

The Canadian maritime sector's perception of the International Maritime Organization's  
(IMOs) short-term measures for greenhouse gas (GHG) emissions

By

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## Abstract

Clarke, T.G., 2021. The Canadian maritime sector perception of the International Maritime Organization's (IMO) short-term measures for greenhouse gas (GHG) emissions [graduate project]. Halifax, NS: Dalhousie University.

In April 2018, the International Maritime Organization (IMO) adopted the Initial Strategy (IS) on reduction of greenhouse gases (GHGs) emissions, contributing to global climate efforts under the Paris Agreement. The Strategy presents a framework to achieve three levels of ambition towards GHG emissions reductions and includes short-, mid- and long-term measures to be adopted by member States. Globally, the contribution of GHGs from the shipping industry is expected to increase approximately 50% by 2050, under a business-as-usual scenario. Short-term measures proposed in the IS are anticipated to only have a modest impact on decarbonization effects and have been criticized by experts. Presently, there is no systematic understanding of the Canadian maritime shipping industry's perception of the proposed short-term measures. This study sought to bridge this knowledge gap through a series of semi-structured interviews. Using this qualitative approach, results from six stakeholders demonstrated a diverse range of perspectives. A collection of topics revealed a spectrum of ideas, whereby perceptions appeared to be largely influenced by stakeholder role within the sector. The results of this study demonstrate the need to facilitate engagement with more Canadian maritime shipping stakeholders such that future regulations and policy can be best informed. Greater research and engagement with more players must occur to ensure strategic building of IMO targets for a plan for Canada to better align with Paris Agreement temperature goals.

## Abbreviations

Carbon Dioxide (CO<sub>2</sub>)

Conference of the Parties (COP21)

Energy efficiency design index (EEDI)

Greenhouse Gas (GHG)

Heavy fuel oil (HFO)

Initial Strategy (IS)

International Maritime Organization (IMO)

Marine Environmental Protection Committee (MEPC)

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

Nationally Determined Contribution (NDC)

Non-government organizations (NGOs)

Research & Development (R&D)

Ship energy efficiency management plan (SEEMP)

Transport Canada (TC)

United Nations Framework Convention on Climate Change (UNFCCC)

World Wildlife Fund for Nature (WWF)

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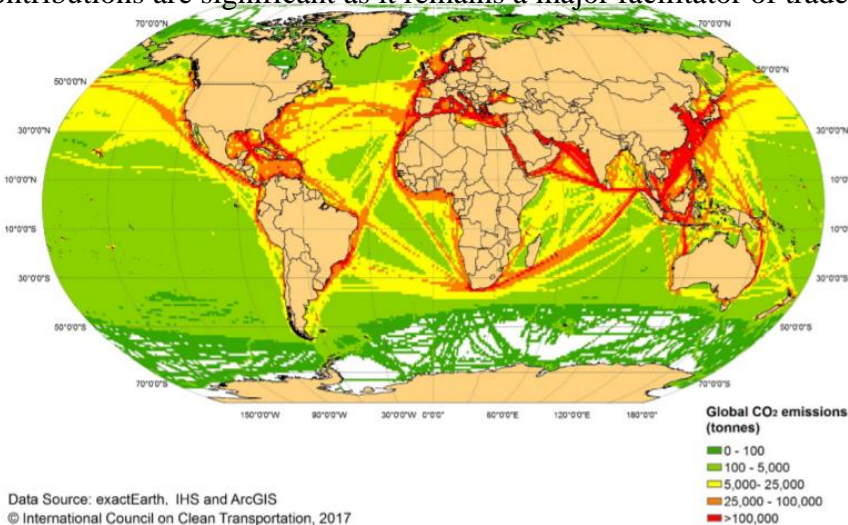
Lastly, thank you to the students and faculty of the MAP program. We have all persevered through a difficult period of online learning together, and I am glad to have experienced this with the group that we have.



## 1. Introduction

### 1.1 Global Shipping, Emissions, and International Regulations

Carbon emissions produced by the maritime shipping industry are a growing environmental concern as both global trade and dependency on ocean transportation proliferate. Maritime shipping is the backbone of international trade, carrying approximately 80% of global trade by volume (Bullock et al., 2020; Garcia et al., 2021) and developing more rapidly than energy consumption and the global population (Bouman et al., 2017). According to the fourth greenhouse gas (GHG) study of the International Maritime Organization (IMO) shipping emissions increased 9.6% between 2012 and 2018 (Faber et al., 2021). By allowing emissions to continue on the current trajectory, they are projected to account for approximately 17% of total global anthropogenic CO<sub>2</sub> emissions by the middle of the twenty-first century, where they currently represent only 2-3% (Gritsenko, 2017). Under various scenarios, shipping emissions are estimated to increase 90-130 % relative to 2008, by 2050 (Faber et al., 2021), indicating both the significant impact of global trade growth on this sector and the urgency required to cut shipping emissions. In 2015, ships emitted a total of 932 million tons of CO<sub>2</sub> distributed amongst common trades routes (Figure 1) (Olmer et al., 2017). Despite sea transport being the most energy efficient means of transporting goods (Chircop, n.d.; Wan et al., 2018), its carbon emission contributions are significant as it remains a major facilitator of trade.



**Figure 1.** Distribution of carbon dioxide emissions globally in 2015 (Olmer et al., 2017).

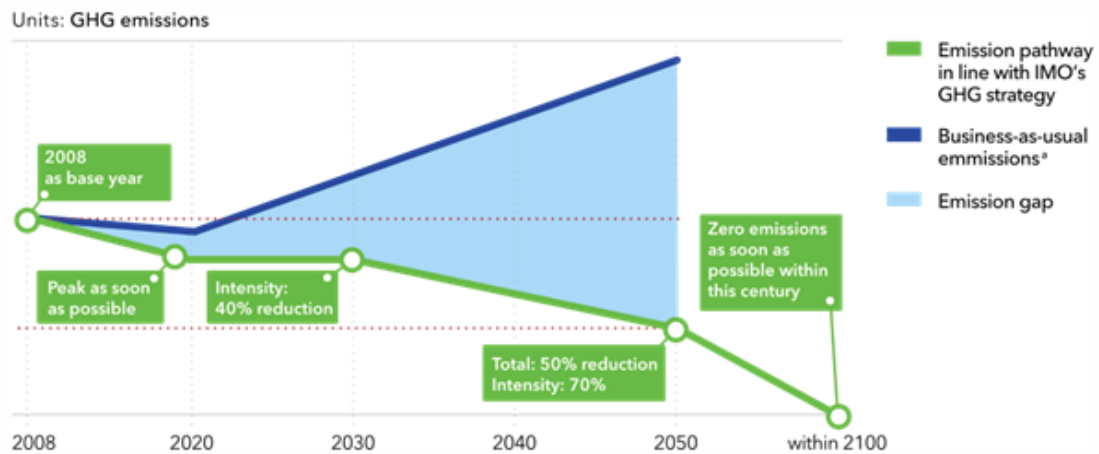
By way of addressing the global emissions crisis, in 2015, at the 21<sup>st</sup> Conference of the parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC), the Paris Agreement was adopted. The agreement articulates that state parties will agree to keep the increase in global average temperature to well below 2°C above pre-industrial levels; and to pursue efforts to limit the increase to 1.5°C (Joung et al., 2020). The agreement established a goal for anthropogenic emissions that is irrespective of geography, economy, and industry (Chircop, n.d.). In response to the global goals established through the Paris Agreement, in 2018 the IMO adopted the “Initial IMO Strategy on Reduction of GHG Emissions from Ships”. Notably, the strategy applies to all IMO member states and pertains to international shipping emissions, i.e., the emissions resultant of ocean transport that occurs between two countries ports (Garcia et al., 2021). The strategy highlights short-, medium- and long-term measures for eventual decarbonization of the shipping sector, although the details for all these milestones have yet to be made concrete by the IMO (Doelle & Chircop, 2019). Respectively, each group of measures is to be agreed upon and implemented between 2018 and 2023, 2023 and 2030, and 2030 and 2050 (Psaraftis & Zis, 2021). Come 2023, a Revised Strategy will be adopted by the IMO (Garcia et al., 2021).

The short, medium, and long-term measures represent part of the IMO framework in achieving three ambitious goals to reduce GHG emissions from shipping. As such, the ambitions directing the Initial Strategy (IS) include: a decline in the carbon intensity of individual ships through implementation of further phases of the energy efficiency design index (EEDI), a reduction in carbon intensity of international shipping by at least 40% by 2030, pursuing efforts towards 70% by 2050 compared to 2008, and to reduce the total annual GHG emissions by 50% relative to 2008 levels by 2050 (Garcia et al., 2021). Overall, the IS has been appraised as being

significant and ambitious for a global industry (Doelle & Chircop, 2019), but is ultimately criticized of generating emissions targets that will not accomplish Paris Agreement global temperature goals (Comer & Rutherford, 2018).

