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Port State Control (PSC) and the Environmental impacts of International Shipping

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Abstract

Seas are the most important and unexplored and unknown ecosystems and the largest source of biodiversity on earth, which make up 90% of the biosphere. Therefore, it is necessary to preserve the marine environment as a precious asset and heritage against the damages caused by human activities, including international shipping. One of the international means to achieve this aim is the port state control (PSC) mechanism, PSC which is rooted in the traditional principle of free access of ships to the ports, also international conventions and regional memorandum of understandings (MoU's) is considered complementary to the competencies of the flag state for environmental protection and maritime safety, allows the port states to assess the compliance of ships with relevant international and regional regulations, and to carry out a non-discriminatory inspection of foreign ships entering their ports. This paper review and criticize the role of current PSC mechanisms in the protection of the marine environment. To that end, use of the descriptive-analytical method to explaining the concept and legal foundations of PSC and the most important environmental challenges caused by the Increasing growth of international shipping and analyze the role of PSC. This study's findings provide that, the international PSC regime suffers some defects, accordingly to be more effective needs to mutation, in a way that includes new environmental damages, as well as, increase international convergence and integration in its Implementation this goal is achieved through the conclusion of a global MoU.

Keywords: Port State Control (PSC), Marine Environment, non-standard vessel, MoU's

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Introduction

The marine environment is a vital resource for life on earth, and marine ecosystems perform important environmental functions, including regulating the weather, preventing soil erosion, absorbing and dispersing solar energy and absorbing carbon dioxide. In addition, the marine environment has a significant role in economic prosperity, social welfare, and improving the quality of human life (European Commission, 2006, p. 4). The shipping industry is an important economic sector that contributes to more than 80 % of global trade with 1-3 % of world Gross Domestic Product (GDP). Throughout history, billions of containers, solid, liquid, and dry bulk cargo are moved annually across the world's oceans. This improves the economy of many countries and substantially increases the availability of food, raw materials, etc. Shipping, is one of the foundations of the global economy, facilitates the transportation of 90% of goods (Dwarakish, G.S., Salim, A.M., 2015, p. 295). The number of commercial ships is increasing dramatically due to the states' goal in achieving economic development.¹ On the other hand, although maritime transport is relatively safe, in the event of an accident, the economic and environmental costs (especially for commercial ships and tankers)² can be very huge (Heij, Ch., Bijwaard, G., Knapp, S., 2010, p. 2). A non-standard vessel threatens the marine environment. As a result of the significant increase in the number of ships and maritime trade, threat or destruction of the marine environment is one of the major consequences of shipping not to mention, creating a balance between economic and environmental benefits become one of the most important issues of sea transportation in the current decade. In this regard, international law has imposed hard and soft obligations on states. Some of these obligations are related to the flag states, and others has addressed the port states, the latter is the subject of our study. Owning

¹. Tens of thousands of ships travel between the ports annually, maintaining the flow of international traffic. According to the latest available statistics, the number of commercial ships around the world has reached more than 53 thousand in 2021 (European Commission, 2022). Also, according to the statistics provided by UNCTAD in 2019, the total volume of international maritime trade has been increasing from 1970 to 2019 and reached 11,005 million tons in 2018 from 2,605 million tons in 1970 (UNCTAD, 2019).

². For example, the collision of the Greek oil tanker *Atlantic Empress* on the coast of Tobago with another giant oil tanker (*Aegean Captain*) in 1979, which resulted in the spill of 287,000 tons of oil into the Caribbean Sea.



to this regime, the incentive of preventive measures by the flag state will increase- to prevent other states from exercising jurisdiction over its ships- and on the other hand, in case of negligence or impossibility of the flag state's supervision, allows the port states to inspect foreign ships (Yan & Wang, 2019, p. 233). By this contrivance, the gaps caused by inadequate flag states supervision are shrieked.

All things considered, PSC can be considered one of the most important powers granted to the port state to protect the marine environment and prevent its pollution.¹ Historically, PSC has been applied since the occurrence of consecutive marine accidents, that is, since the 70s. Later, it has been developed in recent decades in the wake of the increase in the mass of sea transportation. Presently, the port state control is implemented in most of the world's ports around the world (Chung, W., Yuan, C., Cai, C., Sung, S., 2020, p. 746).

Legally, PSC has been enshrined in many hard and soft documents, both global and regional. Among the hard law documents, can refer to the Convention on the Law of the Sea, International Convention for the Prevention of Pollution from Ships (MARPOL), Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM) and Convention on the Control of Harmful Anti-Fouling Systems on Ships. Also, states located in each region began to conclude regional memorandum of understanding (MoU's) as well as national regulations with aim of guaranteeing the implementation of international conventions. The first regional document is the Paris MoU (1982), afterwards several MoU's have been concluded around the world, so that most of the world's maritime areas have their own MoU's for instance the Caribbean sea, the Mediterranean sea, the Indian Ocean, the Persian Gulf, etc.² The aforementioned memorandums do not impose any requirements beyond what is stated in international conventions, but they have provided measures whose their existence is a

¹. However, the PSC system has another goal, and that is the safety of navigation (shipping), which is out of the scope of our discussion.

². Of course, the existence of regional agreements in the mentioned area is to regularize the inspections in the ports of a region and prevent multiple inspections, waste of time, as well as prevent the slowness of doing things related to international trade (Chiu, R., Yuan, C., Cai, C., 2020, p. 641) and to create a uniform regional system in a way.

guarantee for a better and more effective implementation of the states' obligations regarding the port state control. Along with all the efforts made, talking about the global PSC regime will not be complete without mentioning the role of the International Maritime Organization (IMO). With the slogan "safer shipping, cleaner seas", the organization has issued resolutions that describe the details of the port state control.

