

**Title:** Xenoestrogenic Substances and Sexual Disruption in Selected Fish Species from Lake Victoria, Uganda

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**ABSTRACT**

Lake Victoria receives xenoestrogens from domestic, agricultural and industrial sources. Previous studies assessed levels of contaminants in water, sediments and fish tissue. However, prior to this study, there was no evidence of the adverse effects of xenoestrogens on the reproduction of fishes in the lake. This study aimed at identifying harmful effects of xenoestrogens on reproduction and the liver conditions of three important commercial species of the lake. We tested the hypothesis that pollution levels do not affect the selected biomarkers among the sites. Nile perch (*Lates niloticus*), Nile tilapia (*Oreochromis niloticus*), and lungfish (*Protopterus aethiopicus*) specimens were collected by experimental fishing, between September 2016-August 2017 for analyses. The condition factor (K), level of vitellogenin (VTG) production, liver histopathological lesions, and dynamics of follicle development of the species were used as biomarkers. The values of K were lower in more polluted compared to less polluted areas of the lake. VTG production was exceptionally high in less and more polluted areas for Nile tilapia ( $0.77 \pm 0.08 \mu\text{g/L}$ ), Nile perch ( $0.73 \pm 0.09 \mu\text{g/L}$ ) and lungfish ( $0.55 \pm 0.06 \mu\text{g/L}$ ). The prevalence of liver tissue alteration showed normal lesion (19.9%, n = 73), slight (8.2%, n = 30), moderate (41.5%, n = 152), severe (18.6%, n = 68) alterations and irreparable damage (11.8%, n = 43). Severe liver alterations in the species were significantly higher in more polluted compared to less polluted areas. Histological observations showed spermatogenic cells as spermatogonia, spermatocytes, spermatids or spermatozoa. In the ovary, oogenic cells developed through chromatin nucleolar, perinucleolar, cortical alveolar, early vitellogenic and late vitellogenic stages. This study presents the first findings of intersex in the lake, where gonadal development showed testiova among lungfish. Meanwhile, Nile perch and Nile tilapia were found only as gonochorists. Chemical contamination of Lake Victoria caused liver lesions, abnormal VTG production, and reproductive abnormalities in fishes. Over time, such chemical contamination could impact negatively on the predators of fish in the food web.

**Keywords:** Biomarkers; Gonad development; Intersex; Lake Victoria; *Lates niloticus*; *Oreochromis niloticus*; *Protopterus aethiopicus*; Vitellogenin; Xenoestrogens