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# Legal Examination of the International Maritime Organization's Approaches to Environmental Protection

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**ABSTRACT**

The protection of the environment, including marine ecosystems, has gained increasing significance. The International Maritime Organization (IMO) is one of the most important international organizations related to maritime affairs, which has engaged in the formulation of multiple conventions and protocols to achieve its objectives. The role of this international organization in the realm of environmental protection is a critical subject that has been relatively underexplored. The fundamental question examined in this context is: what legislative measures has the International Maritime Organization (IMO) adopted in recent years regarding environmental protection? This study employs a descriptive-analytical methodology and utilizes library research to address the aforementioned inquiry. The findings of this research indicate that the IMO has initiated the drafting and establishment of numerous conventions and protocols aimed at environmental protection. The recent resolutions and approaches of the International Maritime Organization concerning ship-related pollution, waste management, and plastic waste include conventions and protocols for controlling harmful anti-fouling systems on vessels, managing ballast water and sediment control, and ensuring the safe and environmentally friendly recycling of ships. Additional measures include the establishment of an international fund for compensation for oil pollution damage, including regulations about claims processing, efforts to establish liability and compensation for damages associated with the transport of hazardous and toxic materials, and the institution of civil liability for oil pollution damage from vessels. The formulation of requirements concerning the removal and disposal of sunken vessels represents key new approaches taken by the International Maritime Organization regarding damages caused by marine pollution.

**Introduction**

Although humanity has long recognized the importance of the environment in its life, the last decades of the twentieth century should be considered the pinnacle of environmental issues being addressed. Today, the significant danger that humanity faces due to environmental problems has not only disrupted the tranquility and security of life but has also endangered its very existence. Therefore, alongside the myriad problems humans currently encounter, the catastrophe of environmental imbalance—arguably the most critical—remains one of their foremost concerns. The issue of environmental pollution is not confined to a single country or a specific territory; rather, it is a global problem encompassing various facets, including water and air pollution, global warming, rising sea levels, the extinction of plant and animal species, ozone layer depletion, deforestation, acid rain, and more. Supporting and protecting the environment is recognized as a fundamental and essential value at the international level; indeed, the right to a healthy environment is placed alongside other high and fundamental values such as the right to life, health, and a standard of living. Furthermore, the marine environment holds significant economic, social, and other necessities, making its protection essential for the present generation. Protecting the marine environment involves prohibiting certain polluting behaviors and striving for the improvement and rehabilitation of polluted environments. One method of protection is the enactment of international regulations. Given the impact of the environment on life and consequently the survival of humanity, environmental protection is deemed crucial.

Several challenges and issues that have become more prominent and problematic in recent years regarding the marine environment include the expansion of global trade in consumer goods, which has led to an increase in the number of massive cargo ships in the maritime transportation fleet compared to previous years. These large vessels, consuming numerous tons of fuel per hour, contribute to the onset of allergic diseases and increase the likelihood of cancer, making ships one of the largest sources of pollution. Disposal of hazardous materials and heavy metals with special permits, as well as the dumping or incineration of urban waste in the oceans, has resulted in the destruction of marine systems and surface waters, causing irreparable damage that has become more evident in recent decades. This is primarily because of the extensive use of the seas and the rapid discharge of pollutants, which has diminished the self-purification capacity of marine ecosystems, making it increasingly difficult to neutralize the effects resultant from such substances. Additionally, the introduction of environmental issues and human rights documents, which recognize the right to a quality environment as an independent human right, has laid the groundwork for new actions and approaches within the International Maritime Organization (IMO). The enactment of amendments to conventions and other legislation, along with ensuring their enforceability, has become one of the most significant actions undertaken by the IMO in this regard. Among the most recent of these conventions (from 1983 to 2018) are the International Convention for the Prevention of Pollution from Ships and its Annexes (MARPOL), the Convention on the Prevention of Marine Pollution by Dumping Waste and Other Matter (LC PORT), the Protocol on Preparedness, Response, and Cooperation in Combating Pollution Incidents by Hazardous and Noxious Substances (OPRC HNS), the Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS), the International Convention on Civil Liability for Oil Pollution Damage (BUNKERS), the Nairobi International Convention on the Removal of Wrecks (NAIROBI WRC), the International Convention for the Safety of Life at Sea (SOLAS), the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM), and the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (HICSESS). Among the other

activities of the International Maritime Organization is the adoption of numerous resolutions regarding waste management, the most recent of which was adopted in 2018.

**Research Methodology**

In this study, considering the technical and theoretical nature of the subject, a library-based method is employed. This approach utilizes books, articles, theses, fatwas, reputable scientific databases in cyberspace, and the application of existing laws.

## 1.Environment and Marine Environment

Section One: Definition of Environment

The term "environment" is composed of two words: "environment" and "life". In the lexicon, the term environment refers to the habitat, surrounding area, and the encompassing space. Generally, in specialized management literature, the environment refers to the phenomena surrounding an organization, which typically includes factors such as government, competitors, technology, supply and demand of labor, customers, and stakeholders, and lately, the industry associated with the system (Rezaian, 1997) .

