Paper ID: ARCH 0126

Impact of Ship Breaking and Recycling Industry on the Coastal Area of Bangladesh

Tanveer Ahamed Bin Ali Naser[1], Maisha Ashrafi[2]

[1]Department of Architecture, BRAC University, Bangladesh (tanveer.naser@bracu.ac.bd)
[2]Department of Water Sanitation & Hygiene, BRAC, Bangladesh (maisha.ashrafi@brac.net)

Abstract

The ship-breaking industry has a significant impact on the economy, environment, and social conditions of Bangladesh. It is one of the world's largest ship-breaking nations, with shipyards along its coastlines involved in dismantling and recycling old and decommissioned ships. The industry provides raw materials, such as steel and other metals, for manufacturing and construction. It provides direct and indirect jobs to thousands of people, including skilled and unskilled workers, traders, and raw materials suppliers. Nevertheless, Ship-breaking activities result in significant environmental pollution, including air and water pollution, soil contamination, and noise pollution. This adversely affects the health and well-being of workers and nearby communities. The benefits of the ship-breaking industry are not evenly distributed, and many workers face poor working conditions and low wages, resulting in economic and social inequality. This study will explore significant environmental, occupational, and social challenges that must be addressed to ensure sustainable development and mitigate the hazardous situation.

Keywords: *Ship Breaking, Sustainable Industry, Hazardous Industry, Coastal Area*

1. Introduction

Bangladesh has a long coastal belt of about 710 km, enriched with natural resources, especially fish and other aquatic species of different varieties. It has been the focal point of various economic activities. Most of these seashore areas are situated in Chittagong. Sitakunda is a seashore area located a few kilometers north of Chittagong, where most ship recycling industries are concentrated. The shipbreaking industry has not been developed in a day. It has been developed gradually in Bangladesh, passing through various stages of its development at an international level. Though shipbreaking in Bangladesh started in the sixties, commercially, it began in the late seventies. Until then, shipbreaking occurred in port cities of developed countries such as the UK and the USA. Today, however, nearly all shipbreaking yards are located at Sitakunda in Bangladesh, Alang in India, Aliaga in Turkey, and Karachi in Pakistan. Lower labor costs and less stringent environmental regulations are the primary drivers behind this shift in operational locations. There are about 50 forward and backward linkage industries based on this shipbreaking in Bangladesh. Now, there are about 20 shipbreaking Industries in Sitakunda where thousand and hundreds of laborers are working. At present, the position of Bangladesh is third in the world for shipbreaking. The largest ships in the world are cut in the shipyard of Bangladesh. This industry pays about 700 crore taka each year to the government of Bangladesh. Bangladesh needs eight million tons of building materials per year, the most required material being iron, and the shipbreaking industry is supplying 90% of iron materials to the country, YPSA. (2011). the main product of shipbreaking, the steel plate is a precious resource in a growing economy. The plates are small in size however are of very high quality. They do not need blast Furnaces or electric arc furnaces for recycling. The preferred method is to shear them to adequate size and reheat them through a coal-fired Furness to reroll them into bars. This material, known in the industry as ‘ship plate,’ is far cheaper and more energy efficient than producing the same amount of steel from iron ore. The critical aspect of this industry is to lower the cost. The beaching method sharply lowers demolition costs, using labor-intensive dismantling and low investment in equipment. It certainly has problems with labor safety and environmental pollution, yet it can be easily emulated anywhere with favorable conditions, either geographically or economically. It also needs a strong demand for scrap metal in the domestic market. It is projected that the output of Alang is equal to about 17% of the national steel output. In the case of Pakistan, it is even higher, about 50%, and Bangladesh entirely depends upon shipbreaking for its steel. Thus any fluctuation in this scrap metal industry will have vast repercussions on national metal markets. (Hossain and Islam,2006)

2. Research Objectives:

- To minimize the industrial hazardous material from the coastal area.
- To address the existing situation and identify proper solution for environmental problems.
- To minimize the environmental impact in the Ship breaking industry.
- To address coastal living species harmed by hazardous material.

