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EDITOR'S NOTE

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We thank our contributors for responding to our call for papers. We hope that the enthusiasm generated by the invitation for papers will be sustained. We commend our reviewers for working tirelessly to make this publication a reality.

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**THE THREAT, REALITY AND TRAGEDY OF
MARITIME ENVIRONMENTAL POLLUTION IN
NIGERIA***by A.O. Abdulkadir (PhD)¹ and A.E. Arikewuyo-Ajumobi²***ABSTRACT**

Maritime environmental pollution has caused serious damages to human health and its environment. Many factors are responsible for environmental pollution in the maritime sector to wit: air pollution, discharges at sea, ship recycling, noise, collisions with whales, oil pollution and solid waste. This paper examines the reality of maritime environmental impacts from human health and its environment by way of environmental impacts from ocean shipping, impacts of oil spill incidents on Nigerian maritime environment, human health, marine living resources and maritime security. The paper argues that in order to reduce the tragic flaws of maritime environmental pollution in Nigeria, there is need for designation of Special Area as practiced in other jurisdiction to reduce pollution in water among others to avert threats of avoidable maritime pollution. The paper therefore concludes that there should be provision of standardised onshore power supply in ports, harbours and ships burn fuel to generate electricity for lighting, machinery and other onboard at berth to monitor erring ships.

Key Words: Threat, Reality, Tragedy, Maritime, Pollution.

INTRODUCTION

Since the discovery of oil in Nigeria in the 1950s, the country has been suffering the negative environmental consequences of oil development. The growth of the country's oil industry, combined with a population explosion and a lack of enforcement of environmental regulations has led to substantial damage to Nigeria's environment, especially in the Niger Delta region. When there is an oil spill on water, spreading immediately takes place. The gaseous and liquid components evaporate. Some get dissolved in water and even oxidize, and yet some undergo bacterial changes and eventually sink to the bottom by gravitational action. The soil is then contaminated with a gross effect upon the terrestrial life.

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As the evaporation of the volatile lower molecular weight components affect aerial life, so the dissolution of the less volatile components with the resulting emulsified water, affects aquatic life.¹

The harmful effects of oil spill on the environment are many. Oil kills plants and animals in the estuarine zone. Oil settles on beaches and kills organisms that live there. It also settles on ocean floor and kills benthic (bottom-dwelling) organisms such as crabs. Oil poisons algae, disrupts major food chains and decreases the yield of edible crustaceans². It also coats birds, impairing their flight or reducing the insulative property of their feathers, thus making the birds more vulnerable to cold. Oil endangers fish hatcheries in coastal waters and as well contaminates the flesh of commercially valuable fish.³ In the Nigerian coastal environment a large areas of the mangrove ecosystem have been destroyed. The mangrove was once a source of both fuel wood for the indigenous people and a habitat for the area's biodiversity, but is now unable to survive the oil toxicity of its habitat.

Oil spills in the Niger Delta have been a regular occurrence, and the resultant degradation of the surrounding environment has caused significant tension between the people living in the region and the multinational oil companies operating there. It is only in the past decade that environmental groups, the Federal Government, and the foreign oil companies operating in the Niger Delta began to take steps to mitigate the impacts. Large areas of the mangrove ecosystem have also been destroyed. The mangrove forest was in the past a major source of wood for the indigenous people. In some places it is no longer in a healthy state to sustain this use. The Idoho oil spill traveled all the way from Akwalbom state to Lagos state dispersing oil through the coastal states, up to the Lagos coast. This culminated in the presence of sheen of oil on the coastal areas of Cross river state, Akwalbom state, Rivers state, Bayelsa state, Delta state, Ondo state and Lagos state.⁴

¹ Akpofure, E.A., Eftre, M.I. and Ayawei, P., *The Adverse Effects of Crude Oil Spills in the Niger Delta* (Urhobo Historical Society, 2000).

² Nwilo, C. Peter & Badejo, T. Olusegun, 'Oil Spill Problems and Management in the Niger Delta' (Paper presented at the International Oil Spill Conference, Miami, Florida, USA, 2005).

³ Ibid.

⁴ Ibid.

