UiT The Arctic University of Norway

Faculty of Law

A Review of the Legal Framework Governing Shipping's Contributions to Ocean Acidification.

Maryam Zaheri

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Table of Contents

Index of abbreviations

CO2	Carbon Dioxide
EEDI	Energy Efficiency Design Index
EEZ	Exclusive Economic Zone
ECAs	Emission Control Areas
EU	European Union
GHG	Green House Gas Emission
Gt	Giga tone
GSDR	Global Sustainable Development Report
IMO	International Maritime Organisation
ICJ	International Court of Justice
IOC	The Intergovernmental Oceanographic Commission of UNESCO
IPCC	Intergovernmental Panel on Climate Change
ITLOS	International Tribunal for the Law of the Sea
LNG	Liquefied Natural Gas
LOSC	Law of the Sea Convention
MEPC	Marine Environment Protection Committee
MARPOL	International Convention for the Prevention of Pollution from Ships
NM	Nautical Miles
NASA	The National Aeronautics and Space Administration
NOx	Nitrogen Oxides
PH	Potential of Hydrogen
PPMV	Parts Per Million by Volume
SOx	Sulphur Oxides
SRFC	Sub-Regional Fisheries Commission
UNFCCC	United Nations Framework Convention on Climate Change
UNESCO	United Nations Educational, Scientific and Cultural Organization.

1 Introduction

Marine transport has a crucial role in global trade and it contributes significantly to anthropogenic pollution.[1] The Green House Gases (GHGs) including Carbon Dioxide (CO2) from vessels in maritime trade 'have caused significant environmental impacts, especially in coastal areas'.[2] Human and environmental health faced many problems following the adverse impacts of CO2 emissions and air pollution.[3] One of its impacts is ocean acidification.

Ocean acidification is defined by Baird et. al. (2010: 459-471) as follows 'the changing chemistry of the oceans as a result of the uptake of CO2 from the atmosphere'.[4] Therefore, ocean acidification is a result of environmental challenges such as atmospheric pollutants under which the most important pollutant is CO2. Since this phenomenon has been discovered recently, not many studies have been conducted in this field, especially from a legal perspective.

Nevertheless, the land base emission of CO2 seems to be possible to be under the control, the shipping is ongoing. In 2015, the Global Sustainable Development Report (GSDR) of International Maritime Organisation (IMO) indicated that how the shipping industry empowered economic growth all around the world and millions of people have lifted out of poverty by providing access to fundamental products through shipping.[5] The importance of the role of shipping in maritime trade is irreversible and what needs to be attention is how to minimize or eradicate their harmful environmental impact on the ocean.

On the other hand, more than 90 percent of the world trade preform by ships and the third IMO Green House Gas (GHG) study group 2014 found that international shipping is estimated to

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[1] Yuzhu Wei et. al. (2019), 'The Potential Impact of Underwater Exhausted CO2 from Innovative Ships on Invertebrate Communities', *International Journal of Environmental Research*, P 670.

[2] Du et. al. (2019), *Green Ports Strategies in China, Inland and Seaside Sustainable Transportation Strategies*, Elsevier: Cambridge, MA. Pp. 211

[3] Corbett et. al. (2007), 'Mortality from Ship Emissions: A Global Assessment', *Environmental Science & Technology*, 41 (24), 8512-8518, p 24.

[4] Baird Rachel et. al (2010), 'Ocean Acidification: A Litmus Test for International Law', *Carbon and Climate Law Review*, 10/139, p 459-471.

[5] IMO, Fredrik Haag et. al. (2015), *Estimations of The Contribution of International Shipping to Greenhouse Gas Emissions*, available at https://sustainabledevelopment.un.org/content/documents/636488-Haag-Estimations%20of%20the%20contribution%20of%20international%20shipping%20to%20greenhouse%20gas%20emissions.pdf

have emitted approximately 796 million tons of CO2 per year that allocates 2.5 % of global CO2 emissions.[6] Such a percentage may not seem like a big deal at first glance, however, two points need to be taken into consideration. Firstly, according to European Union (EU) intensive programs to reduce Sulphur Oxides (SOx), Nitrogen Oxides (NOx), CO2, and other harmful GHG emissions from the land base emission of these gas that contribute to ocean acidification predicted to be reduced. Secondly, at the same time, the shipping source emissions of ocean acidification estimate to be ongoing and increases. 'Maritime CO2 emissions are projected to increase significantly in the coming decades with increases of 50 to 250 percent predicted by 2050'.[7] The other study conducted by Ida-Maja Hassellöv et al (2013:2731) indicates that CO2-driven acidification can occur in heavily trafficked water.[8] These findings point to the significant role of shipping in CO2 emissions as a main harmful substance of ocean acidification. Therefore, shipping can identify as a source of ocean acidification.

Initially, this thesis tries to introduce ocean acidification in first chapter. Subsequently chapter two discusses the role of shipping in ocean acidification and tries to explain why it is important. Chapter three presents the existing regulations and legal instruments governing shipping emission and acidification. Chapter four discuss the challenges that these regulations and legal instruments by comparing the weaknesses and strengths of the current regulations. At the end, the thesis intends to come up with suggestions and recommendations in chapter five to introduce some solutions for reducing shipping emission.

1.1 Thesis proposal

This thesis is going to analyse the legal framework governing shipping's contributions to ocean acidification and its effects on the marine environment. Meanwhile, the phenomenon of ocean acidification is emerging, the United Nation Convention on Law of the Sea (LOSC)[9] as a main legal framework does not directly mention the acidification of the oceans by ships, the lack of legal studies in this area seems very sensible. Besides, there seems to be no specific legal

[6] European Commission, *Reducing emissions from the shipping sector* (2020), available at https://ec.europa.eu/clima/policies/transport/shipping_en, n 5.

[7] Katja Fennel and David L. VanderZwaag (2015), 'Scientific Surges, Lagging Law and Policy Responses', *Routledge Handbook of Maritime Regulation and Enforcement*, P 352.

[8] Ida-Maja Hassellöv,et. al. (2013) 'Shipping Contributes to Ocean Acidification', *American Geophysical Union*, 40, 2731–2736, P 2731.

[9] United Nation Convention on Law of the Sea (LOSC), dopted 10 December 1982, entered into force 16 November 1994,1833 UNTS 397.

framework for international cooperation against this serious environmental threat, the study intends to raise awareness of the seriousness of the phenomena and provide recommendations at the end by researching in the area. Although, it seems that much further research remains to do.

1.1.1 Delimitation of the scope

Ocean acidification is a complex issue and has many dimensions from chemistry, biology, and science to climate change, policy, and the law of the sea. As this thesis allocates for the master of laws, the main scope of the proposal is providing a legal review of the impacts of shipping emission regulations on ocean acidification. Hence, this thesis will not cover the scientific part of ocean acidification or try to provide any scientific evidence on how the ocean acidification occurs, neither has it talked about other impacts of ocean acidification such as ocean fertilization, fisheries and any other field as each of this topic can be a separate master thesis.

However, in order to define and introduce ocean acidification and to show how this harmful substance will be produce by ships, there is no way to provide some detail information on harmful substances such as CO2, Sox and NOx. This seems helpful for the reader to better understand the phenomena of ocean acidification contributes by shipping.

1.1.2 Research Question

Does the current marine regulatory framework fulfill enough to control or prevent the CO2 emission of ships? What challenges are ahead and how to overcome challenges considering the strengths and weaknesses of current legal instruments?

1.1.3 The objectives of the study

The main objective of the thesis is to assess the strengths and weaknesses of the current legal framework regarding the shipping emissions regulations. Following that, the project intends to start by characterizing the role of shipping in ocean acidification and showing how and to what extent this can affect marine biodiversity. Another purpose of this dissertation is to show how important is the problem of ocean acidification from the law of the see perspective. The last purpose is to make recommendations for the improvement of the deficits and weaknesses.

The preliminary literature review showed that there has been no adequate legal research (especially from the law of the sea perspective) on this phenomenon, with one of the reasons being the negligence or ignorance on the part of many states. Although there is quite a number of studies under the climate change regime about ocean acidification, they are focusing on the

scientific part of the phenomena. Therefore, there is a lack of enough legal studies and knowledge in this field and this project is going to cover some.

1.1.4 Methodology

To answer the research question, the doctrinal research methodology or black letter law will be chosen. The term "Doctrine" has been defined as '[a] synthesis of various rules, principles, norms, interpretive guidelines and values'.[10] This common method of legal research examines soft laws, legal concepts, and principles of case laws, statutes, and rules.[11] The method uses the legal reasoning and treaty interpretation techniques to analyse shipping impacts on ocean acidification. Treaty interpretation clarifies the emergent problems fall under the scope of its mandates or not.[12]

Dennis Pearce et. al. (2010:7) defines doctrinal research as "research which provides a systematic exposition of the rules governing a particular legal category, analyses the relationship between rules, explains areas of difficulty and, perhaps, predicts future developments"[13]. There seems a need to look at the international legal instruments mainly the International Convention for the Prevention of Pollution from Ships so-called MARPOLS[14] and the LOSC as an international law of the sea and customary international law.

To be more specific, there are different categories of the doctrinal methodology[15] of which this thesis selects "problem-based" doctrinal research methodology.[16] This is because, firstly it aims

[10] Hutchinson Terry & Duncan Nigel, (2012) 'Defining and Describing What We Do: Doctrinal Legal Research' *Deakin Law Review*, 17 (1), P 84.

[11] *Ibid*.

[12] Harrould-Kolieb Ellycia R.(2019), *Reframing Ocean Acidification Addressing an Emergent Governance Problem Under Existing Multilateral Environmental Agreements*, A PhD thesis at Melbourne University, Melbourne's research publications, p 27.

[13] Dennis Pearce et, al. (2010), 'A Discipline Assessment for the Commonwealth Tertiary Education Commission', *Australian Law Schools*, P 7.

[14] The International Convention for the Prevention of Pollution from Ships (MARPOL), adopted on 2 November 1973 at IMO, entered into force at 2 October 1983 (Annexes I and II).

[15] Mark Van Hoecke (ed) (2011), *Methodologies of Legal Research Which Kind of Method for What Kind of Discipline?* Hart Publishing.

[16] Hutchinson Terry & Duncan Nigel (2012), n 10, P 106.

to introduce and examine the problem of ocean acidification contributes by shipping. Secondly, it interpret the relevant legal resources in this field. The following steps presented by Hutchinson Terry & Duncan Nigel (2012:106) in the problem-based doctrinal research methodology:

> (1) Assembling relevant facts, (2) Identifying the legal issues, (3) Analysing the issues with a view to searching for the law, (4) Reading background material (including legal dictionaries, legal encyclopedias, textbooks, law reform and policy papers, loose-leaf services, journal articles), (5) Locating primary material (including legislation, delegated legislation and case law, (6) Synthesizing all the issues in context, (7) Coming to a tentative conclusion.[17]

1.2 What is ocean acidification and its effects?

Ocean acidification normally refers to 'the long-term increase in ocean acidity caused by the ocean's uptake of anthropogenic Carbon Dioxide (CO2) from the atmosphere'.[18] Although it will not be confined to CO2 and other, chemical substance produced by the ships also contributes to the ocean's acidity. For instance, Nitrogen Oxide (NOx) and Sulfur Oxide (SOx) are the two other components that are spreading through shipping operation and lead to ocean acidification (it will be discussed in detail in chapter two). Based on the studies done in the area, roughly 590 Giga tone (Gt) of carbon emission was primarily due to fossil fuel combustion and land-use changes as a result of human activities and CO2 emissions increased dramatically from 'a pre-industrial value of 280 Parts Per Million by Volume (ppmv) to 400 ppmv in 2014 with an accelerating rate'. [19] This causes the ocean, which has the capacity to absorb 2 Gt of carbon dioxide a year[20], to absorb more carbon dioxide (almost a third of anthropogenic CO2), the excess amount of which has negative effects on the chemical composition of seawater, such as acidification.

