10-31-2022

Evaluating enforcement of environmental measures to fishing vessels not covered by SOLAS operating in Antarctic waters

Manuel Alejandro Fuenzalida Lopez

WORLD MARITIME UNIVERSITY
Malmö, Sweden

EVALUATING ENFORCEMENT OF ENVIRONMENTAL MEASURES TO FISHING VESSELS NOT COVERED BY SOLAS OPERATING IN ANTARCTIC WATERS

By

MANUEL FUENZALIDA
Chile

A dissertation submitted to the World Maritime University in partial fulfilment of the requirements for the award of the degree of

MASTER OF SCIENCE
in
MARITIME AFFAIRS

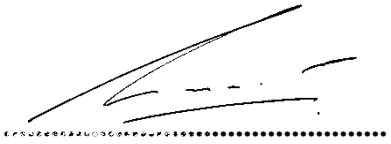
(MARITIME SAFETY AND ENVIRONMENTAL ADMINISTRATION)

2022

Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature): 

(Date): **20 - 09 - 2022**

Supervised by: **Dr. Dimitrios Dalaklis**

Supervisor's affiliation**: Professor - WMU**

Acknowledgements

First and foremost, I must express my utmost gratitude to my beloved wife, Javiera, for being the pillar of our family in this incredible adventure. We left Chile being three, and our second son was born in Malmö, adding all the challenges and complexities of parenthood away from our families to this educational process. However, her strength, support, conviction, and endless motivation were the light that showed me the right path to follow to be the best father and student I could be. I would not have been able to do anything of this without you.

I want to extend my gratitude to the Chilean Navy and its Directorate General of the Maritime Territory and Merchant Marine (DIRECTEMAR), for entrusting me with the honour and responsibility of representing Chile as an MSc student at the prestigious World Maritime University, sponsoring me, and giving our family the chance to live together in the delightful city of Malmö.

I sincerely appreciate all WMU Staff, Faculty, Professors, and World Bistró Crew, whom I got the chance to work with and learn many valuable lessons, not just academically but also from a professional/family life perspective. Your kindness, wisdom, support, and even a friendly smile were vital in every moment, especially the most complicated ones.

Special thanks to all of my classmates from class 22 and especially to MSEA specialization group of professionals and, most surely, future international maritime leaders. It was an incredible journey, and we learned a lot from each other experiences as well as from the excellent lectures we shared. Now we all have the tools our distinguished professors Dalaklis, Baumler, and Hebbar provide to keep building, growing, and improving from it. It is not our time to build more capacities in our respective countries. This graduation from WMU is not the end; it is just the beginning.

I am very much grateful to all my colleagues from Latin American countries whom I was lucky enough to meet on this journey. It was one of the biggest honors of my professional career to study, work, dream, and build with you all. We were able to work as a regional team and give birth to the WMU Latin American Alumni

Association LATAMA; being this living proof of what it takes to make dreams into reality is to have the will and put in the needed effort to achieve our common goals.

Lastly, my deep appreciation goes to my parents, parents-in-law, and family in general for their unconditional support at all stages of this life adventure. Your guidance, moral support, and lifelong lessons have continuously taught me to respect others and be a good man from all perspectives since the beginning. Every success is family merit and effort. Family is everything.

Abstract

Title of Dissertation: **Evaluating enforcement of environmental measures to fishing vessels not covered by SOLAS operating in Antarctic waters.**

Degree: **Master of Science**

Considering the Antarctic as a natural reserve devoted to peace and Science, its protection is related to the three pillars of the Sustainable development goals settled by the United Nations Agenda 2030 (Economical, Social, and Sustainable pillars). Therefore, the research critically analyzes the current Antarctic Governance from an environmental perspective in order to identify risks of Non- SOLAS fishing vessels operations in Antarctic waters and to develop, via qualitative method based on international maritime expert´s opinions, a recommendation for a regulatory path toward the improvement of current regulations and efficient implementation, entry into force, and further enforcement of protective measures.

According to the International Antarctic Treaty, countries with a pending territorial claim and bases/responsibilities within the Antarctic continent must enforce the polar code to vessels, but what about the vessels not regulated under SOLAS? Particularly, fishing vessels/fleets are looking forward to exploring and exploding new areas still pristine and full of resources. Given the complexities of the current governance "status quo" established by the Antarctic Treaty, the research data was collected digitally using surveys and then critically analyzed by qualitative method on the participant's technical opinions to widely address the current implications, challenges, and recommendations of the topic, for a better international environmental assessment.

The research achieved a 100% consensus among its participants to define the Non-SOLAS fishing vessel operations in Antarctic waters as a clear environmental risk for the area. Furthermore, a vast majority of 77,8% believed that extending the measures established by the Polar Code to Non-SOLAS vessels is a good starting point to an effective entry into force. However, given Antarctica's unique international governance conditions, the enforcement approach did not reach common ground

among the participants. In this sense, the definition of which one should be the institution/organization/state in charge of enforcement was a "grey area" that could not be defined. Nevertheless, most experts agreed on the need to stop regulation compliance based only on the "goodwill" of the member states due to a wide range of associated risks, especially from an environmental protection perspective.

KEYWORDS: Antarctic, Antarctic Treaty, Enforcement, non-SOLAS Fishing vessels, International Code for ships Operating in Polar Waters (Polar Code).

Table of Contents

Declaration ..... *i*

Acknowledgements ..... *ii*

Abstract ..... *iv*

List of Tables ..... *viii*

List of Figures ..... *ix*

List of Abbreviations *1*

Chapter 1. Introduction *2*

1.1 Background and Context. **2**

1.1.1 Fishing operations in Antarctic waters. 3

1.1.2. Antarctic Governance 5

1.1.3. IMO and enforcement of environmental measures in Antarctic waters. 5

1.2 Problem Statement **6**

1.3 Research Aims and Objectives **7**

1.4 Research Questions **8**

1.5 Research Methodology **8**

1.6 Anticipated Outcomes **9**

1.6.1. Limitations 9

Chapter 2. Literature Review *11*

2.1 International Code for ships Operating in Polar Waters (POLAR CODE) **11**

2.1.1. Steering the discussion towards gaps and challenges after 5 years since Polar Code entry into force. 13

2.2 The International Convention for the Prevention of Pollution from Ships (MARPOL) **16**

Annex I "Regulation for the Prevention of Pollution by Oil" 17

Annex II "Regulations for the control of pollution by Noxious Liquid Substance in bulk" 17

Annex III "Regulation for prevention of pollution by harmful substance carried at sea in packaged form". 18

Annex IV "Regulation for the prevention of pollution by sewage from ships" 18

Annex V "Regulation for the prevention of pollution by garbage from ships". 18

Annex VI "Regulation for the prevention of Air pollution from ships" 18

Especial Areas under the MARPOL Convention, the case of Antarctic 18

2.3 International Convention for Safety of Life at Sea (SOLAS) **19**

2.4 The Antarctic Treaty System and the Protocol on Environmental Protection to the Antarctic Treaty (The Madrid Protocol) **22**

2.5 Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) **25**

2.6 Conclusions **27**

Chapter 3. Research Methodology *29*
3.1 Introduction **29**
3.2 Research Strategy **29**
3.4 Ethical Considerations **30**
3.4.1 Quantitative Method-Survey Questionnaire 31
3.5 Data Analysis **32**
3.6 Reliability and Validity **33**
3.7 Limitations **34**
Chapter 4. Data Analysis *35*
4.1 Introduction **35**
4.2 Qualitative Data Analysis **35**
4.2.1. Data Collection and Preparation for Analysis 36
4.2.2 Qualitative Data Analysis 36
4.3. Analysis of the Survey Data **44**
4.4 Findings **49**
4.5 Conclusions **51**
Chapter 5. Summary, conclusion, and recommendations. *53*
5.1 Summary of the Study **53**
5.2 Highlighting the main findings **54**
Research Objective One 54
Research Objective Two 55
Research Objective Three 56
5.3 Conclusions **58**
5.4 Recommendations **59**
References *62*
Appendices *67*
Appendix A: Questionnaires **67**
Appendix B: Ethics considerations Sample of Consent Form **69**

List of Tables

Table 1 Breakdown of the Polar Code´s parts and chapters. 13
Table 2 Summary of MARPOL Annexes, along with the date of entry into force... 17
Table 3 MARPOL "Specific Areas" Annexes including Antarctic and its dates of adoption, entry into force, and entry into effect. 19
Table 4 SOLAS´s chapters and the different Codes developed from it. 21
Table 5 The Madrid Protocol´s Annexes, dates of adoption, and date of entry into force. 25
Table 6 General characteristics of participants by gender, working experience, and age groups. 31
Table 7 Participant´s countries of origin and organizations..... 34

List of Figures

Figure 1 Antarctic Fisheries presented by resources relevance, catches, and areas of operations. 4
Figure 2 Maximum extent of Antarctic area application. 12
Figure 3 Polar Code Limitations after 5 years of entry into force. 14
Figure 4 Summary of Gaps in Implementation of the Polar Code Environmental Measures. 16
Figure 5 Territorial claims over Antarctica and its overlappings. 23
Figure 6 CCAMLR Convention Area, Sub-areas, and divisions. 26
Figure 7 Five steps for creating a Qualitative Study. 30
Figure 8 Summary of responses in relation to question number 1. 37
Figure 9 Summary of responses in relation to question number 3. 38
Figure 10 Summary of responses in relation to question number 4. 39
Figure 11 Summary of responses in relation to question number 5. 40
Figure 12 Summary of responses in relation to question number 6. 41
Figure 13 Summary of responses in relation to question number 7. 42
Figure 14 Summary of responses in relation to question number 8. 44
Figure 15 Co-relation between research objectives and questions in the survey. 45
Figure 16 Main Findings into four categories. 49

List of Abbreviations

AT	Antarctic Treaty
ATS	Antarctic Treaty System
ATS	Antarctic Treaty System
ASMA	Antarctic Specially Managed Areas
ASOC	Antarctic and Southern Ocean Coalition
ASPA	Antarctic Specially Protected Areas
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
EEZ	Economic Exclusive Zone
IMO	International Maritime Organization
IUU	Illegal, Unreported, and Unregulated fishing
MADRID PROTOCOL	Protocol on Environmental Protection to the Antarctic Treaty
MARPOL	The International Convention for the Prevention of Pollution from Ships
MPA	Marine Protected Areas
MEPC	Marine Environmental Protection Committee
NCSR	Sub-Committee on Navigation, Communications and Search and Rescue
POLAR CODE	International Code for ships Operating in Polar Waters
PSC	Port State Control
SAR	Search and Rescue
SOLAS	International Convention for Safety of Life at Sea
STCW	The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
UNCLOS	United Nations Convention on the Law of the Sea

Chapter 1. Introduction

1.1 Background and Context.

Global trade is mainly served by sea; as a result, the shipping industry should be considered as the backbone of the global economy and international trade, carrying over 80% of the total volume of goods (UNCTAD, 2021). Nevertheless, there are still two major maritime areas not fully developed on global trade up to their full capabilities, the Arctic and the Antarctic. Both may look similar in a theoretical-extremely simplistic- approach, but they are far from it. A fundamental but at the same time widely known definition for both Polar regions is to call them the nearby areas around the South and the North Pole. Nevertheless, the Antarctic ice cap in the south averages about 2,000 m in thickness and covers the natural landmarks of the Antarctic continent and its surroundings. On the other hand, the Arctic polar region up north refers to mainly packing and floating ice on the Arctic Ocean with a 2-3 m thickness and surrounding land masses (Dalaklis & Ölcer, 2018).

From an environmental perspective, it is proven that the Arctic water's ice has been on a noticeable decline over the past decade due to climate change consequences. Therefore, high economic and security interest is growing in the region, aiming to use new shipping routes and unexploded resources that will now be able to be explored. Moreover, the Arctic is seen from a different perspective, now a promising future connector between Europe and Asia and a developing field for financial activities. On the other hand, the Antarctic currently has no economic activity besides small-scale tourism and fishing off the coast, mainly targeting Antarctic Toothfish, mackerel icefish, and Antarctic Krill (CCAMLR, 2017) (Dalaklis & Ölcer, 2018). Considering the Antarctic as a natural reserve devoted to peace and Science (Hanifah et al., 2012), its protection is related to the three pillars of the Sustainable development goals settled by the United Nations Agenda 2030: Economical, Social, and Sustainable pillars (United Nations, 2015).

The Antarctic represents perhaps one of the last areas of the world still unexplored deeply, with a wide range of resources, ecosystems, and marine life to be

protected. Therefore, Climate change and species migration is accelerating the Economic interest in fishing in Antarctic waters, which look at this reserve as a source of income still unexploded (Brooks et al., 2018). Besides the significant efforts done at the international level to regulate activities in Antarctic waters, all of those legal bodies cover mostly vessels under the International Convention for Safety of Life at Sea (SOLAS), leaving no specific environmental measures to be enforced on the fishing vessels/fleets that are now operating in that region being currently out of that regulation.

1.1.1 Fishing operations in Antarctic waters.

To summarize the current situation on the ground, almost 20 different countries conduct fishing operations in Antarctic waters (Brooks et al, 2018), with Antarctic toothfish and Antarctic Krill being their primary objectives to catch. In addition, industrial fishing technologies have developed high-speed suction systems/vacuum pumps that can suck up to 800 tonnes of krill in one day, leaving both mammals and birds out of the competition when fighting for food in a "shared" environment. This phenomenon has been evidenced over the last years as fishing companies caught four humpback whales as bycatch, mainly during krill catching operations (Dickie, 2022). The same article states that the future of fishing in Antarctica will grow significantly in the following decades. Having substantial investments from countries such as Russia or China could lead to higher depredation of resources, risks to the environment, risks to navigation, and an eventual international governance crisis in such a particular "shared" area of operations with unique scenarios about enforcement of regulations.

In order to estimate the fishing activities in Antarctic waters and the primary ocean resources related to those activities, it is essential to consider how much is being captured in those waters. The following figure shows Antarctic fisheries based on the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). As seen in figure 1, Krill is by far the most crucial resource for the fishing industry in the area, followed by Toothfish. Nevertheless, the areas with the most vessels requesting fishing are not directly related to the previous resources. Furthermore, The

Ross Sea area carries more fishing operations for Toothfish. On the other hand, the Antarctic Peninsula gathers the most significant interest for the fishing vessels looking for Krill, especially on the coast of its west side, due richest shoals of this species. Moreover, it can also be observed how Marine Protected Areas (MPA) cover a small area considering the widespread resources all over the Antarctic waters.

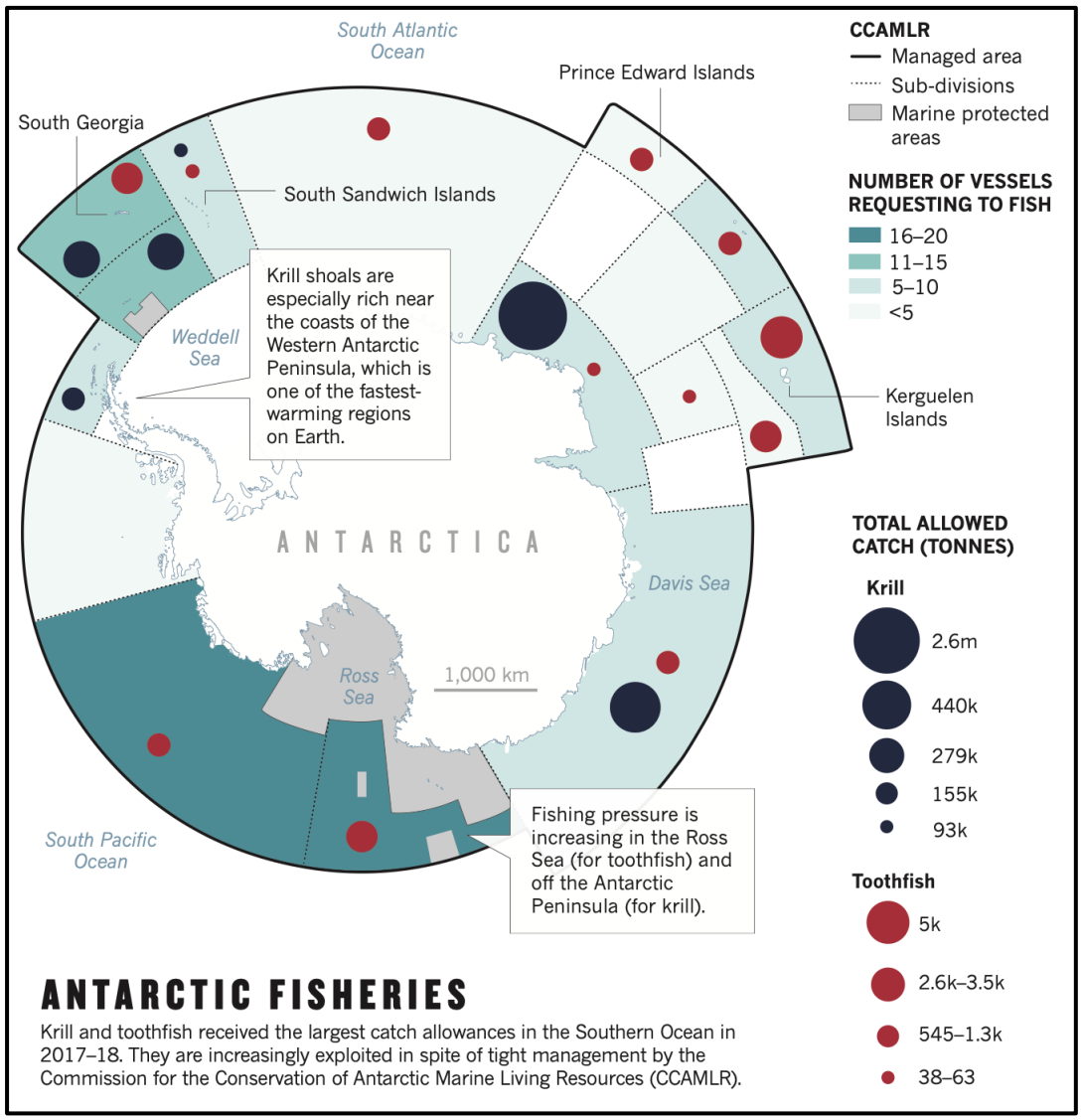


Figure 1 *Antarctic Fisheries presented by resources relevance, catches, and areas of operations.*

Source: Nature.com, 2018. Accessed on July 18th, 2022.