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In many villages near oil installations, even when there has been no recent spill, an oily sheen can be seen on the water, which in fresh water areas is usually the same water that the people living there use for drinking and washing. In April 1997, samples taken from water used for drinking and washing by local villagers were analyzed in the U.S. A sample from Luawii, in Ogoni, where there had been no oil production for four years, had 18 ppm of hydrocarbons in the water, 360 times the level allowed in drinking water in the European Union (E.U.). A sample from Ukpeleide, Ikwerre, contained 34 ppm, 680 times the E.U. standard. Following the major Texaco spill of 1980, it was reported that 180 people died in one community as a result of the pollution. On several occasions, people interviewed by Human Rights Watch said that spills in their area had made people sick who drank the water, especially children.⁷

THOR HEYERDAHL'S THEORY OF OIL POLLUTION

Although, there are many theory that have been postulated on oil pollution, Thor Heyerdahl's Theory is adopted in this paper as it is considered apt. Oil spill simulation model is used in oil response and contingency planning and as a tool in oil fate and impact assessment.⁸ In the event of an oil spill taking place, predictions of the slick can be supplied, provided that the necessary meteorological information is available.⁹ Oil spillage can also be treated or removed by natural means, mechanical systems, absorbents, burning, gelling, sinking and dispersion. Oil spillage can be removed by natural means through the process of evaporation, photochemical oxidation and dispersions.¹⁰ Bioremediation can also be used for managing oil spill problems.¹¹

⁷ Ibid.

⁸ Rossouw, M., 'Oil Spill Simulation: Reducing the Impact' (Paper Presented at Workshop on Climate Change and Coastal Process in Cotonou, Benin, West Africa, 1998).

⁹ Ibid.

¹⁰ Wardley-Smith J, *The Control of Oil Pollution on the Sea and Inland Waters* (Graham and Trotman Ltd, United Kingdom, 1977).

¹¹ Prince R., 'Petroleum Spill Nioremediation in Marine Environments' (1993), *Critical Rev. Micobiol*, 19(4), 217-242. See also Atlas, R.M., 'Petroleum Biodegradation and Oil Spill Bioremediation' (1995), *Marine Pollution Bulletin* 31, 178-182.

Thor Heyerdahl has speculated that the ancient Egyptian and Central American civilizations may have cross-fertilized. If nothing else, a detached observation of the independent construction of massive pyramids on the American and African continents leads one to ponder why these ancient civilisations were so similar. To test his theory, Heyerdahl built a small papyrus reed raft of Egyptian design which he christened "Ra," and set sail from the coast of Africa, heading westward. Ultimately, he succeeded in reaching the islands of the Caribbean, proving that there may indeed have been ancient mariners who shared the accomplishments of the ancient Mediterranean civilisations with those of the Aztec and Mayan cultures.¹² But Heyerdahl traveled in the twentieth century; he experienced a phenomenon his Egyptian predecessors would have been spared. No matter where he sailed in the North Atlantic, the Norwegian explorer was distressed to find clumps of oil in various sizes floating in the waters- some so large that they supported whole colonies of barnacles. This material, the feces of the industrial revolution and the population explosion, had come to spoil even the pure waters of the oceans, to which life on this planet owes its genesis.

In the short term, oil pollution on the high seas will have both aesthetic and economic consequences-tourist and fishing industries will surely suffer. The long term effects may be far more profound. First, hydrocarbons may build up on the food chain, creating possibilities of increased carcinogenic exposure. Second, diminished fishing harvests may impair the ability of man to feed himself. Third, the ultimate sterilization of the oceans may result in the loss of much of the world's oxygen, for the oceans are our major producers of that essential prerequisite to life on earth.¹³

CAUSES OF ENVIRONMENTAL POLLUTION IN MARITIME SECTOR

Many factors are responsible for environmental pollution in the maritime sector. These factors include the following:

Air pollution

¹² Heyerdahl, T, *The Ra Expeditions* (1972).

¹³ Dempsey P.S, 'Compliance and Enforcement in International Law—Oil Pollution of the Marine Environment by Ocean Vessel' (1984) Issue 6 Vol. 2. *Northwestern Journal of International Law and Business*, pp. 462-463.

The shipping sector is a major source of atmospheric pollutants, particularly carbon dioxide (CO₂), sulphur oxides (SO_x), nitrogen oxides (NO_x), hydrocarbons including carcinogenic PAHs (Polycyclic Aromatic Hydrocarbons), and particulates (soot). These arise from the combustion of bunker fuel in ships' engines and are emitted to the atmosphere as exhaust gases. In the absence of standardised onshore power supply in ports and harbours, ships burn fuel to generate electricity for lighting, machinery and other onboard needs whilst at berth.¹⁴ The maritime transport sector is a significant contributor to climate change. In 2000, ships' emissions of the greenhouse gas CO₂ in EU seas were 157 million tones.¹⁵ This is more than aviation emissions in EU air space.¹⁶ Shipping currently contributes about 10% of the deposition of SO_x and NO_x over wide areas of Europe, and up to 15% in some coastal areas.¹⁷ This adds to acid rain and also to a substantial input of nitrogen to the sea (ICES 2003). Sulphate particles may also create health problems in densely populated areas surrounding ports.