Rising CO2 level follows a reduction in the Potential of Hydrogen (PH) of surface ocean water. Solomon (2007:27) defines the ocean role as a sink for a high proportion of the anthropogenic

[17] Hutchinson Terry & Duncan Nigel (2012), n 10, P 106.

[18] Katja Fennel and David L. Vander Zwaag (2015), n 7, P 343.

[19] *Ibid*.

[20] *Ibid*.

CO2 and this proportion contributes to PH reduction and ocean acidification.[21] Decreasing ocean PH has negative effects on calcifying organisms as well as detrimental effects on 'the survival, growth, and reproduction of marine animals in general'.[22]

Ocean acidification has long-term consequences. Twenty-two million tons of CO2 absorbs by the ocean, every day.[23] The high level of CO2 led to 'earth's ocean becoming thirty percent more acid than in recent history'.[24] Ocean acidification involves all countries around the globe. So, as it is not limited to coastal states whose shores are directly at risk, it predicts in a report 'more than one-third of the world's population will be strongly affected by acidification'.[25]

Climate change and global warming are considered in recent years, whereas not much attention was paid to ocean acidification. The similarity between climate change and global warming on the one side and ocean acidification on the other side is the rising level of CO2. Both of the phenomena occur by rising atmospheric CO2 and both of them point to an environmental problem that is not limited to coastal states and at the national level, but it goes beyond the local sea and includes the ocean in general and at the global level.[26] In a report conducted by E. Harrold Kolieb and his colleagues (2009:2) about the impacts of acidification on the countries of the World, it has been predicted that oean acidification will affect more than one-third of the world's population.[27]

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[21] Solomon, et. al. (eds) (2007), *Contribution of Working Group 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press. P 25.

[22] Katja Fennel and David L. Vander Zwaag (2015), n 7, P 348.

[23] See Ocean Acidification, CTR. For Biological diversity, http://www.biologicaldiversity.org/campaigns/endangered_oceans/index.html?gclid=CjwKCAiA 4vbSBRBNEiwAMorER6ubGKlJxzLytE-tblYDBhEqEnkJncalS1QEUvvp73ulytx4iZlJxoCbpOQAvDBwE (last visited Jun. 7, 2020).

[24] Kimberly N. Smith (2019), 'Ocean Acidification: Dealing with Uncharted Waters', *Environmental Law Journal*, 30 (1), P 199.

[25] Ryan P. Kelly & Margaret R. Caldwell (2013), 'Ten Ways States Can Combat Ocean Acidification (and Why They Should*), Harvard Environmental Law Review*, 7, P 2.

[26] *Ibid.*

[27] Oceana, E.Harrould Kolieb et al. (2009), *Major Emitters Among Hardest Hit by Ocean Acidification: An Analysis of the Impacts of Acidification on the Countries of the World,* available at https://oceana.org/reports/major-emitters-among-hardest-hit-ocean-acidification.

There is an argument for the late recognition of the ocean acidification problem comparing to climate change and global warming. As Ocean normally and regularly absorbs a large amount of CO2, the problem of ocean acidification was invisible until recently.[28]
In contrast, there is a report concerning the effects on international rules and standards within the environmental society and shipping industry. According to Chirco Aldo et al (2018:32) referring to Tsimplis and Clarke (2013) 'the shipping sector has been shown to be more influential in affecting the views of decision-making state delegations than those representing environmental interests'.[29]

Intergovernmental Panel on Climate Change (IPCC) in its Fifth Assessment Report (AR5) released in 2013–2014, clarifies that the ocean is in "biophysical transformation"[30]that affects two legal regimes of the ocean which law of the sea is based on.[31] First, changes toward the environmental and global warming and second marine resource of the ocean such as fishing that is vital for human use.[32] The first change followed by environmental and global warming has some link to ocean acidification due to CO2 increase.

'The oceans have a critical role in regulating the Earth's climate',[33] however, there is less care about ocean acidification compared to climate change. That can be due to the fewer number of studies conduct in the area. That is why the actual causes of ocean acidification are still mostly little known. Although, measuring current rates of CO2 emissions is possible by looking at past levels and other measurements[34], this is not enough.

[28] E.Harrould Kolieb et al. (2009), n 27, P 3.

[29] Chircop Aldo et al. (2018), *The International Legal Framework, Shipping and Climate Change: International Law and Policy Considerations*, Centre for International Governance Innovatio, P 32.

[30] Tim Stephen (2015), 'Warming Water and Souring the Seas' (eds), *Oxford Handbook of Law of the Sea*, Oxford Publication, ch 2, P1.

[31] *Ibid*.

[32] *Ibid*.

[33] *Ibid* ,P 2.

[34] Eric V. Hull (2016) 'Legal and Policy Responses to Address Climate Change's Evil Twin, *Washington Journal of Environmental Law & Policy*, 6 (2), P 351.

2 The role of shipping in ocean acidification

2.1 Background

From the 18th century the marine industry faced great changes due to the increase of the CO2 and atmospheric acids, the nutrient loads from rivers also started to increase.[35] There was a huge transformation in maritime shipping shifted traditional vessels (sailing and steamers ships) into modern vessels (petroleum, crude oil, natural gas, and Liquefied Natural Gas (LNG) ships). That increased the capacity of maritime transport and global trade routes.[36]

The National Aeronautics and Space Administration (NASA) study in 2008[37] shows that the ocean slows down global warming by absorbing excess heat-trapping CO2, this results in changing the chemistry of seawater and creating a dead zone for the marine organism and it began since Industrial Revolution. [38] This analysis brought the further study of what is ocean acidification and why it can be detrimental to marine biodiversity and what would be the future trend. It follows by the environmental impact of ocean acidification, and prior legal framework, and "executive action is taken to understand this problem".[39] Today's concern is not limited to the impacts of acidifying oceans in the future, but also it involves current legal instruments that can or are able to tackle this problem.

2.2 Shipping as a source of ocean acidification

There has been a significant number of research studies on PH levels of the ocean in shipping routes. The studies pointed out that decreasing PH levels by ships result in ocean acidification. Hunter et. al. (2011:1) investigated acidification in three sea areas (North Sea, Baltic Sea, and the South China Sea) on an annual basis.[40] They recognized a decrease in PH levels in the

[35] Omstedt et. al. (2015) 'Modelling the Contributions to Marine Acidification from Deposited SOx, NOx, and NHx in the Baltic Sea: Past and Present Situations', *Continental Shelf Research, Elsevier*, 111, P 234

[36] Stopford, M., (2009), *Maritime Economics*, 3rd edition, Taylor and Francis, Hoboken, P 43

[37] See Climate change seep into the sea, NASA, https://www.nasa.gov/topics/earth/features/climate_acidocean.html (last visited Jun. 7, 2020).

[38] *Ibid*, (stating good news has turned out to be bad).

[39] Kimberly N. Smith (2019), n 24, P 200.

[40] Hunter et al. (2011) 'Impacts of Anthropogenic SOX, NOX and NH3 on Acidification of Coastal Waters and Shipping Lanes, *Geophysical Research Letters*, 38, P 1.

shipping-derived area.[41] Hassello¨v et. al. (2013:2732) sampled the shipping-derived area on the sea and their study determined that 'sea areas with heavy shipping traffic and seasonal stratification can be subject to larger PH decreases on a seasonal basis'.[42] Hagens et al. (2014:939) in his research measuring the acidification indicators including CO2 realized that constant acid deposition is high in the coastal areas and they recorded the lowest PH levels in those areas.[43] They applied four costal system models. It can be predicted that coastal area is those areas that have the highest shipping traffic.

Moreover, Omstedt et. al. (2015:234) in their study on analyzing atmospheric depositions and shipping acid emission in the Baltic Sea applied three models to examine land and ship emissions changes during the 1750 to 2014 period.[44] Their study shows the largest total alkalinity sink per surface area is where the shipping is intense in the southwestern Baltic Sea.[45] The key findings of these studies are the existence of a direct link between PH reduction and ocean acidification in shipping routes are at sea. The studies clarified the specific sea area that is shipping-derived faces the problem of PH reduction that leads to ocean acidification.

Pollution from toxic, harmful or noxious substances raised by Article 194(3) (a) of LOSC[46] that are relapsed by land base activities or atmosphere under which Arup Poddar (2014:5) presents the toxic chemicals released by ships across the sea or ocean as the source of a chemical toxic substance.[47]In addition, two chemicals have been shown to have a crucial impact on ocean acidification, namely Sox and NOX reproduced by ships. Johnson et al (2015:794) presented a ratio between sulfur (SOx) Emission of shipping and acidification. As the reduction of SOx follows a decrease in the level of acidifying the ocean and as shipping has increased over the

[41]Hunter et al. (2011), n 40, P 2.

[42] Hassello¨v et al. (2013), n 8, P 2732

[43] Hagen et al. (2014), 'Biogeochemical Context Impacts Seawater PH Changes Resulting from Atmospheric Sulfur and Nitrogen Deposition', *Geophysical Research Letter,* 10.1002 GL058796, P 939.

[44] Omstedt et, al (2015), n 35,P 234

[45] *Ibid*.

[46] See LOSC, PART XII, Art. 194 (3) (a).

[47] Poddar Arup, (2014) 'Marine Pollution and Its Regulation', *International Journal of Legal Studies and Research,* 3 (2), P5.

studied period, emissions have nevertheless increased, especially in and around several major ports.[48]

Turner et. al. (2017:374) examined ocean acidification through SOx and NOx from smokestacks and/or untreated scrubber effluent[49] and found discharges of scrubber effluent will be centered along the shipping routes.[50] Turner and his colleagues conclude that by 2050, the shipping industry causes the highest levels of ocean acidification by emissions of NOx, SOx, and CO2 that comes from shipping operations in the Baltic Sea.[51]

The underwater exhaust system of ships has a significant impact on ocean acidification. In a study conducted by Yuzhu Wei and his colleagues (2019:670) on the impacts of the underwater, the exhaust of vessels into the ocean.[52]They found that there is a tendency in maritime industries to apply underwater exhaust systems to minimize pollution on working decks and to reduce the ship's water resistance and their goal is to lower the direct emissions to the atmosphere.[53] However, as a result underwater exhaust system influence ocean acidification. This is because 'the underwater CO2 emission may significantly increase the locally dissolved CO2 level and could exacerbate local ocean acidification'.[54]

In the study conducted by Stips et al. (2016:38) about of ship-borne SOx on acidification (pH) of seawater in comparison with the impact from climate change in the North Sea regime, the regions with high ship traffic density assumed to have doubled contribution to acidification

[48] Jonson et. al. (2015) 'Model calculations of the effects of present and future emissions of air pollutants from shipping in the Baltic Sea and the North Sea', *Published by Copernicus Publications on behalf of the European Geosciences Union*, 15, P 794.

[49] Scrubbers or Exhaust Gas Cleaning Systems (EGCS) used to remove particulate matter and harmful components, such as sulphur oxides (SOx) and nitrogen oxides (NOx) from the exhaust gasses. Available at https://www.marineinsight.com/tech/scrubber-system-on-ship/ (last visited 14/06/2020)

[50] Turner et al. (2017) 'The potential future contribution of shipping to acidification of the Baltic Sea', *Springer online*, 47, P 374

[51] *Ibid*.

[52] Yuzhu Wei, et. al. (2019) 'The Potential Impact of Underwater Exhausted CO2 from Innovative Ships on Invertebrate Communities', *International Journal of Environmental Research*, 13:669–678, P 670

[53] *Ibid*.