1.1.2. Antarctic Governance

The "Antarctic Treaty System" (ATS, 1959) established the Antarctic Continent as an "international area dedicated to Science and research", between the governments of Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, South Africa, Russia, The United Kingdom, and the United States of America. According to its provisions, Antarctica "shall continue forever to be used exclusively for peaceful purposes and shall not become the scene or object of international discord", prevailing that statement up to our days. For this reason, enforcing regulations (specifically environmental regulations in this case) on fishing vessels enrolling different states' flags get complicated. This specific issue is different under the same operational scenario compared to Arctic fishing regulations and enforcement. At the North Pole, there are established EEZ in neighbouring coastal states.

As a result of the evolution of governance and new challenges facing Antarctica, The Antarctic treaty´s states developed the Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol, 1991). In this case, the entire Madrid Protocol is oriented toward environmental protection, response to emergency incidents, and liability in case of harm to ecosystems. In Addition, another international treaty that aims to regulate Antarctic preservation is the Convention on the Conservation of Antarctic Marine Living Resources (CAMLR Convention, 1982). Its main objective was to conserve Antarctic marine life, but also as a response to everyday's more extensive commercial interest in Antarctic krill. It is essential to mention that the Antarctic krill resource is a crucial piece of the ecosystem's food chain that also carries a recent history of over-exploitation, affecting a wide range of related marine species in the Antarctic waters.

1.1.3. IMO and enforcement of environmental measures in Antarctic waters.

The International Maritime Organization IMO “is the United Nations specialized agency with responsibility for the Safety and Security of shipping and the prevention of marine and atmospheric pollution by ships” (IMO, 2019). Therefore,

under its organizational framework, regulations are constantly developed to achieve a level plain field for all on safety, security, and environmental performance. This last point, environmental performance, get a more relevant approach when related to Polar Areas, given their unique conditions and resources to be protected.

Moreover, The International Code for Ships Operating in Polar Waters (Polar Code) entered into force in January 2017, being mandatory under the International Convention for the Prevention of Pollution from Ships MARPOL and the International Convention for the Safety of Life at Sea (IMO, 2019). Hence, the Polar Code only applied to vessels covered by SOLAS regulation, leaving fishing vessels out of the equation. Just Recently, by June 30th, 2022, the IMO Sub-Committee on Navigation, Communications and Search and Rescue (NCSR) finalized their first draft of amendments to the Polar Code for Non-SOLAS Vessels, including, among others, fishing vessels operating in Polar Waters. On the positive side, there is a clear interest in regulating Non-SOLAS vessels in Polar Waters from a safety perspective. However, on the negative side, it does not yet include any Amendments aiming at Environmental Protection (MEPC) for this type of ship, particularly fishing vessels.

1.2 Problem Statement

Despite the numerous regulations, Treaties, Conventions, and Protocols previously mentioned, there are essential differences between the Arctic Region and the Antarctic regarding Governance (Dalaklis et al. 2016). As a matter of fact, the Arctic region's jurisdiction of coastal states is clearly defined under UNCLOS regulations, mainly by Economic Exclusive Zones EEZ attributions. On the other hand, the unique conditions of the Antarctic Continent Hold immediately make a difference based on the concept of Enforcement and who/under which conditions should be the organization in charge of that.

Another angle on this research is the Environmental Measures to Non-Solas Vessels, giving the known consequences their increasing operation in Antarctic waters can produce to the related Ecosystems and marine species now that “the southern ocean becomes more accessible to fishing” (Steven, 2018). Besides the recent efforts

to regulate this type of ship in Polar Waters done at the IMO level, the environmental measures are yet not part of the efforts. In the light of the timeframe needed to implement such vital regulations at an international level, it is directly against the quick and global response needed to protect the Antarctic resources from environmental collapse in the following years.

Lastly, according to the International Antarctic Treaty, countries with a pending territorial claim and bases/responsibilities within the Antarctic continent must enforce regulations such as the Polar Code (or its eventual future amendments in environmental issues) to all vessels including in the related regulations such as SOLAS. It is essential to realize that the Antarctic Treaty is based on the principle of goodwill of its member states in a current scenario with non-existing international jurisdiction but with high international interests related to the resources located in the same areas. Taking into consideration how essential to predict changes due to global warming, such as the sea-level rise and the implications for affected coastal populations, geopolitical interests also exist (ASOC, 2022) (Dalaklis & Ölcer, 2018).

1.3 Research Aims and Objectives

This academic research aims to evaluate the enforcement of environmental vessels to fishing vessels not covered by the SOLAS Convention operating in Antarctic waters. In the first stage, the objective is to identify the environmental threats from this type of ship in the Antarctic region. Furthermore, the research objective will focus on evaluating the impacts of climate change in the area under discussion and, at the same time, explore the need to enforce (on an efficient IMO timeframe) standardized environmental measures on fishing vessels and fleets operating above) parallel 60 degrees south (towards the South Pole). Finally, the third stage objective is to propose, after a critical/technical evaluation based on international experts' opinions, the environmental measures to be implemented and enforced on fishing ships not covered by SOLAS performing activities in Antarctic waters.

1.4 Research Questions

The impact of human activities in Antarctic waters is managed based on International Consensus and goodwill, but at the same time, environmental changes than can be related to the influence of humans on climate change have been reported in that area. Furthermore, research believes that ongoing and increasing negative changes can be expected (Goldsworthy & Brennan, 2021). Besides the Antarctic Treaty's and Madrid Protocol's good intentions, reaching consensus as a base for processes required to improve the treaty has been a significant challenge. Moreover, the Antarctic Treaty System countries share different views and interests about the region, making it complicated to move forward from the regulatory "status quo". The ATS could, at some point, oscillate its limits by the social pressure from public opinion or smart diplomacy, mainly from powerful and heavily influential states at a global stake (Young, 2021).

To further understand, analyze, and interpret the research data, the questions are as follows:

a. What are the environmental risks to the Antarctic Continent and its resources in relation to fishing vessels not currently covered by SOLAS operating in Antarctic waters?
b. Why is there a need to act on fishing vessels not currently covered by SOLAS operating in Antarctic waters?
c. How to Mitigate environmental risks coming from fishing vessels not currently covered by SOLAS operating in Antarctic waters?

1.5 Research Methodology

Considering the Antarctic as the project's primary focus and the difficulty of finding literature and experts related to the matters to analyze, the primary research methodology will be a Qualitative Approach. In the first place, a thoughtful review of the current regulatory framework for the Antarctic region and its governance system in place (Polar Code, MARPOL, SOLAS, Madrid Protocol, and CCAMLR). Furthermore, a comprehensive description of the issues will be done based on

international maritime experts' opinions collected by surveys, including their technical overview of the problems and eventual solutions related to this academic research. Moreover, this research will jointly consider experts' experience in the field of study with literature written by scientific authors. In any case, a deeper methodological analysis of the research and its results will be provided as part of chapter 3. Therefore, the data obtained by international experts will be interpreted by using methodological tools in that chapter.

1.6 Anticipated Outcomes

The analysis done by this research will lead to identifying the threats to the Antarctic continent and its resources represented by fishing vessels not currently covered by SOLAS. Therefore, evaluate the environmental threats from fishing vessels operating in Antarctic waters and their eventual adverse effects of climate change. In the light of the previous analysis results, propose enforcement measures that could be added to existing international regulations and then be implemented and applied by countries with responsibilities within the Antarctic Region to fishing vessels not covered by current environmental regulations.

1.6.1. Limitations

The chosen way to gather data was by doing web surveys/ online questionnaires with international maritime experts' opinions on different fields like Antarctica, safety, and environmental protection. The online questionnaires are an efficient method to get access to international maritime experts' opinions directly, but also a significant challenge to convince them and make them willing to spend their various time and knowledge to help on this research. Nevertheless, the small number of participants is because very few people have field/practical knowledge of Antarctic waters and its resources, especially in comparison with the Artic. This limitation was permanent throughout the process and linked to the region's current regulation and the lack of will from experts to make their opinions public. Because the Antarctic Treaty defines the Antarctic as a natural reserve devoted to peace and Science, some authors

believe that their opinion might end up representing their state's approach, which can be hard to deal on such a specific area when it comes to governance, environmental protection, and even maritime claims. The data was collected by sending the survey directly to each participant's emails, including specific instructions and clarifications regarding the research process. Therefore, their personal/technical opinions were sent back by them to the researcher automatically by the same online platform that gathered the results to be further critically analyzed and developed.

Chapter 2. Literature Review

2.1 International Code for ships Operating in Polar Waters (POLAR CODE)

On 1 January 2017 and for the first time, there was a standardized set of guidelines and regulations for most of the ships operating in the Arctic and Antarctic (Polar regions). The International Maritime Organization (IMO) officially implemented the International Code for Ships Operating in Polar Waters (POLAR CODE) as a way to provide a set of rules to protect not only vessels and their crews but also (and perhaps even more importantly) the fragile marine ecosystems of the polar regions, including all of the resources and living species from those habitats (WWF, 2022). Nevertheless, the process of getting the POLAR CODE established was long and complex due to many factors. Moreover, the development of the set of rules started way back in time, being agreed upon as amendments to The International Convention for Safety of Life at Sea (SOLAS) during IMO´s 94th session of the Marine Safety Committee (MSC) in November 2014. On the other hand, the environmental guidelines to POLAR CODE were added as amendments to The International Convention for the Prevention of Pollution from Ships (MARPOL) during Marine Environmental Protection Committee´s (MEPC) 68th session in May 2015 (IMO, 2019).

Technically speaking, the POLAR CODE address a broad spectrum of environmental protection, search and rescue, training, operational, equipment, construction, and design matters of critical relevance to ships operating in Polar water in both North and South Poles. Therefore, the mandatory measures regarding Safety are included in part I-A, while pollution prevention (as the leading environmental-related topic) is in part II-B. Building from that idea and according to the code itself, the goal of this set of rules is to "provide for safe ship operation and the protection of the polar environment by addressing risk present in Polar waters and not adequately mitigated by other instruments of the Organization" (POLAR CODE, 2016). An important point to be addressed for a better understanding of this research is the Area legally defined as Antarctic waters, established by SOLAS regulations XIV/1.2, as shown in the following figure. Therefore, the figure presents a perfect circle based on

a latitude of 60 degrees South as a borderline from where Antarctic waters start. Moreover, the SOLAS Convention generally presents the figure as a simple graphic demonstration of the Area without considering the vast complexities coming out of its unique governance system defined by the Antarctic Treaty.

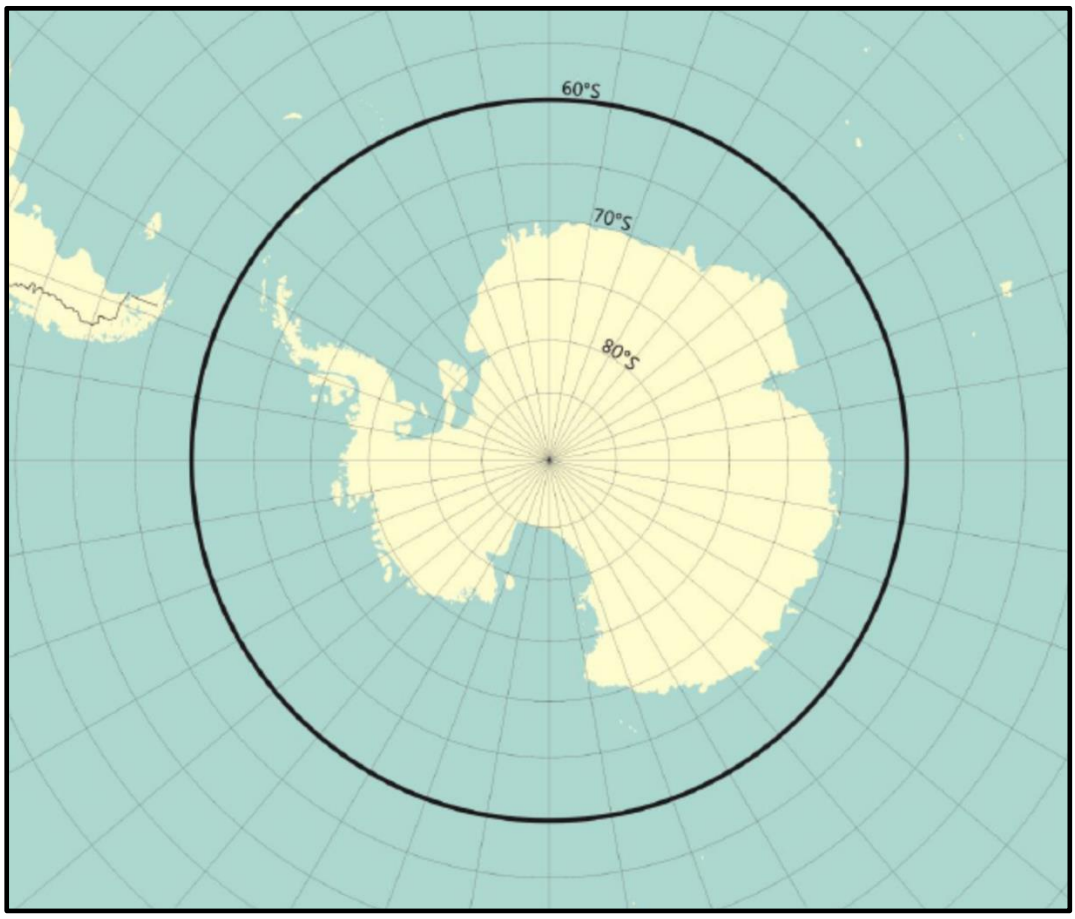


Figure 2 *Maximum extent of Antarctic area application.*

Source: Polar Code, 2016.

In order to have a smoother process of implementation, the Polar Code´s provisions were made mandatory by adding them to existing IMO´s regulations such as SOLAS, MARPOL, and the Standards of Training certifications and watchkeeping Convention (STCW). Nevertheless, after almost five years since the entry into force of the Polar Code, some specific gaps and observations have been presented by member states. The up-to-date version of the Code has a structure that divides the chapters into two sections, part IA and part IIA. To better understand this structure and

division, the following table presents the Code divided into the two parts/main areas (Safety and Environmental Protection) plus the chapters included in each one of them:

PART IA *"Safety Measures"*	PART IIA *"Pollution Prevention Measures"*
Chapter 1: General	**Chapter 1:** Prevention of Pollution by Oil
Chapter 2: Polar Water Operational Manual	**Chapter 2:** Control of Pollution by Noxious Liquid Substances in Bulk
Chapter 3: Ship Structure	**Chapter 3:** Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form
Chapter 4: Subdivision and Stability	**Chapter 4:** Prevention of Pollution by Sewage
Chapter 5: Watertight and Weathertight Integrity	**Chapter 5:** Prevention of Pollution by Garbage
Chapter 6: Machinery Installations	
Chapter 7: Fire Safety/Protection	
Chapter 8: Life-Saving Appliances and Arrangements	
Chapter 9: Safety of Navigation	
Chapter 10: Comunication	
Chapter 11: Voyage Planning	
Chapter 12: Manning and Training	

Table 1 *Breakdown of the Polar Code´s parts and chapters.*

Source: Created by the Author

2.1.1. Steering the discussion towards gaps and challenges after 5 years since Polar Code entry into force.

Now, putting particular focus on the environmental protection part of the Code (Part IIA) and after five years with this set of rules entry into force, more than a few observations/gaps have come into place. Building from that idea, World Wildlife Fund´s (WWF) Arctic Programme conducted a study to identify both challenges and gaps after implementing the Polar Code to address those issues internationally and avoid catastrophic consequences to the ecosystems in the future. Hence, their research identifies some relevant environmental risks not considered at all and need to be strongly regulated as soon as possible (WWF, 2021), such as:

- Underwater noise
- Grey Water discharges (e.g., showers, sinks)
- Air Pollution /Emissions
- Non-Solas Vessels (only "voluntary guidelines")

The following figure presents a summary of the gaps and challenges easy to understand but more complex to solve in the Antarctic, given its unique governance condition established by the Antarctic Treaty System (ATS). As seen in figure 3, limitations have been identified and addressed at the IMO level, but not all of them. Remarkably, the Polar Code limitations regarding part II, "Pollution Prevention Measures," are yet pendant from eventual solutions to a further implementation, as the non-SOLAS fishing vessels are one of the significant threats to it. Another line of thought is related to the lack of MPAs versus the proliferation of fishing operations in the area, leading to serious environmental threats to ecosystems if measures are not soon established, implemented, and enforced.

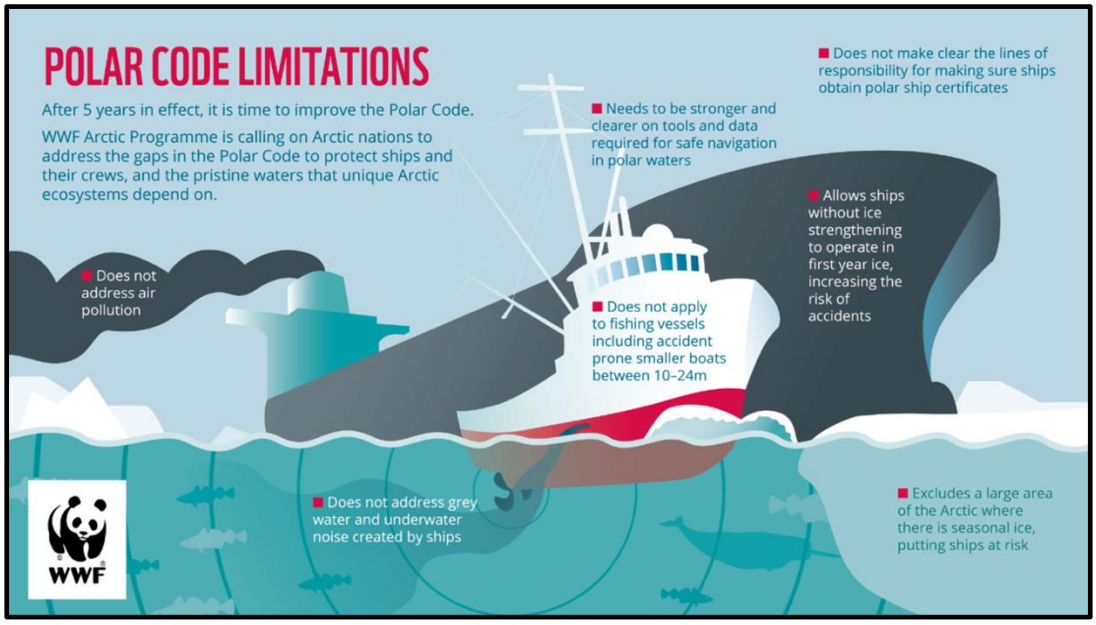


Figure 3 *Polar Code Limitations after 5 years of entry into force.*

Source: WWF, 2021. Accessed on July 26th, 2022

In this sense, the non-SOLAS vessels, and more specifically, the fishing vessels as part of that category, are a significant risk for the environment in the Artic, but maybe even more for the Antarctic. Prior (2022) analyzed the exception of applying the Polar Code to Non-SOLAS Vessels, concluding that besides the "Voluntary Guidelines" recommended by IMO to fishing vessels over 24 meters, it is just some extent that needs to be expanded to cover a vast range of environmental threats. Taking into consideration that IMO is currently working on amendments to

the code for Chapter 9 (Safety of Navigation) and Chapter 11 (Voyage planning) to be implemented by 2026 (IMO, 2022), it is relevant to mention that this only goes for Part IA and IB of the code, both related to safety measures. In other words, part IIA, "Pollution Prevention Measures," has no amendments to be implemented shortly, besides the climate change speed and its consequences (there is no time to lose). Moreover, organizations such as WWF Arctic Programme (2022) welcomed these new mandatory regulations for non-SOLAS vessels but also considered the approach insufficient to mitigate the environmental impacts in the area.