Despite steps to reduce air pollution from ships, such as the entry into force of Annex VI to MARPOL 73/78 on 19 May 2005,¹⁸ there are concerns that if no further measures are introduced, by 2020 emissions of SO_x and NO_x from international shipping around Europe may have surpassed the total emissions from all land-based sources in the 25 EU Member States combined. This will have an impact on environmental and health problems. There is need for reduction in these emissions in line with the recently adopted EU Thematic Strategy on Air Pollution.¹⁹

¹⁴ In May 2006 the European Commission adopted the Recommendation on the promotion of shore-side electricity for use by ships at berth in EU ports. Shore-side electricity means providing electricity to ships at berth in ports from the national grid instead of ships producing electricity using their own engines. This eliminates local air and noise emissions from ships' engines while at berths in port. The Recommendation is not legally binding. Its objective is to promote the consideration of shore-side electricity as a means of abating ships emissions in EU ports, particularly in populated areas which suffer from poor air quality. It aims to do this by providing information on practicalities, benefits and costs; by calling for harmonized international standards; and by highlighting the possible use of electricity tax reductions as an incentive to ship operators to use shore-side electricity (DG Environment).

¹⁵ Quantification of emissions from ships associated with ship movements between ports in the European Community.

¹⁶ See the European Commission 2006.

¹⁷ Ibid.

¹⁸ Annex VI (air pollution) to the International Convention for the Prevention of Pollution from Ships, 1973 and its Protocol of 1978 (MARPOL 73/78, Annex VI) contains provisions on SO_x Emission Control Areas (Baltic Sea, North Sea and English Channel) and NO_x emissions standards for ships' engines.

¹⁹ See European Commission 2006. Communication from the Commission to the Council and the European Parliament "Thematic Strategy on Air Pollution" COM(2005)446.

It needs be emphasised that a consequence of marine engine technologies is increased air pollution. These HTHP engines oxidize nitrogen effectively (thereby increasing NO_x emissions), and emit many of the impurities of residual fuel (including sulfur, toxics, and heavy metals) out the ship stack. Among freight modes, waterborne transportation has been shown to cause significant air pollution locally in port communities, add to long-range pollution transport in coastal regions of heavy trade, and contribute to climate change on a global scale²⁰. Oceangoing shipping is also the least regulated freight mode, at least for air pollution.

Discharges at sea

Oil and oily residue discharges from ships represent a significant threat to marine ecosystems. In general, this type of pollution results from the deliberate washing of tanks or the flushing of bilge or ballast water. Discharges may occur during normal operational activities or may be accidental or illegal. Illegal discharges of oil from ships are often limited in size and scattered, but their sum is higher than that from oil spills, and they may create a chronic impact in certain areas. The International Convention for the Prevention of Pollution from Ships,²¹ 1973 and its Protocol of 1978 (MARPOL 73/78) was established under the IMO to regulate operational discharges from ships. From 1st August 1999, the seas around Ireland and their approaches have been designated as a Special Area with regard to oil and waste, in which stricter anti-pollution regulations apply. As a result, the discharge limit for oily water, from any ship, is 15ppm oil. To this end, designation of certain area as Special Area as it is being practicing in Ireland and Australia will reduce pollution in Nigeria water.

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- ²⁰ Kasibhatla, P., *et al.* 'Do Emissions from Ships Have a Significant Impact on Concentrations of Nitrogen Oxides in the Marine Boundary Layer?' (2000) *Geophysical Research Letters*, 27(15), 2229-2233.
 - ²¹ MARPOL 73/78 is the abbreviated name for the International Convention for the Prevention of Pollution from Ships, 1973, its Protocol of 1978, and its Annexes I (oil), II (bulk chemicals), III (packages), IV (sewage), V (garbage) and VI (air pollution).
 - ²² Other European Special Areas are the Baltic Sea and the North Sea

Ship Recycling

It is no doubt that some ships have been manufactured for more than four decades. The breaking-up and recycling of ships that have reached the end of their economic lives can have serious adverse impacts on the marine environment and on human health among workers in shipyards where ships are recycled. In May 2006, North Sea environment ministers stated that significant progress has been made since the 2002 Bergen Declaration to address the environmental and socio-economic issues concerning ship recycling, within the International Maritime Organization, the International Labour Organization and the Basel Convention.²³ The ministers added that they will contribute actively to the rapid development within IMO of a legally binding instrument to be ready for adoption at the latest by 2009. Whether the claim of these ministers was not ambitious, it is crystal, having regard to the fact that little or nothing have been achieved since the effective date of 2009.

