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**Adapting ocean governance to the impacts of climate change :
The challenges of sustainable management of Arctic shipping**

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Foreword

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Abstract

Climate change is severely affecting the Arctic and accelerating the melting of the ice. Among other things, it is leading to the emergence of new polar routes. This will shorten the distances between Europe and Asia. These new Arctic lanes have led to an increase in maritime traffic in the High North. This new shipping traffic represents economic opportunities for the region, but can cause irreversible environmental damage locally and globally. This thesis analyses whether international law ensures the sustainable management of polar shipping and whether the current framework is fit to do so under the changing conditions of climate change. Thus, this research examines the impacts of climate change on Arctic shipping. It then looks at how Arctic shipping is regulated and what the limitations and gaps of this framework are. Finally, it analyses how a coordination of instruments could be a solution to the polar challenges and enable a more sustainable and effective management of Arctic shipping.

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Abbreviations

AMAP : Arctic Monitoring and Assessment Programme

BRS : Basel Rotterdam Stockholm

CAFF : Conservation of Arctic Flora and Fauna

CO₂ : carbon dioxide

EEZ : Exclusive Economic Zone

HFO : Heavy Fuel Oil

IMO : International Maritime Organization

IPCC : International Panel for Climate Change

LOSC : Law of the Sea Convention

MARPOL : Acronym of Marine Pollution for the International Convention for the prevention of pollution from ships

NO_x : nitrogen oxide

NSR : Northern Sea Route

N₂O : nitrous oxide

PAME : Protection of the Arctic Marine Environment

SOLAS : International Convention for the Safety Of Life At Sea

UNFCCC : United Nations Framework Convention on Climate Change

US : United States

1. Introduction

1.1 Background

The Arctic is an area located in the northern polar region, surrounded by the Arctic Ocean. It is formed by eight states : Norway, Sweden, Finland, Denmark (Greenland), Russia, the United States (Alaska), Canada and Iceland. The Arctic has extreme climatic conditions similar to those of the Antarctic, the southern polar region. It is also home to a rich biodiversity. Climate change is having several effects on the Arctic.¹ It is happening at least twice as fast in the Arctic as in the rest of the world.² Climate change is causing sea ice and glaciers to melt faster, so the Arctic may be ice-free in summer by 2050.³ Rising temperatures are leading to a change in the salinity of the Arctic Ocean and also a rise in sea level.⁴ These changes in ocean structure have repercussions in the Arctic with an impact on species.⁵ There is a change in the distribution of species, e.g. species adapted to cold waters move away or disappear, species adapted to warmer waters arrive in the Arctic.⁶ Moreover, this phenomenon is not restricted to the Arctic, ecosystem changes in the far north have repercussions on other marine ecosystems.⁷ The Arctic Ocean is connected to other marine areas by ocean currents and there are also meteorological interactions.⁸

The Arctic Ocean is extremely rich in fish and nutrients.⁹ Arctic fish resources are valuable because they are large and sustainable.¹⁰ Warming raises concerns that these resources will decline, which could impact not only Arctic communities but also more remote

¹ IPCC (2021)

² IPCC (2021) p2

³ IPCC (2021) p2

⁴ IPCC (2021)

⁵ IPCC (2021)

⁶ IPCC (2021)

⁷ IPCC (2021)

⁸ IPCC (2021)

⁹ IPCC (2019)

¹⁰ IPCC (2019)

communities that depend directly and indirectly on these livelihoods.¹¹ It is therefore important to be aware of the services provided by this polar region locally and globally.¹²

The Arctic Ocean and the oceans as a whole have a role in climate regulation.¹³ They absorb carbon and produce oxygen.¹⁴ Ensuring the health of the oceans so that they can continue this role is important in the fight against climate change.¹⁵ On the other hand, there is also a melting of the permafrost which has serious and direct consequences.¹⁶ As it melts, the permafrost releases substances such as anthrax, methane and other greenhouse gases which caused the death of reindeer and a herder in Russia in 2016 and make the climate change worse.¹⁷ The climate crisis is also having an impact on Arctic species.¹⁸ Indeed, warming and melting ice have consequences on animals. For example, polar bears an endemic species of the Arctic and symbol of the region are threatened with extinction.¹⁹ Fish populations may also decline and pose global livelihood problems.²⁰ Rising temperatures are disrupting ecosystems, with tundra greening and boreal forests browning.²¹ In addition, there are changes in the food chain and interactions between species.²² These changes may be irreversible.²³ Moreover, there is an increase in extreme events, with greater intensity and frequency.²⁴ Climate change has consequences for the Arctic populations and in particular for the indigenous populations, threatening not only the way of life but also health, security and

¹¹ IPCC (2019)

¹² IPCC (2019)

¹³ IPCC (2019)

¹⁴ IPCC (2019)

¹⁵ IPCC (2019)

¹⁶ IPCC (2019)

¹⁷ Ezhova (2021)

¹⁸ IPCC (2021) p2

¹⁹ IPCC (2021) p2

²⁰ IPCC (2021) p2

²¹ IPCC (2021) p2

²² IPCC (2021) p2

²³ IPCC (2021) p2

²⁴ Arctic Council, AMAP (2021) p2

cities.²⁵ Thus, as climate change is occurring faster and stronger in the Arctic, the region is becoming a kind of laboratory for the impacts of climate change.²⁶ Indeed, the Arctic is of great scientific interest in terms of realising what the climate crisis can do to an area and in terms of anticipating the consequences for other areas that will also be affected by climate change.²⁷ The Arctic could enable the rest of the world to better prepare for the climate crisis.²⁸

While the climate crisis is disrupting ecosystems, it also represents new opportunities for the region.²⁹ The melting of the ice allows easier access to gas and oil resources, as well as to fish stocks.³⁰ In addition, new shipping routes are emerging. These will shorten the distances between Europe and Asia. This new shipping traffic will increase in the polar regions.³¹ This poses problems with the introduction of invasive species, the risk of oil spills, black carbon emissions, and underwater noise that disturbs marine species.³² In addition, polar navigation is complex and requires specific equipment and skills to avoid an increase in accidents.³³ Climate change therefore presents new economic opportunities for the Arctic, but also risks of environmental pollution and threats to biodiversity. In addition, conflicts between Arctic states could intensify over the exploitation of resources and shipping routes.³⁴

There is therefore a need for governance instruments to sustainably manage both the environmental impact and the social conflicts in the region. In this thesis, the focus is on instruments for managing the environmental impacts and economic opportunities of Arctic shipping. In order to do so, an analysis of hard law seems important to understand the legal management of the Arctic, but other norms also have consequences on the governance of the region. This plurality of norms suggests that there may be a fragmentation of norms in the

²⁵Arctic Council, AMAP (2021) p2

²⁶ IPCC (2021)

²⁷ IPCC (2021)

²⁸ IPCC (2021)

²⁹ IPCC (2021) p24

³⁰ IPCC (2021)

³¹ Pirotta et al (2019)

³² IPCC (2021) p17

³³ IPCC (2021) p25

³⁴ Pinsky et al (2018)

Arctic. Indeed, when there are several instruments regulating different sectors in the same region it may be difficult to have cooperation between the different standards. A lack of cooperation can lead to legal gaps or conflicting rules. However fragmentation is not necessarily a negative situation and can also be a way to address many issues with different instruments. We will see whether there is an issue with fragmentation of norms in the Arctic. If characterized, this fragmentation of norms could be overcome by a new governance model. Furthermore, the Arctic Council, an institution with a soft law status, completes the normative framework of the Arctic. Its role will be discussed in this paper. Considering these different ways of law-making, it's necessary to coordinate the framework to achieve a sustainable and coherent management of Arctic shipping. Indeed, Antarctica, the other polar region, is managed by a general treaty to do so. Analysing Antarctic management and seeing how it is transferable or not to the Arctic can help improve Arctic management. The short analysis of the Antarctic treaty and comparison with the Arctic show that the regions have different realities. The possibility of an Arctic treaty to harmonize the law in the region is therefore raised but not strongly considered as it does not seem to be the most obvious and easiest solution to improve Arctic management. The low probability of an international Arctic treaty leads us to consider that a coordinated approach between the existing norms might be an easier way to reach consensus. Indeed, other treaty systems have adopted such a mechanism, such as the Basel³⁵, Rotterdam³⁶ and Stockholm³⁷ conventions.

1.2 Purpose and Research Questions

The aim of this thesis is to analyse how the law frames and ensures sustainable management of polar navigation and whether it is fit to do so under the changing conditions of climate change. This leads to a discussion of whether polar shipping is currently managed in a sustainable manner under international law. Furthermore, whether the current framework is

³⁵ Basel Convention on the control of transboundary movements of hazardous wastes and their disposal, signed on 22 March 1989, entry in force on 5 May 1992.

³⁶ Rotterdam Convention on the Prior Informed Consent Procedure for certain hazardous chemicals and pesticides in international trade, signed on 10 September 1998, entry in force on 24 February 2004.

³⁷ Stockholm Convention on Persistent Organic Pollutants, signed on 22 May 2001, entry in force on 17 May 2004.

relevant and suitable to address climate issues and how the law can overcome these current challenges. The following questions will guide the thesis :

- Why is sustainable polar navigation necessary ? How is arctic shipping affected by climate change ?
- How is Arctic shipping currently regulated ?
- How the framework is limited in addressing environmental issues ? How does climate change exacerbate this limitation ?
- How could a coordination of instruments be a solution to polar challenges ? How could it be an effective way to achieve sustainable management of arctic shipping ?

1.3 Methodology

In order to answer my research questions, I am conducting doctrinal research, i.e. I am trying to draw up a general overview of the norms of international law concerning Arctic maritime transport. Then I analyse the relations between these different norms as well as their effectiveness. Next, I try to go beyond the gaps in the existing international law in order to find solutions towards what the law could or should be. This legal system is analysed in three steps. Firstly, I focus on the description aspect of the doctrinal research, I select instruments of international law that seem relevant to answer my research questions, I describe these instruments to get an idea of the existing law. This allows me to find out which rules are currently in force to manage Arctic shipping. Secondly, I focus on the prescription angle of the doctrinal research. This means that the description is complemented by the search for practical solutions that are better adapted to the existing system.³⁸ I see gaps in the existing law and try to find solutions. I try to see what the law could be, if it could be better armed to face the current and future environmental challenges. The third step in my doctrinal research is justification. I have taken note of the existing state of the law, I have raised gaps and solutions. This system of existing norms and new solutions must be justified in relation to the

³⁸ Smits (2015)

legal system.³⁹ That is to say, to see whether this set is coherent and relates to the legal system.⁴⁰ Thus, the acceptability of these new solutions is tested by doctrinal research.⁴¹

These three aims of my research work are achieved by making methodological choices. Concerning the choice of sources, I have chosen to analyse Arctic shipping through the prism of international law. Since maritime transport goes beyond national borders and frameworks, it seemed appropriate to analyse it from an international perspective. Moreover, the Arctic States are not all part of the European Union, so a purely European analysis was not possible. Additionally, analysing only the national legal frameworks would not have allowed me to understand maritime transport, which in essence transcends national borders and maritime territories. After having taken note of hard law, other forms of regulation such as soft law seemed legitimate to be taken into account in order to transcribe the reality of Arctic management.

Finally, I made these choices because they correspond to my conception of the system. In my opinion, the system should aim for cooperative, coordinated and comprehensive management. I think that coherent management requires that local and national interests be taken into account, but that they can only be coherent and effective if they are part of a global vision in which international interests are involved.

1.4 Limitations

In the Arctic, climate change is enabling the development of maritime transport. However, this is not the only opportunity made possible by the climate crisis. Indeed, other activities are facilitated by climate change and in particular by melting ice. There is easier access to gas, oil and fish stocks. Moreover, there is a scarcity of resources in the world, and there could be tensions between Arctic and non-Arctic states for control of Arctic resources. These activities are linked to maritime transport. Indeed, it provides access to and transport of these resources.

³⁹ Smits (2015)

⁴⁰ Smits (2015)

⁴¹ Smits (2015)

In addition, shipping has consequences for other aspects of the Arctic. When there is an accident on a ship and it causes an oil spill, this will have consequences for marine and terrestrial biodiversity. In addition, ships emit noise that can disturb marine species, particularly cetaceans. This highlights another issue in Arctic management: the protection of biodiversity. Indeed, maritime transport has an impact on the preservation of species. These other challenges related to maritime transport are also important issues in Arctic management. Adaptations are also necessary to guarantee sustainable management by law. However, these issues will not be addressed in this thesis.

1.5 Structure

In order to analyse how sustainable management of polar shipping is possible, it is first necessary to understand the reality of the Arctic and climate change (2). I analyse the environmental risks that the climate crisis brings to the Arctic, but also the economic opportunities that this can represent. I look at the consequences of climate change on Arctic shipping. For this, I rely on the reports of the Intergovernmental Panel on Climate Change and the working groups of the Arctic Council. In addition, in order to clarify my research, this part is also dedicated to defining and delimiting the terms of my thesis such as ocean governance and adaptation. Next, an overview of the legal instruments applicable in the Arctic (3) allows us to understand what type of governance is in force. To this end, the content of the United Nations Law of the Sea Convention (LOSC)⁴² and the International Code for ships operating in polar waters (Polar Code)⁴³, the International Convention for the prevention of pollution from ships (MARPOL)⁴⁴ and the International Convention for the safety of life at sea (SOLAS)⁴⁵ are studied. As well as the literature analysing these instruments and their effectiveness. However, this framework has certain limitations and challenges (4). Indeed, the analysis of the instruments shows that they may not be sufficient to ensure sustainable

⁴² United Nations Convention on the Law of the Sea (LOSC), signed on 10 December 1982, entry in force on 16 November 1994.