Therefore, the environment encompasses all natural and human-made elements that encompass human beings, animals, and plants, or all tangible and intangible factors that constitute the framework of life (Mashhadi, 2010) .

In the introduction of the United Nations Conference on the Human Environment in 1972 in Stockholm, it is stated to governments: "Human beings are both the creators and the architects of their environment, which provides the physical survival and the opportunity for spiritual growth (moral, social, and spiritual)" (Kies et al., 2005); in essence, what environmental rights advocate is that humans have the right for their environment to be conducive for a prosperous life, accompanied by security and health .

From the perspective of the International Court of Justice, the environment is the space in which human beings live, and the quality of their life and health, including for future generations, is dependent on that space. According to the resolution of June 27, 1967, by the Council of Europe, the environment includes air, climate, soil, and both intrinsic and extrinsic factors related to the life of each living organism (Mashhadi, 2010). In another definition, the environment comprises all or part of the elements forming the natural environment, including water, air, and soil at surface and subsurface levels, whether in a natural state or modified by human activity (Kies et al., 2005) .

Environmental law is a branch of law concerned with the protection and preservation of the environment, encompassing preventive actions along with measures to establish accountability and remediation for incidents that harm and damage the environment. Such damages are environmental losses imposed on individuals or entities through their respective living environment, where the environment itself is the source of damage rather than the victim. Some believe that this damage stems from pollution and pertains to all damages related to the depletion of natural elements (water, air, soil) (Rajabi et al., 2009) .

In summary, a healthy environment is the divine gift that emerges from all entities, resources, and elements that surround every living organism, facilitating life and existence for all living beings and materially and spiritually enabling humans to achieve perfection .

Section Two: Marine Environment

As previously mentioned, the environment refers to all habitats where life occurs. The environment consists of a collection of external physical factors and living organisms that interact together and influence the growth, development, and behavior of entities. The human environment includes air, water, soil, vegetation, forests, pastures, seas, lakes, rivers, springs, aquatic life, animals, mountains,

plains, lowlands, deserts, towns, or villages. The marine environment, in particular, includes the sea, marine life, and various marine organisms, including algae and corals .

The following characteristics can be briefly considered for a healthy marine environment: (UK Government, 2009)

-Biodiversity

-The presence of invasive species resulting from human activities should not be at levels that adversely affect the ecosystem .

-Industrial fishing of fish and bivalves should not threaten the species with extinction or population decline .

-Food abundance should be sufficient to sustain the long-term and continuous life of organisms .

-Continuous changes in the seabed conditions should not negatively impact the marine ecosystem .

-Accumulation of waste and decay should not reach levels that are classified as pollution .

-The volume of marine litter should not be sufficient to pose problems for the shores and marine environment .

Sound produced from energy generation should not be at levels that adversely impact the marine environment .

In summary, development should not be detrimental to marine ecology, biodiversity, and the protection of the Earth. Should harm occur to a significant degree, corrective measures should be undertaken to mitigate adverse effects; otherwise, the continuation of the project should be reconsidered. Additionally, paying attention to humanity's natural heritage and marine landscapes is crucial in monitoring marine industrial activities.

2.Sources of Marine Environmental Pollution

Chapter One: Disposal and Release of Waste and Hazardous Waste

In general, pollution caused by waste is one of the contemporary concerns of humanity. International environmental documents have established obligations and responsibilities for governments regarding the protection of the environment. Article 3 of the 1972 London Convention on the Prevention of Marine Pollution by Dumping Waste and Other Matter stipulates :

"Dumping means: 1- The intentional disposal of any waste or other matter into the sea from vessels, aircraft, platforms, or other man-made structures in the sea. 2- The intentional disposal of materials from vessels, aircraft, platforms, or other man-made structures into the sea." (Rahiayi et al., 2003) .

Furthermore, Article 1 of the 2003 Tehran Convention concerning the Framework for the Protection of the Caspian Sea Marine Environment during the disposal and release of waste stipulates :

"Disposal and release refer to any intentional transfer or disposal of waste materials or other materials originating from vessels, aircraft, platforms, or other man-made structures, and any intentional abandonment of the wrecks of vessels, aircraft, unused platforms, or other man-made structures in the Caspian Sea ".

In the environmental dictionary, disposal is defined as the final determination, destruction of toxic materials, radioactive materials, or other waste, excess pesticides that are no longer usable, or other chemicals, contaminated soils, or barrels containing hazardous materials removed from operations, while release is defined as a location for discharging solid wastes without environmental control (Golai and Heydari, 2014) .

This deficiency in inadequate collection and disposal systems additionally affects the disposal of solid waste generated by vessels on coastal areas. The increase in solid waste in coastal regions is highly detrimental to the economy of most countries, particularly those reliant on the tourism industry. Scientists have reported a rising number of incidents and deaths among marine mammals, fish, and birds, often due to entanglement in waste (Shelton and Case, 2017) .