Noise

Noise from shipping, fishing vessels, leisure craft, offshore oil and gas activities, naval activities, dredging, offshore wind farms and other sources is a major cause of disturbance to sensitive species in the marine environment. While protected offshore habitats and conservation areas may be outside shipping lanes and off-limits to fishing, navy firing exercises and seismic surveying, the fact that sound propagates over a range of biologically significant distances, from metres to thousands of kilometres depending on its frequency, means that anthropogenic marine noise is a pervasive form of pollution and needs to be regulated accordingly. Unlike terrestrial noise, however, marine environmental noise is virtually unregulated.

Shipping is the dominant contributor of noise to the marine environment. Noise emanates from the ships' propellers, machinery, the passage of the hull through the water, and the increasing use of sonar and depth sounders. Most shipping has a low frequency range, i.e. less than 1kHz (i.e. 1,000Hz), which coincides with the frequencies used, in particular, by baleen whales (e.g. minke, fin and humpback whales) for communication and other biologically important activities. In general, older vessels produce more noise than newer ones and larger vessels produce more than smaller ones. Noise from a supertanker (at 6.8Hz) has been detected 139-463km away.

²³ See the NSMM 2006.

Such distant shipping noise adds to the constant ambient noise level in the marine environment. There has been a large increase in ambient noise in recent years, particularly in the Northern Hemisphere and this has implications for cetaceans. For example, blue whales have been observed to vary the intensity of their vocalizations in response to varying ambient noise levels.

Collisions with Whales

It is well known that ships sometimes collide with whale but the extent of the problem is unknown as the ships are frequently unaware of a collision. With the advent of faster ships, including high speed ferries, the risk has increased, and as average vessel speeds increase. This problem is likely to get worse except proper environmental impact assessments that take cetaceans into account is carried out before the introduction of any new fast ferry route. Shipping shift to larger and faster ships is also associated with increased lethality to marine mammals and other animals that may be struck by vessels.²⁴ The reported number of vessels striking large whales worldwide has increased 3-fold since the 1970s, as has the number, sizes, and speeds of vessels in the world fleet (Corbett *et al.*, under review). Figure 15 shows the relationship between annual reported North Atlantic right whale strikes and average global ship momentum. North Atlantic right whales (*Eubalaena glacialis*) are critically endangered throughout their range along the eastern coast of North America (NOAA, 2003). The primary risk right whales face within this area, along with several other species of large whales, is being struck by large vessels transiting between ports along the eastern seaboard of the United States.²⁵ Approximately 35% of all right whale deaths documented between 1970 and 1989 have been attributed to ship strikes; while data from the period 1991-1998 attributes 47% of right whale deaths to ship strikes.²⁶

Oil Pollution

Collisions between ships, loss of propulsion leading to collisions with the coast, jetties or other port structures, loss of maneuverability in stormy seas accentuated by climate change, navigational errors leading to groundings on reefs and sandbanks, fire at sea, piracy, passage through war zones and threat of terrorist attack.

²⁴ Vanderlaan, A. S. M., and C. T. Taggart, C.T., 'Vessel Collisions with Whales: The Probability of Lethal Injury Based on Vessel Speed', *Marine Mammal Science*, (2007), 23(1), 144-156.
²⁵ Laist, D. W., *et al.*, 'Collisions between ships and whales', *Marine Mammal Science*, (2001) 17(1), 35-75.
²⁶ *Ibid.*

Oil released into the ecosystem is a major environmental problem associated with the shipping industry. Large spills occur during transportation through tanker accidents and spills during loading and off-loading. Waste water from tank washing, discharge from bilges and engine maintenance are common causes of smaller spills. These are hazardous to human beings and the environment through bio accumulation of toxins through the food chain. In addition, oil pollution degrades coastal habitats, smothering tidal pools and killing marsh grass.²⁷

Shipping is a risky business and accidents don't just involve oil tankers. Apart from the potential loss of crude oil and other hazardous cargoes into the marine environment, ships contain bunkers of fuel oil, with potential for spillage during refilling (bunkering) operations, collisions or other accidents.