3. Research Methodology

Considering the research objectives, necessary information has been collected from primary and secondary sources. Preliminary data are the dominating source for this paper. Despite it, some secondary data are also collected for the betterment of the article. Detailed procedures have been given below. The survey report is worked as primary data, and all data is essential for fulfilling the objective. A series of following tasks were conducted in the study:

- Visiting facilities for refining and processing scrap.
- Collection of data on-shore and off-shore and analysis of the experimental data.
- On-site assessments and interviews with relevant personnel, including workers, yard managers, and other stakeholders.

3.1 Selection of study area:

The study was conducted at Lalbagh Ship Breakers (Pvt.) Ltd., Rahim Steel, and Amanat Steel are in Bhatiary, Shitakunda, and Chittagong. The study area was selected considering the points below-

- A clear Tidal, Intertidal, and Shore zone.
- Tidal difference not less than 6m.
- Well, it is connected to National Highway.
- Close to Re-rolling Industry and connective point.
- Where workers are available.

4. Ship Breaking Activities in Bangladesh

In Bangladesh, the shipbreaking industry was born from a severe cyclone in 1960, killing thousands of people. A Greek ship, “M D Alpine,” was driven ashore by the devastating tidal storm and could not be refloated and was confined to the Fauzdarhat sea shore of Sitakunda Upazilla (Fig.2). The ship remained there for a long time. In 1964 Chittagong Steel House bought the vessel and scrapped it.