Chapter Two: Atmospheric and Air Pollution

One significant source of pollution, particularly in oceans, is atmospheric and air pollution. This refers to pollutants that enter the skies and the earth and seas through the atmosphere; therefore, many of the pollutants present in the air can also affect water quality. The origin of these contaminants is also based on the surface of the earth (Robin and Lou, 2011). Consequently, emissions from transportation vehicles, pollutants resulting from industrial equipment, or the use of incinerators on vessels and ships can be considered sources of pollution, thereby posing serious threats to the marine environment .

The issue of sea pollution arising from warfare is addressed in the United Nations Convention on the Law of the Sea. In Article 212 of the aforementioned convention, states are advised to undertake necessary actions to prevent, reduce, and control marine environmental pollution from the atmosphere, such as by enacting necessary laws and regulations applicable within their jurisdiction and on the vessels flying their flags and on the aircraft registered in their countries. According to Article 222, vessels, in addition to enacting laws and regulations concerning the ships flying their flags and the vessels and aircraft registered in their countries, must also comply with applicable international standards and regulations (Taghizadeh Ansari, 1997) .

Chapter Three: Sediments

Sediments are transported by rivers and marine and coastal ecosystems. Geochemical processes control the transport of many suspended and dissolved materials by rivers. Human activities may also increase sediment loads in rivers. These activities include soil erosion in river basins due to deforestation, urbanization, agricultural practices, and pollutants discharged into cities. Many lands surrounding marine ecosystems have undergone erosion due to development activities and a lack of attention to land slope, resulting in substantial sediment entering the marine environment (Najafi Nasab, 2007) .

Improper engineering, such as the construction of breakwaters or sand dredging operations along the coast, has led to erosion, which carries serious ecological consequences. Increasing sedimentation necessitates filtration for photosynthesis. Dredging is one of the most effective sedimentation factors in shallow coastal waters to keep loading facilities open, which generally contain heavy toxic metals, organic pollutants, etc. Although dredging does not generate pollution, it does cause the suspension of sediments, leading to reduced water clarity. Increased turbidity diminishes coral reefs and marine plants that rely on light for photosynthesis. Should sediment load increase, the physical suffocation of plants and benthic organisms may occur due to diminished oxygen availability.

Chapter Four: Oil Hydrocarbons

Another significant pollutant that can severely endanger the marine environment is oil hydrocarbons. In marine environments that possess oil reserves, oil hydrocarbons hold particular importance. In these regions, extensive activities are conducted for exploration, extraction, transportation, and loading, each of which has environmental impacts. The oil produced in the area is either loaded, resulting in the creation of a complex network of distribution routes, or transported to refineries located in coastal areas. These regions are highly vulnerable due to the potential for tanker accidents or pipeline ruptures on the seabed. Each year, approximately 25,000 oil tankers, equivalent to 60% of the world's oil exports, transit through the Strait of Hormuz. About 2,000,000 barrels of oil leak through this route and enter the waters of the Persian Gulf (Hinrichsen, 1996).

In addition to tankers, several oil tankers also operate to support oil refineries and petrochemical industries in the region. Tankers and vessels do not routinely utilize port facilities for the disposal **of** contaminated water for ballast, cooling water, oil sludge resulting from centrifugation, or wastewater from washing engine room facilities. Although the volumes of these discharges are small, their oil content is substantial (Fouda, 1997).

Failure to adhere to proper resource management principles inflicts irreparable damage to the marine environment. Such damage, particularly after the Industrial Revolution, has been exacerbated by the accelerated advancement of machinery and technology. During this period, humanity progressed with little regard for the harm inflicted upon nature, operating under the belief that nature is an infinite resource, capable of sustaining unlimited exploitation and intervention. However, it did not take long

before humans were compelled to acknowledge the reality that natural resources and their exploitation require management.

Potential oil well blowouts, collisions between oil tankers, and the discharge of ballast water can each pose significant risks to the marine environment. Oil and gas exploration represents another source of pollution, which enters the marine environment as a result of oil spills, accidents, or the discharge of associated water during oil processing. The accompanying water contains waste chemicals resulting from drilling mud, which may include oxygen-depleting substances alongside toxic polycyclic aromatic hydrocarbons, gasoline, ethylbenzene, xylene, and heavy metals such as lead, copper, nickel, and mercury.

Accidental oil spills in marine operations often occur due to pipeline failures, well overflows, oil rig fires, and inadequate equipment performance. Generally, one of the most significant sources of marine pollution relates to various activities in the sea, including maritime transportation, coastal equipment, and coastal facilities (including those related to the unloading and loading of crude oil and its derivatives), which result in the introduction of significant volumes of oil substances into the sea. These negative impacts on the global ecosystem have prompted the international community to seek appropriate solutions to mitigate oil pollution, resulting in multiple decisions in this regard, ultimately leading to the adoption and implementation of the International Convention for the Prevention of Pollution from Ships, commonly known as the MARPOL Convention (Qareh Chahi et al., 2016). According to Annex I of this convention, which pertains to controlling oil pollution from ships, the direct discharge of any oil substances into the sea is prohibited. Various oil residues collected aboard ships must be stored in special tanks and either handed over to shore facilities or discharged into the sea only after treatment through oil-water separation equipment.

