CHAPTER SIX
VESSEL SOURCE MARINE POLLUTION

Globalization has been made possible by the progressive dismantling of barriers to trade and capital mobility, fundamental technological advances, steadily declining costs of transport, communication and computing. Its integrative logic seems inexorable, its momentum irresistible.

Secretary-General of the United Nations,
Mr. Kofi Annan, in 2000

From the Phoenicians, through the Egyptians, the Greeks and the Carthaginians, the Chinese, the Vikings, the Omanis, the Spaniards, the Portuguese, the Italians, the British, the French, the Dutch, the Polynesians and Celts, the history of the world is a history of exploration, conquest and trade by sea.¹ The shipping industry can boast of a glorious and proud history. Maritime powers and maritime trade have played a significant role in the emergence of the great Bronze Age mercantile seafaring empires.²

Shipping activity probably began when a log was used to cross a stream.³ Since then there has been no turning back. The wheel, the sail, the steam engine, and the electric motor are among the technological breakthroughs in transportation that allowed man and his materials to be moved from place to place and from one continent to another.⁴

International shipping is today a highly competitive industry that provides an essential service for the international community through the

⁴ Available at http://www.oceansatlas.com/unatlas/uses/transportation_telecomm /transtell html.
profitable transportation of goods, commodities and passengers. The higher number of stakeholders involved makes it essential to have established and mutually accepted set of laws. Maritime transport has been truly international in character. From earliest times, the development of maritime transport and the establishment of transportation routes have been motivated by trade, conquests, armed conflicts and search for new lands and resources. The introduction of steam-powered engines on board ships and the construction of iron and steel hulls fostered by the industrial revolution changed the maritime transport scenario forever. With this change the ships were not any longer at the mercy of wind and tide. Eventually the dangers associated with seafaring diminished and maritime commerce became more credible.

There is a whole lot of human element involved in this mode of transportation. Since the seafarers are bound by contracts of employment and owners have obligations to provide seaworthy ships. Not only does this cover the physical condition of the vessels but the human element, the manning and qualifications of the crew, navigational outfit, fire protection, life saving capability and watertight integrity. In its normal course of commerce, ships require pilots to assist them to enter and work in ports, interact with stevedores and share facilities; they need services; stores; bunkers and water. The seafarers being visitors are subject to immigration and health controls, which are pretty commonly dissimilar in the various countries they visit. Customs too have a direct interest in ships, their cargo, crew and passengers for duties, contraband and drugs.

Shipping can be said to be the most intensive human use of the world’s seas, being active across all maritime zones and jurisdictional boundaries. Some 50,000 merchant ships sail the world’s oceans, transporting everything from food and fuel to construction materials, chemicals, and household items. In 2003, around 6.1 billion tonnes of cargo was shipped by sea, covering a collective distance of over 6 million kilometres. Shipping is justly the lynchpin of the global economy since in the absence of shipping industry, intercontinental trade, the bulk transport of raw materials and the

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import/export of affordable food and manufactured goods would basically not be possible. This would be a highly unprofitable situation given that the international trade has evolved to the point where almost no nation can be fully self-sufficient.

The international community witnessed a string of repeated maritime disasters which had put a question mark on the safety of this form of transport and shipping risked acquiring a bad repute. It was soon realised that only an agreement among States, which categorically lays down minimum standards to be met by a particular ship while performing a particular service, could offer an adequately lasting solution. The sinking of the Titanic on 14 April 1912 after colliding with an iceberg acted as the catalyst for the adoption in 1914 of the first International Convention for the Safety of Life at Sea (SOLAS). The convention introduced new international requirements in connection with safety of navigation for all merchant ships; the provision of watertight and fire-resistant bulkheads; life-saving appliances; and fire prevention and fire fighting appliances on passenger ships.

Whosoever commands the sea commands the trade; whosoever commands the trade of the world commands the riches of the world, and consequently the world itself.

-- Sir Walter Raleigh, "Historie of the Worlde" (1616)

Shipping has always provided the only really cost-effective method of bulk transport over any great distance, and the development of shipping and the establishment of a global system of trade have moved forward together,
These days shipping is truly global, multi-national, and gargantuan.

The issue of transportation and the environment is paradoxical in nature. On one hand, transportation activities support increasing mobility demands for passengers and freight and on the other, transport activities have resulted in growing levels of motorization and congestion.

Shipping is divided into three main types: Domestic shipping that takes place exclusively within a single state's Economic Exclusive Zone (EEZ). International shipping occurs from one state's port to a second state's port. Transit shipping that passes through the region without calling into any port. Vessels are categorised as the following: Merchant vessels which include Containers vessels and tankers; Passenger vessels – Ferries and cruise vessels; Military – Naval and coast guard; Yachts and Pleasure Craft and Fishing vessels – domestic and distant water fleet.

The modern global shipping fleet comprises a bewildering array of ship types and sizes, from super tankers to car ferries to bulk carriers to aircraft carriers, container ships and cruise liners, not to mention all types of fishing vessels. Equally bewildering, is the diversity of cargoes that is carried across the globe. It has been realized in the recent times that Shipping has the potential to impact adversely the economic, environmental and socio-cultural values of the global coastal regions. The key impacts vary from the introduction of invasive marine pests via a ship's hull and ballast water; oil and chemical spills, waste disposal; the use of anti-fouling paints by ships; physical damage from groundings; anchorage and air pollution. The lurking threat to the marine as well as the human life in case of collision of ships and smaller vessels is always there to be concerned for. Pollution arising from shipping movements contributes a relatively small fraction of the overall level

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11 Fishing vessels are different in that they follow no set route, as they will go wherever the fish run. As such they will often venture into unfamiliar and at times uncharted waters.
of marine pollution. But the effects of accidental or deliberate discharges can damage a local area environmentally and economically.

6.1 SHIPPI NG POLLUTION: ITS SOURCES AND CONSEQUENCES

Shipping has its role to play as a contributor to marine pollution. In the light of burgeoning trade and global economic interdependence, the ever-increasing volume of vessel traffic on the oceans has resulted in significant marine pollution problems. Shipping has burst onto the global economic landscape as the preeminent means of moving goods wherever they need to go. According to a general information document published online by the International Maritime Organization (IMO), the industry's global governing body responsible for regulating shipping pollution under the Kyoto Protocol, "It is generally accepted that more than 90 per cent of global trade is carried by sea. Throughout the last century the shipping industry has seen a general trend of increases in total trade volume. ... although the growth in seaborne trade was tempered by the Asian financial crisis of the late 1990s, there was a healthy growth in maritime trade since 1993."

Transport activities have an impact on hydrological conditions too. Increased traffic in ocean ports, pollution from ships directly affects marine environment including the coastal areas. In the present times the trade has become increasingly globalized, exerting an ever increasing pressure on the world's oceans and waterways. Demand for shipping services is increasing; marine transport emissions represent the most important segment of water quality inventory of the transportation sector. Massive marine pollution and damage can be attributed to sub-standard ships and poor shipping practices. As the shipping lanes get congested, the level of vessel sourced pollution too heightens. 12

Ships can carry a whole lot more stuff than planes, making them a much more cost-effective means of transporting goods. As a result, while the

aviation industry transports around 40 million tons of freight a year, the shipping industry carries 6 billion tons of it. Some believe a virtuous circle has been created by advances in shipping technology and the explosion in international trade. As more goods get made in poorer countries, there will be more need to transport them to their customer markets around the world. The increase in the global transfer of goods will therefore dictate the levels of ships’ fuel consumption, and therefore their negative impact on the environment as well.

The peculiarity of the threats posed by shipping is that it is not spread out evenly across the oceans; rather it is concentrated in busy shipping lanes and ports. As a direct consequence the natural habitats around ports and near shipping routes are impacted the most along with the higher chances of spills and accidents. Paradoxically, while shipping and port activities are seen by some as a contributor to marine pollution, in other areas shipping is seen as being one of the most environmentally acceptable modes of transport.

As ships get bigger, the pollution, too, is getting worse. The most staggering statistic of all is that just 16 of the world’s largest ships can produce as much lung clogging sulphur pollution as all the world’s cars.\textsuperscript{13} The main effects of marine transport operations on water quality predominantly arise from dredging, waste, ballast waters and oil spills. The environmental impact from shipping is covered firstly as off planned or accidental impacts such as port construction and marine spills and then as the operational impacts which result from normal operations such as ships waste management.\textsuperscript{14}

Shipping was amongst the very first industries to adopt widely implemented international safety standards. Because of its inherently international nature, the safety of shipping is regulated by various United Nations agencies, in particular the International Maritime Organization (IMO)


\textsuperscript{14} http://www.sprep.org/solid_waste/marine.html, accessed on 29.11.11 SPREP -South Pacific Region Environment Programme.
which has developed a comprehensive framework of global maritime safety regulations.\textsuperscript{15}

Pollution of sea emanates from both deliberate as well as accidental discharges by ocean going ships.\textsuperscript{16} Matters as navigational safety, vessel source pollution maritime security faces litany of regulatory rules. Twentieth century has transformed the ports and the state of shipping.\textsuperscript{17}

6.1.1. Causes of Vessel Sourced Pollution:

There have been a number of environmental issues associated with shipping operations which have been influencing the health of marine ecosystems adversely. Shipping effects on the marine environment and the causes of vessel sourced marine pollution can be grouped and studied as under.

(i) Sewage and Garbage

Ships generate a variety of wastewaters as part of normal operations which when discharged into the marine waters brings about unwanted results. The coastal waters and ports are the most affected from the localised effects of the sewage and wastewater discharged from ships although the overall discharge of sewage from vessels is relatively low when compared to both the treated sewage from land based sources. The discharge of raw sewage into the open sea can create an environmental hazard, while in coastal areas sewage can also lead to oxygen depletion accompanied with an obvious visual pollution which is a major problem for countries with large tourist industries.

Waste streams generated by the ships consist of sewage, graywater, hazardous wastes, oily bilge water, ballast water, and solid waste. And if technically put it is known as marine engine effluent mixed with exhaust,

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\textsuperscript{17} http://www.oceana.org/, accessed on 13.09.11.
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"gray" water (used potable water) and "black" water which is confined to sewage wastes and the ballast, bilge water, and deck runoff. These ship generated grey water (e.g. from showers) and black water (e.g. sewage from toilets) contain high levels of biochemical oxygen demand (BOD5), bacteria, and other constituents potentially harmful to marine organisms. Grey water and black water are typically collected and managed separately.18 Garbage from ships can be just as deadly to marine life as oil or chemicals.19

Marine litter poses a vast and growing threat to the marine and coastal environment. It is estimated that about 6.4 million tons of marine litter are disposed in the oceans and seas each year. According to other estimates and calculations, some 8 million items of marine litter are dumped in oceans and seas every day, approximately 5 million of which (solid waste) are thrown overboard or lost from ships. In some areas most of the rubbish found comes from passing ships which find it convenient to throw rubbish overboard rather than dispose of it in ports. Furthermore, it has been estimated that over 13,000 pieces of plastic litter are floating on every square kilometre of ocean today.20

Bilge water also may contain solid wastes and pollutants containing high amounts of oxygen-demanding material, oil and other chemicals. A typical large cruise ship will generate an average of 8 metric tons of oily bilge water for each 24 hours of operation. 21 To maintain ship stability and eliminate potentially hazardous conditions from oil vapors in these areas, the bilge spaces need to be flushed and periodically pumped dry.

Public attention to the environmental impacts of the maritime industry has been especially focused on the cruise industry, in part because its ships are highly visible and in part because of the industries desire to promote a positive image. It represents a relatively small fraction of the entire shipping

industry worldwide. As of January 2008, passenger ships (which include
cruise ships and ferries) composed about 12% of the world shipping fleet.

(ii) Anti-Fouling Pollution (Tributyltin) 22

Fouling is the unwanted growth of biological material, e.g., barnacles,
algae or molluscs, on the water-immersed surface of a vessel. Anti-fouling
systems are used on a ships' hull to deter the build up of organisms such as
molluscs and algae. They are of critical importance in impeding the spread of
marine pests, parasites and diseases, and contribute to fuel consumption
efficiencies and emissions reduction. When vessel hulls are clean and
smooth, i.e., free of fouling, they travel faster through water and consume less
fuel. Fouling can be removed when a vessel is dry-docked, which occurs
every two to five years. Prior to the 1960s vessel hulls were coated with lime
and later with arsenical and mercurial compounds to reduce fouling. During
the 1960s anti-fouling paints were developed using metallic compounds, in
particular the organotin compound tributyltin (TBT). 23 By the 1970s most
ocean vessels had TBT painted on their hulls. 24

(iii) Oil Pollution

Oil is vital to the world economy. Petroleum (L. petroleum, from Greek
πετρέαiov, literally "rock oil") or crude oil is a naturally occurring, flammable
liquid consisting of a complex mixture of hydrocarbons of various molecular
weights, and other organic compounds, that are found in geologic formations
beneath the earth's surface. Petroleum, in one form or another, has been
used since ancient times, and is now important across society, including in
economy, politics and technology.

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22 Tributyltin compounds are a group of compounds containing the (C4H9)3Sn moiety,
such as tributyltin hydride or tributyltin oxide. They are the main active ingredients in
certain biocides used to control a broad spectrum of organisms.
23 For details see, De Mora, S. J. Tributyltin: Case Study of an Environmental Contaminant.
(2009).
24 "Focus on IMO - Anti-fouling systems". International Maritime Organisation.
Oil pollution of the seas had been recognized as a problem in the first half of the 20th century itself and various countries have since then introduced national regulations to control discharges of oil within their territorial waters.25 Millions of barrels of oil are transported every day in tankers, pipelines and trucks. The IMO notes that the world first saw a tanker in the nineteenth century, and the demand for petroleum fuelled tremendous expansion in the cargo capacity of such tanker.26 The rise in importance was mostly due to the invention of the internal combustion engine and the rise in commercial aviation.27

This transportation system has always been the Achilles heel of the oil industry since oil must be transported between its points of production and its points of use.28 Shipping is simply the most efficient way to move large quantities of oil across the oceans. Thus the world’s waterways are used as highways through which more than 6,000 oil tankers transport 1.5 billion tons of crude oil. Recent estimates are that one-third of all oil pollution of the world’s oceans is caused by activities generally characterized as “marine transportation.” Tankers understandably are the single largest contributor of such pollution. Ocean faring ships, through normal operation of their engineering machinery, produce oil waste that mixes with ballast and other liquids in their bilges. To remain seaworthy, ships must occasionally discharge water from their bilges and ballast tanks, and this water is often contaminated with oil and other byproducts of operation. To allow for such discharges without causing pollution, ships are equipped with oil-water separators (OWSs), devices which are intended to parse these mixtures so that a relatively clean discharge is released. The separated oil waste, or

26 See, Prevention of Pollution by Oil, International Maritime Organisation. http://www.imo.org/Environment/mainframe.asp?topic_id=231. Notably, the size of tankers grew almost 85,000 deadweight tons from post-World War II to 1959. Id. Again, the tankers doubled in size from 1959 to the mid-1960s. Id. This drastically increased the amount of crude traversing the oceans.
27 Available at http://oils.gpa.unep.org.
sludge, is captured and typically disposed of through shore side processing or shipboard incineration.

A tarball is a blob of oil which has been weathered after floating in the ocean. Tarballs are an aquatic pollutant in most environments, although they can occur naturally. Their concentration and features have been used to assess the extent of oil spills. Their composition can be used to identify their sources of origin, and tarballs themselves may be dispersed over long distances by deep sea currents.

Oil is not "the only" and not even the "most dangerous" of all marine pollutants but it has the greatest visual impact; "you can see it, taste it and smell it." It spreads rapidly over large areas and it has dramatic and long-lasting environmental and socio-economic consequences. Catastrophic spills involving tankers, such as Exxon Valdez Ericka prestige have attracted public attention to the problem of oil pollution. This priority for action in all main fora involved with ocean affairs at the global, regional, EC and national level. Despite the much overhyped tanker disasters, shipping is currently considered as the safest, cleanest and cheapest mode of transportation.

