



ELSEVIER

Contents lists available at ScienceDirect

Environmental Development

journal homepage: www.elsevier.com/locate/envdev



A national pilot scheme for monitoring and assessment of ecological integrity of surface waters in China

Yeyao Wang^{a,*}, Enjiang Teng^a, Tingliang Liu^a, Yibing Lv^a, Xiaowei Jin^{a,**,1}, John P. Giesy^{b,c,d,e,f}, Henner Hollert^{f,g}

^a Department of Analytical Technique, China National Environmental Monitoring Center, Anwai Dayangfang No. 8, Chaoyang District, Beijing 100012, People's Republic of China

^b Department of Veterinary Biomedical Sciences and Toxicology Centre, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

^c Department of Biology & Chemistry, City University of Hong Kong, Kowloon, Hong Kong, SAR, People's Republic of China

^d State Key Laboratory in Marine Pollution, City University of Hong Kong, Kowloon, Hong Kong, SAR, People's Republic of China

^e School of Biological Sciences, University of Hong Kong, Hong Kong, SAR, People's Republic of China

^f State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University, Nanjing, People's Republic of China

^g Institute for Environmental Research, RWTH Aachen University, Aachen 52074, Germany

ARTICLE INFO

Article history:

Received 3 December 2013

Received in revised form

18 February 2014

Accepted 18 February 2014

Keywords:

Ecological integrity assessment

Biological monitoring

Watersheds management

Asia

ABSTRACT

Monitoring of status and trends of quality of surface waters is important to assure sustainability of desired structures and functions of aquatic environments. Recently, several sets of legislation worldwide (USA, European Commission, Canada, Australia, South Africa, etc.) have been developed, that consider water bodies as ecological systems, in order to address ecological quality or integrity of watersheds. Current monitoring and assessment of water quality in China, which is still based on amounts of chemical pollutants, such as ammonia and BOD, has been deemed to be insufficient to adequately assess the quality of aquatic environments. Responding to this challenge, China has embarked on a pilot national monitoring program to assess ecological integrities of major watersheds beginning in 2010. The components used in this monitoring and assessment system include hydrology, river morphology, physico-chemical parameters, ecotoxicological aspects, types and numbers of biota and age and growth of fishes.

* Corresponding author. Tel.: +86 10 8494 3007; fax: +86 10 8494 7263.

** Corresponding author. Tel.: +86 10 8494 3201; fax: +86 10 8494 3189.

E-mail addresses: yeyao wang@163.com (Y. Wang), jinxiaowei07@mails.ucas.ac.cn (X. Jin).

¹ Both authors contributed equally to this work.

Based on the results of the pilot scheme an ecological integrity index for surface waters will be established; a national coordination and management system, including methods for comprehensive monitoring of ecological integrity of surface waters in China will be initiated.

© 2014 Elsevier B.V. All rights reserved.

Monitoring of status and trends of the quality of surface waters is an important method to assure sustainability of desired characteristics of aquatic environments, such as structure and function. Monitoring of aquatic environments in China began in the 1970s, and a preliminary nationwide system for monitoring of concentrations of selected indicator contaminants has been developed and has been functioning for several decades. The national monitoring network has 759 stations for monitoring of surface water, 45 cross-border international river sections and 149 automatic monitoring stations covering 10 major watersheds in China. Based on the data from the national monitoring network, surface water in China was determined to be contaminated in most areas, with chemical oxygen demand (COD), total phosphorus and BOD₅ being the indicators most affected at most locations (MEP, 2010). In 2010, 51.9% of the water sections included in the national monitoring program met Grades I–III quality standards, which was 3.7 percentage points worse than the proportion observed in 2009 and 14.4 percentage points worse than of 2005. In addition, 20.8% of water sections failed to meet Grade V standards (MEP, 2002). These results were the same as that observed in 2009, but was 6.6 percentage points worse than that observed in 2005, which met the target of <22%, that was specified by the 11th Five-Year National Plan for Environmental Protection in China (MEP, 2007, 2010).

Current monitoring and assessment of water quality in China is still based on measurements of magnitudes of chemical pollutants, such as ammonia and BOD. This process has been deemed to be insufficient to adequately assess the quality of aquatic environments. Since the early 1980s, methods for assuring qualities of surface waters have changed in some countries, with a greater emphasis on overall quality of ecosystems (Borja et al., 2008). The United States Environmental Protection Agency (USEPA) Clean Water Act set a standard of “chemical, physical, and biological integrity” for rivers. By integrity, the Congress intended to “convey a concept that refers to a condition in which the natural structure and function of ecosystems is maintained.” In 1989, USEPA began Environmental Monitoring and Assessment Program–Surface Waters (EMAP–SW), a program for developing methods to monitor and assess status and trends in the nation’s lakes and rivers in a statistically and ecologically rigorous manner (Hughes et al., 2000). Similarly, the European Commission enacted the Water Framework Directive (WFD) to manage European river basins in a sustainable way. The main objectives of the WFD are to achieve “good ecological and chemical status” for surface water bodies and the “good chemical and quantitative status” for ground waters by 2015 (Kallis and Butler, 2001). Results of current monitoring indicate that 90% of surface waters are yet to reach the WFD objectives and that improvement measures are needed. Recently legislation in countries including Canada, Australia and South Africa, has also been developed in order to address ecological quality or integrity of watersheds that consider water bodies as ecological systems. Most such legislations seek to define quality in an integrative way, by using several biological elements, together with physico-chemical indicators of pollution. Such an approach allows assessment of ecological status at the ecosystem level, rather than at the level of species or quality objectives based on chemical and physical parameters alone (Borja et al., 2008). While this approach has some advantages, such as being site-specific and integrative and accounts for biological availability and interactions between organisms and their environment. The greatest disadvantage is that effects and changes in the structure of ecosystems have already occurred once it is detected.

In China, biological monitoring began in the 1970s simultaneously with monitoring for chemical and physical parameters. In 1984, the Environmental Protection Agency of China held its first working meeting on biomonitoring, after which it promulgated the “Technical specification of biological monitoring: water environment section” in 1986. In 1993, the Environmental Protection Agency of China published “Aquatic Biomonitoring Manual”, and for the first time established a national aquatic monitoring network and began nationwide, routine biological monitoring. Since the 1990s, the quality

Download English Version:

<https://daneshyari.com/en/article/4391461>

Download Persian Version:

<https://daneshyari.com/article/4391461>

[Daneshyari.com](https://daneshyari.com)