

Assessment of Estrogenic Contamination and Potential Risk in Taihu Lake, China

Authors : Guanghua Lu, Zhenhua Yan

Abstract : To investigate the estrogenic contamination and potential risk of Taihu Lake, eight active biomonitoring points in the northern section of Taihu Lake were set up and located in Wangyuhe River outlet (P1), Gonghu Bay (P2 and P3), Meiliang Bay (P4 and P5), Zhushan Bay (P6 and P7) and Lake Centre (P8). A suite of biomarkers in caged fish after in situ exposure for 28 days, coupled with six selected exogenous estrogens in water, were determined in May and December 2011. Six target estrogens, namely estrone (E1), 17 β -estradiol (E2), ethinylestradiol (EE2), estriol (E3), diethylstilbestrol (DES) and bisphenol A (BPA), were quantified using UPLC/MS/MS. The concentrations of E1, E2, E3, EE2, DES and BPA ranged from ND to 3.61 ng/L, ND to 17.3 ng/L, ND to 1.65 ng/L, ND to 10.2 ng/L, ND to 34.6 ng/L, and 3.95 to 207 ng/L, respectively. BPA was detected at all sampling points at all test periods, E2 was detected at 95% of samples, E1 and EE2 was detected at 75% of samples, and E3 was detected only in December 2011 with quite low concentrations. Each individual estrogen concentration measured at each sampling point was multiplied by its relative potency to gain the estradiol equivalent (EEQ). The total EEQ values in all the monitoring points ranged from 5.69 to 17.8 ng/L in May 2011, and from 4.46 to 21.1 ng/L in December 2011. E2 and EE2 were thought to be the major causal agents responsible for the estrogenic activities. Serum vitellogenin and E2 levels, gonadal DNA damage, and gonadosomatic index were measured in the in situ exposed fish. An enhanced integrated biomarker response (EIBR) was calculated and used to evaluate potential feminization risk of fish in the polluted area of Taihu Lake. EIBR index showed good agreement with the observed total EEQ levels in water. Our results indicated that Gong bay and the lake center had a low estrogenic risk, whereas Wangyuhe River, Meiliang Bay, and Zhushan Bay might present a higher risk to fish.

Keywords : active biomonitoring, estrogen, feminization risk, Taihu Lake

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