Chapter 5 of this research will address deeply the gaps observed not only in the Polar Code but also in other specific terms leading to proper enforcement of regulations, also based on maritime experts' opinions that will enhance the development of further recommendations for a better approach to the environmental risk represented by Non-SOLAS fishing vessels Operating in Antarctic Waters. However, for a better picture of the environmental challenges and gaps coming out of the Polar Code after its first official five years of legal existence, figure 4 summarizes some of them from an environmental perspective. As observed in the figure, nine different gaps were identified by the author, being Air Pollution, Grey water discharges, raw/untreated sewage discharges, underwater noise, and introduction of new species via ballast water/biofouling, the ones directly related to non-SOLAS fishing vessels operating in Antarctic waters:

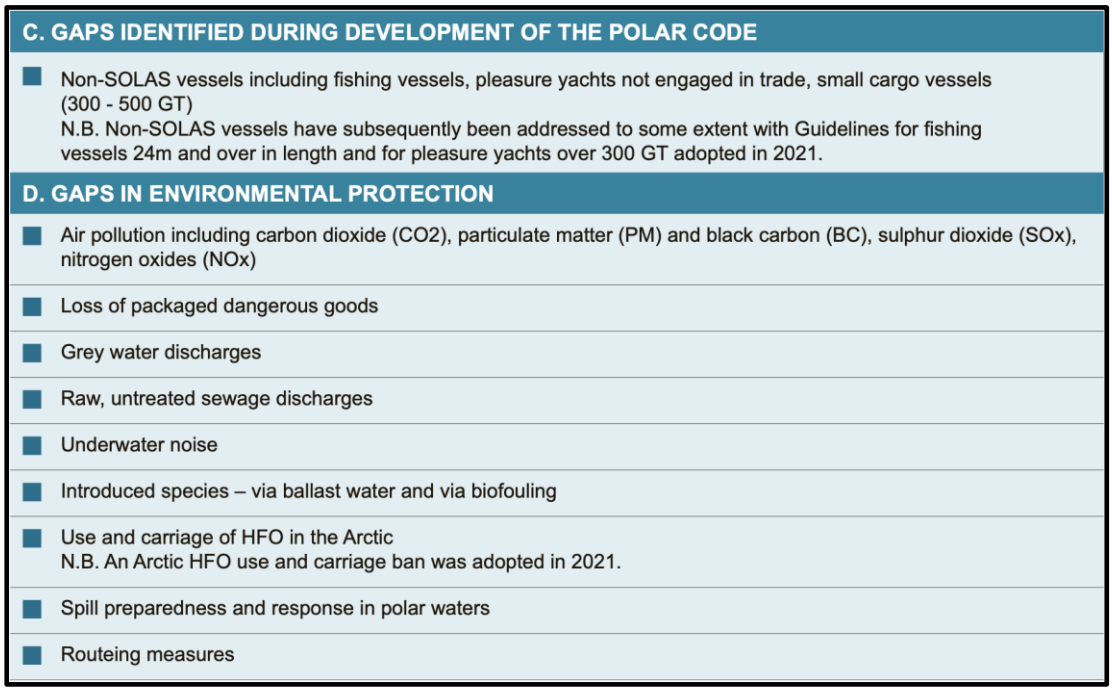


Figure 4 *Summary of Gaps in Implementation of the Polar Code Environmental Measures.*

Source: Prior, 2022.

2.2 The International Convention for the Prevention of Pollution from Ships (MARPOL)

Adopted on November 2, 1973, MARPOL is the leading international Convention that covers the prevention of pollution of the marine environment by ships caused by either accidental or operational reasons (IMO, 2019). Historically speaking, after its adoption, the protocol was added in 1978, before the first document entered into force, so the one from 1973 was "absorbed" by the latest one. Furthermore, that combined set of rules entered into force on October 2, 1983. Fourteen years later, in 1997, a Protocol was agreed to amend the Convention. Subsequently, Annex VI (Prevention from Air Pollution from Ships) was added as an amendment to the Convention on May 19, 2005. In general, the MARPOL convention has been updated through the years to keep pace with the evolution of technologies, science, and the needs of the shipping industry worldwide.

Conceptually, the Convention aimed to prevent pollution and minimize the consequences whenever incidents of this type occur. It ensures shipping industry to

operate being careful with the marine environment on their least damaging modes of transportation (Marine Insight, 2019). Accidental or Operational Pollution incidents have been addressed via mandatory regulations and guidelines, currently divided into Six Annexes for technical purposes. For a better understanding of the code and its structure, the following table presents the annexes by number, title, and date of entry into force as follows:

MARPOL ANEXXES		
Number	**Tittle**	**Entry into force**
Annex I	Regulations for the prevention of Pollution By Oil	02- October - 1983
Annex II	Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk	02- October - 1983
Annex III	Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form	01 - July - 1992
Annex IV	Prevention of Pollution by Sewage from Ships	27 – September- 2003
Annex V	Prevention of Pollution by Garbage from Ships	31 – December - 1988
Annex VI	Prevention of Air Pollution from Ships	19 – May - 2005

Table 2 *Summary of MARPOL Annexes, along with the date of entry into force.*

Source: Created by the Author.

Annex I "Regulation for the Prevention of Pollution by Oil"

It was adopted in October 1983, looking to prevent and control all oil discharges from ships, both intentionally or accidentally. Therefore, annex I is divided into 11 chapters and a total of 47 regulations

Annex II "Regulations for the control of pollution by Noxious Liquid Substance in bulk"

Also established in October 1983 just as Annex I, but in this case aims to prevent and control pollution produced by liquid substances in bulk (intentionally or accidentally). Moreover, it contains ten chapters sub-divided into 22 different regulations.

Annex III “Regulation for prevention of pollution by harmful substance carried at sea in packaged form”.

This annex was added to the convention in July 1992 and addressed all hazardous substances carried in packaged cargo. Hence, this annex is divided into two chapters that contain 11 different regulations.

Annex IV “Regulation for the prevention of pollution by sewage from ships”

This Annex was officially adopted in September 2003, and it is oriented to prevent pollution related to sewage from ships. It is divided into seven chapters that include 18 different regulations.

Annex V “Regulation for the prevention of pollution by garbage from ships”.

It entered into force in December 1988, and the objective of this Annex is to deal with the garbage produced onboard vessels and how prevent the pollution coming out of it. It compresses three chapters, divided into 14 regulations.

Annex VI “Regulation for the prevention of Air pollution from ships”

This Annex is the newest addition to MARPOL Convention by May 2005, and it was created to deal with air pollution from ships specifically, how to prevent it, and reduce those emissions. Currently is being addressed constantly at the IMO level, plus other organizations such as European Union (UE). It is essential to mention that MARPOL Annex VI is not considered (yet) in the Polar Code.

Especial Areas under the MARPOL Convention, the case of Antarctic

MARPOL defines “Special Areas” in Annexes I (Regulation for the Prevention of Pollution by Oil), II (Regulations for the control of pollution by Noxious Liquid Substance in bulk), IV (Regulation for the prevention of pollution by sewage from ships), and V (Regulation for the prevention of pollution by garbage from ships). This “special areas” concept was developed for purely technical reasons concerning their ecological, oceanographical, and sea traffic conditions; the implementation of unique

mandatory methods to prevent pollution at sea is required (IMO, 2019). The entire list of "special areas" under MARPOL is long, but for this research, the ones affecting the Antarctic are as follows:

ANTARCTIC AS MARPOL "SPECIFIC AREA"				
Annex No	**Annex name**	**Addopted**	**Entry into force**	**In effect from**
Annex I	Prevention of Pollution by Oil	16 Nov 1990	17 Mar 1992	17 Mar 1992
Annex II	Control of pollution by Noxious Liquid Substance in bulk	30 Oct 1992	1 Jul 1994	1 Jul 1994
Annex V (*)	Prevention of pollution by garbage from ships	16 Nov 1990	17 Mar 1992	17 Mar 1992

*south of latitude 60 degrees south

Table 3 *MARPOL "Specific Areas" Annexes including Antarctic and its dates of adoption, entry into force, and entry into effect.*

Source: Created by the Author.

2.3 International Convention for Safety of Life at Sea (SOLAS)

The SOLAS convention is often recognized as the most crucial international set of rules concerning the safety of shipping (IMO, 2019). It was internationally adopted after the worldwide famous "Titanic" incident in 1914, and subsequently, its second version was implemented in 1929, the third in 1948, and the fourth in 1960. The up-to-date version was officially accepted in 1974 and included tacit acceptance procedures. In order to keep pace with technological development and stakeholders' needs for better implementation without affecting global trade, the SOLAS 1974 has been amended and updated on various occasions. Furthermore, it is currently referred to as SOLAS, 174, as amended. The principal objective of SOLAS is to define minimum standards for the construction, equipment, and operation of ships compatible with their safety (SOLAS, 1974).

Furthermore, the set of rules contained in SOLAS 74 is divided into fourteen chapters that independently were used to develop specific Codes to address maritime/shipping issues in a broader spectrum. It is relevant to mention that SOLAS 1974, as amended, applies to all passenger ships and cargo ships over 500 GT engaged on international voyages (unless provided otherwise in the Convention) (Joseph & Dalaklis, 2021).

Building from that idea, fishing vessels (as a general rule) are not covered by SOLAS or, even more specifically for this research, by chapter XIV, "Safety measures for ships operating in Polar Waters."

On and historical approach, since the first SOLAS version was approved in 1914, international regulations regarding Safety at sea have come after massive incidents/accidents that changed the shipping industry (and sometimes even world history) forever. The SOLAS Convention has not been the exception to this "writing in blood" rule, and the codes coming out of it prove this previous way of developing international maritime safety regulations. For example, after the Titanic incident, the SOLAS Convention was created; as a result of the Torrey Canyon disaster, the MARPOL convention was created; or after the attacks of 09/11, ISPS Code came into Force (As part of the SOLAS Convention). Hence, in the past, the international maritime community was "motivated" to increase maritime Safety and minimize the risks by developing rules and regulations that we keep using up to these days. In order to visualize the different chapters and codes coming out of SOLAS 74 as amended, the following table makes an easy-to-understand summary of it. As seen in table 4, each SOLAS chapter addresses risks assessed and, most of them, conducted to further the creation of a specific Code (or more than one in some cases) to elaborate deeper into those risks and how to achieve a common standard to mitigate them effectively.

SOLAS CHAPTERS & CODES		
Chapter No	**Chapter name (Risk Assesed)**	**Codes developed**
Chapter 1	General Provisions	SPS CODE RO CODE
Chapter II-1	Construction-Subdivision and Stability, Machinery and Electrical Instalations	Intact Stability Code
Chapter II-2	Fire Protection, fire detection and fire extintion	FSS Code FTP Code
Chapter III	Life Saving appliances and arrangements	LSA Code
Chapter IV	Radiocommunications	
Chapter V	Safety of Navigation	
Chapter VI	Carriage of cargoes	International Grain Code CSS Code IMSBC & BLU Code
Chapter VII	Carriage of dangerous goods	IMDG Code IBC Code & IGC Code
Chapter VIII	Nuclear Ships	INF Code
Chapter IX	Management for the Safe Operation of Ships	ISM Code
Chapter X	Safety Measure for high-speed craft	HSC Code
Chapter XI-1	Special measures to enhance maritime safety	MODU Code
Chapter XI-2	Special measures to enhance maritime security	ISPS Code
Chapter XII	Additional safety measures for bulk carriers	
Chapter XIII	Verification of Compliance	IMSAS Audit Scheme
Chapter XIV	**Safety measures for ships operating in Polar Waters**	**Polar Code**

Table 4 *SOLAS´s chapters and the different Codes developed from it.*

Source: Created by the Author

Furthermore, just as Joseph & Dalaklis (2021) stated in their pa, the SOLAS convention has to continuously improve to be up to date with new technologies developed by the shipping industry. For this reason, the Convention has been "growing" with time, providing new specific codes to address risk in more complex and technical ways. Moreover, after the beginning of this century, the old "reactionary" process has been moving towards "precautionary," trying to address new safety challenges such as Cyber security, Autonomous Shipping, and then, most important for this research, Operating in Polar Waters based on the entry into force of the Polar Code (SOLAS Chapter XIV, 2017). Elaborating deeper into the Polar issues and Antarctic operation, recently, the Sub-Committee on Navigation,

Communications and Search and Rescue (NCSR), in its ninth session on June 21-30, 2022, agreed on the implementation of Safety measures for non-SOLAS ships operating in Polar waters. The first draft of amendments (To the Polar Code) will apply to some Non-SOLAS ships, including fishing vessels of 24 meters in length overall and above, and aim to enhance the safety of ships operating under particular conditions present in polar areas. By November 2022, the IMO Maritime Safety Committee (MSC) will evaluate and eventually approve the amendments to Chapter XIV (and Polar Code parts I-A and I-B). Subsequently, its entry into force would be estimated for January 2026.

2.4 The Antarctic Treaty System and the Protocol on Environmental Protection to the Antarctic Treaty (The Madrid Protocol)

The Antarctic Treaty System (ATS) consists of the Antarctic Treaty plus several agreements related to it that include measures, recommendations, and resolutions from Consultative meetings aimed at issues such as management of tourism, protection of the Antarctic environment, safety, communications, and scientific cooperation. From a historical perspective, the ATS was officially signed by twelve countries in Washington (United States of America) on December 1st, 1959. Its entry into force was in 1961, and the number of nations being part of it has constantly been expanding to a total number of 54 countries. The establisher nations of the treaty were Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, South Africa, United Kingdom, United States, and USSR (now Rusia); being all of them actively involved with Antarctica at the time (Hanifah & Hashim, 2011). Therefore, seven signatories countries (Argentina, Australia, Chile, France, New Zealand, Norway, and the United Kingdom) had territorial claims; the US and Russia kept a "basis of claim," and other countries did not recognize any claim. The following figure presents the actual claims over the Antarctic continent as a context governance reference. As presented in figure 5, there are overlaps among the areas claimed by countries such as the United Kingdom, Argentina, and Chile in the Antarctic Peninsula

area; or the case of France, Australia, Norway, and New Zealand in the Ross Sea/Davis Sea areas (Opposite side of the Antarctic peninsula).

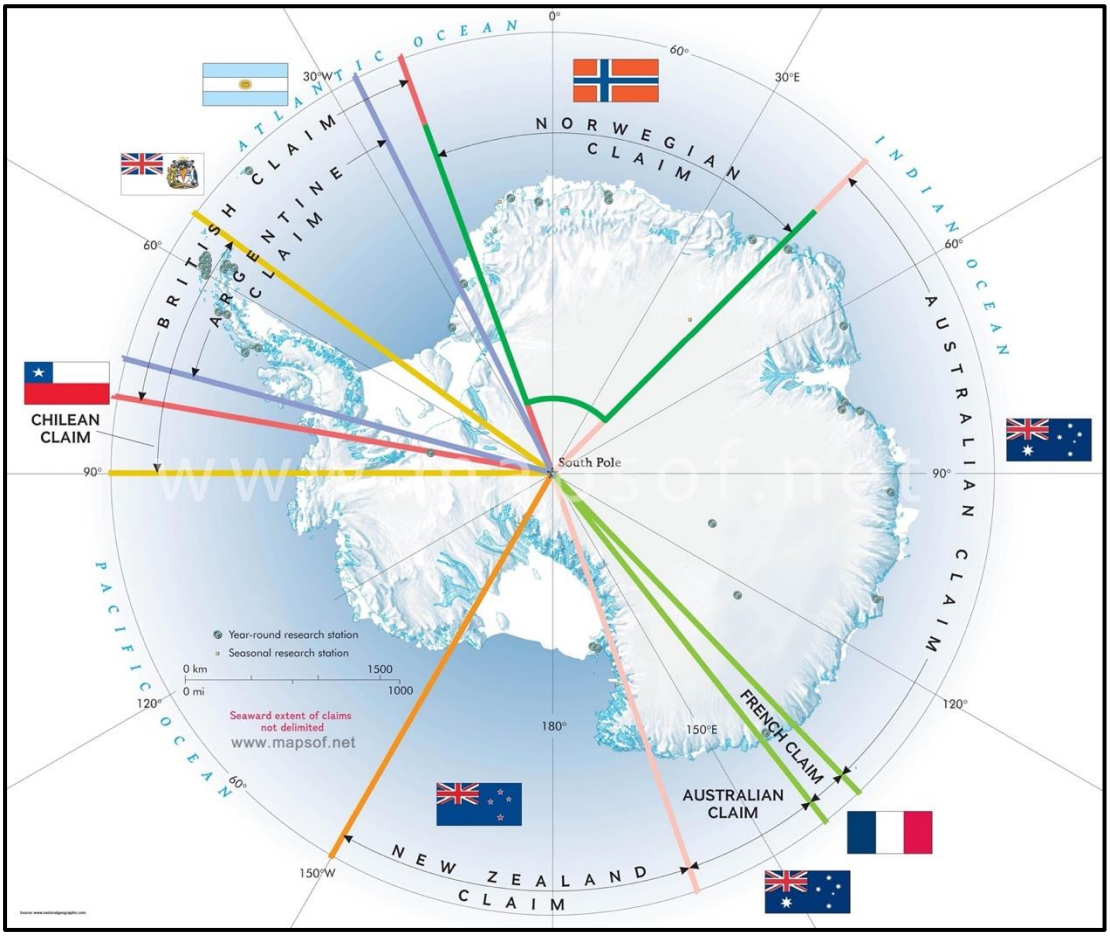


Figure 5 *Territorial claims over Antarctica and its overlappings.*

Source: ILSA E-Magazine, 2016. Accessed on July 29th, 2022.