New safety and environmental standards and advances in technology have considerably reduced the amount of oil spilled intentionally or

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32 The international regime on vessel source pollution has extended considerably to cover new hazardous and noxious substances which include chemicals antifouling paints, sewage, garbage and alien species carried in a ballast waters.


accidentally into the ocean as a result of shipping activities, and today vessel-source pollution accounts for only 12 percent of overall marine pollution.\textsuperscript{35} In shipping, oil pollution arising from incidence of ship grounding and collision has been a major international concern. In recent years, this concern has also included hazardous and noxious substances (HNS), ballast water discharge and antifouling paints.\textsuperscript{36}

**OIL SPILLS**

An oil spill is the release of a liquid petroleum hydrocarbon into the environment due to human activity, and is a form of pollution. The term often refers to marine oil spills, where oil is released into the ocean or coastal waters. The oil may be a variety of materials, including crude oil, refined petroleum products (such as gasoline or diesel fuel) or by-products, ships’ bunkers, oily refuse or oil mixed in waste.\textsuperscript{37} Oil spills can generally be “accidental” spills of either cargo or bunker fuel, which are usually large or, operational oil spills. Operational spills are usually small but repetitive having chronic and localised effects. Operational discharges of oil into the marine environment from ships depend on several factors. These include: type and age of ship; level of maintenance of ship and engines; presence of oil-water separators and other equipment designed to curtail discharges of oil; practice of the LOT (load-on-top) principle; training and vigilance of the crew; level of shipping activity; and presence of adequate reception facilities.\textsuperscript{38}

Operational discharges from ships make up 45% of input of 457,000 tonnes/year (ships), followed by shipping accidents at 36% of the input. Fuel oil sludge from vessels is the major routine operational input (186,000 tonnes/year), or 68% of ship operational inputs. Oil tankers, which are often


\textsuperscript{36} The (2007), GESAMP study ‘Estimates of Oil’ Entering the Marine Environment from Sea-based Activities provides the following estimated average inputs of oil entering the marine environment, in metric tonnes per year, from ships and other sea-based activities; these are based on the most recent 10 year period of data available (1988-97): oil, as defined in MARPOL 73/78, annex I, i.e. oil means petroleum, in any form including crude oil, fuel oil, sludge oil refuse and refined products (other than petrochemicals).

\textsuperscript{37} Available at http://en.wikipedia.org/wiki/Oil_spill.

identified as being major routine polluters, account for 10.3% of ship inputs as tank washings and oil in ballast waters, an operational input. However, tanker and barge accidents are a major input (158,000 tonnes/year). Ship accidents are a major input still, even with the decline of large spills from tankers in recent years.\textsuperscript{39}

There is a long list of oil tankers, offshore oil wells and pipelines that have, over the years, caused large, spectacular, accidental oil spills. Extensive, immediate and long-term damage to coastal and marine habitats and ecosystems, seabirds, mammals, fisheries and people, has been the result invariably. Oil pollution from tankers originates from two principal sources: (1) Various types of tanker accidents, and (2) Normal tanker operations, such as tank cleaning, ballasting, and other operational reasons for periodically discharging oil overboard.

Tanker “operational discharge” has become standard operating practice with tankers and contributes to a large portion of the total of tanker pollution.\textsuperscript{40} As per the U.S. Environmental Protection Agency the Marine Spills are classified into 3 tiers. Major spills that are beyond the capability of one state to respond to or will impact on more than one state and requires international co-operation fall under tier 3. In Tier 2 are those spills that are within the capability of one state to address and impacting only on that state. Lastly Tier 1 deals with minor spills that are within the capability of one facility to address.\textsuperscript{41}

The most common pollution incidents occur during terminal operations when oil is being loaded or discharged - perhaps as many as 92% of oil spills, according to figures published by the International Tanker Owners’ Pollution Federation. A much greater quantity of oil enters the sea as a result of normal tanker operations, usually associated with the cleaning of cargo residues (clingingage) which takes place when the ship is returning from the port of

\textsuperscript{39} Ibid.
\textsuperscript{40} On return voyages, after discharging cargo, tankers usually fill some of their cargo tanks with salt-water ballast to keep the ship at reasonable operating draft. This ballast water, which is consequently mixed with some of the residual cargo oil in the tanks, is usually pumped overboard prior to arriving in a port.
\textsuperscript{41} Available at http://www.epa.gov/oilspill/eduhome.html.
discharge to take on another cargo of oil. Other causes of oil pollution include tank cleaning in connection with dry docking; bilge and fuel oil (from dry cargo ships as well as tankers) and non-tanker accidents.

(iv) Ballast Water

There are two main parts to a ship: the hull and the machinery. The hull is the actual shell of the ship including the superstructure, while the machinery includes not only the engines required to drive it, but also the ancillary equipment serving the electrical installations, winches and refrigerated accommodation.

Vessels are required to occasionally discharge water from their bilges and ballast tanks as a part of their maintenance and operations. The seawater is meant to help stabilize and balance a ship. Therefore when a larger vessel, such as a container ship or an oil tanker unloads cargo, seawater is pumped into compartments in the hull. Similarly, when a larger vessel is being loaded it discharges seawater from these compartments. As the result of this practice it is obvious now that ballast water is taken up in one port and is carried all along the sea route to be released in another port which has a marine environment very different from the point of origin.\(^{42}\)

The two principal environmental concerns typically associated with discharges of ballast water are the potential release of oil or hazardous materials that may be mixed with ballast water, and the transfer of invasive alien aquatic organisms that may be taken up and discharged in ballasting operations. This is considered one of the most significant threats to marine ecosystems globally.\(^{43}\) Ballast discharges from ships are responsible for tar balls in the open oceans and seas, and can cause problems navigating tanker routes. Nevertheless, the discharge of ballast water only accounts for a small percentage of oil pollution in the marine environment.

\(^{42}\) The world’s merchant fleet is known to transport on a daily basis between 3,000 and 7,000 tons (about 10,000 tons per year) of different types of ballast water. On average, 30% of merchant vessels’ dead weight is ballast water; in an oil tanker that percentage represents some 140,000 tons of ballast water and in a freighter, some 20,000 tons. This can result in serious damage to the local flora and fauna, as well as other effects to marine-related business that, in some cases can be extremely costly.

\(^{43}\) Available at http://globallast.imo.org/.
The role of ships’ ballast water in spreading unwanted species was first addressed jointly by the WHO and IMO in the early 1970s, when the concern was the spread of epidemic disease bacteria. Just as the ships speed increased, so did the survival rate of species carried in ballast tanks. The world shrunk, through growing travel and transport and marine species ended up, frequently, breeding and thriving, far from their original habitats. The shipping industry is principally responsible for transporting goods internationally, overseeing the trans-shipment of an estimated 80 percent of the world’s commodities (IMO 2006a). Shipping vessels transport approximately 10 billion tons of ballast water globally per year (IMO 1999). When it is taken up, ballast water may contain a variety of plant and animal life, some of which will survive the voyage. When this water is dumped into the sea, some these species (including pathogens) may be introduced in a new ecosystem. This traffic increases the potential for the accidental transfer of unwanted species; an estimated 3,000 species are transferred to new environments each day in ballast water (IMO 1999).

(v) Chemicals: Hazardous and Noxious Substance

Chemical substances form an essential part of our everyday environment. They can be naturally occurring, like trace metals in the Earth’s crust, formed as unintended by-product of natural and human-induced processes, or synthesised specifically for use in various industrial process and consumer products. Hazardous substances are found in sea water, sediments and marine organisms. It is a term used to describe a substance other than oil which, if introduced into the marine environment is likely to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea. In marine areas near heavily populated and industrialised areas, concentrations have been measured in sediment and organisms which are at levels that pose a risk to marine life and to humans consuming seafood.

Whether a substance is classed as hazardous or noxious is largely determined by its inclusion in one or more lists found in a number of IMO Conventions and Codes designed to ensure maritime safety and prevention of pollution. If the chemical transported has one or more of the following...
properties, it is likely to be considered as a ‘hazardous and noxious substance’. These properties are Flammable, Explosive, Toxic, Corrosive and Reactive.

(vi) Air Emissions:

James Corbett, of the University of Delaware, is an authority on ship emissions. He calculates a worldwide death toll from respiratory problems to about 64,000 a year, of which 27,000 are in Europe. Corbett predicts the global figure will rise to 87,000 deaths a year by 2012.

Over 90 percent of world trade is carried across the world’s oceans by some 90,000 marine vessels. Like all modes of transportation running on fossil fuels, ships too produce carbon dioxide emissions and are significant contributor to the global climate change and ocean acidification. Ships and support operations in ports account for considerable air emissions from engine combustion, cargo transfer and fueling operations, among other sources. More than three percent of global carbon dioxide emissions can be attributed to ocean-going ships.

Ships emit various global warming pollutants, including carbon dioxide (CO2), black carbon (BC), nitrogen oxides (NOx) and nitrous oxide (N2O). The International Maritime Organization (IMO) calculated that ocean-going vessels released 1.12 billion metric tons of carbon dioxide in 2007. This is equivalent to the annual greenhouse gas emissions from over 205 million cars, or more cars than were registered in the entire United States in 2006 (135 million). Shipping is responsible for over three percent of global anthropogenic carbon dioxide emissions, and is growing. Over the last three

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44 Radioactive and infectious substances are outside the scope of the HNS regime.
47 Ibid.
48 Available at http://www.usctcgateway.net with data from EPA Inventory.
decades, the shipping industry has grown by an average of five percent per year.\textsuperscript{50}

vii) Shipping Noise

The marine environment contains many natural sources of noise (\textit{e.g.}, surf, wind, earthquakes, biological activity) which the marine animals have apparently evolved to accommodate over the many millions of years of their existence in the marine environment. Most marine animals, particularly marine mammals and fish, are very sensitive to sound, using sound for almost all important aspects of their life including reproduction, feeding, avoiding hazards like predators, and navigation.\textsuperscript{51}

Anthropogenic (human generated) sound in the ocean which has grown notably in recent years can be attributed to the use of various frequency sonar technologies by navies and for oil and gas exploration and as a byproduct of increased vessel traffic, including noise associated with the growing number, size and routes of marine vessels (cargo ships, cruise ships, jet skis, etc.). In addition other sources of human induced ocean noise include the use of explosives, oceanographic experiments, geophysical research, underwater construction, ship traffic, military active sonar, and air guns used for oil and gas exploration, as well as oil drilling and shipping activities. Over 90 percent of world trade is transported by ship, effectively producing an ever-present and rising aural “fog” that masks crucial natural sounds and is the most pervasive source of ocean noise today.\textsuperscript{52}

6.1.2. Consequences of Vessel Sourced Pollution

Raw untreated sewage, or Blackwater being wastewater from toilets and medical facilities, can contain harmful bacteria, pathogens, diseases, viruses, intestinal parasites, and harmful nutrients. Untreated or inadequately


treated sewage discharges can cause bacterial and viral contamination of fisheries and shellfish beds, producing risks to public health. Nutrients in sewage, such as nitrogen and phosphorous, promote excessive algal growth, which consumes oxygen in the water and can lead to fish kills and destruction of other aquatic life. A large cruise ship (3,000 passengers and crew) generates an estimated 15,000 to 30,000 gallons per day of blackwater waste. It is a perfect example of a substance that is definitely biodegradable, but still extremely toxic.

Graywater is wastewater from the sinks, showers, galleys, laundry, and cleaning activities aboard a ship. It can contain a variety of pollutant substances, including fecal coliform bacteria, detergents, oil and grease, metals, organics, petroleum hydrocarbons, nutrients, food waste, and medical and dental waste. All soaps and detergents, whether "natural" or otherwise, contain surface-active agents, or surfactants, which create the suds or foam. Discharged in grey water, these surfactants plug the gills of fish, literally suffocating them.

Sampling done by Environment Protection Agency and the state of Alaska found that untreated graywater from cruise ships can contain pollutants at variable strengths and that it can contain levels of fecal coliform bacteria several times greater than is typically found in untreated domestic wastewater. It may contain phosphate, an increase of which in the water may cause excessive algae growth. As the algae decompose, they rob the water of oxygen, damaging fish and other wildlife. Graywater has potential to cause adverse environmental effects because of concentrations of nutrients and other oxygen-demanding materials, in particular. Graywater is typically the largest source of liquid waste generated by cruise ships (90%-95% of the total). Estimates of graywater range from 30 to 85 gallons per day per person, or 90,000 to 255,000 gallons per day for a 3,000-person cruise ship. Solid

53 Pathogens in sewage can cause such illnesses as diarrhoea, dysentery, and hepatitis in humans. Filter feeders such as clams, oysters and mussels concentrate these disease-causing organisms; as a result, thousands of hectares of shellfish beds have to be closed every year.


55 EPA Draft Discharge Assessment Report, p. 3-5 - 3-6.
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 it can then pose a threat to marine organisms, humans, coastal communities, and industries that utilize marine waters.\textsuperscript{56} Sewage has been known to lead to deterioration of water quality, alter faunal and floral assemblages near large ocean outfalls, and has been responsible for disease outbreaks attributed to faecal coliforms.\textsuperscript{57}

The final major source of marine litter is the shipping industry, which contributes items such as oil drums, strapping bands and crates to our oceans.\textsuperscript{58} For centuries seafarers threw their garbage over the side, probably with little harm done to the environment. The waste products of earlier days were mostly natural materials, biodegradable, and food for the creatures of the ocean. By contrast, modern packaging products use materials which persist in the marine environment and therefore require special processing on board a ship before disposal. There is a sinister twist to all this as well. The plastics can act as a sort of "chemical sponge".\textsuperscript{59} They can concentrate many of the most damaging of the pollutants found in the world's oceans: the persistent organic pollutants (POPs). So any animal eating these pieces of plastic debris will also be taking in highly toxic pollutants. Not all plastic floats. In fact around 70 percent of discarded plastic sinks to the bottom.\textsuperscript{60} In the North Sea, Dutch scientists have counted around 110 pieces of litter for every square kilometre of the seabed, a staggering 600,000 tonnes in the North Sea alone. These plastics can smother the sea bottom and kill the marine life which is found there.\textsuperscript{61}

\textsuperscript{56} http://www.sciencedirect.com/science, accessed on 12.05.10.
\textsuperscript{60} Sally Ann Lentz, (1987), 'Plastics in the Marine Environment: Legal Approaches for International Action' 18 Marine Pollution Bulletin 361.
\textsuperscript{61} Available at http://www.greenpeace.org/international/en/campaigns/oceans/pollution/trash-vortex.
Oil spills into the rivers, bays, and the ocean are caused by accidents involving tankers, barges, pipelines, refineries, and storage facilities. Impacts of oil spills on marine habitats in general include physical disturbance, toxic exposure to sensitive species and organic enrichment of the sediments. Oil spills can seriously affect fisheries and shell fisheries either by a toxic effect or by tainting the marketable fish.

The fate of petroleum in marine ecosystems has been intensively studied.\(^{62}\) Crude oil and petroleum distillate products introduced to the marine environment are immediately subject to a variety of physical and chemical, as well as biological, changes. The natural tendency for the oil will be to spread, break up and get dissipated over time. This dissipation is a result of a number of chemical and physical processes acting on the spilt oil. These processes are collectively referred to as weathering. Oil floats on salt water (the ocean) and usually spreads out rapidly across the water surface to form a thin layer that is known as an oil slick. As the spreading process continues, the layer becomes thinner and thinner, finally becoming a very thin layer called a sheen, which often looks like a rainbow. Depending on just where and when a spill happens, from just a few up to hundreds or thousands of birds and mammals can be killed or injured.\(^{63}\) Persistent oils are oils which do not evaporate readily and include crude oil, fuel oil, heavy diesel oil and lubricating oil. Oil on being introduced to the marine environment, has the tendency to associate with suspended particulate matter, then the volatile components evaporate off, leaving the non-volatile components to settle on the sediment. The remaining emulsion which contains water and oil mixture is not likely to be lost from the system and will settle to the sediment. While being toxic to marine life, polycyclic aromatic hydrocarbons (PAHs), the components in crude oil, are very difficult to clean up, and last for years in the sediment and marine environment.\(^{64}\)

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63 http://response.restoration.noaa.gov accessed on 23.11.10.

