Effects and Solutions of Marine Pollution from Ships in Nigerian Waterways

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Abstract— The effects of marine pollution are enormous, ranging from impairment of surface water quality, disruption of aquatic growth, and reduction of amenities, affecting the health of man, etc. The main problem that leads to the pollution of aquatic environment is the attitude of not adhering to laid down standards for the protection of marine environment. Based on this, investigations have been made on Nigerian waterways in finding solution to these problems. Questionnaires were formulated, and research responses gotten were inputted in tables. After analysis, 84.7% of the responses showed that pollution of the marine environment and aquatic lives affects the economy of such community being polluted and the health of people are affected negatively. It means that the solution to the pollution of the aquatic environment is for the enforcement of the necessary laws by Government, such as the IMO regulations, to ensure that full compliance by operators within the industry in order to conserve and protect aquatic resources, provide safe seafood for human consumption and protect means of livelihood. Re-educating the citizen, ship owners, crew of a ship, oil exploring companies, and other corporate bodies, to be concerned and responsible for the respect and protection of the marine environment would also bring about control to the rate at which the marine environment is polluted especially from the vessels. This will go a long way in protecting the Nigerian waterways

Index Terms— Pollutions, Vessels, IMO Regulations, Marine Environment, Ballast Water, waterways, ship waste.

1 INTRODUCTION

THE internationally recognized definition for the marine environment was developed by Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), currently known as Aspects Of Marine Environmental Protection, which states: 'Introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazard to human health, hindrance to marine activities, including fishing, impairment of quality for use of sea-water, and reduction of amenities'.

Marine pollution is classed as point source or non-point source. Point source pollution occurs when there is a single, identifiable, and localized source of the pollution. That is, "point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. An example is directly discharging sewage (i.e. water-carried waste, in solution or suspension, which is intended to be removed from a community, also known as wastewater) and industrial waste into the ocean [1]

Non point source pollution occurs when the pollution comes from ill-defined and diffuse sources. It arises from a broad group of human activities for which the pollutants have no obvious point of entry into receiving watercourses. Obviously, non-point source pollution is much more difficult to measure, identify and control than point sources. These include agricultural storm water discharges and return flows from irrigated agriculture, urban runoff (from roofs, streets, parking lots, etc), transportation (roads, railways, pipelines, hydro-electric corridors) etc.

Industries and businesses may discharge wastes to street gutters and storm drains. Overloading and malfunction of septic systems lead to surface runoff [2]

1.1 Nature of the Marine Environment:

The marine environment can be described or characterized at a number of different scales, ranging from ocean-level processes through to those that occur at species and genetic level. The scales of relevance here are marine landscapes, habitats and species; their inter-relationship can be expressed as follows:

• Species provide the globally accepted original classification of biological diversity, with well-established rules of taxonomy to distinguish between different types. Their classification is arranged in a hierarchy of genera, families, orders, classes and phyla.
• Habitats comprise suites of species (communities or assemblages) that consistently occur together, but which are derived from different parts of the taxonomic hierarchy (e.g. kelps, molluscs and fish in a kelp forest habitat). Their classification can also be structured in a hierarchy (biotopes, biotope complexes, broad habitats), reflecting degrees of similarity.

• Marine Landscapes comprise suites of habitats that consistently occur together, but which are often derived from different parts of the habitat classification hierarchy (e.g. saltmarsh, intertidal mudflats, rocky shores and subtidal mussel beds in an estuary).
The approach to classification or characterization at each scale differs, each adopting differing factors to suit the requirements at that scale [3]-[4].

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1.2 Sources of Marine Pollution from Ships:

Sources of pollution from ship are:

- Oily-water discharge from ships.
- Tanker accidents.
- Accidental spillage during terminal loading.
- Wastewater discharged from ships.
- Garbage and Other Solid waste.
- Ballast-water discharged from ships at ports.
- Marine Machinery Exhaust.
- Anti-fouling Paints.
- Sound pollution

Oily-water discharge from ship:

The operation of ships' power plants often results in spills of lubricating oil, fuel oil, grease and water into bilges. The resulting emulsified water and oil, if pumped into the sea or river when oily-water separator is not fitted or if fitted and is faulty becomes a source of marine pollution from ships. Another source of oily-water pollution is ballast water pumped into oil cargo tanks. Such water usually contains some quantities of oil residues and foreign species that would have to be pumped overboard before fresh crude oil is loaded. Also the cleaning process of crude oil tanks of these vessels contributes to marine pollution because the oily-water from the cleaning process contains detergent, solid matters, rusty scales from corrosion which are discharged overboard [5].