**1. Recent Resolutions and Approaches of the International Maritime Organization Regarding** Ship-Related Pollution

This discussion aims to examine the recent resolutions and approaches of the International Maritime Organization concerning pollution caused by ships .

First topic: Control of Harmful Anti-Fouling Systems on Ships

In order to control harmful anti-fouling systems on ships, the International Maritime Organization adopted the International Convention on the Control of Harmful Anti-Fouling Systems on Ships (adopted in 2001) .

It is noteworthy that the underwater parts and walls of ships, which are always submerged, are suitable locations for the growth and development of algae that attach to them. Over time, these algae accumulate, causing damage to the hull and even reducing the ship's speed. To prevent such phenomena, shipowners use a series of anti-fouling systems that contain toxic substances. Scientific research has shown that the toxic substances in these anti-fouling agents, such as tributyltin and its compounds, can be very dangerous and harmful to the marine environment, particularly to the fish that humans rely on for sustenance. With public awareness of the destructive effects of these substances and the growing use of them, as well as the increase in the number of ships globally, the international community, led by the International Maritime Organization, sought to take practical steps towards eliminating, controlling, and reducing the use of these toxic substances. For the first time, the harmful effects of anti-fouling systems were discussed in 1988 at a meeting of the Marine Environment Protection Committee. Subsequently, during its 30th session held in 1990, this committee adopted its initial recommendations in the form of resolution MEPC 30/46 .

The issue of reducing pollution caused by chemical compounds used in anti-fouling systems was addressed at the "United Nations Conference on Environment and Development" held in 1992. With increasing environmental concerns and the importance of the subject, the IMO Assembly, at its 21st session held in November 1999, tasked the Marine Environment Protection Committee with urgently beginning work on preparing a legally binding international instrument to confront the harmful effects of anti-fouling systems. The committee, by forming a special working group, succeeded in preparing a

draft convention in this regard before the next assembly meeting, which took place in November 2001, and was prepared for an international conference for final approval.

**Chapter Two: Ballast Water Control and Management**

Maintaining the stability of ships when they are traveling empty is very important for their safety. For this reason, it is necessary for ships to take on large amounts of water in designated tanks for this purpose. This massive volume of water, known as "ballast water," along with the sediments contained in it, is discharged into the sea before loading at a port. Ballast water may be taken on thousands of kilometers away from where it is discharged. Although the marine ecosystems and environments of different regions of the world have many commonalities, they also differ in many respects. Many marine species and fish that are taken on board with ballast water can be considered dangerous to the marine environment of the area where the ballast water is discharged, disrupting its ecosystem. These species are referred to as "invasive marine species." For example, to clarify the harms of introducing aquatic species from one area to another through ballast water, we can refer to the arrival of North American jellyfish (Mnemiopsis leidyi) from the eastern seas of North America to the Black Sea, which severely devastated the fishing industry there, and also the introduction of zebra mussels from the Black Sea to North America, which caused blockages in power plant cooling pipes and altered the food network of the Great Lakes.

Cargo vessels (tankers, cargo carriers, container ships, etc.) as well as some recreational and passenger ships use ballast water—referred to as seawater—to ensure the stability and balance of the ship. The required amount of ballast water depends on the loading conditions of the vessel. Ballast water may pose public health risks, such as the cholera bacteria, which have been identified multiple times in ballast water samples.

Gray water also includes non-sewage wastewater, including drainage from sinks, showers, washing machines, baths, kitchens, and toilets. It may contain pollutants such as coliform bacteria, food waste, oil and grease, detergents, shampoos, cleaners, pesticides, and heavy metals. So far, gray water has accounted for the majority of liquid waste generated by passenger ships. Oceanic protection estimates that the production of wastewater by passenger ships ranges from 114 to 322 liters per person per day. Passenger ships must be equipped with wastewater treatment systems on board that are recognized as marine sanitation devices and record their outputs. In contrast, they are not required to monitor the quality of the water where they typically discharge their waste. Despite the toxicity of many of their components, gray water is currently not subject to legal restrictions by MARPOL. If a ship is more than three miles away from the shore, it is allowed to discharge untreated gray water.

Additionally, black water refers to sewage resulting from wastewater from toilets and medical facilities on board. Black water is different from other wastewater in terms of storage time and lower water content. Furthermore, it is usually directly sent to wastewater treatment plants. It is worth noting that the amount of wastewater produced depends on the type of ship (Tarchi, 2001).

Several reports indicate that these invasive marine species have led to the extinction of some other marine species or fish in the receiving areas, thereby threatening and disrupting the marine ecosystem of the region that has accepted these species. The first official report of this nature was in 1988 by Canada to the Marine Environmental Protection Committee of various global regions, which approved the first guideline to prevent the discharge of unwanted and pathogenic marine organisms in ballast water and ship sediments in 1991. At the twentieth meeting of the IMO Assembly held in 1997, a resolution numbered (20)868.A was adopted, calling on countries to implement necessary management and control over the ballast water of ships to reduce the transfer of harmful and pathogenic marine organisms. Additionally, in this resolution, which replaced previous regulations, the Marine Environmental Protection Committee was requested to begin work on preparing a legal international document in this field.