The ecological harm can vary in degrees, ranging from being catastrophic, having largely acute lethal effects on invertebrates, fish and wildlife, to having long term or chronic sub-lethal and cumulative effects. The latter remain a concern, especially in relation to continuous discharges of oil from ships onto water surfaces, with lethal and sub-lethal effects on long-lived, slow-breeding wildlife such as seabirds.65

Oil spills tend to have grave effects on marine life as the marine ecosystem is highly complex and natural fluctuations in species composition, abundance and distribution are a basic feature of its normal function. Large oil spills have the potential for serious damage to the marine environment including corals, mangroves, shorelines, dugongs, turtles and seabirds.66 The effects of oil spills can be far-reaching, from environmental as well as socio-economic perspectives. Marine and coastal habitats, wildlife species, recreational activities, local industry, and fisheries, are among the resources and sectors that can be negatively affected by oil spills.67

Damage from oil can be extensive and catastrophic, affecting several hundred kilometers of the shoreline. Recreational activities, local industry, fisheries, and marine life are among the resources that can be adversely affected by oil spills.68

The typical environmental impacts range across a wide spectrum from toxicity (especially for light oils and products) to smothering (heavier oils and weathered residues). The presence of toxic components does not always cause mortality, but may induce temporary effects like narcosis and tainting of tissues, which usually subside over time.

68 As in the case of the supertanker Amoco Cadiz spill. Entire communities have been impacted or even eliminated.
Seabirds are amongst the most vulnerable inhabitants of open waters since they are easily harmed by floating oil. The oil penetrates up the structure of the plumage of birds, reducing its insulating ability, and so making the birds more vulnerable to temperature fluctuations and much less buoyant in the water. It also impairs birds' flight abilities to forage and escape from predators. As they attempt to preen, birds typically ingest oil that covers their feathers, leading to lethal consequences like kidney damage, altered liver function, and digestive tract irritation. This and the limited foraging ability quickly cause dehydration and metabolic imbalances. The most common cause of death is from drowning, starvation and loss of body heat following fouling of plumage by oil. Hormonal balance alteration including changes in luteinizing protein can also result in some birds exposed to petroleum. ⁶⁹ Most birds affected by an oil spill face the risk of fatality unless there is timely human intervention⁷⁰

Marine mammals exposed to oil spills are affected in similar ways as seabirds.⁷¹ The oil floating on top of water limits the amount of the light that penetrates into the water, restraining the photosynthesis of marine plants and phytoplankton. Further it decreases the fauna populations, affects the food chain in the ecosystem. Some oils are more toxic to marine life than others. When oil is suspended in solutions such as in the early stages of an oil spill, it may result in impacts to larvae and less mobile organisms, in terms of feeding and reproductive cycles. ⁷² Heavy wave action brings on dispersal of large volumes of oil close inshore which further leads to the perishing of marine species such as shellfish. The maximum onslaught is experienced by the shorelines since this is where the oil naturally tends to accumulate because of

⁷¹ Oil coats the fur of Sea otters and seals, reducing its insulation abilities and leading to body temperature fluctuations and hypothermia. Ingestion of the oil causes dehydration and impaired digestions.
⁷² Therefore, oil spills during coral spawning have the potential to cause immediate and long lasting effects within that area. Wave action or dispersant chemicals which when used inappropriately cause spill damage in shallow waters as the oil gets mixed into the sea.
the wave action. The overall functioning and productivity of these shores seems unimpaired. The gravity and magnitude of the damage in spill effects is to be judged by its aftereffects on the breeding success, productivity, diversity and the overall functioning of the marine ecosystem.

There are considerable difficulties in evaluating the potential costs associated with pollution incidents arising from oil spills as there is a poor correlation between the types of spills, quantity and clean-up costs. Nevertheless, a large spill affecting the coastline, can involve significant costs, including the costs of the lost vessel and cargo, clean-up costs, fines and compensation for loss or damage caused to third parties as a result of a spill.

Aerial reconnaissance which is an essential element of effective response to marine oil spills is used for assessing the location and extent of oil contamination and verifying predictions of the movement and fate of oil slicks at sea. Over a period of time the spilt oil biodegrades into simple compounds such as carbon dioxide, water and biomass. Bioremediation is the term used to describe a range of processes which can be used to accelerate natural biodegradation. More specifically biostimulation is the application of nutrients, and bioaugmentation or seeding is the addition of microbes specially selected to degrade oil.

Spills of chemicals and other Hazardous and Noxious Substances (HNS) too pose a threat to the marine environment. The behaviour and fate of spilled HNS depends on its chemical and physical properties. The potential impacts arising from a chemical spill are varied and depend on the toxicity and the quantity of chemicals involved, how the materials are packaged and transported, relative toxicity, quantity spilled, site and ecological sensitivity. The affect of the HNS spill impact depends upon the prevalent local

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73 The Torrey Canyon oil spill in 1967 is a case in point. Heavy and inappropriate use of toxic cleaning agents caused massive damage to some shores, and although recolonisation by most of the dominant organisms was rapid, subtle differences in the distribution of species could be traced over more than twenty years when compared with un-oiled sites.
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conditions which can produce variations. The aftereffect may be diluted by water movement arising from tidal flow, ocean currents and turbulent diffusion. Sub-lethal concentrations, incase the concentration is below what would be considered lethal, can still lead to longer term impacts. The overall ability of the organism to reproduce, grow, feed or otherwise function normally is stalled by the stress induced by the chemical spilt. The characteristics of some chemicals, particularly metals and some organic compounds can result in the bio-accumulation of these materials in the marine environment.

Sessile marine organisms that filter seawater for food, such as shellfish, are particularly vulnerable to this phenomenon. Bio-magnification may follow if the materials pass up the food chain. GESAMP has published a Hazard Evaluation of Substances Transported by Ships for the most commonly transported chemicals. The chemical properties of the substances in the eventuality of a spilt at sea are evaluated in relation to a number of predefined effects. These effects include HNS’s tendency to bioaccumulate or biodegrade; acute and chronic toxicity on marine organisms; its long term health effects on humans; its effect on marine wildlife, on benthic habitats and on other marine resources. When chemicals are spilt, they act in one of the five typical characteristic ways. To enumerate it can dissolve, evaporate, float, gas or sink.

It is important to understand the main physical and chemical properties and consequently the behaviour of a spilt substance, to ensure safety of human health and marine resources as well as to consider the most effective response. The ‘fate’ of a substance in marine surroundings is determined by the properties of volatility, solubility and density and in turn, the nature of the hazard presented by the substance (toxicity, flammability, reactivity, explosive, corrosive, etc). The world’s oceans can be divided into two zones: coastal and open. In the Indian Ocean there are increasing risks of pollution

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77 Bioaccumulation refers to the build up of a substance within a living organism, or certain tissues of a living organism, due to the rate of uptake of that substance being greater than the rate of elimination by metabolic transfer or excretion. The term tends to be associated with certain lipid-soluble organic chemicals that are not readily metabolised by living organisms such as pesticides (e.g. DDT) and organometallic compounds such as methyl mercury and tetra-ethyl lead (TEL).

78 http://www.hnsconvention.org, accessed on 17.05.11.
from oil spills because this is the main transportation route for oil from the Middle East to Europe and America, with an estimated 470 million tonnes transported annually.

The International Maritime Organization (IMO), a specialized United Nations agency entrusted with decreasing ship pollution and improving maritime safety (IMO 2006b), contends that the introduction of invasive species is one of the greatest threats to Earth's oceans.\(^79\) The introduction of non-native species via the discharge of ballast water is well documented.\(^80\) The shipping industry and the ballast water of its vessels unmistakably play a crucial role in the conservation or destruction of global ecosystems.

When a ship takes in water as ballast at ports, there the water is shallow and is proliferate with marine species, particularly larvae and eggs. When the ballast water is discharged, these species have the potential to become invasive species in their new environment, although decades may pass before they expand and become invasive. Alien invasive species are known to have catastrophic effects,\(^81\) threatening biodiversity and causing economic harm. Invasive species thrive in their new environment, competing with the habitat's naturally-occurring species, and may replace keystone species or potentially cause the decline or extinction of one or more indigenous species, severely disrupting the ecosystem. “On land and in the sea, invasive species are responsible for about 137 billion dollars in lost revenue and management costs in the U.S. each year.”\(^82\)

European zebra mussels have done damage worth many millions of dollars in the Great Lakes of North America, the European green crab has

\(^79\) Alongside marine pollution, overexploitation of marine resources and the physical alteration/destruction of marine habitats (IMO 2006a).


\(^81\) Alien species are not necessarily harmful; intentionally introduced non-indigenous species have proven to be beneficial to the world's agricultural and livestock industries. Crops such as potatoes, wheat, rye, rice, corn, soybeans and peanuts were spread throughout the world to feed its growing population.

had a similarly costly impact in Latin America and the United States, and so has the North Pacific seastar from Japan in Australia. One of the worst cases of a single invasive species causing harm to an ecosystem can be attributed to a seemingly harmless jellyfish.\textsuperscript{83} The effects of a jellyfish invasion on the Black Sea is one of the best documented examples of the far reaching—almost catastrophic—economic and ecological consequences that can follow the introduction of an alien species into an environment favouring its almost unlimited expansion. It was first introduced in 1982, and thought to have been transported to the Black Sea in a ship’s ballast water. The result was that the population of the jellyfish shot up exponentially and, by 1988, it wreaked havoc upon the local fishing industry. “The anchovy catch fell from 204,000 tons in 1984 to 200 tons in 1993; sprat from 24,600 tons in 1984 to 12,000 tons in 1993; horse mackerel from 4,000 tons in 1984 to zero in 1993.”\textsuperscript{84} The introduction of and invasion of new territory by alien species threatens the integrity of aquatic ecosystems in all parts of the world. With regard to biodiversity, introduced species occasionally become the dominant life-forms in an ecosystem and can lead to homogenization of the biota.\textsuperscript{85}

Furthermore, ballast and bilge discharge from ships can spread human pathogens and other harmful diseases and toxins potentially causing health issues for humans and marine life alike. Toxins can be accumulated by marine plants, animals, and microorganisms causing alterations such as changes in growth, disruption of hormone cycles, birth defects, suppression of the immune system, and disorders resulting in cancer, tumors, and genetic abnormalities or even death by Paralytic shellfish poisoning (PSP). Sources of

\textsuperscript{83} Mnemiopsis leidyi, a species of comb jellyfish that inhabits estuaries from the United States to the Valdés peninsula in Argentina along the Atlantic coast, caused notable damage in the Black Sea. Mnemiopsis leidyi, a comb jellyfish, originates on the Eastern seabords of both North and South America.

\textsuperscript{84} Meinesz, A. (2003), Deep Sea Invasion. \textit{The Impact of Invasive Species}. PBS: NOVA. http://www.pbs.org/wgibh/nova/algae/impact.html, accessed on 12.09.11. Hermaphroditic and self-fertilising, the numbers of jellyfish exploded from 1988 onwards. The populations of plankton crashed as the invaders ate them. Fish stocks collapsed, partly because the jellyfish deprived them of their food and ate their eggs and larvae. The catch of the former USSR states plummeted from 250,000 tonnes to 30,000 tonnes a year, and it was much the same story in Turkey. At least $300 million was lost in falling fishery revenues between the mid 1980s and the early 1990s, with grave economic and social consequences.

seafood can become contaminated and unhealthy for consumption. Not surprisingly, cholera outbreaks have been attributed to ship operations. "Current research indicates that the bacterium responsible for causing cholera, Vibrio cholerae can spread through attachment to marine organisms in ship ballast water." 

They are hard to control. Greater commerce in sea life is bound to make introductions of alien species even more common. It usually takes a long time often decades before an introduced species has multiplied enough to manifest its presence and effects. And, with present technology, control measures are insufficient and haphazard, even when implemented.

Carbon dioxide emissions from shipping is currently estimated at 4 to 5% of the global total, and estimated by the International Maritime Organisation (IMO) to rise by up to 72% by 2020 if no action is taken. Marine vessel emissions are a global issue, and should be addressed from a global perspective. Although shipping may be a more efficient mode of transport than planes or trucks, it is indisputably a major source of carbon dioxide and other greenhouse gases. Ships produce carbon dioxide emissions that significantly contribute to global climate change and ocean acidification. Besides carbon dioxide, ships also release a handful of other pollutants that also contribute to the problem. To make matters worse, these ships also burn the dirtiest fuel on the market (the bunker fuel), a fuel that is so unrefined that it can be solid enough to be walked across at room temperature.

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86 The vibrio bacterium causing Cholera is also known to be transported in ballast tanks and represents a human health hazard.
88 http://www.guardian.co.uk/environment/2007/mar/03/travelsenvironmentalimpact transportintheuk, accessed on 10.03.11.
GESAMP's 1990 assessment attributed, on a global basis, 33 percent of marine pollution to atmospheric sources. Ships contribute a significant amount of carbon dioxide to the atmosphere. The International Maritime Organization (IMO) calculated that ocean-going vessels released 1.12 billion metric tons of carbon dioxide in 2007. This is equivalent to the annual greenhouse gas emissions from over 205 million cars, or more than the emissions from the number of cars that were registered in the entire United States in 2006 (135 million). Shipping is responsible for over three percent of global anthropogenic carbon dioxide emissions, and is growing. Over the last three decades, the shipping industry has grown by an average of five percent per year. The IMO predicts that without introducing measures to reduce emissions from shipping, carbon dioxide emissions from the industry could rise to 1.48 billion metric tons by 2020, equivalent to putting 65 million new cars on the road. CO2 is also starting to be a cause for concern. Increased speeds and high performance engines increase the emission of not only of CO2 but also Sox and Nox. Sox, Nox, from engine emissions and CFC's egg Halons and VOCs are all regarded as contributing to atmospheric pollution leading to global warming, poor air quality and acid rain.

The biocides in antifouling coatings e.g. TBT, copper and Triazines, in some antifouling coatings can leach into the surrounding water and accumulate in bottom living organisms and sediments. These biocides, by

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90 Sub-Committee on Bulk Liquids and Gases (2007), Review of MARPOL Annex VI and the NOx Technical Code: Report on the outcome of the Informal Cross Government/Industry Scientific Group of Experts established to evaluate the effects of the different fuel options proposed under the revision of MARPOL Annex VI, IMO.
91 Calculated at http://www.usctcgateway.net with data from EPA Inventory, accessed on 02.10.11.
95 Ibid.
96 Calculated at http://www.usctcgateway.net with data from EPA Inventory, accessed on 04.07.11.
97 Sox imputes are related to fuel quality in terms of the sulphur content of the bunker fuel, while NOX emissions are related to the age, and service condition of the ships engines.
their nature, are harmful to a range of marine organisms. The nature of the toxicity is chronic and can affect such functions as morphology, growth and reproduction of a range of marine species. Some anti-fouling paints can be harmful to the marine environment and are toxic to some marine species, particularly those containing organotin-based biocides such as tributyltin (TBT). While anti-fouling TBT paints have been found to be effective in killing sealife attached to vessel hulls, they have also killed and caused genetic alterations in other marine life, e.g., shell deformations in oysters. TBT contaminated sediments affects metamorphosis and recruitment in larvae of hard scleractinian corals. Also highly toxic to octocorals, cnidarians, molluscs, bryozoans and echinoderms which are all part of the coral reef ecosystem.

The IMO ban on TBT based paints was made effective from January 2003 which affected the world’s merchant fleet. TBT is the most toxic substance ever deliberately introduced into the marine environment. It persists in the marine environment. High concentrations of TBT have been found in the world’s coastal waters, especially in ports and harbors where the number of boats and vessels are concentrated.