With this in mind, the question is, the PSC can properly protect the marine environment or not? To answer the question, this paper is divided into five parts, firstly according to international rules and regulations, we explain the concept, basics, and limits of the port state's role in controlling foreign ships. Then, to evaluate the performance and efficiency of the PSC, subsequently examine the most important environmental damages and threats of non-standard ships then evaluating the control and inspection tools and eventually criticize the most important defects of the current regime on port state control.

1. Legal basis of the international PSC regime

Port state controls the international regime of inspection of foreign ships entering the ports to ensure compliance of their conditions and equipment with various international conventions and standards (Yan & Wang, 2019, p. 234). The principle of access to ports has been recognized since 1923 with the formulation of the Convention on the International Regime of Maritime Ports (Yan & Wang, 2019, p. 234). The principle of access to ports has been recognized since 1923 with the formulation of the Convention on the International Regime of Maritime Ports (Abdulrazaq Abdulkadir, O., Syed, A., Sharifah, Z., 2012, p. 218) and with the conclusion of the Convention on the Law of the Sea, ships faced relative restrictions (Hosseini, M., 2020, p. 76). According to these regulations, the control should be carried out by competent authorities and officers of the port, be reasonable and do without any discrimination (Xu, S., 2001, p. 28). Therefore, it can be said that the port state control is the visit of the ship by the expert, trained and qualified officers of the port state to check the validity of the certificates and other related documents, the general condition of the ship, its equipment and crew, without applying any discrimination in terms of the ship's flag or its size is aimed at protecting the marine environment and maritime safety.

In order to survey the jurisdiction of the port state in the control and inspection of foreign ships, it is necessary to examine international custom,



international treaties and conventions, regional memorandums, and soft law i.e. Guidelines and resolutions of the International Maritime Organization.

1.1. International custom

International customary law, entitled the port state to exercise its jurisdiction extensively the International Court of Justice has also confirmed issue in the Nicaragua case, also reflected in the UNCLOS 1982. International customary law considers the jurisdiction of the port state, based on the principle of the state's sovereignty, the territorial sovereignty requires that the ship entering the port of a foreign state falls under the jurisdiction of the port state, due to ports as parts of internal waters has the same legal status as other parts of the territory of a state.

1.2. International treaties

Contrary to the international customary law, treaties go beyond the mere territorial jurisdiction. Some of treaties obliges the port state to inspect or even if it is necessary to detain foreign ships. Therefore, it can be said that the flourishing of the international regime of port state control has been done by international treaties.

1.2.1. The MARPOL Convention

The MARPOL Convention¹ raises the issue of inspection of ship's certificates and documents related to carriage of hazardous materials²,³ such as hazardous liquids, packaged harmful substances and nuclear

¹. As of January 2018, 156 states, including Iran, have become members.

². Harmful substances are substances that are known as dangerous according to the regulations on the international maritime dangerous goods (IMDG Code). The IMDG Code was developed as an international code for the maritime transport of dangerous goods in packaged form, in order to enhance and harmonize the safe carriage of dangerous goods and to prevent pollution to the environment. The transportation of harmful substances is prohibited unless it is based on certain conditions and special restrictions related to the safety of the ship and the protection of people's lives at sea (PMO, 2019).

³. Of course, there is no explicit mention of the inspection of the documents for packaged harmful materials, but considering the additional provisions related to packaged harmful materials of the MARPOL Convention, which makes the transportation of these materials

materials. According to Article 5 (2) of this convention, authorities of the port state must ensure that if the ship lacks the required valid certificates and as a result is likely to pose an unreasonable threat to the marine environment, not allowed to leave the port unless in cases where it is necessary to go to the nearest appropriate repair yard available.

1.2.2. Convention on the Law of the Sea 1982

The UNCLOS is considered an innovative document in the jurisdiction of the port state. According to customary law, port states did not have the authority to monitor the activities of foreign ships in the high seas. However, with the ratification of UNCLOS (Articles 218 and 219) the port state is somehow organ or representative of the international community in protecting the marine environment (Tanaka, Y., 2011, p. 376). Foresaid articles allow port states to take necessary measures to prevent the delinquent ship from entering. Even this jurisdiction, through regional and global arrangements, is gradually moving from a voluntary basis to a comprehensive and mandatory jurisdiction (Molenaar, E.J., 2007, p. 247). According to article 218 (1), if the inspections and other evidence shows a history of pollution or environmental damage (in respect of any discharge from that vessel) before entering to the port or the possibility of its occurrence (in the future) in other sea points outside the national jurisdiction of states, the port state will have the right to take enforcement measures (such as proceedings) against the offending ship and according to article 218 (2), in case of environmental damage in areas under the jurisdiction of other states and upon the request of the damaged state, the port state has the right to take necessary executive measures against the offending ship. Also, according to article 218 (3), if the flag state of the offending ship requests, the port state, regardless of the location of the violation, has the authority to deal with the relevant violations.

In general, the jurisdiction of the port state to control and monitor ships is a combination of territorial and extraterritorial jurisdiction. The

subject to compliance with special ship safety restrictions, it can be argued that the competent authorities of the ports can verify the compliance of the conditions of transporting these materials with the international safety and environmental standards. and it cannot be accepted simply by the claim of the captain or the crew of the ship that the conditions of the ship are in accordance with international regulations.



extraterritorial jurisdiction extends to the destructive activities of the marine environment that are carried out outside the territory of the port state but at the same time harm to the marine environment as a common human benefit, (Kopela, S., 2016, p. 96).