Solid Waste

All ships produce solid wastes during voyages. Most of these wastes can be legally disposed at sea, as long as they are released at a distance from the shore. Plastics must be properly incinerated on land. Solid waste from shipping enters the environment when cargo is lost at sea or accidentally released during loading and unloading. 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. Cruise ships typically manage solid waste by a combination of source reduction, waste minimisation, and recycling. However, as much as 75 percent of solid waste is on board, and the ash typically is discharged at sea, although some is landed ashore for disposal or recycling. Marine mammals, fish, sea turtles, and birds can be injured or killed from entanglement with plastics and other solid waste that may be released or disposed off of cruise ships. On average, each cruise ship passenger generates at least two pounds of non-hazardous solid waste per day.²⁸

²⁷ Bellefontaine N, (2010), 'Lecture hand out on Marine Environmental Science', World Maritime University. Malmo, Sweden, p. 19.

²⁸ The Center for Environmental Leadership in Business, "A Shifting Tide, Environmental Challenges and Cruise Industry Responses," p. 14.

With large cruise ships carrying several thousand passengers, the amount of waste generated in a day can be massive. For a large cruise ship, about 8 tons of solid wastes are generated during a one-week cruise.²⁹ It has been estimated that 24 percent of the solid waste generated by vessels worldwide (by weight) comes from cruise ships.³⁰ Most cruise ship garbage is treated on board (incinerated, pulped, or ground up) for discharge overboard. When garbage must be off-loaded,³¹ cruise ships can put a strain on port reception facilities, which are rarely adequate to the task of serving a large passenger vessel.³² All ships produce solid wastes during voyages. Most of these wastes can be legally disposed at sea, as long as they are released at a distance from the shore. Plastics must be properly incinerated on land. Solid waste from shipping enters the environment when cargo is lost at sea or accidentally released during loading and unloading. Recent studies carried on Nigerian coastline showed that certain members of merchant ships screw dumped overboard about 600 cardboards and paper boxes; 500 plastic beer-can holders, 190 plastic bags, ten plastic drums, metal drums, 300 bottles and certain quantities of toxic wastes.³³

²⁹ Blue water Network, "Cruising for Trouble: Stemming the Tide of Cruise Ship Pollution," March 2000, 5. A report prepared for an industry group estimated that a 3,000-person cruise ship generates 1.1 million US gallons (4,200 m³) of graywater during a seven-day cruise. Kim, D.K., 'Cruise Ship Waste Dispersion Analysis Report on the Analysis of Graywater Discharge', presented to the International Council of Cruise Lines, September 14, 2000.

³⁰ National Research Council, Committee on Shipboard Wastes, Clean Ships, Clean Ports, Clean Oceans: Controlling Garbage and Plastic Wastes at Sea (National Academy Press, 1995), Table 2-3, 38-39.

³¹ For example, glass and aluminum cannot be incinerated.

³² National Research Council, Committee on Shipboard Wastes, Clean Ships, Clean Ports, Clean Oceans: Controlling Garbage and Plastic Wastes at Sea (National Academy Press, 1995), 126.

³³ Oni S.I, 'Onwards Sustainable Coastal Hazard Management in Nigeria International Conference on Estuaries and Coasts', November 9-11, (2003), Hangzhou, China at page 185. Note that environmental problem due to globalization is the introduction of invasive species [Bright, 1999]. Research has consistently identified shipping (hull fouling, solid and water ballast) as a major invasion pathway since the 1500s when global maritime trade established routine intercontinental waterborne routes. Native species can be transported by ships many thousands of miles and then released into non-native waters. These "non-native species" sometimes have the capacity to become "invasive", i.e., they can reproduce rapidly and tip sensitive species balance that often exists in a given ecosystem. See generally, Corbert J.J and Winebrake J, 'The Impact of Globalisation on International Maritime Transport Activity: Past trends and Future Perspectives', Paper presented at International Transport Forum, 10-12 November, 2008, Guadalajara, Mexico, 22.