⁴³ International Code for ships operating in polar waters (Polar Code) entry in force on 1 January 2017.

⁴⁴ International Convention for the prevention of pollution from ships (MARPOL), signed on 17 February 1973, entry in force on 2 October 1983.

⁴⁵ International Convention for the safety of life at sea (SOLAS) entry in force on 25 May 1989.

management of Arctic sea lanes. They need to be complemented by other instruments. This section points out some of the gaps in the treaties. Indeed, it appears that the scope of application does not cover certain areas or fields of polar shipping. A solution to these shortcomings can be found in a better cooperation between instruments. A coordinated approach could be a solution to polar challenges (5). It could be a way to achieve sustainable management of Arctic shipping. This analysis is followed by concluding remarks (6).

2. The necessity of sustainable Arctic shipping

Climate change is causing global upheaval.⁴⁶ Human activities are accelerating these changes.⁴⁷ Shipping is a human activity that can have negative consequences for the environment.⁴⁸ Arctic Shipping is valuable for the region as it offers economic opportunities. Moreover arctic navigation is facilitated by climate change as new shipping routes are created by melting sea ice and glaciers.⁴⁹ This shipping needs to be managed in a sustainable way so as not to create irreversible damage to the Arctic region and also to avoid cascading impacts on other parts of the world.⁵⁰ It is important to consider the impact of climate change on Arctic shipping. In addition, it is opportune to study the environmental risks of this activity and the exacerbation of these risks by the accelerating climate crisis (2.1). Secondly, in order to address the environmental challenges posed by maritime transport, it is necessary to be aware of the governance of maritime transport. This governance is a component of ocean governance. It is important to see how ocean governance addresses environmental concerns (2.2). Finally, I focus on adaptation, the distinction with mitigation and the importance of avoiding maladaptations in Arctic governance which could make the situation worse (2.3).

2.1 Arctic Shipping and Climate Change

Arctic shipping and climate change are linked.⁵¹ Indeed, climate change has consequences for the Arctic.⁵² Arctic shipping could also have consequences for the polar region.⁵³ Indeed, the new polar routes made possible by melting ice offer economic opportunities for the region.⁵⁴

⁴⁶ IPCC (2021)

⁴⁷ IPCC (2021)

⁴⁸ IPCC (2021)

⁴⁹ Melia et al (2016)

⁵⁰ IPCC (2021)

⁵¹ IPCC (2021)

⁵² IPCC (2021)

⁵³ Melia et al (2016)

⁵⁴ Melia et al (2016)

Firstly, it is a route that could shorten the distances between Europe and Asia, which represents cost savings for maritime trade.⁵⁵ In addition, the Arctic routes provide easier access to fish, gas and oil resources, and more and more ships could travel to the polar region.⁵⁶ With warming, even ships that are not specifically designed for cold waters can access these areas.⁵⁷ These economic opportunities are not without environmental risks. Arctic shipping has environmental impacts.

If an increasing number of ships sail in the Arctic, these risks will be multiplied. One environmental risk from shipping is the emission of greenhouse gases and black carbon.⁵⁸ Indeed, maritime transport is dependent on fossil fuels and in particular on heavy fuel oil (HFO).⁵⁹ HFOs through combustion produce emissions of sulphur oxides, heavy metal, volatile organic compounds and black carbon particles.⁶⁰ Other pollutants are emitted such as carbon dioxide (CO₂), nitrogen oxide (NO_x) and nitrous oxide (N₂O).⁶¹ In addition, HFOs are the most widely used fuel in the Arctic.⁶² These pollutants trap heat in the atmosphere and create greenhouse gases, thereby contributing to climate change.⁶³ A continuous rise in temperature could lead to a chain of disasters.⁶⁴ First of all, extreme weather events such as storms or droughts.⁶⁵ The change in temperature will also have an impact on rising sea levels.⁶⁶ Extinctions of species could also accelerate.⁶⁷ In addition, there are also direct consequences for mankind, as Arctic shipping is responsible for the development of

⁵⁵ Melia et al (2016)

⁵⁶ IPCC (2021)

⁵⁷ IPCC (2021)

⁵⁸ Zhang et al (2019)

⁵⁹ Zhang et al (2019)

⁶⁰ Transport and Environment (2018)

⁶¹ Harrould-Kolieb (2008)

⁶² International council on clean transportation (2017)

⁶³ Harrould-Kolieb (2008)

⁶⁴ Harrould-Kolieb (2008)

⁶⁵ Harrould-Kolieb (2008)

⁶⁶ Harrould-Kolieb (2008)

⁶⁷ Harrould-Kolieb (2008)

cardiopulmonary and lung cancer.⁶⁸ Also, there could be negative consequences for agriculture with the changing climate.⁶⁹ Moreover, black carbon has specificities compared to other pollutants. First of all, it is a solid and not a gas.⁷⁰ Although it is not the main pollutant emitted, it has physical properties with significant environmental consequences.⁷¹ The emission of black carbon reduces the albedo of snow and ice, i.e. their ability to reflect light. By reducing the albedo, it has a warming effect that accelerates the melting of ice.⁷² Some regions are more exposed to black carbon emissions, such as the Arctic. Indeed, the intensity of black carbon emissions varies from one area to another.⁷³ However, the Arctic is particularly vulnerable, due to the impact of black carbon on ice and snow.⁷⁴ Black carbon can also contribute to the melting of permafrost.⁷⁵ Increased Arctic shipping implies increased black carbon emissions.⁷⁶ A continuous increase in black carbon emissions is likely to put continued pressure on the melting ice and the Arctic as a whole.⁷⁷ This is all the more alarming as the polar region is already warming twice as fast as the rest of the world.⁷⁸ A transition from HFOs to distillate fuels is needed to reduce these emissions.⁷⁹

Another impact of maritime transport is the acidification of the oceans. Carbon dioxide (CO₂) emissions from human activities such as shipping contribute to climate change and ocean acidification.⁸⁰ However, climate change is a consequence of greenhouse gas emissions

⁶⁸ Harrould-Kolieb (2008)

⁶⁹ Harrould Kolieb (2008)

⁷⁰ Harrould-Kolieb (2008)

⁷¹ Peters et al (2011)

⁷² Arctic Council (2009)

⁷³ Harrould Kolieb (2008)

⁷⁴ Zhang et al (2019)

⁷⁵ Harrould-Kolieb (2008)

⁷⁶ Zhang et al (2019)

⁷⁷ Zhang et al (2019)

⁷⁸ IPCC (2021)

⁷⁹ Zhang et al (2019)

⁸⁰ Arctic Council, AMAP (2018)

whereas ocean acidification is a result of increased CO₂ in the atmosphere.⁸¹ Indeed, the chemistry of the oceans is modified by a higher concentration of CO₂ in them.⁸² Both phenomena require a drastic reduction of CO₂ emissions.⁸³ The absorption of CO₂ by the oceans changes their chemistry and makes them more acidic.⁸⁴ This acidification threatens marine species and disrupts the food chain. These changes could threaten the marine resources on which some populations depend.⁸⁵ As with black carbon, the Arctic is particularly vulnerable to ocean acidification which is very intense in the Arctic Ocean.⁸⁶ Ocean acidification has local and global consequences, both ecological and socio-economic.⁸⁷ Indeed, Arctic marine ecosystems will be able to adapt more or less to the new conditions, some will adapt, others will be disadvantaged or will become extinct.⁸⁸ In addition to these ecological consequences, there are economic impacts. As with rising temperatures, the subsistence needs of populations may no longer be met by the consequences of ocean acidification.⁸⁹

Maritime transport also presents a potential risk of introduction and spread of invasive species.⁹⁰ This is because ships travel long distances, moving from one area to another. They can transport species from one place to another. Maritime transport is the main means of unintentional species introduction.⁹¹ These species introductions take place via the hull, tank or water of ships.⁹² Species cling to them or are found in them. However, measures exist to limit these invasions, such as replacing ship water. For example, there is an exchange between

⁸¹ Harrould-Kolieb & Herr (2011)

⁸² Arctic Council, AMAP (2018)

⁸³ Harrould-Kolieb & Herr (2011)

⁸⁴ Harrould-Kolieb (2008)

⁸⁵ Harrould-Kolieb (2008)

⁸⁶ Arctic Council, AMAP (2018)

⁸⁷ Arctic Council, AMAP (2018)

⁸⁸ Arctic Council, AMAP (2018)

⁸⁹ Arctic Council, AMAP (2018)

⁹⁰ Chan et al (2019)

⁹¹ Molnar et al (2008)

⁹² Drake & Lodge (2007)

water from the coast and water taken from the sea to eliminate coastal species that could have nested in the ships after passing through a port for example.⁹³ In addition, models try to predict which species are most likely to spread in order to avoid introductions.⁹⁴ The models are able to predict the next invasive marine species.⁹⁵ These predictions are important because introductions and spreads of alien marine species can have negative effects on the new area where they are introduced. Threats to nature, human health and the economy have been identified.⁹⁶ In the Arctic, climate change is increasing the vulnerability of the region to species introductions. As Arctic waters become warmer, species from temperate zones can adapt more easily to polar waters.⁹⁷ Arctic shipping therefore has consequences for species.

The introduction and spread of alien species is not the only consequence of shipping. Shipping also has impacts on wildlife through the underwater noise emitted by its ships. This underwater noise is increasing because the number of ships in circulation is also increasing.⁹⁸ This sound is emitted by all kinds of private and commercial vessels and in all maritime areas: coastal or open sea.⁹⁹ The increase of this underwater noise is not harmless for marine animals because it has consequences on the vital functions of marine fauna.¹⁰⁰ It can be the source of behavioural disturbances, hearing damage and even death in marine species.¹⁰¹ There are probably differences in the consequences of underwater noise for different species but scientific research has not yet determined all the impacts.¹⁰² More studies have been conducted on the impacts for dolphins and whales than for other deep sea mammals for example.¹⁰³ As for the Arctic, the region has been less subject to underwater noise due to the

⁹³ Keller et al (2011)

⁹⁴ Seebens et al (2016)

⁹⁵ Seebens et al (2016)

⁹⁶ Seebens et al (2016)

⁹⁷ Ware et al (2014)

⁹⁸ Erbe et al (2019)

⁹⁹ Erbe et al (2019)

¹⁰⁰ Erbe et al (2019)

¹⁰¹ Halliday (2020)

¹⁰² Erbe et al (2019)

¹⁰³ Erbe et al (2019)

presence of ice limiting shipping.¹⁰⁴ The melting of the ice and the increase in underwater noise may have strong repercussions for marine species. Indeed, mammals are less used to underwater noise and more sensitive to it.¹⁰⁵ We can therefore see that Arctic shipping has many environmental impacts on the Arctic. As the intensity of shipping in the Arctic increases, these risks may become stronger as well. Thus, the Arctic faces great vulnerability due to a double exposure. The region has to deal with the consequences of maritime transport but also with the impacts of climate change. Adaptation strategies can help to limit the risks of Arctic shipping.

Moreover as shipping is increasing, this could lead to a more frequent risk of accidents in case of changes in sailing conditions. Other accidents could result from collisions with icebergs and cause oil spills that heavily pollute the Arctic marine environment and threaten marine and land biodiversity.¹⁰⁶ In addition, there is a risk of pollution from shipping itself but also from the emissions and pollution that will result from the extraction of resources.¹⁰⁷ There is also a lack of information and studies on the most appropriate routes for navigation given the recent emergence of these waterways.¹⁰⁸ The covid-19 pandemic has also slowed down the information gathering and research process. Indeed, expeditions and discussions forums have been cancelled.¹⁰⁹ Furthermore, Sea tourism is also an issue for Arctic shipping.¹¹⁰ With the accelerating climate crisis and the risk of losing the Arctic's extreme features, last chance tourism could increase.¹¹¹ That is, cruises to see the glaciers and the Arctic ice pack before they disappear.¹¹² We must therefore ensure that there is no uncontrolled development of these maritime activities that could cause environmental damage.