The establishment of binding regulations applicable at the international level regarding the balance of ships is

somewhat a response to the request of the "United Nations Convention on the Law of the Sea" ratified in 1982. Paragraph 1 of Article 196 of this treaty states: "States must take all necessary measures and actions to prevent, reduce, and control pollution of the marine environment resulting from the use of technologies subject to their jurisdiction and control, and also to prevent and control the intentional or accidental introduction of foreign or new species into a specific marine environment that may cause significant changes and harm to it".

As a result, it must be said that the directives related to the convention cannot be considered mandatory and binding. However, it should not be forgotten that given the prominent position and status of the Committee on the Protection of the Marine Environment and the various technical discussions raised during the preparation of the directives and ultimately their approval with the agreement of the majority of the states present in the relevant committee sessions, these directives hold such credibility and weight that they compel member states to comply with them in order to implement uniform regulations. The complex technical directives of the IMO result from the efforts of pioneers in the field of navigation and the technologies of this industry, and all states with an industrial presence, as well as governmental and especially non-governmental international organizations, play a role in their preparation. If concerns or questions are raised, they are taken into account and efforts are made to address them. Therefore, regardless of the theoretical legal discussion presented, all states, if they are members of the discussed convention or similar conventions, practically take the provisions of the directives into account and implement them.

Section Three: Safe and Environmentally Friendly Ship Recycling

Every year, hundreds of ships around the world reach the end of their operational life after years of marine activity and are sold to companies active in this field for dismantling and recycling. Many of these obsolete or damaged and sunken ships are sent to locations within a country different from that of the flag state and even the ship owners. Nowadays, ship dismantling is considered one of the profitable industries. The dismantling and recycling operations of ships take place more in developing countries like Bangladesh, Pakistan, and India than in other regions. Numerous reports from international organizations and non-governmental organizations indicate that most of these recyclings are conducted outside the necessary regulations and standards. This not only leads to pollution of the marine environment but also severely endangers the safety and health of those working in this industry. With this public and international awareness, the International Maritime Organization (IMO) sought to take actions to regulate recycling.

IMO's intervention in this area can be seen as a response and reaction to the lack of sufficient laws and regulations and improper supervision by some states where most ship recycling takes place. The initiatives of the IMO, initially in the form of guidelines and recommended resolutions, and then in 2009 in the form of a binding legal document, addressed three topics: the marine environment, the safety of recycling operations, and the health and safety of workers in the dismantling operations. Considering the introduction and provisions of the convention, the objectives of the treaty and its annexes can be summarized as follows:

- Effectively addressing environmental hazards, occupational health, and safety related to ship recycling and alleviating the increasing concerns regarding the safety, health, and welfare of workers employed in the dismantling industry;
- Achieving the best method and option for decommissioning obsolete ships;
- Establishing a binding international legal document related to ship recycling with the goal of standardizing regulations;
- Adopting a proactive approach regarding environmental issues;
- Using non-harmful or less harmful materials for the environment and individuals instead of harmful materials in the construction and maintenance of ships, without compromising the safety and operational efficiency of the ships.

.1New Resolutions and Approaches of the International Maritime Organization Regarding Waste and Plastic Waste

This discussion aims to examine the new resolutions and approaches of the International Maritime Organization regarding waste and plastic waste .

First Topic: New Resolutions and Approaches of the International Maritime Organization on Waste
Significant efforts have been made in recent years by the maritime community to reduce the flow of waste generated by ships. The MARPOL Convention, which serves as the global constitutional framework for this goal, appears to have positive effects. Waste from ships refers to any harmful materials (both for the marine environment and public health) produced during the regular daily operations of ships .

The most significant example of waste is garbage. Garbage pertains to all types of packaged materials (plastic, glass, aluminum, paper) and food waste. Waste management and control are concerns for recreational and passenger vessels. Shipping lines tend to visit various ports every day. It should be noted that a maritime cruise generates as much waste as a small city. For a vessel carrying 3,000 passengers and crew members daily, waste production exceeds 7 tons. Annex (2) of MARPOL completely prohibits rubber in the sea and imposes strict restrictions on the discharge of other waste from ships into coastal waters and special areas like the Aegean Sea (Ziniko Laou, 2004). This annex also requires governments to provide options and facilities in ports and terminals for waste reception. Ship operators are required to maintain a waste record book to document all fueling and disposal operations .

Oil pollution is the most significant type of pollution in seas and oceans. Annually, millions of tons of hydrocarbon materials, including light hydrocarbons, crude oil, heavy hydrocarbons, aromatic multi-ring hydrocarbons, among others, are discharged into seas and oceans. Oil spills from ships cause extensive environmental and economic damage. Studies on the fate of oil pollution and the natural self-purification process of the sea indicate that light oil compounds evaporate while aromatic compounds partially dissolve, and heavy compounds either wash ashore as oil clumps or settle on the sea floor, mixing with other suspended particles in the seawater. Thus, the toxicity of oil decreases over time due to the physical and chemical changes it undergoes. A small amount of these compounds is broken down by bacteria and other organisms (Rahmani Khazari, 1380) .