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TAXONOMY OF ENVIRONMENTAL IMPACTS

Environmental impacts from ocean shipping are several, and they can be summarised in different contexts. For this overview, environmental impacts of ocean shipping will be categorized as either *episodic* or *routine*. These designations help to explain why some aspects of ocean shipping, such as stack emissions, are so challenging to address. Example environmental impacts under this taxonomy are listed in Table 1. Some pollution related to ocean shipping is not directly from the ships, but from efforts to serve the ocean shipping sector through port infrastructure maintenance and fleet modernization. Episodic pollution discharges are among those best understood by the commercial industry and policy makers, as evidenced by the international conventions and national regulations addressing them. The dominant mitigation approach is to prohibit pollution episodes from occurring (as in ocean dumping), to design systems that are safer (as in double-hulls to prevent oil spills or traffic separation schemes to avoid collisions), to confine activities that produce untreated discharges to safer times or locations (e.g., environmental windows for dredging), to require onboard treatment before discharge (e.g., oily water separators), and/or to provide segregated holding and transfer to reception facilities at port (as in sewage handling).³⁴

Routine pollution releases are different than episodic discharges because they represent activities necessary for the safe operation of the vessel, whether at sea or in port. Regulation of routine releases has lagged policy action to address episodic discharges, partly because these impacts were not as well understood in the past, and partly because operational behavior must change and/or new technology is required.

³⁴ Corbert J.J and Winebrake J, 'The Impact of Globalisation on International Maritime Transport Activity: Past trends and Future Perspectives', Paper presented at International Transport Forum, 10-12 November, 2008, Guadalajara, Mexico.

Table 1: Showing types of ocean shipping pollution

Episodic environmental events	Routine environmental events
Vessel-based	
Oil spills	Engine air emissions
Ocean dumping	Invasive species introductions (ballast water/hull fouling)
Sewage discharges	Hull coating toxics releases
Oily wastewater	Underwater noise
Vessel collisions	
Ship-strikes with marine life	
Port-based	
Dredging	Storm water runoff
Port expansion	Vessel wake erosion
Ship construction, breaking	Cargo-handling air emissions

Source: OECD, Globalisation, Transport and the Environment (2010), p.174.

Impacts of Oil Spill Incidents on Nigerian Maritime Environment

Impact on Human Health

Pollution from ocean-going ships impacts our environment and public health. The same fine particles that can be breathed deep into the lungs adversely affecting human health also cause the haze that pollutes scenic vistas in national parks and wilderness areas and creates "brown clouds" in our urban centers. The constituents of diesel exhaust also contribute to the acid rain that continues to harm sensitive ecosystems. Acid rain occurs when pollutants like SO₂ and NO_x react with water, oxygen, and other chemicals in the atmosphere to form various acidic compounds. The result is a mild solution of sulfuric acid and nitric acid.³⁵ When this acid falls back to the earth, it harms our nation's revered ecosystems—causing acidification of lakes and streams and contributing to the damage of trees, like red spruce trees, at high elevations and many sensitive forest soils.

³⁵ Regulating Greenhouse Gas Emissions Under the Clean Air Act; Proposed Rule (July 30, 2008) 73 Fed. Reg. 44354 at 44466 Ramanathan, V. and G. Carmichael (2008) Global and Regional Climate Changes due to Black Carbon, Nature Geoscience. May be accessed online at: http://www.ramanathan.ucsf.edu/publications/Ram_Carmichael-NatGeol-221.pdf. Lack, Daniel, et al. (2008) Light Absorbing Carbon Emissions from Commercial Shipping, Geophysical Research Letters. L13815 Ramanathan, V. and G. Carmichael (2008) Global and Regional Climate Changes due to BlackCarbon, Nature Geoscience http://www.ramanathan.ucsf.edu/accessed_on_8_August_2014, Lack, Daniel, et al. (2008) Light Absorbing Carbon Emissions from Commercial Shipping, Geophysical Research Letters. L13815 Flanner, M. G., C. S. Zender, J. T. Randerson, and P. J. Rasch (2007), Present-day climate forcing and response from black carbon in snow, J. Geophys. Res., 112, D11202, doi:10.1029/2006JD008003. Lack, Daniel, et al. (2008) Light Absorbing Carbon Emissions from Commercial Shipping, Geophysical Research Letters.

Essentially, inhaling or Concentration of contaminants have been a consumption that in itself products for precautions inhaling vapour getting in skin waterproof one's body principle, beaches—be careful

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Essentially, people's health could be adversely affected by oils either when inhaling or touching oil products, or when eating contaminated sea food. Concentrations of petroleum contaminants in fish and crab tissue, as well as contamination of shellfish, could pose a significant potential for adverse human health effects, and until these products from near shore fisheries or aquaculture have been cleared by the health authorities, they could be banned from human consumption. However, oil-tainted fish and shellfish will usually taste bad, and that in itself will keep people from eating these products. When cleaning up oil products from the water surface or the shoreline, one must always take certain precautions. One needs to wear a face mask or filter mask be protected from inhaling vapours from oils. One also needs to use protective clothing to avoid getting in skin contact with the oil — and protective clothing means oil- and waterproof gloves and oil- and waterproof clothes that cover at least the front of one's body, as well as strong rubber boots. The same safety precautions, in principle, apply to people who risk coming into contact with lingering oil on beaches — one should always avoid touching it, and in an acute phase one should be careful not to inhale vapours from oil slicks.