Noise pollution caused by shipping and other human enterprises has increased in recent history. Marine animals use sound to navigate, find food, locate mates, avoid predators and communicate. Introduction of concentrated sounds in their surroundings interferes with these activities and results in serious consequences. The deleterious effects of ocean noise includes damaged hearing

- Reduced catch rates of 40-80 percent and fewer fish near seismic surveys reported for cod, haddock, rockfish, herring, sand eel and blue whiting
- Disruption in schooling structure, swimming behaviour, and, possibly, migration in bluefin tuna
- Secretion of stress hormones in several fish species in the presence of shipping noise
- Alteration of gene expression in the brain of codfish following air gun exposure
- A significant increase in heart rate in embryonic clownfish with exposure to noise
- Negative impacts on sand eels from airguns
- Avoidance behaviour in capelin and eels when exposed to noise.

98 In the 1970s TBT contamination was linked to the high mortality of oyster larvae in the Arcachon Bay on the west coast of France. In the 1980s in south-west England, TBT poisoning was linked to the decline of the dog whelk.
100 The deleterious effects of ocean noise includes damaged hearing
prevents marine animals from hearing their prey or predators, from finding their way, or connecting with mates, group members, or their young ones.

Noise has deafened fish, produced dramatically reduced catch rates, caused stress responses, and interfered with fish communication, schooling, and possibly the selection of suitable habitat.¹⁰¹ Whales are found to have moved from their feeding and breeding grounds, shown stress, and foraged less efficiently due to noise. Whales have been found to die within hours, by stranding or deaths at sea, from even a transient and relatively brief exposure to moderate levels of mid-frequency military sonar.¹⁰² Noise has been thought to contribute to several whale species’ population declines or lack of recovery. Many (at least 55) marine species have been shown to be impacted by ocean noise pollution to some degree. Thus, marine biodiversity is likely to be compromised by undersea anthropogenic noise.

6.2. REGULATIONS

The seas are used for many purposes, which include exploration, fishing, fish farming and leisure activities. The littoral is also used for economic activities such as tourism and can also contain sensitive ecological habitats. The need is to satisfy the needs of society for cheap efficient transport with the demands for safety and environmental protection. The answer of course lies in the complex regulatory mechanisms, which have evolved over centuries.

When crossing the oceans, ships move from one maritime zone and jurisdictional regime to another. Effective control of vessel-source pollution necessarily assumes international cooperation, coordination and regulation. As such, it is part of the Law of the Sea which constitutes a traditional field of Public International Law.¹⁰³

The legal concept of the “freedom of the oceans” had been formulated as early as the 17th Century. In the great debate between Grotius and Selden, Grotius advocated the free use of the oceans and proclaimed that the seas were infinite and thus open to unlimited common use by the world’s inhabitants. Selden however, called for the seas to be divided and regulated by independent nations. Ultimately, Grotius’ views prevailed, forming the genesis of the concept of free navigation for centuries to come.104

The chief international treaty-making bodies making provisions which regulate merchant shipping are: The International Maritime Organization (IMO); The International Labour Organization (ILO); The World Health Organization (WHO); and The International Telecommunications Union (ITU).

At the macro level, the United Nations Convention on the Law of the Sea (UNCLOS) governs pollution from international shipping.105 UNCLOS, described as the “constitution of the oceans,” establishes some jurisdictional backdrops for enforcement of marine pollution laws detailed regulatory framework, specifically enforceable amongst the signatory States” to other instruments.106 The most important of these devices are the 1973 International Convention for the Prevention of Pollution from Ships and the Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships (together MARPOL).107

International conventions and the institutional processes they establish are a means to an end. They embody common perceptions of problems and how to deal with them. They afford a platform for regular review to ensure honesty in the process and to adjust and update agreed measures in response to new scientific findings, technological developments, and other changing circumstances. By virtue of clearly-defined objectives, they both

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stimulate, and serve as an organizing framework for, a wide range of disperse initiatives. The existing environmental conventions started from a cautious orientation protective of sovereign rights. Gradually they have grown to embrace a more forward-looking approach to national rights and duties; they increasingly reflect a common but differentiated responsibility and recognize that using natural resources sustainably and preserving the benefits and functions of ecological systems are essential for human wellbeing.

More than ninety-five percent of the world’s shipping tonnage is moved by ships sailing under the flags of MARPOL signatory states.

(a) Jurisdiction in Vessel Source Pollution

Jurisdiction may be defined as the power of a State to affect under international law the conduct of others, by measures of regulation, adjudication or enforcement. “Coastal jurisdiction” suggests one of the key elements in the Law of the Sea, directly applicable to vessel-source pollution. In general, it refers to three sets of jurisdiction: regulatory jurisdiction, enforcement jurisdiction and judicial jurisdiction. A vessel needs to be associated with a State, since a ship by itself is no international legal subject. The ship shall always carry a flag of a State which commonly is the flag of the State where the ship is registered.\(^{108}\) The flag State is presumed more suitable to exercise jurisdiction over the ship. There exists a factual link between the ship and the State in which it is registered. Jurisdiction of each state extends to vessels and aircraft registered in its territory, flying its flag, or loading matter to be dumped within that state’s territory or its territorial seas; it also applies to vessels and platforms under the jurisdiction of a member party believed to be engaged in acts of dumping at sea.

In keeping with the traditional international law, it is the responsibility of the flag state to ensure compliance by its vessels with applicable international rules and standards.\(^{109}\) The LOS Convention stipulates the circumstances in which coastal and port states may inspect foreign vessels and institute

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\(^{108}\) In the shipping parlance the flag indicates the State which is authorized to exercise flag State jurisdiction over the vessel and also identifies the nationality of the ship in question.

\(^{109}\) Articles 94 and 217, UNCLOS.
proceedings against them for violations of applicable national and international rules on vessel-source pollution. In specified circumstances, a flag state may pre-empt either port or coastal state proceedings as long as it meets its environmental duties under the Convention. (Article 228) Only monetary penalties may be imposed for violations by foreign vessels of national laws or applicable international rules, except in the case of a wilful and serious act of pollution in the territorial sea. (Article 230. The concept of jurisdiction over vessel source pollution and jurisdictional conflicts arise when two or more States claim to have legal competence over the same vessel. Under customary international law, the flag State has in principle unrestricted legislative and enforcement jurisdiction over vessel source pollution from ships flying or sailing under their flags. But when the ship enters a maritime zone where another State exercises jurisdiction under international law, conditions may arise pertaining to concurrent jurisdiction.

The rules of Territorial jurisdiction give a State full legal competence over activities taking place within the territory of a State. Territorial jurisdiction is predominantly exclusive. Other States have in principle no jurisdiction within another State’s territory. Jurisdiction that is not territorial is often referred to as extra-territorial. Extra-territorial enforcement jurisdiction is only allowed under the consent of the State in the territory of which the enforcement is carried out. The flag State possesses legislative and enforcement jurisdiction over the ship and other States must act in conformity with this rule.

UNCLOS defines zones of coastal State jurisdiction and the legal status the High Seas and establishes regulations for the control of marine pollution. States in dispute about their interpretation of UNCLOS may submit their disagreements to competent courts such as the International Court of Justice (in The Hague), or the Law of the Sea Tribunal (in Hamburg).

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111 UNCLOS sets the width of the territorial sea at 12 nautical miles, with a contiguous zone at 24 nautical miles from the baseline. It defines innocent passage through the territorial sea and defines transit passage through international straits. It defines archipelagic States and allows for passage through archipelagic waters.
(b) UNCLOS Provisions Relating to Port State, Coastal State and Flag State Obligations and Vessel Sourced Pollution

Flag States are made mainly responsible for enforcement of regulations. This includes both national and international regulations. Coastal state enforcement refers to the right of the state within whose waters a pollution violation may have occurred to enforce applicable national laws and international rules. Its authority to take action is more limited further offshore but increases with the seriousness of the pollution incident. The influence of coastal State jurisdiction and, ultimately, port State jurisdiction, gradually increases as the vessels enter zones closer to the coast. When a vessel is voluntarily within a port or at an offshore terminal, the port State may, where the evidence warrants, begin proceedings in respect of discharges in violation of international rules (i.e. regulations in MARPOL 73/78). Article 200 which deals with the issue of coastal State jurisdiction in relation to marine pollution empowers the coastal State to inspect the vessel and institute proceedings including detention of the vessel (where evidence warrants) provided there are clear grounds for believing that the vessel navigating in the territorial sea of a State has violated laws and regulations of the coastal State adopted in accordance with UNCLOS or applicable international pollution regulations. Vessels believed to have violated pollution laws in an Exclusive Economic Zone (EEZ) may be required to give identification and voyage information to the coastal State. The 1958 Convention on the High Seas also obliges the flag State to give rules for protection of the environment. Its Article 24 reads:

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112 While Article 217 deals with enforcement by flag States. Article 218 deals with port State jurisdiction.

113 Article 211(2) of the LOS Convention, which calls for the flag State to adopt laws and regulations for the ‘prevention, reduction and control of the marine environment from vessels flying their flag or of their registry. Such laws and regulations shall at least have the same effect as that of generally accepted international rules and standards established through the competent international organization or general diplomatic conference’.

114 Article 94 deals with duties of the flag State, Article 94(1) imposes on the flag State a duty to exercise effective jurisdiction over its vessels. This obligation includes the responsibility to ‘...maintain a register of ships containing the names and particulars of ships flying its flag...’ and to ‘...assume jurisdiction under its internal law over each ship flying its flag...’

115 Another State in which a discharge violation has occurred, or the flag State, may request the port State to investigate the violation.
‘Every State shall draw up regulations to prevent pollution of the seas by the discharge of oil from ships...’ Additionally, Article 10 provides that the flag State shall ensure that ships sailing under their flag fulfill certain technical standards. Flag States obligations are also found in regional conventions concerning pollution from vessels, relevant here is Article 4(1) and 6(4) of MARPOL 73/78. Sanctions shall be established and proceedings may be instituted, however, only when ‘sufficient evidence is available’. An article 90 and 91 of the LOS Convention confirms respectively the right of every State under international law to sail ships under its own flag and fix the conditions for the use of it.

Under the LOS Convention, port state enforcement is restricted to violations of the applicable international discharge standards and may be exercised in respect of violations anywhere in the world. It refers to the right of a state, when a foreign vessel is voluntarily in its ports or at an offshore terminal, to undertake investigations and, if warranted, institute proceedings. If the violation has taken place within waters under another state’s jurisdiction, either that state, the flag state, or a state damaged or threatened by the discharge must request that the port state intervene, unless the port state itself is damaged or threatened by the discharge violation. A coastal state within whose waters the violation occurred may request that proceedings instituted by the port state be suspended and the evidence and records transmitted to it. (Articles 218, 219)

Regional Marine Environment Protection Associations (MEPAs) have been established by the shipping sector to preserve the marine environment through educating those in the sector, port communities and children. This initiative was started in Greece in 1982 by the local shipping community as a response to public concern about marine pollution in the Mediterranean. Several regional initiatives followed. They are now co-ordinated by the International Marine Environment Protection Association (INTERMEPA). The

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116 The flag State is obliged to enforce its regulation under Article 217(1) of the LOS Convention.
MEPAs' commitment ‘To Save the Seas’ includes voluntary co-operation to protect the marine environment from pollution, awareness and educational activities, promotion of health and safety standards, and enhancement of quality standards and professional competence throughout the organization’s membership.¹¹⁹

6.2.1. Conventions Regulating Vessel Sourced Pollution:

Difficulties with regard to the development of customary rules often make regulation of vessel source pollution very technical. The mainstream noteworthy regulations linked to marine pollution are contained in treaties. Shipping being an international activity is required to confirm the international regulations, treaties and similar bilateral agreements.¹²⁰ The demanding craving of global industrialization feeding on fuels has propelled the oceans, already the highways of commerce between nations, to take on the additional role of fuel lines for the mega industrial complexes of the western world. The adoption of the International Convention for the Prevention of Pollution from Ships (MARPOL) marked a pivotal stage in the ambitious endeavor of the international community to deal with vessel-source pollution.


The Basel Convention created during a treaty negotiation under the guidance of the United Nations intends to prevent nations from transporting wastes to other nations for disposal in case of a likelihood of an improper waste disposal resulting from the transfer in question. The Basel Convention is separate from MARPOL, which deals with waste disposal rather than its transport.

As per the Basel Convention, the international shipments of waste are permitted under very explicit conditions and documentation. Most of these

¹²⁰ Till the end of the Second World War, most of the agreements were confined to a few nations and had their origin in the British or European laws or practices.
restrictions apply to hazardous waste, which is defined in several annexes, using a system of classification different from the one MARPOL uses. For the purpose of the convention, waste is a substance that is disposed of according to national law or is listed specifically in the convention. Hazardous waste is waste that fits one of several definitions in the Basel Convention or is defined as hazardous waste by the domestic laws of the waste importer, exporter, or domestic country of the transporting service. Since the Basel Convention’s classifications of waste are different from MARPOL’s and those of individual countries, it is possible that garbage may contain substances that are classified as hazardous wastes under the Basel Convention.

(b) Oil Pollution:

Until the late 1960s, it had been almost taken for granted that the oceans in their vastness would be able to cope with whatever pollution and wastes that were being dumped into them. This myth was dispelled soon. Oil was the first of the recognized “marine pollutants” to be controlled and regulated. Combating oil pollution from merchant shipping has hence been among the first environmental issues ever discussed at the international level and its global regime has as of today reached coverage and a level of specificity with few equivalents in other environmental areas. And following several environmental near misses and direct hits, world powers began a rapid move to legislate the movement of oil across the world’s oceans.122

The basis of this articulated and comprehensive regime are two interdependent bodies consisting of an “umbrella” framework (i.e., customary law, the Law of Sea Convention and chapter 17 of Agenda 21) and a special regulatory regime which is contained almost exclusively in instruments adopted by the International Maritime Organization.123 Shipping being a global activity is better regulated at global level and regional maritime safety and anti-pollution standards have traditionally been an exception. Public attention and regulation has tended to focus most sharply on seagoing oil tankers.

123 Frank, Veronica. The European Community and Marine Environmental Protection in the International Law of the Sea,Implementing Global Obligations at the Regional Level, (2007).
The international concern started to show with the International Convention for the Prevention of Pollution of the Sea by Oil, 1954, which was adopted in London at a conference organized by the United Kingdom. Following entry into force of the IMO Convention in 1958, the depository and Secretariat functions in relation to the Convention were transferred from the United Kingdom Government to IMO. It was the first landmark agreement designed to deal with vessel-source ocean pollution. Its emphasis was directed at curtailing discharge by ships of "persistent oils" -- primarily crude and heavy fuel oil -- within "prohibited zones" that extended 50 nautical miles seaward from coastal states. In effect, all the world's high seas were brought under the regulatory aegis of this instrument, which essentially aimed to protect and preserve the marine environment. It cannot be denied that the 1954 OILPOL Convention did go some way in dealing with oil pollution but the further developments in industrial practices and growth in oil trade in the subsequent years made it clear that this would not suffice and additional action was essential. In 1971, IMO adopted further amendments to OILPOL 1954 to afford additional protection to the Great Barrier Reef of Australia and also to limit the size of tanks on oil tankers, thereby minimizing the amount of oil which could escape in the event of a collision or stranding.