Tanker Accidents:

Most commonly associated with ship pollution are oil spills. Oil tankers, chemical and gas carriers are prone to normal sea risk such as collision, grounding, explosion or fire. The exploration, exploitation and transportation of oil, gas and their derivatives have resulted in a number of catastrophic accidents.

While less frequent than the pollution that occurs from daily operations, oil spills have devastating effects. Effective measures are usually taken to combat this spillage when it occurs.

Accidental Spillage during Terminal Loading:

The malfunctioning of pumps and valves, rupture of pipes or operational errors can cause oil spillage during loading and discharge of crude oil at offshore oil terminals. Operational spills may also occur when a ship is loading bunker oil or lubricating oil for its engines. A hose can break spilling oil. If someone is not watching the level of oil going into the ship's tanks, the tanks could overflow.

Wastewater discharged from ships:

Two different types of wastewater are created on board vessels: black water and grey water. Blackwater is sewage, wastewater from toilets and medical facilities, which can contain harmful bacteria, pathogens, viruses, intestinal parasites, and harmful nutrients. Grey water is water that has been used in the kitchen, showers, sinks and laundry. This includes water containing dissolved or undisclosed by-products such as fat and oil, food scraps, household chemicals, soap and detergent rich in phosphate, nitrate and microbiological pathogens (e.g. bacteria and viruses). If either type of wastewater is discharged into aquatic environments, it can damage ecosystems, create algal blooms and pose significant human health risks [6].

Garbage and Other Solid waste:

Non-oil pollutants such as garbage and other solid waste from ships are normally dumped into the sea or river when there is no enforcement. Solid waste generated on a ship includes glass, paper, cardboard, aluminum and steel cans, and plastics. It can be either non-hazardous or hazardous in nature. Solid waste that enters the ocean may become marine debris, and can then pose a threat to marine organisms, humans, coastal communities, and industries that utilize marine waters [7].

Ballast-water discharged from ships at ports:

Since the introduction of steel hulled vessels around 120 years ago, water has been used as ballast to stabilize vessels at sea. While ballast water is essential for safe and efficient modern shipping operations, it may pose serious **ecological, economic and health** problems due to the multitude of marine species carried in ships' ballast water. These include bacteria, microbes, small invertebrates, eggs, cysts and larvae of various species. The transferred species may survive to establish a reproductive population in the host environment, becoming invasive, out-competing native species and multiplying into pest proportions. Direct and indirect health effects are becoming increasingly serious and the damage to environment is often irreversible.

Marine Machinery Exhaust:

Exhaust emissions from ships are considered to be a significant source of air pollution. Sulfur in the air creates acid rain which damages crops and buildings. When inhaled the sulfur is known to cause respiratory problems and even increase the risk of a heart attack. According to Irene Blooming, a spokeswoman for the European environmental coalition Seas at Risk, the fuel used in oil tankers and container ships is high in sulfur and cheaper to buy compared to the fuel used for domestic land use. "A ship lets out around 50 times more sulphur than a lorry per metric ton of cargo carried. These emissions from marine diesel engines contribute to ozone and carbon monoxide nonattainment (i.e., failure to meet air quality standards), as well as adverse health effects associated with ambient concentrations of particulate matter and visibility, haze, acid deposition, and eutrophication and nitrification of water. Shipboard incinerators also burn large volumes of garbage, plas-

tics, and other waste, producing ash that must be disposed of. Incinerators may release toxic emissions as well. Bunker fuel can also emit volatile organic compound (VOC) when tanks are vent during loading.

Anti-fouling Paints:

Anti-fouling paints functions by slowly releasing a poison into the laminar seawater surrounding of the ship. The soluble poison is toxic to marine organisms. Some antifouling compounds, such as copper, can bioaccumulate in areas of high shipping activity, leading to indirect impacts on marine wildlife further up the food chain. Heavy concentrations of shipping related activity antifoulants have been proven to lead to damage in non target species, e.g. bi-valves and crustaceans [8].

Sound pollution:

Noise pollution caused by shipping and other human enterprises has increased in recent history. The noise produced by ships can travel long distances, and marine species that may rely on sound for their orientation, communication, and feeding, can be harmed by this sound pollution. The Convention on the Conservation of Migratory Species has identified ocean noise as a potential threat to marine life [7].