1.2.3. Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)¹

According to this convention, firstly each party shall require that ships entitled to fly its flag have a shipboard oil pollution emergency plan as required by and in accordance with the provisions adopted by the IMO on board (Art 3(1) (a)).

Ships are subject, while in a port or at an offshore terminal under the jurisdiction of a Party, to inspection by officers duly authorized by that Party, in accordance with the practices provided for in existing international agreements or its national legislation (Art 3(1) (b)).

1.2.4. Convention on the Control and Management of Ships' Ballast Water and Sediments. (BWM)

Inspection of the ballast water record book and sampling of the ship's ballast water is another case of exercising the port state control. According to the provisions of the Convention on the Control and Management of Ships' Ballast Water, every ship must have a ballast water record book and register all operations related to the discharge of ballast water at sea and delivery to port reception centers and present it to the competent authorities of the port state. It should be noted that according to this convention, the inspection of ships is not limited to the inspection of the ballast water record book, and the inspection of valid certificates and sampling of ballast water is also carried out.²

1.2.5. Convention on the Control of Harmful Anti-Fouling Systems on Ships (AFS)

The AFS convention emphasizes the necessity of stopping the entry of anti-fouling systems consisting organic compounds into the environment. AFS allows the port state to inspect to verify the presence or absence of a valid

¹. By 2018, 112 countries, including Iran, have become members of the aforementioned convention.

². For more details, referring to articles 9 - 10 of convention. Currently 86 countries, including Iran, have ratified the mentioned convention and become its members by 2021.

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international certificate of the anti-fouling system or declaration of the anti-fouling system on the ship. In addition, the port state can, under certain conditions, take a partial sampling of the ship's anti-fouling system¹ in any case, the time required to process the results of the sampling should not prevent the movement and departure of the ship (referring to article 11(1)(2)).

1.3. Regional Memorandums of Understanding (MoU): Complementary to treaty regimes

Regional Memorandums of Understanding (MoU) forms the hardstone of the PSC regional regime. This regional regime implicitly acknowledges that individual actions for reduce the rate of substandard shipping are not sufficient. The purpose of MoU's is to guarantee the effective implementation of international standards in each region .in other words, compared to treaties which shape the international PSC regime, do not include new standards or rules. The Hague regional memorandum of understanding is the origin of the regional PSC regime, which was concluded in 1978 among the eight coastal states of the North Sea. The Hague memorandum was concluded with the aim of more effective implementation of Convention No. 147 of the ILO² (Ozcayir, z., 2008, p. 208). In March 1978, the accident of the Liberian oil tanker Amoco Cadiz, caused widespread pollution on the coast of France, led to the Paris regional maritime safety conference in 1980. In the final statement of this conference, the need to improve maritime safety, working and living conditions on ships, protecting the marine environment and the necessity of concluding an instrument to ensure controlling and monitoring by the port state was emphasized. Subsequently, Paris Memorandum of understanding was concluded in 1982³ (Knight, A., 2019, p. 463) and (Ozcayir, z., 2008, p.209).

¹. These conditions are: 1- Considering IMO guidelines and 2- Sampling should not affect the integrity, structure or performance of the ship's anti-fouling system.

². ILO Convention No. 147 was concluded in 1976 and allow inspecting the ships.

³. The Erica (Maltese registered tanker) incident in the Bay of Biscay located 45 miles off the French coast in 1999, despite to have valid certifications and more than 16 times of inspections by different port state's officers between 1991 to 1999, caused oil pollution of about 400 km of coastline (including popular beach resorts for holiday) and the Prestige incident in November 2002 in south of Spain (despite previous inspections and having valid certificates) in which a tanker carrying 77,000 tons of oil broke in half and sank. These events caused several amendments to the Paris Agreement, which is currently in process its 43rd revised version. Following the Erica incident, the European Commission, on March 21 and December 6, 2000, respectively, issued the post-Erica package of measures in the form of "Communication on the safety of oil trade at sea (known as the Erica I package)" and the second set of community measures for maritime safety that adopted the form of a "Communication from the Commission to the European Parliament and the Council (known as the Erica II package)" which resulted in the tightening of existing port state control rules, the



In 1991 the IMO Resolution A.682 (17)¹ was issued to encourage regional cooperation. This resolution creates a framework for concluding more regional MoU. Accordingly, the Tokyo Memorandum was concluded for the Asia-Pacific region, as well as seven other memorandums for the Caribbean, South America, West and South Africa, the Indian Ocean, the Mediterranean, the Black Sea and the Persian Gulf areas (Knight, A., 2019, p. 465) and (Chen, J., Zhang, S., Xu, L., Wan, Z., Fei, Y., Zheng, T., 2019, p. 22).

1.4. Common principles of MoU's

It is important to emphasize that the content of this regional MoU's is mainly similar in such a way that they can be considered as a single corpus. The introduction of all the memorandums contains equivalent phrases, indicating the necessity of regional measures to prevent the activity of non-standard ships and to avoid improper competition between ports through drawing a coordinated control system.²

1.4.1. Applying similar standards in each region

Analogous provisions and obligations of regional MoU's, causes the port states in different regions apply similar standards and also no port can enjoy a more desirable situation in competition with others by adopting a more favorable approach. At the same time, ship's operators also benefit from the uniformity of control standards; because the multiplicity of regulations results in nothing but confusion and difficulty in implementation.

1.4.2. Non-discrimination based on the flag

According to this principle, each member state of one MoU, must consider the ships of other member states as a foreign ship. In fact, each regional

acceleration of the phase-out of single-layer tankers to improve shipping in European waters, the establishment of the European Maritime Safety Agency (EMSA), and the creation of a supplementary fund for the compensation of pollution victims. Following the Prestige incident, a computer network was developed, and a shipping monitoring network was created with the aim of facilitating the identification of ships at risk after their entry to European waters (Ozcayir, 2008).