¹⁰⁴ Halliday (2020)

¹⁰⁵ Halliday (2020)

¹⁰⁶ Stephenson et al (2018)

¹⁰⁷ Stephenson et al (2018)

¹⁰⁸ IPCC (2021)

¹⁰⁹ Arctic Council, AMAP (2021) p2

¹¹⁰ IPCC (2021)

¹¹¹ IPCC (2021)

¹¹² IPCC (2021)

However, the idea of a massive development of Arctic shipping must be qualified.¹¹³ There will not necessarily be a race to the Arctic as the climate crisis accelerates.¹¹⁴ This projection is also based on the fantasy of polar expeditions.¹¹⁵ These myths of Arctic passages, the exploration of which has generated great interest.¹¹⁶ This interest in Arctic shipping can be seen as an extension of the interest in polar expeditions. Indeed, for centuries the collective imagination has been entertained by the search for a passage linking the Atlantic and the Pacific through the Arctic.¹¹⁷ There was a romantic vision of the northern regions as a paradise on earth.¹¹⁸ This fantasy of the Arctic was reinforced by the myth of the explorer.¹¹⁹ The press through its portrayal of explorers contributed to this myth.¹²⁰ They were pictured as heroes.¹²¹ There was a complex cultural construction of the expeditions and they were the subject of multiple representations.¹²² The construction of a myth or even a cult around polar expeditions can also be explained by the need of explorers for funding and support from governments.¹²³ Having a good collective image made it easier to obtain economic support.¹²⁴ Furthermore, the development of the myth was also facilitated by the nature of the polar expeditions.¹²⁵ They were remote and therefore not attended by the public.¹²⁶ Whether the expedition was a success, an exploit, depended on the publicity the explorers made of it.¹²⁷ The romantic imagination of the public was therefore more a perception than a reality. This

¹¹³ Lasserre (2019)

¹¹⁴ Lasserre (2019)

¹¹⁵ Lasserre (2019)

¹¹⁶ Lasserre (2019)

¹¹⁷ Bockstoce (2018)

¹¹⁸ Martin (1988)

¹¹⁹ Riffenburgh (1994)

¹²⁰ Riffenburgh (1994)

¹²¹ Riffenburgh (1994)

¹²² Lewis-Jones (2017)

¹²³ Lewis-Jones (2017)

¹²⁴ Lewis-Jones (2017)

¹²⁵ Lewis-Jones (2017)

¹²⁶ Lewis-Jones (2017)

¹²⁷ Lewis-Jones (2017)

may be one explanation for why, while there are other viable passages for shipping, the North Passage is still being explored despite the fact that it presents many practical difficulties.¹²⁸ However, just because access to the Arctic passages is now easier, it does not necessarily mean that states will rush to compete to use them.¹²⁹ In fact, this idea might not be accurate.¹³⁰ If the routes are shortened by the northern passages compared to the passages through the Suez and Panama Canals and the Straits of Malacca.¹³¹ The economic factor is not necessarily more advantageous for the transport companies, as they have to invest in ships adapted to polar conditions.¹³² Pilots also have to be trained for polar navigation.¹³³ This involves permanent darkness and ice in winter.¹³⁴ Moreover, preparing for this type of navigation is complicated by the lack of charts and navigation data.¹³⁵ Indeed, even when there are maps, they are not always of sufficient quality.¹³⁶ Furthermore, the Arctic is an isolated region with a lack of infrastructure, and in the event of accidents, cargo ships may find themselves unarmed.¹³⁷ A distinction must also be made between transit traffic and destination traffic.¹³⁸ Transit traffic is not so attractive for the reasons mentioned above.¹³⁹ Destination traffic, on the other hand, could develop significantly.¹⁴⁰ Indeed, Arctic resources are attractive and there may also be an interest in better serving local communities.¹⁴¹

¹²⁸ Riffenburgh (1994)

¹²⁹ Lasserre (2019)

¹³⁰ Lasserre (2019)

¹³¹ Lasserre (2019)

¹³² Lasserre (2019)

¹³³ Lasserre (2019)

¹³⁴ IPCC (2021)

¹³⁵ IPCC (2021)

¹³⁶ IPCC (2021)

¹³⁷ Lasserre (2019)

¹³⁸ Lasserre (2019)

¹³⁹ Lasserre (2019)

¹⁴⁰ Lasserre (2019)

¹⁴¹ Lasserre (2019)

Despite these nuances, it is essential to have a sustainable management of Arctic shipping, whether it develops massively or not, it could create negative consequences for the environment.

2.2 Addressing environmental concerns in shipping governance

There is a need to address environmental concerns in shipping governance. Shipping governance is a part of ocean governance. Making the link between Arctic shipping and climate change is key to establishing appropriate ocean governance. It is opportune to look at what these terms ‘‘ocean governance’’ cover in order to better understand how environmental issues are included. Governance is defined as :

a comprehensive and inclusive concept of the full range of means for deciding, managing, implementing and monitoring policies and measures.¹⁴² Whereas government is defined strictly in terms of the nation-state, the more inclusive concept of governance recognises the contributions of various levels of government (global, international, regional, sub-national and local) and the contributing roles of the private sector, of nongovernmental actors, and of civil society to addressing the many types of issues facing the global community, and the local context where the effectiveness of policies and measures are determined.¹⁴³

The definition of governance is broad. It includes various means of regulation and various scales of decision-making. Here in this analysis we focus on international governance, i.e. regulations that have an international scope. The multiplicity of means that constitute governance and the diversity of the actors who are at the origin of it is an opportunity to have several solutions to take into account the protection of the environment, but it can also lead to fragmentation. This fragmentation can allow different issues to be addressed by different instruments and be effective. Fragmentation of standards can also lead to other problems preventing governance from being coherent and effective. Problems such as a lack of cooperation between different actors or norms, a lack of representation of the different populations governed or a lack of cohesion leading to contradictory rules or legal gaps. Here these governance issues apply to the Arctic region and in particular to the Arctic Ocean, as the issue is the management of Arctic shipping. The Ocean is defined as :

¹⁴² IPCC (2019)

¹⁴³ IPCC (2019)

the interconnected body of saline water that covers 71% of the Earth's surface, contains 97% of the Earth's water and provides 99% of the Earth's biologically-habitable space.¹⁴⁴ It includes the Arctic, Atlantic, Indian, Pacific and Southern Oceans, as well as their marginal seas and coastal waters.¹⁴⁵

We can see that the oceans represent a considerable part of the earth's surface. Their management is therefore of particular importance. Widespread pollution of these marine areas would have serious consequences for the humankind. The shipping activity that takes place in these areas must therefore be managed in such a way as not to damage the oceans. The focus here is therefore on how a range of decisions taken in relation to marine spaces should be sustainable. However, even if there is a requirement for sustainability in the decisions that are taken, the importance of ocean governance also lies in the need to maintain peace. Indeed, the Arctic is a valuable region. The Arctic states must have fair access to resources, but control of the routes is also an issue. These power issues must be discussed to avoid conflicts.

The Russian-Ukrainian conflict also has consequences in the Arctic.¹⁴⁶ Indeed, Russia, as an Arctic state having used force, violating a principle of international law, makes the international community concerned about other violations.¹⁴⁷ Furthermore, the condemnation of Russia by a large part of the international community implies a diminished cooperation with Russia.¹⁴⁸ A large part of the Arctic is Russian territory. This partial or total break with Russia will have consequences for the management of Arctic shipping and the Arctic more globally.¹⁴⁹ Even if the Arctic is not affected by armed conflicts, a lack of cooperation with the Russian state may slow down measures to combat climate change in the polar region.¹⁵⁰ Indeed, there will be less exchange between the Arctic states on climate change mitigation and

¹⁴⁴ IPCC (2019)

¹⁴⁵ IPCC (2019)

¹⁴⁶ Koivurova (2022)

¹⁴⁷ Canavera (2022)

¹⁴⁸ Koivurova (2022)

¹⁴⁹ Koivurova (2022)

¹⁵⁰ Koivurova (2022)

adaptation.¹⁵¹ Other issues may also see their development slowed down, such as improving maritime rescue capacity or promoting sustainable development.¹⁵² In addition, some adaptations are initiated by civil society, but conflict is becoming central to people's concerns and overshadowing the fight for environmental issues.¹⁵³ Very concretely, this could lead to a growing lack of coordination in rules or opacity in practices.¹⁵⁴ Also there could be no more control in the Russian Arctic regions on the respect of the LOSC requirements for example. In addition, fewer discussions would be possible with the Russian representatives in the Arctic Council.¹⁵⁵ Or it is precisely through cooperation that standards and their requirements for adaptation to climate change can be advanced.¹⁵⁶ These fears of a Russian withdrawal from international forums remind the US retreat on environmental issues during the Trump administration.¹⁵⁷ Thus, effective international collaboration to achieve sustainable management requires a climate of peace.¹⁵⁸ In order to build a solid environmental foundation in collaboration with all Arctic states.¹⁵⁹ However, the analysis here does not focus on conflicts over shipping. It is still important to mention that the context may have consequences for the governance of Arctic shipping.

Thus, in order to control the development of activities enabled by climate change and maintain peace, governance must ensure that activities are sustainable to not cause damage to the environment.¹⁶⁰ Indeed, the current framework must be adapted to better address environmental challenges.¹⁶¹ This framework is currently fragmented.¹⁶² Indeed, several

¹⁵¹ Koivurova (2022)

¹⁵² Koivurova (2022)

¹⁵³ Koivurova (2022)

¹⁵⁴ Koivurova (2022)

¹⁵⁵ Koivurova (2022)

¹⁵⁶ Koivurova (2022)

¹⁵⁷ Koivurova (2022)

¹⁵⁸ Canavera (2022)

¹⁵⁹ Canavera (2022)

¹⁶⁰ Haas et al (2020)

¹⁶¹ Haas et al (2020)

¹⁶² Haas et al (2020)

actors are at the origin of ocean governance such as States but also other organisations such as the International Maritime Organisation, International Seabed Authority, Regional Fisheries Organisations.¹⁶³ These organisations mostly regulate sectors or regions, which contributes to the fragmentation of governance.¹⁶⁴ There are therefore several ocean governance bodies, which complicates coherent and harmonised decision making.¹⁶⁵ Moreover, there are difficulties in implementing and enforcing the rules developed by these institutions.¹⁶⁶ Some maritime areas are remote, and it is not easy to control that the activities carried out there are sustainable.¹⁶⁷ There are problems of marine pollution and overfishing.¹⁶⁸ However, improving the state of governance is hampered by a lack of political will.¹⁶⁹ Furthermore, there is a lack of communication between the governance actors and the legal instruments concluded to organise the management of the oceans.¹⁷⁰ To improve sustainability in governance, cooperation between different agreements is needed.¹⁷¹ In particular between the Convention for the Law of the Sea, an international convention, and the different regional agreements.¹⁷²

Furthermore, ocean governance presents challenges of representation, as some communities are not or not sufficiently represented in the decision-making processes, such as indigenous peoples.¹⁷³ However, in order to have sustainable governance, it is also necessary to address

¹⁶³ Haas et al (2020)

¹⁶⁴ Haas et al (2020)

¹⁶⁵ Haas et al (2020)

¹⁶⁶ Haas et al (2020)

¹⁶⁷ Haas et al (2020)

¹⁶⁸ Haas et al (2020)

¹⁶⁹ Haas et al (2020)

¹⁷⁰ Haas et al (2020)

¹⁷¹ Haas et al (2020)

¹⁷² Haas et al (2020)

¹⁷³ Haas et al (2020)

issues of equality and poverty.¹⁷⁴ Governance must be inclusive and take into account the interests of isolated or marginalised populations.¹⁷⁵

2.3 Adaptation, Mitigation and Maladaptation

2.3.1 Adaptation and Mitigation

Measures taken to combat climate change include adaptation and mitigation measures.¹⁷⁶ Adaptation is defined as "in human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects"¹⁷⁷. It should be distinguished from a related term mitigation defined as "a human intervention to reduce emissions or enhance the sinks of greenhouse gases"¹⁷⁸. Both adaptation and mitigation are ways of managing climate change. Adaptation acts on the impacts of climate change. Mitigation addresses the causes of climate change. Here, the research focuses on the adaptation of ocean governance to the impacts of climate change. The focus here is therefore on adaptation. But in order to respond effectively to the climate crisis and to manage sustainably arctic shipping, adaptive and mitigating measures are needed.

Adaptation can be sustainable as well as unsustainable and have damaging consequences for the environment. This unsustainable adaptation is called maladaptation. This idea will be developed below. Sustainable adaptation is a developing concept.¹⁷⁹ Four main principles define it, adaptation must take into account the context of vulnerability and stressors, different interests, integration of local knowledge and cooperation between global and local

¹⁷⁴ Haas et al (2020)

¹⁷⁵ Haas et al (2020)

¹⁷⁶ IPCC (2021)

¹⁷⁷ IPCC (2019)

¹⁷⁸ IPCC (2013)

¹⁷⁹ Eriksen et al (2011)

processes.¹⁸⁰ Sustainable adaptation is complex to achieve in that it must ensure that it does not privilege one group over another.¹⁸¹ Indeed, adaptive measures could exacerbate vulnerability and have negative consequences for one group.¹⁸² Also, the importance of taking into account the global context implies taking into account all the concerns of an area.¹⁸³ Furthermore, sustainable adaptation is linked to sustainable development.¹⁸⁴ The objectives are social justice and environmental integrity.¹⁸⁵ Depending on the region and the sector, the adaptation to be implemented can strongly differ.¹⁸⁶ The Arctic is a region with unique characteristics. Adaptation in the Arctic faces particular challenges and it is noted that several adaptations have been initiated.