**Table 1.** Collection of measures outlined by the International Maritime Organizations (IMO) Initial Strategy (IS) for the reduction of GHGs from ships. Bolded measures were incorporated into questions for this study (MEPC, 2018).

Type	Years	Measure
Short-term	2018-2023	Develop technical and operational energy efficiency measures for both new and existing ships
		Continue and enhance technical cooperation and capacity-building activities under the ITCP
		Initiate research and development activities addressing marine propulsion, alternative low-carbon and zero-carbon fuels, and innovative technologies to further enhance the energy efficiency of ships
		Undertake additional GHG emission studies and consider other studies to inform policy decisions
		Actively promote the work of the Organization to the international community
		Consider and analyse measures to address emissions of methane and further enhance measures to address emissions of Volatile Organic Compounds
		Incentives for first movers to develop and take up new technologies
		Establishment of an Existing Fleet Improvement Programme
		Further improvement of the existing energy efficiency framework with a focus on EEDI and SEEMP
		Consider and analyse the use of speed optimization and speed reduction as a measure
Mid-term	2023-2030	Alternative low-carbon and zero-carbon fuels implementation program
		Further operational efficiency measures (e.g. SEEMP, operational efficiency standard)
		Market-based Measures (MBMs)
Long-term	2030+	Development and provision of zero-carbon or fossil-free fuels



**Figure 2.** Trajectory of global GHG emissions under a business-as-usual scenario (Joung et al., 2020).

## 1.2 Shipping Emissions and Environmental Impacts

Keeping global temperatures to well below 2°C, or further limiting them to 1.5°C, will require urgent and rapid reductions in emissions. If further delays in achieving these targets occur, reductions measures will need to become increasingly drastic to make an impact (Ritchie & Roser, 2020). GHGs have therefore been recognized as the largest contributor to climate change (Shi, 2016a), and for the shipping industry, these emissions will persist as this sector continues to service the global economy by transporting goods (Scott et al., 2017). It has been estimated that human activities have been the source of at least 1.0°C of warming above pre-industrial levels and that the globe will reach 1.5°C between 2030 and 2052 if the current emissions path is followed (IPCC, 2018). Carbon dioxide emissions produced by the shipping sector equate to approximately those generated by the country of Germany, the sixth greatest CO<sub>2</sub> emitter based by country (Olmer et al., 2017).

One of the greatest concerns surrounding GHGs is that they are pervasive globally and will create irreversible problems for ecological systems (Doney et al., 2012); as it is said the emissions being released into the atmosphere will be present for millennia (Hansen et al., 2013).

As such, the alterations in climate due to increased temperatures is expected to exacerbate biodiversity loss in the future (Rinawati et al., 2013). Warming global temperatures driven by GHG emissions puts species at risk, challenges vulnerable ecosystems, and creates shifts in climate for geographic spaces that lack the resilience to withstand it (Hansen et al., 2013). In addition to CO<sub>2</sub>, ships emit sulphur oxides and nitrogen oxides that contribute to the formation of acid rain. As well as various volatile organic compounds (VOCs) and particulate matter (PM) which includes black carbon (BC); all of which are harmful to human health with BC being the second greatest climate enforcer after CO<sub>2</sub> (Serra & Fancello, 2020). The GHGs produced by the shipping industry will continue to have long-term impacts on the coastal and marine environments. In fact, approximately 70% of conventional pollutants and GHGs from marine shipping are present less than 400 km from land (Walker et al., 2019) however, the effects of these emissions can be witnessed in places far from human activity.

To combat this issue, a significant achievement occurred in 2011 when the IMO introduced technical and operational regulations under Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL) (Shi, 2016b). These changes included the mandatory adoption of the EEDI for new ships and a Ship Energy Efficiency Management Plan (SEEMP) for all existing ships; with implementation in 2013 for ships greater than 400 GT (Joung et al., 2020). Following these changes and the adoption of the Paris Agreement, the IMO created the IS for the reduction of GHGs from ships, acting as the cornerstone for future action towards decarbonization (Serra & Fancello, 2020). Despite these advancements towards further limiting GHGs, the effects of these emissions to our global environment are visible and will continue to make impacts.

### 1.3 The Crucial Role of Industry

In June 2021, the 76<sup>th</sup> annual meeting of the Marine Environmental Protection Committee (MEPC) was held. MEPC is the specialized subcommittee of the IMO responsible for environmental policy development (Hendriksen, 2020) and addresses various environmental issues with respect to the IMO and the shipping sector (International Maritime Organization, 2021). The shipping industry's impact to global climate and the status of the marine and coastal environment is significant and urgent. Thus, the agenda for this meeting aimed to address a suite of pressing concerns, including GHGs and other peripheral issues such as a ban on the use and carriage of heavy fuel oil in the Arctic, black carbon, and exhaust gas cleaning systems. MEPC 76 resulted in discussions that were evaluated by some as lacking ambitious and decisive climate action and facilitated the continuation of business-as-usual scenarios regarding sector emissions (WWF, 2021a). In fact, the MEPC outcome for reducing the carbon intensity of ships landed at a 1.5% reduction, when other groups determined an annual 7% carbon intensity reduction is needed to further align with Paris Agreement goals (Hendrie, 2021). Therefore, the decisions related to furthering environmental protection from shipping that were finalized by the IMO at MEPC 76 have been assessed as being not nearly as ambitious as they should be.

Notably, the IMO is responsible for the international *regulation* of shipping. Decision-making occurs most often via consensus through national delegations enhanced with the inclusion of industry members (Dalziel et al., 2021). Many member nations appoint delegates that hold large financial stakes within the industry to speak on behalf of governments (Apuzzo & Hurtes, 2021), giving the industry a dominant role and voice for that given member state. In addition, the maritime industry holds significant resources that can facilitate greater lobbying and dialogue with decision-makers and can introduce technical documentation to promote their

interests to potentially cloud those of other active parties (Dalziel et al., 2021). Thus, the outcomes of MEPC meetings have been assessed by some as being too industry-centric; not allowing for other voices to be as prominent or enact change for other purposes.

Furthermore, the lenient guidelines for representation at the IMO have been criticized for fostering an environment of poor transparency and contributing to the atmosphere of over-representation of industry voices (Psaraftis & Zis, 2021). Despite the imbalance that is occurring, it should be noted that the views of the shipping industry do provide substantial expertise and knowledge to aid the regulatory processes; acknowledging the risks and uncertainty of the industry – a view that all government agencies do not hold to the same degree. The above circumstances, however, have cultivated the phenomenon of regulatory capture, whereby industry plays a considerable role in influencing maritime administration and regulation through various pathways and processes (Dalziel et al., 2021).

Therefore, given the dynamic of influence and representation at MEPC and within the IMO, it is imperative to understand the perceptions of industry as they can have a critical role in impacting both decision-making processes and the introduction of regulatory measures. The IMO, and therefore MEPC, face considerable pressure to establish agreement on crucial measures and facilitate appropriate implementation for the industry (Garcia et al., 2021). The maritime shipping industry in Canada will likely be faced with increased regulatory change soon as the pressure to reduce GHG emissions continues.

In Canada, the perceptions of the shipping industry regarding the IMO GHG strategies have yet to be explored. To date, there have been no formal assessments dedicated to understanding how Canadian shipping industry stakeholders perceive the IMO GHG strategies. Developing an understanding of these perceptions is crucial for guiding future industry engagement with respect

to emissions reductions, and ultimately for informing the development of effective policies and regulations.