¹. Under the title "Regional Cooperation for the Control of Ships and Discharges"

². The main characteristic of ports, both domestically and internationally, is competition, and ports compete strongly with each other in terms of service costs for international trade and transportation. Even the big ports of the world such as Hong Kong, Singapore, and Rotterdam, which historically and geographically have more competitive advantages than other ports in the world, are aware of this competition and need to maintain their sea traffic.

MoU has an agreed inspection mechanism, according to which, it is guaranteed that all ships visiting the ports are inspected without any discrimination (Knight, A., 2019, p. 464). Therefore, the port state control regime includes all ships visiting ports, regardless of the flag they fly.

1.4.3. Six-month validity of inspections

Although the nature of the inspection in different ports all over the world has not been announced in advance, regional MoU have accepted the criterion that the inspection carried out by one party of the agreement will be valid for the other parties up to 6 months, unless there is a clear reason for a new inspection. In other words, if a ship visits the ports located in the same area twice or more within 6 months, and no defects were reported during the first inspection, or if the defects were minor, will not be inspected (Ozcayir, z., 2008, p. 212).¹

1.4.4. No more favorable treatment towards ships of non-parties

This principle is rooted in combating and eliminating non-standard shipping, which is one of the main goals of regional agreements for increasing maritime safety and protect the marine environment. In other words, the principle of

¹. However, the Tokyo and Paris memorandums has clearer priorities for the inspection of ships among other memorandums, and these priorities in the Tokyo memorandum are: a. passenger ships, oil tankers, gas carriers and similar ships that may have a special risk; b. Ships that have defects and deficiencies in recent inspections; c. Ships that have not been inspected within the last six months.

The Paris Agreement also considers several conditions for the inspection of ships under the 10 clauses: a. Ships that have not been inspected by any authority within the last 6 months; b. Ships that visit the port of a member state of the MoU after a 12-month absence; c. Ships whose certificates have been issued by an organization that the port state does not recognize; d. ships with the flag of the blacklisted country; e. Defective ships, which are allowed to leave the previous port under certain conditions; and ships with defects recorded in the previous inspection; f. ships detained in the previous port; g. ships of states that are not members of the memorandum; h. Ships with structural defect are known to have a higher than average risk factor; i. Ships mentioned in Section 8 of Appendix 1: Oil tankers with a tonnage of more than 3000 and a life of more than 15 years based on the date of construction inserted in the ship's safety certificate, bulk carriers with a life of more than 12 years based on the date of construction inserted in the ship's safety certificate, passenger ships with a life of more than 15 years, except for RO-RO ships (i.e. ships used to transport cars and other wheeled cargo) and high-speed passenger ships under the regulation 1999/35/EC, gas and chemical tankers with a life of more than 10 years based on the date of construction inserted in the ship's safety certificate (in fact, this type of inspection is a type of extensive inspection that is only provided for in the Paris Agreement); and k. Other ships over 13 years old.



lack of favorable treatment requires ships that raising the flag of non- parties of the relevant conventions or ships below convention's size, are not exempted from inspection.

1.4.5. Consultation and information exchange

In order to advance the goals of the MoU's, port authorities of each member port state must consult and exchange information with the port authorities of other members. This is an important part of environmental obligations of port state in facing with offending ships (Hosseini, M., 2020, pp. 84-100). Sharing of information (related to specific vessels or their owners or operators) between various ports in which these vessels trade within or outside is critical to the better functioning of the PSC.

The evolved form of information exchange can be seen in the Paris Agreement and in the framework of the European Union. Although other agreements also have such databases, modeling the Paris agreement (Knight, A., 2019, p. 465). According to Paris consultation method, state members committed to record the inspection findings and register them to the database in a way that is available for all members of the other regional MoU's. Therefore, ship owners and captains cannot leave the port where they were inspected by promising to repair and eliminate defects in the next port. The main shortcoming of these method is that each regional regime only uses its own inspection information. As a result, not only the inspection results of other regimes, but also the industry inspections that are mainly carried out on dry bulk carriers and oil tankers are ignored.¹ Meanwhile, the information obtained from the port state control is supplemented with data from other regimes and data of the industry inspections, and in fact, it is a composite data that shows at which entrances and with how many defects in each inspection, the ship will be detained (Heij, Ch., Bijwaard, G., Knapp, S., 2010, pp. 11-13)

¹. The meaning of the industry inspection is a more intense type of inspection, which is carried out due to the greater sensitivity and environmental risks that some ships, including oil tankers have. Two inspection regimes are most widely used in the tankers industry: The Ship Inspection Reporting Program (SIRE) regulated by the Oil Companies International Marine Forum (OCIMF) and the Chemical Distribution Institute (CDI) inspection system.

1.5. IMO Resolutions

The first IMO resolution on the PSC was approved in 1981 (Resolution No A.466(12)) (IMO, 1981). This resolution has been amended many times by new resolutions responding to new developments (Ozcayir, z., 2008, p. 211).¹ Currently, 2019 Resolution No A. 1138(31) is in force. This resolution is a key guidance for how to apply the inspection and the port state control and implies stability in the application of inspection and control procedures and shows the methods of evaluating the defects of the ship, its equipment and crew (IMO, 2019).