[54] *Ibid*.

from SOx that from increasing CO2 concentrations.[55] This is more visible on the Dutch coast, German Bight, Skagerrak, and Rotterdam port area that can be '20 times larger than the North Sea'.[56] These authors conclude that the largest effects are confined to near-coastal areas, most particularly shipping lanes.

2.3 Future Trend

There is a prediction that up to five billion metric tons of CO2 will be intake by the ocean per year by 2100 if the ocean's PH levels continue to decrease.[57] Moreover, 'the ocean is acidifying ten times faster today than it has over the last fifty million years'.[58] That is estimated in future acceleration rates of acidification.

Although the last report available by IMO in 2014 states that international shipping emitted 796 million tons of CO2 in 2012[59] and this includes 2.5% of the total global anthropogenic CO2 emissions for that year, that emissions from international shipping could grow between 50% and 250% by 2050 mainly due to the growth of the world maritime trade.[60]

3 Existing legal instruments governing shipping emissions

This chapter addresses all the relevant legal instruments in ocean acidification that shipping has a role in it. It begins by identifying the legal framework for the law of the sea, which is UNCLOS and later discusses the IMO regulations. The last part of this chapter reviews other related legal instruments in this field. The chapter aims to provide a general overview of these

[55] European Commission, Stips, A. et. al. (2016), *Scoping report on the potential impact of on-board desulphurization on water quality in SOX Emission Control Areas*. Report EUR 27886 EN, P 38, available at https://www.researchgate.net/publication/321723195 (last visited Aug 2020)

[56] Ibid.

[57] Congressional Research Service, Harold F. Upton & Peter Folger (2013), *Ocean Acidification*, congress research service, available at https://www.oceanfdn.org/sites/default/files/CRS%20ocean%20acidification%20July%202013%20report.pdf

[58] Amanda M. Carr (2013) '"We Can Lead": Washington State's Efforts to Address Ocean Acidification', *Washington Journal of Environmental Law & Policy*, 3, P 194.

[59] IMO (2014) Third IMO Greenhouse Gas Study 2014, n 6.

[60] See IMO, GHG emissions from international shipping, available at http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/GHG-Emissions.aspx (last visited 08/06/2020.).

laws and the next chapter makes an in-depth analysis of the provisions of these legal instruments.

3.1 LOSC

The nature of the LOSC provides **a regulative framework** for (i) the protection of the marine environment and identifying different types of pollution at the sea of which (ii) pollution from vessels (and acidification) is the focus of this thesis.

Protection of the marine environment: The function of the LOSC is identified for all as it creates the general obligation for all states to protect the ocean. Baird et. al. (2010:11) introduce LOSC as 'The international regulatory framework for environmental protection in marine areas within and beyond national jurisdiction'.[61]

LOSC further requires states to tackle problems threatening the ocean, including shipping and ocean acidification. Part XII presents, among else, the protection of the marine environment. Article 192 provides a general obligation to protect the marine environment.[62] Even though there is no explicit mention of ocean acidification, LOSC provides a foundation for regulating the protection of the marine environment. That is mainly because the concept of ocean acidification did not exist at the time of its adoption. However, the provisions of this part are broad enough to cover ocean acidification in general.

LOSC has some relevant and specialized provisions discussing vessel source pollutions. Consider Art.211 as an example that gives legislative power to the states to establish rules and regulations concerning 'prevent, reduce and control pollution of the marine environment from vessels and promote the adoption, in the same manner'.[63] It shows that controlling and reducing pollution from vessels, marine environment, and conservation and protection of the oceans are the chief concerns of the LOSC.[64] Article 211 also divide different level of regulative and jurisdiction discretion within the different maritime zone that has been discussed above.[65]

Vessel source pollution: before explaining the vessel source pollution, it is necessary to start with the general definition of the pollution according to LOSC. Subsequently, different types

[61] Baird Rachel et. al (2010), n 4, P 11.

[62] LOSC, n 9, Art. Part XII 192.

[63] *Ibid* , Art. 211(1).

[64] Poddar Arup, (2014), n 47, P15.

[65] LOSC, n 63.

of pollution are categorized in the provisions of LOSC including land base pollution, atmospheric pollution, dumping at sea.[66] For this purpose, Articles 195, 204, 212 allocated to different types of pollution of the marine environment and atmosphere.

The question raised here is what is the relation between pollution and ocean acidification?

The response is ocean acidification can be defined as pollution caused by the effect of human activities. This is owing to the fact that the shipping emissions (that cause ocean acidification) can be characterized as pollution under Article 1 of the LOSC.

Ocean acidification is the direct consequence of ocean absorption of atmospheric CO2, which would make CO2 a substance or energy that introduce directly or indirectly by human activities into the marine environment.[67] This pollution particularly ocean acidification can be produced by ships and their activities. Following that, article 194(3) (b) requires the state to take the necessary measures to control pollution of the marine environment from vessels.[68]

Applying the preventive measurements for reducing and controlling pollution of the marine environment from any source (Art. 194 (1)), and adopting relative laws and regulations with the same purpose (Art. 212) is the next obligations imposed on the state according to LOSC.[69]

There is a responsibility for flag state and coastal state in controlling and preventing the ship-source pollution according to international standards and rules and competent international organization (Art.211).[70] IMO is best known as a competent international organization.

Another responsibility defined by LOSC to conduct a general environmental impact assessment (Art. 206) that can include projects and activities at the national level that may contribute to the reduction of CO2 emissions and 'thus lead indirectly to ocean acidification'.[71]

[66] See LOSC Articles1, 43, 194, 195, 199, 204 and part XII, sec 5 and 6, Art. 207 to 222.

[67] Nilufer Oral (2018), 'Ocean Acidification: Falling between the Legal Cracks of UNCLOS and the UNFCCC', *Ecology Law Quartely*, 45 (9), P 10.

[68] LOSC, Part XII, Art. 194 (3) (b).

[69] See Art.194 and 212 LOSC.

[70] LOSC, n 9, Art. 211.

[71] Katja Fennel and David L. VanderZwaag (2015), n7 , P 349.

3.2 IMO

International Marine Organization (IMO) plays a vital role in the reduction of CO2 emissions and energy efficiency of international shipping. IMO has a role in controlling and taking measures against CO2 emission at national and regional levels and assessing the amount of CO2 'per ton/km of actual net transport work carried out in the shipping industry'.[72]

In 1997, IMO started to adopt its first legal instruments called resolution 8 on CO2 emissions from ships, after it became aware of the role of shipping in CO2 emissions.[73] The resolution invited members to study the 'relative percentage of GHG emissions from ships as part of the global inventory of GHG emissions'.[74]

In June 2000, the IMO study group of "Greenhouse Gas Emissions from Ships" was completed and introduced to the Marine Environment Protection Committee (MEPC).[75] 'The structure directly responsible for the environmental aspects of shipping is the MEPC'.[76] This was intended to study the identification and development of the preventive mechanisms by MEPC and the work plan defined for MEPC consider technical (new ships), operational (all ships), and market-based measures to 'deal with GHG emissions from ships in international trade'.[77] Following that in Dec 2003, IMO adopted Resolution A.963(23) on 'IMO Policies and Practices related to the Reduction of Greenhouse Gas Emissions from Ships' to introduce mandatory technical and operational measurements for ships in reducing ocean pollution by acidification.[78] According to the IMO working group report in 2008, a mandatory CO2 index and an interim operational index for ships have designed by IMO.[79]

IMO commits to protect the marine environment from shipping pollution.[80] Not only IMO has Marine Environment Division, but also it has a Maritime Environment Protection Committee

[72] Ibid.

[73] IMO, Fredrik Haag et. al. (2015), n 5 , P 1.

[74] *Ibid*.

[75] *Ibid* , P 2

[76] Chircop Aldo et al. (2018), n 29, P 32.

[77] IMO, Fredrik Haag et. al. (2015), n 5 , P 2

[78] *Ibid*.

[79]Iliana Christodoulou Varosti (2009), 'Demystifying Air Pollution From Ships Via Trading Schemes: How Far Can We Go?', *Journal of International Maritime Law*, 15 ,P175.

[80] See IMO (2020), *Marine Environment*, available at http://www.imo.org/en/OurWork/Environment/Pages/Default.aspx (Last visited 10/07/2020).

(MEPC) in charge of addressing the environmental issues for the IMO and this considers the shipping impacts on ocean acidification. MPEC has various working groups of which one of them works on the agenda on greenhouse emission including CO2 as the main source of ocean acidification and it may issue resolutions and circulars.[81]

The International Convention for Prevention of Pollution from Ships as modified by the Protocol of 1978 (MARPOL), in its Annex VI particularly regulates shipping emission[82] including emissions of CO2. Although some Annexes of this regulation is binding, it can only make a small contribution to the mitigation of ocean acidification.[83] For the reason that Annex VI is specifically for the prevention of air pollution from ships is voluntary.[84]

There are different types of Actors and responsible persons in a vessel that each of them has a role and duty towards implementing the IMO's and environmental protection regulations. 'The IMO's goal is to provide the vessel owners and operators with a set of tools to reduce the amount of greenhouse gas emissions'.[85] Here are the most important and responsible actors of a vessel:

The ship owner(s): is the one who pays for the vessels. The shipowner has direct responsibility to control emissions and is accountable in case of pollution.[86] The ship owner should be aware of a violation of the IMO regulation under Art.4 of MARPOL 73 in case of pollution.[87]

The charterer and the management company: have a similar role to a ship owner and they might rent a ship from the owner. Hence, they have large responsibilities of which the most important

[81] Ibid.

[82] Ellycia R. Harrould-Kolieb, (2019), n12, P 27.

[83] Scott, K. N. (2018), *Ocean Acidification and Sustainable Development Goal 14: Goal but No Target?*, Center for Oceans Law and Policy, Nijhoff ,22 (323-341), P 330.

[84] Zabi Bazari and Tore Longva, (2011) 'Assessment of IMO Mandated Energy Efficiency Measures for International Shipping', in IMO Doc. MEPC 63/INF.2, Annex, 31 October 2011, at 7.

[85] Ben-Hakoun et al. (2016) 'Economic Evaluation of the Environmental Impact of Shipping from the Perspective of CO2 Emissions', *Journal of Shipping and Trade*, , 1 (5), P 20.

[86] *Ibid*.

[87] Djadjev Ilin (2015), *How to comply with MARPOL 73/78, A commentary on the IMO's pollution-prevention instrument and the implications for the shipping industry*, Groningen, P 3.

is hiring crew, operating the vessel at various speeds.[88] They are responsible for shipping emissions and 'operate the vessel in an environmentally efficient manner'.[89]

The registered keeper is the one who registers the vessels under its flag. Registered keepers under its flag have access to adequate allowances.[90] They are responsible for following the environmental terms and conditions imposed by competent organisations. [91] According to Varosti (2009:176), there is a presumption that the state with 'less good environmental credentials are more like to support free allowances'.[92] Free allowance point to the service that is provided free of charge and has less adequate environmental considerations.[93]

The master, officers, and crew: they 'will be trained and certified in accordance with international standards to navigate the ship in a safe, environmentally responsible, and economically efficient manner'.[94]

Energy Efficiency Design Index (EEDI) is a requirement that MARPOL imposes on new ships according to chapter 4 of annex VI.[95] Appendix III (Criteria and Procedures for Designation of Sox Emission Control Areas), known as regulation 14 aims to 'prevent, reduce, and control air pollution from SOx emissions from ships and their attendant adverse impacts on land and sea areas'.[96] Specifically, paragraph 6 of part 2.2 of this regulation points to ocean acidification[97].

3.3 Other related legal regimes

It was from 1960 to 1970 that the first notions of global warming and CO2 emission were noticed by scientists. Following that, the Intergovernmental Panel on Climate Change (IPCC)

[88] Chircop Aldo et al. (2018), n 29, P 28.