Furthermore, some crucial provisions of the treaty that established rules, promote objectives, ensure observance of provisions, and preserves "status quo" can be seen on the following articles (ATS, 2022):

Art. I "Antarctica shall be used for peaceful purposes only

Art. II "Freedom of scientific investigation in Antarctica and cooperation toward that end….shall continue".

Art. III "Scientific observations and results from Antarctica shall be exchanged and made freely available".

Therefore, The Treaty established that the Antarctic should only be used for peace. In other words, no military activities of any kind should take place in that territory. Thus, the primary purpose of ATS is to protect the Antarctic environment (ATS, 2022), being this reinforced by the creation of the Madrid Protocol on Environmental Protection that was added to the Antarctic Treaty in 1991. The Madrid Protocol entered into force in 1998, at a point in time when it was known how a central role is performed by Antarctica in both oceanic and climate patterns, holding about 90% of the planet´s Freshwater (Hanifah et al., 2012). The Article II of this protocol established Antarctica as a "natural reserve to peace and science). It is relevant to mention that the Madrid Protocol cannot be modified up till 2048 unless there is a unanimous agreement of all consultative parties to the Antarctic Treaty. Also, mineral resource extraction is forbidden unless a binding legal regime is in force (Art. 25.5).

Structurally speaking, the Madrid Protocol is divided into six annexes. Annexes I to IV were adopted in 1991 and entered into force simultaneously as the protocol in 1998. Moreover, Annex V was separately adopted in 1991 and entered into force in 2002. Lastly, Annex VI was agreed upon and adopted in Stockholm in 2005 and still has not entered into force. This Annex VI refers to Liability regarding Environmental Emergencies, being this a matter of high complexity given Antarctica's unique governance and jurisdictional conditions. It is mainly "surprising" how this annex is yet not into force, considering how Article 16 of the Madrid Protocol requested to elaborate "rules and procedures relating to damage arising from activities taking place in the Antarctic Treaty area and covered by this protocol". In theory, annex VI should have been entered into force no later than five years after its adoption in 2005, yet being in 2022 (17 years later and 12 years after the original deadline), the countries (and also stakeholders) have not reached enough consensus to get the job done (Hemmings, 2018). The following table presents a summary of the Madrid Protocol's annexes, topics, dates of adoption, and dates of implementation as follows. As previously described, Annex VI "Liability" remains pendant, clearly demonstrating how complicated it is to achieve consensus among so many different interests. At the same time, the non-completion of the whole implementation process of the Madrid

Protocol takes International Maritime regulations back to the XX century from a reactionary perspective. Moreover, a status quo that sooner or later could be broken, and must be responsibly addressed to avoid further confrontations in the future and, more importantly, put the environment and ecosystems at risk due to humans' inability to agree on common goals, such as environmental protection in this case.

MADRID PROTOCOL ANNEXES			
Annex No	**Annex name**	**Addopted**	**Entry into force**
Annex I	Environmental Impact Assesment	04 Oct 1991	14 Jan 1998
Annex II	Conservation of Antarctic Fauna and Flora	04 Oct 1991	14 Jan 1998
Annex III	Waste Disposal and Waste Managment	04 Oct 1991	14 Jan 1998
Annex IV	Prevention of Marine Pollution	04 Oct 1991	14 Jan 1998
Annex V	Area Protection and Management	04 Oct 1991	25 May 2002
Annex VI	Liability Arising from Environmental Emergencies	17 Jun 2005	Not yet

Table 5 *The Madrid Protocol´s Annexes, dates of adoption, and date of entry into force.*

Source: Created by the Author.

2.5 Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)

The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) came to life as a multilateral response effort by the Antarctic Treaty System, represented by its Consultative Parties (ATCPs), due to eventual threats to Antarctic Marine Ecosystems produced by the increased commercial/industrial interest in fisheries resources from the south Pole waters. Moreover, the commission was established as an international convention in 1982, entering into force in that year and aiming to protect and promote the conservation of Antarctic Marine Life (CCAMLR, 2022). Therefore, CCAMLR is integrated by 26 member states plus 10 Acceding States, which means statutes that are part of the Convention but not a commission member. Building from that structure, the Commission adopts measures on compliance (goodwill) such as area bases management, data reporting, Research, Catch limits, and minimization of impacts on the Ecosystem (FAO, 2021).

Nevertheless, linking the commission adopted measures with this research, enforcing those under voluntary compliance is the main Challenge, considering enforcement as complicated (to say at least) operation under Antarctic waters given the current regulation.

As a mandate, the CCAMLR convention applies to all marine living resources south of the Antarctic Converged, which form part of the Antarctic Marine Ecosystem. Therefore, the Convention´s area of competence covers about 10% of the planet´s oceans with a surface of 35716100 km2. Hence, for a better understanding of CCAMLR´s area of voluntary compliance, the following figure will present it graphically as follows:

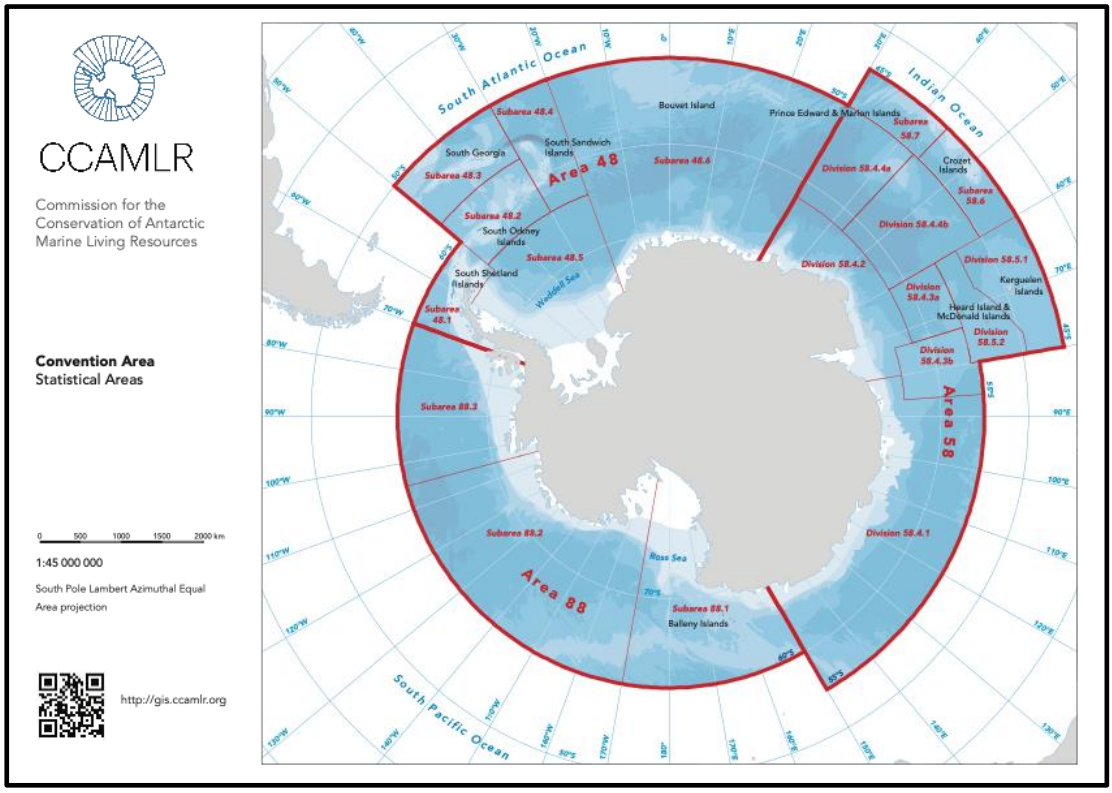


Figure 6 *CCAMLR Convention Area, Sub-areas, and divisions.*

Source: CCAMLR, 2022. Accessed on August 1st, 2022.

The Convention defines its own achievements over the last 30 plus years as a set of global benchmarks for operationalising an ecosystem approach to support the sustainable use of marine living resources (CCAMLR, 2020). Building from this idea, CCAMLR achievements includes as follows:

- Addressing the challenge of Illegal, Unreported, and Unregulated (IUU) fishing.
- Establishing Marine Protected Areas (MPAs) in the Southern Ocean
- Reducing seabird mortality
- Establishing the CCAMLR Ecosystem Monitoring Program (CEMP)
- Managing Vulnerable Marine Ecosystems (VMEs).

IUU Fishing remains an uncertain issue in Antarctic waters/Areas of the convention. The current concerns are basically the absence of verifiable information on fishing operations, the impact of IUU Operations on species, and the lack of detailed information concerning removals by IUU vessels (CCAMLR, 2020)

It is essential to mention that CCAMLR has conducted two performance reviews of its processes, the first in 2008 and the last in 2016. Therefore, both reviews are published and open to access. It was conducted to more than one conclusion that will be analyzed in chapter three of this research.

2.6 Conclusions

In conclusion, this chapter analyses the related literature that gives context to the research, and its questions, based on Antarctic governance, safety measures, and environmental protection. It is essential to consider the fact that the Antarctic Continent does not legally belong to any particular state, being this, in a general perspective, the main difference with the Arctic waters. Furthermore, and giving Antarctic conditions a being devoted to peace and science, protecting its resources and ecosystems is one of the primary concerns in all regulations addressed in this chapter. Nevertheless, there is also global consensus on how relevant it is to preserve the pristine condition of Antarctic ecosystems giving its relevance to the world. However, at the same time, everything regarding Antarctic regulations relies upon voluntary compliance or goodwill, making any enforcement of measures complicated, to say at least. By this phenomenon, the consequences of nom compliant vessels or even states are higher every time, also giving the growing interest in the resources and living species for the area for business purposes.

It is especially relevant to mention The Madrid Protocol Annex VI, “Liability arising from environmental emergencies”, as the perfect example of how hard it is to make mandatory regulations that will be tested in tricky scenarios, such as accidents and legal compensations out of it. The fact that it has been 17 years since approval but still not agreed upon by enough member states to enter into force demonstrates how the “status quo” works at some point but also leaves many relevant “grey areas” that sooner or later will collapse. This approach is like going back to the 20th century “Modus operandi” of reactionary regulations after very relevant accidents that gave birth to maritime regulations as we have today. On the other hand, the Polar Code, and its recently established second stage, now covering safety measures for some non-SOLAS vessels (such as fishing vessels), is a good demonstration of IMO not being reactionary, at least on the safety part of the problem.

Nevertheless, it was stated that the Polar code also has “gray areas”, primarily centered on the environmental protection of the issues. The continuous improvement processes are hard to get done, but climate change speed is not getting any slower. Thus, maritime regulators must add environmental protection updates as a priority for international governance in Antarctic Waters, specifically upon fishing vessels/fleets that sometimes are not compliant with “goodwill”, putting its financial success over “recommended” regulations in the area. The environmental consequences of such behaviours could be catastrophic for the ecosystems and the whole planet.

Chapter 3. Research Methodology

3.1 Introduction

In their book "Principles of Methodology: Research Design in Social Science, "the authors define methodology as "the understanding of how to proceed from the findings of empirical research to make inferences about truth- or at least the adequacy- of theories" (6 & Bellamy, 2012, p. 1). As a researcher, finding the proper methodology to give validity to a project constitutes a significant academic challenge. Therefore, this chapter discusses the methodology applied to develop the study. Moreover, the methodological approach covers the Research Strategy, Ethical Issues, Data Gathering, Data analysis, validity and reliability, and the limitations of this research.

3.2 Research Strategy

The research investigated the figure of fishing vessels not covered by SOLAS operating in Antarctic waters under the current regulations and the existing challenges to facing environmental threats coming from this type of ship, especially when it comes to enforcement of present of future regulations. For this purpose, the study focused on international experts' opinions from various countries, professions, and expertise; that could add value to the research. It is relevant to mention that the Antarctic is defined as a natural reserve devoted to peace and science that does not belong to any state but must be protected given the relevance of its resources, ecosystems, and environmental influence on the planet.

To develop this academic research, the methodology applied was a Qualitative Approach. The first stage involved profoundly understanding the problems through literature (regulatory) review and technically developed questionnaires to international maritime experts. Secondly, a description of the issues in a comprehensive matter, based on interpretation of the data gathered by experts, contrasting it with the current regulation on the subject and published academic studies. Finally, the small number of participants was due to the lack of experts in the specific Antarctic filed s of the study and the complexity of giving unbiased technical opinions giving the pending (status

quo) territorial claims of some states in that territory. As a result of the methodology process, the data gathered allowed the critical analysis and aim of the study´s objectives by following the design steps explained in figure 7.

Figure 7 *Five steps for creating a Qualitative Study.*

Source: Questionpro, 2022. Accessed on August 2, 2022.

3.4 Ethical Considerations

This study involved people as participants in questionnaires where their technical opinions were given for academic purposes. Hence, all ethical considerations were followed according to the in-depth review given by WMU Research Ethics Committee to ensure the high standard established by the University. Furthermore, the participant's privacy and rights were always protected, considering data protection, confidentiality, and anonymity. Since the first-person approach to the participants, it was crystal clear that their eventual contributions were purely voluntary, with no fees associated with their technical support to develop the research. It is also important to mention that no modifications to the data collected were done, and the entire material gathered was erased after the dissertation's submission. In addition, the WMU

Research Ethics Committee Protocol is attached in Appendix C.1: WMU Research Ethics Committee Protocol.

3.4.1 Quantitative Method-Survey Questionnaire

In this stage, the research collected data using a survey questionnaire as the primary source. The Survey was targeted at maritime experts from different countries involved in technical areas that could add value to the study. However, given the complexities of finding maritime experts willing to participate in the research, the process survey was distributed to a much higher number of experts than the ones that finally voluntarily agreed to be part of the process. To better understand what is considered an expert for this specific case of study and their professional backgrounds, the following figure presents their general characteristics and expertise based on gender, years of service/work in their organizations, and age groups.

General Characteristic of Participants			
Maritime Experts	**Division**	**Number**	**Porcentage**
Gender	Male	16	88,9%
	Female	2	11,1%
Working experience	Less tan 10 years	1	5,6%
	Between 10 and 20 years	4	22,2%
	More tan 20 years	13	72,2%
Age Groups	Less than 30 years old	0	0%
	Between 30 and 50 years old	11	61,1%
	More tan 50 years old.	7	38,9%

Table 6 *General characteristics of participants by gender, working experience, and age groups.*

Source: Created by the Author.

Building from the information presented in the above table, it can be seen that the international maritime experts participating in this study are 100% over 30 years old and a vast majority (72,2%) have at least more than 20 years of working experience as well. Besides the low amount of women participating in this research (only 11,1%), which will be further considered as a limitation, it can also be observed that there is a

direct relationship between age and working experience. Furthermore, to give the international perspective needed for this research, the participating experts with different backgrounds related to the topic were mandatory. In this sense, regardless of the difficulties finding maritime experts willing to participate, a vast number of them (considering a topic involving the Antarctic) supported the research, coming from the organizations and countries to later be presented in the chapter 3.6, table 7.

The questionnaire development was done based basically on the previous review of the literature related to Antarctic Governance, and the exploratory analysis conducted to establish the problem statements and the questions to give support to the expected outcomes of drafting the experts took time and did not cover all the countries that have direct-relevant interest in the area of Antarctic waters. The lack of research aiming specifically at the subject of this investigation led the study to create its approach to provide the answers needed and, by this, be able to achieve the previously established objectives. Furthermore, after the previous exploratory study plus the assigned lecturer's professional orientations, the questionnaire's final draft developed 18 questions covering the needed aspects to provide technical orientations to the research. Hence, the questionnaire was designed to collect data quantitively from international maritime experts. It is relevant to mention that all the questionnaires were sent and fulfilled in English, regardless of the nationality or mother languages of the participants, not to miss information in translation and to validate the international/global relevance of the Antarctic environmental protection related issues., under one common language/understanding.

3.5 Data Analysis

The main objective of the survey questionnaire was to enhance common ground of concerns and to gather proposals on how to address the challenges of regulations upgrades related to the research topic, implementation processes, and, more importantly, enforcement in the area itself. Building from that idea, the questions created to meet that academic role were guided by the questions presented in Appendix B “Questionnaires”. After finalizing the data collection phase, the content of it was

analyzed manually and with the support of google forms tools. By doing that, the ideas were better organized, and the outcome was more accessible to interpret from a technical perspective.

3.6 Reliability and Validity

The methodology based on a qualitative method used to collect the technical data needed to develop this study delivered great deep approaches and technical opinions aligned with the research's objectives. The questions included in the survey were faithfully prepared to provide a logical structure and to be technically validated by a WMU professor with a broad professional, academic, and "know-how" expertise in the international maritime sector and Polar issues. Furthermore, the participation of international maritime experts from eight different countries of origin and with an extensive spectrum of both technical experience and practical knowledge in the areas of international maritime governance, environmental protection, safety and security, Search and Rescue, law enforcement, Port State Control, maritime administration, coastal state duties, flag state duties, and IMO officials. Therefore, the results obtained from participants' opinions lead to developing a nice technical sample with a reliable and valid outcome. In order to provide a better interpretation of the participants, table 7 presents the countries, organizations, number of experts per country, and percentage of the total as follows:

Countries and Organizations of Participants				
No	**Country**	**Organization**	**Number**	**Porcentage**
1	**Canada**	Marine Institute	1	5,5%
2	**Chile**	Chilean Navy/Coast Guard	5	33,4%
		IMO Oficial	1	
3	**Colombia**	Colombian Navy/Coast Guard	1	5,5%
4	**Ecuador**	Ecuatorian Navy/Coast Guard	1	11,2%
		IMO Alternate Representative	1	
5	**Finland**	One Sea/Dimecc	1	5,5%
6	**Perú**	Peruvian Navy/Coast Guard	1	5,5%
7	**Singapur**	Maritime Port Authority MPA	1	5,5%
8	**United Kingdom**	Royal Navy	1	16,7%
		ITOPF	2	
9	**United States of America**	US Coast Guard	2	11,2%

Table 7 *Participant´s countries of origin and organizations.*

Source: Created by the Author.

