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## Characteristics and Risk Assessment of Estrogenic Compounds in Rivers of Southern Jiangsu Province, China

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### Abstract

Significant attentions are rising for estrogenic compounds in environment, because their potential impacts on water ecosystem and human health. Estrogenic compounds (Estrone[E1], 17 $\beta$ -Estradiol[E2], Estriol[E3], 17 $\alpha$ -Ethinylestradiol[EE2] and Bisphenol A [BPA]) in rivers of southern Jiangsu, China were investigated to realize their distributions and risks. The results showed E1, E2, E3 and BPA ranged from 1.96 to 143.29ng/L in rivers, with the detection rates from 12.5% to 100%. These estrogenic compounds in waters showed higher contents in winter than in spring and autumn. Levels of E1, E2 and E3 were higher in rivers nearby livestock breeding areas, while the concentrations of BPA were higher in the rivers nearby industrial areas. The risk assessment of estrogenic compounds were performed by the calculation of risk quotient (RQ) based on the predicted no effect concentration (PNEC), which was deduced through a species sensitivity distribution (SSD) model. The RQ values of E1, E2, E3 and BPA were 0.02~1.87, 1.28~23.22, 0.01~0.80 and 0.03~0.44 respectively. These results imply that harmful ecological effects might happen in some rivers. It indicates that different anthropogenic activities will lead to diverse inputs of estrogen compounds into rivers and pose different risks.

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### 1. Introduction

Estrogenic compounds contain natural estrogens and synthetic estrogens which have estrogenic activities. The former widely exist in the vertebrate body, and the later are synthetic components, mainly from drugs,

pesticide and surfactant[1, 2]. Estrogenic compounds in aquatic environment are acquiring prominent attention, because they are ubiquitous in the waters [3,4,5]. Many studies have shown that estrogenic compounds can damage human and animal reproduction, immune and nervous system, inducing deformity of reproductive organ, hermaphrodite or male feminization[6,7,8]. Therefore, the monitoring and assessment of estrogenic compounds in river has an important implication for protection of aquatic ecological system.

The rivers studied are situated in the southern Jiangsu province, one of economic-developed areas in China. Because of the densely population and the network rivers, pollutants from industry, agriculture and residential areas can enter the river environment through various pathways. Among these pollutants, estrogenic compounds are a group of ubiquitous pollutants. In addition, the rivers are main channels for estrogenic compounds entering a multipurpose lake-Taihu Lake. The purposes of this study are: 1. Investigate spatial distributions of estrogenic compounds in different rivers and link them with sources; 2. Research the variations of estrogenic compounds in different seasons; 3. Assess the ecological risks of rivers by the hazard quotient method.

## 2. Materials and Methods

### 2.1 Sample collecting

Surface water samples (0-0.5m) of rivers were collected according to the surroundings of sampling sites in October, 2012(fall), December 2012(winter) and May, 2013 (spring) (Fig.1). The sampling sites include four surrounding types (industrial area, residential area, farmland area, breeding area) according to the river locations. They comprise of six samples in industrial areas (S06, S07, S08, W08, Y07, Y08), six samples in

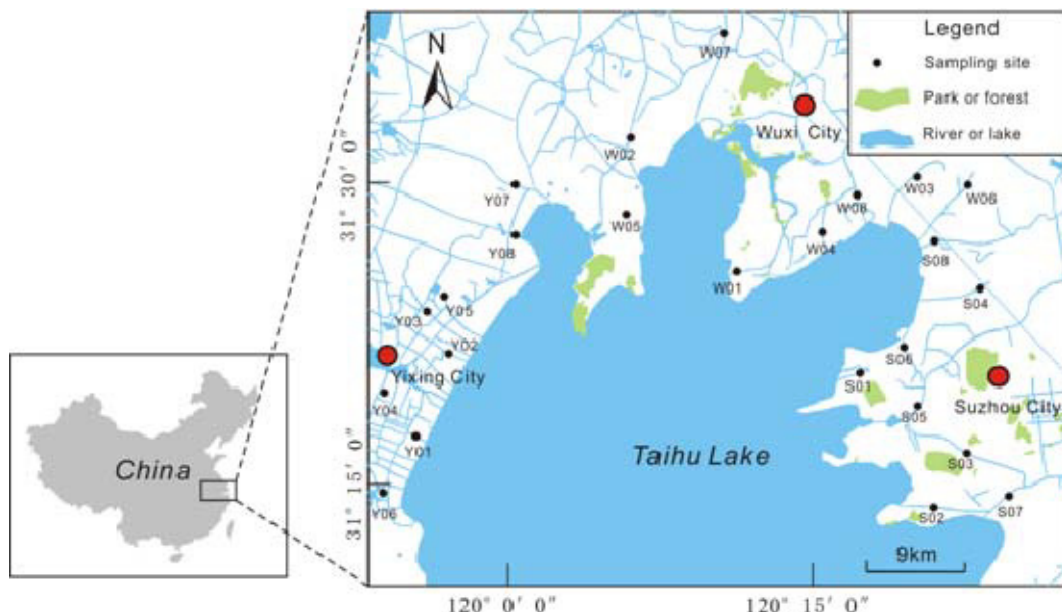


Fig. 1 Sampling map showing the locations in rivers of southern Jiangsu. These rivers are linked with Taihu Lake. farmland areas (S01, W03, W04, Y01, Y02, Y03), five samples in breeding areas (S04, S05, W05, W06, Y06), and seven samples in residential areas (S02, S03, W01, W02, W07, Y04, Y05). Before sampling, the glass bottles were cleaned with distilled water, acetone, methanol, deionized water, and were cauterized

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