1.3 Effects of Marine Pollution:

The effects of marine pollution are as huge and varied as the causes themselves. Aquaculture installation, reserved breeding ground, fishponds and cages are particularly at risk. Toxins along with garbage deplete the oxygen content of the water thus making it impossible for many life forms including bigger species like whales, dolphins, penguins, shark, iguana and seals to survive. An excess of oxygen depleting chemicals in the water can lead to (hypoxia) inadequate supply of oxygen and the creation of a dead zone. Also Storm water runoff is precipitation that travels across paved surfaces. It can accumulate deposits of air pollution, automotive fluids, sediments etc. In fact vessel storm water runoff from Marine Ports is a source of impairment in Nigeria coastal waters and its estuaries [5].

Plastic debris, discarded fishing nets and other similar items that are there purely because of human negligence act as severe agents of marine pollution and have an effect that cannot be imagined unless witnessed. A large scale death of animal results from plastic consumption, like the sea turtles which consume it thinking it to be jellyfish is an example.

Excessive inputs of nutrients into water bodies are primary cause of (eutrophication) increase in chemical nutrients, typically compounds containing nitrogen or phosphorus, in surface waters. It can result in an increase in the ecosystem's primary productivity (excessive plant growth and decay), and further effects including lack of oxygen and severe reductions in water quality, fish, and other animal populations. Excess nutrients stimulate algal growth.

These marine toxins can be transferred to land animals, because, many animal feeds have a high fish meal or fish hydrolysate content, and appear later in meat and dairy products, which becomes hazard to human life, when consumed.

Oil is the most common pollutant in the oceans. More than 3 million metric tons of oil contaminates the sea every year. The majority of oil pollution in the oceans comes from land. Runoff and waste from cities, industry, and rivers carries oil into the ocean. Ships cause about a third of the oil pollution in the oceans when they wash out their tanks or dump their bilge water.

Impact of pollution on marine bio-system:

Spilled oil for example, poses serious threats to fresh water and marine environments, affecting surface resources and a wide range of subsurface organisms that are linked in a complex food chain that includes human food resources. This can harm the environment in several ways, including the physical damages that directly impact wildlife and their habitats (such as coating birds or mammals with a layer of oil), and the toxicity of the oil itself, which can poison exposed organisms [9].

Drifting oil contaminates the feathers of seabirds and the fur of seals. In the birds, it clogs and destroys the insulating and waterproofing properties of the feathers. As the bird tries to maintain its body temperature, it will exhaust its fat reserves and become weakened. It is almost impossible to replace these reserves because, in its weakened condition, whenever it flies the bird has to carry as mush as 20% extra body-weight in sodden feathers. Also, oil transferred to the surface of its eggs during incubation reduces their hatchability.

Oil pollution also results in disruptions to the cycle of coral reefs, clogging of the gills of fishes thereby resulting in their death and hampering the process of photosynthesis of marine plants leading to their end [9].

Impact of pollution on Local industries (often fishing and tourist industry):

Fishing Industry: The fishing industry suffers badly when oil spill occur. Firstly because the fish are often covered in oil, or have swallowed oil making them poisonous. Also a large number of fish die, decreasing the number of fish that could have possibly been caught. The economic impact of this pollution is far-reaching, since it affects the population of seafood. The local economies of coastal towns that depend on these industries can be devastated by a large scale disaster, such as an oil spill.

Tourist Industry: Tourism suffers in beach communities that are overcome by pollutants in the ocean. For example, if spilled oil reaches the shore, it contaminates the inter-tidal zone and the beaches. The local tourist industry suffers as aesthetic beauty of sea shore is lost due to oil slick. Industries that rely on clean seawater for routine operations can also suffer because operations have to be stopped while the water is cleaned. This in turn, affects the economy of the community.

Impact of Marine Pollution on Public health:

When oil is spilled into a residential neighborhood, for example, the most immediate health concerns are those caused by volatile chemicals - airborne toxins that leave people complaining of symptoms like headaches and nausea and worrying about long-term problems like cancer [10].
But crude oil also contains small amounts of heavy metals that rarely evaporate into the air. Instead, they stay with the oil as it spills onto the waterways. These compounds, which include mercury, manganese, nickel and chromium, are toxic at high doses, and some, like arsenic and lead, can damage the nervous system even at relatively low doses [8].