3.7 Limitations

The protection of the resources of Antarctic water is a topic that generates international consensus regarding its relevance but, at the same time, gets complicated to regulate/implement/enforce, given the unique governance conditions of Antarctica. Hence, this research's first limitation was finding international al maritime experts willing to be part of academic research such as this. The international "status quo" developed by the Antarctic treaty and the state's territorial claims could complicate giving technical opinions while staying out of bias. Also, very few people have the knowledge or field experience in Antarctic waters compared to what can be seen in the Arctic. Therefore, comprehensive research, including maritime experts' opinions from countries with high relevance in Antarctic issues, such as Norway, China, Russia, South Korea, Japan, and Argentina, among others, would be highly recommended to provide a more general/global approach to find the best path to follow in order to protect the environment from threats such as non-SOLAS fishing vessels operating in Antarctic waters.

Chapter 4. Data Analysis

4.1 Introduction

In chapter 1 and chapter 2, the theoretical context framework and the proposed methodology to conduct the study were explained. In chapter 4, the data collected via surveys filled by international maritime experts providing their professional/technical opinions were critically analyzed using qualitative methodology.

4.2 Qualitative Data Analysis

The main idea of the qualitative survey for this research was to directly address the topic of interest by guiding the participants to provide their technical opinions on the matter precisely and avoiding deviations. Therefore, 18 international maritime experts agreed to voluntarily participate in the research process, as described in Chapter 3.6 (table 7). Consequently, data was saved and organized using google forms to display the information quickly to be fulfilled by the experts and afterward analyzed by the researcher. According to the information given individually by the participants, it took them between twenty minutes to an hour to conduct the surveys. This difference in the timeframes was basically due to the time needed to think and develop their own opinions, plus add technical data in some cases.

As a result, the data collected was critically analyzed, the areas of similarities were identified, and significant differences in technical opinions about the same topic were assessed. By doing this, the study developed recommendations based on standard approaches to solve the problems stated and established the “grey areas” in which there was no expert consensus for a deeper investigation if needed.

4.2.1. Data Collection and Preparation for Analysis

The questions and survey were prepared and conducted from Malmö (Sweden), and they were sent to the experts for completion starting from May 27th, 2022. The Data collection from the expert´s process was closed on July 17th, 2022, with 18 participants from 9 different countries. Therefore, all the questionnaires received were considered for the analysis phase to develop possible solutions for the problem statements. The software used to collect the data was google forms, sending the surveys directly to previously agreed experts to be fulfilled. Moreover, using the software mentioned before allowed the researcher to add participants from abroad with specific experience and technical knowledge, allowing them to elaborate as much as they wanted under the survey´s guidance, based on the questions and opinions requested. Furthermore, the "drafting" stage started in February 2022 with the first approaches, getting more participants during May, after the questionnaires were being sent. Besides the decrease of replies compared to the first stage of approaches to experts, the 18 participants provided precious answers that were highly useful for critical analysis development.

Once the survey's collection stage was closed, the data collected was organized to get both individual and general analyses. Hence, the main "yes or no" questions presented a clear tendency in most of them, but at the same time, specific areas of the research showed that no consensus existed between the expert's opinions from participants. Thus, the data will be statistically presented in chapter 4.2.2 to develop a clear interpretation of the data and an easier understanding of both tendencies and incongruencies from the surveys analyzed.

4.2.2 Qualitative Data Analysis

In order to provide general professional context to the research, the first question was conducted to evaluate how many participants were familiarized with the Polar Code. Building from the idea that this is the essential IMO regulation regarding Antarctic waters operations (even though the operations from fishing vessels are not currently included in that legal set of rules). It is relevant to mention that even though

most experts were indeed familiar with the Polar Code, three were not. Therefore, those three experts were professional law enforcers specialized in the fields of Economic Exclusive Zone operations, International Joint Training and Operations, and Professional Oil Spill private international instructor/responders. Hence, their professional opinions were also precious for the research from a technical perspective, especially regarding implementing and enforcing environmental regulations in specific areas. Furthermore, figure 8 shows that 15 experts (83,3%) were familiar with the polar code, while 3 (16,7%) were not.

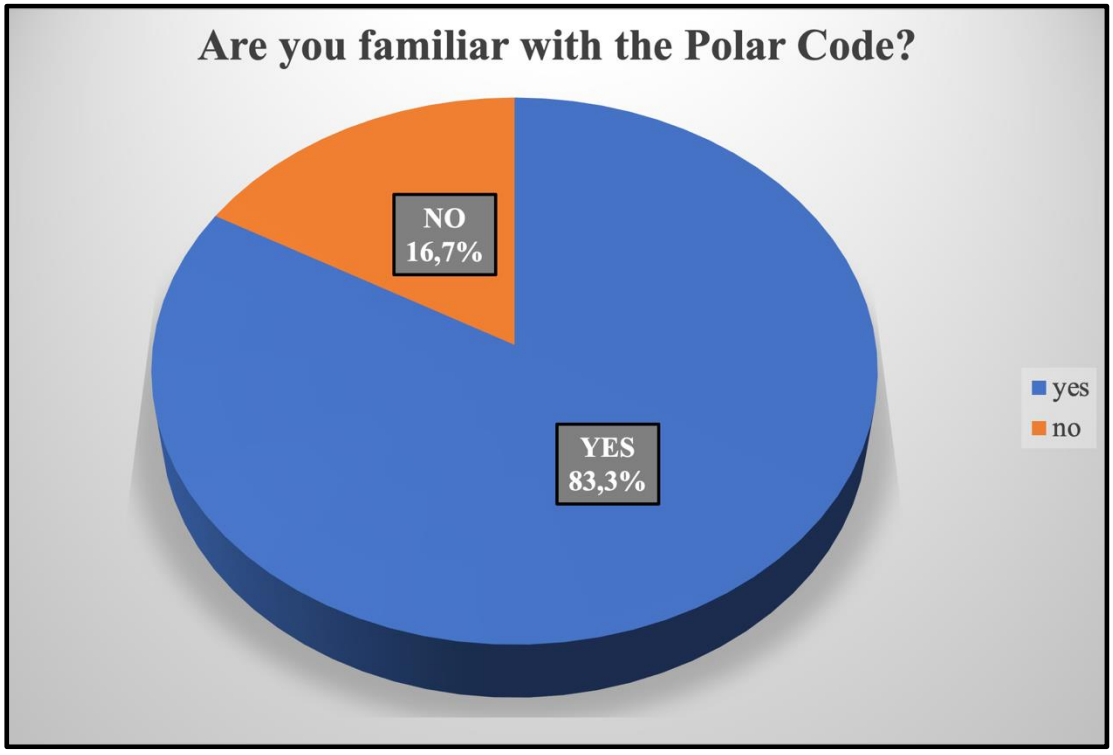


Figure 8 *Summary of responses in relation to question number 1.*

Source: Created by the Author.

The second question was developed to evaluate the perception of the participants regarding the effects of non-SOLAS fishing operations in Antarctic waters and the environmental risk represented by it. In this sense, 100% of the international maritime experts believe fishing vessels currently not covered by SOLAS operating in Antarctic waters represent environmental risks. It is worth to be considered that this was the only question from the entire survey where a complete consensus was achieved. By this consensus, the research analysis can build on the idea that fishing

vessels operating in Antarctic waters are environmental threats to that ecosystem and its resources. Also, considering that the international IMO regulation does not cover these types of operations from an environmental perspective, it needs to be established at that level for further implementation and standardization of enforcement procedures.

Following the same environmental line of research, the third question aimed to relate the environmental risk of these operations in the area with the importance of developing and implementing international regulations fully applicable for non-SOLAS vessels in Antarctica. Thus, it also addresses explicitly (for the first time) the concept of enforcement of regulations in the Antarctic, considering the international Governance Regime established by the Antarctic Treaty System previously described in chapter 2.4, "The Antarctic Treaty System and the Protocol on Environmental protection to the Antarctic Treaty (The Madrid Protocol). Nevertheless, 88,9% of participants project potential risk to the Antarctic and its resources in the following years if strong environmental measures are not enforced on non-SOLAS fishing vessels operating in Antarctic waters, as figure 9 shows accordingly:

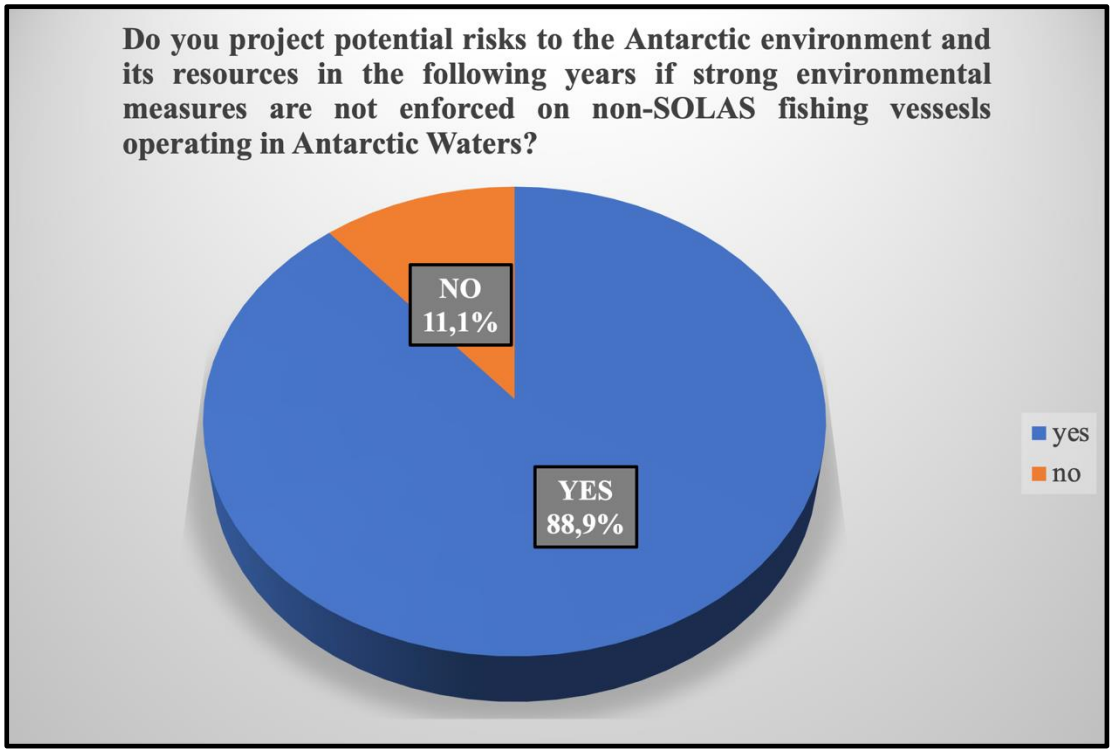


Figure 9 *Summary of responses in relation to question number 3.*

Source: Created by the Author.

Moving on to evaluate the non-SOLAS fishing vessels (or fleets) operations in Antarctic waters influence Climate Change speed if standardized measures are not enforced, the fourth question was designed to get an estimation of participants experts referred to this concept. In that regard, a majority of 61,1% of the international experts consulted (11 participants) believed that non-SOLAS fishing operations in the area could not increase climate change speed if not adequately addressed. Subsequently, 38,9% (7 participants) think the previously referred operations could increase climate change speed if not appropriately addressed. This particular question had the closest definition of all. In other words, for the experts consulted, the effects of climate change speed coming from non-SOLAS fishing operations in Antarctic waters are hard to measure and, subsequently, challenging to evaluate due to a lack of scientific data. The reasons for this close result were later elaborated on individually by every expert and will be critically analyzed in the next chapter, 4.3 "Analysis of the survey Data." Figure 10 graphically presents the results of this question in the survey as follows.

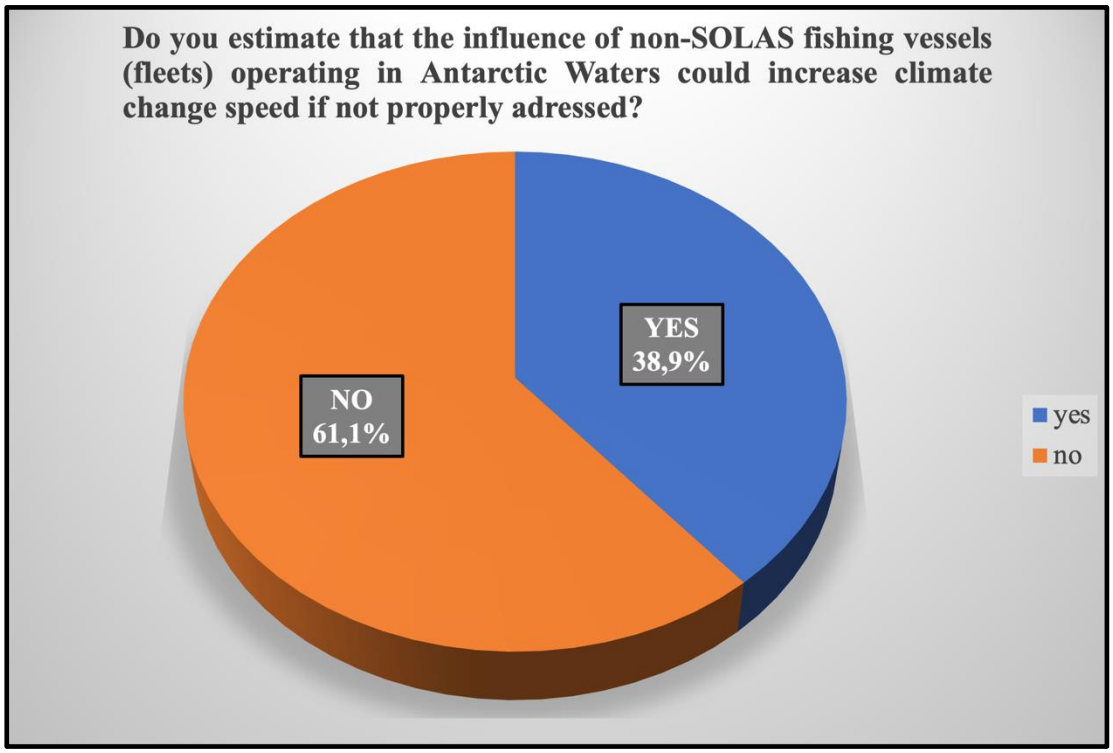


Figure 10 *Summary of responses in relation to question number 4.*

Source: Created by the Author.

The second question established a complete consensus among the expert participants, establishing a real imperative need to enforce environmental measures on non-SOLAS fishing vessels operating in Antarctic waters. Building from that idea, the fifth question aims to establish what kind of environmental enforcement measures (if any) should be applied to correctly address the threats coming from this type of vessel. In that regard, the survey presented five different options to the participants, using the Polar Code to reference how "strong" the enforcement of environmental measures should be applied. Moreover, the Polar Code´s measures were the middle point, going from a lot less to a lot more of what the code established for SOLAS vessels in the Antarctic region. Nevertheless, a substantial majority of 77,8% of experts believe that an eventual application of environmental enforcement measures to non-SOLAS fishing vessels in Antarctica should be the same as Polar Code, followed by 16,7% that think it should be less than Polar Code, and 5,6% that believes it should be more. Figure 11 presents the results mentioned above as follows.

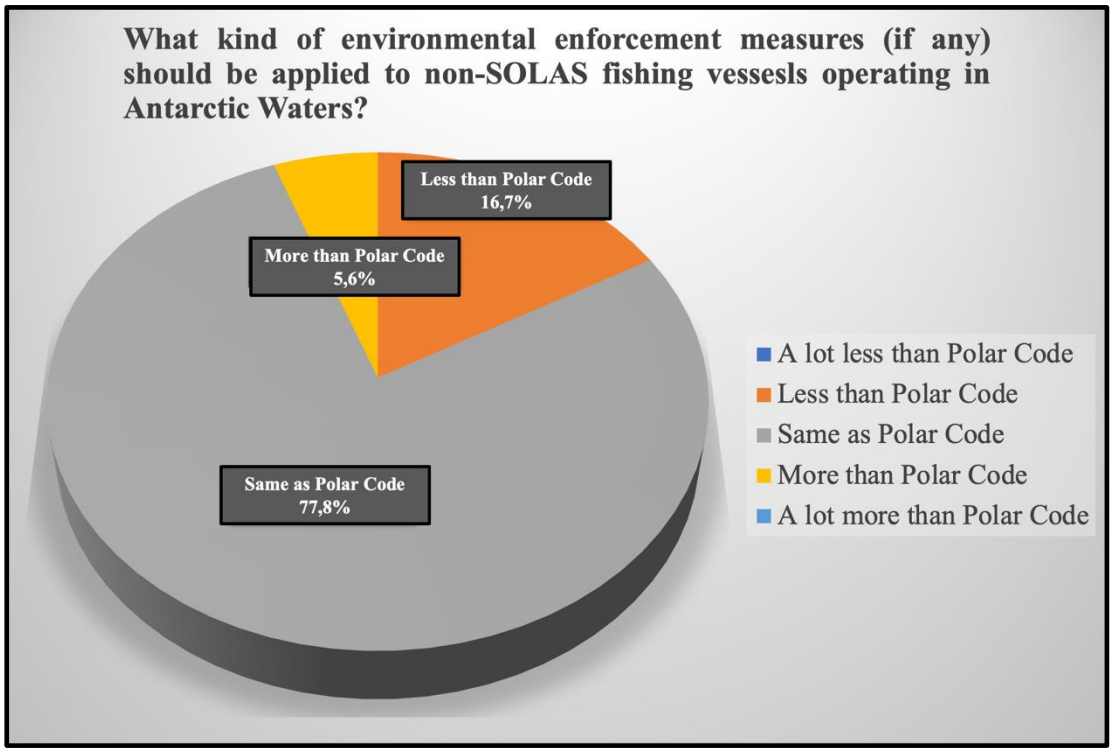


Figure 11 *Summary of responses in relation to question number 5.*

Source: Created by the Author.

The sixth question looks to get participants' perspectives regarding the application of restrictions to the extractions of resources in Antarctic waters, being those resources the key elements to protect, considering the relevance of the ecosystems in the area. Hence, the question only has a "yes" or "no" option to further elaborate if needed by the international maritime expert's perspectives. In this case, the data collected showed a clear tendency to support the idea of applying restrictions to the extractions of resources in Antarctic waters with 77,8% (14 participants), followed by 22,2% (4 participants) against the same procedure. By this result, it can be established that there is a need to implement extractions measures (restrictions in this case) in the area, under an existing set of rules to be applied and a maybe even more relevant enforcement capacity to control its application. The general results found on the survey for these questions are presented in Figure 12 accordingly.