Diesel engines installed in large vessels use high-sulfur fuels, thus producing sulfur dioxide, nitrogen oxides, and especially along with carbon monoxide, carbon dioxide, and other hydrocarbons. The sulfur emissions discharged from ships are estimated to be between 4.5 to 6.5 million tons annually. The overall sulfur pollution in the open sea is milder than in specific pathways like the English Channel, the South China Sea, and the Strait of Malacca, whose environments are significantly affected. Nitrogen oxide pollution from ships is estimated to be approximately 5 million tons annually—about seven percent of global nitrogen oxide pollution .

Based on research conducted in recent years regarding pollutants emitted by ships, it has been determined that more than 14% of nitrogen oxides and 5% of sulfur oxides produced by combustion engines are the result of marine engine activities. Other interesting findings from these studies over the years include the following :

٪85of ship-generated pollution occurs in the Northern Hemisphere .

Approximately 70% of pollution caused by ships is produced up to 400 kilometers from the shores.
Ships produce 2% of the world's carbon dioxide.
International ships produced about 6.2 million tons of sulfur dioxide and 6.3 million tons of nitrogen oxides (in the year 2000) in the coastal waters of mainland Europe.
The latest actions by the International Maritime Organization regarding waste are the following two resolutions:
1- Resolution 671 adopted in 2009 by the Marine Environment Protection Committee on guidelines for providing adequate reception facilities in the ports of coastal states to eliminate deliberate marine environmental pollution by ships, including pollution caused by waste.
2- Resolution (63) 219 adopted in 2012 by the Marine Environment Protection Committee on the implementation of Annex 5 of the MARPOL Convention (on regulations to prevent pollution from ship waste).
Ship waste (such as oil and chemicals) can lead to the destruction of marine life; one of the dangers of ship waste is plastics, which can float in the oceans for years. Sometimes fish and marine organisms mistake plastics for food. In this regard, the IMO adopted the MARPOL Convention in 1973 to prevent

pollution from ships. The MARPOL Convention, especially under Annex 5, provides ways to eliminate and reduce the amount of waste discharged into the sea by ships. The Marine Environment Protection Committee amended Annex 5 of the MARPOL Convention in October 2006, which came into effect in 2013. The amended annex generally states that the discharge of all types of waste into the sea must be prevented. (According to this annex, waste includes all types such as food waste, all plastics, cooking oils, fishing gear, etc.) According to this annex, governments are obliged to provide the necessary facilities for the disposal of waste in ports and ship stopover locations so that ships can adequately dispose of their waste.

The special attention of the IMO to preventing pollution from waste in the marine environment and also to the pollution factors in the sea indicates the focus of this organization on waste management. The main goals of the IMO are maritime safety and the prevention of marine pollution, in which the General Assembly and the Marine Environment Protection Committee play a significant role in formulating regulations and strategic principles.

The adoption of the MARPOL Convention regarding the prevention of pollution from ships and its Annex 5 (which addresses pollution from ship waste) and the adoption of multiple IMO resolutions for reforming and improving environmental issues caused by waste pollution are effective efforts of this organization in waste management. Additionally, monitoring the implementation and providing advisory assistance to the members of the 1972 London Convention regarding the prevention of marine pollution from waste disposal and its protocol adopted in 1996 regarding the prevention of pollution caused by waste, environmental assessments, and cooperation with relevant international organizations in the prevention and control of pollution are among the other services of the IMO related to marine pollution from the discharge of waste and other materials.

Considering technical cooperation between developed and developing countries and allocating financial resources for executing technical plans and implementing specific projects, as well as routinely calling its bodies such as the General Assembly and the Marine Environment Protection Committee to review existing rules and regulations to align with current conditions and capabilities, the IMO strives to overcome obstacles in order to minimally fulfill its role in protecting the marine environment concerning pollution from waste. Today, it is these member countries that, besides their membership in the approved conventions for the protection of the marine environment, must pay attention to the recommendations of this organization regarding waste and pollutants and work towards improving the existing environmental capacities in the sea.

Chapter Two: The Role of IMO Resolutions and Conventions Regarding Special Marine Areas

One of the innovative actions of MARPOL in the protection of the marine environment is the identification of special areas under MARPOL oversight. The concept of special marine areas was first introduced by the IMO Marine Environment Protection Committee in 1978. Discussions and exchanges on the subject from 1986 to 1991 led to the formulation and approval of guidelines for the selection of special areas. Furthermore, according to paragraph 6 of Article 211 of the United Nations Convention on the Law of the Sea, if international laws and standards are insufficient to clarify the special conditions of a marine area, the coastal state may establish laws and regulations regarding the prevention, reduction, and control of pollution from vessels for those special areas within its exclusive economic zone. These areas must be clearly defined, and specific mandatory measures should be adopted for well-documented technical reasons related to ecological and oceanographic conditions to determine the manner of exploitation and/or safeguarding of their resources and the specific traffic conditions of that area. In line with the aforementioned article for special areas requiring specific mandatory requirements, laws and regulations have been specified in Appendices I, II, IV, and V of MARPOL. However, in comparison, it should be noted that the areas designated in the United Nations Convention on the Law of the Sea are limited to the exclusive economic zone, whereas the special areas under the MARPOL convention cover enclosed or semi-enclosed regions, which can include parts of the territorial sea, the exclusive economic zone, and the high seas. These areas are designated by the Marine Environment Protection Committee and through amendments to the MARPOL appendices. As mentioned, such regions are governed by Appendices I, II, IV, and V of MARPOL. These areas under Appendix VI of MARPOL are known as emission control areas and relate to air pollution from vessels. Regarding the criteria for selecting these areas, a resolution on the guidelines for identifying special areas under MARPOL was approved at the 28th session of the IMO Assembly in December 2013, replacing a previous resolution, resulting in the