Mercury is now recognised as a potential hazard on a regional scale. World Health Organisation recommends a maximum tolerable consumption in food of 0.3 mg of mercury.
Since mercury is odorless, invisible and accumulates in the meat of the fish, it is not easy to detect and can't be avoided by trimming off the skin or other parts.
Once in the human body, mercury acts as a neurotoxin, interfering with the brain and nervous system.

Exposure to mercury can be particularly hazardous for pregnant women and small children. During the first several years of life, a child's brain is still developing and rapidly absorbing nutrients. Even in low doses, mercury may affect a child's development, delaying walking and talking, shortening attention span and causing learning disabilities. Less frequent, high dose prenatal and infant exposures to mercury can cause mental retardation, cerebral palsy, deafness and blindness.
In adults, mercury poisoning can adversely affect fertility and blood pressure regulation and can cause memory loss, tremors, vision loss and numbness of the fingers and toes. A growing body of evidence suggests that exposure to mercury may also lead to heart disease [9].

1.4 Monitoring, Control and Preventive Measures Of Marine Pollution

Measures need to be taken to prevent the sea from being made a dumping ground for waste oil and chemicals. National and international regulations, guidelines and codes exist for the control and prevention of marine environmental pollution.

International Maritime Organisation:
The International Maritime Organisation (IMO) based in London is a United Nations Body that is responsible for the prevention and control of pollution of the sea from ships.
The MARPOL 73/78 Convention is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes.
IMO Conventions currently includes six technical Annexes [12]

Annex I- Regulations for the prevention of pollution by Oil: This covers oily mixtures, distillates, gasoline, jet fuels, etc.
shown in figure 1(a). The regulation requires that oil content in the clean water outlet does not exceed the limit of 15 parts per million.

Annex II- Regulations for the control pollution by Noxious liquid substances carried in bulk: This control mainly chemicals including, acids, alcohols, castor oil, hydrogen peroxide, pentanol sodium sulphite, etc. Also citric juice, glycerine, milk, molasses, wine, etc.

Annex III- Prevention of pollution by harmful substances carried in packaged form: This contains general requirements for the issuing of detailed standards on packing, marking, labelling, documentation, stowage, quantity limitations, exceptions and notifications for preventing pollution by harmful substances.

Annex IV- Prevention of pollution by Sewage waste: This contains a set of regulations regarding the discharge of sewage from any form of toilets, drainage from spaces containing live animals etc. into their sea, ships equipment and systems for the control of sewage discharge, provision of facilities at ports and terminals for the reception of sewage, and requirements for survey and certification of ships.

Annex V- Prevention of pollution by Garbage from ships: This requires the separation of different types of garbage, such as plastic bags, synthetic ropes, food waste, paper products, glass, metal, crockery, packaging materials, synthetic fishing nets, etc. and specifies the distance from land and the manner in which they may be disposed of, otherwise, they should be delivered to shore based reception facilities.

Annex VI- Prevention of air pollution from ships: This set limit on sulphur oxide SOx and Nitrogen oxide NOx emissions from ship exhaust as well as particulate matter and prohibits deliberate emissions of Ozon depleting substances, such as Hydro-Chloroflourocarbons [13].

Provision of Reception Facilities:
One of the major requirements of Annex 1 of the MARPOL 73/78 Convention is that parties to the Convention must provide adequate reception facilities for oil residues and oily mixtures at oil loading terminals, repair ports and in such ports where ships have such residues to discharge.

Equipment and Constructional Features of Tankers:
In the relevant Annexes, IMO has regulated the specification of oil monitoring equipment and the design of tankers.

Oily-water Separator:
Annex 1 of the Convention made it mandatory that oil tankers and any ship of 400 gross tonnages and above must be fitted with an oily-water separating equipment or filtering system as

Design Criteria for Tankers

In March 1992 the marine Environmental Committee of IMO adopted new regulation for new and existing tankers. Annex I made it mandatory for new oil tankers to have double hull.
The requirement for new tankers in respect of double sides and double bottoms is shown in figure 1(b).

Ballast Water Management

The International Maritime Organization (IMO) has adopted a Ballast Water Management Convention which requires all commercial ships to install and operate ballast water treatment system (BWTS). To address this critical requirement, N.E.I. developed, patented and commercialized the Venturi Oxygen Stripping™ (VOS™) System. VOS™ induces a low-oxygen (hypoxic) condition in ship ballast tanks using inert gas. This hypoxic condition deprives aquatic organisms – both plants and animals – of the oxygen needed to survive. This low-oxygen environment also limits the amount of oxygen available to form iron oxide, or rust, thereby protecting the internal steel surfaces of the ballast tank against corrosion and preventing premature deterioration of ballast tank coatings [14]-[15].