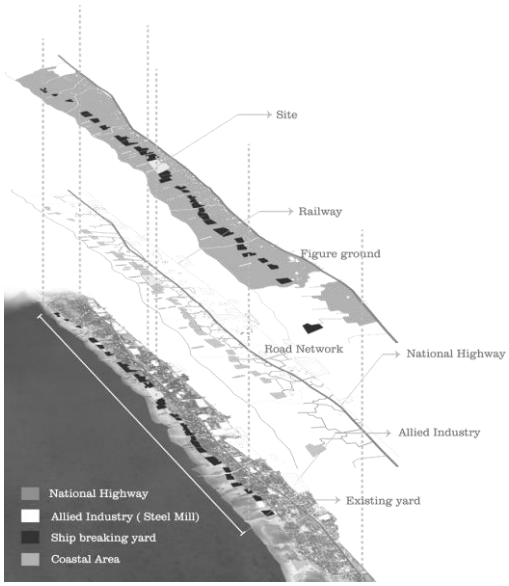

Fig. 01 Major ship scrapping area near Chattogram in Bangladesh

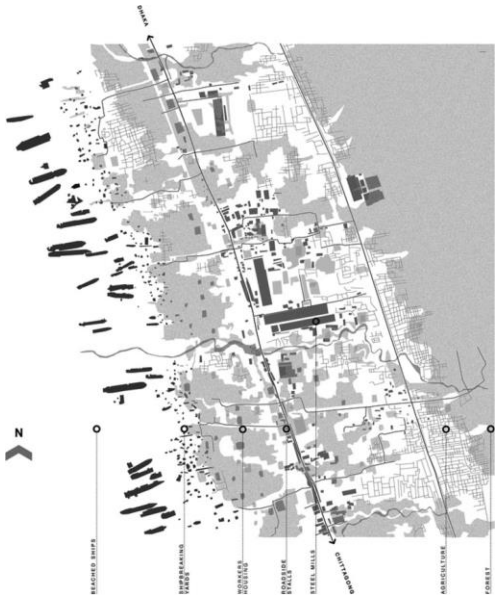

Fig. 02 Overview of the ship scrapping area of Chattogram (DNV, 2001

It took years to scrap the vessel, but the work gave birth to the industry in Bangladesh. During the Liberation War in 1971, a Pakistani ship, "Al-Abbas," was damaged by bombing. Later on, this was salvaged by a Soviet salvation team from Chittagong port and bought to the Fauzdarhat seashore. In 1974 Karnafully Metal Works Ltd bought this as scrap, which is considered an introduction to commercial shipbreaking in Bangladesh. Most of the Ship Recycling Industries are situated in Sitakunda, Chittagong. However, some small ship recycling industries also operate near Potuakhali and Rupsha, Khulna region. Following these tentative beginnings, the shipbreaking sector experienced a boom in the 1980s. As developed countries like the United Kingdom, Spain, Scandinavian countries, Brazil, Taiwan, and South Korea wanted to eliminate an industry that did not comply with the new environmental protection standards, Bangladeshi industrialists took the opportunities allured by colossal profit. Business people involved in the sector imported more and more ships, and Bangladesh gradually began to play a significant role. As a result, within a short period, Bangladesh established a monopoly in the international market of big ship scrapping. Statistics (DNV, 1999) show that about 52% of giant ships are dismantled in Bangladesh (Hossain & Mahmoud, 2008). In Sitakunda, ships are dismantled on the shore, where 90%of the vessel body lies in the intertidal zone, typically with the bow lying on the beach, making it impossible to prevent oil pollution and other liquid contamination. While a dry dock system could prevent the release of liquid pollutants into the environment, they are not used. Pollution from oil and oil products remains the foremost environmental concern relative to aquatic communities in marine coastal areas due to the indiscriminate disposal of oil-contaminated drilling muds, cuttings, and oil spillage.

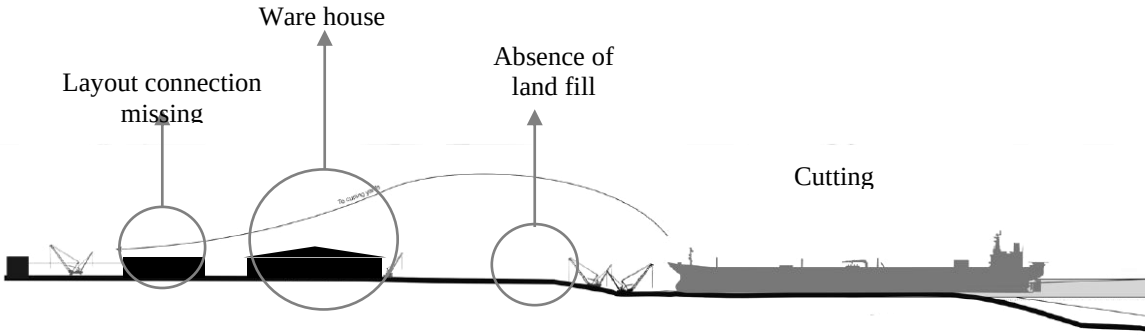

Fig. 03 Section of the typical Recycling yard of Sitakunda

5. Pollutants' Environmental Impacts and their sources

The entire ship-breaking process comprises several hazardous tasks and serves as a vault for dangerous materials that endanger the surrounding environment and the workers. Scrapped ships range in weight from 5,000 to 40,000 tons unloaded, or an average of 13,000 tons, with 95% of the importance being steel and 10 to 100 tons of paint that contains lead, cadmium, organotin, arsenic, zinc, and chromium. Several thousand liters of oil (engine oil, bilge oil, hydraulic and lubrication oils, and grease), sealants containing PCBs, up to 7.5 tons of various forms of asbestos, and other hazardous pollutants are also on board ships. Additionally, tankers may contain up to 1,000 cubic meters of leftover oil. Most of these materials are defined as hazardous waste under the Basel Convention (Hossain & Islam, 2004). Brief descriptions of these materials are described below:

i. Flammable Oil:

Oil is a flammable substance primarily composed of hydrocarbons, sulfur-containing chemicals, and other substances; about 75% of oil's constituents are hydrocarbons. Oil leftovers and other waste are spilled and mixed with soil and water on the beach due to the ship breaking, and the destiny of the released oil is unknown in the coastal waters. Fish can be severely harmed and even killed when oil leaks into shallow or enclosed waterways. When a body of water is not very deep, fish eggs may not hatch or be destroyed.

ii. Paint and preservative coating:

A ship's interior and external surfaces can be coated with paint and protection coatings. Paint may be flammable or contain dangerous substances like polychlorinated biphenyls (PCBs), heavy metals (including lead, barium, cadmium, chromium, and zinc), and pesticides, especially on older ships. Hazardous air pollutants (HAPs) and volatile organic compounds (VOCs) are released into the atmosphere by the chemicals and solvents used to remove paint or coating. Other removal techniques (such as mechanical removal and abrasive blasting) produce emissions that contain lead and other containments, as well as dust, particulate matter, and dust. These pollutants

are harmful to human health because they possess the potential to have short- and long-term adverse effects, as well as lead to cancer.