[89] *Ibid*.

[90] Iliana Christodoulou Varosti (2009), n 79, P 175.

[91] *Ibid*.

[92] *Ibid*, P 176.

[93] *Ibid*.

[94] Chircop Aldo et al. (2018), n 29 , P 28.

[95] *Amendments to MARPOL Annex VI (Data Collection System for Fuel Oil Consumption of Ships)*, 28 October 2016, IMO Doc MEPC 70/18/ Add.1 (entered into force 1 March 2018), annex 3. The flag state has the responsibility to monitor, report and issue a statement of compliance to its ships and transfer the reported data to the IMO Ship Fuel Consumption Database.

[96] IMO, Fredrik Haag et. al. (2015), n 5, P 2.

[97] MARPOL, Appendix VI.

was created in 1988 and two years later issued its first assessment reflecting views of 400 scientists.[98] That encouraged states to think about the United Nations Framework Convention on Climate Change (UNFCCC) and its proposal was introduced at the 1992 United Nations Conference on Environment and Development, named the "Earth Summit" - in Rio de Janeiro.[99]

However, UNFCCC does not cover ocean acidification directly; reduction of Green House Gas (GHG) emission has been emphasized as an obligation for state parties.[100] State parties have discretion in choosing the type of GHG[101] to be reduced. For instance, CO2 can be amongst the GHG selected for the reduction by the state parties or cannot. Therefore, if the state parties choose another type of GHG that does not have effects on ocean acidification the result of combating ocean acidification will not be reached. “Adverse effects” of climate change that has deleterious effects on nature and ecosystem” mentioned at Art.3 of UNFCCC.[102] This broad definition might include ocean acidification as an adverse effect requiring the state parties to address.[103]

Thereafter, Kyoto Protocol 1998 was introduced as a key instrument adopted under the UNFCCC with specific targets for the mitigation of anthropogenic greenhouse gases for the period 2008 to 2012.[104] It is an instrument to give an effect to the UNFCCC and transform the regime from a “pledge-and review” system to a binding-targets-and-timetable system.[105] The main objective of the Kyoto Protocol was to reduce anthropogenic emissions of greenhouse gases.[106] So, this can be used as a strong foundation for ocean acidification, as it only includes a modest decrease of 5% of greenhouse gas emissions. What is in common between the

[98] See IMO Historic background, IMO and the UNFCCC policy framework, available at http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Historic%20Background%20GHG.aspx

[99] Ibid.

[100] UNFCCC, Art. 1 (4) (C).

[101] James Harrison (2017), ‘Addressing the Marine Environmental Impacts of Climate Change and Ocean Acidification t’, *Saving the Ocean Through the Law*, Oxford Publication, ch 9, P 3.

[102] UNFCCC, Art. 3.

[103] Nilufer Oral (2018) n 67, P 15.

[104] Id.

[105] Bodansky D. Et. al. (2010), *The Evolution of Multilateral Regimes: Implication for Climate Change*, Pew centre on global climate change, P 14.

[106]Kyoto Protocol to the United Nations Framework Convention on Climate Change (1998), Art. 6.

UNFCCC and the Kyoto Protocol is the role of developed countries as leaders of GHG reduction and there are fewer responsibilities for developing countries in this sense.

Later in 2015, Paris Agreement is known as an implementation of the UNFCCC.[107] The protection and conservation of the ocean and the ecosystems mentioned in the preamble of the agreement to take action against climate change.[108] Unlike the Kyoto Protocol, the Paris agreement goes one-step-back to the pledge-and-review system to give the same place to developing countries as developed countries in mitigating greenhouse emissions.[109] As it is obvious, this agreement lacks the legally binding component and still does not include a detail or clear addressing of ocean acidification, and the agreement is limited to greenhouse emissions in general.

London Convention "on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972", has the main objective of control of all sources of marine pollution.[110]Any measures to store CO2 'will need to comply with the terms of the dumping regime'.[111] Parties of the convention recognized some risks associated with CO2 sequestration, however, this risk led to the adoption of 'Specific Guidelines for the Assessment of CO2 streams for disposal into Sub-Seabed Geological Formations'[112] to minimize the danger.

[107] Paris Agreement on Climate change (2015), Art 2, 18-19.

[108] See Paris Agreement, Preamble.

[109] James Harison (2017) , n 100, ch 9, P 5.

[110] London Convention, Art. I.

[111] Tim Stephen (2015), n 30, Ch. 2, P 6.

[112] *Ibid*.

4. Strengths and weaknesses of shipping emissions regulation

This chapter aims to provide a detailed legal analysis of the existing legal framework that governs shipping emissions and ocean acidification. To do this, the first part of this chapter begins with the strengths and weaknesses of LOSC regarding the protection of the marine environment and the regulation of ship source pollution that results in ocean acidification. Specific focus of LOSC is given to (i) the general obligations, and (ii) issues of enforcement.

The second part of this chapter analyses the most important IMO regulations concerning shipping emissions. It starts by examining the general problems and challenges with reference to the legal responsibility for enforcing shipping emissions regulations and applying the same regulations in different classes of ships. Next, it analyses three directives of the IMO concerning the rreduction of shipping emissions: Energy Efficiency Design Index (EEDI) and Emission Control Areas (ECAs), and Reduction of (GHG) emissions together with the challenges to their implementation. In the third and last part, this chapter discusses the strengths and weaknesses of the UNFCCC, the Kyoto Protocol, and the Paris Agreement.

4.1 The general obligations under LOSC

One of the strengths of LOSC is that it is considered it be a jurisdictional framework, which means that it 'dictates which States have the power to adopt and enforce rules and standards'.[113] These rules and standards relating to environmental marine protection are necessary to control and mitigate shipping source pollution resulting in ocean acidification. However, the obligations that LOSC imposes on states seem so general that they have given rise to numerous interpretations that some of which might lead to different understandings of an Article.

To begin with, Article 192 that provides a general obligation imposed on states to protect the marine environment.

[113] Harrison James (2017), 'The United Nations Convention on the Law of the Sea and the Protection and Preservation of the Marine Environment', *Saving the Ocean Through Law*, Oxford publication, ch 2, P 3.

David A. Ring (1997:93) explains the intention of the law-maker for using the word "states" instead of "state parties" in the text of Article 192.[114] In his opinion, the purpose of the legislator was to codify a customary norm and extend the obligation to all countries around the world .[115] This broad interpretation of Article 192 can be considered as a strength because it generalises the binding aspect of the law of the sea to all countries.

There is a debate concerning the "normative status" of Article 192. In the *South China Sea case*, the Tribunal concluded that Article 192 of UNCLOS brings a responsibility to all states in all maritime zones within and beyond national jurisdiction regardless of sovereignty.[116] The same interpretation of this article has been made by International Tribunal for Law of the Sea (ITLOS) in its Advisory Opinion concerning the Sub-Regional Fisheries Commission (SRFC).[117] These Institues define a general responsibility for all states in all of the maritime zones to protect the marine environment and the court recognises a kind of substantive [118]character of Article 192. Substantive role in a way that it gives effect to all dimensions involving matters of major or practical enforcement relates to the protection and preservation of the marine environment. In other words, a mere reference to the general application of Article 192 is sufficient to implement the detailed regulations of shipping emissions reduction.[119] Owing to the fact that shipping emission and ocean acidification regulations are likely considered as preventive measures to control pollution and preserve the marine environment. Article 192 is general and shipping emission reduction is a specific measure to control pollution. However, if one assume a substantive role for Article 192 that includes the whole measurements of preventive pollution and protecting marine environment

[114] David A. Ring (1997), 'Sustainability Dynamics: Land-Based Marine Pollution and Development Priorities in the Island States of the Commonwealth Caribbean', 22 , *Jounal of Environmental Law*, P 93.

[115] *Ibid*.

[116] *South China Sea Arbitration* (Merits) (2016) para. 940.

[117] *Request for An Advisory Opinion Submitted by The Sub-Regional Fisheries Comission (SRFC),*Advisory Opinion of 2 April 2015, ITLOS Reports 2015, para. 120, P 37.

[118] Substantive: relating to the essential legal principles administered by the courts, as opposed to practice and procedure. Available at https://dictionary.reverso.net/english-definition/substantive+role (last visited 09/11/2020).

[119] LOSC, n 9, Art. 192.

of which shipping emission is one of those. Therfore, Art.192 is enriching enough to include the implementation of shipping emission regulations.[120]

On the one hand, some scholars like James Harrison (2017:6) think that it is unlikely that Tribunals recognize a substantive role for Article 192 without having the legislation and law-making power.[121] Legislative power is needed to recognize such a substantive role for Article 192. In the *South China Sea case*, the Tribunals did not have the competency to identify the substantive character of this Article and the Tribunals could only deal with litigation and not legislate. [122] He believes that further and supplementary rules need to support the implementation of Article 192 and it cannot be enforced solely and this article is like a guideline for the whole Part XII which is about marine protection in general.[123] If one considers the ocean as a whole, Article 192 discusses the protection of the whole oceans against any threat in the whole marine environment and also about all types of harm to the marine environment in his point of view.[124] Hence, Article 192 generalises the obligations under all of Part XII. He concludes that Tribunals tend to identify the "norm-creating character" of Article 192 and this Article cannot be interpreted in "isolation".[125]

From what has been discussed above, it can be concluded that there is common ground in these discussions. That is the general aspect of this Article. From the point of view of the proponents of both interpretations, the extension of the responsibility for the protection of the marine environment to all states is accepted. The point of contention is whether this Article alone is sufficient for implementation or whether it requires additional rules. It is true that in the *South China Sea case*, the Tribunal found that China was obliged to the protect marine environment[126] referring to the normative aspect of Article 192. The Tribunal is opposed to Chinese hegemonic actions in this area of the sea by referring to Art. 192,[127] however, it does not mean that Tribunal objects to the enactment of supplementary laws to enforce Article 192. It seems possible to combine both views in a way that provides a broad interpretation of this Article. To sum up,

[120] *Ibid*.

[121] Harrison James (2017), n 112, P 6.

[122] *Ibid.*

[123] *Ibid.*

[124] LOSC, n 118.

[125] *Ibid.*

[126] *South China Sea Arbitration* (Merits) (2016) para. 940.

[127] *Ibid*, n 125, para 894.

Article 192 can be considered as a confirmation of the general rule of protection of the marine environment,[128] yet also requires the enactment of more detailed laws to adequately preserve the marine environment.

Regarding shipping emissions that result in ocean acidification, specifically surplus CO2 that is released by ships in the atmosphere above the water column, it is not clear whether the general obligation of Article 192 extends to the airspace beyond sea level or not[129]. So that by considering the strength of Article 192, the response can be considered positive due to the wide interpretation of this article that has been explained above.

Article 194 is a rule that contains 'measures to prevent, reduce and control pollution of the marine environment'.[130] In the study conducted by Guruswamy (1998:70) Article 194 deals with both types of pollutions including a land base in general and atmospheric pollution in specific.[131] Nevertheless, the weakness is where it is unlikely to implement Article 194 without having knowledge about the definition of pollution under which shipping emission is the target. In other words, it can not be enforced in isolation.

Article 1(4) LOSC defines pollution activities by;

> Man directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, a hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of seawater and reduction of amenities.[132]

As can be understood from the context of this Article, the lack of the wording of "ocean acidification" is visible in this context which can be considered as a deficit. Shipping emission

[128] LOSC, n 118.

[129] M Nordquist et. al. (1985), *United Nations Convention on the Law of the Sea 1982: A Commentary*,(eds), Vol. IV, Martinus Nijhoff, P 70.

[130] LOSC, n 9, Art.194.