In less than 10 seconds, N.E.I.'s patented VOS™ System safely removes 95% of dissolved oxygen from ballast water by mixing very low-oxygen inert gas with natural water as it is drawn into the ship as ballast. In a process similar to evaporation, the inert gas strips the water of its dissolved oxygen.

Ships Waste Water Treatment

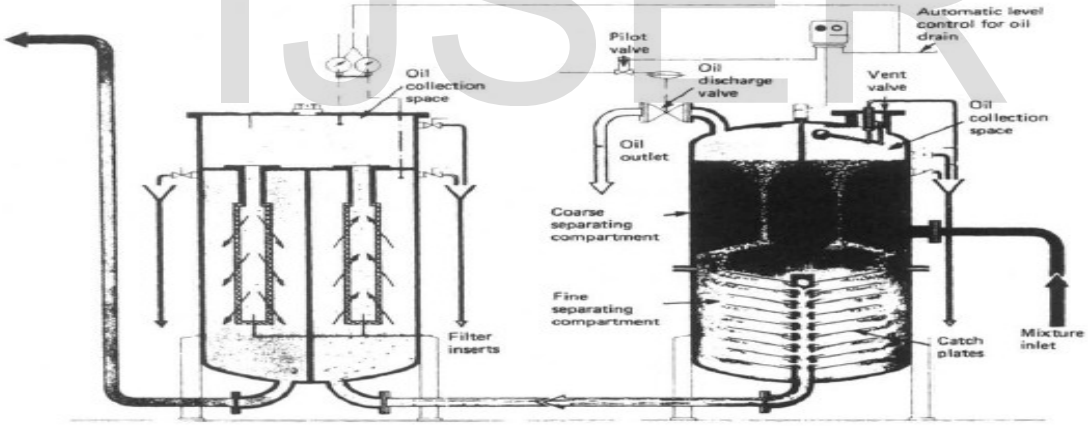
Wastewater produced on board ships is required to be treated to acceptable level before being discharged overboard to prevent pollution of the sea. The wastewater comes in the form of grey and black water and their treatment can be carried out separately or by using the same equipment for the treatment.

Regulations for the Prevention of Pollution from Sewage are contained in Annex IV of Marpol.

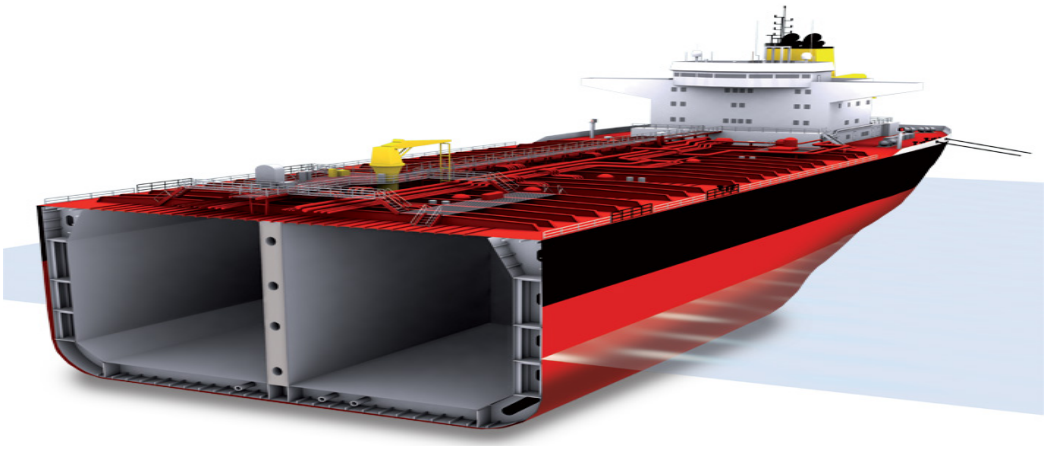
The discharge of sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land. Sewage which is not comminuted or disinfected has to be discharged at a distance of more than 12 nautical miles from the nearest land.

Sewage treatment plants on ships are of two types: (see fig 1 (c)..