iii. Asbestos:
The elimination and disposal of asbestos during ship scrapping operations is a primary environmental concern and a safety and health issue. A class of minerals called "asbestos" naturally includes long, silky fibers. Repeated inhalation of asbestos fibers longer than or equal to 5 m by workers may cause a steady accumulation of scar-like tissue in the lungs and the membrane that covers the lungs. As a result of this scar-like tissue's inability to expand and contract like healthy lung tissue, breathing becomes difficult, and the body's ability to exchange gases is hampered. The heart may expand due to decreased blood supply to the lungs. Asbestosis is the scientific term for this illness. Shortness of breath in those with asbestosis frequently comes with a cough. People exposed to high levels of asbestos over an extended period may eventually become disabled or pass away from this deadly disease. The two central cancers that asbestos workers are more likely to develop are mesothelioma, a cancer of the thin membrane that covers the lung and other internal organs, and cancer of the lung tissue itself. It should be emphasized that smoking and asbestos exposure have a synergistic impact that dramatically increases one's risk of developing lung cancer.

iv. Poly Vinyl Chloride (PVC):
PVC is a widely used material in ship equipment and construction. PVC poses substantial risks to environmental health at every stage of its life—production, usage, and disposal. Because it is costly and dangerous to burn, PVC waste poses intractable disposal challenges at the end of its useful life. When buried, it emits dangerous chemicals into the air and ground, and recycling it is neither straightforward nor inexpensive. PVC has the potential to harm both the environment and people's health. Raynaud's syndrome, scleroderma, cholangiocarcinoma, asthma angiosarcoma, liver cancer, brain cancer, acro osteolysis, and risks of compromised human reproduction are only some diseases that PVC has been associated with. (S. Steingraber, 2004)

v. Bilge and Ballast Water:
Bilge water is the stagnant, dirty liquid allowed to drain from the lowest inner part of a ship's operating conditions, together with other liquids like condensed steam and valve and piping breaches. In order to modify a ship's draft, buoyancy, trim, and list to improve stability under varied operating situations, the bilge is typically a port or seawater that is purposefully pumped into and carried in tanks. Metals that cannot be removed by treatment may be present in bilge and ballast water. Ingesting metals can result in several health issues for people, including cancer and lead poisoning. Bilge water may contain hazardous organic substances like polychlorinated biphenyls (PCBs), which can cause cancer and other severe illnesses like anemia, kidney and liver damage, and heart failure.

vi. Heavy metals
Toxic heavy metals, including lead (Pb), mercury (Hg), and cadmium (Cd), are among the metals linked with the ship-breaking business that should be of concern. These metals can harm human health and ecological systems since they are not biologically necessary. Other metals used in the breaking industry include zinc (Zn), aluminum (Al), and iron alloy (Fe) steel. Numerous items onboard a ship may contain the metals in varied amounts. While mercury often only appears in very minute levels (in paints, batteries, and instruments), steel is present in huge quantities. Heavy metal can impair hearing, vision, the kidneys, the heart, the reproductive system, and the peripheral nervous system.

vii. Other substances
Isocyanates are frequently utilized in procedures like polyurethane coating and spray painting. Exposure at work can lead to respiratory conditions, including asthma. Because of its corrosive nature, sulfuric acid can severely burn the skin or eyes. However, any sulfuric acid that does separate will probably only be in trace amounts. Batteries will not impact the environment if they are in good condition. However, if batteries are piled high, the accumulated leakages can be significant and should raise the alarm. On a ship, radioactive elements could be found in smoke detectors, liquid level monitors, or emergency signs. These sources produce low-level radioactive waste, but its processing and disposal are typically highly regulated. Ionizing radiation can have serious adverse effects on the environment and human health (Ali & Chowdhury, 2015)

6. Impact on Biodiversity

The marine ecology and coastal ecology were harmed by the higher amount of trace metals and hazardous compounds in the environment of the Sitakunda shipbreaking yard sites—the hazardous chemicals described above reduced primary productivity by eradicating intertidal phytoplankton and zooplankton. As a result of the food shortage, fish resources suffered severe degradation. In the research area, the habitat was destroyed and degraded due to deforestation, contaminated water, and toxic soil. This hindered the expansion of biodiversity.