The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) classifies ship generated waste into six categories, called Annexes, to provide general restrictions for each class of waste. The annexes covered pollution by oil, chemicals, sewage, garbage and harmful substances in packaged form. As the London-based Oil Companies International Marine Forum (OCIMF) wrote in 1974:

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124 The 1954 Convention primarily addressed pollution resulting from routine tanker operations and from the discharge of oily wastes from machinery spaces - regarded as the major causes of oil pollution from ships. The 1954 OILPOL Convention, which entered into force on 26 July 1958, attempted to tackle the problem of pollution of the seas by oil -- defined as crude oil, fuel oil, heavy diesel oil and lubricating oil in two main ways: it established "prohibited zones" extending at least 50 miles from the nearest land in which the discharge of oil or of mixtures containing more than 100 parts of oil per million was forbidden; and it required Contracting Parties to take all appropriate steps to promote the provision of facilities for the reception of oily water and residues.
"The 1973 Convention represents an historic and major step forward in the prevention of pollution from ships. It extends the existing restrictions upon operational pollution by oil and requires both equipment and design features in tankers and other ships, while also introducing controls against other forms of pollution from ships."\(^{125}\)

For preventing pollution by oil from ships the most fundamental regulations are contained in Annex I of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78). Annex I of the MARPOL Convention which deals with oil pollution from ships has incorporated an oil discharge criterion from the OILPOL era.

Some of the other major international efforts in the form of treaties are the Marine Pollution Treaty, Honolulu, which deals with regulating marine pollution from ships, and the UN Convention on Law of the Sea, which deals with marine species and pollution.\(^{126}\)

The MARPOL Convention which incorporated much of OILPOL 1954 and its amendments into Annex I, covering pollution from oil expanded and improved on OILPOL in several ways. Annex I specified requirements for continuous monitoring of oily water discharges and included the requirement for Governments to provide shore reception and treatment facilities at oil terminals and ports. Under the Annex I there are stricter controls on discharge of oily wastes in the designated special areas. The discharge of oil is completely forbidden in certain "special areas"\(^{127}\) where the threat to the marine environment is especially great. These special areas would be

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\(^{127}\) Special area means a sea area where for recognized technical reasons in relation to its oceanographically and ecological condition and to the particular character of its traffic the adoption of special mandatory methods for the prevention of sea pollution by oil is required. Annex I Reg 1 Special areas shall include those listed in regulation 10 of this Annex. Certain areas which are more susceptible to the adverse impacts of oil pollution have been conferred special area status.
implemented when the littoral States concerned had provided adequate reception facilities for dirty ballast and other oily residues.  

The “Particularly Sensitive Sea Areas” (PSSAs) designation is provided for under Guidelines developed by the IMO’s Marine Environmental Protection Committee, and set forth in IMO Resolution No. A.927 (22). PSSAs are areas that are identified as requiring special protection through action by the IMO, because of their significance for ecological, socio-cultural and economic, or scientific and educational reasons, and which may be vulnerable to damage by international maritime activities. These criteria relate to areas within and beyond the limits of the territorial sea, and may straddle different state zones of jurisdiction. The special areas in Annex I are: Mediterranean Sea area; Baltic Sea area; Black Sea area; Red Sea area; "Gulfs" area; Gulf of Aden area; Antarctic area; and North West European Waters. The Oman Sea area of the Arabian Seas is designated a special area in the revised Annex I.

Amendments made in 1992 brought in the double-hull requirements for tankers. The most significant change of MARPOL’s Annex I is the phasing out of single-hull oil tankers and the introduction of double-hulled oil tankers. The revised MARPOL Annex I incorporated the various amendments adopted since MARPOL entered into force in 1983, including the amended regulation 13G (regulation 20 in the revised annex) and regulation 13H (regulation 21 in the revised annex) on the phasing-in of double hull requirements for oil tankers. The revised Annex I included new requirements related to pump room bottom protection, accidental oil outflow performance and conditions for oil discharge. According to the most recent amendment to the MARPOL Convention regarding this issue, all pre-


130 Regulations for the Prevention of Pollution by Oil was adopted in October 2004 and entered into force on 1 January 2007.

131 Available at www.imo.org.

MARPOL single-hull tankers of 20,000 GWT (Category-1) were to be phased out by 2007. Moreover, all post-MARPOL single-hull oil tankers of 20,000 GWT (Category-2) and single-hull oil tankers of above 5000 GWT but below 20,000 GWT (Category-3) had to be phased out by 2010. As the WWF points out on its web site: "It was only after the single-hulled Exxon Valdez went down off the coast of Alaska in 1989 that the U.S. introduced a phase-out of these old tankers...It took the sinking of the single-hulled Erika ten years later off the coast of France for the member states of the IMO to accelerate the global phase-out to match that of the US."

Keeping in line with the aim of reducing the amount of dirty bilge water being discharged into the ocean, the Annex I re-institutionalised the ‘load on top’ (LOT) system which had been developed by the oil industry in the 1960s. This involves the fitting of appropriate equipment, including an oil-discharge monitoring and control system, oily-water separating equipment and a filtering system, slop tanks, sludge tanks, piping and pumping arrangements. The LOT system requires a vessel to transfer dirty ballast water into a special slop tank in ballast voyage. After some days the oil flows up. After pumping out the clean water under the oil, new cargo oil is loaded on top of the residue oil in the next voyage.

Annex I requires implementation of the Crude Oil Washing Operation and Equipment Manual (COW) on all new tankers of over 20 thousand DWT. Annex I introduced a system of certification, survey and monitoring. A ship or tanker has to carry some certificates and records including the international oil pollution prevention certificate and oil.

133 Slop tank means a tank specifically designated for the collection of tank drainings, tank washings and other oily mixtures.
134 For proper functioning of this process, Annex I requires oil tankers to be equipped with oil-discharge monitoring and control systems, and oily water separators. It also requires slop tanks, sludge tanks and piping arrangements. MARPOL 73/78, Annex I, regs 29 to 30. See also Alan Khee Jin Tan, Vessel Source Marine Pollution: The Law and Politics of International Regulation (2006).
135 The crude oil washing system (COW) was developed by the oil industries in the 1970s as an alternative to SBT by the oil industry. The COW involves washing tanks by oil instead of using water.
136 Tankers and other ships must carry and maintain an Oil Record Book in which all operations involving oil are to be recorded. The book can be inspected by the authorities of any State which is a Party to the Convention (regulation 20).
The 1978 MARPOL Protocol introduced a further element. This is the concept known as protective location of segregated ballast tanks. Oil tankers must be fitted with segregated ballast tanks (SBTs) large enough to provide adequate operating draught without the need to carry ballast water in cargo oil tanks. The SBT now has to be located in such a way that they can protect cargo tanks in incidents of collision. All newly-built tankers must meet a range of stability damage requirements for survival of the oil cargo in collision incidents.\(^{137}\)

It means that the ballast tanks (which are empty on the cargo-carrying leg of the voyage and only loaded with water ballast for the return leg) are positioned where the impact of a collision or grounding is likely to be greatest. In this way the amount of cargo spilled after such an accident will be greatly reduced. The 1983 MARPOL amendments banned the carriage of oil in the forepeak tank - the ship's most vulnerable point in the event of a collision. With this the oil spilt during a tanker collision can be regulated.

Governments, industry and intergovernmental organizations, have put in concerted efforts to bring about many positive changes in the oil and shipping industries in order to reduce the oil inputs from routine operations, and to recover oil from small spills and large accidents.

**(c) Sewage\(^ {138}\) and Garbage\(^ {139}\) Regulation:**

For decades various categories of wastes generated on ships and dumped into the ocean have had negative impacts on marine environments. There are serious health and environmental problems, as well as legal issues, involved in the simple discharge overboard (via a "through-hull" fitting, as has been common in the past) of both grey water—from sink and shower drains—

\(^{137}\) *MARPOL 73/78, Annex I: Prevention of pollution by oil.\(^{138}\) Annex IV of MARPOL 73/78* Regulations for the Prevention of Pollution by Sewage from Ships defines Sewage as:
- (a) drainage and other wastes from any form of toilets, urinals, and WC scuppers;
- (b) drainage from medical premises (dispensary, sick bay, etc.) via wash basins, wash tubs and scuppers located in such premises;
- (c) drainage from spaces containing living animals; or
- (d) other waste waters when mixed with the drainages defined above.

\(^{139}\) Under Annex V of the Convention, garbage includes all kinds of food, domestic and operational waste, excluding fresh fish, generated during the normal operation of the vessel and liable to be disposed of continuously or periodically.
and raw sewage (also known as black water) from the head. Annex IV of MARPOL 73/78 is titled Regulations for the Prevention of Pollution by Sewage from Ships.\textsuperscript{140} A revised Annex was adopted on 1 April 2004, with an entry into force date of 1 August 2005.

MARPOL being the primary international treaty governing ship-generated waste, its Annex IV regulates the type of waste which can be discharged overboard and the locations where it can be discharged. Fundamental issues like discharge of sewage into the sea, ships’ equipment and systems for the control of sewage discharge, the provision of facilities at ports and terminals for the reception of sewage, and requirements for survey and certification are managed through a set of regulations provided by the Annex IV.

The vessel sourced sewage is further regulated by providing for a model International Sewage Pollution Prevention Certificate to be issued by national shipping administrations to ships under their jurisdiction. It is generally considered that on the high seas, the oceans are capable of assimilating and dealing with raw sewage through natural bacterial action and therefore the regulations in Annex IV of MARPOL prohibit ships from discharging sewage within a specified distance of the nearest land, unless they have in operation an approved treatment plant.

Revised international regulations for the prevention of pollution of the sea by sewage from ships (revised MARPOL Annex IV) have entered into force on 1 August 2005. Under current thinking it is assumed that the oceans are capable of assimilating and dealing with raw sewage through natural bacterial action. However, the regulations prohibit the discharge of sewage by ships within a specified distance of the nearest land, unless they have an approved sewage treatment plant or system in operation. This annex requires ships to have either an approved sewage treatment facility, a sewage comminuting and disinfecting system, or a sewage holding tank\textsuperscript{141} The

\textsuperscript{140} Available at http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-%28MARPOL%29.aspx.
discharge of sewage is prohibited in less than 12 miles from land unless it is via a comminuting and disinfecting system. This implies that within three miles of shore, Annex IV requires that sewage discharges be treated by a certified MSD prior to discharge and between three and 12 miles from shore, sewage discharges must be treated by no less than maceration or chlorination; At more than 12 miles from land the discharge of sewage will be prohibited from holding tanks unless the ship is on route proceeding at more than four knots or the discharge is from a sewage treatment plant. Sewage discharges beyond 12 miles from shore are unrestricted. Individual Governments are required to ensure the provision of adequate reception facilities at ports and terminals for the reception of sewage.

Within the provisions of MARPOL, there are certain regions in the world that are designated as Special Areas. A Special Area is geographical regions where additional restrictions exist that pertain to dumping of a specific class of waste overboard. MARPOL is also known as the International Convention for the Prevention of Pollution from Ships. Pollutants including oil, chemicals, garbage, sewage, and food waste are all being dumped into the ocean. At the same time, ports find it difficult to manage all of the waste received. This is particularly problematic in regions that are defined by MARPOL as Special Areas, which have stricter requirements on pollution control and that have insufficient infrastructure in port reception facilities to handle the increased amount of waste.

The sewage can be processed through a method which uses a bio-membrane reactor. This reactor has active agents inside that eat away at the harmful bacteria, which then are filtered out using a membrane. 142 This process produces semi-clean water that can be used in technical processes such as engine cooling, offloaded at port reception facilities, or discharged overboard. Untreated sewage must be discharged at a distance of at least 12 nautical miles from shore, however, if the ship has a sewage treatment facility it may discharge waste at least3 nautical miles from shore.

Garbage from ships can be just as deadly to marine life as oil or chemicals. The Annex V sets restrictions on the handling of garbage, including all food, domestic, and operational waste. Annex V totally prohibits the disposal of plastics anywhere into the sea, and severely restricts discharges of other garbage from ships into coastal waters and "Special Areas". The Annex also obliges Governments to ensure the provision of reception facilities at ports and terminals for the reception of garbage. The annex completely prohibits the dumping of plastics at sea.\(^{143}\) It further divided into six categories, including: (1) plastic, (2) floating wrapping, lining or packaging material, (3) ground paper products, rags, glass, metal, bottles, (4) paper products, rags, glass, 8 metal, bottles and crockery, (5) food waste, and (6) incinerator ash. The Caribbean was designated a Special Area with restrictions on Annex V due to its heavy maritime traffic, sensitive marine ecosystem, and the nature of the currents through the region. Although it is optional, most member nations are signatories to Annex V, and it contains some additional provisions for enforcement. For instance, a Garbage Record Book must be kept on ships of sufficient size, and procedures for the collection and disposal of garbage must be compiled in writing in the ship’s Garbage Management Plan. Requirements for shipboard incinerators are also included. Governments that ratify Annex V must also ensure garbage reception facilities are provided by ports.

Some waste can be disposed of overboard so long as it is outside a certain distance from shore and outside of a Special Area. The restrictions on the dumping of garbage prohibit the discharging of plastics anywhere on the ocean. These regulations exist for important reasons. For instance, some material that is dumped overboard can take up to 450 years to degrade (see Appendix C). In case of a Special Area, waste that was previously disposed of in this manner will now be required to be collected in port reception facilities.

The Marine Environment Protection Committee (MEPC) at its 55th session in October 2006 adopted revised Guidelines on Implementation of

The MEPC in 2006 had adopted a standard for the maximum rate of discharge of untreated sewage from holding tanks when at a distance equal or greater than 12 nautical miles from the nearest land. According to the MEPC Resolution 219(63) adopted on 2 March 2012, the new International requirements to be effective from 1 January 2013 for MARPOL Annex IV - Sewage and MARPOL Annex V - Garbage have been decided upon. Annex IV - Sewage has been revised so that a higher level of protection against sewage pollution can be applied in Special Areas. Annex V - Garbage has been revised to strengthen the current provisions so to continue to reduce pollution caused by garbage.144

The revised MARPOL Annex IV apply to new and existing ships of 400 gross tonnage and above or ships which are certified to carry more than 15 persons, engaged in international voyages. Existing ships will be required to comply with the provisions by 27 September 2008 (five years after the entry into force of MARPOL Annex IV). The Annex requires ships to be equipped with either a sewage treatment plant, a sewage comminuting and disinfecting system or a sewage holding tank. The discharge of sewage into the sea will be prohibited at a distance of 12 nautical miles, or less, from the nearest land. Exceptions apply when the ship has an approved sewage treatment plant in operation or when discharging commented and disinfected sewage using an

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approved system at a distance of more than three nautical miles from the nearest land.\textsuperscript{145}

The issue of naval nuclear power, weapons and disposal of waste continues to be a major environmental issue. Over the past decade there has been an increasing public concern over nuclear powered ships, resulting in many countries, e.g. New Zealand in banning nuclear powered or weaponed ships from entering ports. Some naval ports are in heavily populated areas bringing concerns regarding the possibility of nuclear accidents. One source reports 14 documented accidents releasing radiation associated with naval reactors. Naval vessels are not bound by international conventions controlling pollution from ships, many navies will comply when it is practicable. The International Convention for the Prevention of Pollution from Ships (MARPOL 1973/1978) is one intergovernmental initiative that has proved successful in reducing marine pollution from ships. Amongst other outcomes of this convention, plastic disposal at sea is now prohibited.\textsuperscript{146}

(d) Chemical Pollution: MARPOL Annex II

Under IMO rules and recommendations a distinction is made between dangerous goods in packaged form, in solid form in bulk, and liquid form in bulk. The latter category is divided into oil, noxious liquid substances and liquefied gases. Regulations covering the carriage of dangerous cargoes and the ships that carry these cargoes are found in the International Convention for the Safety of Life at Sea (SOLAS, 1974), as amended, and the International Convention for the Prevention of Marine Pollution from Ships\textsuperscript{147} 73/78. These conventions are supplemented by the following: The International Maritime Dangerous Goods Code (IMDG Code); The Code of Safe Practice for Solid Bulk Cargoes (BC Code); The International Code for

\textsuperscript{145} When a Party to Annex IV requires ships under its jurisdiction, i.e. ships under its flag, and other ships operating in its waters, to comply with the discharge requirements, then it must ensure adequate facilities at ports and terminals for the reception of sewage are provided.


\textsuperscript{147} Carriage of chemicals in bulk is covered by regulations in SOLAS Chapter VII – Carriage of dangerous goods and MARPOL Annex II - Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk.