Also, it is worth of consideration the incident of toxic waste carried into Nigeria by MV Marevia. On 5 January 2013, MV Marevia came into Berth 4 of Tin-Can Island Container Terminal (TICT), Lagos with hazardous materials that are injurious to human health. Investigation revealed that the ship carried expired electronics and electrical equipment. Most of the imported items were used electrical and electronic equipment that that were not functional, the electrical cords of those substances were already cut, the equipment was not well packaged and was only moved to Nigeria for the purpose of dumping. The provision of the Nigerian extant law, specifically, the Human Waste (Special Criminal Provision) Act,³⁶ prohibits the carrying, depositing and dumping of harmful waste on any land or territorial waters or contiguous, exclusive economic zone of Nigeria or its inland waterways.

Impact on Marine Living Resources

Oil can cause a lot of damage to marine life ranging from intoxication, reduced temperature regulation, loss of ability to migrate and death.³⁷ Exposure to oil can also result in non-lethal impacts including liver and eye damage and skin irritations.³⁸ While these effects may not cause immediate death, they can reduce survival rates by compromising an animal's ability to find food and shelter, reproduce and avoid predators.³⁹ Mankind will suffer as the ocean harvests decline; and the world food requirements will soar as the world's population explodes. Shrimp harvests in the Gulf of Mexico have plummeted from fourteen tons per day to a mere two tons per day in the thirty years since offshore drilling operations began. Shellfish beds off Brittany were despoiled by the TORREY CANYON and Amoco Cadiz disasters. If the world is to feed itself at the end of the century, it cannot afford this injury to commercial fish. Although annual fish harvests will have to increase their protein yield by over 100 million metric tons from current levels to satisfy nutritional requirements by the year 2000, the dismal news is that the global harvest has peaked and will decline. If oil pollution from tankers is not controlled, the most immediate effect will be on ocean fisheries, where anchovy and cod will be supplanted by bloodworms and jellyfish, species better adapted for oil-thick waters.⁴⁰

Importantly, the impact of plastic waste cannot be over-emphasised. Although there is little research on the specific impacts of plastic waste on land-based wildlife, there is concern that incorrectly managed landfills could lead to either the escape of plastic waste or the escape of landfill leachate containing the chemicals associated with plastic.⁴¹

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³⁷ Cap H1 LFN 2004.

³⁸ Stanislav, P. (1999). *Environmental Impact of the Oil and Gas Industry*. (New York, EcoMonitor Publishing) 120.

³⁹ Effects of Oil on Marine Life", available at [www.http://na.oceana.org/en/our-work/stop-ocean-pollution/oilpollution/](http://na.oceana.org/en/our-work/stop-ocean-pollution/oilpollution/) accessed on 25 July, 2014.
learn-act/effects-of-oil-on-marine-life

⁴⁰ Ibid.

⁴¹ Dempsey P.S, 'Compliance and Enforcement in International Law—Oil Pollution of the Marine Environment by Ocean Vessel', p. 469.

⁴² Plastic Waste: Ecological and Human Health Impacts, 'In-depth Report' (European Commission, Science for Environmental Policy, 2011)

In addition, unofficial recycling methods, particularly in developing countries, can cause the release of chemicals into the environment, for example, the burning of plastic coated wires to extract metal. UNEP claims that plastic waste causes the death of up to a million seabirds, 100,000 marine mammals and countless fish through various impacts. Although this figure is useful in raising awareness, it is important to remember that it has been derived from the scaling up of smaller samples from a study in Canada.⁴² Probably a more accurate representation is that compiled by Laist,⁴³ which reported that at least 267 different species are known to have suffered from impacts of plastic waste. This includes 86 per cent of all sea turtle species, 44 per cent of all seabird species and 43 per cent of all marine mammal species.⁴⁴ This is likely to be an underestimate as the list was compiled over ten years ago and, even with updating, there are probably a large number of species that have not been studied and therefore impacts are not included. There is a huge amount of literature on ingestion and entanglement and the Figure below lists examples of known impacts on wildlife in terms of entanglement⁴⁵ and ingestion. This list is far from complete, but gives a good indication of impacts.

⁴² UNEP Ecosystems and Biodiversity in Deep Waters and High Seas 'UNEP Regional Seas Reports and Studies No. 178' (UNEP/IUCN, Switzerland 2006).