2.3.2 Arctic and shipping Adaptations

In order to address the climate challenge, implementing adaptation is urgent. Adaptation in the Arctic must allow economic opportunities to be taken advantage of while minimising risks.¹⁸⁷ However, adaptation is plural, there are many possible ways to adapt.¹⁸⁸ Adaptation can come from different scales of governance.¹⁸⁹ At the family or local level in the Arctic, particularly for indigenous populations, adaptation consists of actions, changes in equipment or behaviour.¹⁹⁰ For example, fishing or harvesting activities are less frequent and places are varied.¹⁹¹ At the institutional or governmental level, adaptation is more about the economy or

¹⁸⁰ Eriksen et al (2011)

¹⁸¹ Eriksen et al (2011)

¹⁸² Eriksen et al (2011)

¹⁸³ Eriksen et al (2011)

¹⁸⁴ Eriksen et al (2011)

¹⁸⁵ Eriksen et al (2011)

¹⁸⁶ Eriksen et al (2011)

¹⁸⁷ Ford et al (2014)

¹⁸⁸ Ford et al (2014)

¹⁸⁹ Ford et al (2014)

¹⁹⁰ Ford et al (2014)

¹⁹¹ Ford et al (2014)

trade.¹⁹² Adaptation will differ from region to region and sector to sector.¹⁹³ In concrete terms, adaptation can address vulnerability issues such as investing in better mental health care.¹⁹⁴ It can also be about improving roads as the weather becomes more changeable and roads are more damaged.¹⁹⁵ The melting of permafrost causes damage to roads, for example.¹⁹⁶

Furthermore, not all adaptation measures implemented are necessarily documented.¹⁹⁷ Having a complete picture of what forms adaptation takes is complicated.¹⁹⁸ In the Arctic, it is even more complicated because there is no one Arctic language, so some documentation is less accessible.¹⁹⁹ Adaptation also requires research and monitoring to ensure that it is sustainable and effective over the long term.²⁰⁰ At the moment, adaptation in the Arctic is in its infancy, there are many gaps, differences between regions in the risks to be addressed and the nature of the adaptation being implemented.²⁰¹ Some adaptations are existing actions that are being extended.²⁰² These actions are effective in the short term but can increase vulnerability in the long term.²⁰³ There is a need to collect information and data to implement the most sustainable adaptation.²⁰⁴ We need to have as accurate and complete a profile of the Arctic as possible.²⁰⁵ But this has been slowed down by the pandemic and there is also a lack of political will to develop adaptation measures.²⁰⁶ In fact, development is more marked at local

¹⁹² Ford et al (2014)

¹⁹³ Ford et al (2014)

¹⁹⁴ Ford et al (2014)

¹⁹⁵ Ford et al (2014)

¹⁹⁶ Ford et al (2014)

¹⁹⁷ Ford et al (2014)

¹⁹⁸ Ford et al (2014)

¹⁹⁹ Ford et al (2014)

²⁰⁰ Ford et al (2014)

²⁰¹ Ford et al (2014)

²⁰² Ford et al (2014)

²⁰³ Ford et al (2014)

²⁰⁴ Ford et al (2014)

²⁰⁵ Ford et al (2014)

²⁰⁶ IPCC (2021)

levels, individual initiatives than national or international.²⁰⁷ Furthermore, some adaptations are not about climate change, there are other factors that push societies to adapt.²⁰⁸ The Arctic must adopt a new governance model to address climate change.²⁰⁹ This model must be flexible, equitable, inclusive and follow an integrated approach across sectors and governance actors.²¹⁰ With regard to climate change adaptation measures for maritime transport. There are a variety of possible adaptations. Firstly, general adaptations such as better cooperation between the instruments regulating maritime transport.²¹¹ Cohesion between different actors such as the IMO, regional fisheries organisations and states.²¹² Better representation of the populations affected by maritime transport.²¹³ More specific adaptations can be mentioned: there is a transition to be made from HFOs to distillate fuels.²¹⁴ In addition, there is a need to reduce carbon dioxide emissions, and more broadly greenhouse gases and black carbon.²¹⁵ The adaptation of maritime transport to climate change will be further developed below.

2.3.3 Avoiding the maladaptation

Some adaptations may not be sustainable or may even have negative impacts on communities or the environment and worsen the climate crisis, known as maladaptation.²¹⁶ Indeed, implementing an adaptation does not necessarily mean that it will be a good adaptation.²¹⁷ Some measures may increase vulnerability, have negative long-term impacts or disadvantage groups.²¹⁸ Care must therefore be taken to avoid such measures. To this end, the overall

²⁰⁷ Ford et al (2014)

²⁰⁸ Ford et al (2014)

²⁰⁹ Ford et al (2014)

²¹⁰ IPCC (2021)

²¹¹ IPCC (2021)

²¹² IPCC (2021)

²¹³ IPCC (2021)

²¹⁴ Zhang et al (2019)

²¹⁵ Zhang et al (2019)

²¹⁶ IPCC (2021)

²¹⁷ Eriksen et al (2011)

²¹⁸ Eriksen et al (2011)

context must be taken into account.²¹⁹ One example is the Norwegian case.²²⁰ In Oslo, with global warming, the days when there is enough snow and ice for skiing and ice skating are getting rarer.²²¹ Winter sports are an integral part of the Norwegian identity.²²² The fact that they are no longer possible is a concern for the state.²²³ A project for a giant ice rink near Oslo and the massive dumping of artificial snow on the ski slopes to adapt to the new climate conditions have been imagined.²²⁴ While these are adaptations to cope with the climate crisis, they could have negative consequences for the environment. Indeed, carbon emissions will be emitted to run the rink and large quantities of water are needed for the artificial snow.²²⁵

Another example is the Winter Olympics in Beijing in February 2022. They were organised in China but there was not enough snow to hold the events, and a controversy arose over the use of artificial snow to compensate for the lack of snow. Indeed, the use of artificial snow requires large quantities of water. The region of the games is arid, and water was transported over long distances. This adaptation also raises questions of sustainability and environmental impact.

We have seen how it is necessary to have sustainable polar navigation and how Arctic shipping is affected by climate change. Now we need to see what legal framework is in place in the Arctic and for maritime transport.

²¹⁹ Eriksen et al (2011)

²²⁰ Eriksen et al (2011)

²²¹ Eriksen et al (2011)

²²² Eriksen et al (2011)

²²³ Eriksen et al (2011)

²²⁴ Eriksen et al (2011)

²²⁵ Eriksen et al (2011)

3. Overview of legal instruments applicable in the Arctic

This chapter is dedicated to the state of play of the Arctic legal framework. The Arctic is not regulated by a single instrument like the Antarctic. Some instruments regulate sectors or regions, others are more general. This section aims to see what measures are put in place by legal instruments to regulate maritime transport in the Arctic and how the oceans are governed. Here, a synthetic description is made to have an overall idea of the content of the norms. The next chapter will be dedicated to their analysis in order to see if they are part of a process of adaptation to climate change. Here we will focus on the description of four of these instruments: the LOSC, the Polar Code, the International Convention for the Prevention of Marine Pollution from Ships²²⁶ and the Safety of Life at Sea Convention²²⁷. The Law of the Sea Convention because it is a framework convention for ocean management (3.1). Its study is necessary to understand the rules that are applicable to each maritime area in the Arctic. It also sets out general rules for environmental protection. Our research work focuses on the sustainable management of maritime transport, as the SOLAS and MARPOL conventions regulate maritime transport, and it seems relevant to look at them as well (3.2). Finally, the SOLAS and MARPOL framework has been complemented by the Polar Code to adapt to the characteristics of the polar regions. This instrument should therefore also be examined in order to get an idea of the legal framework for Arctic shipping (3.3). However, other instruments are applicable to the Arctic, such as the Convention on Biological Diversity²²⁸ or the Agreement to prevent unregulated fisheries.²²⁹

3.1 LOSC : a framework convention for the ocean management

The LOSC allows us to understand what ocean management has been put in place internationally. Indeed, the Law of the Sea Convention delimits marine areas into maritime

²²⁶ International Convention for the prevention of pollution from ships (MARPOL), signed on 17 February 1973, entry in force on 2 October 1983.1340 UNTS 61.

²²⁷ International Convention for the safety of life at sea (SOLAS) entry in force on 25 May 1989. IMO Doc. Res. A.851 (20).

²²⁸ Convention on Biological Diversity (CBD) signed on 5 June 1992, entry in force on 29 December 1993.

²²⁹ Agreement to prevent unregulated high seas fisheries in the central arctic ocean, entry in force on 18 March 2019. OJ L 73.

zones. Each zone has specific management rules. The first zone is the territorial sea.²³⁰ It extends to 12 nautical miles from the baseline.²³¹ The Convention provides for techniques to delimit the baseline.²³² The territorial sea includes not only the marine area but also the airspace, the seabed and its subsoil.²³³ The coastal State is sovereign over this space.²³⁴ However, other states have a right of innocent passage, i.e. they must not prejudice the security and peace of the coastal state.²³⁵ The coastal State has the obligation not to prevent this innocent passage.²³⁶ Secondly, there is the contiguous zone, which extends to 24 nautical miles from the baselines of the territorial sea.²³⁷ The state exercises control and can punish violations of its laws.²³⁸ The third zone is the Exclusive Economic Zone (EEZ).²³⁹ It extends to 200 nautical miles from the baselines of the territorial sea.²⁴⁰ The coastal state has sovereign rights over the EEZ.²⁴¹ It can explore, exploit, conserve and manage the natural resources found in the waters, seabed and subsoil of the EEZ.²⁴² It may carry out other energy-related economic activities.²⁴³ It has jurisdiction to conduct marine scientific research, to protect and preserve the marine environment and to install artificial structures and islands.²⁴⁴ Other states also have rights in the area.²⁴⁵ They have freedom of navigation,

²³⁰ LOSC, Part II, art 2

²³¹ LOSC, Part II, art 3

²³² LOSC, Part II, art 14

²³³ LOSC, Part II, art 2

²³⁴ LOSC, Part II, art 2

²³⁵ LOSC, Part II, art 17

²³⁶ LOSC, Part II, art 24

²³⁷ LOSC, Part II, art 33

²³⁸ LOSC, Part II, art 33

²³⁹ LOSC, Part V, art 55

²⁴⁰ LOSC, Part V, art 57

²⁴¹ LOSC, Part V, art 56

²⁴² LOSC, Part V, art 56 a)

²⁴³ LOSC, Part V, art 56

²⁴⁴ LOSC, Part V, art 56 b) i) ii) iii)

²⁴⁵ LOSC, Part V, art 58

overflight and the laying of submarine cables and pipelines.²⁴⁶ The coastal State also has rights over the continental shelf, an area comprising the seabed and subsoil up to 200 nautical miles from the baselines of the territorial sea.²⁴⁷ It can explore and exploit it and other states must obtain the consent of the coastal state to carry out such activities.²⁴⁸ However, the coastal State cannot prevent other States from exercising their freedoms and rights such as freedom of navigation.²⁴⁹ Next is the high seas. It includes all marine areas that are not included in the maritime zones mentioned above.²⁵⁰ There is the principle of freedom of the high seas.²⁵¹ This space is open to all states. States have the freedom of navigation, overflight, laying cables and pipelines under the sea, fishing and scientific research.²⁵² This space must be used for peaceful purposes.²⁵³ There can be no claim of sovereignty.²⁵⁴ In this area, it is the flag State that exercises jurisdiction.²⁵⁵

The seabed and the subsoil of the high seas are part of the Area.²⁵⁶ The resources of the zone belong to the common heritage of mankind and are alienable.²⁵⁷ States may not claim sovereignty over the Area or its resources.²⁵⁸ The Authority is responsible for the management of its resources.²⁵⁹ All States Parties to the Convention are members of the Authority.²⁶⁰ Like

²⁴⁶ LOSC, Part V, art 58

²⁴⁷ LOSC, Part VI, art 77

²⁴⁸ LOSC, Part VI, art 77

²⁴⁹ LOSC, Part VI, art 78

²⁵⁰ LOSC, Part VII, art 86

²⁵¹ LOSC, Part VII, art 87

²⁵² LOSC, Part VII, art 87

²⁵³ LOSC, Part VII, art 88

²⁵⁴ LOSC, Part VII, art 89

²⁵⁵ LOSC, Part VII, art 94

²⁵⁶ LOSC, Part XI, art 133

²⁵⁷ LOSC, Part XI, art 136, art 137

²⁵⁸ LOSC, Part XI, art 137

²⁵⁹ LOSC, Part XI, art 156

²⁶⁰ LOSC, Part XI, art 156

the High Seas, the Area is exclusively for peaceful purposes.²⁶¹ Part XII of the Convention provides for a general obligation to protect and preserve the marine environment.²⁶² States may exploit their resources but must respect this obligation.²⁶³ It sets out specific rules on environmental risks such as prevention of pollution of the marine environment or the introduction of alien species.²⁶⁴ The Convention provides special rules for ice-covered areas for the protection of the environment.²⁶⁵ The Arctic is an ice-covered area and is therefore covered by this dimension of the Convention.²⁶⁶ This will be analysed in the next chapter. In addition, there is a section dedicated to the settlement of disputes that may arise between States Parties.²⁶⁷

3.2 SOLAS & MARPOL: a framework for maritime transport

After having seen how marine areas were managed according to different maritime zones, we will see how maritime transport is managed. Indeed, our study focuses on the management of maritime transport. We need to see what management has been put in place by legal instruments. We will describe the content of two instruments: the MARPOL (3.2.1) and SOLAS (3.2.2) conventions.

3.2.1 MARPOL : preventing marine pollution

The acronym of the MARPOL Convention²⁶⁸ (International Convention for the prevention of pollution from ships) derives from Marine Pollution. It was adopted after maritime accidents

²⁶¹ LOSC, Part XI, art 141

²⁶² LOSC, Part XII, art 192

²⁶³ LOSC, Part XII, art 193

²⁶⁴ LOSC, Part XII, art 194, art 196

²⁶⁵ LOSC, Part XII, art 234

²⁶⁶ LOSC, Part XII, art 234

²⁶⁷ LOSC, Part XV

²⁶⁸International Convention for the prevention of pollution from ships (MARPOL), signed on 17 February 1973, entry in force on 2 October 1983. 1340 UNTS 61.

resulting in polluting oil spills.²⁶⁹ It consists of 6 annexes to prevent the different sources of pollution, whether the pollution results from an accident or from the operation of ships.²⁷⁰ The first two annexes are mandatory. The first annex deals with the prevention of oil pollution with the requirement of a double hull.²⁷¹ The second annex deals with the prevention of pollution by noxious liquid substances carried in bulk.²⁷² There are rules for the discharge of such substances, including a ban on discharges within 12 miles of the coast.²⁷³ In addition, there is a list of harmful substances.²⁷⁴ The third annex concerns the prevention of pollution by harmful substances carried by sea in packages.²⁷⁵ This part contains rules on marking, packaging and quantity limits.²⁷⁶ The harmful substances are listed in the International Maritime Dangerous Goods Code.²⁷⁷ The fourth annex concerns the prevention of pollution by sewage from ships.²⁷⁸ The fifth annex concerns the prevention of pollution by ships' rubbish.²⁷⁹ The last annex concerns the prevention of air pollution from ships.²⁸⁰ These annexes include a ban on the dumping of plastics, sewage with some exceptions and limits on greenhouse gas emissions.²⁸¹

²⁶⁹ OMI (2020)

²⁷⁰ MARPOL, art 2

²⁷¹ MARPOL, Annex I

²⁷² MARPOL, Annex II

²⁷³ MARPOL, Annex II

²⁷⁴ OMI (2020)

²⁷⁵ MARPOL, Annex III

²⁷⁶ MARPOL, Annex III

²⁷⁷ The International Maritime Dangerous Goods Code, entry in force on 1 January 2004.

