

Science for Environment Policy

Marine biodiversity under threat from high levels of heavy metal pollution in Bay of Bengal

Bangladesh's economy is heavily dependent on ship recycling. However, the shipbreaking industry is polluting the Bay of Bengal, an area of high biodiversity. This study measured trace metals in sediments around the area, concluding that heavy metal pollution is at an alarming stage and an urgent threat to marine life.

In 2012, over 1250 ocean-going ships reached the end of their useful life and were broken down for parts¹. However, very few were recycled sustainably. Due to lower health and safety standards and less stringent environmental regulations, countries with developing economies host the majority of the shipbreaking industry. Asia demolished over 90% of vessels by weight in 2013², with major ship recycling centres in Bangladesh, China, India and Pakistan.

The Chittagong ship recycling industry was born in the 1960s and today this coastal area in Bangladesh is a major ship recycling centre. The industry, which scraps a large proportion of the world's ships, is of huge importance to poverty-stricken Bangladesh, employing around 25 000 people and offering indirect employment to a further 200 000.

However, in recent years, Bangladesh has come under criticism due to its shipbreaking practices, which are causing harm to the environment and human health. Ships are broken down directly on the beach (a practice known as 'beaching'), allowing harmful contaminants to enter the coastal environment.

The Bangladeshi coastal environment is highly dynamic and ecologically diverse with critical terrestrial and aquatic habitats, such as mangrove forests, seasonally and permanently inundated wetlands and tidal flats. These enriched ecosystems are at risk due to environmental impacts and human intrusion. The wastes from scrapped ships, including oils and persistent organic pollutants (POPs), enter the Bay of Bengal. This, the world's largest bay, is home to a range of marine life, including many endangered and vulnerable species, and pollution has been identified as one of three major transboundary issues affecting its marine ecosystem.

This study prioritised metal pollution around the ship recycling areas. Although some metals are needed for the ecosystem to function, when heavy metals accumulate in aquatic habitats they can reach toxic levels because they are not biodegradable. Metals eventually become incorporated into the bottom sediment where organisms living there (benthic organisms) can accumulate them. Heavy metals also have an impact on organisms higher up in the water.

Recorded level of cadmium and copper were high enough to impact hatching and increased fish mortality in the sea area around shipbreaking areas. The impact of a higher level of mercury has delayed development in molluscs, and lead has caused a loss of breeding capacity in sea birds in the Chittagong coastal area.

The researchers measured heavy metals in the sediment at four sites along the 10 km shipbreaking strip in Chittagong. They also measured levels at a nearby unpolluted site. They measured levels of:

- **Iron:** the maximum concentration was 41 361 micrograms (μg) per gram of sediment, while the lowest concentration (3393 $\mu\text{g/g}$) was lower than that of the unpolluted marine sediment. The average value was 27 370 $\mu\text{g/g}$, which concurs with previously published values from Chittagong. The researchers, however, note that the concentration of iron may not be significantly affected by anthropogenic input, as it can fluctuate naturally, is abundant in the Earth's crust and is an essential nutrient for aquatic organisms.

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Source: Siddiquee, N.A., Parween, S., Quddus, M.M.A. & Barua, P. (2012). Heavy Metal Pollution in Sediments at Ship Breaking Area of Bangladesh. In: *Coastal Environments: Focus on Asian Coastal Regions*. India: Springer, pp. 78–87. DOI: 10.1007/978-90-481-3002-3_6. Originally published in 2009, in the *Asian Journal of Water, Environment and Pollution*. 6(3): 7-12.

Contact:
prabalims@gmail.com

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1. <http://www.shipbreakingplatform.org/main-aspects/problems-and-solutions/>

2. http://unctad.org/en/PublicationsLibrary/rmt2014_en.pdf

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³<http://www.unep.org/PDF/PressReleases/GlobalMercuryAssessment2013.pdf>

- **Manganese:** this metal is biologically important and has low toxicity. However, even the lowest level found at the polluted site (1.8 µg/g) was significantly higher than the unpolluted sediment (1.17 µg/g) - the standard of the [Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection](#) (GESAMP).
- **Chromium:** distribution of this metal in the shipbreaking area was very complex in nature and its concentration did not follow any regular pattern of distribution. Average concentrations in affected and control sites were below the maximum value recommended by the [International Atomic Energy Authority](#) (IAEA) (77.2 µg/g).
- **Nickel:** levels (average of 33 µg/g) were below the IAEA threshold (56 µg/g).

Of greater concern were:

- **Zinc:** concentrations (average 112 µg/g) were higher than the IAEA recommended level of 95 µg/g, and higher than in marine sediment from other parts of the world, the researchers assert. Levels of just 0.1–1 µg/g of zinc in soft water are lethal to all fish species.
- **Copper:** at some sites, levels were above the recommended value of 33 µg/g, which could increase mortality in fish.
- **Lead and cadmium:** levels of lead and cadmium were approximately 6.5 and 8.5 times higher than the levels recommended by GESAMP, respectively.
- **Mercury:** levels of mercury in polluted sites were an astounding 94 times higher than the recommended concentration. This is a major concern, as methylmercury is a nervous system toxin and a significant threat to human and environmental health³.

Researchers suggest that fishery resources in the coastal area of Chittagong seem to be affected by the shipbreaking activities as revealed by increased fishing efforts, reduced catch per unit effort (CPUE) per boat/day and reduced species diversity. The researchers say that this decrease of catch and availability of fish is not only due to pollution or destruction of fish larvae, but also due to other factors, such as an increase of the number of boats and demand for fish.

The researchers conclude that heavy metal pollution in this area is at an 'alarming' level. They suggest shipbreaking is a serious environmental hazard and that if the industry is to continue in Bangladesh, efforts must be made to minimise the pollution. For example, they say the authorities should use a separate area for the shipbreaking activities, such as a dockyard, to mitigate damage to the coastal environment.