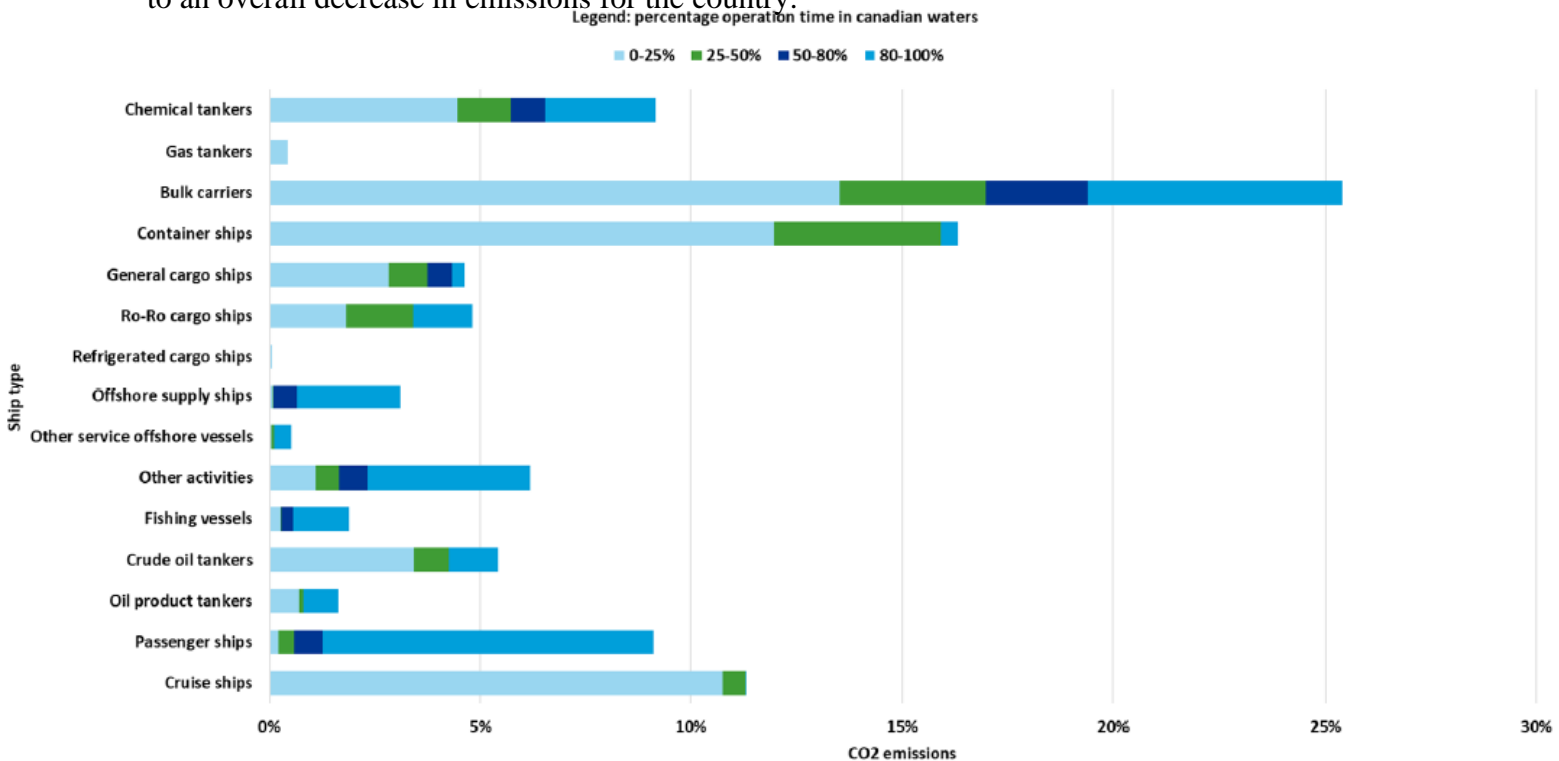
#### **1.4 Carbon Emissions in a Canadian Context**

In 2021, Canadian Prime Minister Justin Trudeau announced that Canada would enhance their emissions reduction target to further align with Paris Agreement commitments. This target, known as a Nationally Determined Contribution (NDC), has been announced as a reduction in emissions by 40-45% from 2005 levels, by 2030 (Tasker & Wherry, 2021). Despite this promising ambition, Canada has yet to produce any guidance on a path in achieving this target. With Transport Canada (TC) being the lead federal department in Canada for maritime administration duties, they would be the body responsible for fulfilling any obligations to the IMO (Dalziel et al., 2021) had stronger measures been established for the industry to follow. Local Canadian government leaders and environmental non-government organizations (ENGOS) are calling upon the federal government to establish a framework and national action plan that includes specific targets, timelines, and funding to address the carbon emissions produced by the maritime shipping industry (Meyer, 2020). The development of a firm framework and plan for the reduction of GHG from ships in Canada is one of the short-term measures within the IS that needs urgent implementation.

The emissions specific to vessels in Canadian waters have been investigated to better understand impacts that GHGs have on the marine and coastal environment, and to aid in policy development for future reduction of shipping emissions (Hammer et al., 2020). Some key findings from this report include that the greatest CO<sub>2</sub> emissions originated from bulk carriers, container ships and cruise ships, approximately 50% of fuel is being consumed/emitting GHGs between the provinces of British Columbia and Quebec (30% within Nova Scotia and



Newfoundland and Labrador), and vessels spending the greatest amount of operating time in Canadian waters are passenger ships and bulk carriers (Hammer et al., 2020) (Figure 3). Present government reports have indicated that Canada increased its carbon dioxide emissions marginally between 2018 and 2019 and have only decreased emissions by 1.1% since 2005 (Tasker & Wherry, 2021). The Canadian Institute for Climate Choices has highlighted in its latest report that reducing emissions from Canada's shipping industry is critical for achieving net-zero emissions in 2050 (Dion et al., 2021). Therefore, it would be beneficial for Canada to take immediate steps to further reducing emissions from ships, such that this effort would contribute to an overall decrease in emissions for the country.



**Figure 3.** Total CO<sub>2</sub> emissions in Canadian waters in 2019 based on ship type and operation interval (Hammer et al., 2020).

### 1.5 Research Objectives

Within the IS for the reduction of GHG from ships, short-term measures have been outlined by the IMO and are to be agreed upon and implemented between 2018 and 2023. These measures

include implementation and enhancement of the EEDI and the SEEMP, improvement to technical and operational efficiency of ships, a fleet improvement program, addressing of methane emissions and volatile organic compounds, a national action plan, port enhancement, research and development (R&D) into zero emission technology and incentives for early adopters (Doelle & Chircop, 2019).

With a specific focus on the short-term, this research aims to investigate the Canadian maritime shipping industry's perspectives on the above measures presented in the IS by the IMO.

Stakeholders from various facets of the shipping industry will be interviewed to establish a greater understanding of the scope of knowledge within the sector. This research will serve to strengthen future engagement with industry stakeholders for further action on GHG reduction strategies. In addition, these interviews will demonstrate the alignment or disconnect of Canadian maritime shipping stakeholders towards the measures set forth by the IMO in the IS. Lastly, this research will reveal where industry stakeholders believe improvements can be made within the current regulations, to achieve greater emissions reductions targets. The above project objectives will be used to address the following questions:

**Primary Research Question:** What is the perception of the short-term IMO measures on GHG emissions amongst maritime shipping stakeholders?

- **Secondary Research Question:** What is the scope of knowledge and insight towards these short-term measures amongst stakeholders?
- **Secondary Research Question:** What do stakeholders think about the impacts these measures will have on the future of the industry for Canada?
- **Secondary Research Question:** How can this insight be used for future engagement with stakeholders regarding emissions reduction strategies in Canada?

## **1.6 Management Problem**

Action towards stronger measures for the reduction of shipping emissions within Canada and internationally is urgently required. The maritime shipping industry is vital for Canada as it provides ample economic, cultural, and societal benefits (Council of Canadian Academies, 2017). Shipping fosters interconnectivity between distanced nations and accelerates growth and economic opportunities within Canada and across the globe (Mitropoulos, 2005). Maritime culture and traditions are facilitated by the shipping activity that occurs in coastal communities, where many regions are dependent on it for basic needs (Council of Canadian Academies, 2017). Thus, the importance of the industry to Canada is undisputed; as such, its contribution to greater GHG emissions must be handled with diligence and urgency. More decisive, and constructive action must occur to further a transition to lessen the emissions from this industry. The engagement of stakeholders is essential to assess values and interests, design risk management strategies, and improve overall outcomes (IRCG, 2017). These industry perspectives are critical in understanding future directions for emissions reductions and the Canadian maritime shipping sector is being tasked with responding to urgent environmental concerns. To successfully address the issues surrounding GHGs in the shipping industry, collaboration with industry will be essential, and this can begin with establishing the sector perceptions on some of the current emissions measures and ambitions as generated by the IMO.

## **2. Methods**

### **2.1 Study Design**

To evaluate the perspectives of Canadian maritime shipping stakeholders, semi-structured interviews were conducted and audio-recorded via Zoom. The qualitative method of semi-

structured interviews was used to allow for follow-up questions, more flexible dialogue, and the use of probing, open-ended questions (Adams et al., 2010). The interview questions were shaped using the primary and secondary research questions stated in Section 1.5. Questions were grouped into three categories: 1) profiling questions whose purpose was to characterize the participants organization and their familiarity with the IMO/MEPC practices and GHG strategies, 2) scaled questions related to the three ambitions to reduce GHGs internationally as highlighted in the IS, and 3) questions pertaining to the short-term measures within the IS and actions by Canada to address reducing GHGs from ships. The interview script and questions can be found in Appendix A. Questions were a mix of short answer, scaled, and open-ended.

Interviews were conducted between July 5<sup>th</sup>, 2021, and August 5<sup>th</sup>, 2021, and were completed within 30-45 minutes. One participant requested to review the interview questions in advance before confirmation of participation in the study; all other participants received the questions at the time of interview. Question X was revised in response to feedback from the first participant; as such, the script and questions were considered a work in progress and an adjustment was made when feedback was provided (Wholey et al., 2010). Post interview, audio recordings were transcribed and compiled into a data sheet. One participant declined the use of audio recording and manual notes were taken. Each participant was provided with a copy of their transcribed interview notes within one day of their interview to review and amend as necessary. Two participants made small changes to wording post interview. The methodology for this study was approved by the Marine Affairs Program Ethics Review Standing Committee (MAPERSC file # 2021-06).