The International Bulk Chemical Code (IBC Code), gives international standards for the safe transport by sea in bulk of liquid dangerous chemicals, by prescribing the design and construction standards of ships involved in such transport and the equipment they should carry so as to minimize the risks to the ship, its crew and to the environment, having regard to the nature of the products carried. The IBC Code lists chemicals and their hazards and gives both the ship type required to carry that product as well as the environmental hazard rating. The chemical wastes generated by carriage of Noxious Liquid Substance are potentially more harmful than oil for the marine environment. The transportation of chemicals is therefore technically and logistically different from the transportation of oil and oil products. Chemicals are carried in ships in two ways. Chemical bulk carriers are specially designed and constructed with chemical cargo tanks. Chemicals can also be carried in a packaged form e.g. drum, and stowed in a container carried by a container ship. 148

Chemical tankers are required to be more advanced in many ways because the cargoes may be hazardous and noxious chemicals or products such as edible oils and fats. Chemicals require sophisticated handling for safety, health and loss prevention reasons which is attributed to their being of high value. Their integrated system of cargo tanks, sophisticated cargo operating systems and supply of deck services enable the tankers to carry a broad range of chemicals, in accordance with the requirements of the International Code for the Construction and Equipment of Ships Carrying Dangerous Cargoes in Bulk (IBC/BCH Code), and in strict accordance with anti-pollution regulations under MARPOL Annex II. The world’s biggest vegetable oil trades are the transportation of palm oil from Malaysia and Indonesia.

MARPOL Annex II Regulations for the control of pollution by noxious liquid substances in bulk has elaborated certain discharge standards and mechanisms for the control of Noxious Liquid Substance pollution (NLS). NLS discharge is permissible only in designated reception facilities until some conditions are fulfilled. Annex II introduced a system to control discharge which is based on certain thresholds, such as the distance from land, nature and concentration of effluent and the depth of the sea at the place of discharge. The Annex II delineates a categorization system for noxious liquid substances, based upon the severity of their impact on the marine resources and human health on being discharged into the sea from tank cleaning or deballasting operations of a vessel.\footnote{149}

Discharge of NLS is totally prohibited within 12 miles of the nearest land,\footnote{150} although the discharge of bilge or ballast water or other residues or mixtures containing these substances are not subject to any requirements of MARPOL Annex II.\footnote{151} The revised Annex II regulations on carriage of noxious liquid substances carried in bulk (including chemicals and vegetable oils) introduced significant changes to the way certain products may be transported, so that the marine environment is not open to the elements of further harm.\footnote{152}

\footnote{149} The four categories are:
- **Category X**: Noxious Liquid Substances which, if discharged into the sea from tank cleaning or deballasting operations, are deemed to present a major hazard to either marine resources or human health and, therefore, justify the prohibition of the discharge into the marine environment;
- **Category Y**: Noxious Liquid Substances which, if discharged into the sea from tank cleaning or deballasting operations, are deemed to present a hazard to either marine resources or human health or cause harm to amenities or other legitimate uses of the sea and therefore justify a limitation on the quality and quantity of the discharge into the marine environment;
- **Category Z**: Noxious Liquid Substances which, if discharged into the sea from tank cleaning or deballasting operations, are deemed to present a minor hazard to either marine resources or human health and therefore justify less stringent restrictions on the quality and quantity of the discharge into the marine environment; and
- **Other Substances**: substances which have been evaluated and found to fall outside Category X, Y or Z because they are considered to present no harm to marine resources, human health, amenities or other legitimate uses of the sea when discharged into the sea from tank cleaning of deballasting operations.

\footnote{150} Annex II also provides for necessary reception facilities for NLS.
\footnote{151} *MARPOL 73/78*, Annex VI, reg. 17.
\footnote{152} Stricter rules on carrying vegetable oils in bulk by ship were among the changes introduced by amendments to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (*MARPOL 73/78*), which enter into force on 1 January 2007.
Following the hazard evaluation process\textsuperscript{153} and the categorization system, vegetable oils which were previously categorized as being unrestricted are now required to be carried in chemical tankers.\textsuperscript{154} With a view to strengthen the regime to prevent marine pollution, Chemical tankers and other vessels under this code are to be built to conform to internationally agreed design and construction standards, and with operational requirements.\textsuperscript{155} Ships constructed after 1986 carrying substances identified in chapter 17 of the IBC Code must follow the requirements for design, construction, equipment and operation of ships contained in the Code.

The International Bulk Chemical Code (IBC Code) has adopted consequential amendments which reflect the changes to MARPOL Annex II.\textsuperscript{156} The new pollution categories that replace the current 5-category system (A,B,C,D and Appendix III products)\textsuperscript{157} influence what products can be carried in the different IMO ship types. The IBC Code provides standards for the construction of three types of chemical tankers generally known as IMO ship Types 1, 2 and 3.\textsuperscript{158}

\textsuperscript{153} The marine pollution hazards of thousands of chemicals have been evaluated by the Evaluation of Hazardous Substances Working Group, giving a resultant GESAMP Hazard Profile which indexes the substance according to its bio-accumulation; biodegradation; acute toxicity; chronic toxicity; long-term health effects; and effects on marine wildlife and on benthic habitats.

\textsuperscript{154} An MEPC resolution on \textit{Guidelines for the transport of vegetable oils in deep tanks or in independent tanks specially designed for the carriage of such vegetable oils on board dry cargo ships} was adopted in October 2004. It allows general dry cargo ships that are currently certified to carry vegetable oil in bulk to continue to carry these vegetable oils on specific trades. The guidelines took effect on 1 January 2007.

\textsuperscript{155} Such as:
- Efficient stripping of cargo tanks;
- Pre-washing with subsequent discharge to reception facilities;
- Vapour containment;
- Strict requirements for the discharge of tank washings at sea;
- Special fire fighting arrangements and personnel safety precautions where necessary; and;
- Recording of operational activities in log books.

\textsuperscript{156} The amendments incorporate revisions to the categorization of certain products relating to their properties as potential marine pollutants as well as revisions to ship type and carriage requirements following their evaluation by the Evaluation of Hazardous Substances Working Group.

\textsuperscript{157} The current IBC Code earlier contained 5 pollution categories: A, B, C, D and an Appendix III which listed products to which the IBC Code does not apply.

\textsuperscript{158} An IMO Ship Type 1 is a chemical tanker intended for the transportation of products considered to present the greatest overall hazard, and Type 2 and Type 3 for products of progressively lesser hazards. The quantity of cargo required to be carried in a Type 1 ship should not exceed 1,250 m$^3$ in any one tank. An IMO Ship Type 2 is intended to transport products with appreciably severe environmental and safety hazards which require significant preventive measures to preclude escape of such cargo. The quantity of cargo required to be carried in a Type 2 ship should not exceed 3000 m$^3$ in any one tank.
The International Maritime Dangerous Goods Code (IMDG) was first adopted by IMO in 1965 and lists hundreds of specific dangerous goods together with detailed advice on storage, packaging and transportation. The IMDG code sets requirements regarding the transport of dangerous goods in respect to detailed recommendations for individual substances, materials and articles (including their classification) and requirements relating to packing, labelling, stowage, segregation and handling. With the mandatory adoption of the 2008 edition on the 1st of January 2010, training for shore based personnel will become a mandatory element of compliance with the IMDG code. The code also provides a number of recommendations for good operational practice including advice on terminology, and emergency response actions.

MARPOL Annex III includes regulations for the prevention of pollution by harmful substances in packaged form and includes 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. The interior rationale of the regulations is to pack and store the chemical cargo on board ship in a manner that would in the eventuality of a marine accident involving chemicals help identify the marine pollutants which would at one hand minimise the resulting accidental pollution and on the other aid recovery by using the clear marks to differentiate them from other (less harmful) cargoes.

A clear definition of harmful substances carried in packaged form was arrived at by the appropriate amendments to IMDG Code so as to include marine pollutants within its ambit. All packages containing marine pollutants

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159 Annex III is optional so that States who sign up to MARPOL 73/78 Annexes I and II are not required adopting the Annex at the same time. Annex III received sufficient ratifications by 1991 and entered into force on 1 July 1992.
160 The amendments extending the Code to cover marine pollutants, entered into force in 1991, added the identifier "marine pollutant" to all substances classed as such.

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must be marked with a standard marine pollutant mark. This was accompanied at the same time with an amendment to the Annex III of MARPOL. It was established that “harmful substances are those substances which are identified as marine pollutants in the International Maritime Dangerous Goods Code (IMDG Code).” For the purpose of Annex III, “harmful substances” are those identified as “marine pollutants” in the IMDG Code.

The Marine Environment Protection Committee (MEPC) at its 55th session in October 2006 adopted the revised MARPOL Annex III Regulations for the prevention of pollution by harmful substances carried by sea in packaged form. The Annex applies to all ships carrying harmful substances in packaged form, or in freight containers, portable tanks or road and rail tank wagons. 161

The rules on discharging harmful goods are uncomplicated: “Jettisoning of harmful substances carried in packaged form shall be prohibited, except where necessary for the purpose of securing the safety of the ship or saving life at sea”. The Annex states that “appropriate measures based on the physical, chemical and biological properties of harmful substances shall be taken to regulate the washing of leakages overboard, provided that compliance with such measures would not impair the safety of the ship and persons on board.” (MARPOL Annex III, Regulation 7 (1)) Chemicals which are carried in packaged form or in solid form or in bulk are regulated by Part A of SOLAS Chapter VII - Carriage of dangerous goods which includes provisions for the classification, packing, marking, labelling and placarding, documentation and stowage of dangerous goods.

The IMDG Code has been developed as a uniform international code for the transport of dangerous goods by sea covering such matters as packing, container traffic and stowage, with particular reference to the segregation of incompatible substances. The IMDG Code includes products considered to be marine pollutants. Annex III is dedicated to prevention of

161 The Annex was revised to harmonize its regulations with the criteria for defining marine pollutants that had been adopted by the UN Transport of Dangerous Goods (TDG) Subcommittee, based on the United Nations Globally Harmonized System of Classification and Labelling of Chemicals (GHS).
pollution by harmful substances in packaged form. This Annex elaborated common requirements and standards on packing, marking, labelling, documentation, storage, and notifications for preventing pollution by harmful substances. Most important of these are the International Pollution Prevention Certificate for Noxious Liquid Substances Carried in Bulk and the International Sewage Pollution Prevention Certificate. Finally, in all these annexes, parties to the Convention undertake to ensure reception facilities for different purposes including: reception facilities for sewage in ports of some areas where the port State determines that the sewage from ships will be unacceptable to the local people; and reception facilities for garbage in all ports handling national and international trade.\(^\text{162}\)

The victims of accidents involving HNS\(^\text{163}\) are provided to be recompensated based on the principle of strict liability for the shipowner and a system of compulsory insurance and insurance certificates under the provisions of International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances (HNS) by Sea 1996.\(^\text{164}\)

The Convention defines damage as including loss of life or personal injury; loss of or damage to property outside the ship; loss or damage by contamination of the environment; the costs of preventative measures and further loss or damage caused by them.

**(f) Invasive Species**:

Ballast water management is a complex issue raising the challenge of merging international regulations, ship’s specific configurations, and ecological conservation. IMO has implemented the GEF/UNDP/IMO Global Ballast Water Management Programme (GloBallast) and has provided


\(^\text{163}\) HNS are defined by reference to lists of substances included in various IMO Conventions and Codes. These include oils; other liquid substances defined as noxious or dangerous; liquefied gases; liquid substances with a flashpoint not exceeding 60°C; dangerous, hazardous and harmful materials and substances carried in packaged form; and solid bulk materials defined as possessing chemical hazards.

\(^\text{164}\) The Convention also covers residues left by the previous carriage of HNS, other than those carried in packaged form.
technical support and expertise for enhanced understanding and appropriate monitoring of the situation.\textsuperscript{165}\textsuperscript{165} The International Convention for the Control and Management of Ships’ Ballast Water and Sediments targets the potentially devastating effects of the spread of harmful aquatic organisms carried by ships’ ballast water. All ships are obliged to implement a Ballast Water and Sediments Management Plan, carry a Ballast Water Record Book and to carry out ballast water management procedures to a given standard. The Convention will enter into force 12 months after ratification by 30 States, representing 35 per cent of world merchant shipping tonnage. As of October 2010, 27 States have ratified the Convention, representing 25.32\% of world merchant shipping tonnage.

\textbf{(g) Anti-Fouling Systems Convention (AFSC)}

The entry into force requirements for the AFS Convention has now been met, following the accession to the treaty by Panama.\textsuperscript{166}\textsuperscript{166} A “harmful anti-fouling system” is currently defined as any system that includes organotin compounds which act as biocides, although there is a rider for inclusion of additional harmful systems in the future. In order to comply with the provisions of this convention the ships are required to forbear the use of such compounds on their hulls or external parts or surfaces; or bear a coating that forms a barrier, preventing leaching of the compounds from the underlying noncompliant anti-fouling systems.

This applies to all ships except fixed or floating platforms, floating storage units (FSUs), and floating production storage and off-loading units (FPSOs) that have been constructed prior to 01 January 2003 and that have not been in dry-dock on or after 01 January 2003. While fixed or floating platforms, FSUs and FPSO which have been constructed prior to 01 July 2003, but have not been into dry-dock on or after that date, are not legally required to comply with the ban on bearing TBT compounds, it is recommended that they do so as soon as is reasonably practicable.

\textsuperscript{165} The problem of harmful aquatic organisms in ballast water was first raised at IMO in (1988), and since then the MEPC, together with MSC and technical sub-committees, has been dealing with the issue.

\textsuperscript{166} The Convention has entered into force internationally on (17 September 2008).
6.2.2. The International Marine Pollution Liability and Compensation System

'Pollution damage' is defined as loss or damage caused by contamination. In the case of environmental damage (other than loss of profit from impairment of the environment) compensation is restricted to costs actually incurred or to be incurred for reasonable measures to reinstate the contaminated environment.'

The international compensation regime for damage caused by spills of persistent oil from laden tankers was based initially on two IMO conventions - the 1969 International Convention on Civil Liability for Oil Pollution Damage (1969 CLC) and the 1971 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (1971 Fund Convention).

In 1992, this 'old' regime was amended by two protocols, which resulted in increased compensation limits and scope of the original conventions was broadened.167 'Pollution damage' includes, in all liability Conventions, the costs of reasonable preventive measures, i.e. measures to prevent or minimise pollution damage. To attract the application of these conventions the damage in question must result from oil pollution and have caused a quantifiable economic loss. The claimant must be able to show the amount of his loss or damage by producing accounting records or other appropriate evidence. Under the 1992 Civil Liability Convention, the ship owner has strict liability for any damage by pollution caused by the oil, i.e. the owner is liable even if there was no fault on the part of the ship or its crew.

However, the shipowner can normally limit his financial liability to an amount that is determined by the tonnage of the ship. This amount is guaranteed by the ship owner's liability insurer. Normally, the Convention only applies to tankers carrying persistent oil as cargo. However, under certain circumstances, the Convention also applies to spills from unladen tankers.

167 As more States ratified or acceded to the 1992 Conventions, the original conventions rapidly lost significance and the 1971 Fund Convention was terminated altogether on (24th May 2002). In 1992, a Diplomatic Conference adopted two protocols amending the 1969 CLC and 1971 Fund Convention, which became the 1992 CLC and 1992 Fund Convention. These 1992 Conventions, which provide higher limits of compensation and a wider scope of application than the original conventions, entered into force on 30th May 1996.
The International Oil Pollution Compensation Funds (IOPC Funds) are three intergovernmental organisations established by States (the 1971 Fund, the 1992 Fund and the Supplementary Fund) that provide compensation for victims of oil pollution damage caused by spills of persistent oil from tankers.\textsuperscript{168}

Persistent oil spills from oil tankers that cause pollution damage in the territory (including the territorial sea) or the exclusive economic zone (EEZ) or equivalent area of a State Party to the respective treaty instrument come within the ambit of the 1992 Civil Liability Convention, the 1992 Fund Convention and the Supplementary Fund Protocol.