The IMO Marine Environmental Protection Committee (MEPC) is responsible for taking necessary measures to prevent and control pollution from shipping. In recent years, the Committee has adopted resolutions on PSC that clearly demonstrate the importance of ship inspection. These resolutions provide necessary guidance for port states to inspect based on the Convention on the Control and Management of Ships' Ballast Water and Sediments (Res. MEPC.252(67)) (MEPC, 2014) ,as well as Annex 6 (prevention of air pollution) of the MARPOL Convention (Res. MEPC.321(14)) (MEPC, 2019).²

The purpose of these guidelines is to ensure the implementation of related conventions by member states, which leads to the protection of the environment, human health and states' property and resources.

Since IMO resolutions, have been included in regional MoU's for many years, it can be said that has succeeded in creating an internationally harmonized PSC system worldwide (Kulchytsky, A., 2012, p. 17). In addition, chapter 1 of Resolution A.1138 (31) in paragraph 1-2, while referring to

¹. In 1995, the Assembly of the International Maritime Organization made the first amendment to the above resolution by approving Resolution A.787(19) under the title "Port State Control Procedures" (IMO, 1995). The said resolution was amended in 1999 with resolution A.882(21) and its valid version was until 2008 (IMO, 1999).

². Resolution MEPC.321(14). Guidelines for Port State Control under MARPOL Annex VI, Chapter 3 (2019).

The International Maritime Organization Environmental Protection Committee Resolution No 321. (14) is a highly specialized resolution for the prevention of air pollution caused by ships (Chapter 3, Appendix 6 of the MARPOL Convention). The sixth appendix includes control requirements regarding substances that deplete the ozone layer, nitrogen oxides, sulfur oxides, volatile mineral compounds resulting from the loading of petroleum products, gases resulting from the burning of materials in the ship's furnace, facilities for receiving waste materials in ports, and the quality of fuel consumed by ships, and every deliberate release of these materials is prohibited.



several conventions such as MARPOL, SOLAS, Water Ballast and ... stated that the provisions of the resolution are applied to all ships that are covered by the provisions of these conventions.¹ It can be argued that this resolution is not merely a recommendation document and compliance with its provisions is mandatory for the members of the conventions mentioned in the resolution.

2. Environmental impacts related to shipping

The shipping industry has been actively operating for hundreds of years in different parts of the world. And it has revolutionized the way of life for millions of people by connecting lots of countries. Huge amounts of goods, food, and ... are being transported across the world . The shipping industry plays an important role in maintaining the world's economy. due to the necessity of international transportation, the amount of goods transported by ships as well as the variety of transported goods, consist of bulk goods, chemicals, dangerous radioactivity materials, ... has increased yearly. International shipping has caused the intensity of pollution and environmental impacts in the seas and oceans, the top environmental effects of international shipping are outlined below.

2.1. Air pollution

More than 18 percent of some air pollutants on earth are caused by ships. This is a common problem inshore because large diesel engine fumes concentrate. According to statistics, 33 percent of fossil fuels are used in commerce. Meanwhile, 3/3 percent of global carbon dioxide emissions from maritime transport (Crista, A., Hummels, D., Puzzello, L., Avetisyan, M., 2020, p. 153). The amount of pollutants emission depends on the type of fuel, engine,

¹. These documents include: SOLAS Convention 1974 and its Additional Protocol 1988, Load Line Convention 1966 and its Additional Protocol 1988, MARPOL Convention 1973 and its Additional Protocol 1978, Convention on Standards of Training, Certification and Watch keeping for Seafarers (STCW), 1978, Convention on the International Regulations for Preventing Collisions at Sea, 1972, The 1969 International Convention for the Tonnage Measurement of Ships 1969, Maritime Labor Convention 2006, Convention on Civil Liability for Oil Pollution Damage 1969 and its Additional Protocol 1992, The International Convention on the Control of Harmful Anti-fouling Systems on Ships, International Convention on Civil Liability for Bunker Oil Pollution Damage 2001, Convention on the Control and Management of Ships' Ballast Water and Sediments 2004, and The Nairobi International Convention on the Removal of Wrecks, 2007.

and its efficiency (Pham, H.T., Nguyen, T.M., 2015, p. 258). Among the various factors of air pollution, the emission of greenhouse gases caused by fuel combustion has a significant contribution. Ship-source pollutants include carbon dioxide (CO₂), nitrogen oxides (NO_x), Sulphur oxides (SO_x) and particulate matter due to the bunker fuel shipping causes the emission of 10-15 percent (NO_x) and (SO_x) (Eide, M.S., Dalsøren, S.B., Endresen, O., Samset, B., Myhre, G., Fuglestad, J., Berntsen, T., 2013, p. 2). Faster ships emit less (CO₂) than slower ships (Smith, T.W.P., Jalkanen, J.P., Anderson, B.A., Corbett, J.J., Faber, J., Hanayama, S., 2014). The carbon dioxide emission changes the oceans' chemistry, causing it to become more acidic, jeopardizing the future of shells producing organisms and coral reefs. The ocean becomes warm, thus increasing the intensity of storms, resulting in sea level risings, disrupting of ecosystems and ocean circulation (Walker, T.R., 2018, p. 507). Also, increasing the emission of carbon dioxide and its absorption by the oceans aggravates the environmental conditions caused by climate change. Nitrogen oxide contributes to environmental pollution, leading to ground-level ozone. Sulphur oxide contribute to the premature deaths of more than 60,000 people globally and causes respiratory problems in millions of people, specifically those living close to congested ports.

2.2. Water pollution

Ship cargo, ship breaking and decomposition, waste, pollution caused by sediments in ports and docks during transportation or ship activity, as well as the discharge of ballast water of ships are factors of water pollution by ships. Generally, ships carry three types of cargoes: liquid or wet bulk (such as oil), dry bulk cargo (such as iron ore and grain)¹ and Containers (Grote, M., Mazurek, N., Grabch, C., Zeilinger, J., Lefloch, S., Wahrendorf, D., 2016, p. 511).