²⁷⁸ MARPOL, Annex IV

²⁷⁹ MARPOL, Annex V

²⁸⁰ MARPOL, Annex VI

²⁸¹ OMI (2020)

3.2.2 SOLAS : insuring the safety of life at Sea

One of the reasons of the adoption of SOLAS Convention was a reaction to the sinking of the Titanic.²⁸² There was a need to ensure greater safety on board ships.²⁸³ It therefore establishes minimum safety standards for ships.²⁸⁴ It contains measures providing for the issue of certificates by the flag State to attest that ships meet safety standards.²⁸⁵ Its structure consists of articles containing general obligations, with the required safety measures detailed in 14 chapters of the Annex. There are requirements for the construction of ships. There are also measures to prevent fires.²⁸⁶ The Convention provides rules for adequate life-saving and radio communication systems.²⁸⁷ With regard to safety of navigation, the Convention sets out a general obligation to rescue persons in distress.²⁸⁸ Also ships must record their navigational activities, they must have voyage data recorders.²⁸⁹ SOLAS also sets out specific rules for the carriage of cargoes and dangerous goods.²⁹⁰ The last chapters are dedicated to special measures to enhance maritime safety and security.²⁹¹ For example, there are regulations on surveys and port state control.²⁹²

3.3. The Polar Code : a polar adaptation to the shipping framework

The SOLAS Convention and the MARPOL Convention make the Polar Code mandatory after the adoption of amendments.²⁹³ This Code makes it possible to adapt to the specificities of the

²⁸² OMI (2020)

²⁸³ OMI (2020)

²⁸⁴ OMI (2020)

²⁸⁵ OMI (2020)

²⁸⁶ SOLAS, Chapter III.

²⁸⁷ SOLAS, Chapter IV.

²⁸⁸ SOLAS, Chapter V.

²⁸⁹ SOLAS, Chapter V, regulation 20, regulation 28.

²⁹⁰ SOLAS, Chapter VI, Chapter VII.

²⁹¹ SOLAS, Chapter XI

²⁹² SOLAS, Chapter XI, regulation 4, regulation 2.

²⁹³ OMI (2020)

polar regions.²⁹⁴ It complements existing instruments and sets standards adapted to the Arctic and Antarctic characteristics.²⁹⁵ These standards concern the safety and operation of ships and also environmental protection.²⁹⁶ The code is mandatory for all vessels operating in polar waters.²⁹⁷ However, some vessels, such as fishing vessels and pleasure craft, are not subject to these rules.²⁹⁸

In terms of its scope of application. The code is relevant for both polar regions: the Arctic and the Antarctic beyond latitude 60° North and South.²⁹⁹ However, the Barents Sea, the Greenland Sea, the Baltic Sea and the Sea of Okhotsk are not subject to the Code.³⁰⁰ The rules are sometimes different in the Arctic and Antarctic regions.³⁰¹ Indeed, the Code recognises that the regions have differences and therefore require specific rules.³⁰² The Code provides for a certificate that classifies ships into 3 categories: A, B and C. Category A ships can navigate in polar waters with average 1 year old ice, category B with thinner ice and category C can navigate in open waters or less solid ice than categories A and B.³⁰³ This certificate is required for all vessels to which the code applies.³⁰⁴ A certificate is issued following a survey of the vessel and it must comply with the safety requirements of the Polar Code.³⁰⁵ Vessels dated after 1 January 2017 must comply with the requirements of the Polar Code.³⁰⁶ The certificate is issued by the flag state.³⁰⁷

²⁹⁴ Polar Code, Preamble

²⁹⁵ Polar Code, Preamble

²⁹⁶ Polar Code, Preamble

²⁹⁷ OMI (2020)

²⁹⁸ OMI (2020)

²⁹⁹ OMI (2020)

³⁰⁰ OMI (2020)

³⁰¹ Polar Code, Preamble

³⁰² Polar Code, Preamble

³⁰³ Polar Code, Introduction - 2 Definitions

³⁰⁴ Polar Code, Chapter 1

³⁰⁵ Polar Code, Chapter 1

³⁰⁶ OMI (2020)

³⁰⁷ Polar Code, Chapter 1

The code is structured in two main parts. Parts I-A and II-A are mandatory, parts I-B and II-B contain recommendations relating to the first parts. If we look at the content of the code. The first part concerns measures for the safety of ships.³⁰⁸ Part I contains rules on the design and functional requirements.³⁰⁹ With regard to design and construction, the structure and materials must be reinforced and resistant to ice conditions.³¹⁰ Machinery installations must also be adapted to polar conditions.³¹¹ Vessels must be equipped with thermal polar suits and thermal immersion suits in sufficient quantity for all crew.³¹² Also rescue boats must be at least partially enclosed.³¹³ Means of removing ice and fire protection are also mandatory on board.³¹⁴ Vessels, especially windows, must have mechanisms to remove ice, snow and fog.³¹⁵ Finally, for operation and manning, vessels must have the Polar Operations Manual and the Polar Ship Certificate.³¹⁶ In addition, the crews must have undergone training in polar navigation.³¹⁷

The second part concerns environmental protection.³¹⁸ It contains provisions on oil, invasive species, sewage, rubbish and chemicals.³¹⁹ The discharge of oil from the ship into the sea is strictly prohibited.³²⁰ There is a distinction between the Arctic and Antarctic for heavy fuel oil. The regime is stricter for the Antarctic where there is a total ban on heavy fuel oil in the

³⁰⁸ Polar Code, Introduction - 4 Structure of the Code

³⁰⁹ Polar Code, Part I - A, Chapter 1.

³¹⁰ Polar Code, Part I-A, Chapter 3

³¹¹ Polar Code, Part I-A, Chapter 6

³¹² Polar Code, Part I-A, Chapter 5

³¹³ Polar Code, Part I-A, Chapter 8

³¹⁴ Polar Code, Part I-A, Chapter 8

³¹⁵ Polar Code, Part I-A Chapter 7

³¹⁶ Polar Code, Part I-A, Chapter 12

³¹⁷ Polar Code, Part I-A, Chapter 12

³¹⁸ Polar Code, Part II-A

³¹⁹ Polar Code, Part II-A, Chapter 1

³²⁰ Polar Code, Part II-A, Chapter 1

southern region.³²¹ For the Arctic, the code only encourages ships to refuse to carry or use this oil.³²² There is also a recommendation to use biodegradable or non-toxic lubricants for the submerged part of the hull of ships in contact with sea water.³²³ The structure of vessels should be reinforced to resist ice conditions.³²⁴ For invasive species, their introduction should be minimised.³²⁵ The discharge of waste water and chemicals is prohibited in polar waters.³²⁶ However, there are exceptions to this principle for sewage and under certain conditions, discharge is possible within 12 or 3 miles of the fast ice or ice shelf.³²⁷ For rubbish, the discharge of food waste and animal carcasses is prohibited.³²⁸ Again, there are exceptions - shredded food waste can be discarded.³²⁹ More sensitively, cargo residues can be dumped if they are not harmful to the environment and if there is no infrastructure to deposit the residues.³³⁰

We have seen the various instruments that organise the management of the oceans and Arctic shipping. We will see whether they are part of a process of adaptation to climate change. Whether they make it possible to combat the environmental risks posed by Arctic shipping. If they allow a balance to be struck between economic opportunities and environmental protection. Indeed, we need to see the limits and challenges of the Arctic and shipping framework.

³²¹ Polar Code, Part II-A, Chapter

³²² OMI (2020)

³²³ Polar Code Part II-B

³²⁴ Polar Code, Part I-A, Chapter 3

³²⁵ Polar Code, Part II-B

³²⁶ Polar Code, Part II-A, Chapter 3

³²⁷ Polar Code, Part II-A, Chapter 3

³²⁸ Polar Code, Part II-B

³²⁹ Polar Code, Part II-A, Chapter 5

³³⁰ Polar Code, Part II-A, Chapter 5

4. Limits and challenges of the current management

The content of the legal instruments constituting the framework for maritime transport and Arctic maritime transport, namely the Convention on the Law of the Sea, the MARPOL and SOLAS Conventions and the Polar Code, was studied. Now that we have seen the content, we need to consider whether it is effective, efficient and sufficient. Our analysis focuses on climate change adaptation in maritime transport and sustainable management of Arctic shipping. This chapter is dedicated to analysing how these instruments take environmental issues into account. In addition, it is necessary to see whether or not they face certain limitations in addressing these issues. Finally, whether climate change exacerbates these limitations. We will focus on the Polar Code and the LOSC. Indeed, the MARPOL and SOLAS conventions are the framework for maritime transport and we want to study Arctic maritime transport in particular. The Polar Code being the polar adaptation of these conventions, the choice of these two instruments seems judicious. Firstly, we will see whether the content of the instruments shows a willingness to set up environmental protection. We will see what is being done to take account of the environmental issues of Arctic shipping (4.1). Next, the relationship between the LOSC and the Polar Code must be analysed to see whether the instruments are complementary or conflicting in terms of the implementation of environmental standards (4.2). Then, the difficulty for the instruments to remain relevant and suitable given the changing nature of climate change will be discussed. Indeed, see how the climate crisis poses challenges to existing law (4.3).

4.1 The treatment of environmental issues by the LOSC and the Polar Code

The Law of the Sea Convention and the Polar Code both have a part of their content dedicated to environmental protection. Part XII of the LOSC sets out a general environmental protection regime and a special regime for the Arctic in Article 234 (4.1.1) and the Polar Code has a second part dealing with environmental protection (4.1.2).

4.1.1 LOSC: Part XII and article 234 : a general obligation and a special Arctic regime

Part XII of the LOSC is devoted to the protection and preservation of the marine environment. Article 192 contains a general obligation for States Parties to protect and preserve the marine environment. If they have a right to exploit their natural resources, they must do so taking into account the obligation to protect marine areas.³³¹ Article 194 contains measures to prevent and control pollution. Measures must also be taken by States to prevent the introduction of alien species.³³² In addition, article 211 is important for maritime transport. It provides that States, with the assistance of international organisations, shall establish standards to prevent, reduce and control pollution of the seas from ships. In addition, the LOSC also contains a special regime for the Arctic. This regime is laid down in Article 234³³³ :

Coastal States have the right to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution from vessels in ice-covered areas within the limits of the exclusive economic zone, where particularly severe climatic conditions and the presence of ice covering such areas for most of the year create obstructions or exceptional hazards to navigation, and pollution of the marine environment could cause major harm to or irreversible disturbance of the ecological balance.³³⁴ Such laws and regulations shall have due regard to navigation and the protection and preservation of the marine environment based on the best available scientific evidence.³³⁵

The aim of this article is to establish a stricter regime to protect the fragile and vulnerable Arctic environment.³³⁶ The setting of environmental protection standards is left to the Coastal States. The scope of this regime extends to the limits of the EEZ of the Coastal States. This regime aims at limiting pollution from ships. However, the interpretation of this article has

³³¹ LOSC, Part XII, art 193.

³³² LOSC, Part XII, art 196.

³³³ LOSC, Part XII, section 8 ice covered areas, art 234.

³³⁴ LOSC, Part XII, section 8 ice covered areas, art 234.

³³⁵ LOSC, Part XII, section 8 ice covered areas, art 234.