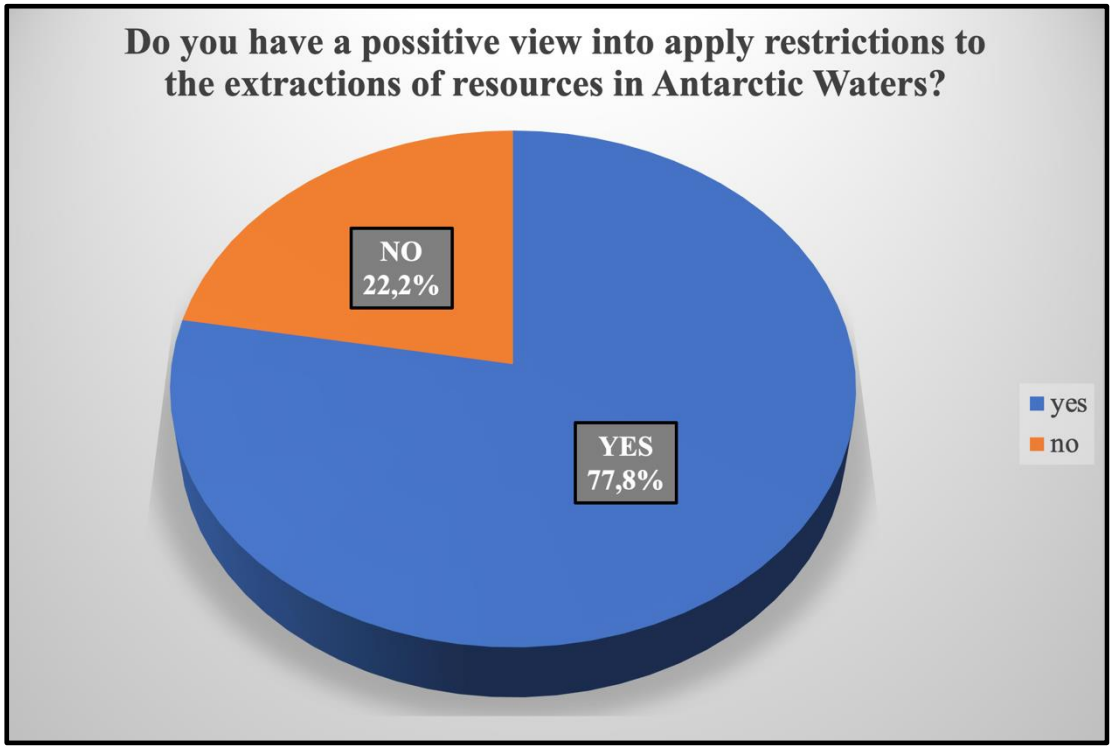


Figure 12 *Summary of responses in relation to question number 6.*

Source: Created by the Author.

Building from the idea mentioned above of implementing restrictions on the extraction of resources in Antarctic waters, the seventh question aims to get a deeper spectrum on what specific restrictions should be applied to non-SOLAS fishing vessels operating in Antarctic waters. Furthermore, the question presents five different options to choose from, with no limitations on how many options to be included by each participant. Therefore, the idea behind this multiple option question was to come up with a variety of options to be eventually implemented, accordingly to the research's third hypothesis (how to mitigate environmental risks coming from fishing vessels not currently covered by SOLAS operating in Antarctic waters). In this sense, the expert's opinions covered most of the options in the survey. Moreover, 88,9% of the participants (sixteen experts) think fishing techniques regulation limits should be applied, while 83,3% (fifteen experts) believe the minimum size and maximum capture per season must be considered. Also, 66,7% (twelve experts) considered environmental restrictions related to marine resources, and 61,1% (eleven experts) marked the option of environmental restrictions related to the ecosystem. Finally, only 11,1% (just two experts) considered other options, further analyzed in chapter 4.3, "Analysis of the survey Data." The results of the seventh question are presented in figure 13. As follows.

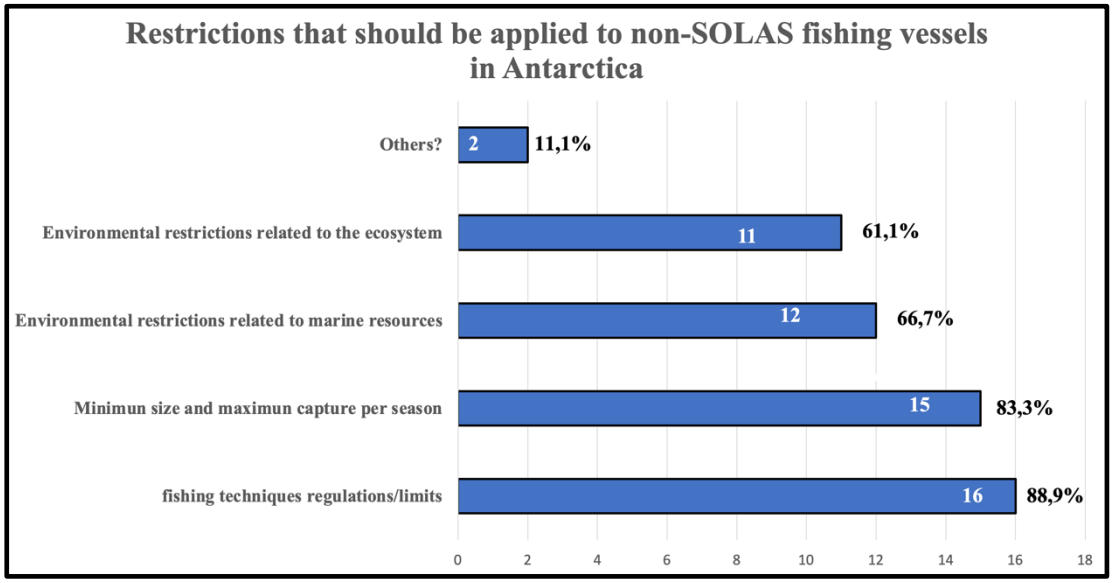


Figure 13 *Summary of responses in relation to question number 7.*

Source: Created by the Author.

Lastly, question number eight was developed to directly address the concept of enforcement, from the perspective of which one should be the institution/organization/state in charge of enforcing the standardized environmental measures implemented to non-SOLAS fishing vessels operating in Antarctic waters. From this paradigm, considering the previously analyzed unique governance condition of the Antarctic in chapter 2.4, "The Antarctic Treaty System and the Protocol on Environmental Protection to the Antarctic," the participants were given five different options to choose from, with no restrictions to pick more than one and also with the chance to elaborate deeper if needed afterward.

The elaboration phase was critically analyzed in chapter 4.3, "Analysis of survey Data," but the general results from the five given options presented an appropriate variety of tendencies. Therefore, 72,2% of the experts (thirteen participants) think that the enforcement of environmental measures should be done by the flags states of the fishing vessels (by their regulation), while 55,6% (ten participants) believe that it should be the same states as SAR areas of responsibility. However, 22,2% (four participants) think an International Task Force should do the enforcement of environmental measures, and also 22,2% (four participants) believe in other enforcement procedures, including using more than one of the previously described. It is essential to mention that 11,1% (two participants) think that no enforcement can be done in Antarctic waters due to the exceptional governance condition of Antarctica. This last statement will also be critically analyzed in the next chapter and the conclusions. Figure 14 presents the results of the survey graphically as follows, by option given, number of participants supporting the option and percentage out of the total.

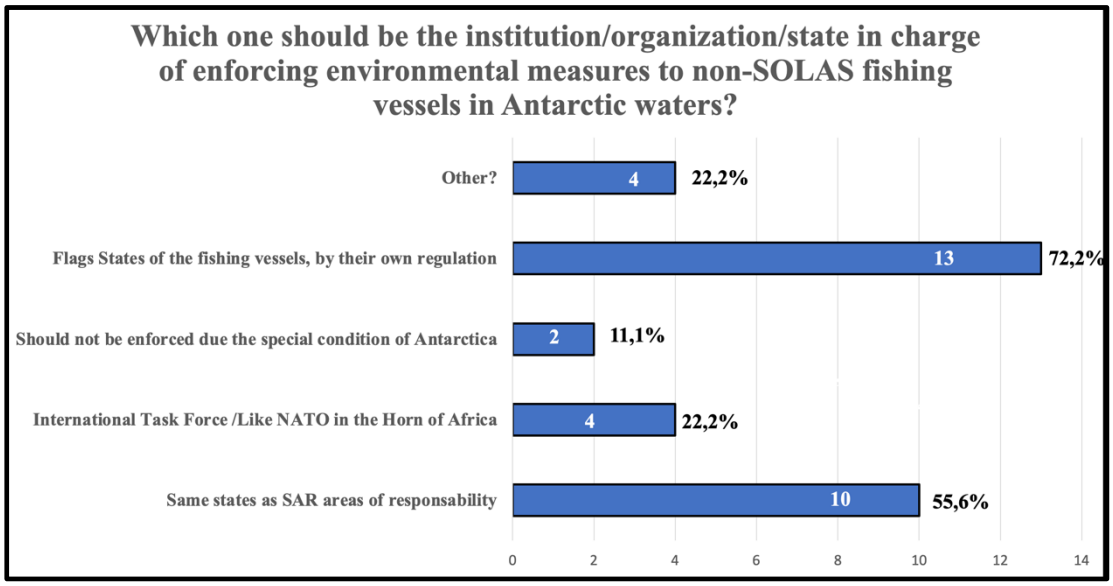


Figure 14 *Summary of responses in relation to question number 8.*

Source: Created by the Author.

4.3. Analysis of the Survey Data

As indicated in chapter 4.2, the main idea of the qualitative survey for this research was to directly address the topic of interest by guiding the participants to provide their technical opinions on the matter precisely and avoiding deviations. Building from that idea, after finishing the qualitative analysis, it is vital to critically address the answers elaborated by the international maritime experts in relation to the questions provided in the survey. By doing this, the complement of technical approaches will allow the researcher to propose measures to be eventually implemented, as well as further deeper/more specific studies if needed. Firstly, the questions were aimed directly at the research objectives to build from the opinions and develop the proposals identified as expected results. Figure 15. presents the co-relation between the questions on the survey and the objectives of the research.

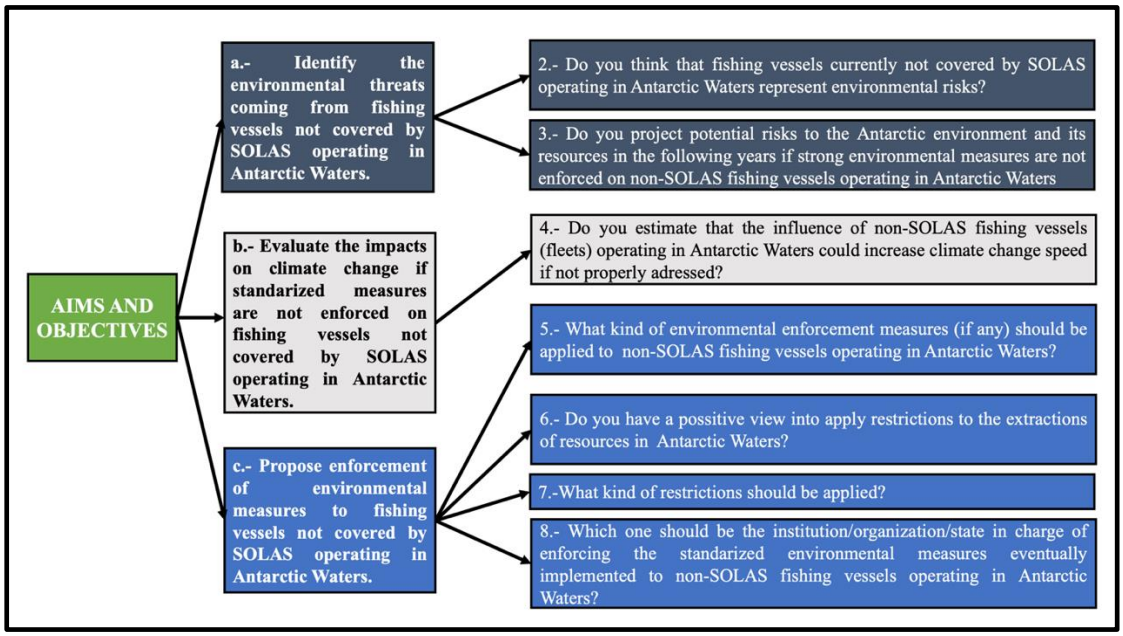


Figure 15 *Co-relation between research objectives and questions in the survey.*

Source: Created by the Author.

Building from the ideas provided by experts in the question that gave them the chance to elaborate deeper on their technical approaches, the following section will be addressed those opinions accordingly. By doing this, a common perspective will be developed, and areas with less consensus to be further addressed. Therefore, the questions that included more profound elaboration are described and critically analyzed as follows:

1.- Are you Familiar with the Polar code?

The first question was developed to get a general background and context from the maritime experts participating in the survey, and it was the only one not directly related to the research aims and objectives. Furthermore, the result provides the qualitative information presented in chapters 3.4.1 and 3.6. Nevertheless, when explicitly asked if they were familiar with the Polar Code, the answers provided by the 83,3% that had that previous experience were precious for a better context. In that regard, participants had: delegates that were part of the code redaction, currently working at IMO in the new update to the code, Port State Control Officers, former Antarctic base commanders, Flag States representatives, Member states representatives, Maritime Education Training canter providing Antarctic courses,

professional law enforcers, and previous experience working on Antarctic affairs internationally.

2.- Do you think that fishing vessels currently not covered by SOLAS operating in Antarctic waters represent environmental risks?

As mentioned in Chapter 4.2.2, this was the only question that had a complete consensus among the participants, with 100% of opinions thinking that this type of vessel represents environmental risks. Hence, the elaboration of their opinions presented valuable technical perspectives, with common factors among most of them. In this regard, the non-existence of an international convention regarding fishing vessels' safety standards operating in Antarctic waters, plus the lack of cooperation in this sector, were the main factors considered. From that idea, experts described that by having no regulation, there was no effective control system for vessels' safety, leading to a high chance of sub-standard ships operating in the area prone to accidents that may result in environmental Pollution. Remarkably, one opinion coming from an IMO Official caught researchers' attention. Moreover, the expert opinion said Antarctica's main difficulty is based on the concept of "goodwill" of Antarctic Treaty members and not on non-existent international jurisdiction. Therefore, CCMLR is what primarily "regulated" fishing vessels in Antarctica, based on the flag state's "goodwill" and aiming at the resources, not on the environmental impacts of the activities in the area.

4.- Do you estimate that the influence of non-SOLAS fishing vessels (fleets) operating in Antarctic waters could increase climate change speed if not properly addressed?

The fourth question was developed to address the issue of climate change regarding the influence of non-SOLAS vessels in this regard. Therefore, it was the closest result of all the questions, as presented in figure 10. Moreover, the expert's opinions pointed out uncertainty about the co-relation between climate change speed and how non-SOLAS vessels influence its speed. Also, the lack of technical studies considering the unique governance scenario in Antarctica makes it hard to estimate the actual incidence correctly from this angle. Nevertheless, it was undoubtedly stated by a vast majority of experts that more of the fisheries are displacing extreme latitudes

such as Antarctic waters to follow fishing resources scaping from the increase of temperatures in the equatorial zones.

5.- What kind of environmental enforcement measures (if any) should be applied to non-SOLAS fishing vessels operating in Antarctic waters?

Question number five aimed to develop a critical analysis of the need to implement mandatory environmental regulations for non-SOLAS fishing vessels operating in Antarctic waters from an international legal perspective. Therefore, this question had a clear tendency to equalize the non-SOLAS vessels to the mandatory Polar Codes Restrictions already in place as part of a process that should increase its obligations with time, as presented in figure 11. Therefore, equal regulations create equal responsibilities, but it has been proven that no international consensus has been achieved when it comes to Liability in Antarctic affairs. As presented in chapter 2.4, chapter 6 of the Madrid Protocol (Liability) should have entered into force no later than five years after its adoption in 2005, but the job is still not done (Hemmings, 2018).

7.- What kind of restrictions should be applied to fishing vessels not covered by SOLAS operating in Antarctic waters?

Figure 13. presented the qualitative results of this question according to experts' opinion, but it is also essential to consider the analysis each of them provided to support their decisions. In that regard, the need to decrease the environmental blueprint of fishing vessels in the Antarctic area was a common denominator. Therefore, despite all the measures related to the Safety of life at sea, the application of Annex VI of MARPOL (Prevention of air pollution from Ships) could be a good idea to minimize impacts on Climate change. Experts also pointed out that traditionally, restrictions on fishing vessels are applied via fishing quota, so demand compliance with protection measures applicable to vessels is strictly necessary. On the other hand, compliance in Antarctica relies entirely on "goodwill", leaving no space for enforcement or verification of compliance in the area under the current regulations in place.

Another vital point to consider is the effect of used and abandoned fishing gear in Antarctic waters (e.g., fishing nets) from an environmental perspective. Abandoned fishing gear becomes a severe risk for navigation and an environmental threat. Therefore, it develops another type of risk from fishing vessels. Moreover, it was considered relevant for the participants to evaluate the risk for non-SOLAS fishing vessels operating in Antarctic water and add the fishing gear left behind after finishing those commercial operations in the area.

8.- Which one should be the institution/organization/state in charge of enforcing the standardized environmental measures eventually implemented to non- SOLAS fishing vessels operating in Antarctic waters?

Lastly, question eight addressed the main topic of an eventual implementation phase in Antarctic waters: enforcing future regulations for non-SOLAS vessels. As shown in figure 14, the results were not massively similar and presented exciting contrasts between the expert´s opinions. Moreover, not one but a mixture of two or more institutions was the main idea for future implementation and enforcement of measures. Firstly, flag states are the services of administrations in charge of dealing with matters of implementing regulations in vessels raising their flags, mainly on a previous stage of construction/certification. Nevertheless, verifying compliance in Antarctic water constitutes a significant challenge for almost every flag state, given the distance and complications from a geographical/logistical perspective. Another relevant tendency was to address the enforcement issue from an international collaboration perspective, given the unique conditions of governance in Antarctica. The capacity to deploy assets to the area is not accessible and requires significant financial/logistical support. Considering the relevance and interest in the area, an essential international negotiation should be developed to materialize an international task force to do this. Politically looks like a complicated scenario, but operationally could be achievable if the will is present in countries with interest and significant enforcement capacities.