2.2.1. Oil spill

Oil spill (including gasoline, diesel, ship fuel, and unrefined crude oil) is one of the most common environmental disasters around the world. Studies show that large accidental oil spills account for about 10–15 percent of all oil that enters the ocean worldwide every year. After the oil spill, its physical and chemical properties are subjected to weathering, decomposition, oxidation, and evaporation, which results various environmental effects.

¹. Dry bulk constitutes about 54% of the world's transportation volume (UNCTAD, 2014).



2.2.2. Dangerous and harmful cargoes

According to the Protocol of Hazardous and Noxious Substances (HNS) of the Convention on Oil Pollution Preparedness, Response and Cooperation, these substances include coal, cement, and various metal ores. Based on the nature of dangerous substances, IMO has classified them into 9 major groups, which include explosives, gases, flammable liquids and substances, oxidizers, toxic and infectious substances, radioactive, corrosive, and miscellaneous hazardous substances (IMO, 2015b). Approximately 10 - 15 percent of marine cargoes are hazardous (Purnell, K., 2009, p. 6). Due to the potential risks of hazardous and harmful substances to aquatic organisms as well as their socio-economic effects, it has raised concerns for environmental scientists. The increases in chemical shipping volumes increase the risk of hazardous noxious substances (HNSs) spills at sea. IMO defines HNS as “any substance other than oil that, if HNS is introduced into the marine environment, it 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” (International Maritime Organization 2000), The effects of hazardous and toxic substances spills depend on the amount and nature of the chemicals and the location of the spill (Kirby, F., Law, R.J., 2010, p. 797) and (Rocha, A.C.S., Reis-Henriques, M.A., Galhano, V., Ferreira, M., Guimaraes, L., 2015, p. 729)

2.2.3. Dry bulk cargoes

Iron ore, coal, grain, bauxite, and phosphate rock constitute about 57% of the total volume of all dry bulk goods transported (UNCTAD, 2014). Although many dry bulk materials that are dumped into the sea are not toxic and dangerous, they can create negative environmental effects. The rate of disposal of dry bulk materials by ships in the sea is more than oil spills, but because it is not recorded, it is less considered as a pollutant (UNCTAD, 2019)

2.2.4. Wastes

The international shipping industry dumps more than 250 million gallons of gray and black water into the sea each day. Leaking engines and

machinery mix with water. This leads to water pollution and the death of fish and other species in the ocean. Wastes generated by ships includes glass, metal, plastic, organic wastes, paper and cardboard packaging wastes, sewage, and hazardous wastes (such as batteries, toxic liquids, paint waste, and pharmaceuticals) (Zuin, S., Belac, E., Marzi, B., 2009, p. 3037). Generally, plastic wastes are dumped on the beach or burned; because dumping and burning them in the sea is prohibited (IMO, 2017d) (IMO, 2017e). Recyclable materials are often separated and stored for disposal in the port or processed on the ship itself. Therefore, the installation and operation of the proper facilities for receiving waste produced on ships plays a fundamental role in protecting the marine environment (Encheva, S., 2015, p. 51). Foodstuffs are often the largest waste stream on ships. Food waste can reduce water quality. Plastic waste is also dangerous for the environment due to being eaten by aquatic organisms (Xanthos, D., Walker, T.R., 2017, p. 20).

2.3. Noise pollution

Oceans have always been noisy environments due to the natural underwater noise caused by waves, sounds of mammals and other marine species. But underwater noise has increased in the last 50 years due to increased shipping, marine resource extraction, fishing, and other human activities. Noise caused by human activities differs from underwater sound in terms of direction, frequency and duration (Celi, M., Filicitto, F., Maricchiolo, G., Genovese, L., Quinci, E., Maccarone, V., 2016, p. 639). Underwater noise has detrimental effects on marine species due to the nature of sound propagation, which moves approximately five times faster than air. The extent of the effects of marine noise pollution depends on duration and intensity. For example, low-intensity noise pollution caused by marine vessels in the long term can have more negative effects compared to explosions that produce high but short-term noise pollution (Slabbekoorn, H., Bouton, N., van Opzeeland, I., Coers, A., ten Cate, C., Popper, A.N., 2010, p. 424). Sensitivity of an animal to noise results from the interaction of bottom-up effects, where genetic, cellular, and physiological level responses affect the individual; and top-down effects, where these base responses are modulated by the life style of an animal. Underwater noise can include a wide range of changes, from behavioral changes such as



swimming direction, speed and breathing patterns, physical damage, and stress to even the death of marine organisms (Erbe, C., 2012, p. 277).

2.4. Destruction or disruption of biodiversity

Disruption of biodiversity under the influence of international shipping can occur due to the creation of oil slicks caused by oil spills, the discharge of ballast water from ships containing invasive aquatic species, and material used in the hull and external surfaces of ships.

2.4.1. Oil slicks

Oil slicks are the biggest threat to birds and marine mammals. The level of oil toxicity has various side effects on health and disturbance in marine ecosystem. Ingestion or inhalation of toxic petroleum products have many negative effects on the digestive system, respiration, and blood circulation of various species of fish, mammals or birds (Williams, T.M., Antonelis, G.A., Balke, J., 1994). It estimated that seabird deaths from oil are about 10 times higher than reported cases. Even oil ingested or absorbed on birds' feathers can affect their egg-laying process (Vidal, M., Domínguez, J., 2015, p. 178).