³³⁶ Bartenstein (2011)

raised questions about its scope.³³⁷ Indeed, the article can be interpreted in several ways on several points. It is considered ambiguous and even controversial.³³⁸

Firstly, giving full legislative power to coastal states threatens the freedom of navigation and the innocent right of passage included in the LOSC.³³⁹ The article mentions that the laws made must have a "due regard to navigation" but the outline of this expression is unclear. The balance to be struck between preserving navigation for the international community and the imperative of protecting the marine environment in this article is not clearly stated.³⁴⁰ "Due regard" is seen as requiring a reasonable attitude on the part of coastal states.³⁴¹ They must allow some navigation.³⁴² This exclusive authority of coastal states is questioned.³⁴³ Is unilateralism really appropriate to improve the protection of the Arctic environment?³⁴⁴ Indeed, this article gives a great responsibility, a great power to the coastal States to adopt national laws to protect the Arctic. However, they are not necessarily the most competent to ensure this protection. Russia, for example, was against stricter protection standards when the Polar Code was negotiated.³⁴⁵ Whether the Arctic environment will be best protected by extensive unilateralism is not certain. Moreover, multilateralism is often preferred for dealing with international environmental issues.³⁴⁶ Yet the Arctic and the risks posed by Arctic shipping are international environmental issues. Oil spills are a good example of how the risk of pollution from ships in the Arctic is international rather than local.³⁴⁷ An oil spill rarely stays in a small area, the pollution migrates.³⁴⁸ International action and exchange between

³³⁷ Bartenstein (2011)

³³⁸ Bartenstein (2011)

³³⁹ Solski (2022)

³⁴⁰ Solski (2022)

³⁴¹ Gavrilov et al (2019)

³⁴² Gavrilov et al (2019)

³⁴³ Solski (2022)

³⁴⁴ Solski (2022)

³⁴⁵ Bognar (2018)

³⁴⁶ Bartenstein (2011)

³⁴⁷ Bartenstein (2011)

³⁴⁸ Bartenstein (2011)

states could be more relevant than unilateral decisions by coastal states.³⁴⁹ Moreover, it avoids conflicting laws. Furthermore, coordination of these domestic laws by the IMO or another international organisation is not mandatory. Even though practice shows that states often have recourse to the IMO for the enactment of their standards.³⁵⁰

Secondly, there is uncertainty about the word "where"³⁵¹ which can mean when there is ice and where there is ice. The consequences are different for the application of this article if one interprets the term "where"³⁵² spatially or temporally. However, the spatial interpretation is preferred.³⁵³ Furthermore, "for most of the year"³⁵⁴ is also ambiguous, the expression lacks precision about the requirement of ice on Arctic lands and for how long precisely this ice should be present.³⁵⁵ This leads to another difficulty in the application of this regime and the expression used by the article "ice covered areas"³⁵⁶. With the melting of the ice during the summer, question arises. Should this regime continue to apply when certain areas previously covered by ice are no longer covered? This is similar to considering that the melting of the ice could cancel Article 234.³⁵⁷ The lack of anticipation of ice melt by the authors of the article is somewhat surprising as climate change and sustainable development issues were beginning to emerge at the time of the drafting of the LOSC, notably with the Rio Summit.³⁵⁸ However, in order to know whether the Arctic regime should be linked to the condition of the ice cover, it is necessary to refer to the Vienna Convention on the Law of Treaties of 1969 and its Article 31(1).³⁵⁹ One should not limit oneself to the interpretation of the terms but look for the

³⁴⁹ Solski (2022)

³⁵⁰ Solski (2022)

³⁵¹ LOSC, Part XII, art 234

³⁵² LOSC, Part XII art 234

³⁵³ Gavrilov et al (2019)

³⁵⁴ LOSC, Part XII art 234

³⁵⁵ Bartenstein (2011)

³⁵⁶ LOSC, Part XII, section 8 ice covered areas, art 234.

³⁵⁷ Gavrilov et al (2019)

³⁵⁸ Redgwell (2019)

³⁵⁹ Gavrilov et al (2019)

intention of the authors of the article.³⁶⁰ Here the intention of the drafters was to establish a special protective regime for EEZs in the Arctic Ocean.³⁶¹ However, melting ice does not prevent pollution of the Arctic marine environment.³⁶² On the contrary, melting ice allows an increase in human activities in this region.³⁶³ The vulnerability of marine areas is increased.³⁶⁴ The original reason for the article therefore remains.³⁶⁵ The reduction of ice-covered areas does not cancel or change the article.³⁶⁶ It still poses difficulties in the spatial application of the article, there are uncertainties in determining which areas remain under the article. In the future, however, the presence of the article could be questioned, if there is no ice in the Arctic at all.³⁶⁷

On the one hand, this article has an important function for the protection of the Arctic, as minimum standards are not sufficient to protect the fragile Arctic environment.³⁶⁸ But to really guarantee the effectiveness of this protective regime, it is questionable whether unilateralism is really the best solution. If the Arctic States are in the most appropriate position to act, if their interests are in line with the common interest of protecting the Arctic. On the other hand, granting coastal states extensive powers can lead to conflicts with the Northern Passages. Indeed, by using environmental protection, Russia and Canada can restrict other States from using the Northeast and NSR passages.³⁶⁹ These States can use this article to exercise unreasonable control over these passages and undermine the freedom of the seas of other states.³⁷⁰ It can be seen that the multiplicity of possible interpretations of this article and the lack of clarity of these provisions is an obstacle to the implementation of protective

³⁶⁰ Gavrilov et al (2019)

³⁶¹ Gavrilov et al (2019)

³⁶² IPCC (2021)

³⁶³ IPCC (2021)

³⁶⁴ IPCC (2021)

³⁶⁵ Gavrilov et al (2019)

³⁶⁶ Gavrilov et al (2019)

³⁶⁷ Gavrilov et al (2019)

³⁶⁸ Gavrilov et al (2019)

³⁶⁹ Gavrilov et al (2019)

³⁷⁰ Gavrilov et al (2019)

environmental standards.³⁷¹ Indeed, there is a difficulty in delimiting the power given to coastal States by this article.³⁷² The complexity of Article 234 shows a certain limitation of the Law of the Sea Convention in establishing an effective regime for the Arctic. The lack of clarity and certainty in this article is a hindrance to providing legal security for the special Arctic regime.

However, this is not the only instrument that contains provisions for the protection of the Arctic marine environment. The Polar Code is a second instrument that also has this environmental objective. This leads us to consider whether the work of the IMO might not be more appropriate to address Arctic environmental issues. Indeed, it is in a multilateralist approach that could avoid conflicting, insufficient or uncoordinated standards of Arctic coastal states that may arise in the LOSC regime.

4.1.2 Polar Code : a second part dedicated to environmental protection

The second part of the Polar Code is dedicated to environmental protection. This shows the interest of maritime transport to take into account the environmental impact of the maritime industry. As seen above, the Polar Code puts in place a number of measures to limit the impact of shipping on Arctic marine areas. It takes measures to limit the introduction of invasive species or the discharge of waste water. But these measures are not necessarily sufficient to protect the Arctic environment. For heavy oil fuels (HFO), the Polar Code does not go far enough to prevent damage. Indeed, HFOs are banned in Antarctica. But in the Arctic, ships are only encouraged to limit their use. However, these HFOs represent considerable risks in terms of emissions or environmental consequences in the event of oil spills.³⁷³ They also produce black carbon, which accelerates climate change. By not banning these pollutants, we can already see a first limitation of the code to fully address the environmental risks in the Arctic and also to fight against the accelerators of the climate crisis. However, a ban on HFOs is desired by several actors in the Arctic: the States, but also the

³⁷¹ Bartenstein (2011)

³⁷² Bartenstein (2011)

³⁷³ Sun (2019)

indigenous populations and local communities.³⁷⁴ There was also an interest that went beyond the Arctic framework as non-Arctic states were also in favour of this ban.³⁷⁵ There is a common concern to use cleaner energy but most ships in the Arctic use HFO because it is the cheapest fuel.³⁷⁶ Moreover, to ensure that the rules set out in the Polar Code are in place and effective, arctic States can do port controls.³⁷⁷ However, an obstacle to the effectiveness of the code is conflicting standards. States must ensure that their national laws are compatible with the standards set by the Polar Code.³⁷⁸

Furthermore, the Polar Code is the result of the work of the IMO. This organisation has initiated other initiatives to decarbonise maritime transport. Indeed, maritime transport is the most energy-efficient means of transport, but it is no less polluting.³⁷⁹ Solutions are encouraged, such as the transition from HFOs to distillate fuels or alternative fuels.³⁸⁰ Also, low impact and fuel efficient vessels should be increasingly favoured to reduce emissions from maritime transport.³⁸¹ In addition, IMO adopted in 2018 a strategy for the global reduction of greenhouse gases by the shipping industry. This strategy is intended to achieve the objectives of the Paris agreements.³⁸² There are short, medium and long term measures to reduce GHG emissions and prevent pollution from ships.³⁸³ In June 2021, IMO introduced new binding measures that will come into force in November 2022 by amending the MARPOL Convention.³⁸⁴ They combine technical and operational measures.³⁸⁵ These measures are part of the strategy to reduce greenhouse gas emissions from ships and the

³⁷⁴ Sun (2019)

³⁷⁵ Sun (2019)

³⁷⁶ Sun (2019)

³⁷⁷ Bai (2015)

³⁷⁸ Bai (2015)

³⁷⁹ Wan (2018)

³⁸⁰ Zhang et al (2019)

³⁸¹ Zhang et al (2019)

³⁸² Chircop (2019)

³⁸³ Chircop (2019)

³⁸⁴ IMO (2021)

³⁸⁵ Zhang et al (2019)

objective of reducing emissions by 40% by 2030 compared to 2008 numbers.³⁸⁶ These measures include improving the energy efficiency of ships by assigning a letter to classify ships according to their impact or setting a rate of gas reduction.³⁸⁷ The IMO is preparing other work to continue this GHG reduction movement.³⁸⁸ For the effectiveness of IMO's work, strengthened cooperation between sectors is needed, such as between scientists, decision-makers and maritime sector actors.³⁸⁹ Also close cooperation between IMO, Arctic and non-Arctic states and other fora such as the Arctic Council should be pursued.³⁹⁰ These different actors must act both locally and globally to achieve sustainable governance of Arctic shipping.

Cooperation is therefore an essential element of coherent and effective governance. We have just seen that the LOSC and the Polar Code have a pregnant role to play in the sustainability of the maritime industry. The question arises whether these instruments conflict or complement each other in the sustainable management of Arctic shipping.

4.2 LOSC and Polar Code : conflicting or complementary relationship ?

The relationship between the LOSC and the Polar Code is not a conflicting one. There is no conflict of norms because that is not the objective contained in the Code. It is not intended to replace the special Arctic regime of article 234.³⁹¹ It therefore does not affect the rights of coastal states to make domestic laws to protect the marine environment in their EEZs.³⁹² Moreover, article 211(1) of the LOSC provides for the adoption of legal instruments such as the Polar Code to regulate maritime transport.³⁹³ Rather, the two instruments may be seen as complementing each other. Even if the framework needs to be clarified and unified between

³⁸⁶ IMO (2021)

³⁸⁷ IMO (2021)

³⁸⁸ IMO (2021)

³⁸⁹ Zhang et al (2019)

³⁹⁰ Zhang et al (2019)

³⁹¹ Gavrilov et al (2019)

³⁹² Gavrilov et al (2019)

³⁹³ Gavrilov et al (2019)

international law instruments and national laws adopted by Arctic coastal states.³⁹⁴ Uniformity of this framework would better address the environmental challenges of the region while preserving the rights of other states to exercise their freedom of navigation.³⁹⁵

4.3 Two instruments facing similar challenges and limits

The Polar Code is a recent instrument. It came into force in 2017. This must be taken into account when analysing its effectiveness and its capacity to adapt to climate change. There is still little hindsight on the effectiveness of its provisions. However, it can be recognised that it is linked to climate change. One of the reasons for its development is a consequence of climate change. The melting of the ice is opening up new Arctic shipping routes and raising concerns about an increase in shipping activity.³⁹⁶ This increase may cause damage to the marine environment.³⁹⁷ Its second part is devoted to responding to these environmental threats. The code takes into account the climate crisis and the need of not causing irreversible damage. Even if we have seen above, some measures do not go far enough to really protect the Arctic environment and not accelerate the climate crisis. Thus, to respond to climate threats, the polar code is not the only relevant instrument.³⁹⁸ All of the IMO's work can be part of an approach to adapting to climate change and responding effectively. Impact assessments, frequent monitoring and flexibility to adapt existing instruments are also tools to enable the law to respond to the environmental risks posed by the climate crisis.³⁹⁹ In addition, the changing nature and rapid evolution of conditions is another challenge for international law. Indeed, the need for models, recent and regular studies of the Arctic such as the IPCC reports are additional challenges for the law to remain relevant and responsive. Also, the process of law making is not always quick, especially in international law as it requires the consensus of several actors with different interests, it's another difficulty for this framework in address environmental issues and adapting to climate change.

³⁹⁴ Williams (2017)

³⁹⁵ Williams (2017)

³⁹⁶ IPCC (2021)

³⁹⁷ IPCC (2021)

³⁹⁸ Williams (2017)

³⁹⁹ IPCC (2021)

As for the LOSC and its capacity to face the challenges posed by climate change. This is an older instrument. Climate change was only an emerging issue when it was created and there is no explicit mention of climate change in the LOSC.⁴⁰⁰ However, the LOSC is a flexible and living instrument.⁴⁰¹ These characteristics may allow it to be adapted to act on the impacts of climate change. There are several ways in which the mechanisms of the LOSC can be used for this purpose. Firstly, the classical method of treaty amendment, but this takes time and is not necessarily easy to obtain a consensus of the parties. There is also the interpretation of treaty provisions which allows the LOSC to be a dynamic and evolving instrument.⁴⁰² If we analyse these provisions and their function in adapting to climate change, Article 194(2) aimed at preventing marine pollution and protecting other states against damage caused by it is a good example.⁴⁰³ Indeed, this article sets out a duty of due diligence, requiring States to adopt a course of conduct that reduces their pollution and environmental impact.⁴⁰⁴ The general obligation to preserve and protect the environment in Article 192 is also an example of provisions that can allow states to adapt to climate change through the LOSC.