It is also relevant to mention that two experts believed that no enforcement should be done due to the exceptional condition of Antarctic governance established

by the Antarctic Treaty. Thus, the reigning "status quo" based on "goodwill" clearly establishes that no military activities should be done in the area, mainly affecting eventual enforcement procedures. Therefore, the areas of responsibilities already established for SAR operations could also be extended to fishing control/environmental protection away from national jurisdiction, but this is a critical difference with the Arctic. The particular characteristics of Antarctica make it more prone to difficulties due to its international water regime. The experts that pointed out no enforcement in Antarctica strongly believe it is the only true answer under the current international regime in the area.

4.4 Findings

After the critical analysis done over this chapter content, based on experts opinions from survey, a variety of relevant findings were recognized and addressed. Therefore, figure 16 associate the findings into 4 different categories, that will be further described accordingly.

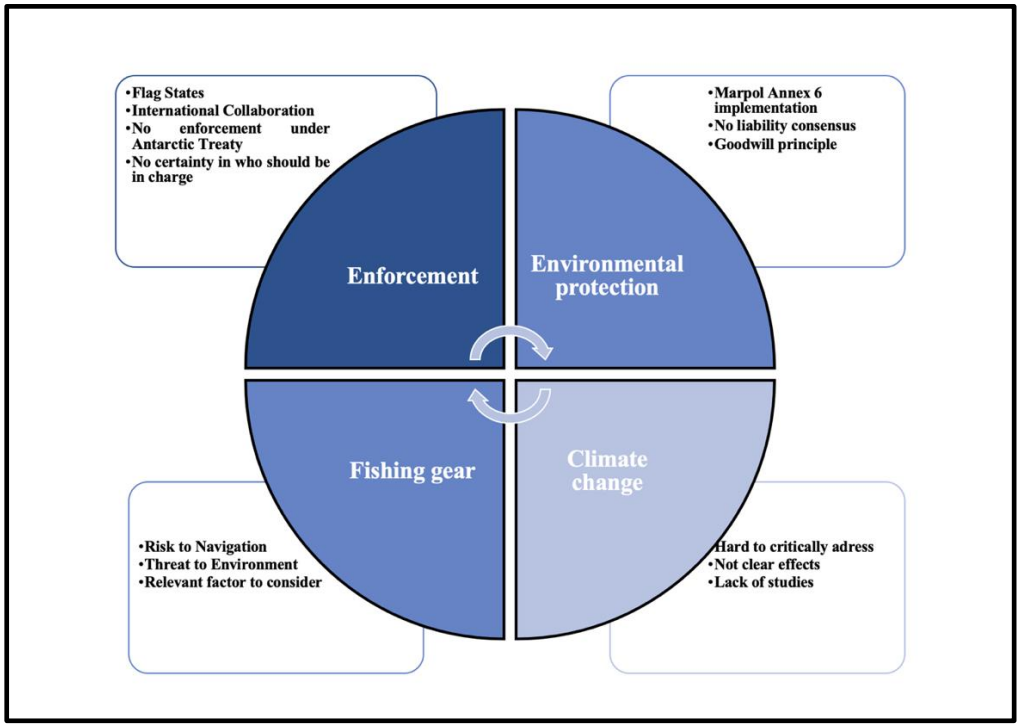


Figure 16 *Main Findings into four categories.*

Source: Created by the Author.

1.- Environmental Protection.

It was not a surprise that 100% of participants believed that non-SOLAS fishing vessels are indeed a threat to the Antarctic water ecosystem and environment. Hence, the main findings were how experts evaluate the main gaps in this regard with the corresponding proposals. In this sense, implementation of Anexx VI of MARPOL (Emissions from ships) was presented as an option. Furthermore, the principal gap is defined as legal liabilities, as seen after the still pendant entry into force of Chapter VI of the Madrid Protocol (Liability). If there is no common ground for liabilities, the status quo will never be changed, but the environmental damage will continue. It is relevant to mention that participants also pointed out how the Antarctic Treaty bases its compliance on "Goodwill," but with no tools or procedures to validate this compliance, defining this as the critical difference between Arctic and Antarctic in this regard.

2.- Climate Change

In general, the main factor in this regard was that Climate Change is not considered as influenced by non-SOLAS fishing vessels on a critical scale. Being such a complicated topic to define, fishing fleets' influence over Climate change's speed is a grey area these days. The lack of studies that co-relate both concepts led the experts to not take climate change seriously as one of the environmental threats coming from non-SOLAS fishing vessels operating in Antarctic waters. However, there was a common denominator by stating that climate change itself includes a wide variety of factors, being this type of vessel's operations also one of them and, therefore, essential to be taken into consideration for future preventive regulations.

3.- Fishing gear

An exciting finding of experts' elaboration of the questions was to realize the relevance most of them gave to abandoned/used fishing gear in Antarctic waters. Considering that fishing in the south Pole is an activity that will tend to increase in the future, plus the always challenging conditions present in waters around the South Pole,

this abandoned fishing gear develops new threats to both safety and the environment. The “goodwill” concept that conducts the Antarctic Treaty regulations makes it complex to verify compliance with the set of rules into force. In that regard and looking to protect the environment, the participants pointed out the need to directly addressed the fishing issues with mandatory international regulations. Therefore, an essential part of future international fishing regulation should include a definition of suitable fishing gear and mandatory recovery of all gear compulsory.

4.- Enforcement

The concept of enforcement of regulations in Antarctic waters, mainly for fishing vessels, was by far the most complex to analyze by the participants. This complexity resulted from various factors, the most repetitive was the current governance system based on the Antarctic Treaty System (ATS). Building from that idea, enforcing regulations after their international entry into force gets challenging to say at least, considering how difficult it is for most flag states to deploy assets to Antarctic waters. Therefore, the need to have the capacity to enforce regulations on the fishing industry operating in Antarctic waters was identified by all of them, but the “formula” to get it done had no consensus, mainly due to current regulations. Furthermore, exciting proposals that will be later addressed in chapter 5 were presented by experts, but a few of them defined “unrealistic” the chances of getting consensus on enforcement procedures. Moreover, international collaboration via specially developed task forces was also identified as a viable option after the lengthy legal process to agree in the conditions for actual operations in the area.

4.5 Conclusions

Chapter four, "Data analysis," covered the critical assessment of the data collected via experts' opinions using a profoundly prepared survey shared with them by google forms. Therefore, qualitative data analysis was conducted, explaining the process of preparation for the analysis and the critical analysis itself from a qualitative perspective and the elaborated answers given in the surveys. Furthermore, the

qualitative process allowed the researcher to find relevant information conducting to the objectives of the study, identifying four main points of interest from participants regarding the research as follows:

- Environmental protection
- Climate Change
- Fishing gear (abandoned/used)
- Enforcement (to fishing vessels)

Building from those ideas and with the data collected, the researcher gathered the necessary information to develop conclusions accordingly to the study's objectives, to be further presented in chapter five of the present academic research.

Chapter 5. Summary, conclusion, and recommendations.

This chapter presents a summary of the conducted study, providing a discussion based on the data and opinions collected, a conclusion from the topics critically analyzed, and recommendations to be considered for future research and eventual implementation at the IMO/flag states level.

5.1 Summary of the Study

In the light of the research conducted, this study critically addressed the environmental protection threats coming from non-SOLAS fishing vessels operating in Antarctic waters, their effect on climate change speed (if any), and the options to enforce environmental regulations in the area. In order to achieve these goals, the technical opinions provided in a survey by 18 international maritime experts were examined, addressed, and analyzed. Therefore, three research objectives were developed to enhance the achievement of the study's primary focus:

1. Identify the environmental threats coming from fishing vessels not covered by SOLAS operating in Antarctic waters.
2. Evaluate the impacts on climate change if standardized measures are not enforced on fishing vessels not covered by SOLAS operating in Antarctic waters.
3. Propose enforcement of environmental measures to fishing vessels not covered by SOLAS operating in Antarctic waters.

To get this research done, the researcher conducted a qualitative method based on 17 international maritime experts' opinions from a structured survey prepared jointly with the assigned lecturer. By doing this process, the data collected allowed the researcher to critically analyze different aspects related to the research, identifying common areas for further development and topics with no clear path to follow under current governance regulations for the area. The first and third research objectives were achieved by analyzing the survey answers and elaborated opinions provided by the experts when answering the related questions, using their statements, and identifying common ground for international development and proposals for

enforcement options in the study area. On the other hand, objective number two migrates from evaluating the impacts to establishing, according to the participant's opinions, that is not possible to be scientifically stated. In that sense, a consensus was achieved regarding the existence of impacts in climate change from every single human interaction, and non-SOLAS fishing vessels operating in Antarctic waters are indeed an increasing threat to environmental protection, especially taking into consideration the most probable massive development of the industry in south Pole Areas in the future.

5.2 Highlighting the main findings

As previously stated, the research conducted was based on three objectives. These objectives were directly related to the research topic and the questions formulated via surveys. Building from that idea, figure 15 presents the co-relation between research objectives and survey questions in order to develop a logical order for a critical analysis of the data collected. Therefore, the findings described in section 4.4 and graphically presented in figure 16 will now be individually discussed regarding the research questions.

Research Objective One

"Identify the environmental threats coming from fishing vessels not covered by SOLAS operating in Antarctic waters"

Research Question 1: *What are the environmental risks to Antarctic continent and its resources in relation to fishing vessels not currently covered by SOLAS operating in Antarctic Waters?*

Survey questions two and three were developed to find the answer to this research question. In this regard, the qualitative analysis of both answers (to get a general picture) and individual elaboration/justification provided by experts' opinions allowed the researcher to build the answer by following the structure of the participant's statements. Therefore, there was a total consensus among the international maritime experts about the real threats to the Antarctic environment from non-SOLAS vessels operating in the Area. Moreover, the risk was generally defined by experts

from safety and environmental protection perspectives but had a direct co-relation among both concepts. It was stated that IMO is already working to implement Polar Code Safety measures to non-SOLAS vessels in Polar Areas, but at the same time evidenced how no International Regulation address directly the threats to the environment from vessels/fleets (fishing) not covered by the set of rules previously referred.

Building from the ideas mentioned above, risks to the safety of navigation, human error, or any accident in Antarctic water will most definitely lead to a different environmental emergency, being even more complex to overcome than the original safety issue, given the extreme conditions of Antarctica. Another risk factor identified was the legal one, which arose from the liability concept; still, pendant from The Madrid Protocol (Annex VI) as part of the Antarctic Treaty System, as explained in chapter 2.4. The Unique governance system present in Antarctica makes it even more complicated to have an efficient operational reaction to contain an environmental emergency (for example), leading to a "status quo" based on "goodwill" that sooner or later will be broken by a principal/catastrophic event. As maritime regulations history was developed in most of the 20th century, the reactionary procedures and implementation of rules were the consequence of significant incidents. Lessons learned or to be learned in this case?

Research Objective Two

"Evaluate the impacts on climate change if standardized measures are not enforced on fishing vessels not covered by SOLAS operating in Antarctic waters"

Research Question 2: *Why is there a need to act on fishing vessels not currently covered by SOLAS operating in Antarctic waters?*

In this case, the qualitative process states an imperative need to act on non-SOLAS fishing vessels operating in Antarctic waters. It was clearly identified that no international regulation covered this activity in the area, plus the legal complexities out of the governance system established by the Antarctic Treaty. Therefore, there is an implicit need to act to prevent ecosystems from over-depredation from industrial fishing, which most probably will increase over the following years due to the

migration of species and industrial depredation from other latitudes. Having no regulation and, furthermost, no control system (enforcement) in the area facilitates the existence of sub-standard fishing vessels operating in Antarctic waters that instantly become threats from safety and environmental protection perspectives. Both concepts (Safety and Environmental protection) are directly connected given the eventual circumstances of incidents such as groundings, leading to further oil spills and brutal consequences for the ecosystems. In addition, having the capacity to react against major events gets more complicated, having no tacit jurisdiction more than search and rescue areas of responsibility, which is not the same as environmental protection under coastal state conditions.

Another angle on this debate was to find the relevance given by the international maritime experts participating in this research to the used/abandoned fishing gear in Antarctic waters. Moreover, this situation was repeatedly pointed out as highly dangerous for the safety of all vessels, ecosystems, and species, besides the consequences of eventual maritime accidents caused by it. Considering the operation of large fishing fleets in the area, their activities and abandoned gear could potentially lead to significant environmental damage. On the other hand, the effect of non-SOLAS fishing vessel operations in Antarctic water over climate change speed was not considered a significant factor by the participants, given the lack of studies addressing the issue specifically to provide a scientific-based answer. According to the critical analysis done by the researcher based on the data collected, undoubtelly non-SOLAS fishing vessels are more prone not to be aware of dangers that could lead to accidents on which pristine waters could be damaged, but the direct relationship between climate change speed and its operations need further studies to be defined.

Research Objective Three

"Propose Enforcement of environmental measures to fishing vessels not covered by SOLAS operating in Antarctic waters"

Research Question 3: *How to mitigate environmental risks coming from fishing vessels not currently covered by SOLAS operating in Antarctic waters?*

In order to be able to answer this research question and to address the third objective adequately, the study first defines what could be the best path to gradually follow for a successful implementation of international regulations looking to mitigate environmental risk in Antarctic waters. Therefore, using the Polar Code as a reference, most participants estimated that the same rules included in that code should extend to non-SOLAS fishing vessels to increase environmental protection gradually. In this regard, IMO is starting to build an actualized version of Polar Code, adding non-SOLAS vessels on Safety related issues, with no environmental approach yet considered. Moreover, giving the unique governance condition established in Antarctica by the Antarctic Treaty System, the keystone to building an enforcement procedure is to establish a common ground to operate in the area, with particular jurisdiction to organizations/states in charge to verify compliance with future environmental regulations. In this regard, the qualitative process defined options to be evaluated and eventually implemented as follows:

1. Mandate flag states to verify compliance to all future international environmental regulations to vessels raising their flags as a preventive measure before set sails to Antarctic waters and to validate this even by using Class Societies certifications.
2. Develop internationally recognized regulations to establish fishing restrictions such as capture limits/quotes, proper fishing gear, minimum sizes, protected areas (nesting), and mandatory recovery of fishing gear after use (among others).
3. Define pending legal definitions such as Liability (Madrid Protocol Annex VI) and enforcement jurisdictions embraced by updated regulations to be added to the Antarctic Treaty.
4. Gradually implement enforcement operations to non-SOLAS fishing vessels in Antarctic waters via international Scientific/operational/environmental task forces, as well as extend the current Search and Rescue responsibilities areas to cover environmental protection operations (in a preventive and reactionary manner).

5.3 Conclusions

The academic motivation to conduct this study was based on the concept of Antarctic Governance and the lack of international regulation in force to address such a major environmental threat to its pristine waters and ecosystems as fishing fleets operations in the area, currently not covered by SOLAS or any of the codes "born" from it. Therefore, several conclusions emerge from the critical analysis conducted via the qualitative method, developing exciting points of intersection among international maritime experts' opinions on research subjects and grey areas where no consensus was achieved and need further investigation. To summarize the main concepts studied, the Antarctic Treaty Systems and its derived protocols, such as Madrid Protocol, established a unique governance system in the Antarctic, where no complete national jurisdiction is in place. Moreover, no "Coastal States" can apply their rights and responsibilities according to international regulations in the same conditions as the rest of the world, or more specifically, The Arctic, being that area the most accurate comparison to Antarctica and the Polar Code implementation process.

Therefore, the first stage was to identify the environmental threats coming from non-SOLAS fishing vessels operating in Antarctic, to further critically address them from a constructive perspective. Moreover, the co-relation between safety of fishing operations and environmental protection was established by the methodology applied, especially when referred from a risk analysis and mitigation approaches. Building from that idea and evaluating the current regulation into force, the researcher identified common areas for development as well as evidenced the main legal barriers up to date, where there is a real need for improvement in order to efficiently protect the Antarctic environment, resources and ecosystems.

Secondly, the study focused on evaluating the impacts of climate change if standardized measures are not enforced on non-SOLAS fishing vessels operating in Antarctic waters. In this sense, the research evolved from the original idea by realizing how had a real consensus on the effects on the environment coming from these activities, but on the other hand, pointing out the lack of specific scientific data to define if there is a relation between the fishing operations in Antarctica and the climate

change speed. Furthermore, establishing the environmental threats and the lack of international regulation to address the issues, the study developed a new risk not considered initially. In this sense, the most relevant finding was the importance associated with used/abandoned fishing gear left behind in Antarctic waters, with the correspondent risk to both safety of navigation and environmental protection, being these two concepts interconnected from a proactive risk assessment perspective.

Another angle on the research was to address the concept of enforcement, as a relevant stage on the entry into force of future regulations, with the complexities derived from the Antarctic treaty System governance established for Antarctic waters. Subsequently, a common understanding among the experts established a mandatory need to find a proper formula to implement regulations accordingly, elaborating proposals for this objective that will be described in the recommendations section accordingly. Nevertheless, the critical research analysis put into evidence the mandatory need to develop international regulations to address the non-SOLAS fishing vessels operating in Antarctic waters to protect the environment and the safety of navigation simultaneously. Since the Antarctic is a natural reserve devoted to peace and Science, its protection is a challenge for the world. As learned in the past from the reactive processes applied by IMO regulations after significant accidents, being proactive is mandatory to avoid the mistakes done in the past and to prevent the Antarctic environment from threats that could damage the ecosystem irrevocably in the future. More research is necessary to get deeper into the technical data for better decision-making. However, the international will must also evolve from the current dangerous "status quo," as proven by still pendant entry into force of the Madrid Protocol Annex VI "Liability".

5.4 Recommendations

The first recommendation is to get into work internationally and legally address an update to Polar Code that covers non-SOLAS fishing vessels operating in Antarctic waters (and also Arctic, obviously) not only from a Safety of navigation perspective but also from an environmental Protection one. The fishing industry is more prone to

sub-standard operation when not legally mandated to comply with international regulations. Moreover, the flag states have a vital responsibility in this manner, but the need for enforcement in the operations areas also becomes critical to protect the environment, safety of navigation, human life, and resources from over-depredation. In this sense, the same measures applied to SOLAS vessels are a good starting point, but the nature of fishing operations requires more specific rules for better implementation and compliance. Building from that idea, a proper timeframe would be to create the regulation no later than 2026 to enter into force in 2030, to match its implementation with the same year as Sustainable Development Goals (SDG) concept.