2.4.2. Aquatic Invasive Species

Ballast water is a necessary partial to ensure the strength, safety and structural integrity of the ship (DiBacco, C., Humphrey, D., Nasmith, L., Levings, C., 2012, p. 483) (Walker, T.R., 2018, p. 12). Along with the rapid growth of international transportation and the activity of more than 53 thousand commercial ships in the world (until 2021) (European Union, 2021), about 3 to 5 billion tons of ballast water are transported by the shipping fleet. This increases the risk of non-native and aquatic invasive species entering to different regions of the world. The most of the primary and secondary invasions of aquatic invasive species occur through the exchange of ballast water in ports. (Bailey, S., Chan, F., MacIsaac, H., 2015, p. 1230) (Scriven, D.R., DiBacco, C., Locke, A., Therriault, T.W., 2015, p. 121). Aquatic invasive species can have significant environmental impacts. For example, the introduction of jelly combs into the Sea of Azov and the Black Sea is thought to have caused a significant reduction in commercial fish catches with an

estimated loss of \$16.8 million (Daskalov, G., Grishin, A., Rodionov, S., Mihneva, V., 2007, p. 22). The Arctic situation is also worrying due to the occurrence of climate change, because with the melting of the polar ices, new traffic routes have been created in the region, which increases the possibility of the spread of aquatic invasive species to the Arctic region through the ballast water (Bailey, S., Chan, F., MacIsaac, H., 2015, p. 1230).

2.4.3. Materials used in the hull and external surfaces of the ships

The effects of biocide compounds on the environment and aquatic, due to their long-term persistence in water, are really undesirable. Disturbance in the growth process of crustaceans and oysters, disruption in the endocrine system, and the number of hormones secreted by larger aquatic such as marine mammals, lead to the bioaccumulation of toxic substances, infertility, or even death of these species. In addition, the entry of these substances into the food chain and the accumulation in the body tissues of aquatic endangers human health. With efforts of the IMO Environmental Protection Committee, in 2001, the International Convention on the Control of Anti-Fouling Systems on Ships was developed to reduce or eliminate the adverse effects on the marine environment and human health (Rasouli, M., Zare doost, M., 2012). According to this convention, anti-fouling systems that use tin-containing organic compounds in their production are "biocide" and are considered to be one of the most dangerous and harmful substances to the marine environment. Also, according to the annex 1, ships should not use tin-containing organic compounds on external surfaces, external parts, or compounds on their hulls.

3- PSC's executive guarantees

When kind of violation of the provisions of the conventions is verify in the inspections carried out, port state may apply measures for the safety of the marine environment. These guarantees include reporting, suspension of inspection and seizure of non-standard vessels.

3.1. Reporting

Reporting mechanism means, the port state must firstly notify Specifications of the offending ships then send the full report of the violation along with relevant documents to the flag states and relevant



organizations. The Ship Classification Association has stated: in a situation if the ship is allowed to move despite a technical defect (for example, due to repairs in another port), port state is obliged to inform the authorities of the next port as soon as possible.¹

3.2. Suspension of inspection

Suspension of inspection is one of the detailed inspection guarantees before the suspension, the control officer must record all the defects according to Appendix 2 of the IMO resolution 1138 (31). The suspension can continue until the necessary measures are taken to comply with the ship and its conditions with the requirements outlined in international PSC's documents².

3.3. Detention the offending ship

It is an intervention measure taken by the port state to ensure that the non-standard ship does not leave the port without posing a risk to the ship, the people on board and the marine environment.³ The ship is obliged to comply with the conditions agreed upon by the port state and the flag state regarding not leaving the port before removing possible risks to the marine environment.⁴ However, if it is not possible to fix the defects in the port where the inspection is carried out (due to the lack of facilities and equipment), at the choice of the ship's captain and the officer's approval, provided that the departure of the ship from the port and its entry into the sea do not pose a serious risk to the safety of navigation and the marine environment the control officer may allow the ship to leave the port to proceed to the nearest repair berth in another port.

It is worth noting that although seizure and suspension of ship inspection are key tools for protecting the marine environment, the delay caused by seizure operations imposes lots of costs on shipping companies, so these

¹. According to paragraph 3 of article 11 of the Convention on the Control and Management of Ships' Ballast Water and Sediments of Ships, as well as paragraph 1-4 of IMO Resolution A.1138.

². Clause 3-6-1 of IMO Resolution 1138

³. Paragraph 1-7-4 of IMO Resolution 1138, Article 5 of the MARPOL Convention, Paragraphs 1 and 2 of Article 8 of the Third Appendix of the MARPOL Convention, and the provisions contained in Appendix 2 of the aforementioned resolution.

⁴. Clause 3-7-3 of IMO Resolution 1138.

guarantees are an alarm for those companies to pay more attention to the PSC's international requirements and the standards contained in the IMO resolutions (Chen, J., Zhang, S., Xu, L., Wan, Z., Fei, Y., Zheng, T., 2019).¹

4. The PSC regime Shortcomings

Although the environmental system of the port state control has made significant progress in recent years with the conclusion of several regional MoU, multilateral conventions and the efforts of the IMO. Our investigations in this article, indicate the existence of deficiencies in PSC regime, the most important of which will be mentioned below.