[131] Guruswamy, Lakshman (1998) 'The Promise of the United Nations Convention on the Law of the Sea (UNCLOS): Justice in Trade and Environment Disputes', *Ecology Law Quartely,* 25 (189), P 189.

[132] LOSC, n9, Art 1 (4).

of which the CO2 is one of its most harmful elements is the most detrimental substance that causes ocean acidification. Art. 2 (2) MARPOL includes a definition of " harmful substances":

> "… means any substance which, if introduced into the sea, is liable 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, and includes any substance subject to control by the present Convention".[133]

The definition provided for MARPOL is entirely compatible with the definition of "pollution of the marine environment" at Art. 1(4) of LOSC.[134] CO2 is the main substance that acidifies the seawater and creates a dead zone that lacks oxygen for marine creatures.[135] As a result, CO2 has the features of considering harmful substances. Chapter two explained the role of shipping in the creation of CO2. Therefore, shipping emissions creates the harmful substance of CO2 defined as a kind of pollution according to these provisions.

Article 1(4) LOSC identified all types of pollution that are harmful to the marine environment and the quality of seawater. Ocean acidification contributes by shipping emissions have direct effects on the water quality and endanger marine biodiversity as well as the atmosphere.[136] With a broad interpretation, shipping emission can also be included in pollution definition.

4.2 Issues of enforcement under LOSC

The second challenging issue that arises with Article 194 is to answer the question that to what extend the coastal state is responsible and has jurisdiction to control and reduce pollution raised by shipping emission. This deals with the jurisdiction and responsibility of the coastal state and a need to identify the enforcement power of coastal states and flag states in different maritime zones. According to Article 194 (2);

> "States shall take all measures necessary to ensure that activities under their jurisdiction or control are so conducted as not to cause damage by pollution to other States and their environment and that pollution arising from

[133] MARPOL, n 14, Art. 2 (2).

[134] LOSC, n 9, Art. 14.

[135] Donald R. Rothwell &Tim Stephens (2016), *International Law of the Sea*, Bloomsbury, 2nd edition, P 357.

[136] The Intergovernmental Oceanographic Commission of UNESCO (IOC), Kirsten Isensee and Luis Valdes, *Ocean Acidification* (2015) , available at https://sustainabledevelopment.un.org/content/documents/5844Ocean%20acidification.pdf.

incidents or activities under their jurisdiction or control does not spread beyond the areas where they exercise sovereign rights in accordance with this Convention".[137]

This provision has a strength and a weakness. The strength is that it principally divides maritime zone based on jurisdictional power within and beyond the national jurisdiction of coastal states;

4.2.1 Within the national jurisdiction:

Coastal states are known as the strongest advocates of enacting and enforcing marine environmental protection regulations[138] according to four reasons. Firstly, the coastal states have sovereignty within their territorial sea that is up to twelve nautical miles from its baselines.[139] Secondly, coastal states can unilaterally set regulations for the protection of their marine environment.[140] Foreign ships shall comply with all laws and regulations of coastal states and all generally accepted international regulations relating to the prevention of pollution at sea.[141] Thirdly, coastal states can forbid and control any types of shipping pollution within their territorial seas.[142] Nevertheless, there is an exception confining the sovereign rights of the coastal state; innocent passage within the territorial sea, straits used for international navigation subject to Art.45, and archipelagos. [143] Setting shipping regulations is permitted so as to preserve the marine environment according to Article 21 (1) (f), however, these regulations should not hamper the right of innocent passage of foreign ships (Art. 24 and Art. 211 (3), (4)).[144] The passage should be considered innocent[145] to be allowed, meaning that not all types of passage considers innocent according to Article 19. For instance, those types of passage that create "willful and serious pollution" within the national jurisdiction of the coastal states are

[137] LOSC, n 9, Art.194 (2).

[138] M Nordquist et al (eds), United Nations Convention on the Law of the Sea 1982: A Commentary—Vol. I (Martinus Nijhoff 1985) 70–2.

[139] UNCLOS, Article 2 and 3.

[140] LOSC, n 9, Art. 211 (3).

[141] LOSC, n 9, Art. 21.

[142] LOSC, n 140.

[143] LOSC, n 9, Art. 45 and 46.

[144] LOSC n 9, Art 21, 24, 211.

[145] Innocent passage is "continuous and expeditious" for the purpose of:

(a) traversing that sea without entering internal waters or calling at a roadstead or port facility outside internal waters; or

(b) proceeding to or from internal waters or a call at such roadstead or port facility. (Art. 18 LOSC)

not innocent. [146]Thus, the coastal state has full jurisdiction to prevent such a passage according to paragraph "h" of Art. 19 and Art. 25.[147] Fourth, a coastal state can impose monetary policy including a penalty against the accused and violating ship (Art. 230).[148] This is a kind of strong enforcement power given to the coastal to react against shipping pollution.

According to Art. 45 of LOSC, straits used for international navigation that is located 'between a part of the high seas or an exclusive economic zone **and** the territorial sea of a foreign State' (Art. 45 (1) (b)) benefited from the rights of innocent passage.[149] As a result, coastal states are not allowed to enact pollution prevention and controlling shipping emissions laws that prevent ships from passing these types of straits under the pretext of protecting the marine environment (Art. 45 (2)).[150]

Archipelagos[151] are within the national jurisdiction of the coastal state and the same rules of sovereignty have been explained above applies to them. The coastal state shall respect the right of innocent passage for foreign ships when imposing shipping emissions regulations in Archipelagos (Art. 52), and they cannot suspend the right of innocent passage unless it 'is essential for the protection of its security'.[152] There is not a distinct definition of security in LOSC rather than the one in Art.19 that 'Passage is innocent so long as it is not prejudicial to the **peace, good order or security'** of the coastal State. [153] Such passage shall take place 'in conformity with this Convention and with other rules of international law'.[154] When the security of the coastal states is threatening, they can suspend the passage. [155]Therefore, the

[146] LOSC, n 9, Art. 19 and 230.

[147] LOSC, n 9, Art. 19 and 25.

[148] LOSC, n 148.

[149] LOSC, n 9, Art. 45.

[150] *Ibid*.

[151] According to Art.46 of LOSC;

(a) "archipelagic State" means a State constituted wholly by one or more archipelagos and may include other islands;

(b) "archipelago" means a group of islands, including parts of islands, interconnecting waters and other natural features which are so closely interrelated that such islands, waters and other natural features form an intrinsic geographical, economic and political entity, or which historically have been regarded as such.

[152] LOSC, n 9, Art.52.

[153] LOSC, n 9, Art. 19.

[154] *Ibid*.

[155] *Ibid*.

reason that converts the rights of suspension of passage to the coastal state should be related to security and to protect the state. This seems quite a strong reason and it is far likely to include shipping emission regulations amongst security reasons because it does not seem to threaten the national security and public order of the coastal state.

4.2.2 Beyond the national jurisdiction:

The area which is called Exclusive Economic Zone (EEZ), the continental shelf beyond 200 nautical miles (nm) and high seas falls in this category. Coastal state's jurisdiction and enforcement power are limited in these areas according to LOSC.[156] The EEZ is up to 200 (nm) from its baselines from the baselines from which the breadth of the territorial sea is measured (Art. 57).[157] According to Art. 56 (1) (iii), the coastal state has exclusive jurisdiction over the protection and conservation of the marine environment in its exclusive economic zone.[158] Establishing regulations to control and reduce shipping emissions falls in the categories of marine protection and pollution preservation due to the impacts of shipping on the marine environment. [159] Therefore, not only the coastal state has exclusive jurisdiction to set shipping emission regulations, they can enforce and implement those regulations (211 (5)).[160]

On the other hand, there are also rights and duties for other states in the EEZ. The duty to comply with the regulations regarding the protection and conservation of the marine environment is set by the coastal state (58 (3)). [161]The rights to navigate freely in the EEZ (Art. 58 (2)). [162]

So, on the one hand, there is an exclusive jurisdiction for the coastal state to protect and preserve the marine environment and on the other hand, there is freedom of navigation for the other state in the EEZ. Now the question raise here is that to what extend the coastal state can exercise its jurisdictional power regarding shipping emission regulations so as to protect the marine environment.

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[156] LOSC, Part V, VI and VII.

[157] LOSC, n 9, Art. 57.

[158] LOSC, n 9, Art. 56.

[159] *Ibid*.

[160] LOSC, n 9, Art. 211.

[161] LOSC, n 9, Art. 58.

[162] *Ibid*.

The coastal state can adopt laws and regulations for shipping emission to the extent that is 'conforming to and giving effect to generally accepted international rules and standards established' (Art. 211 (5)).[163] These regulations should be in consultation with the competent international organization that is IMO (Art.211 (6) (a) and (c)). [164] IMO shall decide within 12 months that these regulations are in correspondence to the requirements or not. [165] Therefore, the restrictions can be set by the competent organisation, and setting shipping emission regulations in the EEZ is not as easy as in its territorial sea. These shipping emission regulations should also respect the 'due regard to the rights and duties of other States' that are presenting in Article 56 (2).[166] As a result, restrictive regulation of shipping emission control cannot be set without the respect of such standards, without the consultation and confirmation of IMO and other related competent organisations, and the respect to the navigational rights of other vessels in the area.

The weakness of Article 194 might be seen in those maritime zones that are beyond the national jurisdiction, this is wehere there are environmental obligations stand against freedom of high seas. [167] It is difficult to blame a polluting ship and force it to protect the marine environrment while it claims to exercise its right to high seas freedom because of the following reasons;

1. In the high seas, the doctrine of freedom governs meaning that "no single State has overall competence" for the protection of the marine environment and it is the "global commons" and there is not any sovereignty.[168] High seas do not belong to a single state and every state either land lock or coastal has the right to navigate in the high seas.[169] Therfore, controlling and reducing shipping emissions on the high seas is more complex than other maritime zones due to the **lack of single authority**.
2. There will be not a specific enforcement power to set regulations on the high seas and this follows by the principle of "**flag of convenience**" that also applies to shipping

[163] LOSC, n 162.

[164] *Ibid*.

[165] *Ibid*.

[166] LOSC, n 9, Art. 56 (2).

[167] Tore Henriksen & Henrik Ringbom (2017), *Governance Challenges, Gaps and Managements Opportunities in Areas Beyond National Jurisidction*, Global Environment Facility, P 19.

[168] Harrison James (2017), n 112, ch 2, P 4.

[169] UNCLOS, Article 90.

standards.[170] This means that 'any flag state that is incapable of enforcing its own and international standards is considered a threat to the maritime safety'.[171] Vessels navigating under their flag of convenience creates more pollution than those under national registration.[172]

3. In addition to the general obligations to protect the marine environment that has been mentioned earlier, there are some other general environmental obligations imposed on flag states. For instance, Article 217 empowers the flag states to set laws and regulations for the prevention, reduction, and control of pollution of the marine environment from vessels.[173] Flag states are also obliged to take necessary measures for the implementation of marine protection regulations.[174] However, **failure to specify the implementation details in the environmental obligations** of these provisions by LOSC has made these regulations seem weak.[175] 'This means that there are few mechanisms to ensure that the general environmental obligations are actually followed by states'.[176]
4. There is **lack of a coordinated and united action** to preserve the marine environment from acidification imposed by shipping in the high seas. This is where conflict of interests and benefits occur. Some flag states have a stricter environmental policy than others. According to James Harrison (2017:5), it is only possible 'if all States are able to agree upon common rules and standards […] this is a major challenge for developing effective international rules'.[177] For instance, although Article 211 and 217 of LOSC provide legislative and enforcement power to the coastal and flag states, they do not provide a guarantee for non-compliance with the obligations beyond national jurisdiction and the high seas.[178] On the other hand, as these areas belong to all states

[170] Hamad Bakar Hamad (2016), n 167, P 215.