⁴³ See Laist, D. W., 'Impacts of marine debris: entanglement of marine life in marine debris including a comprehensive list of species with entanglement and ingestion records'. In: Coe, J. M. and Rogers D.B (Eds.), *Marine Debris – Sources, Impacts and Solutions* (Springer-Verlag, New York, 1997) 99-139.

⁴⁴ Ibid.

⁴⁵ Gregory, M.R. 'Environmental Implications of Plastic Debris in Marine Settings – Entanglement, Ingestion, Smothering, Hangers-On, Hitch-Hiking and Alien Invasions' *Philosophical Transactions of the Royal Society B* (2009) 364:2013-2025.

Figure 2: Showing examples of known impacts on wildlife in terms of entanglement and ingestion.

Species group	Total number of species worldwide	Number and % of species with entanglement records	Number and % of species with ingestion records
Sea turtles	7	6 (86%)	6 (86%)
Seabirds	312	51 (16%)	111 (36%)
Penguins	16	6 (38%)	1 (6%)
Grebes	19	2 (10%)	0
Albatrosses, petrels, shearwaters	99	10 (10%)	62 (63%)
Pelicans, boobies, gannets, cormorants, frigatebirds, tropicbirds	51	11 (22%)	8 (16%)
Shorebirds, skuas, gulls, terns, auks	122	22 (18%)	40 (33%)
Other birds	-	5	0
Marine mammals	115	32 (28%)	26 (23%)
Baleen whales	10	6 (60%)	2 (20%)
Toothed whales	65	5 (8%)	21 (32%)
Fur seals and sea lions	14	11 (79%)	1 (7%)
True seals	19	8 (42%)	1 (5%)
Manatees and dugongs	4	1 (25%)	1 (25%)
Sea otter	1	1 (100%)	0
Fish	-	34	33
Crustaceans	-	8	0
Squid	-	0	1
Species total		136	177

Source: Laist, D. W. (1997)

Impact on Maritime Security

One may wonder about the nature of pollution by ships that could be regarded as security threat. The position is that where there is a wanton discharge of oil by a ship, and such discharge is intentional or of high magnitude, it is regarded as maritime security.⁴⁶ The vessel-sourced operational, intentional or accidental discharge arises when pollutants such as oily-water, noxious liquids, sewage, garbage, or contaminated ballast water are released into the marine environment.⁴⁷ In other words, in the maritime law perspective, it is intentional

⁴⁶ Abdulkadir O.A and Abdul Kader, S.Z, 'Vessel-Sourced Pollution: A Security Threat in Malaysian Waters', (2014) 3:1, *Journal of Sustainable Development Law and Policy*, 26.

⁴⁷ Juita Ramli, 'Dumping in Malaysian Seas: An Assessment of the Present Situation vis-à-vis International Legal Regimes' (1998), vol.3 (1), *Asia Pacific Journal of International Law*, 24

damage and/or unintentional but severe pollution that are considered as maritime security.⁴⁸ Therefore, there is a need for adequate legal regulation to decongest marine environment from the threat of avoidable pollution. The threat of pollution resulting from oil spillage in ports will be alarming if there is insufficient legal framework to combat it. Thus, the occurrence of oil spillage might have a catastrophic effect on the public and health security of states where the legal regime is weak.

CONCLUSION

It has been established in this paper that oil can cause a lot of damage to marine life ranging from intoxication, reduced temperature regulation, loss of ability to migrate and death. Exposure to oil can also result in non-lethal impacts including liver and eye damage and skin irritations. It is also stated that ocean-going ships contribute about 1.7% of global black carbon emissions every year. Black carbon refers to the solar-absorbing component of soot, which is released during the combustion process and it is another potent global warming pollutant. Studies show that black carbon triggers snow and ice melting and contributes to Arctic warming. It emphasises that pollution from ocean-going ships impacts our environment and public health. The same fine particles that can be breathed deep into the lungs adversely affecting human health also cause the haze that pollutes scenic vistas in national parks and wilderness areas and creates "brown clouds" in our urban centers. The causes of environmental pollution in maritime sector are also examined. The causes include, air pollution, collision with whales, noise, ship recycling, discharge at sea, oil pollution, solid and waste. Some of these identified causes arise from the combustion of bunker fuel in ships' engines and are emitted to the atmosphere as exhaust gases. In the absence of standardised onshore power supply in ports and harbours, ships burn fuel to generate electricity for lighting, machinery and other onboard needs whilst at berth.