## **2.2 Participants and Outreach**

Stakeholders within the Canadian maritime shipping industry were selected as the target demographic for this study. These stakeholders fall broadly into one of two categories: infrastructure (e.g., ports) and operators (e.g., merchant shipping, marine tourism, and trade associations). These two categories were chosen to limit the scope of the study, and to align with the short-term measures in the IS (i.e., measures related to port enhancements and technical and operational measures). Other stakeholders including Canadian ENGOs, Indigenous groups and governments, and the Government of Canada were considered during the initial planning stages of this project but ultimately fell outside the scope of this work.

To recruit participants, an extensive list of Canadian maritime industry stakeholders was generated with input from Dalhousie University and World Wildlife Fund Canada (WWF). Since the interview questions focus on the content of the IS, it was crucial to connect with subject area experts from each of the participating organizations; relevant points of contact were identified through a combination of online research and referrals. Stakeholders were contacted by email using a WWF email address. The initial message sent to all the stakeholders explained the purpose and design of the study and included a consent form. In total, thirty stakeholder organizations were contacted including nine from the port/infrastructure category and twenty-one from the ship operator category.

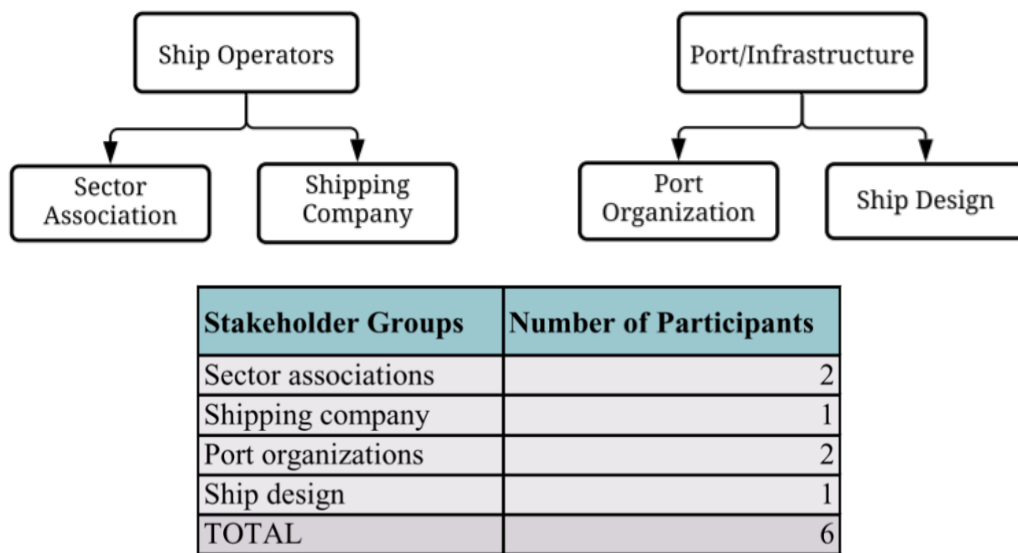
## **3. Results**

### **3.1 Outreach Outcomes**

Following initial outreach via email to thirty organizations, a total of 3 reached out to decline participation, 2 requested further information without confirming, and 6 organizations confirmed and participated in the study. A seventh organization confirmed participation in the study past

the data collection period and was declined due to time constraints for the project. From the 6 confirmed organizations, 2 made small amendments to wording of responses post-interview.

A total of 3 organizations were interviewed from the port/infrastructure group and 3 from the ship operators' group. From the port/infrastructure stakeholder group, 2 port authorities and 1 ship design organization were interviewed. And from the ship operator's stakeholder group, 2 sector/trade associations and 1 shipping company was interviewed (Figure 4).

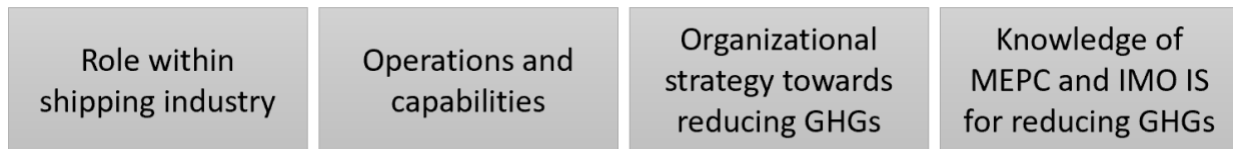


**Figure 4.** Categories of stakeholder groups that participated in the study

Regarding the 3 organizations that responded and declined participation, each provided comments and brief context as to their reasoning. One organization found they could not speak on behalf of all their member organizations on such an issue. Another replied indicating that their organization does not have the technical capabilities to handle the issue locally in Canada, as vessel alterations related to GHG mitigation occur in other countries. Lastly, one organization simply declined due to uncertainty regarding future collaboration with WWF on the topic.

## 3.2 Profiling Questions

The purpose of the profiling questions was to gather information to characterize each organization within the study and to ensure that they were able to answer questions specific to the IMO IS on GHGs. The questions within this section of the interview can be described within the following 4 categories: the organizations' role within the shipping industry, their general operations and capabilities, their organizational strategy towards cutting GHGs, and their knowledgeability towards the IMO IS on GHG/ their general awareness on the practices of the MEPC (Figure 4).



**Figure 5.** The four categories of questions covered within the initial profiling questions in each interview.

### 3.2.1 Role within the Shipping Industry

Amongst the 6 participating organizations, the roles of each differed considerably within the broader shipping industry. The two sector organizations represented various operators for ocean-going vessels within Canada that involve the transport of both freight and people. Both the port organizations are responsible for the facilitation of trade, importing and exporting goods for the use of all Canadians. The shipping operator was responsible for distributing bulk goods. And lastly, the ship design organization specifically engineers small vessels utilizing clean energy. Importantly, technical standards implemented under MAPROL Annex VI specify applicability to ships above 400 gross tonnes and above, as well as 5,000 gross tonnes and above (Transport Policy, 2021); these standards are interwoven into some of the short-term measures of the IMO IS and do not encompass all small vessels.

### 3.2.2 Operations and Capabilities

Within the broader Shipping Operators stakeholder group, 3 organizations participated, hereinafter identified as either sector association A, sector association B or shipping operator (Table 2). The number of vessels within the fleets of each organization ranged between approximately 125 and 275. It was found that each of the organizations were primarily dependant on fossil fuel-based fuels such as heavy fuel oil and diesel. Only sector association A had vessels capable of utilizing shore power and each of the three organizations had a small minority of vessels with exhaust gas cleaning systems installed (scrubbers).

**Table 2.** Characterization of shipping operators.

<b>Shipping Operators</b>			
	Sector Association A	Sector Association B	Shipping Company
Vessels in fleet	~275	~125	~200
Types of vessels	Tourism vessels	Vessles that accommodate dry bulk	All varieties
Vessels using heavy fuel oil	Majority use diesel	All of them	All but a handful
Vessels using shore power	3	None	None
Vessels with scrubbers	A minority	Roughly two thirds	Small growing minority
Regions vessels service in Canada	Canada	Canada and globally	Canada

Within the broader port/infrastructure stakeholder group, two port organizations participated and were characterized with a few questions related to size and operations. Port organization A handles a volume of approximately 150 million metric tonnes of cargo whereas Port organization B handles a volume of approximately 4 million metric tonnes of cargo annually. Both port



organizations handle cruise, container, bulk, breakbulk, roll-on/roll-off and project cargo. The third participating group within this stakeholder category (ship design) was not subject to the profiling questions as they were specific to port information. However, the ship design group was still evaluated from the remaining profiling questions.

### 3.2.3 Organizational Strategy towards reducing GHGs

Across the 6 participating organizations, there was a range of strategies and actions towards GHG reduction. Between the sector associations, sector association A described diversity in the strategies of each of the associations members. The association overall is highly supportive of efforts to reduce GHGs noting that to make the transition and encourage members to do so, they would require support and funds. Sector association B described that the strategy and actions of their members would also vary considerably however, the current goal of the association is educating members on the importance of reducing GHGs. The shipping operator detailed that they have multiple departments that are working towards greater regulatory measures and future fuel innovations. They have greater than a dozen programs within these departments dedicated to the above. Port organization A conducts a port emissions inventory, has a clean air strategy, incentives programs, collaborative programs and partnerships and has electrification efforts ongoing. Port organization B is in the process of analyzing data from recent years to produce programs that focus on fuel innovation and establishing electrification infrastructure. They are also developing targets and timelines to align with Canada's carbon emissions reductions goals. Lastly, the ship design group has created its entire mandate on reducing GHGs via improved ship design and utilizing electrification.