[171] Ibid.

[172] Levantino, B. A. (1882), 'Protection of the High Seas from Operational Oil Pollution: A Proposal'. *Fordham International Law Journal, 6*(1), 72-99.

[173] LOSC, n 9, Art.217.

[174] LOSC, n 9, Art. 94 and 217.

[175] Tore Henriksen & Henrik Ringbom (2017), n 166, P 24.

[176] *Ibid*.

[177] Harrison James (2017), n 112, ch 2, P 5.

[178] LOSC, n 9, Art. 211 and 217.

and there is freedom of high seas, a state cannot easily claim against the polluting state for polluting the environment.

Therefore, the problem raise here concerning marine pollution on the high seas is the punishment of the polluting government.

It can be concluded that the main challenge that states are facing toward reduction or controlling of shipping emissions is the "generalization" of the LOSC and using the term "Environmental Marine Protection" in general that is not enough. Consider Article 192 as an example of one of several similar cases mentioned above, it cannot be interpreted and applied solely and it needs supplementary rules to deal with the issue.[179] Therefore, lack of detailed transparent rules is visible in the field of shipping emission regulation while implications of ocean acidification regulation due to shipping contained to LOSC. LOSC does not seem to be sufficient to reduce the acid pollution of ships and it only stands as a support umbrella for supplementary laws, directives, guidelines, and detailed rules in this area.

4.2 IMO/MARPOL

The issue of ship-source pollution legislation has been left to the International Maritime Organization (IMO) as a competent international organization.[180] The IMO provides a regulatory approach to mitigate shipping emissions. On the one hand, the diversity of actors and legal responsibility as well as multiple classes of ships create problems for implementing the IMO regulation in general.

On the other hand, IMO measurements to control shipping pollution like identifying the Emission Control Area (ECAs), Energy Efficiency Design Index (EEDI), and reduction of GHG emissions pose challenges while enforcing IMO's directives of shipping pollutions. These factors contain positive and negative issues. Nevertheless, general negative points that seem common problems in implementing all of the IMO regulations toward shipping emission will be discussed first. The specific challenges that allocate to the IMO directives concerning shipping emission regulations will be argued afterward.

[179] LOSC, n 177.

[180] Chircop Aldo et. al. (2018), n 29, P 27.

4.2.1 Common problems in implementing IMO shipping emission regulations

Diversity of actors and legal responsibility: as explained in chapter 3, shipowners, registered keeper, management company, charterer, crew, and officers, supporting vessels and ports have responsibilities concerning shipping pollution.[181] From a general point of view, it can be considered positive and a strength that each actor has a responsibility to implement shipping emissions regulations based on its position.

However, if one goes deeper and in detail about the actor's responsibilities, the shortcomings and problems become apparent. For instance, ship-owners intend to achieve maximum benefit or 'optimizing the earning capacity of the ship'[182] to cover their costs and earning more interest. By applying for environmentally friendly and emission reduction programs, ship owners should scarify their benefits and at the same time they spend the cost for vessels and this is where conflict of interest occurs and can be considered as one of the obstacles to imply shipping emission reductions.[183]

On the other hand, normally merchant ships have multiple shareowners regardless of the nationality of the ships. In this case; one is the state in which the ship is registered under its flag and another is the shipowner who can be more than one person, so there might be different trading partners for one vessel. The main deficit that occurs here is the problem of "flag of convenience", or in other words the system of the open registry. The relationship between having multiple owners and an open registry system is where the owner may be held by foreign interests [184] and it is very difficult to have control over ownership. For instance, Kenya and Panama [185](registered keeper) are two famous open registry states and they do not care so much about the environmental considerations and ocean acidification. They provide very cheap registration to their customers. So the registered keeper put the burden of responsibility on the

[181] Ben-Hakoun et al. (2016), n 85, P 20.

[182] Chircop Aldo et al. (2018), n 29, 27.

[183] *Ibid*.

[184] Chircop Aldo et. al. (2016), *Canadian Maritime Law*, (ed), Irwin Law, Dalhousie University Schulich School of Law, P 322.

[185] Gregory, William R. (2012), *Flags of convenience: the development of open registries in the global maritime business and implications for modern seafarers*, Georgetown University, P 50.

shipowner or the one who rents or by the ship. At the same time, the shipowner divide shares between other trading partners. In this situation, this is very difficult to find a responsible person who cares about shipping emission reduction regulations.

However, the responsibility to control shipping emission regulation is not constrained to ship owners, management company, and/or charterer has the possession of the ship concerning operational matters and control of the ships concerning emission reduction plan.[186] Also, the charterer might lease a ship for a specific period.[187] According to Chircop Aldo et al. (2018), when the ships are operated by charter, higher voyage and lower cargo, as well as high speed, is important than other factors (such as emission reduction plans) due to maximizing the earning power of the ship that is in favor of charterer.[188] So, it does not matter the ship is under the control of the owner, management company, or charterer, all have the same responsibility to implement shipping emission regulations.

Crew members and officers influence shipping emission as they are supposed to be trained and certified concerning the international standards of safety and navigation. [189] They are responsible for environmental consideration of vessels and have an "economically efficient manner"[190]. The situation is much more challenging in open registry vessels where the costs of the crew will be quite cheaper as they can employ international crew[191] and use it from the cheap labour force. Negligence of the crew and officers may lead to shipping pollution.

Supporting vessels are the last actors that affect shipping emission. These are the types of ships assisting other vessels at ports and providing navigational aids, these types of ships are known as a workhorse of the ocean.[192] These vessels may consume more fuel than other types of vessels due to the high torque power that they need when providing assistant. [193] Even trade vessels need their assistant at port and cargo delivery. Cargo may be selling more than one time

[186] Chircop Aldo et al. (2018), n 27, P 28.

[187] *Ibid*.

[188] *Ibid*.

[189] Iliana Christodoulou Varosti (2009), n 79, P 175.

[190] Chircop Aldo et. al. (2018), n 185.

[191] Chircop Aldo et. al. (2016), n 183, P 322.

[192] Bourneuf Jr. Gus (2008), *Workhorse of the fleet; A History of the Liberty Ships,* American Bureau of Shipping, P 35.

[193] Chircop Aldo et. al. (2018), 27, P 29.

at sea, so different ports and different supporting vessels are involving in cargo delivery that each of which contributes to shipping emissions. [194]

To sum up, the responsibilities of ship owners, company management, and charterer to reduce shipping emission seems to be placed more crucial than other factors. Therefore, it depends on the seriousness of the actors in applying the factors and laws to reduce ship emissions at sea.

A wide variety of classes of ships and the problem of implementing the united regulation: This is not possible to apply the same regulation to different classes of ships. [195]For instance, slow steaming vessels have their way of regulation. There are different factors such as technical constraints, legal feasibility, cost and benefits as well as the feasibility of implementation, possible policy designs, and current speed regulations identifiyng the type of ships that need to be taken into consideration while setting the standards of emissions control.[196] It also depends that the ship designed for the general or specialized trades or the specialized functions.[197] Each of these classes needs specific shipping emission regulations.

4.2.2 The Energy Efficiency Design Index (EEDI)

It was initiated by IMO at MEPC 62 (July 2011) with the adoption of amendments to MARPOL Annex VI (resolution MEPC.203 (62).[198] This was made mandatory for all the new ships.[199] So, there is a minimum energy efficiency level per capacity mile that needs to comply with every new ship since January 2013.[200]

[194] Chircop Aldo et. al. (2018), n 192.

[195] Faber Jasper et al. (2012), *Regulated Slow Steaming in Maritime Transport, An Assessment of Options, Costs and Benefits*, Delft, P 7.

[196] *Ibid*.

[197] Chircop Aldo et al. (2018), n 27, P 28.

[198] See IMO Energy Efficiency Measures available at : http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Technical-and-Operational-Measures.aspx

[199] *Ibid*.

[200] When Annex VI (resolution MEPC.203 (62) entered into force.

Shipping Fuel and the need for new international safety regulation: shipping fuel has a direct influence on ocean acidification. In order to enforce Energy Efficiency regulative of IMO that reduces shipping emission, the type of fuel is very important and LNG fuel recognize as the best option for this purpose in many studies.[201] Aymelek M. et al. (2015:771) present LNG as a non-pollutant fuel that does not cause any sort of marine pollution 'even if it spills to the sea and related coastal marine environment'.[202] However, even with LNG, there are some flaws that this thesis tries to identify as below:

Comparative and stable price[203] of LNG may show it as an economic cost-effective fuel, however, Adamchak & Adede (2013) indicates in their study that the main challenge concerning LNG fuelling is funding and investing.[204] They indicate that investment is needed in ship propulsion, fuel handling systems, and bunkering facilities to provide the LNG bunker system and that also requires new international safety regulations to support such an investment.[205] 'Cold material handling capability of relevant ship structures, asphyxiation risk of people involved in bunkering, dependent on facts occurring at the moment of LNG spill pool fire, vapor cloud fire, explosions, rapid phase transition (RPT)' [206] presented as safety challenges of LNG bunkering. These challenges need to be overcome in new safety regulations.

Even though price advantages and time-saving opportunities of LNG make it desirable for shipping owners and operators,[207] the second problem was introduced by Skramstad (2013) regarding the availability of the LNG for ships.[208] This brings many difficulties for ship owners. Norway cab is taken as an example of the leading European country in the field of LNG fuel,

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[201] IMO (2013), IMO Train the Trainer (TTT) Course on Energy Efficient Ship Operation, *Climate Change and the Shipping Response*, P11, available at https://pdfs.semanticscholar.org/054a/6a237012fec22d511b2456569fde6cc17e3f.pdf.

[202] Aymelek M. et al. (2015) 'Challenges and opportunities for LNG as a ship fuel source and an application to bunkering network optimization', *Taylor & Francis Group*, London. P 771.

[203] *Ibid*.

[204] Adamchak F., & Adede A., (2013) 'LNG as a marine fuel, 17th International conference and exhibition on Liquefied Natural Gas (LNG 17)', *Houston*, P 776.

[205] *Ibid*.

[206] Jonsdottir G.J., (2013), *LNG as a ship fuel in Iceland: A feasibility study*, Master of Science Thesis, Reykjavik University, Iceland, P 24-26.

[207] Aymelek M. et al. (2015), n 201, P 770.

[208] Skramstad E., (2013), 'International guidelines for bunkering LNG as a marine fuel, 17th International conference and exhibition on liquefied natural gas (LNG 17)', *Houston*, P 17.

has only a small number of ships equipped with this fuel due to unknown operational puzzles of LNG in deep-sea shipping.[209] Lack of the availability of LNG bunkering recognizes as the main reason for investors' reluctance to invest in this fuel.[210]

The third problem concerning fuel is speed. Normally the higher the speed of the vessel is, the greater the fuel consumption is.[211] For instance, oil and gas and wind farms vessels, assistant and supporting vessels movement is based on high speed and high torque power.[212] Therefore, the function of some of the vessels depends on high fuel consumption.

Compliance with emission regulations is necessary for the utilisation of LNG as a ship fuel source.[213] Thus, it seems that considering all of the difficulties and deficits mentioned above, LNG advantages and positive impacts as an environmentally friendly fuel overweigh its problems. It has been predicted by Aymelek and his colleagues (2015) that 'LNG is expected to be one of the main bunker sources for deep-sea container liner shipping by 2030'.[214]

4.2.2 Emission Control Areas (ECAs)

The IMO short term and long-term measures to reduce CO2 emissions became stronger in resolution MEPC 305. (73) Adopted in October 2018 as it aims to fully decarbonize international shipping within the century and introduce an Action plan that provides additional and stricter measures to complete before 2023.[215] Some of the most important measures in the Action Plan include the new lower 0.50% limit on sulphur in ships' fuel oil[216] and new limit (even lower at 0.10%) for designated ECAs.[217]

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[209] Skramstad E., (2013), n 207.

