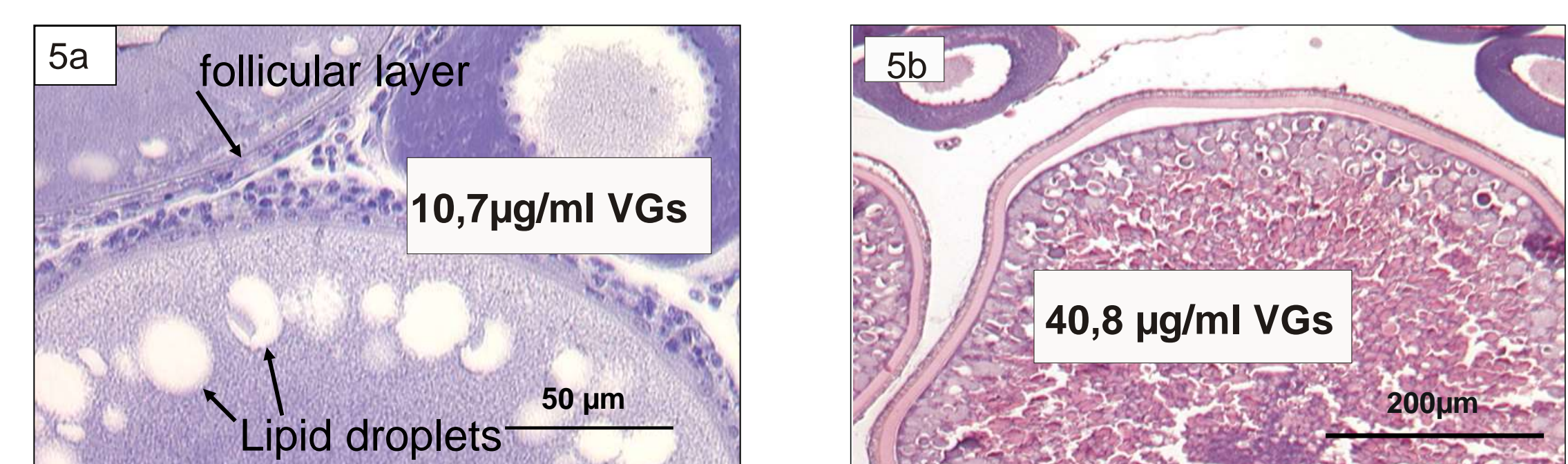


Fig. 5: Cross section of oocytes during early (a, cortical-alveoli phase) and late phase (b, maturation phase) of oogenesis resp. VGs: Vitellogenin serum titer.

Histopathology

Gonadal growth in female perch as well as in roach from a sewage polluted sampling site was retarded. A functional two-layered estradiol secreting follicle at the periphery of oocytes was not differentiated.

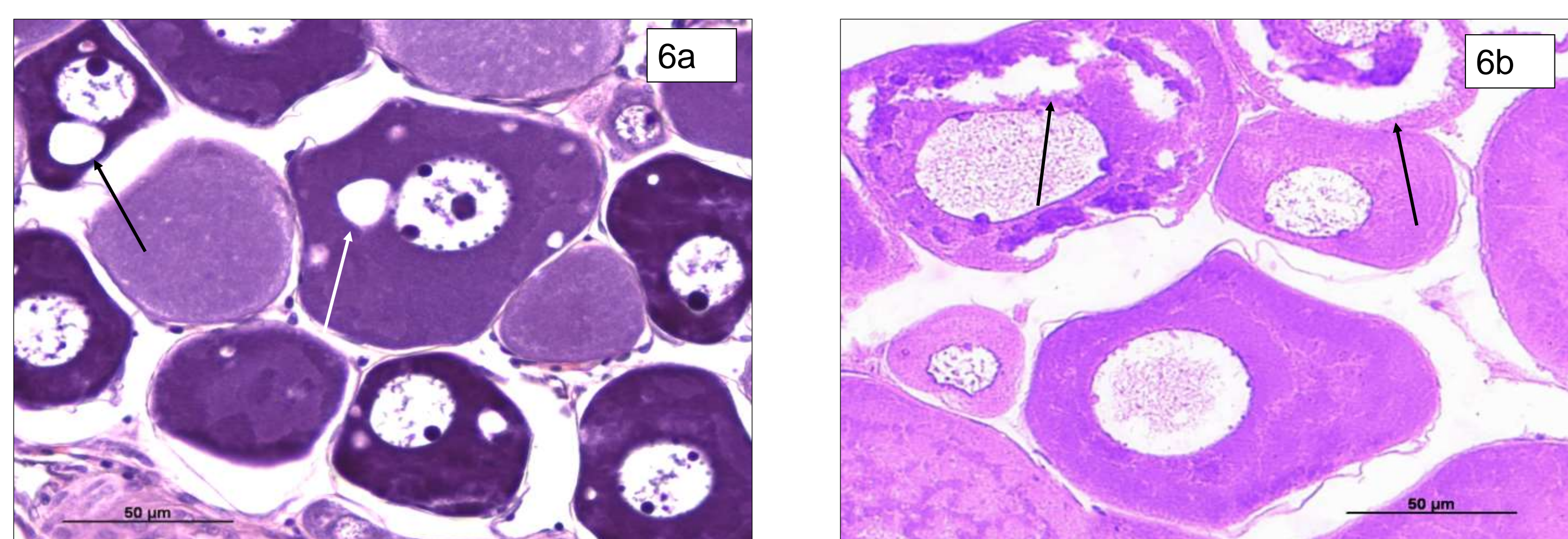


Fig. 6: Retarded oocyte differentiation in a) perch and b) roach caught from a creek with a high sewage burden (up to 80%). Only the inclusion of lipids (fixation equivalent = white areas (arrow)) into cytoplasm of previtellogenic oocytes took place, whereas cytological features of vitellogenin uptake (reduced basophilia of oocyte plasma) was not observed.

Conclusion

Peculiarities of reproductive physiology of the chosen indicator species should be considered to assess data on sex ratio/differentiation or vitellogenin induction. Since sewage pollution related suppression of gonadal differentiation occurred in both species, this biomarker seems to be more reliable than paradoxical elevated vitellogenin titer.