designation of ten special areas according to Appendix I of MARPOL to date. These areas include the Mediterranean Sea, the Baltic Sea, the Black Sea, the Red Sea, the Persian Gulf, the Gulf of Aden, Antarctica, the waters of Northwest Europe, the Oman region in the Arabian Sea, and the southern waters of South Africa. According to Appendix II of MARPOL, only Antarctica has been designated as a special area. According to Appendix IV, the Baltic Sea was announced as the first special area under this appendix. According to Appendix V, eight special areas have also been designated, including the Mediterranean Sea, the Baltic Sea, the Black Sea, the Red Sea, the Persian Gulf, the North Sea, Antarctica, and the vast Caribbean area, which includes the Gulf of Mexico and the Caribbean Sea. Additionally, four emission control areas have been specified under Appendix VI of MARPOL, which include the Baltic Sea, the North Sea, the North American region, and the Caribbean Sea region of the United States.

Chapter Three: Resolutions and New Approaches of the International Maritime Organization Regarding Plastic Waste

One of the characteristics of plastic, which is widely used in various industries, is its durability. However, this feature also causes it to remain in the environment. One characteristic of plastic is its photodegradable nature, which breaks down into smaller pieces under sunlight. However, the intensity of sunlight in the oceans is lower than on land, and the breakdown process in the marine environment takes significantly longer. While plastic debris is slowly decomposing in the ocean, more plastic waste is continuously discharged into the sea. As a result, a significant amount of plastic waste exists in the ocean in all shapes and sizes, floating on the water's surface, suspended in the water column, or settling on the ocean floor, thereby impacting the marine ecosystem (Van Franeker and Law, 2015). According to a scientific report, plastic waste in the sea affects over 600 marine species within the food chain, often leading to aquatic mortality due to plastic ingestion. According to a report by Greenpeace, at least 267 different species of marine life, including sea turtles, seabirds, sea lions, whales, and fish, have been identified as being affected through plastic consumption and entanglement in plastic debris, including fishing nets. The scale of marine contamination by plastic debris is extensive. These waste products are found floating in all oceans of the world, from polar regions to the equator.

According to research conducted, a large volume of plastic waste fragments has accumulated in the Atlantic, Indian, and Pacific Oceans, with the largest pieces of waste spreading in the Pacific Ocean between Japan and North America. The highest concentration of waste is between California and Hawaii, where scientists estimate the density of plastic to be about 480,000 pieces per square kilometer. Microplastics are plastic particles smaller than 5 millimeters, which enter the marine environment due to the degradation of larger plastic waste. Microplastics are now recognized as a significant threat to the marine environment and human health. Scientific surveys have shown that microplastics are widespread in the world's oceans and have a negative impact on marine life and the health of humans who rely on seafood as a primary source of protein. On the other hand, polystyrene beads and plastic fragments are not easily digestible, so they accumulate in the digestive systems of marine animals that consume them. This causes animals to feel completely satiated, leading to a cessation of feeding, ultimately resulting in death from starvation. Lightweight plastic packaging is easily swept into the sea by wind or rain, and if not properly managed, it may be directly discharged into the sea. Ultimately, plastic waste in the marine environment breaks into smaller pieces and is mistakenly consumed by marine animals and seabirds instead of food. For example, sea turtles mistake discarded plastic bags for jellyfish and consume them as food, or seabirds feed their chicks plastic fragments, leading to increased chick mortality and a decline in marine species. As predators in the food chain feed, more and more toxins accumulate in their fatty tissues over time. Studies have shown that apex marine predators, including killer whales and polar bears, are among the most contaminated marine mammals. These pollutants reduce their fertility and immune system, making them vulnerable to diseases (Wright et al., 2013).

The International Convention for the Prevention of Pollution from Ships was adopted in 1973 following an international conference on marine pollution organized by the IMO, and subsequently amended by the 1978 Protocol. This regulation encompasses various sources of pollution from ships, with its main goal being to eliminate the intentional pollution of the marine environment by oil and other harmful substances and to reduce the discharge of such materials, whether intentional or unintentional, through the enactment of laws and regulations governing ships and ports. The MARPOL Convention's