[210] Aymelek M. et al. (2015), n 201, P 777.

[211] Chircop Aldo et al. (2018), n 27, P 29.

[212] *Ibid*.

[213] IMO (2013), n 200.

[214] Aymelek M. et al. (2015), n 201.

[215] IMO (2018), Marine Environment Protection Committee (MEPC), *73rd session*, available at http://www.imo.org/en/MediaCentre/MeetingSummaries/MEPC/Pages/MEPC-73rd-session.aspx (Last visited 11/08/2020)/

[216] will be in force from 1 January 2020 (under IMO's MARPOL treaty) according to IMO Implementation of sulphur 2020 limit, available online at http://www.imo.org/en/MediaCentre/MeetingSummaries/MEPC/Pages/MEPC-73rd-session.aspx (Last visited 11/08/2020)

[217] *Ibid*.

ECAs designated under regulation 13 of MARPOL Annex VI (NOx emission control): 'It is a regional sulfur emission control regulation that restricts the maximum sulfur content in the marine bunker burnt inside the regulated areas'.[218] When it comes to enforcement, it controls the fuel consumption of ships that produce CO2.[219] Therefore, ECA regulation controls and limits the Co2 and sulfur emissions (the source of ocean acidification) in maritime transportation. [220] More precisely, the strength of ECA regulation is compelling the shipping companies to equip their ships with the modern and somehow expensive fuel instead of traditional heavy fuel oil to be able to navigate within the ECA area.[221] The role of ECA regulation is important where it affects emission contributors (such as Co2 and Sulphur) to ocean acidification in the shipping industry.

Although, one should not overlook the challenges that enforcing such laws poses for shipping companies. Maybe, it is better to use the word obstacles and deficits instead of weaknesses that make the enforcement of these regulations difficult.

Price differences: The first obstacle posed by the implementation of the ECA regulation is the difference between the cost of modern fuel and traditional fuel.[222] Due to the fact that ECA regulations authorize less polluting fuel with higher emission control technology in the ECA areas and such rules resulted in a level of coercion for shipping companies.[223] This has incurred a lot of costs for shipping companies, for instance changing from heavy fuel oil to the expensive marine gasoline oil that is costly.[224]

[218] Yewen et. Al (2016), 'The Impact of Bunker Risk Management on CO2 Emissions in Maritime Transportation Under ECA Regulation', A discussion paper, *Institute for foretaksokonami*, P 3.

[219] *Amendments to MARPOL Annex VI (Data Collection System for Fuel Oil Consumption of Ships)*, 28 October 2016, n 94.

[220] Dorota Pyć(2018),'ECA Compliance and Enforcement- legal regime for ships', *EDP Sciences*, 58, P2.

[221] Yewen et. Al (2016), n 217.

[222] *Ibid*.

[223] *Ibid*.

[224] *Ibid*.

Speed reduction: The second obstacle is speed reduction. The study conducted by Maloni et al. (2013:158) showed that there will be a 19% to 28% reduction of CO2 emission by using a slow steaming strategy in shipping navigation.[225]

4.2.3 Reduction of GHG emissions from shipping

By having adopted resolution MEPC.304 (72)[226] by IMO in April 2018, about the reduction of GHG emissions from shipping, it becomes clear for the shipping industry to commit themselves to CO2 reduction programs.[227] However, fulfilling this commitment was not easy for seagoing ships. Besides, it was costly and expensive to enforce reduction measurements. In this resolution, IMO aims to reduce the total annual GHG emission of international shipping by at least 50% by 2050.[228]

To be more specific, Annex VI of MARPOL 73/78 allocates to Regulations for the Prevention of Air Pollution from Ships. [229] This is a strength in IMO regulations. The provisions of Annex VI apply to all types of ships. [230] An exception is given to (i) saving and emergency ships (providing emergency assistance), (ii) damaged ships (unintentional damages provided that all reasonable precautions have been taken).[231]

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[225] Maloni, et. al. (2013) 'Slow steaming impacts on ocean carriers and shippers', *Maritime Economics & Logistics*, 15(2): P 158

[226] IMO (2018), *Resolution MEPC. 304(72),* available pdf at http://www.imo.org/en/OurWork/Documents/Resolution%20MEPC.304%2872%29%20on%20Initial%20IMO%20Strategy%20on%20reduction%20of%20GHG%20emissions%20from%20ships.pdf (Last visited 11/08/2020)

[227] ESCA (2020), *Policy Priorities, Co2 Emission*, available at https://www.ecsa.eu/policy-priorities/safety-and-environment/co2-emissions (last visited 11/08/2020)

[228] IMO (2018), *Resolution MEPC.304(72), level of ambitious and guiding principles,* available at https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/ResolutionMEPC.304(72)_E.pdf.

[229] Amendments to MARPOL Annex VI (Data Collection System for Fuel Oil Consumption of Ships)(2016), n 94.

[230] Djadjev Ilin (2015), n 87, P 15.

[231] Ibid.

The weakness is the nature of shipping emission prevention regulation that is voluntary and not binding. 'A State to become a Party to MARPOL must ratify MARPOL Annexes I and II'.[232] Annex I of MARPOL 73/78 (date of entry: 2 October 1982) regulates the prevention of pollution by oil.[233] Annex II (date of entry: 2 October 1982) regulates the control of pollution by noxious liquid substances (NLS) in bulk.[234] States that are the parties to MARPOL oblige to implement annex I and II of the convention that is about control and prevention of pollution by Oil and Noxious Liquid Substances in Bulk. Not only ocean acidification is not targeted at Annexes I and II, but also Annex VI that is for Regulations for the Prevention of Air Pollution from Ships more focused on air pollution rather than ocean acidification.

4.3 Other related legal instruments

UNFCC provides the policy framework for a global reduction in CO2 emissions and it discusses the 'dangerous anthropogenic interference with the climate system'[235] and how to adopt preventive measurement for this. The positive point of UNFCCC is that it can be interpreted in a way that it can lead to reducing the rate of acidification in the world's oceans if one considers UNFCCC as a document that can be interpreted differently according to the circumstances and time.[236]

From this point of view, UNFCC can be considered as a useful policy framework, but from another perspective, it can have shortcomings. Firstly, it makes very limited reference to ocean acidification. Secondly, ocean acidification has been only discussed by the Subsidiary Body for

[232] Čampara Leo et. al (2018), '*Overview of MARPOL ANNEX VI regulations for prevention of air pollution from marine diesel engines'*, SHS Web of Conferences 58, 01004. P, 2, footnote 6, avilable pdf at: https://www.shs-conferences.org/articles/shsconf/pdf/2018/19/shsconf_globmar2018_01004.pdf (last visit 11/11/2020)

[233] Djadjev Ilin (2015), n 87, P 2.

[234] Ibid.

[235] UNFCCC (2003), Climate Change Secretariat ,*Caring for climate A guide to the Climate Change Convention and the Kyoto Protocol* ,UNFCCC Bonn, Germany, P 6.

[236] Heidi R. Lamirande (2011), 'From Sea to Carbon Cesspool: Preventing the World's Marine Ecosystems from Falling Victim to Ocean Acidification', *Journal of Environmental Law Review*, P 204.

Scientific and Technical Advice and by associated research dialogue as an 'emerging issue'[237] and not within the convention. Thirdly, it seems that the view on the issue of ocean acidification in UNFCCC was minor and marginal as it was raised by side-events at the UNFCCC Conference of Parties since 2010.[238] Although the UNFCCC clarifies a 1990 model for GHG reduction with the best available scientific knowledge for their parties according to Annex I, it 'does not set a specific numeric goal for the reduction of GHG'.[239] If ocean acidification increases, UNFCCC's 1990 model is not sufficient to overcome the negative effects of ocean acidification.[240]

Kyoto Protocol has a strength and a weakness. It is effective because it is applicable through IMO tasks or in other words, the reduction of GHG emissions that is the specific target of the Kyoto Protocol is measured by the MEPC group in IMO.[241] It has been reported by Chircop Aldo and his colleague (2018) that in 1997, 'An IMO air pollution conference invited the MEPC to consider what CO2 strategies might be feasible in light of the relationship of that gas with other atmospheric pollutants, citing the IMO's task under the Kyoto Protocol'.[242] 'IMO Assembly resolution A.963(23) acknowledged the relevant provisions of the Kyoto Protocol'.[243] So that there is a strong link between the Kyoto Protocol, resolution 8 of IMO on shipping emission reduction, and MEPC group and they are all enforcing shipping emission regulations. The second achievement of the Kyoto Protocol is having the common ground for the technical measurements on GHG reduction from ships between developing and developed countries[244].

The weakness of the Kyoto Protocol is that some countries like China interpreted the protocol in a way that only obliges developed countries (in Annex I of UNFCC) to pursue the reduction

[237] Expert meeting on 2nd Dec 2010, at Seventh Framework Programme, European Commission conducted by Ms. Elisabeth Lipiatou; Latest results and emerging issues on ocean acidification. Available at : https://unfccc.int/event/climate-change-research-updated-information-emerging-scientific-findings-and-research

[238] Secretariat of the Convention on Biological Diversity (2014). *An Updated Synthesis of the Impacts of Ocean Acidification on Marine Biodiversity* (Eds: S. Hennige, J.M. Roberts & P. Williamson), P 24.

[239] Heidi R. Lamirande (2011), n 235, P 194.

[240] *Ibid*, P 204.

[241] *Ibid*.

[242] Chircop Aldo et al. (2018), n 27, P 36.

[243] *Ibid*.

[244] *Ibid*, P 37.

of greenhouse gas emissions and it has been rejected by the IMO Assembly.[245] The opponent of the idea believes 79% of greenhouse gases emitted by the developed countries and that is why they are responsible more than developing countries. On the other hand, a developing country is not so equipped in terms of technology.[246] As a result, IMO decided to assign different levels of responsibilities for developed and developing countries rather than exempt developing countries from responsibility in total.

Paris agreement caused the discussion of GHG emission reduction has been renewed at IMO once more time and formed the "long-term vision" and "fair contribution" regarding this issue at the IMO.[247] It caused to examine strengths and weaknesses of the IMO performance concerning GHG emission and how they can develop this plan further. One of the positive outcomes of the Paris agreement was causing pressure on the implementation of MEPC 70 of the IMO regarding the climate change concern.[248] The next achievement of the Paris agreement was the "technology mechanism" that was included in the Paris agreement.[249] Later, the technological cooperation and transferring of technology have been presented at the provision of chapter 4 of MARPOL Annex VI. [250]

In contrast, not only Paris agreement does not address the shipping industry's contribution to the global response to climate change, but also there is not any direct reference to the ocean acidification contributes by ships. It mainly discusses the GHG emission in general.

[245] Report of the One-day Technical Workshop on GHG Indexing Scheme held at IMO Headquarters on Friday, 15 July 2005, IMO Doc MEPC 53/ WP.3 (15 July 2005).

[246] Chircop Aldo et al. (2018), n 241.

[247] *Ibid*.

[248] *Ibid*, P 46.

[249] *Ibid*, P 49.

[250] MARPOL, n 96.

5 Conclusion: suggestion and recommendation

As set out in Chapter one, there are two questions that this thesis intends to answer. The first one is "Does the current marine environmental regulatory framework adequate to control or prevent CO2 emissions from ships"? And, the second one is "given the strengths and weaknesses of the marine environmental regulatory framework, how can these challenges be overcome?" This chapter attempts to summarize the answers to these questions. The chapter is divided into two parts: conclusions and recommendations.