### 3.2.4 Knowledge of MEPC and the Initial Strategy from the IMO

Participants were asked if they had any knowledge of the efforts of the MEPC that operates through the IMO. Both the sector organizations, the shipping operator and port organization A confirmed their awareness of the MEPC. Sector association B and the ship design groups were mostly aware with the group however less familiar and less involved with any actions related to the committee.

Participants were also asked specifically for their knowledge of the document created by the IMO in 2018 titled: “Initial IMO Strategy on the Reduction of GHG from ships” (MEPC, 2018). All groups were familiar with the document.

### 3.3 Ambitions by the IS

The next series of questions relates to the three ambitions established within the IS (Table 3). These questions were developed using a 5-point Likert-type scale which gave categories of excellent, good, poor, or very poor for selection. These questions were designed to 1) determine how each organization representative evaluated their organization in contributing to each of the ambitions and 2) their general perceptions of the Canadian maritime industry in achieving each of the ambitions outlined.

**Table 3.** Levels of Ambition as outlined in the Initial Strategy of the IMO (MEPC, 2018)

IMO Levels of Ambition
1. Reduce carbon intensity of new ships through implementation of further phases of the energy efficiency
2. Reducing carbon intensity for International shipping by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008
3. Reducing the total annual GHG emissions by at least 50% by 2050 compared to 2008 whilst pursuing efforts towards phasing them out

### 3.3.1 Efforts of each organization in achieving IMO Initial Strategy Ambitions

Participants were asked to rank their perception of their organizations contribution to achieving each of the ambitions. Ambition 1 is: Reduce the carbon intensity of new ships through implementation of further phases of the energy efficiency index. For this question, only 2 of the total 6 participants felt they had the ability to give their insight. Sector association A ranked themselves as excellent, noting that enforcement and implementation of measures goes beyond the organization, although they are highly supportive of this ambition. The shipping operator ranked themselves as good due to their operations with a modern and environmentally friendly fleet.

Ambition 2 is: Reducing carbon intensity for international shipping by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008. Sector association A could not elaborate due to not being involved in international shipping activities. The shipping operator ranked their themselves as good for this ambition, noting that the technological developments to give an excellent score are immature and that infrastructure and integration would be required for ship owners to comply.

Ambition 3 is: Reducing the total annual GHG emissions by at least 50% by 2050 compared to 2008 whilst pursuing efforts to phase them out completely. Sector association A ranked themselves as excellent for achieving this ambition and voiced their support for this goal. The shipping operator also ranked themselves as excellent for this question noting their opinion that by 2050, technology, pricing, and commercial pressure will all be present to reach this ambition.

### 3.3.2 Efforts by the Canadian maritime shipping industry in achieving IMO Initial Strategy Ambitions

The same scaled questions were given to participants and in this case, they were asked to rank their perception of the Canadian maritime industry in achieving each of the three ambitions. For this question, the shipping operator, sector association B, and port organization B all had comments. Regarding ambition 1, the shipping operator ranked Canada as good describing that the industry has been well informed of the efforts needed and that there should be more advocacy on behalf of ship owners. Sector association B gave a ranking of fair for ambition one, mentioning that Canada is not a leader in this area. For ambition 2, the shipping operator gave a ranking of good noting that Canada engages with good dialogue and outreach however, they have not been advocating that these measures are needed. Sector association B also ranked Canada as good here touching on the fact that Canada could have has a stronger voice in advocating for these measures. For ambition 3, only the shipping operator could provide insight to this question, giving a ranking of fair and describing that for this ambition, there are no discussions on how it would be achieved for the Canadian industry. Port organization B answered this question by speaking broadly about the three ambitions as a whole and giving an overall ranking of fair. Noting that two years previous this ranking would be considerably lower. However, there have been improvements and a better understanding of change management and knowledge transfer within the industry.

### **3.4 Short-term measures**

Below, five of the total thirteen short-term measures outlined in the IS will be discussed through interview questions. Five measures were chosen to limit study length and because stakeholders were likely not knowledgeable to all thirteen measures. Thus, the selected five measures were

chosen due to their relevance to current issues and efforts ongoing with WWF. Participants were asked their perspective on these measures and their ability to be accomplished in the designated timeline of 2018-2023. Note that port organization A only answered the short-term measure question that was directly related to ports.

#### 3.4.1 Will these short-term measures be accomplished in their timeline?

##### a) *Develop technical and operational energy efficiency measures for both new and existing ships*

Sector association A and sector association B gave contrasting answers to this short-term measure, with A answering this change would be unlikely, particularly for the whole sector. And B believed this measure to be highly accomplishable. The shipping operator believes this measure may be achievable however, makes a strong point on safety being the biggest hurdle to be overcome and mentions this does not appear to be a priority at MEPC meetings. The ship design group believes this measure to be accomplishable in its timeline and lastly, port organization B also agrees that this could be accomplished.

##### b) *Consider and analyse the use of speed optimization and speed reduction*

Sector association A and B again, gave differing perspectives on this measure. Sector association A stated this measure not likely to be accomplished and sector association B believes it to be accomplishable between 2018-2023. The shipping operator, however, believes this measure to be highly accomplishable as it is the cheapest option to the ship owner and perceives it as being a fair measure industry wide. Both port organization B and the ship design group unanimously agreed this measure should be accomplished in its timeline.

##### c) *Encourage the development and update of national action plans to develop policies and strategies to address GHG emissions from international shipping*

Sector association A believes this to be an unlikely measure to be accomplished in this timeline. With the reasoning that implementation is a far more important tool to see effective change and that this measure should be emphasizing clear guidelines and implementation. Sector association B believes this measure to be achievable and the shipping operator thinks that Canada may not be involved in developing the measure soon but emphasizes the importance of enforcement. Port organization B was unsure if this measure could be achieved however, the ship design group think that there should be no issues in generating this measure for Canada in time.

*d) Consider and analyse measures to encourage port developments and activities globally to facilitate reduction of GHG emissions from shipping*

Sector association A and B agree that this measure is highly accomplishable for its 2018-2023 timeline. The shipping operator, however, believes this measure to be too aggressive as it would create excessive costs to ship owners and highlights some of the impractical aspects of this measure such as uptake by the industry. Port organization A believes that this measure and other measures established by the IMO are sufficient in providing baseline guidance, but overall, there is more that can be accomplished than what has been outlined in this measure. Port organization B thinks this measure to be accomplishable by 2018-2023, like the ship design group.

*e) Develop robust lifecycle GHG/carbon intensity guidelines for all types of fuels*

Sector association B believes this measure to be achievable whilst sector association A mentions that guidelines such as this will be no issue for Canada, however noting again that implementation would be a challenge. The shipping operator on the other hand states that this measure will not be accomplishable and notes that both the IMO and the Canadian government have not adequately dealt with the complexity of this task. Similarly, port organization B does

not feel like this measure will be accomplished by 2023 given the progress of some fuels. Lastly, the ship design group believes that this measure is accomplishable in its designated timeline.

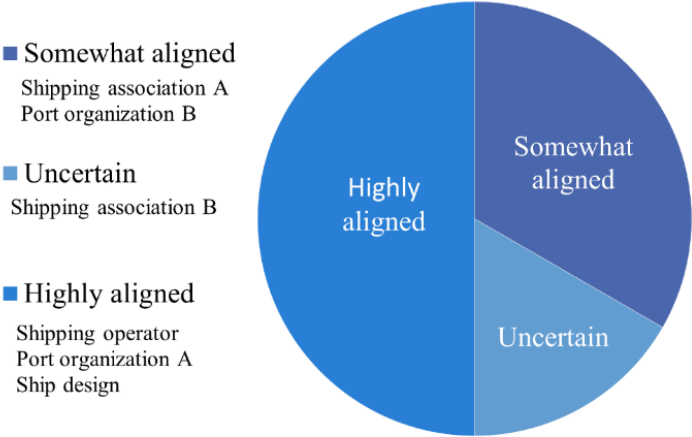
#### 3.4.2 Will these measures bring challenges to your organization's operations?

Sector association A affirms that they will experience challenges with introducing the short-term measures mentioning that infrastructure, capacity, and costs must be worked out for the guidelines to be feasible. Sector association B mentions that this largely depends on the member, as this association represents many ship owners and operators. The shipping operator anticipates challenges, but less so on the technical aspect as their fleet is modernized. They indicate larger commercial and economic impacts to the sector and are requesting guidelines to achieve the greater solutions that are being spoken of. They also call for greater responsibility on behalf of the IMO and the Canadian government. Port organization A does not anticipate any significant challenges and will adapt to any change or move beyond them. Port organization B indicates that their organization would experience challenges with new measures in place noting that all businesses will have to shift away from traditional practices to accommodate this change. However, port organization B also believes that with prioritization of the economy, these measures will not be accelerated particularly in post-Covid-19 circumstances. The ship design group will not be impacted by these short-term measures.