The flexibility of the LOSC makes it an important legal tool for the adaptation of maritime transport to climate change. However, the Polar Code and the LOSC are not sufficient to address all the international impacts of climate change.⁴⁰⁵ They are part of a broader framework. It's necessary to take into account the multiplicity of available legal instruments in order to have a coordinated, effective and efficient response to the climate crisis.⁴⁰⁶ Climate change management goes beyond the law of the sea regime.⁴⁰⁷ It also requires multiple scales

⁴⁰⁰ Redgwell (2019)

⁴⁰¹ Redgwell (2019)

⁴⁰² Redgwell (2019)

⁴⁰³ Boyle (2012)

⁴⁰⁴ Boyle (2012)

⁴⁰⁵ Redgwell (2019)

⁴⁰⁶ Redgwell (2019)

⁴⁰⁷ Redgwell (2019)

of governance, multiple actors and multiple areas of law.⁴⁰⁸ Climate change law instruments such as the Kyoto Protocol⁴⁰⁹, UNFCCC⁴¹⁰, Paris Agreements⁴¹¹ are also standards that address climate issues. Coordination and cooperation between the different legal instruments could be more effective in addressing the climate crisis. Moreover, the hard law of international conventions is not the only form of norms existing in the Arctic. Coordination between different sources of law could be a solution to the polar challenges. Indeed, going beyond the Law of the Sea regime and have a better cooperation between the norms could lead to a more sustainable management of Arctic shipping.

⁴⁰⁸ Redgwell (2019)

⁴⁰⁹Kyoto Protocol to the United Nations Framework Convention on Climate Change, adopted 10 December 1997, in force 16 February 2005, (1998) 37 ILM 22.

⁴¹⁰United Nations Framework Convention on Climate Change, signed June 1992, entry in force on 21 March 1994.

⁴¹¹Paris Agreement under the United Nations Framework Convention on Climate Change, adopted 12 December 2015, entry in force 4 November 2016.

5. Coordinated approach : a solution to face polar challenges

We have seen that Arctic shipping is governed by UNCLOS and the Polar Code. These instruments provide for rules to protect the environment. However, they do not always go far enough. Therefore, to remedy these shortcomings. There are several solutions to consider. One solution could be to have a coordinated approach to standards. This can mean several things. Either, as mentioned above, coordinate the different regimes that have similar objectives. For example, having better communication between law of the sea instruments and climate change law instruments. Another coordination could be between hard and soft law, between the different ways of developing norms. Indeed, while there are binding treaties that regulate the Arctic, the Arctic Council, an institution with soft law status, also has effects on the region. Moreover, discussions to move towards an Arctic treaty are also underway (5.1). This treaty could be similar to the Antarctic Treaty, the other polar region (5.2). However, the possibility of an Arctic treaty must be put into perspective. It may not be necessary to have a new instrument, to develop a coordinated approach in the Arctic (5.3).

5.1 The Arctic Council : from soft law towards an Arctic Treaty ?

The Arctic is regulated by international treaties, but there are other forms of law that have an impact on the region. There are also soft law instruments that set standards for the region. This form of law is easier to elaborate because it does not imply big constraints for states and could fill the gaps left by hard law instruments. However, while it is simpler to emerge and can address issues that states do not wish to include in treaties, its non-binding status complicates the achievement of objectives. Indeed, there are no binding mechanisms to ensure that the standards set are respected. The Arctic Council is a good example. Its work addresses environmental issues, but its soft-law status is a hindrance to the Council having a truly effective role in protecting the Arctic environment.⁴¹²

⁴¹² Koivurova (2008)

The Arctic Council is an intergovernmental forum, established in 1996 by the Ottawa Declaration.⁴¹³ It is an institution that brings together Arctic states, indigenous peoples and non-Arctic states that have observer status.⁴¹⁴ The Council has six working groups and a group of experts such as PAME (Protection of the Arctic Marine Environment), AMAP (Arctic Monitoring and Assessment Programme) or CAFF (Conservation of Arctic Flora and Fauna).⁴¹⁵ They work notably on the protection of the Arctic marine environment, the limitation of pollutants and the protection of fauna and flora.⁴¹⁶ More generally, the Council's objective is to protect the Arctic environment and promote sustainable development.⁴¹⁷ The working groups produce environmental and social assessments. The Council is also a forum for discussion and negotiation between the various Arctic stakeholders.⁴¹⁸ However, the Council has a soft law status.⁴¹⁹ Its work is not binding on the states. Its status is rather weak and it does not have the authority to impose its decisions, particularly to regulate maritime transport in the Arctic.⁴²⁰ To overcome this weakness, some authors have put forward the idea of making a transition from this soft-law status to a binding status by concluding an international treaty for the Arctic. The Arctic Council could be a first step towards an international agreement.⁴²¹ The idea of an Arctic treaty is not new. There was already an international treaty between the Arctic states for the protection of polar bears in 1973.⁴²² But there is no general binding agreement for the polar region. The Arctic states are opposed to this idea, they do not want to give up a part of their sovereignty.⁴²³ Moreover, as the region is rich in natural resources, a treaty could considerably reduce the possibility to exploit them in

⁴¹³ Arctic Council (2022)

⁴¹⁴ Arctic Council (2022)

⁴¹⁵ Arctic Council (2022)

⁴¹⁶ Arctic Council (2022)

⁴¹⁷ Arctic Council (2022)

⁴¹⁸ Arctic Council (2022)

⁴¹⁹ Koivurova (2008)

⁴²⁰ Young and Kim (2021)

⁴²¹ Verhaag (2002)

⁴²² Verhaag (2002)

⁴²³ Verhaag (2002)

order to protect the Arctic environment.⁴²⁴ For some authors, an Arctic treaty could drastically transform Arctic governance, others are more in favour of moderate changes to current governance.⁴²⁵ This treaty could be more effective in addressing current and future environmental challenges.⁴²⁶ It could also clarify and harmonise the complex Arctic framework.⁴²⁷ In addition, it could address issues that are amplified by melting ice, such as underwater noise or invasions of alien species.⁴²⁸

The development of such a treaty to coordinate the Arctic legal framework and address polar challenges echoes the Antarctic Treaty. Indeed, the other polar region has a treaty to protect the region. However, the two regions have different realities and what has been possible to implement for one is not necessarily possible for the other.

5.2 Arctic Treaty : a possible replica of the Antarctic treaty

The Antarctic Treaty⁴²⁹ includes principles for the South Polar Region. The activities carried out must be peaceful.⁴³⁰ There may be scientific research activities.⁴³¹ International cooperation is encouraged.⁴³² Regarding sovereignty, the treaty does not constitute a renunciation by States of their claim of sovereignty.⁴³³ It can be seen that activities in the Antarctic are highly regulated. The Antarctic treaty is seen as a possible inspiration for an Arctic treaty.⁴³⁴ However, a similar treaty for the North Polar region seems more complicated to implement. Indeed, while in Antarctica there are very few populations, this is not the case

⁴²⁴ Verhaag (2002)

⁴²⁵ Rahbek-Clemmensen (2019)

⁴²⁶ Rahbek-Clemmensen (2019)

⁴²⁷ Young and Kim (2021)

⁴²⁸ Young and Kim (2021)

⁴²⁹ Antarctic Treaty signed 1 December 1959, in force 23 June 1961. 402 UNTS 71.

⁴³⁰ Antarctic Treaty, article I

⁴³¹ Antarctic Treaty, article II

⁴³² Antarctic Treaty, article II, article III

⁴³³ Antarctic Treaty, article IV

⁴³⁴ Koivurova (2008)

in the Arctic, where there are local and indigenous populations.⁴³⁵ The Antarctic Treaty freezes states' claims to sovereignty, but a freeze on the exercise of sovereignty in the Arctic seems highly unlikely.⁴³⁶ Indeed, the Arctic states are opposed to having their sovereignty over the region limited.⁴³⁷ However, both regions face similar environmental protection issues. They have similar characteristics: extreme conditions with a cold and dark period. One of the authors' arguments is to apply the principle of common interest to the Arctic, making it a marine protected area open only to tourism and scientific research.⁴³⁸ For the time being, this idea does not reach consensus among the Arctic states. Moreover, a treaty will not necessarily be more effective than the current framework, as international conventions take some time to be drafted and accepted by all parties concerned. Also, in order to deal with climate change, flexible and adaptable instruments are needed, and treaties do not necessarily have this capacity to deal to changing conditions.⁴³⁹

5.3 Arctic treaty : superfluous for achieving a coordinated approach ?

If one takes into account the opposition of the Arctic states to a general treaty, this opposition could be an obstacle to the emergence of a truly ambitious instrument capable of addressing climate challenges. Indeed, it could be a lot of effort and time without obtaining a really effective response to the polar challenges.⁴⁴⁰ So perhaps the solution is not to draft a new instrument but to strengthen the existing ones. For exemple by amending the LOSC and the IMO conventions so that they better address existing and future challenges. The Arctic can also draw inspiration from the BRS system. This system includes the Basel, Rotterdam and Stockholm Conventions. They regulate the management of waste and pollutants on an international scale. These issues are transnational and like Arctic shipping, their management requires coordination between instruments. There are three separate treaties in the BRS system and to better coordinate these instruments the working groups of each treaty have been

⁴³⁵ Koivurova (2008)

⁴³⁶ Koivurova (2008)

⁴³⁷ Koivurova (2008)

⁴³⁸ Koivurova (2008)

⁴³⁹ Baker and Yeager (2015)

⁴⁴⁰ Young (2011)

brought together to better cooperate and communicate. Indeed, there is a common secretariat for the three conventions and conferences of the parties are held jointly between the instruments. In the Arctic too, there is a need for coordination mechanisms to ensure the effectiveness of the complex Arctic legal framework. A coordinated approach to existing Arctic instruments could also be a solution to polar challenges without the need for a new instrument. It could establish mechanisms for dialogue and harmonisation between the different Arctic instruments and actors and fill the gaps in the current framework. This improved cooperation between norms could contribute to a more sustainable management of Arctic shipping.

6. Conclusions

Climate change is happening twice as fast in the Arctic as in the rest of the world. It has many consequences for the polar region. It is accelerating the melting of the ice and disrupting ecosystems. This melting ice represents economic opportunities. Indeed, it enables greater maritime traffic in the Arctic and easier access to resources. However, an increase in maritime transport also has environmental impacts. Greenhouse gas and black carbon emissions from ships contribute to climate change. In addition, there are increased risks of pollution, introduction of invasive species and oil spills. There is therefore a need for sustainable governance of Arctic shipping to avoid irreversible damage to the Arctic environment. Adaptation measures have been initiated and need to be pursued to ensure effective and efficient management of this sector. International law is a means to achieve sustainable management of the Arctic environment. It could help to reconcile the different interests: allowing the exploitation of economic opportunities and ensuring the protection of the environment.

The Arctic legal framework is complex. The Law of the Sea Convention and the Polar Code are instruments that regulate Arctic shipping. The LOSC establishes a general obligation to protect the environment and a special regime for the Arctic marine environment. The Polar Code also has a section dedicated to environmental protection. It contains provisions aimed at limiting pollution from ships, among other things but these two instruments do not go far enough to ensure that shipping does not have a negative impact on the polar region and does not also contribute to climate change. However, the role of these instruments must be put into perspective. The law of the sea regime is not the only relevant instrument to fight climate change. All legal regimes need to be exploited to address the climate crisis. Moreover, given the changing nature of the climate crisis and polar issues, flexible and adaptable mechanisms must be employed to better address these challenges. Coordination of instruments could be a solution. Indeed, the idea of an Arctic treaty is being discussed to better coordinate the different existing norms. The Arctic Council institution with soft law status could be a first step towards an international treaty for the Arctic. However, the emergence of such a treaty is not widely supported by Arctic actors. Another option could be to strengthen the existing

framework by improving cooperation and creating even more spaces for dialogue between actors and instruments. This could help to improve the sustainability of the Arctic shipping framework.

7. List of references

Literature

Bai Jiayu, « The IMO Polar Code : The emerging rules of Arctic shipping governance. » (2015) *The International Journal of Marine and Coastal Law*. Vol 30(4), p 674-699. doi 0.63/578085-34376

Baker Betsy and Yeager Brooks, « Coordinated ocean stewardship in the Arctic : Needs, challenges and possible models for an Arctic ocean coordinating agreement. » (2015) *Transnational Environmental Law*. Vol 4(2), p359-394. <https://doi.org/10.1017/S2047102515000151>

Bartenstein Kristin, « The “Arctic exception” in the Law of the Sea Convention: a contribution to safer navigation in the Northwest Passage ? » (2011) *Ocean Development & International Law*. Vol 42(1-2) p22-52. <https://doi.org/10.1080/00908320.2011.542104>

Bockstoe John R, « White fox and icy seas in the western Arctic » in *White fox and icy seas in the Western Arctic*. Yale University Press, 2018. <https://doi.org/10.12987/9780300235166>

Bognar Dorottya, « Russia and the polar marine environment : the negotiation of the environmental protection measures of the mandatory Polar Code. » (2018) *Review of European, Comparative & International Environmental Law*. Vol 27(1), p35-44. <https://doi.org/10.1111/reel.12233>

Boyle Alan « Law of the Sea Perspectives on Climate Change » (2012) *The International Journal of Marine and Coastal Law*. Vol 27(4), p831-838. DOI: 10.1163/15718085-12341244

Canavera Leslie, « A peaceful Arctic does not mean a neutral one » (2022) *Polar Research & Policy Initiative*.

