

# Effect of Ship Scrapping Activities on the Soil and Sea Environment in the Coastal Area of Chittagong, Bangladesh

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Ship scrapping activities pollute the soil and sea water environment in the coastal area of Foujderhat to Kumira of Chittagong District, Bangladesh mainly through the discharge of various refuse materials and metal fragments from the scrapping of ships. As a result, toxic concentration of ammonia for marine organisms was found in both beach soil and sea water with an increase in pH. Extensive human and mechanical activities accelerate the rate and amount of sea shore erosion and results in higher turbidity of sea water. Critical concentration of DO and higher BOD were found with an abundance of floatable materials (grease balls and oil films) in the sea water.

The ship scrapping business (breaking of old, damaged and obsolete sea-going ships, cargo and oil tankers) has been practised in the coastal areas of Bangladesh to meet the increasing demand of raw materials for re-rolling mills and other purposes. This activity began in 1969 and continued indiscriminately after 1980, involving about 150 companies. As a result, various refuse and disposable materials are being discharged and spilled from scrapped ships and often get mixed with the beach soil and sea water. The scrap from the ships is stacked haphazardly on the sea shore, leaving behind an accumulation of metal fragments and rust (particularly iron) in the soil. These together with extensive human and mechanical activities often go on as a matter of routine work for the scrapping of ships in that area.

A study has been made of the possible effect of ship scrapping activities on the soil and sea water environment in the affected coastal area.

## Materials and Methods

This study was conducted in July–August, 1984 covering the coastal area about 15 km long from Foujderhat to Baraoliar Mazar in the District of Chittagong, Bangladesh. Beach soil and sea water samples (in triplicate) were collected simultaneously during the low tide from 6 stations. Stations 1, 2, 3 and

4 were selected within the ship scrapping area (Foujderhat to Kumira) and stations 5 and 6 were selected at Baraoliar Mazar which was outside the ship scrapping area (Fig. 1). Sea water samples were collected in 2 l. glass stoppered bottles for the estimation of oil content by gravimetric extraction. Soil samples from the beaches were collected in airtight polythene bags.

The soil samples were analysed for pH, EC, chloride, iron, and ammonia. Water samples were analysed for turbidity, total solids (TS), total dissolved solids (TDS), pH, EC, chloride, iron, ammonia, oil content, dissolved oxygen (DO) and biological oxygen demand (BOD). The analysis of soil and water samples was performed by following standard methods of analysis (Black, 1965; APHA–AWWA–WPCF, 1980).

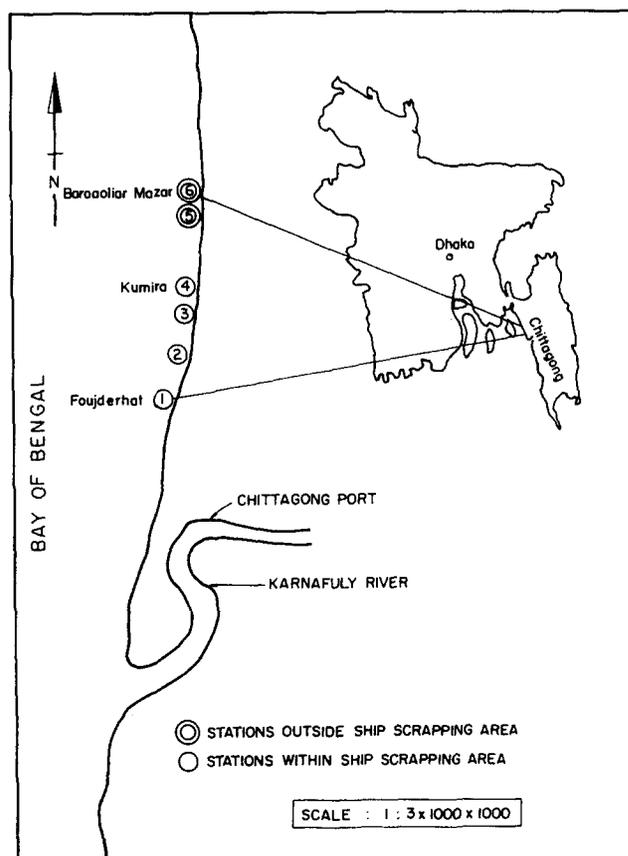


Fig. 1 Investigated area (Chittagong)

## Results and Discussion

Maximum surface accumulation of metal fragments was found 1.2 cm deep in the soil of the ship scrapping area (Table 1). High pH of the soil (8.4) was found at the stations 1 and 4 compared to 7.3 at the station 6. EC and chloride content were minimal ( $296 \mu\text{cm}^{-1}$  and  $110 \text{mg l}^{-1}$ ) at station 2. Significant amounts of iron in the soil was  $2.1 \text{mg l}^{-1}$  at station 3, compared with only  $0.6 \text{mg l}^{-1}$  at station 5. An abnormal amount of ammonia ( $16.10\text{--}21.06 \text{mg l}^{-1}$ ) was found in the soil samples collected from the ship scrapping area. Thin layers of burned oil were also abundant in the sea beach soil.