#### 3.4.3 To what extent is each organization aligned with the short-term measures?

Sector association A notes that they are aligned with the measures but are ultimately concerned with the technical and financial feasibility of the changes and would prefer greater assistance from the Canadian government. Sector association B was uncertain. The shipping operator is highly aligned with the short-term measures as their current operations comply with

requirements and can go beyond. Port organization A is highly aligned with the short-term measures and port organization B is somewhat aligned with these measures as they are currently working towards developing strategies. The ship design organization is highly aligned with these measures as eliminating GHGs is their entire mandate.



**Figure 6.** Organizational alignment with IMO's short-term measures from the Initial Strategy (IS).

3.4.5 What recommendations to alter the short-term measures would these organizations make?

Sector organization A would add more time to the measures to make them more realistic and would put greater emphasis on implementation. The shipping operator would recommend introducing fleet averaging and allow for a greater time for fuel innovations. Port organization A recommends caution with the uptake of any measures, noting some of the unintended consequences of previous measures that have been implemented, like use of scrubbers where air pollution has been transformed into marine pollution. Also mentioned, was attention towards the timeline for implementation to ensure future measures are robust. The ship design group notes that the short-term measures do not apply to smaller vessels and would like to see these regulations expand given they still contribute to GHG levels.



#### 3.4.6 Which of the measures is most effective in reducing GHGs?

Sector association A believes shore power and a national action plan to be effective. Sector association B considers technical and operational efficiency measures as important. The shipping operator favours speed reductions as it appears the most feasible method for reaching 2030 targets. Port organization A notes that technical and operational energy efficiency measures as well as speed reductions would be most effective. Port organization B believes speed reductions to be the most effective solution for reducing GHGs and the ship design organization points to a national action plan such that regulatory bodies can build stronger regulations.

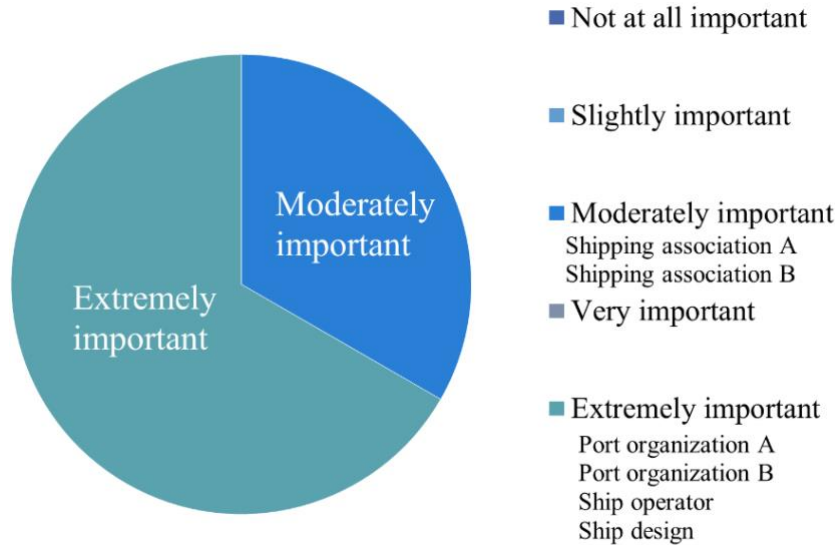
#### 3.4.7 Can these organizations withstand stronger measures than what has been outlined in the short-term measures?

Sector association A believes they are capable of stronger measures if they were to receive funding and support. Sector association B believes that there is a large variety in capability amongst their membership where some are able, and some face greater challenges in making changes. The shipping operator believes that at present, these measures could not be stronger without impacting ship safety. Port organization A is currently going beyond the short-term measures and port organization B feels that resources and support would greatly enable their ability to move beyond these measures. The ship design group is offering greater solutions than what the short-term measures highlight.

#### 3.4.8 Ranked importance of Canada introducing a National Action Plan

Sector association A agrees that a plan developed for Canada to reduce GHGs from shipping is critical however, the implementation of this plan should be of far greater importance. Sector association B ranks this as moderately important, keeping in mind any current GHG reduction

strategies that different regions of Canada currently have must meld into this overarching framework. The shipping operator states that this action would be critical and government participation and resources are important for developing alternative fuels, technologies etc. Both port organizations and the ship design group rank this as extremely important. Port organization A notes that the plan is essential to facilitate and support a transition that is suitable for industry.



**Figure 7.** Perceived importance of Canada introducing a national action plan.

3.4.9 What targets and timelines would these organizations like to see on a national action plan for Canada?

Sector association A is looking for a national plan from Canada that contains a realistic timeline; emphasizing that Canada is a trading nation with a large coastline therefore requiring great financial resources to facilitate any plan. Sector association B would like to see more short- and mid-term measures with targets strongly aligning with Paris Agreement goals. The shipping operator notes that the short-term measures are somewhat negligible now and that we must adhere to the same guidelines that the IMO has outlined. Port organization A is asking for a plan that focuses on phasing out emissions entirely by 2050. Port organization B is asking for a plan

urgently to have guidance and a framework to act collaboratively to avoid future pressure to reach stronger targets. Lastly, the ship design group wants to see speed limit reductions take seriously with widespread ship behavioural changes and greater attention to smaller vessels.

3.4.10 What kind of support measures would these organizations want from the Canadian government?

Sector association A would look for funding from the government such that their members could make the technical and operational alterations needed to help land targets. They are looking for resources, capacity-building, infrastructure, and alternative energy sources for use in the future such as nuclear power. Sector association B is advocating for greener port solutions, greater incentives for vessels that become more efficient, and electrification of vessels using shore power. The shipping operator is specifically looking for funding focused on fuel innovations. Fundamentally, money must be put into technology for products to be on the market for use commercially. Port organization A emphasizes the need for funding in addition to more regulations. However, the regulations must be flexible and suitable for a variety of businesses' operations. Noting that the government must provide the structure and support so the risk and cost can be alleviated for sector organizations. Port organization B is also seeking funding and incentives to organizations who take the initiative in proactively changing technical and operational measures to operate in an economically sustainable fashion. Lastly, the ship design group again emphasizes slowing down of vessels as a nation-wide priority, also noting that upcoming changes to the political atmosphere in Canada could change the course of any anticipated goals for a plan to reduce GHGs within the industry.

#### 4. Discussion

Maritime shipping stakeholders hold valuable insight into the regulatory practices and dynamic of the shipping industry. Perspectives from this diverse group of stakeholders were able to provide a variety of directions and opinions on actions to reduce GHGs from shipping both within Canada and globally.

The objective of this study was to gather an exploratory view of Canadian maritime shipping stakeholder perspectives on the short-term measures in IMO's IS on GHG reduction. Based on the results of semi-structured interviews with a varied group of stakeholders, a broad range of perspectives was revealed. A key insight that was evident in discussions across all stakeholders was the need for government funding and guidance to facilitate greater efforts towards reducing GHGs.

All stakeholders were aware and/or knowledgeable on the IMO IS. Of the three shipping operators, most vessels within each respective fleet are using either heavy fuel oil or diesel. Despite this, all organizations/participants did express support in mitigating GHGs. Some participants highlighted programs underway to help combat this issue and others elaborated on related barriers, such as the need to educate industry members on urgency for GHG mitigation. The port/infrastructure stakeholder group revealed vast differences that exist within capacity/ability to reduce GHGs in shipping ports and within infrastructure.

#### **4.1 Scope of stakeholder knowledge: IMO's short-term measures**

This study incorporated interview questions specific to select short-term measures within the IMO IS (Table 1). Participants were asked if they thought each of the described measures would be accomplishable within its deadline of 2023, prior to the release of the revised IMO strategy (Doelle & Chircop, 2019; Garcia et al., 2021). The responses to these questions emphasized the

diversity in expertise for each of the shipping-related participants and impacted responses considerably. Each of the participants were knowledgeable towards certain aspects of shipping activities, which provided variance in responses and explanation. Experts have criticized these short-term measures for likely having a modest impact on decarbonization efforts (Doelle & Chircop, 2019). As such, stakeholders from the maritime shipping industry in Canada were asked for their thoughts. Below, each of the select short term measures will be discussed in more detail.

*Developing technical and operational energy efficiency measures for new and existing ships* was agreed upon by majority of respondents to be accomplished by 2023 (MEPC, 2018) (Table 1).

Technologies, operational practices, and industrial research and development initiatives are rapidly being explored within the industry and have generated increased awareness and knowledge on fuel efficiency, GHG emissions reductions, and emission control policies. Despite this, generating GHG reducing measures is complicated and faces barriers in economic, technical and political realms (Bouman et al., 2017).

