

# Heavy Metal Pollution in the Yancheng Biosphere Reserve, Jiangsu, China

Ping ZUO\*

Jinju GENG

Xueqin ZHAO

Shandao ZHAO

Houfeng TENG

School of Geographic and Oceanographic Sciences  
Nanjing University  
Nanjing, China

\*E-mail Address: zuoping@nju.edu.cn

Yancheng Biosphere Reserve (YBR) is the first and largest tidal flat nature reserve in China, which is located in Jiangsu Province along the southeast coast of the Yellow Sea. It is recognized as one of the most important MPAs in China since 1980s. It was established in 1983 with the major aim of protecting an endangered bird species, the red-crown crane (*Grus japonensis*) and its habitats. It is a stopover for more than 200 species of migratory birds from northeast Asia and Australia, including the Saunder's gull (*Larus saundersi*). It was approved as an international biosphere reserve in UNESCO's Man and Biosphere Program in 1992. The paper chooses the core area (18,700 hm<sup>2</sup>) of YBR as the study site, which has less human impacts than other areas along the Jiangsu coast. It is also the last original coastal wetland with typical floral succession from the land to the sea, which should act as a site with only external heavy metal pollution sources, enabling comparison with other sites.

As part of the YSLME's small grants programme, we examined the concentrations of total Cu, Pb, Zn, Cr, Ni, Cd, Hg, & As in water, sediments, wetland plants, economic macrobenthos, sampled from different parts of the core area in Yancheng Biosphere Reserve (YBR), Jiangsu Province, China in July, 2008 (see Figure 1). The study was conducted in cooperation with both the local stakeholders and the management station in YBR who were very eager to know whether the environmental quality in YBR is healthy enough and the seafood safe enough to eat, and they helped us with sampling and propagating the results. Involving stakeholders in this manner is a



good method to raise environmental protection issues and improving public awareness of the importance of environmental quality.

The current heavy metal concentrations were compared with both the national standards and historical heavy metals data from studies in 1978-1979, to assess environmental impacts caused by economic development in recent years and the possible food safety implications.

Analysis of Hg and As in seawater indicated water quality was better than 1st class water according to GB 3097-1997 Sea Water Quality Standard, with the exception of As concentrations in the surface water in *Spartina alterniflora* wetland that was 2nd class. However, As concentrations had increased since measurements in 1978-1979 (the background values), which showed the influence of anthropogenic activities since 1980 with arsenic levels increasing in seawater.

The average concentrations of metals in the sediment samples all exceeded the background values for 1978-1979 in the coastal zone of Jiangsu Province except mercury. The concentrations of mercury, arsenic, chromium, lead, copper belonged to the first class of sediments, while the concentrations of cadmium belonged to the second class comparing to the Sediments of National Standards. The absorption capacity of heavy metals in vegetated wetlands with reed, *Suaeda glauca* and *Spartina alterniflora* was higher than that in non-vegetated wetlands with high density of macrobenthos, especially *Bullacta exarata* and *Macraa veneriformis* Reeve. *Spartina alterniflora* wetland had a higher absorption capacity for heavy metals than other vegetated wetlands in the core area. The concentrations in the underground parts of plant were higher than those in the aboveground parts.

In macrobenthos, the contents of mercury, arsenic, chromium, copper, lead, nickel in the snail, *Bullacta exarata*, living in tidal flat were the highest, which indicated higher pollution by environments. The contents of cadmium in the clam, *Macraa veneriformis* Reeve, was the higher than that in other animals. The snail and clams are consumed locally and both of them are economically harvested by local stakeholders who pick them up during the low tide time. Analysis also showed that nearly all the concentrations of heavy metals in the three macrobenthos were far higher than the background value. And some of them exceeded the limit for pollution-free food according to 'NY5073-2006 Pollution-free Food at Seafood Toxic Substances Harm Limited'. Thus, food safety is very important for those seafood consuming people, especially local stakeholders.

Results showed that concentrations of heavy metals have accumulated in the core area of YBR coinciding with economic development in recent years, which implies that anthropogenic activities are threatening the ecosystem health in the core area, and heavy metals are being transferred from water, sediments to plants, animals and microorganism along the food chain. Thus, there is an urgent need of sewerage treatment before discharge to the Yellow Sea in those areas surrounding the Reserve.

The results of these heavy metal studies in the core area have raised the public awareness of the pollution coming from industrial development in recent years. Pollution from heavy metals is affecting the protected coastal areas. If there is no further work to control waste along the north Jiangsu coast, the pollution will threaten the health of local stakeholders through accumulation in macrobenthos that is harvested by local fishermen for consumption. Pollution control should be strengthened by regulating the sewage discharge from different industries. What's more, public awareness of environmental protection and ecosystem health should be propagated widely for a cleaner coastal zone in the near future.