Chan Farrah T, Stanislawczyk Keara, Sneekes Anna C, Dvorestsky Alexander, Gollasch Stephan, Minchin Dan, David Matej, Jelmert Anders, Albretsen Jon, Bailey Sarah A. « Climate change opens new frontiers for marine species in the Arctic : current trends and future invasion risks ». (2019) Vol 25(1). *Global change biology*. p25-38. <https://doi.org/10.1111/gcb.14469>

Chircop Aldo, « The IMO initial strategy for the reduction of GHGs from international shipping: A commentary. » (2019) *The International Journal of Marine and Coastal Law*, Vol 34(3) p 482-512. doi:10.1163/15718085-13431093

Drake John M, Lodge David M. « Hull fouling is a risk factor for intercontinental species exchange in aquatic ecosystems ». (2007). Vol 2(2). *Aquatic Invasions*. p121-131. DOI 10.3391/ai.2007.2.2.7

Erbe Christine, Marley Sarah A, Schoeman Renée P, Smith Joshua N, Trigg Leah E, Embling Clare Beth, « The effects of ship noise on marine mammals - a review » (2019) *Frontiers in Marine Science*. p606. <https://doi.org/10.3389/fmars.2019.00606>

Eriksen Siri, Aldunce Paulina, Bahinipati Chandra Sekhar, Martins D'almeida Rafael, Molefe John Isaac, Nhemachena Charles, O'Brien Karen, Olorunfemi Felix, Park Jacob, Sygna Linda, Ulsrud Kirsten. « When not every response to climate change is a good one : Identifying principles for sustainable adaptation » (2011) *Climate and Development*. Vol 3 (1) p 7-20. <https://doi.org/10.3763/cdev.2010.0060>

Ezhova E, Orlov D, Suhonen E et al. «Climatic Factors Influencing the Anthrax Outbreak of 2016 in Siberia, Russia.» (2021) *EcoHealth* 18, 217–228. <https://doi.org/10.1007/s10393-021-01549-5>

Ford James D, McDowell Graham, Jones Julie. « The state of climate change adaptation in the Arctic » (2014) *Environmental Research Letters*. Vol 9(10). p104005. doi: 10.1088/1748-9326/9/10/104005

Gavrilov Viatcheslav, Dremluga Roman, Nurimbetov Rustambek, « Article 234 of the 1982 United Nations Convention on the law of the sea and reduction of ice cover in the Arctic Ocean. » (2019) *Marine Policy* Vol 106, p103518. <https://doi.org/10.1016/j.marpol.2019.103518>

Haas Bianca, Mackay Mary, Novaglio Camilla et al « The future of ocean governance » (2020) *Reviews in fish biology and fisheries*. Vol 32(1) p253-270. <https://doi.org/10.1007/s11160-020-09631-x>

Halliday William D, Pine Matthew K, Insley Stephen J, « Underwater noise and Arctic marine mammals : review and policy recommendations » (2020) *Environmental Reviews*. Vol 28(4) p438-448. <https://doi.org/10.1139/er-2019-0033>

Harrould-Kolieb Ellycia. « Shipping impacts on climate » (2008) *Oceana*. https://europe.oceana.org/sites/default/files/reports/Oceana_Shipping_Report1.pdf

Harrould-Kolieb Ellycia, Herr Dorothée. « Ocean acidification and climate change : synergies and challenges of addressing both under the UNFCCC » (2011) Vol 12(3). *Climate Policy*. p378-389. <https://doi.org/10.1080/14693062.2012.620788>

Keller Reuben P, Drake J, Drew M.B « Linking environmental conditions and ship movements to estimate invasive species transport across the global shipping network ». (2011) Vol 17(1). *Diversity and Distributions*. p93-102. <https://doi.org/10.1111/j.1472-4642.2010.00696.x>

Koivurova Timo, « Alternatives for an Arctic treaty- Evaluation and a new proposal. » (2008) *Review of European Community & International Environmental Law*. Vol 17 (1), p14-26. <https://doi.org/10.1111/j.1467-9388.2008.00580.x>

Koivurova Timo, « The war on Ukraine : consequences for Finland and the Arctic » (2022) Polar Research & Policy Initiative.

Lasserre Frédéric « Le retour du mythe des passages arctiques : quel trafic maritime dans l'Arctique au XXIe siècle ? » (2019) Nordiques. Vol 37 p 9-23. <https://doi.org/10.4000/nordiques.422>

Lewis-Jones Huw, « Imagining the Arctic : Heroism, spectacle and polar exploration » Bloomsbury Publishing, 2017.

Martin Constance, « William Scoresby, Jr (1789-1857) and the open polar sea - myth and reality » (1988) Arctic. Vol 41(1) p39-47. <https://www.jstor.org/stable/40510661>

Melia N, Haines K, Hawkins E. « Sea ice decline and 21st century trans-Arctic shipping routes ». (2016) Vol 43(18) Geophysical Research Letters. p9720-9728. <https://doi.org/10.1002/2016GL069315>

Molnar Jennifer L, Gamboa Rebecca L, Revenga Carmen, Spalding Mark D. « Assessing the global threat of invasive species to marine biodiversity ». (2008) Vol 6(9). Frontiers in Ecology and the Environment. p485-492. <https://doi.org/10.1890/070064>

Peters G.P, Nilssen T.B, Lindholt L, Eide M.S, Glomsrød S, Eide L.I, Fuglestedt J.S. « Future emissions from shipping and petroleum activities in the Arctic ». (2011) Vol 11(11) Atmospheric Chemistry and Physics. p 5305-5320. <https://doi.org/10.5194/acp-11-5305-2011>

Pinsky Malin L, Reygondeau Gabriel, Caddell Richard, Palacios-Abrantes Juliano, Spijkers Jessica, Cheung William W.L. « Preparing ocean governance for species on the move » (2018) Vol 360(6394) Science p1189-1191. DOI: 10.1126/science.aat2360

Pirotta Vanessa, Grech Alana, Jonsen Ian D, Laurance William F, Harcourt Robert G. « Consequences of global shipping traffic for marine giants. » (2019) Vol 17(1) *Frontiers in Ecology and the Environment*. p39-47. <https://doi.org/10.1002/fee.1987>

Rahbek-Clemmensen, Jon, « When do ideas of an Arctic Treaty become prominent in Arctic governance debates ? » (2019) *Arctic*. Vol 72(2), p116-130. <https://www.jstor.org/stable/26739923>.

Redgwell Catherine, « Treaty evolution, adaptation and change : is the LOSC ‘enough’ to address climate change impacts on the marine environment ? » (2019) *The International Journal of Marine and Coastal Law*. Vol 34(3), p440-457. doi:10.1163/15718085-13431096

Riffenburgh Beau, « The myth of the explorer : the press sensationalism & geographical discovery//Review » (1994) *Arctic*. Vol (47)3 p315.

Seebens Hanno, Schwartz Nicole, Schupp Peter J, Blasius Bernd. « Predicting the spread of marine species introduced by global shipping ». (2016) Vol 113(20). *Proceedings of the National Academy of Sciences*. p5646-5651. <https://doi.org/10.1073/pnas.1524427113>

Smits Jan M. « What is legal doctrine ? On the aims and methods of legal-dogmatic research » (2015) Rob Van Gestel, Hans-W Micklitz, Edward L Rubin (eds), *Rethinking Legal Scholarship : a Transatlantic dialogue*, New York. Cambridge University Press. (2017) p207-228. Maastricht European Private Law Institute Working Paper No 2015/06. <https://dx.doi.org/10.2139/ssrn.2644088>

Solski Jan Jakub, « The “due regard” of article 234 of UNCLOS : Lessons from regulating innocent passage in the territorial sea. » (2022) *Ocean Development & International Law*. Vol 52(4). p398-418. <https://doi.org/10.1080/00908320.2021.1991866>

Stephenson Scott R, Wang Wenshan, Zender Charles S, Wang Haillong, Davis Steven J, Rasch Philip J, « Climatic responses to future trans-Arctic shipping » (2018) *Geophysical Research Letters*. Vol 45(18) p9898-9908. <https://doi.org/10.1029/2018GL078969>

Sun Zhen, « International regulation of heavy fuel oil use by vessels in arctic waters » (2019) *The International Journal of Marine and Coastal Law*. Vol 34(3), p513-536. doi: 10.1163/15718085-13431095

Verhaag Melissa A, « It's not too late : the need for a comprehensive international treaty to protect the Arctic environment. » (2002) *Georgetown International Environmental Law Review*. Vol 15, p555. HeinOnline, <https://heinonline.org/HOL/P?h=hein.journals/gintenlr15&i=567>.

Wan Zheng, El Makhloufi Abdel, Chen Yang, Tang Jiayuan, « Decarbonizing the international shipping industry : solutions and policy recommendations. » (2018) *Marine pollution bulletin*. Vol 126, p428-435. <https://doi.org/10.1016/j.marpolbul.2017.11.064>

Ware C, Berge J, Sundet J.H, Kirkpatrick J.B, Coutts A.D, Jelmert A, Alsos I.G. « Climate change, non indigenous species and shipping : assessing the risk of species introduction to a high-Arctic archipelago » (2014) Vol 20 (1) *Diversity and Distributions*. p10-19. <https://doi.org/10.1111/ddi.12117>

Williams Laura C, « An ocean between us : the implications of inconsistencies between the navigational laws of coastal arctic council nations and the United Nations Convention on the Law of the Sea for Arctic Navigation. » (2017) *Vanderbilt Law Review*. Vol 70, p379.

Young Oran R, « If an Arctic Ocean Treaty is not the solution, what is the alternative ? » (2011) *Polar Record*. Vol 47(4), p327-334. <https://doi.org/10.1017/S0032247410000677>

Young Oran R and Kim Jong-Deog, « Next steps in Arctic Ocean governance meeting the challenge of coordinating a dynamic regime complex. » (2021) Marine Policy Vol 133, p104726. <https://doi.org/10.1016/j.marpol.2021.104726>

Zhang Qiang, Wan Zheng, Hemmings Bill, Abbasov Faig, « Reducing black carbon emissions from Arctic shipping : Solutions and policy implications. » (2019) Journal of Cleaner Production. Vol 241, p118261. <https://doi.org/10.1016/j.jclepro.2019.118261>

Reports

Arctic Council, « Arctic Marine shipping assessment 2009 report » (2009).

Arctic Council, « AMAP Assessment 2018: Arctic Ocean Acidification. » (2018).

Arctic Council, Arctic Monitoring and Assessment programme (AMAP) « Arctic Climate Change Update 2021 : Key trends and impacts. Summary for policy-makers. » (2021).

Arctic Council, NOAA « Executive summary » (2021). DOI: 10.25923/5s0f-5163

IPCC, « Climate Change 2022 : Impacts, Adaptation and Vulnerability, Cross-Chapter Paper 6 : Polar Regions. » (2021)

IPCC, « Special Report on the ocean and cryosphere in a changing climate. Chapter 3 Polar Regions. » (2019).

IPCC, « Special Report on Climate Change and Land (2019).

IPCC, « Climate Change 2013: The Physical Science Basis » - AR5-WG1 (2013).

Transport and Environment (2018) Cost analysis of Arctic HFO ban for Cruise shipping.
https://www.transportenvironment.org/sites/te/files/publications/2018_10_Cost_analysis_Arctic_HFO_ban_cruise%20shipping_FINAL.pdf

Comer Bryan, Olmer Naya, Mao Xiaoli, Roy Biswajoy, Rutherford Dan. « Prevalence of Heavy Fuel Oil and Black Carbon in Arctic Shipping, 2015 to 2025 » (2017) International Council on clean Transportation.

Internet sources

Arctic Council, “About the Arctic Council” <<https://www.arctic-council.org/about/>>(last accessed 25 May 2022).

International Maritime Organization, “International Code for Ships Operating in Polar Waters (Polar Code)”<<https://www.imo.org/en/OurWork/Safety/Pages/polar-code.aspx>>(last accessed 25 May 2022).

International Maritime Organization, “Further shipping GHG emission reduction measures adopted”<<https://www.imo.org/en/MediaCentre/PressBriefings/pages/MEPC76.aspx>> (last accessed 25 May 2022).

Official Sources

Agreement to prevent unregulated high seas fisheries in the central arctic ocean, entry in force on 18 March 2019. OJ L 73.

Antarctic Treaty signed 1 December 1959, in force 23 June 1961. 402 UNTS 71.

Basel Convention on the control of transboundary movements of hazardous wastes and their disposal, signed on 22 March 1989, entry in force on 5 May 1992.

Convention on Biological Diversity (CBD), signed on 5 June 1992, entry in force on 29 December 1993.

International Code for Ships Operating in Polar Waters (Polar Code), entry in force on 1 January 2017. IMO Doc. MEPC 68/21/Add.1 Annex 10.

International Convention for the prevention of pollution from ships (MARPOL), signed on 17 February 1973, entry in force on 2 October 1983. 1340 UNTS 61.

International Convention for the safety of life at sea (SOLAS), entry in force on 25 May 1989. IMO Doc. Res. A.851 (20).

Kyoto Protocol to the United Nations Framework Convention on Climate Change, adopted 10 December 1997, in force 16 February 2005, 2303 UNTS 148 37 ILM 22.

Paris Agreement under the United Nations Framework Convention on Climate Change, adopted 12 December 2015, entry in force 4 November 2016. UN Doc. FCCC/CP/2015/10/Add.1.

Rotterdam Convention on the Prior Informed Consent Procedure for certain hazardous chemicals and pesticides in international trade, signed on 10 September 1998, entry in force on 24 February 2004.

Stockholm Convention on Persistent Organic Pollutants, signed on 22 May 2001, entry in force on 17 May 2004.

United Nations Convention on the Law of the Sea (LOSC), signed on 10 December 1982, entry in force 16 November 1994, 1833 UNTS 3.

United Nations Framework Convention on Climate Change, signed June 1992, entry in force on 21 March 1994.