Table 2 shows that turbidity of the sea water varied between 690 JTU and 722 JTU at stations 1 and 2 as compared with 470 JTU at station 6. Higher content of TS and TDS were  $4195 \text{mg l}^{-1}$  and  $1990 \text{mg l}^{-1}$ , respectively, found in the sea water of the ship scrapping area. A slight variation of the pH was observed whereas EC and chloride content were found minimum  $1600 \mu\text{cm}^{-1}$  and  $470 \text{mg l}^{-1}$  at station 1 compared with maxima of  $3040 \mu\text{cm}^{-1}$  and  $785 \text{mg l}^{-1}$  at station 5. Iron content  $41.26 \text{mg l}^{-1}$  was observed at station 3 in comparison with  $2.8 \text{mg l}^{-1}$  at station 5. Concentration of ammonia in water ranged from 2.67 to  $3.16 \text{mg l}^{-1}$  in the ship scrapping zone as against only  $0.2 \text{mg l}^{-1}$  in the outside area. DO content in sea water varied between  $3.7 \text{mg l}^{-1}$  and  $4.1 \text{mg l}^{-1}$  at stations 2 and 1 whereas it was  $6.36 \text{mg l}^{-1}$  at station 6. The maximum DOD was

**TABLE 1**  
Physico-chemical properties of beach soil

	Sampling station					
	1*	2*	3*	4*	5†	6†
Accumulation of metal fragments (cm depth)	1.0	0.7	1.2	0.6	—	—
pH	8.4	8.1	8.3	8.4	7.4	7.3
EC ( $\mu\text{cm}^{-1}$ )	324	296	360	302	500	508
Chloride ( $\text{mg l}^{-1}$ )	113	110	116	119	202	213
Iron ( $\text{mg l}^{-1}$ )	2.0	1.8	2.1	1.6	0.6	0.56
Ammonia ( $\text{mg l}^{-1}$ )	16.1	20.1	21.06	17.22	1.02	0.87

\*Stations within ship scrapping area.

†Stations outside ship scrapping area.

**TABLE 2**  
Physico-chemical properties of sea water

	Sampling station					
	1*	2*	3*	4*	5†	6†
Turbidity (JTU)	720	690	708	723	475	470
TS ( $\text{mg l}^{-1}$ )	4195	3678	4186	4038	2335	2284
TDS ( $\text{mg l}^{-1}$ )	1990	1860	1906	1982	1320	1288
pH	7.8	7.7	7.9	7.7	7.3	7.2
EC ( $\mu\text{cm}^{-1}$ )	1600	1860	1842	1710	3040	3036
Chloride ( $\text{mg l}^{-1}$ )	470	478	460	502	785	789
Iron ( $\text{mg l}^{-1}$ )	36.02	40.10	41.26	37.62	2.80	2.26
Ammonia ( $\text{mg l}^{-1}$ )	2.67	3.06	3.16	2.92	0.20	0.26
DO ( $\text{mg l}^{-1}$ )	4.10	3.70	3.82	3.90	6.20	6.36
BOD ( $\text{mg l}^{-1}$ )	7.63	7.82	7.9	6.98	4.30	4.08
Oil ( $\text{mg l}^{-1}$ )	10 600	10 340	10 800	9280	—	—

\*Stations within ship scrapping area.

†Stations outside ship scrapping area.

$7.90 \text{mg l}^{-1}$  at station 3 as compared to  $4.08 \text{mg l}^{-1}$  at station 5. Maximum oil content  $10 800 \text{mg l}^{-1}$  was extracted from sea water at station 3.

The results show that the ship scrapping activities contaminate the coastal soil and sea water environment mainly through the discharge of ammonia, burned oil spillage, floatable grease balls and lubricants, metal rust (iron) and various other disposable refuse materials together with high turbidity of sea water. The high pH of the soil and sea water observed may be due to the addition of ammonia, oils and lubricants (Ludzack *et al.*, 1957; Karim, 1975). Edwards (1980) stated that  $0.6\text{--}2.0 \text{mg l}^{-1}$  ammonia in water is toxic to fish, since it is lipid soluble and thus can readily diffuse across the gill membranes. Due to extensive human and mechanical activities, the sea beach soil loses its binding properties and this accelerates the rate and amount of shore erosion and increases the turbidity of sea water in the ship scrapping area. High turbidity of water may decrease the concentration of DO (Cairns, 1960) and substantially increase the BOD (Hossain, 1983). Furthermore, oil spilling may cause serious damage by reduction of light intensity underneath an oil layer, inhibiting photosynthesis by phytoplankton, reduce the exchange of oxygen and carbon dioxide across the air-sea water interface, and by acute toxicity.

It is clearly evident that the present indiscriminate ship scrapping activities in the coastal areas of Bangladesh contaminate the beach soil and sea water environment to a critical condition. As a result, the growth and abundance of marine organisms specially plankton and fishes may seriously be affected.

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