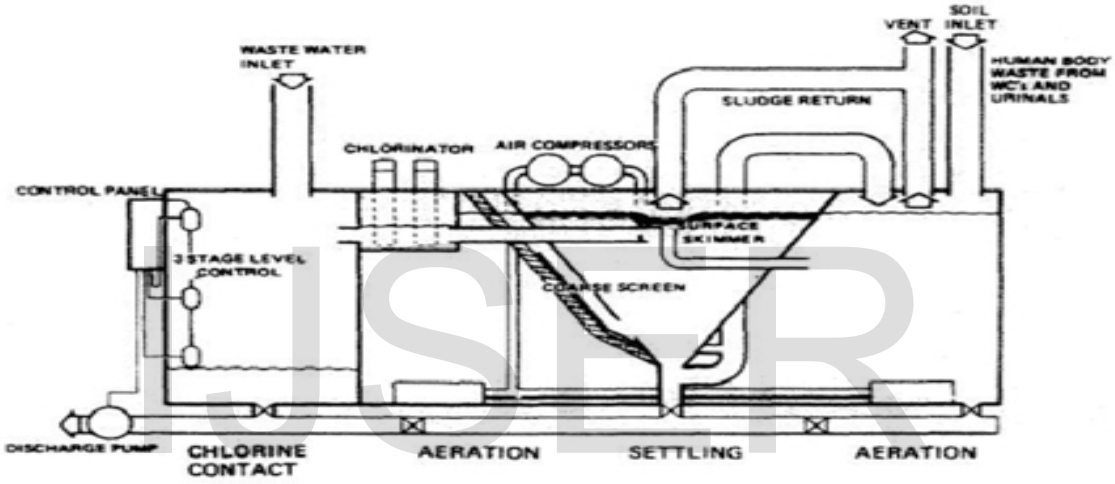
- Chemical sewage treatment plant
- Biological sewage treatment plant



(a) Oily water Separator



(b) Tanker showing double sides



(c) Biological Sewage Treatment Plant

Figure: 1 **Operating Systems on Board a vessel**

2 METHODOLOGY

To achieve the set objectives of this research work, a questionnaire/descriptive method was used to find out the effects and solution of marine pollution from ships in Nigerian waterways.

Setting

Nigeria is located approximately between latitude 4º and 14º North of the Equator, and between longitudes 3º and 14º East of the Greenwich meridian. The estimated population of more than 170 million, spread unevenly over a national territory of 923,768 sq km, 18,000 km squared of which is brackish water or freshwater swamps. Nigeria has a coastline of 853 km (i.e. total length of boundary between the land area (including Islands) and sea, from Lagos in the west to Calabar in the south, Mangrove area of 12,200 sq. km, and total marine area of 182,500 sq. km. With main sea ports at Lagos (Apapa, Tin-Can Island) Warri, Port Harcourt, Onne Deep Sea and Hub Port, Calabar Export Processing Zone [16]-[17]

Sampling Method

The sampling method used was purposive-non-probability sampling methods, where the researcher formulated research questions and picked respondents who in his opinion are likely to posses the desired set of information. About 50 questionnaires were sent out to gather information for the research.

Data Presentation

Data are analyzed in a simple table of the frequency type and converted to percentages, for easy understanding. 50 copies of questionnaire that were distributed (to people in the marine industry) in the study area were properly filled, collected and analyzed.

Some calculations are presented in this chapter for effectiveness of the study.

Table 1: What are the Sources of Marine Pollution?

Questions	Response		
	Yes	No	Total
Do shipping activities pollute the marine environment?	50	0	50
Can bilge water discharged from ships pollute the marine environment?	50	0	50
Tanker accident is one of the sources of pollution of the Nigerian waterways from ships.	45	5	50
Can untreated wastewater discharged from ships cause pollution of the marine environment?	50	0	50
Is it true that garbage disposed into our rivers pollute the marine environment?	50	0	50
Can organisms carried in ballast water cause problematic ecological effects	47	3	50
Can pumps and valves operational errors cause oil spillage in the Marine Vessels	50	0	50

Total Percentage of respondents that said bilge discharge, tanker accident, untreated wastewater discharged, garbage disposed, ballast discharge and accidental discharge are sources of marine pollution from ships

$$= \frac{1.0 + 1.0 + 0.9 + 1.0 + 0.94 + 1.0}{6} \times 100\% = 97.3\% \quad (1)$$

Table 2: Does Marine Pollution have adverse effects on human health, as well As the Marine Environment?