The CLC governed the liability of ship-owners for oil pollution damage and made them strictly liable within a limitation ceiling which was linked to the vessel's tonnage. The amounts recoverable under the scheme are calculated as Special Drawing Rights (SDRs) of the World Bank. The International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1971 (FUND).\textsuperscript{169} The FUND was financed by a state levy on oil imports in contracting states and is thus based on 'oil at risk at sea'. It is administered by the International Oil Pollution Compensation Fund (IOPCF), an international organization composed of FUND member states. These funds too are calculated in SDRs.\textsuperscript{170}

In May 2003 a Supplementary ('third tier') Fund was established at the IMO through a new protocol that increases the amount of compensation in the ratifying States to about US$1.2 million (including the amounts paid under the 1992 CLC and Fund Convention).\textsuperscript{171} The Supplementary Fund Protocol entered into force on 3 March 2005 and was financed by contributions payable by oil receivers in the States which opted to ratify it. However, for the

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\textsuperscript{169} The convention entered into force in 1978 and has been accepted by more than 80 states. It came into operation in cases where the CLC coverage is insufficient.

\textsuperscript{170} By becoming party to the 1971 Fund Convention, a country became a Member of the 1971 IOPC Fund. Payments of compensation and the administrative expenses of the 1971 IOPC Fund were financed by contributions levied on companies in Fund Convention countries that received crude oil and heavy fuel oil after sea transport.

\textsuperscript{171} In October 2000 agreement was reached on increasing the limits of the 1992 CLC and Fund Convention by a little over 50% with effect from (1st November 2003).
purpose of contributions it was considered that there will be a minimum aggregate quantity of 1 million tons of contributing oil received in each Member State. Anyone in a Member State of the 1992 Fund who has suffered pollution damage caused by oil transported by a tanker can claim compensation from the shipowner/insurer under the 1992 Fund and, if the case may be, the Supplementary Fund.

The 1971 Fund Convention provided for the payment of supplementary compensation to those who could not obtain full compensation for oil pollution damage under the 1969 CLC. Claims for compensation for oil pollution damage (including clean-up costs) were to be brought against the owner of the tanker which caused the damage or directly against the owner’s P&I insurer. The 1992 Conventions and the Supplementary Fund Protocol apply to spills of bunker oil from unladen tankers provided they have residues of a persistent oil cargo aboard.

The International Oil Pollution Compensation Fund (1971 IOPC Fund) was set up for the purpose of administering the regime of compensation created by the Fund Convention when it entered into force in 1978. As in the case of the original conventions, the tanker owner and P&I insurer are liable for the payment of compensation under the 1992 CLC, and oil receivers in countries that are party to the 1992 Fund Convention are liable for the payment of supplementary compensation through the 1992 IOPC Fund. The 1992 Civil Liability Convention covers spills of cargo and/or bunker oil from laden, and in some cases unladen sea-going vessels constructed or adapted to carry oil in bulk as cargo (but not to dry cargo ships). States which ratify these legal instruments must implement them into their national law. The great majority of maritime States are members of the IOPC Funds.¹⁷²

On 1 March 2006, the 1992 Fund had 92 Member States, and a further six States will become Members by the end of 2006. In addition, 16 States have already ratified the Supplementary Fund Protocol.

Amount of compensation available

The maximum amounts of compensation payable by the shipowner’s insurer and the IOPC Funds were fixed by Governments at the Diplomatic Conferences that adopted the relevant international treaties. Since their establishment, the 1992 Fund and the preceding 1971 Fund have been involved in some 135 incidents of varying sizes all over the world. In the great majority of cases, all claims have been settled out of court. Compensation payments made to date total over US$900 million. No incidents have occurred so far which have involved or are likely to involve the Supplementary Fund.

Damage claims covered by the Conventions

An oil pollution incident can generally give rise to claims for five types of damage: Property damage, Costs of clean-up operations at sea and on shore, Economic losses by fishermen or those engaged in mariculture, Economic losses in the tourism sector and Costs for reinstatement of the environment.

The owner is exempt from liability only if he proves that the damage resulted from an act of war, hostilities, civil war, insurrection or a natural phenomenon of an exceptional, inevitable and irresistible character; or the damage was wholly caused by an act or mission done with the intent to cause damage by a third party; or the damage was wholly caused by the negligence or other wrongful act of public authorities in maintaining lights or other navigational aids.

In 2009 the IMO Legal Committee approved a draft Protocol to the HNS Convention, designed to address the practical problems that have prevented many States from ratifying the original Convention. Among the obstacles has been the requirement for States to report the quantities of HNS received to IMO, which has proved difficult, in part, due to the sheer range and diversity of hazardous and noxious substances that will be governed by

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173 Claims against the 1992 Fund are assessed according to criteria established by representatives of the Governments of Member States. These criteria, which also apply to claims against the Supplementary Fund, are set out in the 1992 Fund’s Claims Manual, which is a practical guide on how to present claims for compensation.
the HNS Convention. The Protocol aims to address this problem as well as others thought to be acting as barriers to ratification of the Convention. The Protocol was adopted at a diplomatic conference convened in April 2010. ITOPF is a not-for-profit organisation established on behalf of the world's shipowners to promote an effective response to marine spills of oil, chemicals and other hazardous substances.

The Hazardous and Noxious Substances (HNS) Convention will establish a two-tier system for compensation to be paid in the event of accidents at sea, specifically involving hazardous and noxious substances, such as chemicals. Tier one will be covered by compulsory insurance taken out by shipowners, who would be able to limit their liability. In the cases where the insurance does not cover an incident, or is insufficient to satisfy the claim, a second tier of compensation will be paid from a Fund, made up of contributions from the receivers of HNS. Contributions is to be calculated according to the amount of HNS received in each Member State in the preceding calendar year. By 2009, the HNS Convention had still not entered into force, due to an insufficient number of ratifications. A second International Conference, held in April 2010, adopted a Protocol to the HNS Convention (2010 HNS Protocol), that was designed to address practical problems that had prevented many States from ratifying the original Convention. Once the 2010 HNS Protocol enters into force, the 1996 Convention, as amended by the 2010 Protocol, will be called: “the International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea, 2010”.

6.2.3. (a) Safety And Ship Routing\textsuperscript{174}

Navigation, once truly independent throughout the world, is an increasingly regulated activity. The consequences on the marine environment of collision or grounding for a large, modern ship carrying tremendous quantities of high-value, perhaps dangerous cargo, are so severe that

\textsuperscript{174} Routing System: Any system of routes or routing measures designed to minimize the possibility of collisions between ships, including Traffic Separation Schemes, two way routes, recommended tracks, areas to be avoided, inshore traffic zones, precautionary areas, and deep-water routes.
authorities have instituted many types of regulations and control systems to minimize the chances of loss. These range from informal and voluntary systems to closely controlled systems requiring compliance with numerous regulations. The regulations may concern navigation, communications, equipment, procedures, personnel, and many other aspects of ship management. These provisions do not deal with the marine environment directly but it is inherent that the safety in the shipping industry be it the designs or provisions related to other operations will definitely ensure the safety and well being of the marine ecosystems.

The Safety of Life at Sea (SOLAS) Convention in its successive forms is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The 1960 Convention - was the first major task for IMO after the Organization's creation and it represented a considerable step forward in modernizing regulations and in keeping pace with technical developments in the shipping industry. The 1974 Convention has been updated and amended on numerous occasions. The Convention in force today is sometimes referred to as SOLAS, 1974, as amended. The current SOLAS Convention includes Articles setting out general obligations, amendment procedure and so on, followed by an Annex divided into 12 Chapters.

The SOLAS Convention lays down the specifications regarding the minimum standards for the construction, equipment and operation of ships, compatible with their safety. Flag States are made responsible for ensuring that ships under their flag comply with its requirements, and a number of certificates are prescribed in the Convention as proof that this has been done. In addition there is a procedure known as port State control. If there are clear grounds for believing that the ship and its equipment do not substantially

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175 The first version was adopted in 1914, in response to the Titanic disaster, the second in 1929, the third in 1948, and the fourth in 1960.
176 Adopted on (17 June 1960) and entered into force on (26 May 1965).
177 A completely new Convention was adopted in 1974 which included the amendments agreed up until that date and a new amendment procedure. The earlier procedure being very slow had impeded the coming into the force of most of the amendments. The new amendment procedure - the tacit acceptance procedure sought to ensure that changes could be made within a specified (and acceptably short) period of time.
comply with the requirements of the Convention according to the control provisions the Contracting Governments are capacitated to inspect ships of other Contracting States.

6.2.3. (b) Convention On The International Regulations For Preventing Collisions At Sea, 1972 (COLREGS)

The 1972 Convention was designed to update and replace the Collision Regulations of 1960 which were adopted at the same time as the 1960 SOLAS Convention. Traffic separation schemes were the major outcome of the 1972 COLREG.\textsuperscript{178} In shipping parlance it meant a routing measure which separates opposing traffic flow with traffic lanes. In 1971 the IMO Assembly adopted a resolution stating that that observance of all traffic separation schemes be made mandatory and the COLREGs made this obligation clear. The COLREGs include 38 rules divided into five section which deal with the various aspects of shipping navigation.\textsuperscript{179}

There are also four Annexes containing technical requirements concerning lights and shapes and their positioning; sound signaling appliances; additional signals for fishing vessels when operating in close proximity, and international distress signals.

6.2.3.(c) International Convention Relating To Intervention On The High Seas In Cases Of Oil Pollution Casualties, 1969 - 6/5/1975

Following the Torrey Canyon disaster the need for a new regime which, while recognizing the need for some State intervention on the high seas in cases of grave emergency, clearly restricted that right to protect other legitimate interests was felt. A conference to consider such a regime was held in Brussels in 1969.\textsuperscript{180} The Convention which resulted affirms the right of a

\textsuperscript{178} Rule 10 gives guidance in determining safe speed, the risk of collision and the conduct of vessels operating in or near traffic separation schemes.

\textsuperscript{179} Part A - General; Part B - Steering and Sailing; Part C - Lights and Shapes; Part D - Sound and Light signals; and Part E - Exemptions.

\textsuperscript{180} The Torrey Canyon disaster of 1967 revealed certain doubts with regard to the powers of States, under public international law, in respect of incidents on the high seas. The moot questions raised were as to the extent to which a coastal State could take measures to protect its territory from pollution where a casualty threatened that State with oil pollution, especially if the measures necessary were likely to affect the interests of foreign ship owners, cargo owners and even flag States.
coastal State to take such measures on the high seas as may be necessary to prevent, mitigate or eliminate danger to its coastline or related interests from pollution by oil or the threat thereof, following upon a maritime casualty subject to other considerations. In the case of non compliance of this clause the coastal State which takes measures beyond the ones permitted under the Convention is liable to pay compensation for any damage caused by such measures.


The Nairobi International Convention on the Removal of Wrecks (WRC) was adopted by an IMO Diplomatic Conference on 18 May 2007. The new Convention establishes a sound legal basis for States to remove, or have removed, from their exclusive economic zones (EEZs) wrecks that may pose a hazard to navigation or, because of the nature of their cargo, a threat to marine and coastal environments. The WRC makes ship owners financially liable for the costs of removing hazardous wrecks and to this end requires them to take out insurance or provide other financial security to cover the costs of wreck removal.

The Nairobi International Convention on the Removal of Wrecks 2007 aims to provide the first set of uniform international rules for ensuring wrecks located beyond the territorial sea are identified, marked and, if it is deemed necessary, removed. The IMO has estimated that around 1,300 shipwrecks have been abandoned, some of which may pose a risk to navigation or a risk to the marine and coastal environments (from oil and cargo remaining on board). Concerns have been raised that the potentially high costs involved in removing a wreck and the hazardous materials on board may be prohibitive for some states. The new Convention aims to resolve these and other issues and will enter into force twelve months after it has been ratified by 10 states.

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181 The coastal State is empowered to take only such action as is necessary, and after due consultations with appropriate interests including, in particular, the flag State or States of the ship or ships involved, the owners of the ships or cargoes in question and, where circumstances permit, independent experts appointed for this purpose.
India is party to several marine pollution conventions developed by the I.M.O. and the United Nations Organization. The International Labour Organization also develops conventions and recommendations relating to the working conditions of seafarers, their safety, identity and other welfare measures for the seafaring community at large. India is a member of International Labour Organization also. To give effect to the requirements of all these conventions, suitable statutory provisions have been made in the Merchant Shipping Act 1958. The Act is also suitably amended as per the requirements of the conventions for giving statutory backing for implementation of the provisions of these conventions.

(a) MERCHANT SHIPPING ACT, 1958.

India has been a seafaring nation for centuries. The Indian ships used to sail across many seas and carried on prosperous trade with Asian and Middle East countries. Though Indian Merchant Shipping Law was nebulous and sketchy as it existed in 19th century, after the independence the Merchant Shipping Act, 1958 was passed by the Indian Parliament to suit the requirements of a maritime country like India. This Act had made good the main deficiency in the earlier laws since they did not provide for registration of what may be termed as Indian Ships.182

The MSA applies to every Indian ship, wherever it is, and every foreign ship while it is at a port or place in India or within the territorial waters of India or any marine areas adjacent thereto over which India has exclusive jurisdiction in regard to control of marine pollution. The MSA does not apply to warships or ships owned or operated by a state for non-commercial purposes.

The International Convention for the Prevention of Pollution of the Sea by Oil, 1954 is the first treaty at the international level for the reduction of oil pollution of the sea. In order to give effect to this Convention, the Merchant

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182 In the preindependent India the British law was applicable to Indian ships trading in international sea voyages as these ships were required to be registered under U.K. Merchant Shipping Act and therefore, technically they were British Ships although registered in India.
Shipping Act regulates and controls the discharge of oil or oily mixture by an Indian tanker or ship within any of the prohibited zones or by a foreign tanker or other ship within the prohibited zone adjoining the territories of India. The act empowers the Central Government to prohibit the discharge of oil and oily mixtures, inspection and control of ships to which Oil Pollution Convention applies, maintenance of Oil record book, oil reception facilities at the ports in India and powers of the Government to take measures for preventing or containing oil pollution, direction to certain ships to render assistance and levy of oil pollution cess. Further, there is a prohibition for discharging any oil anywhere at sea from an Indian ship. This part does not contain provision for the action to be taken when oil is escaped. The review Committee has recommended to empower the Central Government to take appropriate action when oil is escaped.

The Act is divided into 24 parts, each part dealing with specific aspects of merchant shipping like registration of ships, sailing vessels and fishing vessels, National Shipping Board, manning of ships, engagement, discharge and repatriation of seamen and apprentices, safety of passenger and cargo ships, control of Indian ships and ships engaged in the coasting trade, collisions, prevention and control of pollution of the sea by oil from ships, limitation of shipowners' liability, civil liability for oil pollution damage etc.

India being a Maritime Nation and a member of the IMO has to ratify the changes approved by IMO and incorporate the same subsequently in its National Legislation. The merchant shipping law deals mainly with technical matters and many of these are regulated by International Conventions like the Safety Pollution, Limitation of Liability, Prevention of Collisions and Loadline Convention, the International Labour Organisation(ILO) Conventions, etc.

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183 Part XI A – Prevention and containment of pollution of sea by Oil: This part contains provision for prevention of pollution. Rules can also be framed by the Government under the provision of this part.