Mentioned by one of the study participants was the opinion that “we all have a different idea of what developing means, but I think we are going to get there”. This comment highlights how the measure outlined by the IMO presents as vague and unambitious. It is highly simplified and does not provide guidance for operational and technical changes to advance as soon as possible.

Notably, the IMO IS serves as an initial structure to frame the measures that will be adopted (Chircop, n.d.). In 2023, there will be a revised strategy generated by the IMO however, this condenses the available time to adopt the measures that have been declared for the short term.

Most of the study participants anticipate that this measure is accomplishable by 2023 and before the release of the revised IMO strategy for reduction of GHG from ships. However, this is likely

because this measure is nondescript and provides ample room for interpretation by stakeholders with varying levels of expertise and insight.

*Considering and analyzing the use of speed optimization and speed reduction* was an additional short-term measure of focus (MEPC, 2018) (Table 1). Most participants agreed to this measure as being achievable for 2023 and it was viewed mostly positively amongst stakeholders for being relatively fair amongst the industry as a GHG reduction measure. One participant stated that this measure could be “the primary means at this point and the cheapest to the shipowner”.

Deployment of commercial vessel speed regulations is viewed as a strategic choice that could heavily impact ship/fleet emissions although, the greatest critique of limiting vessel speed is the need to operate a greater number of vessels maintain the service frequency (Cariou et al., 2019). Thus, this short-term measure was favourable amongst stakeholders and was determined plausible for the near term. Regulating vessel speeds was viewed as an ideal tactic amongst all stakeholders and it would be beneficial for this measure to exceed the *considering and analysing* descriptor, to ensure more concrete and ambitious direction.

*Encouraging the development and update of national action plans to develop policies and strategies to limit GHG emissions* was an additional measure discussed amongst participants (MEPC, 2018) (Table 1). The perspectives of this measure occurring by 2023 were met with hesitation by stakeholders. Canada has yet to take a leadership role in establishing guidelines and a framework to assist shipowners and operators to mitigate emissions; no plan exists or has been discussed outwardly (Meyer, 2020). Thus, some of the stakeholders were even further concerned with implementation and enforcement of such a plan, as this is of critical importance to the success of reducing emissions for the sector. Partial to this conversation was mention of the impacts of a shifting political atmosphere in Canada and how this effects the ability for change to

materialize for the industry. Stakeholders were uncertain of the initiative by Canada to facilitating GHG reductions from the industry with a national mandate and plan.

Looking beyond Canada, skepticism was evident from study participants towards other global efforts, such as maritime decarbonization plans on behalf of Norway and the United Kingdom. For example, the Department for Transport of the United Kingdom aims for zero maritime emissions by 2050 (The Department for Transport, 2021), and Norway is a co-lead in the Zero Emission Shipping Mission whose goal is to set international shipping on a zero emissions trajectory (Mission Innovation, 2021). Multiple stakeholders within this study that were familiar with the above global efforts viewed these strategies and plans to be “not sustainable, unrealistic, and having arrogance in their procedure regarding maritime decarbonization plans”. However, some suggestions from other participating stakeholders emphasized the need for more short and medium-term measures that align with Paris Agreement and IMO targets to be incorporated in a plan for Canada before 2050. These contrasting opinions did not correlate with stakeholder category but appeared to be associated with the personal perceptions of everyone in their lens of expertise.

The short-term measure of *considering and analyzing measures to encourage port developments* presented with mixed results from stakeholders (MEPC, 2018). Some were in favour of this measure occurring by 2023 and others could not see this being achieved. Notably, in discussion it was mentioned the importance of having the IMO IS measures as a guide, but to go beyond these if able. The challenge with the IMO IS short-term measures is the large jurisdiction these measures are held against and how standards can vary within it. A global approach to regulating shipping is desirable for sake of consistency however, it can create greater challenges on smaller scales. This was evident between both port organization participants interviewed for this study.

Lastly, in discussion of the *development of robust lifecycle GHG/carbon intensity guidelines for all types of fuels*, there were some stronger opinions that this measure was far from any IMO IS targeted timelines. In relation to both the Canadian Government and the IMO IS, some stakeholders felt as though this issue has not been adequately dealt with. Alternatively, although this issue was viewed as not being prioritized, there was acknowledgment of alternative fuels within research and development. However, there was a lack of confidence that this short-term measure would occur within its 2023 timeline.

To conclude, 5 short-term measures were selected from the IMO IS to gather perspectives and insights of Canadian maritime stakeholders. To date, there are no additional studies that have sought out this information. Through interviews, it was evident that specific knowledgeability to all measures was not common amongst participants. For example, Port organization B only felt comfortable discussing in detail their understanding of the short-term measure related to ports. Other stakeholders would also only give a brief response to the measure if no further extrapolation could be made. Interestingly, the participant representing the shipping company stakeholder category had insight into each of the short-term measures; no other stakeholder elaborated on all. This evidence reinforces the importance of industry stakeholder involvement in processes that require experience and insight to guide the introduction of future regulatory structure and policy.

#### 4.1.1 Alterations to Short-Term Measures

When asked about how these measures could be altered, some recommendations were made, but largely it appeared as though most of the stakeholders could not elaborate immensely or suggest alterations outside of their personal scope of knowledge. This observation contributes to the discussion on the varied yet highly specific knowledgeability of participating stakeholders. To



those stakeholders who did provide recommendations to alter the short-term measures, it was specific to their skill set and experience in the industry. For example, Port organization A discusses the relevance of size and diversity of businesses in relation to ports and how this creates a challenge when applying and enforcing broad measures such as those within the IMO IS. In addition, the shipping company stakeholder suggests incorporating a method known as fleet averaging and encourages a greater focus on developing and integrating sustainable fuels into the market. Lastly, the ship design stakeholder proposed specific alterations to IMO's measures such that they are inclusive of vessels of lower tonnage as these ships can still impact emissions contributions with the large quantities, they exist in. Each of the proposed recommendations presented valuable insight into the direction global guidelines have taken and further, some of the objectives being sought for regulations within the Canadian maritime shipping industry. To generate more robust recommendations to alter the guiding short-term measures within the IMO IS, it would be beneficial to collaborate with a greater number of involved stakeholders from broader disciplines within the shipping industry.

#### 4.1.2 Ability to exceed short-term measures

When asked whether these stakeholder organizations could manage stronger measures than what has been outlined by the IS for 2023, a few were certain they were able, some believed this to be accomplishable with the appropriate funding, and others noted the mixed abilities of organizations across Canada. Depending on the extent of the operations of the organization, it was noted how some can afford to be more ambitious than others. The issue of ship safety was also discussed as an inevitable consequence of strengthening emissions reductions progress; this comment came from the shipping company participant and was the only stakeholder response that demonstrated opposition to this hypothetical scenario of imposing stronger measures.

Importantly, the gap in capability was also mentioned; being that many organizations face challenges in accomplishing these goals and require support in various forms. Two participants firmly responded and expressed an absolute need for resources to accomplish any further emissions reductions: “If you give us money, we will do everything we can”. The innovations that can facilitate greater reductions in emissions from the shipping industry are largely out of reach for most of the stakeholders participating in this study. To improve at a pace that exceeds that of measures outlined by the IMO IS, considerable collaborative support and guidance would be required on behalf of the IMO, Canadian Government, and Transport Canada.

#### 4.1.3 Most effective short-term measure

Based on this small sample of stakeholders within the Canadian Maritime industry, the group collectively named various short-term measures from the IMO IS as measures that would be most effective in reducing shipping emissions in Canada. Generally, there was no consensus amongst the participants for any one measure being preferable above others. As this study represents only an exploratory approach to understanding the perspectives of stakeholders on the IMO IS, these results demonstrate the need to engage more stakeholders in relevant conversations to help mitigate GHGs in the industry.

## **4.2 Challenges for industry amidst future measures**

Overwhelmingly evident throughout discussions with shipping stakeholders was expressed interest for financial support, guidance, and structure. Presently, there are no emissions reduction measures or regulations specific to the shipping industry in Canada that align with Paris Agreement targets. Notably, our federal government has formally submitted Canada’s enhanced nationally determined contribution (NDC) which is a commitment to cutting carbon emissions by

40-45 percent below 2005 values (ECCC, 2021); this NDC will aid in Canada's commitment to the 2015 Paris Agreement. Although, there are no commitments to tackle GHG reduction from ships. Overall, there is an absence of guidance for the shipping sector specifically on how to contribute to reducing emissions from maritime shipping. No framework, regulations or financial support is available to guide the industry. Below are multiple sections related to discussions with stakeholders on challenges to future operations amidst implementation of regulations, and the form of support the industry is urgently requesting.