Questions	Response		
	Yes	No	Total
One of the adverse effects of marine pollution on human health is the development of cancer	34	16	50
Marine pollution affects the immune and endocrine systems of human	35	15	50
Failure to comply with IMO regulations have contributed to pollution of Nigerian waterways	45	5	50
Impairment of water quality and reduction of amenities are as a result of pollution of the marine environment	48	2	50
Does marine pollution affects fishing activities?	50	0	50
Can pollution of marine environment affects the economy of the host community?	50	0	50
Oil spill is the most important source of marine environmental pollution	39	11	50

Total Percentage of respondents that said marine pollution has adverse effects on human health, economy, as well as the marine environment

$$= \frac{0.68 + 0.7 + 1.0 + 0.96 + 1.0 + 1.0 + 0.78}{7} \times 100\% = 87.4\% \quad (2)$$

Table 3: What are the ways forward for Proper Monitoring, Prevention and Control of Marine Pollution in Nigeria

Questions	Response		
	Yes	No	Total
Are you aware of any IMO regulations for the control and prevention of marine environmental pollution?	44	6	50
If question 15 above is yes, are the regulations implemented in Nigeria?	38	12	50
Annex 1 of IMO convention, can this guarantee control of pollution of oily-water discharge?	50	0	50
Has the introduction of double bottom tanks from tankers prevented the pollution of marine environment by tankers during accident?	32	18	50
Will ballast water treatment save the marine environment from introduction of invasive pest from ballast discharge?	38	12	50
Is the seaport or terminal in your locality equipped with functional reception facilities, for the reception of sewage, oily-water, and ballast water?	30	20	50
Ship sewage treatment help to control the amount of bacteria discharged into water bodies	50	0	50

Total Percentage of respondents that said implementation of IMO regulations, use of oily water separator, building of double bottom ships, treatment of bilge and ballast water and installation of port reception facilities can help to control and prevent pollution of Nigerian waterways

$$= \frac{0.88 + 0.76 + 1.0 + 0.64 + 0.76 + 0.6 + 1.0}{7} \times 100\% = 80.6\% \quad (3)$$

Tables 4, 5 and 6 shows the results of respondence for for sources of Marine pollution, effects of Marine pollution and ways of prevention of Marine pollution respectively while figures 2, 3, and 4 shows the chart of respondence for for sources of Marine pollution, effects of Marine pollution and ways of prevention of Marine pollution respectively