requirements regarding the prevention of pollution by ships serve as the primary legal basis for managing waste from ships. This convention includes laws and regulations that prevent pollution of the sea by oil, noxious liquid substances in bulk, harmful substances in packaged form, sewage, garbage, and air pollutants. These regulations are contained in six annexes. According to Annex V of the MARPOL Convention, various types of waste, including plastics, dunnage or timber from the ship's hold, packing materials intended to protect cargo, food waste generated by the ship's personnel, packaging materials such as cans, shredded paper, cardboard, newspapers, ceramics, metal, cargo-related materials and waste, ash from incinerated waste, and other types of waste produced in the crew's living quarters and ship's kitchen, must be segregated on board and stored in garbage bags. Upon arriving at port, the generated waste must be delivered to the port's waste reception facilities. Annex V of the convention includes requirements concerning waste discharge in special marine areas and outside special areas. These special areas include the Mediterranean Sea, the Baltic Sea, the Black Sea, the Red Sea, North Seas, polar regions, and the Greater Caribbean Sea, including the Gulf of Mexico and the Persian Gulf and the Sea of Oman. This annex obliges ports to provide adequate facilities for the reception of ship waste. It is stated in this annex that ships are required to prepare and maintain waste management plans and a waste record book on board, which will be inspected during periodic inspections by the controlling and inspecting unit. All reports concerning waste disposal to reception facilities in ports, the amount of waste generated during the voyage, and any intentional or unintentional waste discharges into the sea and their geographical discharge locations must be recorded in the waste record book.

In 1994, the MARPOL amendments were adopted by the conference of parties, aimed at improving the enforcement of the convention which allowed for the inspection of ships in the ports of other member states of the convention to ensure that crews were capable of taking necessary actions to prevent marine pollution. In 1995, through resolution (37) 65.MEPC related to the Marine Environment Protection Committee (MEPC, one of the main committees of the International Maritime Organization), amendments were made to Annex V regarding the requirement for vessels to install placards in various waste collection locations on board, waste management plans, and waste disposal maintenance. In 2006, during MEPC 54, the revised amendments to Annex V concerning the prevention of sea pollution caused by waste were approved. After five years of intensive work, during MEPC 62 (July 2011), a review of Annex V of the convention was conducted and approved for implementation on January 1, 2013. One of the significant features of the revisions was the general prohibition of discharging waste into the sea, except for certain cases mentioned in the annex, including items such as food waste, animal carcasses, cleaning agents, and additives found in washing solutions, deck and surface cleaning, and cargo residues that are not harmful to the marine environment. However, the prohibition of discharging plastics is reflected in the overall ban .

Additionally, ships are required to prepare and maintain a waste management plan for vessels with a gross tonnage of 100 and above and related reporting requirements, including accidental loss of fishing gear, given that all reasonable precautions have been taken to prevent such losses; the discharge of fishing gear, including fishing nets, from a ship to ensure the safety of the vessels or their crew is mandated if the fishing gear poses a serious threat to the marine environment or safe navigation. In 2017, guidelines on research, technology development, reporting, and sharing information regarding marine plastic waste were presented in resolution (71) 295.MEPC. Proposed options in the guidelines for reducing plastic waste include avoiding plastic packaging materials, using reusable or recyclable materials, and using reusable coverings for load protection instead of single-use coverings. In 2015, through resolution (68) 265.MEPC, it was decided that stricter regulations and laws would be applied to vessels operating in polar regions due to the specific conditions prevailing in the polar area, and these regulations were implemented on January 1

## Summary and Conclusion

Since its establishment, the International Maritime Organization (IMO) has prioritized marine environmental issues. To this end, numerous documents have been approved in the form of conventions, codes, and other resolutions. However, the most important legal tool of the IMO regarding the marine environment has always been the MARPOL Convention. This convention includes many regulations for the protection of the marine environment. One of its innovative actions was the identification of vulnerable marine areas. Initially, the organization identified special areas and, in this context, adopted mandatory special measures based on recognized

technical reasons related to specific ecological and oceanographic conditions. The manner of exploitation or protection of their resources and the specific traffic conditions of those areas were determined. To date, 10 special areas have been identified. Furthermore, considering that marine areas encompassing unique ecosystems should be prioritized, other areas have also been identified as Particularly Sensitive Sea Areas (PSSAs), which require special protection due to the significance of their known ecological, social, economic, or scientific characteristics. To date, 17 particularly sensitive marine areas have been identified. Overall, and in light of this innovation in the MARPOL Convention, the identification and protective measures established for these areas have contributed to the sustainability of unique ecosystems and marine areas at risk. Notably, the designation of these areas at two different levels has clearly outlined the focus and prioritization for endangered regions .

Plastic waste has always been a constant problem in the environment; however, undoubtedly one of the most significant environmental challenges we face is marine plastic debris. Two major sources of marine debris include plastic waste produced on land that enters the oceans through runoffs, as well as the intentional and unintentional disposal of waste collected on vessels or the dumping of waste by fishing boats, along with discarded plastic fishing nets in the sea. According to existing studies, a high percentage of marine debris is generated from shoreline sources. The Marine Environment Protection Committee (MEPC), as one of the main committees of the IMO, reminded during its seventy-second meeting (April 9-13, 2018) that plastic pollution problems in the sea, as addressed in Annex V of the MARPOL Convention concerning the prevention of pollution from ships, should pursue a global solution to prevent and significantly reduce marine pollution from plastics by the year 2025.

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