5.1 conclusion

As discussed in Chapter two, the shipping industry plays a crucial role in transportation and marine pollution. Shipping emissions are a source of ocean acidification as demonstrated by many studies in previous chapters. There is a statistic that shows that 90% of world transport is carried out by ships.[251] Therefore, marine transportation is one of the biggest sources of Co2 emissions due to the large amount of marine fuel consumed by ships[252]. Pollution imposed by vessels leads to the closing down of some coastal beaches due to the terrible impact of marine pollution.[253]

On the other hand, it can be determined that there are some weaknesses and challenges toward the regulatory framework of marine environmental protection, and to control and prevent shipping emission, supplementary rules and guidelines have been used in most of the studies. This analysis has been confirmed and repeated by many researchers such as James Harrison (2017), Catherine Redgwell (2014), Iliana Christodoulou-Varotsi (2016), Chircop Aldo et al. (2018), David A. Ring (1997), and many other scholars.

James Harrison (2017) concludes, 'The analysis of the environmental provisions of LOSC has made clear, the Convention by itself is not sufficient to offer comprehensive and effective

[251] European Commission, *Reducing emissions from the shipping sector* (2020), n 6.

[252] Yewen et. al. (2016), n 217, P 2.

[253] Poddar Arup, (2014), n 477, P5.

protection to the marine environment'.[254] All of these studies show why now it is time to have an International Treaty on ocean acidification in general. The studies particularly indicate that how to implement the current marine environmental regulations on the shipping industry in particular.

The interplay of LOSC with other sources of rules: LOSC with other regimes is a response to the threats of ocean acidification that contributes by shipping. It provides general environmental obligations to the states and these obligations 'need to be read together with the more specific provisions for individual sources of marine pollution'.[255] Therefore, it does not seem sufficient to rely upon LOSC alone to combat shipping emissions. Incorporating and interpreting LOSC with other international rules and standards such as IMO, Kyoto Protocol, UNFCCC, and other related legal instruments is suggested. In other words, 'harmonise [UNCLOS] with existing instruments and replace the (generally unsatisfactory) *lex generalis* with explicit treaty rules'.[256] James Harrison (2017:15) calls this (LOSC) a 'rule of reference" that can change accordingly and "without having to amend'.[257] This is like the LOSC that is general enough to be used as a constitution[258] for law of the sea and accepts new changes accordingly.

Although LOSC might not be comprehensive enough in a way that clarifies and defines each dimension of the environmental threat with detail, it brings minimum standards[259] for the regulations to be set and develop further in proportion to the environmental threat. By considering ocean acidification contribute by shipping as a target, provisions of vessel-source pollutions of LOSC Articles 194(3) (b) and 211 bring a minimum obligation for state actors to protect and preserve the marine environment. [260]

Setting the minimum standards by LOSC: LOSC as a regulative framework sets the minimum standards. This can be a solution when the flag of convenience applies in the high seas. Some

[254] Harrison James (2017), Chapter 2: The United Nations Convention on the Law of the Sea and the Protection and Preservation of the Marine Environment, Oxford publication, P 17.

[255] Tore Henriksen & Henrik Ringbom (2017), n 166.

[256] Redgwell, Catherine (2014) 'Mind the Gap in the GAIRS: The Role of Other Instruments in LOSC Regime Implementation in the Offshore Energy Sector', *The International Journal of Marine and Coastal Law*, P 610.

[257] Harrison, James (2017), n 112, ch 2, P 15.

[258] Tore Henriksen & Henrik Ringbom (2017), n 254.

[259] *Ibid*.

[260] LOSC, Art. 194 and 211.

states or actors might not be the party of a specific treaty or agreement and they choose open register vessels for their vessels to undertake the minimum or no responsibility concerning the vessel. However, the relative LOSC provisions put different types of duties on these states, for instance: Art. 192 (general obligation), Art. 194 (preventive measure), Art. 195 (duty not to transfer damage), Art. 204 (monitoring), Art. 205 (reporting), Art. 206 (assessing), Art. 217 (enforcement measures specifically for flag states) all for (vessel) pollutions. Moreover, LOSC specific provisions concerning pollutions goes beyond the theory and merely speaking and bring up enforcement and implementation as a minimum obligation for the states.[261] In this case, there are no free-riding states on the high seas, and flag states need to comply with the minimum obligation that UNCLOS defied for them even if they are not a party to a specific treaty or regulations. This is because UNCLOS is a codification or restatement of customary international law[262] and thus it is binding for non-parties as well.

Previous chapters indicate that IMO is the most effective organization in implementing shipping emission reduction programs and that is where most of the responses and solutions can be found. According to the current strategic plan of the IMO (2018 to 2023), sustainable shipping is the target.[263] The development of a suitable alternative to decrease shipping emission and air pollution as well as its impact on climate change were among the goals raised in this strategic plan.[264]It was also pointed to the reduction of greenhouse gas emissions that contributes by ships.[265] In this context, IMO find a response for many of the challenges and play a crucial role as UNCLOS in controlling and preventing Co2 emission of ships and establishing framework guidelines.

According to what stated about jurisdiction and enforcement power in the different maritime zones in chapter 4, it can be concluded that coastal states can have better control over the movement of vessels and set stricter rules for shipping emission in their maritime zones. Coastal state measurements have an effective impact on shipping emission reduction and reduce marine

[261] Poddar Arup, (2014), n 47, P 29.

[262] Sohn Louis B. & Gustafson Kristen (1984) *The Law of the Sea in a Nutshell*, 1st edition, West Academic, P 238.

[263] IMO (2017), Strategic Plan for the Organization (2018 to 2023), *IMO Assembly Resolution A.1110 (30),* 6 December 2017, IMO Doc A 30/Res.1110.

[264] *Ibid*.

[265] *Ibid*.

pollution.[266] Although setting regulations and rules for shipping emission should be following the provisions of international rules and standards, it can be more 'stringent within the territorial sea limit than of exclusive economic zone'.[267]

5.2 Recommendations:

LOSC, IMO, UNFCCC, Kyoto Protocol, and Paris Agreement were among the most relevant and important legal instruments in the field of ocean acidification by ships. Each of these faces its challenges and shortcoming when implemented that has pointed out in chapter 4. The following part tries to make recommendations to address some of these problems, shortcomings, and even obstacles based on the studies conducted. It is worth noting that the implementation of these suggestions also requires a proper platform for legislation and investment and the support of actors and governments.

MARPOL 'is an all-embracing legislation aimed against environmental pollution from ships'.[268] What lacks in its implementation and impose challenges for enforcing shipping emission regulations is the non-binding nature of Annex VI of MARPOL. Annex VI contains Regulations for the Prevention of Air Pollution from Ships and needs a strong enforcement mechanism to control and stop shipping emissions. The suggestion is to consider the same amount of enforceability for this Annex such as Annex I and II that is mandatory. As explained in Chapter 3, states want to be a part of MARPOL must ratify Annex I and II.[269]

Concerning Energy efficiency and EEDI, one of the factors influencing IMO shipping emission regulation, a recent report conducted by Aishwarya Lakshmi (Nov 2017), found that although the liquefied natural gas (LNG) bunkering market-facing infrastructure challenges, it seems like a low-cost alternative to reducing shipping's emissions.[270] Compliance with emission regulations is necessary for the utilisation of LNG as a ship fuel source. Thus, it seems that considering all of the difficulties and deficits mentioned previously, LNG advantages and positive impacts as an environmentally friendly fuel overweigh its problems. Aymelek and his

[266] Poddar Arup, (2014), n 47, P 31.

[267] *Ibid*.

[268] Djadjev Ilin (2015), n 87, P 17.

[269] Čampara Leo et. al (2018), n 231.

[270] Lakshmi Aiswarya (2017), n 130.

colleagues (2015) that 'LNG is expected to be one of the main bunker sources for deep-sea container liner shipping by 2030' have predicted it.[271]

The diversity of actors and the challenges of legal responsibility has raised as one of the problems that face the implementation of IMO shipping emission regulation with difficulties. On the other hand, if Article 197 of UNCLOS enforces completely it may pave the way to cooperation. "Duty to cooperate" is mandatory under Article 197 and not only has its obliged state but also institutions and actors to enforce their duty.[272] Cooperation according to this article is not an activity to suggest or recommend, it is an obligation and a duty that must be fulfilled to protect the marine environment. Besides, Article 197 can be as a pollution prevention strategy of the LOSC.[273] It can be concluded that if each actor fulfills its commitment to the cooperation of another actor, there seems that this problem can be solved to some extent.

The International Tribunal for the law of the sea (ITLOS) in the *MOX Plant Case (2001)* point to Article 197 and force UK and Iceland to cooperate to prevent pollution.[274] This can be assumed in the intention of the UNCLOS drafters and lawmakers why they did not define a single responsible actor for all of the marine protection and ocean management. This is owing to their intention to identify different institutes for developing a legal framework[275] for pollution prevention and environmental marine protection and this can direct only with cooperation.

As has been mentioned in Chapter four relating to the IMO GHG reduction programs, these programs are costly and this can be seen as an obstacle for reduction efforts. This problem could be solved by the application of the Marine Emission Trading Scheme (METS) that's is designed for emission permits. [276]It diminishes not only the general shipping emissions but also the costs of emissions reduction plans.[277] Referring to Ben-Hakoun et al. (2016:4), The METS have

[271] Aymelek M. et al. (2015), n 201, P 770.

[272] LOSC, n 7, Art. 197.

[273] Harrison James (2017), n 27, P 14.

[274] *MOX Plant Case* (2001) UK vs. Iceland; Request for provisional measures, para. 82.

[275] Harrison James (2017), n 272.

[276] For more info please see Zehui Huang et. al. (2013)'How Will the Marine Emissions Trading Scheme Influence the Profit and CO2 Emissions of a Containership, *Springer*.

[277] Ben-Hakoun et al. (2016), n 85, P 2.

been presented and discussed in the following IMO conventions: 'GHG-WG 1/5/3; GHG-WG 1/5/5; GHGWG 1/5/6; GHG-WG 1/5/7; MEPC 58/4/19 & MEPC 58/4/25; MPEC 60/4/8; MPEC 60/4/37; MPEC 60/4/40; MPEC 60/4/12; MPEC 60/4/39; MPEC 60/4/22; MPEC 60/4/26; MPEC 60/4/41; MPEC 60/4/10 and MPEC 60/4/55'.[278]

Increasing the endorsing regional agreement: one recommendation that has been emphasized in many studies to control marine pollution was regional agreement. This will minimize the number of states who are non-party and lead to an adequate measure to control pollution. There is an argument mentioned by Arup Poddar (2014) presenting 'pollution to the high seas by any other nation, would lead either pollution to none or pollution to everyone'.[279] In other words, when the number of regional agreements increases, if pollution occurs on the high seas, it will encompass all states and the other nations can initiate legal action against the polluter nation under the regional agreement.[280] However, when there is not a regional agreement, it is unlikely to be possible to start a legal against the polluter nation on the high seas. The enforceability of LOSC provisions regarding the general obligations to protect and preserve the marine environment in the high seas is facing many difficulties due to the reasons mentioned in Chapter four. As a result, the pollutant state cannot be blamed in most of the cases. This shortcoming can be partially remedied by developing regional agreements.

Considering all mentioned above and the important role of shipping in creating emission and pollution, there seems a need for establishing specific regulations under a new treaty regarding ocean acidification that contributes to shipping emissions. An integrated response seems suitable to the global problem of shipping emissions cause ocean acidification threatening the ocean and marine biodiversity as well as the marine ecosystem.[281] This can be seen in an integrated approach imposed by a new legal regulation for ocean acidification caused by shipping.

[278] *Ibid* , P 4.

[279] Poddar Arup, (2014), n 47, P 30.

[280] *Ibid*, P 31.

[281] Baird Rachel et. al (2010), n 4 , P 22.

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