Table 4: Result of Respondence for sources of Marine Pollution

Yes	No
50	0
50	0
45	5
50	0
50	0
47	3
50	0

Table 5: Result of Respondence for effects of Marine Pollution

Yes	No
34	16
35	15
45	5
48	2
50	0
50	0
39	11

Table 6: Result of Respondence for ways of prevention of Marine pollution

44	6
38	12
50	0
32	18
38	12
30	20
50	0

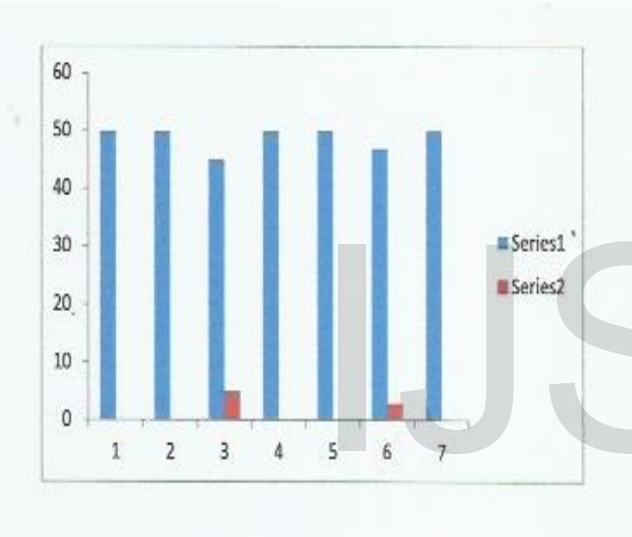


Figure 2: Cchart results for Table 4

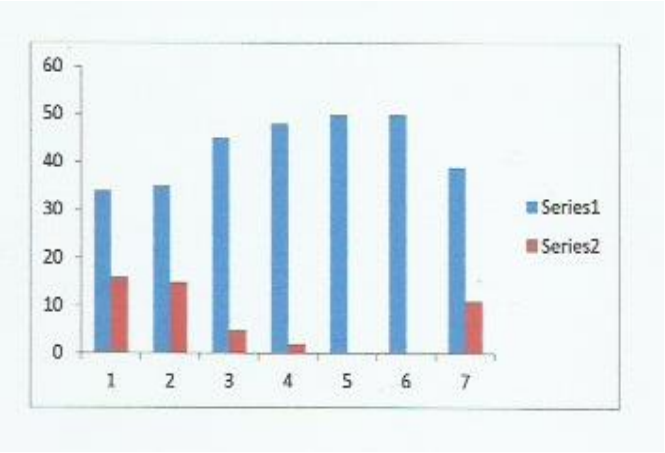


Figure 3: Chart results for Table 5

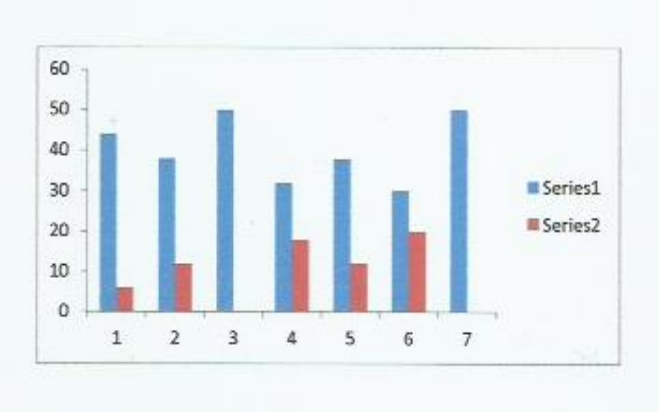


Figure 4: Chart results for Table 6

3 Results and Discussion

The result presented in equation 1 and chart in figure 2 shows that 97.3% of respondents agreed that the sources of marine pollution outlined and explained in the literature review are the major sources of marine pollution. From equation 2 and Chart in figure 3, it could be observed that marine pollution has adverse effects on the marine environment, marine life, and human life.

From equation 3 and chart in figure 4, it could be observed that a greater percentage of respondents believe the laid down regulations by IMO, can save our marine environment, if adhered to. Therefore, the result obtained in monitoring, control and prevention of marine pollution is in good agreement with standard practices as laid down by IMO.

It was reported by (New Scientist Magazine) that just 16 of the world's largest ships can produce as much lung-clogging sulphur pollution as all the world's cars. Because of their colossal engines, they can burn the fuel with high sulphur content.

Bunker fuel is also thick with sulphur. IMO rules allow ships to burn fuel containing up to 3.5 percent sulphur as at 2012. The sulphur comes out of ship funnels as tiny particulars, and it is this that gets deep into lungs.

Furthermore, Nigeria has a total of eleven points and eight oil terminals, organized in three zones of western, central and eastern zones.

The report by the Nigerian Ports Authority indicated that a total of 2,719 Oceans going vessels calling in the first half of 2014, showing an increases of 12% over the 2013 figure. The total Gross Registered Tonnage (GRT) of vessels within the period is 70,659,820 metric tons indicating an increase of 17.57% over the corresponding period in 2013 (NPA 2014 Report Extract).

The increase in port/terminal operations thereby increases the risk/pollution on human health as well as the marine environment. The health effects from such pollution may include Asthma, cardiovascular disease, lung cancer, and premature death

4. CONCLUSION

Surveys were carried out to evaluate the adverse effects of pollution of the marine environment.

1. Sources of marine pollution from ships have been established, which included discharge of oily water from bilge, invasive organisms from ballast, accidental discharge of oil from tankers ships and operational discharge, etc.

2. The adverse effects of introducing pollutants into the marine environment have also been established. The effects appear to be damaging to the ecosystem, ships life and human health.

3. Control and preventive measures have been established, which include adherence and enforcement of standard operations, as contained in ANNEX I-VI of IMO conventions.

RECOMMENDATION

The recommendations are as follows:

1. There should be policies by the Federal government to control pollution from ships by introducing penalties in terms of levy and restrictions to ships found polluting the marine environment in order to conserve and protect aquatic resources, provide safe seafood for human consumption and protect means of livelihood.
2. There should be greater exchange of technical information, technology, and experience between countries resulting from research development programme.
3. An improved level of organization, coordination, and cooperation between the agencies responsible for the protection of aquatic environment.
4. Strict adherence to IMO standard.
5. Improvement in planning, emergency management, risk assessment studies, availability of monitoring and control equipments, timely and suitable procedures for cleanup of the environment.
6. Creating awareness by re-educate the citizen, ship owners, crew of a ship, oil exploring companies, and other corporate bodies, to be concerned and responsible for the respect and protection of the marine environment.
7. Safety drills should be carried out at regular intervals to make crew accustomed to their responsibilities.

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