Secondly and from a purely environmental protection approach, to vigorously address the still pendant Annex VI ¨Liability¨of the Madrid protocol by establishing a date to finally make its entry into force not later than 2026 (for years prior 2030 SDG goal). In addition, con considers non-SOLAS fishing vessels into MARPOL Annex 6 "Prevention from Air Pollution from ships", which entered into force in 2005 but is still not added to the Antarctic as MARPOL "Specific Area". It is also essential to consider the relevance of used/abandoned fishing gear by making its recovery mandatory after fishing operations. This recovery of fishing gear should be added to both Polar Code and, even better, to a specific fishing-related international convention, Such as Cape town Agreement, with a particular chapter on polar operations.

Lastly, an important recommendation is to encourage IMO to work appropriately to find a formula for enforcement operations and better environmental protection. The natural reserve of Antarctica is a significant source for the fishing industry that will look at it more and more over the years. The current "status quo" established by the Antarctic Treaty System could dangerously make prone non-SOLAS vessels operate out of control in the area. The research did find joint proposals among the expert participants to enforce new regulations for the industry. In that manner, International Collaboration via Task Scientific force could be the best option. In addition, to extend the existing SAR areas of responsibility to cover environmental protection on preventive (proactive) and reactive approaches. Moreover, the primary responsibility of verifying compliance to regulations lands on flag states, but given the

unique governance conditions of Antarctic waters, with no Coastal State “in place” (main difference with the Artic), “goodwill” is the only concept to follow theoretically. Furthermore, after critically analyzing all data gathered, the study presents a mandatory need to strongly regulate fishing operations in Antarctica at all levels, including enforcement as the last stage of the process.

References

Antarctic Treaty System. (2022). The Antarctic Treaty. https://www.ats.aq/e/antarctictreaty.html

Antarctic Treaty System. (2022). The protocol on Environmental Protection to the Antarctic Treaty. https://www.ats.aq/e/protocol.html

Antarctic and Southern Ocean Coalition. (2022). Rising sea levels: what are the impacts? https://www.asoc.org/learn/antarctic-ice-and-rising-sea-levels/#impacts

Brooks, C., Ainley, G., Abrams, P., Dayton, P., Hofman, R., Jacquet, J., Siniff, D. (2018). Antarctic Fisheries: factor climate change into their management. Nature.com. https://www.nature.com/articles/d41586-018-05372-x

Convention for the Conservation of Antarctic Marine Living Resources. (2017). Fisheries. https://www.ccamlr.org/en/fisheries/fisheries

Convention for the Conservation of Antarctic Marine Living Resources. (2022). About CCAMLR. https://www.ccamlr.org/en/organisation

Convention for the Conservation of Antarctic Marine Living Resources. (2020). Achievements and challenges. https://www.ccamlr.org/en/organisation/key-challenges-and-achievements

Dalaklis,D, Evi, B., Siousiouras, P. (2016). The future of Arctic Shipping Bussines and the Positive Influence of the Polar Code. Research Gate. https://www.researchgate.net/publication/309194454_The_Future_of_Arctic_Shipping_Business_and_the_Positive_Influence_of_the_Polar_Code

Dalaklis,D & Ölcer, A. (2018). Guest´s editor note. The Journal of Ocean Technology: Polar Water Operations, mitigating risks. https://www.thejot.net/article-preview/?show_article_preview=993

Dickie, G. (2022) In Antarctica, does a burgeoning krill fishery threaten wildlife?. Reuters. https://www.reuters.com/business/cop/antarctica-does-burgeoning-krill-fishery-threaten-wildlife-2022-02-24/

Food and Agriculture Organization [FAO]. (2021). Fisheries and Aquaculture. Regional Fishery Bodies (RFB). Commission for the Conservation of Antarctic Living Resources (CCAMLR). https://www.fao.org/fishery/en/organization/20010/en

Gardiner, N. (2020). Marine protected areas in the Southern ocean: Is the Antarctic Treaty System ready to co-exist with a new United Nations instrument for areas beyond national jurisdiction?. Science Direct. https://www.sciencedirect.com/science/article/pii/S0308597X20308587?via%3Dihub

Goldworthy, l. & Brenan, E. (2021) Climate Change in the Southern Ocean: Is the Commission for the Convention for the Conservation of Antarctic Marine Living resources doing enough?. Science Direct. https://www.sciencedirect.com/science/article/pii/S0308597X21001603

Hanifah, N., Shah, Hashim, R. (2011). The Madrid Protocol 1991 and its Environmental Impacts towards the Quality of Life. Science Direct. https://reader.elsevier.com/reader/sd/pii/S1877042812004168?token=16BF977C68DA8A777D196809E897162F416AE2BC11AB991AE70BC1C51468D7511F94BC6A20784113324A66256E7B072F&originRegion=eu-west-1&originCreation=20220729084616

Hanifah, N., Sha, R., Hashim, R. (2012). Impact of Human Activities in Antarctica: Dissecting the Concepts of Ecologically Sustainable Development and Natural Reserve for Peace and Science. https://www.sciencedirect.com/science/article/pii/S2212670812000292

Hebbar, A., Schröder-Hinrichs, j., Mejia, m., Deggim, H., Painstrom, S. (2020). The IMO Regulatory Framework for Artic Shipping: Risk Perspectives and Goal Based Pathways. Springer. https://link.springer.com/content/pdf/10.1007%2F978-3-030-44975-9_12.pdf

Hemmings, A. (2018). Liability Postponed: The Failure to bring Annex VI of the Madrid Protocol into Force. Research gate. https://www.researchgate.net/publication/327980683_Liability_Postponed_The_failure_to_bring_Annex_VI_of_the_Madrid_Protocol_into_force

Hughes, K., Convey, P., Turner, J. (2021) Developing Resilience to climate change impacts in Antarctica: An evaluation of Antarctic Treaty System protected area policy. Science Direct. https://www.sciencedirect.com/science/article/pii/S1462901121001490

ILSA E-Magazine. (2016). Glacier-covered Continent: Antarctic. http://www.ilsaedergi.com/en/glacier-covered-continent-antarctic/

International Maritime Organization [IMO]. (1974). International Convention for Safety of Life at Sea. SOLAS Convention.

International Maritime Organization [IMO]. (1978). International Convention for the Prevention of Pollution from Ships. MARPOL Convention.

International Maritime Organization [IMO]. (2016). International Code for Ships Operating in Polar Waters. Polar Code.

International Maritime Organization. (2019). International Code for Ships Operating in Polar Waters (Polar Code). https://www.imo.org/en/OurWork/Safety/Pages/polar-code.aspx

International Maritime Organization. (2019). How the Polar code Protects the Environment. https://wwwcdn.imo.org/localresources/en/OurWork/Safety/Documents/How%20the%20Polar%20Code%20protects%20the%20environment%20(English%20infographic).pdf

International Maritime Organization [IMO]. (2019). International Convention for the Safety of Life at Sea (SOLAS), 1974. https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx

International Maritime Organization [IMO]. (2019). Introduction to IMO. https://www.imo.org/en/About/Pages/Default.aspx

International Maritime Organization [IMO]. (2019). Special Areas under MARPOL. https://www.imo.org/en/OurWork/Environment/Pages/Special-Areas-Marpol.aspx

International Maritime Organization. (2019). International Convention for the Prevention of Pollution from Ships MARPOL. https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx

International Maritime Organization [IMO]. (2022). Sub-Committee on Navigation, Communications and Search and Rescue (NCSR), 9th session, 21-30 June 22. Safety measures for non-SOLAS ships operating in polar waters. https://www.imo.org/en/MediaCentre/MeetingSummaries/Pages/NCSR-9th-session.aspx

Joseph, A. & Dalaklis, D. (2021). The international convention for the Safety of life at sea: highlighting interrelations of measures towards effective risk mitigation. https://commons.wmu.se/cgi/viewcontent.cgi?article=1505&context=lib_articles

Marine Insight. (2019). MARPOL (The International Convention for Prevention of Marine Pollution for Ships): The Ultimate Guide. https://www.marineinsight.com/maritime-law/marpol-convention-shipping/

Marine Insight. (2020). Safety of Life at Sea (SOLAS) – The Ultimate Guide. https://www.marineinsight.com/maritime-law/safety-of-life-at-sea-solas-convention-for-prevention-of-marine-pollution-marpol-a-general-overview/

Liu, N. & Brooks, C. (2018). China´s changing position towards marine protected areas in the Southern Ocean: Implications for future Antarctic governance. Science Direct. https://www.sciencedirect.com/science/article/pii/S0308597X17308977?casa_token=UY7ppsIDjUgAAAAA:iDolbKyqWWK5iF_9zYXtdqvAGYe-OCnN7BJdbTLU9hspz9yvypPlCI0TckmqCT44KNVjGfSs0v4

Prior, S. (2022). World Wide Fund for Nature [WWF]. Review of perceived Gaps and challenges in the implementation of the Polar Code. https://apiwwfarcticse.cdn.triggerfish.cloud/uploads/2022/04/12144330/22-4372_polar_code_220408_links-3.pdf

Questionpro. (2022). 5 Steps for Creating a Qualitative Study. https://www.questionpro.com/blog/creating-qualitative-study/

Steven, C. (2018). Polar Collaborations are key to successful policies. Nature.com. https://www.nature.com/articles/d41586-018-05369-6

The Journal of Ocean Technology. (2018). Polar Water Operations, mitigating risks. https://www.thejot.net/archive-issues/?id=61

Trathan, P., Warwick-Evans, v., Young, E., Friedlaender, A., Kim, J., Koubun, N. (2022). The Ecosystem approach to management of the Antarctic Krill fishery – the "devils are in the detail" at small spatial and temporal scales. https://www.sciencedirect.com/science/article/pii/S0924796321000968

United Nations. (2015). Economic and Social Council: Sustainable Development. https://www.un.org/ecosoc/en/sustainable-development

United Nations Conference on Trade and Development. (2021). Review of Maritime Transport 2021. https://www.un-ilibrary.org/docserver/fulltext/9789210000970/9789210000970_web.pdf?expires=1658138031&id=id&accname=id25661&checksum=CF6801A5A071440973CF924CFB51934B

World Wide Fund for Nature [WWF]. (2022). Improving the Polar Code to better Protect Arctic Waters. https://www.arcticwwf.org/newsroom/features/improving-the-polar-code-to-better-protect-arctic-waters/

World Wide Fund for Nature [WWF]. (2022). Mandatory measures for non-SOLAS ships finalized. https://www.arcticwwf.org/newsroom/news/mandatory-measures-for-non-solas-ships-finalized/

Young, C. (2021). Eyes on the price. Australia, China and the Antarctic Treaty. Lowy Institute for International Policy. https://www.jstor.org/stable/pdf/resrep29466.pdf

Hughes, K., Convey, P., Turner, J. (2021) Developing Resilience to climate change impacts in Antarctica: An evaluation of Antarctic Treaty System protected area policy. Science Direct. https://www.sciencedirect.com/science/article/pii/S1462901121001490

6, P., Bellamy, C. (2012). Principles of Methodology: Research Design in Social Science (p.1) https://eds.p.ebscohost.com/eds/ebookviewer/ebook/bmxlYmtfXzU5NTcwM19fQU41?sid=54076690-2e81-4da3-8474-6671243dc803@redis&vid=1&format=EB&lpid=lp_1&rid=0

Appendices

Appendix A: Questionnaires

1) **Please answer the following questions to provide relevant background information to the research analysis:**

    1. Gender:
    2. Age:
        i. Less than 30
        ii. Between 30 and 50
        iii. More than 50
    3. Working experience (years):
    4. Professional background (no more than 200 words):
    5. Are you familiar with the POLAR CODE? Yes / No
        i. Is yes, WHY? (100 words).

2) **Do you think that fishing vessels currently not covered by SOLAS operating in Antarctic waters represent environmental risks?**
    a. Yes
    b. No
    c. Why? (Elaborate your answer in no more than 200 words)

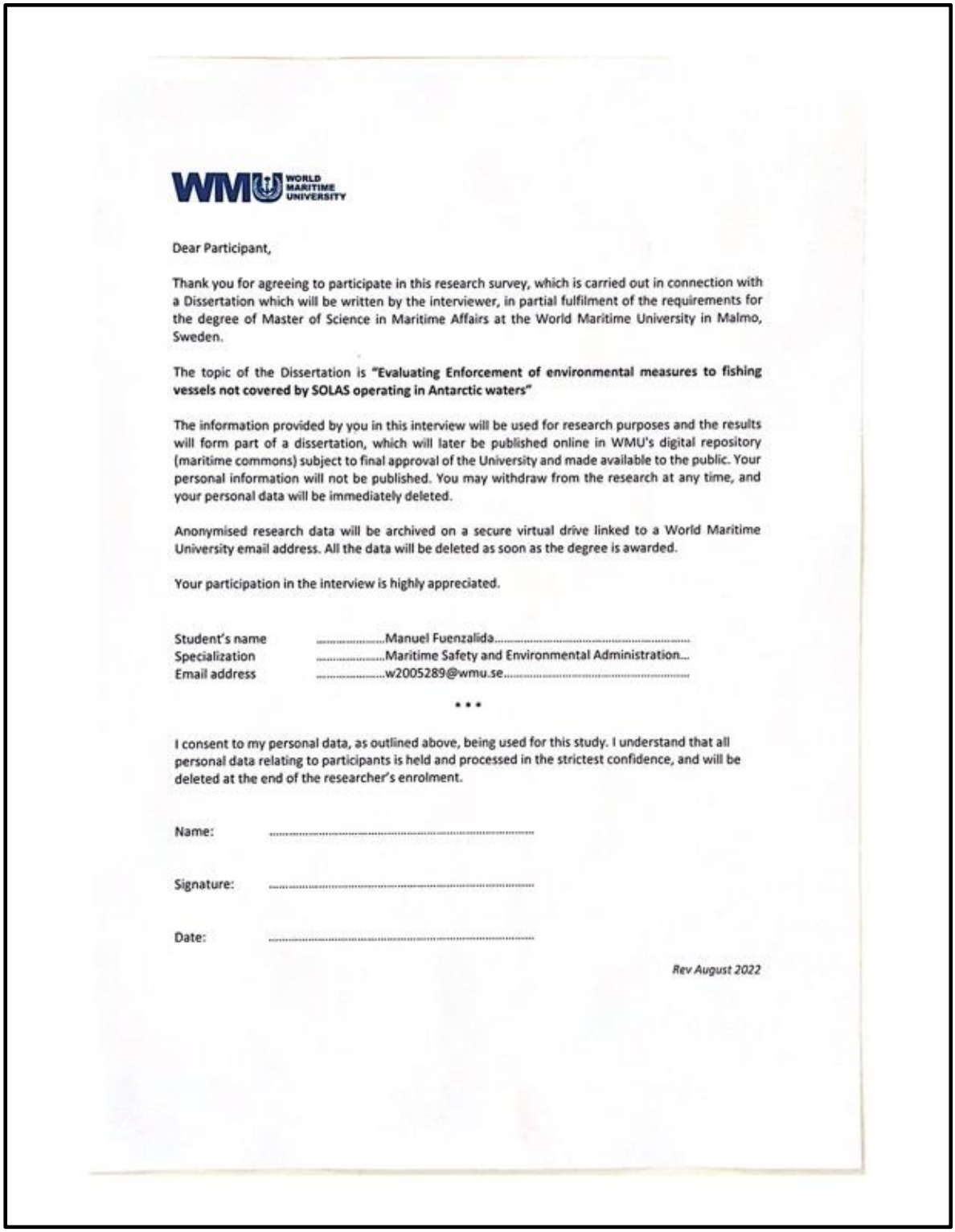
3) **Do you project potential risks to the Antarctic environment and its resources in the following years if strong environmental measures are not enforced on non-SOLAS fishing vessels operating in Antarctic waters?**
    a. Yes
    b. No

4) **Do you estimate that the influence of Non SOLAS fishing vessels (fleets) operating in Antarctic waters could increase climate change speed if not properly addressed?**
    a. Yes
    b. No
    c. Why? (Elaborate your answer in no more than 200 words)

5) **What kind of environmental enforcement measures (if any) should be applied to non-SOLAS fishing vessels operating in Antarctic waters? Mark all the answers you want. Elaborate your answer in no more than 200 words.**
    a. A lot less than Polar Code
    b. Less than Polar Code
    c. Same as Polar code
    d. More than Polar Code
    e. A lot more than Polar Code

6) **Do you have a positive view into apply restrictions to the extractions of resources in Antarctic waters?**
    a. Yes
    b. No
7) **If your previous answer was yes, what kind of restrictions should be applied? (Mark as many as you want).**
    a. Fishing techniques regulations/limits (e.g. fishing nets)
    b. Minimum size and maximum capture per season.
    c. Environmental Restrictions related to the marine resources to catch?
    d. Others?
    e. Why? (Elaborate your answer in no more than 200 words)
8) **Which one should be the institution/organization/state in charge of enforcing the standardized environmental measures eventually implemented to non- SOLAS fishing vessels operating in Antarctic waters?**
    a. Same states as Search and Rescue area of Responsibility in the Antarctic.
    b. International Task Force (like NATO in the Horn of Africa).
    c. Should not be enforced due the special condition of the Antarctic.
    d. Flag States of the fishing vessels, by their own regulation.
    e. Oher? Please elaborate

Appendix B: Ethics considerations Sample of Consent Form



WMU WORLD MARITIME UNIVERSITY

Dear Participant,

Thank you for agreeing to participate in this research survey, which is carried out in connection with a Dissertation which will be written by the interviewer, in partial fulfilment of the requirements for the degree of Master of Science in Maritime Affairs at the World Maritime University in Malmo, Sweden.

The topic of the Dissertation is **"Evaluating Enforcement of environmental measures to fishing vessels not covered by SOLAS operating in Antarctic waters"**

The information provided by you in this interview will be used for research purposes and the results will form part of a dissertation, which will later be published online in WMU's digital repository (maritime commons) subject to final approval of the University and made available to the public. Your personal information will not be published. You may withdraw from the research at any time, and your personal data will be immediately deleted.

Anonymised research data will be archived on a secure virtual drive linked to a World Maritime University email address. All the data will be deleted as soon as the degree is awarded.

Your participation in the interview is highly appreciated.

Student's name .....Manuel Fuenzalida.....
Specialization .....Maritime Safety and Environmental Administration...
Email address .....w2005289@wmu.se.....

* * *

I consent to my personal data, as outlined above, being used for this study. I understand that all personal data relating to participants is held and processed in the strictest confidence, and will be deleted at the end of the researcher's enrolment.

Name: .....

Signature: .....

Date: .....

Rev August 2022