184 Part XB giving provisions for civil liability for oil pollution damage was inserted by Amendment Act of 1983 came into force from 18.5.1983. Part IX A Deals with Nuclear Ships which includes application or non application of certain provision of this Act to Nuclear ships, issue of Nuclear passenger and Nuclear Cargo Ship Safety Certificate and powers to make rules in this respect Part X - This part deals with the collision, accident at sea and liability which includes provision for division of loss in case of collision, damages for personal injury etc. Part X B – gives provision for civil liability for oil pollution damage. It embodies provisions for limitation of liability of the owner, constitution of limitation fund, consolidation of claims & distribution of fund amongst claimants, provision for compulsory insurance or other financial guarantee and rule making powers.
"Oil" means any persistent hydrocarbon mineral oil such as crude oil, fuel oil, heavy diesel oil and lubricating oil, whether carried on board a ship as a cargo or in the bunkers of such a ship. The MSA is clear that it covers only persistent hydrocarbon mineral oil. There is ambiguity in the lack of a clear distinction between persistent and non-persistent oils. Many cases of grave and imminent threat of pollution damage which have been prevented at significant costs, do not, nevertheless, attract the provisions of the MSA because the MSA definition of pollution damage involves an actual escape or discharge.

The Act does not provide compensation for damage to the environment except for the costs incurred in restoration of environmental damage. No compensation is payable for damage which is not reparable. Under the MSA only the owner is liable. Section 352(1) of the Act imposes strict liability on all ship owners, irrespective of their nationality or flag, in respect of cases of oil pollution damage. Although liability is strict, the shipowner is allowed to escape liability if it can proved that the discharge or escape resulted from an act of war, hostilities, civil war, insurrection or a natural phenomenon of an exceptional, inevitable and irresistible character. There is nothing in the MSA to prevent a claim in negligence from being made against a third party other than those exempted persons. Remedial actions by the shipowner against third parties are expressly preserved.

To give full impact to the provisions of MARPOL and its annexes and in exercise of the powers conferred by sub-section(3) of section 356 E, clause (ee) of section 356-O and Section 457 of the Merchant Shipping Act, 1958(44 of 1958), the Central Government has made the appropriate rules. 187

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185 MSA, Section 352H (b).
186 Id., Section 352H (d).
187 (i) The merchant shipping (prevention of pollution by sewage from ships) rules, 2010
(ii) The merchant shipping (prevention of pollution by harmful substances carried by sea in packaged form) Rules, 2010
(iii) The merchant shipping (control of pollution by noxious liquid substances in bulk) Rules, 2010
(iv) The merchant shipping (prevention of pollution by Garbage from ships) Rules, 2009

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(b) Hazardous Substances

The MSA does not contain any provisions regarding carriage of hazardous substances. Hazardous substances are extensively regulated in India by other rules, though not necessarily maritime transport specific. The liability and compensation issues in connection with the carriage of hazardous and noxious substances by sea are covered in Public Liability Insurance Act, 1991 and National Environmental Tribunal Act, 1995.

Public Liability Insurance Act, 1991 provides for public liability insurance to give immediate relief to the persons affected by an accident occurring while handling any hazardous substance. "Hazardous substance" means any substance or preparation which is defined as hazardous substance under the Environment (Protection) Act, 1986, and exceeding such quantity as may be specified, by notification, by the Central Government. Under Section 2(e) of the Environment (Protection) Act, 1986 the term hazardous substance means "any substance or preparation which, by reason of its chemical or physicochemical properties or handling, is liable to cause harm to human beings, other living creatures, plants, micro-organism, property, or the environment. A list of Hazardous and toxic chemicals has been given under Part-II of Schedule 1 of the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 issued by the Central Government in exercise of powers conferred by Sections 6, 8 and 25 of the Environment (Protection) Act, 1986."

According to the provisions of section 2 of the Public Liability Insurance Act, 1992, accident means an accident or incident occurring while handling any hazardous substance which, in relation to any hazardous substance, includes transportation by vehicle. Vehicle means any mode of surface transport other than railways. Therefore, maritime transport is included in it as well thus clearly indicating that the Act is applicable to the accidents occurring during maritime transport. The owner's liability to pay compensation is two-

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fold. Firstly he has to provide immediate relief out of the fund known as Environment Relief Fund. Secondly, as per the owner must obtain insurance before commencing hazardous activities such as the carriage of oil or hazardous substances. The owner is liable for compensation as specified in the Schedule of the Act for death, injury or damage to any property resulted from an accident.

The National Environment Tribunal Act, 1995, takes into account only those cases where accidents are caused while handling a hazardous substance, exceeding the quantity as specified under the Public Liability Insurance Act, 1991. Similarly the intent of the Civil Liability Convention (CLC) is to impose strict liability on tanker owners for damage to the coastline or related interests of any state caused by pollution of the sea by oil. As a supplementary instrument to this convention, the Fund Convention was adopted. It provides additional compensation to victims of oil pollution damage over and above the remedies available under the CLC. India has ratified these Conventions and their 1976 and 1992 Protocols. Part X B of the MSA amended by the Merchant Shipping (Amendment) Act, 2002, deals with civil liability for oil pollution damage. Part X C was also introduced by the Amendment Act, 2002 to deal with the requirements of the international oil pollution compensation fund.

Part X A of the MSA, containing Sections 352 to 352F deals with limitation of liability provisions applicable to ship owners in India. This part was amended by the Merchant Shipping (Amendment) Act, 2002. This Amendment is intended to give effect to the provisions of the Convention on Limitation of Liability for Maritime Claims, 1976.

(c) Indian Coast Guards

One of the statutory duties of the Indian Coast Guards is marine environmental preservation, protection, and prevention and control of pollution in the maritime zones of India. The Coast Guard identifies marine environment security through four activities: Protection of marine environment,
Preservation of marine environment, Prevention of marine pollution, and Control of marine pollution. This is termed as the P3C factors of environment security. Preservation and Protection of marine environment and Prevention and Control of Pollution (P3C) is a statutory duty of the Coast Guard under the Coast Guard Act 1978. Thus marine environment security is a wholesome concept laid down in the Coast Guards Act, 1978. Responsibilities of coordination in the event of an oil spill at sea were transferred to the Coast Guard from the Director General (Shipping) on 07 Mar 1986. A draft National Oil Spill Disaster Contingency Plan (NOS-DCP) was prepared on 14 Apr 1988 and forwarded to all concerned agencies for comments. Final draft was approved by the Committee of Secretaries on 04 Nov 1993. The NOS-DCP declares the Director General Coast Guard (DGCG) as the Central Coordinating Authority (CCA) for marine oil spill response activities in the maritime zones of India, and delineates the duties and responsibilities of each participating agency. National Oil Spill Disaster Contingency Plan (NOS-DCP) stipulates the organisational and operational details to effectively combat a national oil spill contingency. After the adoption of the OPRC convention by the IMO in 1990 with final Act and ten resolutions and promulgation of the Convention in 1995, India became one of the few countries that readily accepted the Convention. Coast Guard is also the Central Coordinating Agency for marine pollution response in the country since March 1986.191

191 The following government departments and agencies will act as resource agencies as required to support the actions of the Indian Coast Guard :-
(a) Indian Navy (IN)
(b) Ministry of Shipping (MOS)
(c) Department of Ocean Development (DOD)
(d) Ministry of Environment and Forests (MOEF)
(e) Ministry of Petroleum and Natural Gas (MOPNG)
(f) Department of Agriculture and Co-operation (DAC)
(g) Major Port Authorities
(h) Coastal State Authorities
(i) Central and Coastal State Pollution Control Boards (CPCB/SPCB)
(j) Oil and Natural Gas Corporation (ONGC)
(k) Oil India Limited (OIL)
(l) Oil Refineries (n) Indian Oil Corporation (IOC)
(m) (p) Mercantile Marine Department (MMD)
(n) (q) Directorate General of Shipping (DGS)
(o) (r) Shipping Corporation of India (SCI)
(p) (s) National Institute of Oceanography (NIO)
(q) (t) Central Marine Fisheries Research Institute (CMFRI)
(r) (u) Any other concerned agency
In execution of these duties the Coast Guard is engaged in gradually building up pollution response capability to deal with a major oil spill of approximately 20,000 tonnes in the Exclusive Economic Zone of India. Indian Coast Guard is responsible for implementation and enforcement of the relevant marine pollution laws. Indian Coast Guard with the approval of the Ministry of Defence may seek assistance from outside resources (International tier 3 facilities) depending on the oil spill situation. In such cases customs and immigration authorities of ports and airports need to provide immediate facilitation for temporary import of equipment and personnel in order to transfer them to the scenes of action, expeditiously. This plan is intended to delineate functions of various concerned departments and agencies for the operational responsibility to marine incidents which could result due to spillage of oil into water.

The Coast Guard inventory consists of containment, recovery and dispersant equipment of different capacities, including both aerial and vessel-based systems. Some port facilities and oil companies have also developed limited capabilities for oil spill response. The Coast Guard aims for all ports, facilities and offshore installations to have a Tier 1 response capability.

Various support agencies have been allotted specific roles for implementation of The National Oil Spill Disaster Contingency Plan. The Indian Navy/coastal state authorities/port authorities will make the facilities of their communication/operation centres available to receive and disseminate reports of marine pollution accidents. The Port Authority will provide tugs and pollution control equipment at the incident site within port limits. Ministries of Shipping, and Petroleum and Natural Gas will provide tankers or tank barges for storage of recovered oil or oil in water emulsions, and will arrange for storage and eventual disposal of recovered oil. Director General of Shipping, Ministry of Shipping, has been made responsible for all negotiations with the vessel, cargo owners, and insurers and will also conduct all negotiations regarding compensations and indemnification. Either the Ministry of Environment or Agriculture is to provide scientific advice regarding species at
risk, shore-line sensitivity, restriction of fishing activities, use of dispersant chemicals, beach cleaning methods, etc. Ministry of Finance will provide authorisation for expenditure and funds for initial response and ensure adequate financial records are maintained. Coastal state authorities / departments / public works / civil defence corps will provide personnel and equipment, as required, for shoreline clean-up and ensure safety and protection of the local population and resources.

In the thirteenth National Oil Spill Disaster Contingency Plan (NOS-DCP) and Preparedness Meeting, the important notable issues which were discussed and deliberated upon included the establishing Tier-I facilities, major oil spill exercise and training, role of State Pollution Control Boards, preparation of Local Contingency Plan, contingency plan for LNG, status report on joint inspection of Tier-I OSR facilities, procurement of pollution control vessels for ports, inclusion of new ports under NOSDCP, oil spill response centre at Gulf of Kutch region, revolving trophies for best port and best oil handling agency, Prevention of oil spillage in water, legislations etc.

India is an active partner in the South Asian Seas Programme of the United Nations through which it has been involved in developing a regional contingency plan for South Asia for combating oil and chemical spills at sea. The nodal agency is the Department of Ocean Development. The Coast Guard is a party to the plan. Once established, it is expected that there will be bilateral cooperation between the South Asian maritime states in oil spill response in the area. The Coast Guard needs to be prepared for it. Indian Coast Guard regularly participates in joint exercises with the Maldivian Coast Guard in which it also tests its joint capabilities in combating oil spill at sea. This is in addition to imparting training to their response personnel on request. India is also active in the meetings of the Marine Environment Protection Committee (MEPC) of the International Maritime Organisation (IMO). The nodal agency is the Ministry of Shipping. The Coast Guard is represented in the Indian delegation.

192 Held at Vigyan Bhavan, New Delhi on 15th Apr 09.
The Ministry of Environment Forests oversees the Environment and ecology including environment in coastal waters, in mangroves, coral reefs. The main focus, especially, is: 1. Enactment of legislation for prevention and control of marine pollution from land and sea based sources. 2. Prevention and control of marine pollution at source, on land or the sea. 3. Monitoring of pollution upto the shore. 4. Cleaning of beaches affected by oil pollution through coastal states and Union Territories.

The Ministry of Shipping supervises the prevention and control of pollution arising from ships all over the sea including the major ports areas and the enactment and administration of the legislation related to prevention, control and combating of pollution arising from ships. It functions through DG (Shipping). To comply with provision made in section 356 G(1) and (2) of Merchant Shipping Act, 1958 (Amendment) for the Purpose of (a) Inspection of construction of ships and tankers in order to comply with provision of MARPOL 73/78 or of the other convention on maritime pollution formulated by IMO or other related bodies, Merchant Shipping Act and issue of necessary certificates, and penalising the offenders apprehended by the Indian Coast Guard and port authority for violations of the above provisions of the Act, including processing of pollution damage claims etc. It also functions through major ports authorities within port limits and it takes charge of the following: (a) Inspection of oil record books; (b) Apprehending of violators of anti-pollution provisions mentioned under section 356 G (1) and (2) of the Merchant Shipping Act; (c) Checking of vessels for carrying necessary insurance certificate against oil pollution damage; (d) Empowered to handle necessary anti pollution provisions mentioned under Indian Ports Act, 1908 (Amendment). (e) Monitoring and combating of oil pollution in the port areas.

The Ministry of Petroleum and Natural Gas is entrusted with combating of oil pollution around offshore exploration and production platforms upto 500 mtrs and combating of oil pollution around coastal refineries through the concerned refineries. The Department of Ocean Development (now the Ministry of Earth Sciences), conducts scientific monitoring of marine pollution arising from land based ship-based and other resources in various maritime to zones including coastal waters, but excluding monitoring and of oil pollution within the limits of major ports, oil platforms, of oceans installations and structures.
The Ministry of Defence, Indian Coast Guard Organisation deals with the surveillance of maritime zones against oil spills and combating oil spills in various maritime zones except in the waters of major ports. It acts as the Central Co-ordinating Agency for combating of oil pollution in the coastal and marine environment of various maritime zones of the country. Implementation of national contingency plan for oil spill disaster comes within its ambit. It oversees the following controlling activities in various maritime zones except within the limits major ports: (a) Inspection of oil record books, (b) Apprehending violators of anti-pollution provisions mentioned under Sections 356 G(1) and (2) of the Merchant Shipping Act, (c) Checking of vessels for carrying necessary insurance certificates against oil pollution damage.

There are three response centres - in Mumbai, Chennai and Port Blair reach with qualified personnel and a well stocked inventory of response equipment. Limited capabilities exist with the Coast Guard at Kochi and Vadinar on the west coast. The Coast Guard has experience in response activities based on incidents, regular exercises and involvement in related activities. There have been 12 spill incidents so far where the Coast Guard has undertaken response actions in Indian waters, including the MV LAJPAT RAI in Bombay Port (1984) and MV PUPPY (1989) which occurred offshore but lead to shoreline oiling. Oil from MAERSK NAVIGATOR spill in 1993 was monitored by Coast Guard aircraft and treated with dispersant from a Coast Guard cutter.

(d) Ship Breaking Activities:

Ship breaking is an important activity along the West Coast of India especially in Gujarat. Alang, a small coastal town in the state, houses the world’s largest ship breaking yard. Forty five thousand workers recycle about 200 ships in this yard each year. This produces 2.6 million tons of scrap steel per year, equivalent to 15 % of the country’s total steel production.

Ship breaking industry creates numerous hazards for the coastal and marine environment. Due to the activity of ship breaking large number of dangerous pollutants including toxic waste, oil, polychlorinated bi phenyls and heavy metals are released in the surrounding coastal area which ultimately
reaches the sea due to very high tidal range. While most of the oil is removed before a ship is scrapped, the sand and other sorbents which are used to mop up the remaining oil are not disposed off in an environmental friendly manner. High concentration of oil, and other non degradable items ultimately reach the sea as they are far removed from the public eyes.¹⁹⁴

(e) Sethusamudram Ship Canal Project (SSCP):

The proposed Sethusamudram Ship Canal Project (SSCP) is a 167 km long shipping canal, and envisages the creation of a navigable canal from the Gulf of Mannar to the Bay of Bengal to facilitate the movement of ships. It is claimed that the ships moving from the west coast to the east coast of India will not need to navigate around Sri Lanka but can use the channel to save 36 hours of shipping time and 570 nautical miles. The construction and maintenance of the canal will involve a range of coastal and marine engineering activities, and when completed will be the largest such undertaking of its kind for India. For a project such as the Sethusamudram Ship Canal Project (SSCP) to be environmentally sound and well-designed, a full understanding of the project area, its ecology, its environmental processes, the project activities – namely dredging and waste disposal and movement of ships in the region is a must.