4.1. Not Including all types of environmental impacts

The current inspection system does not cover all challenges related to international shipping. In particular, the regional agreements on ship inspection do not include air pollution and noise pollution. This lack is more visible at least in the case of air pollution. Despite the important measures that have been taken in international conventions to regulate and manage air pollution by the shipping industry, these efforts have not yet been reflected in regional MoU. Annex 6 of the MARPOL Convention imposes restrictions on the production of nitrogen oxides and sulfur oxides and prohibits the deliberate release of ozone-depleting substances from ships. The IMO Marine Environment Protection Committee has revised this document. The goal of the revised version, which has been implemented since January 2020, is to reduce the level of sulfur in the world, from 3.5% to 0.5% (IMO, 2017b).² In 2016, the IMO agreed to reduce greenhouse gas emissions from ships that includes short-, medium-, and long-term measures. Subsequently, the European Union announced in 2017 that large ships are required to submit an annual report on greenhouse gas emissions and to reduce emissions by 40% from 2005 to 2050. According to these developments, it is expected that the air

¹ For example, according to paragraph 3 of article 9 as well as paragraphs 2 and 3 of article 10 of the Convention on the Management and Control of Ballast Water and Sediments of Ships, the guarantee of the inspection carried out in case of proof of a violation by the member state of the convention is to warn, detain and prevent the entry of the offending ship and prevent the unloading of the ballast water of ship (paragraphs 2 and 3 of article 10 and paragraph 3 of article 9).

² The reduction of nitrogen oxide emissions from marine diesel engines depends on their age and maximum operating speed.



pollution will be implemented in the framework of MoU's, as a result, the port states will be allowed to seize air polluting ships.

Regard noise pollution, Article 36 of the SOLAS Convention and the Maritime Labor Convention¹ include the protection of people's health against noise pollution. However, the health and life of marine animals and mammals affected by noise pollution have not been considered by international law.

In addition, the lack of preventive and regulatory regulations concerning some other sources of environmental damage such as oil spills, dry bulk cargoes, waste management and even dangerous and harmful cargoes also causes the current control system of the port owner government to be unable to protect the marine environment. Full protection was implemented

4.2. Financial issues

The difference in the level of development of the countries and their lack of equal access to the facilities and even skilled and trained officers in a region, makes the capability of the member states to implement the provisions of that region's MoU to be different. One of the key issues in the effective implementation of the PSC is facilitating the transfer of related technologies, especially green one, to developing and less developed countries. Also, prediction a fund may solve financial issues related to a MoU improve the financial cooperation in the region and provide financial assistance to deprived and less developed countries.

4.3. Centralized global informing system

Considering the creation of a new generation of ports known as "network ports", the ideal condition is to create a centralized information system between all ports around the world (not only a specific region). The statistics of violations committed by ships or port state's operators and the type of violations is among subjects which needed to be informed. Current regulations only emphasize the principle of reporting ship's violations within a regional framework. Also, the existing regulations are silent on reporting violations committed by port operators. However, can guarantee the non-discriminatory implementation of PSC regulations and prevent the competition of the ports.

¹.Regulation 3.1 (Accommodation and recreational facilities) of Explanatory note to the Regulations and Code of the Maritime Labor Convention.

4.4. Regional supervisory intensive body

It is well known that an effective centralized monitoring system can improve the PSC, in addition, the cooperation of port states and flag state depends on a coherent control system. Lack of centralized regional supervision causes some ports to adopt a negligent approach in inspection. While a regional consistent monitoring causes there is no economic opportunity for non-standard ships, hence they will be forced to change their practice. The existence of a regional monitoring mechanism is vital, and requirements is an obstacle to protection of the marine environment as a whole. The high competition between ports around the world may cause some ports to facilitate the general conditions of accept and observation in order to gain more profit. Also, due to the fluidity of the sea water and the ships' transport in different routes between ports, the pollution spreading to other ports and coasts is not so far-fetched.

5. Conclusion

Non-standard ships and diversity of ships' cargoes, affecting the marine environment with major problems such as pollution (water, noise and air) endangering the biodiversity of marine living. Oil spills and dumping of toxic wastes and other harmful materials into the sea are all major sources of pollution in the ocean. Pollution directly affects ocean organisms, and indirectly affects human health and other resources. States can establish, internationally or as part of co-operative arrangements, special rules for the prevention, reduction and control of vessel pollution. The most important of these measures includes the flag state's environmental responsibilities and the port state control. Although, the flag state charge with the main responsibility of ship's compliance, but the negligence of the flag state is not far-fetched. Therefore, PSC mechanism has been established by a number of conventions and strengthened and developed by MoU's along with IMO measures.

In recent years, application of control tools such as general and detailed inspections, reporting, suspension of inspections and finally seizure of non-standard foreign ships, has been prevent adverse environmental effects caused by international shipping inspections and finally seizure of non-standard foreign ships, have prevented the adverse environmental effects caused by international shipping or in some cases, decrease its severity. Notwithstanding, the PSC regime suffers from some shortcomings.

- a) The absence of some environmental pollution caused by maritime transport, i.e. noise and air pollution in PSC regulations.



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- b) Lack of a comprehensive information system. Importantly, its existence greatly helps the implementation of PSC regulations in a Tran's regional or global manner.
- c) Deficiency of a regional monitoring system. It should be noted that this dearth leads to heterogeneous implementation of regional MoU's.
- d) Financial issues should be added to the above list. Key differences between developed and developing countries in each region, causes the unsuccessful implementation of PSC. As a result, the tendency of developing countries to circumvent the PSC rules and create competitive ports increases. Significantly, the resolving of these deficiencies, above all depends on highlighting the role of PSC regime in preserving the marine environment and is subject to the more serious cooperation of the international community to deal with the substantive and operational challenges.

All things considered, IMO, as a competent body, potential to construct greater coordination between member states in each regions and different regions together; an impressive role that has been neglected so far. Couple with, the conclusion of an international memorandum of understanding, as an umbrella to bring together all regional MoU, providing a complete and comprehensive database for the exchange of information about non-standard vessels in a trans-regional level, are other suggestions of this study to overcome the challenges.

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