

**EFFECTS OF ENDOCRINE DISRUPTING COMPOUNDS ON
WALLEYE, *STIZOSTEDION VITREUM*, NEAR THE METRO SEWAGE
TREATMENT PLANT, SAINT PAUL, MINNESOTA**

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EXTENDED ABSTRACT ONLY – DO NOT CITE

Recent studies in the United Kingdom and the United States have reported the presence of estrogenic compounds, natural and synthetic, in treated domestic and industrial sewage effluent released from sewage treatment plants (STPs) (Desbrow et al., 1998, Ternes et al., 1999). These compounds may reduce the reproductive potential of exposed fish. Evidence of exposure to estrogenic compounds has been verified by the presence of elevated levels of vitellogenin (VTG), a female egg yolk protein precursor, in male fish. Male fish, although capable of synthesizing VTG, typically only do so when exposed to chemicals with estrogenic properties. VTG induction in male fish has been linked to the

presence of estrogenic chemicals in sewage effluent in the United Kingdom (Desbrow et al., 1998) and is a bio-indicator of the presence of estrogenic chemicals in the aquatic environment (Sumpter and Jobling, 1995).

This research is attempting to determine if estrogenic compounds in the Minneapolis and St. Paul Metropolitan STP effluent are having a significant effect on the reproductive potential of male and female walleye (*Stizostedion vitreum*) exposed to the effluent. It is currently unclear whether the presence of vitellogenin (VTG) in male fish is only a biomarker for exposure to estrogenic compounds or if it indicates an impact on fish reproductive health. Numerous studies have indicated that estrogenic compounds may reduce the reproductive potential of fish populations in a number of ways including: disrupting of normal hormonal activities, causing the development of intersexed gonads, affecting sexual differentiation, and causing decreased gonad size relative to unexposed populations (Purdom et al., 1994, Jobling et al., 1998).

Results

In the present study, we investigated the effects of the Metro STP effluent on the reproductive potential of walleye by evaluating VTG induction, steroid hormone levels, gonadosomatic index (GSI), sex ratio, reproductive condition, and histopathology. Impacts on reproduction of walleye is of particular concern because this species is the major sport fish sought by anglers in Minnesota and throughout much of the United States, has considerable economic importance, and is recognized as the "Minnesota state fish," giving it high public visibility.

In 2000, 2001, and 2002 walleye were collected from the Metro STP effluent channel and a reference site 20 km upstream prior to and during the spawning season. In 2000 and 2001, exposure of the walleye to estrogenic compounds was confirmed by the presence of VTG in males. Male walleye appeared to be extremely sensitive to VTG induction in contrast to other species reported in the literature. Male walleye collected from the Metro STP effluent channel had decreased gonad size, no expressible milt, elevated levels of serum estradiol, and one case of intersexed testes. Upstream males had low VTG concentrations and expressible milt. Female walleye were found with atretic ovaries at the Metro STP and the reference site. Table one summarizes gonadal abnormalities among fish from the 2000 and 2001 field seasons. Preliminary data from 2002 collections show similar trends. No males collected from the Metro STP expressed milt; 12 out of 13 collected from the reference site expressed milt.

VTG and hormone levels and gonadal histopathology have not yet been analyzed on the fish collected in 2002.

Table 1. Summary of fish collected during the 2000 and 2001 field season and frequency of gonadal abnormalities at the Metro sewage treatment plant (STP) site and a reference site.

	Reference 2000	Metro STP 2000	Metro STP 2001
Number of Males (Intersex)	5 (0)	2 (0)	4 (1)
Number of Females (Atretic)	4 (2)	14 (9)	6 (0)
Immature Females	0	4	6
Totals	9	20	16

During the 2001 field season, we tagged 68 walleye and returned them to the effluent channel over 12 sampling dates between November 15, 2000 and March 26, 2001. Only five were recaptured, suggesting that the walleye did not spend the entire winter in the effluent channel. This suggests that walleyes collected from the Metro STP effluent channel for VTG, hormone, and histological evaluation were exposed to the effluent, but not necessarily resident in the channel.

The combination of the presence of high levels of VTG in males, a highly skewed sex ratio biased towards females, lack of milt production in males, and frequent gonadal abnormalities in both sexes suggests a likely exposure of walleye in the effluent channel to endocrine disrupting chemicals.

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