Ecological risk assessment of heavy metals in sediment and implications for sustainable management of Baiyangdian watershed in China

Su, Liya; Liu , Jingling; Christensen, Per

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Ecological risk assessment of heavy metals in sediment and implications for sustainable management of Baiyangdian watershed in China

Liya Su[1,2], Jingling Liu[1], Per Christensen[2]

[1]State Key Joint Laboratory of Water Environmental Simulation and Pollution Control & School of Environment, Beijing Normal University, China.

[2] Department of Development and Planning, Aalborg University, Denmark

Introduction

The term 'ecological risk assessment' although barely used twenty five years ago, is now fully developed and has become an important tool in watershed management. It provides policy makers, resource mangers as well as the public with systematic methods that can feed into decision making. Nevertheless, among practitioners there remain many frustrations and much confusion regarding the application of risk assessment procedures on real projects . Among all the impacts threatening ecosystems, heavy metals play a decisive role. Its distribution in water is often little and stochastic.



Materials and methods

In April 2008, 10 samples were collected (Figure 1) . To assess the ecological risk three benchmarks were applied:

- Literature analysis compared the maximum concentration of total heavy metals with other water bodies around the world;
- Chinese Environmental Quality Standard for Soils (GB 15168-1995) (SEPA, 1995);
- Soil and Aquatic Sediment Guidelines and Standards issued by the New York Department of Environmental Conservation (NYSDEC, 1999) which could also called sediment quality guidelines (SQGs).

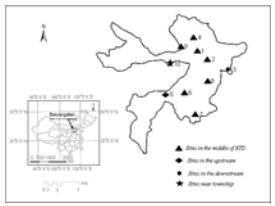
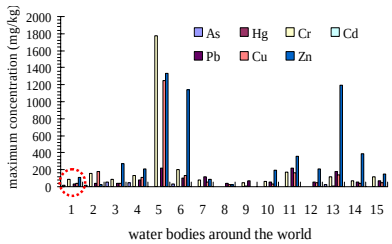


Figure1. Location of Baiyangdian and sampling sites

Results

Comparison between heavy metal in BYD and other water bodies around the world

Compared to other water bodies around the world (Figure 2), the seven metals found in the sediment were lower.



1.Baiyangdian,China
2.Luan River, China
3.Hengshuihu Wetland, China
4.Yellow river, China
5.Moshui Lake, China
6.Yangtze River, China
7.Huaihe River, China
8.Taihu lake, China
9.Mississippi River, US
10.Southern Baltic sea
11.Thermaikos Gulf, N. Greece
12.Vembanad wetland, India
13.Izmit Bay, Turkey
14.French Guiana
15.Gulf of Lions, Mediterranean Sea

Figure 2. Compare Maximum total heavy metal concentrations with other water bodies

Assess by Environmental Quality Standard for Soils in China

Table 1. Assess the contamination status and distribution by Chinese EQSS

Site	As	Hg	Cr	Cd	Pb	Cu	Zn
1	○	○	○	▲	○	○	○
2	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○
4	○	○	○	○	○	○	○
5	○	○	○	○	○	○	○
6	○	○	○	○	○	○	○
7	○	○	○	○	○	○	○
8	○	○	○	▲	○	○	○
9	○	○	○	○	○	○	○
10	○	○	○	★	○	○	▲

Cd in site 1 Site 8（Table 1) were in the second grade and site 10 in the third. From the profile of BYD and the sites' location (Figure3), the most polluted place is the village. The lower polluted area site 1 and 8 were also near the village.

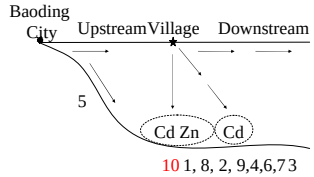


Figure 3. Heavy metals' sources from profile of BYD

Assess by NYSDEC (1999) guideline

This method compared the concentration of heavy metals with the lowest effect level (LEL) and the severe effect level (SEL). The result shows (Figure 4) the most polluting heavy metal is now arsenic (As). It decreased from site 4 .

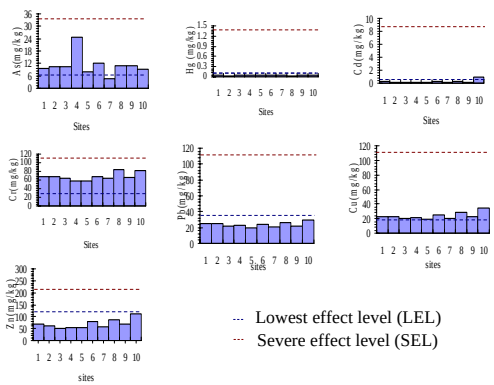


Figure 4. Result after compared with NYSDEC (1999) guideline

Conclusions

✓Compared to other water bodies, the seven heavy metals in sediment of Baiyangdian were low. Nevertheless, some of these heavy metals can cause a potential risk according to other assessment methods.

✓It is strongly recommended to use NYSEDC methodology as it gives a more precise picture of the potential risk facing the benthic communities. But other methods do give a complementary picture.

✓All three methods points to the sediments close to the village as the most polluted spot, and here it becomes very important as an uniform picture develops that management measures should be devoted to solve this local problem near site 10. Then in general make sure the whole Baiyangdian is protected from heavy metals pollution in the future so that this potentially pristine area can be restored for the enjoyment of future generations.

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For further information

Liya Su
Department of Development and Planning,
Aalborg University , Denmark
Email: liya@plan.aau.dk