6.1 Sitakunda Ship Breaking Areas- Missing Fish Species (Siddique, 2004; Alam et al., 1989)

Scientific Name of the Fish	Local Name	Scientific Name of the Fish	Local Name
Carangoides malabaricus	**Lohamuri Mach**	Dendrophysa Russell	**Kala poa**
Carangoides melampygus	**Bungda muri**	Sphyraena forestage	**Khika Mach**
Arius thalassinus	**Kata Mach**	Pomadasys opercularis	**Grunti mach**
Uranoscopus guttatus	**Foton Mach**	Eleotris fusca	**Dora barilla**
Sauridia elongate	**Tiktiki Mach**	Gobuis sadanandio	**Nandi bailla**
Bahaba chaptis	**Chapti mach**	Osteogeniosus staenocephalus	**Aspisoa katamach**
Apocryptes serperaster	**Dosa chau mach**	Anodontostoma chacunda	**Koiputi mach**
Polynemus sextarius	**Kala tailla**	Scolopsis vosmere	**Nemipscol mach**
Pricanthus macracavthus	**Prica mach**	Gobuis melanosoma	**Kalthu Bailla**

7. Conclusions and Recommendations:

Bangladesh's Shipbreaking industries significantly contribute to the GDP; for this reason, the shipbreaking industry cannot be stopped. Instead, a sustainable approach should be taken to minimize the adverse effects of shipbreaking activities in the coastal zone.

1. Dealing harmful waste into the ocean and beach soil must be legally prohibited.
2. Before beginning the ship's breaking, a well-organized layout should be created.
3. A sustainable management plan for the coastal zone must be implemented to keep ship-breaking operations in a specific coastal area.
4. A practical Environmental Management Plan (EMP) and Effluent Treatment Plant (ETP) should be introduced for maximum pollution abatement.
5. It is necessary to periodically conduct pre- and post-environmental impact assessments to monitor and control ship-breaking operations.
6. The government must ensure tighter law enforcement and less environmental degradation for the shipbreaking sector.
7. Short and long-term scientific studies should be immediately started to assess the impacts of ship-breaking activities on coastal water, soil, fishery resources, and human health.

This study has demonstrated significant dangers to the environment due to shipbreaking. Finally, it could be proposed that adequate preventive measures should be taken during shipbreaking and recycling operations to ensure a safe, sound, and healthy atmosphere for Bangladesh.

References

Ali, Mohd M, and Panini Chowdhury. “Impacts of Ship Breaking Industries on Environment and Socio-Economic Condition of Bangladesh - A Case Study of Sitakunda Shitolpur Ship Breaking Yard, Chittagong.” ResearchGate, 2015.

Buerk, Roland. Breaking Ships : How Supertankers and Cargo Ships Are Dismantled on the Beaches of Bangladesh. , 2006.

Hossain, Khandakar Akhter. “Overview of Ship Recycling Industry of Bangladesh.” Journal of Environmental & Analytical Toxicology, vol. 05, no. 05, 2015, https://doi.org/10.4172/2161-0525.1000312.

Hossain, Md. Shakhaoat et al. “Impact of Ship-Breaking Activities on the Coastal Environment of Bangladesh and a Management System for Its Sustainability.” Environmental Science & Policy, vol. 60, 2016, pp. 84–94, https://doi.org/10.1016/j.envsci.2016.03.005.

Hossain, Sayed Mukit, and Kashif Mahmud. Ship Breaking and Recycling Industry in Bangladesh - Towards Sustainable Development to Mitigate Environmental Hazards, 2008.

Steingraber, S. Update on the Environmental Health Impacts of Polyvinyl Chloride (PVC) as a Building Material: Evidence From, 2004.

Siddiquee, N. A. (2004). Impact of ship br eaking on marine fi sh diversity of theBay of Bengal (p. 46). Dhaka: DFIDSUFER Project

YPSA, 2011. “Shipbreaking in Bangladesh: Ship Breaking in the Newspaper.” http://www.shipbreakingbd.info/Newspaper_%20News.html.