#### 4.2.1 Operational Challenges

When discussing the potential operational challenges for future implementation of GHG reduction measures, conversations struck the same key points: a lack of guidance on behalf of the IMO/Canadian government, poor regulation, and the need for economic assistance within the sector. For example, related to the short-term measure of shore power, one stakeholder discussed the steps to be taken to accomplish electrification at ports. This would include changes to shore infrastructure, environmental impact assessments, consultation with various stakeholder groups and Indigenous communities, amongst other processes. The capacity, costs, and feasibility of making these alterations to accommodate shore power present major challenges to ship owners, operators, and broader sector associations. Without financial assistance to facilitate an improved emissions practice within the industry such as through shore power, operations will likely remain business as usual. This is because operators would rather pay to operate in the same capacity than to shift to a complex new structure, particularly if support to make these kinds of transitions is not visible.

In addition, operational challenges were discussed in a commercial context if measures to mitigate GHGs would be implemented for the sector. The issue in this scenario for ship operators

is the chartering disparity that could occur once standards are implemented and enforced. From the perspective of a shipping operator, this is a serious challenge; to either scrap their fleet or take less money commercially for what they must work with. In an analogy made by this stakeholder, the situation would be like: if the government had instructed individuals to replace their cars with electric cars within two months. How would people be expected to have the money to do so? The perspective of the shipping operator is that of not being given a clear pathway from maritime administrative bodies on achieving a solution that is well characterized and understood.

Contrary to the above, the idea of future emissions reductions measures was also viewed as welcome and necessary to some of the stakeholders. “We will adapt to whatever is needed” and “challenge is good, change is necessary” are some of the statements received when asked if stricter measures would pose a challenge to operations. Acknowledgment of an urgent transition to better operational practices was emphasized. Although, also present within this discussion was the importance of the global economy and how in times of crisis, such as with the COVID-19 pandemic, the environmental priorities have retreated within the industry, despite their urgency. Overall, through the lens of six different maritime shipping stakeholders, there appears to be a broad spectrum of capability for change.

#### 4.2.2 Support Measures for the Industry

Unanimously discussed amongst all stakeholders was the need for funding as an essential form of government support to transition reducing GHGs from the shipping sector. In these discussions, financial support was viewed as mandatory to facilitate emissions mitigation projects, innovations for fuels, improved shore infrastructure, and technology advancement. In Canada, there exists funded programs such as the Emissions Reduction Fund that assists the

offshore and onshore oil and gas industry in achieving greener solutions to mitigate GHGs, and the Zero Emission Transit Fund to support electrification of public transportation. Approximately \$3.5 billion dollars has been allocated to support emissions reductions in these programs from the Government of Canada (NRC, 2021, Infrastructure Canada, 2021). The shipping sector accounts for nearly 3% of global anthropogenic GHG emissions and is anticipated to reach 17% by the middle of this century if no intervention occurs (Gritsenko, 2017)/DNV. To date, there does not exist any financial support by part of the Canadian Government to support the reduction of GHGs from ships.

Without funding or economic assistance, the shipping industry is left stuck with little room for improvement or action in mitigating GHGs. Stakeholders from this study feel that government involvement is essential in shifting industry towards a future that is less dependent on fossil fuels. Notably, the impacts of any novel regulations for GHG mitigation within the industry would be varied between stakeholder groups. Thus, it would be tremendously valuable to assess the differences in economic impacts amongst stakeholders in the maritime shipping industry prior to the development and/or implementation of GHG mitigation measures.

In different regions of the world there are pilots and demonstrations that have received funds and support to move forward; these efforts are slowly bringing change. The governments of the United States, Norway, and Denmark are collaborating with The Global Maritime Forum and the Maersk McKinney Moller Center for Zero Carbon Shipping for a new initiative called the Zero-Emission Shipping Mission. This international partnership aims to develop and deploy zero-emission fuels, ships, and bunkering infrastructure to cover 5% of global deep-sea fuel consumption by 2030 (The Maritime Executive, 2021; Mission Innovation, 2021). In Canada, there must be similar initiatives and involvement to shift the current emissions trajectory

resultant of the maritime shipping sector. Most notably, Canadian shipping industry stakeholders are asking for funding to assist them in investing in advancements and solutions for innovative fuels and technology.

### **4.3 Stakeholder Engagement Essential for Effective Policy Production**

The results of this study have demonstrated the importance of open dialogue and discussions with stakeholders in the maritime shipping sector in Canada. A wealth of views has been generated in relation to the short-term measures in the IMO IS, providing a glimpse into the diverse perspectives of industry stakeholders. In some instances, conversations aligned amongst stakeholders however, in most cases there was a great variety in opinions and responses. This can be demonstrated through the consensus amongst stakeholders when asked what form of support measures they wished to see from the Canadian government, vs which of the short-term measures would be most effective in mitigating GHGs in Canada.

Six individuals from areas of port organizations, ship design, shipping company, and broader sector organizations were involved in this study; these participants were a suitable mix to generate an exploratory view on the industry perspectives of the short-term measures outlined by the IMO. Notably, the IS is directed towards IMO Member States and the IMO only plays the role of orchestrator when it comes to regulating the sectors activities. Decisions on regulatory tools adopted under the IMO are mediated between member states but are influenced by large shipping companies (Garcia et al., 2021). Thus, it is in the hands of Canadian maritime administrative bodies (Transport Canada) and shipping industry stakeholders to inform the measures that can aid in the mitigation of GHGs from ships. For this reason, it is imperative to generate conversations and dialogue on the current perspectives of shipping emissions reductions in Canada.

For the purposes of this study, stakeholders were required to be familiar with the short-term measures and IS created by the IMO, as these will likely guide and inform new measures implemented by Canada in the future as a National Action Plan. As such, the next steps to further conversations around the topic of shipping emissions mitigation, is to involve more players. To establish meaningful policy, stakeholder engagement must be widened to accommodate the opinions and significance of politicians, interests groups, media, and others (Roe, 2013). The shipping industry contains many more players than what was explored within this study, all of which have valuable insights to be considered amidst future changes to operations for ships and port infrastructure. To enhance the results of this study, it would be beneficial to pursue further conversations with stakeholders within engineering, tourism, ship management, shipyards, northern and Indigenous shipping communities, and to include additional perspectives from terminals/ports and ship owners and operators. Furthermore, it would be valuable to expand and connect with interrelated stakeholders outside of the immediate marine industry, such as with pathways related to research, development, and education. With this route, gaps and uncertainties related to generating effective change could be better explored.

Canada presently has no established framework or plan that aligns with IMO strategies to reduce emissions from the maritime shipping industry. The production of policy in the form of a National Action Plan for the shipping industry is critical for emissions trajectories to shift. The IS was created to encourage countries to develop National Action Plans that set out policies to address *international* shipping GHG emissions. These national plans are the appropriate policies and programs for IMO Member States to define specific measures to be implemented *domestically* to meet the Strategy's emission targets (Garcia et al., 2021). As mentioned by various stakeholders throughout this study was the absence of guidance for ship owners and

operators to follow. Canada needs to urgently move forward with direction and support for industry members to transition to greater emissions reductions. Failures in governance of the maritime sector occur with inadequacies in shipping and/or ports policy due to lack of acknowledgment of environmental, economic, safety, and security problems (Roe, 2013). Thus, through discussions with study participants representing a small glimpse into the sectors perspectives, it appears as though the regulation of policy for the shipping industry in Canada to reduce GHG is simply insufficient.

The results of this study have indicated the importance of gathering information from stakeholders in advance of policy implementation for the maritime shipping industry. This study only incorporated the voices of a fraction of the available stakeholders relevant to emissions reductions policies for shipping in Canada; those knowledgeable on the IMO IS short-term measures. Through these conversations emerged a range of opinions and perceptions. However, more discussions on future changes to the industry in reducing GHGs from ships must incorporate the views of a larger grouping of relevant stakeholders. The impacts of future changes to the industry will have downstream effects for many. As such, an integrated approach to change is best.

#### **4.4 Study Limitations and Challenges**

Outreach to study participants occurred through email via partnership with WWF. This approach may have inserted bias into the results of the study because of any perceived ideals about work/collaboration with a well-known NGO that operates in Canada. WWF is the world's leading conservation organization (WWF, 2021b). This element coupled with a study invitation which addressed GHG emissions mitigation in the shipping industry may have impacted willingness to participate among shipping stakeholders. NGOs are characterized by humanitarian



or cooperative efforts as opposed to commercial objectives, with engagement in international development (Werker & Ahmed, 2008). Shipping industry stakeholders may be less inclined to participate in a study being facilitated by an NGO which has efforts ongoing to shift commercial efforts to become more sustainable, particularly if this impacts economic growth.

An additional limitation of this study was the lack of targeted engagement with Indigenous communities related to shipping and/or port organizations. The voices of Indigenous communities in arctic regions for example, are increasingly being heard through forums such as the United Nations (UN), IMO and the Arctic Council (Hildebrand & Brigham, 2018). Maritime policies will make an impact on the natural resource availability and livelihood of Indigenous communities and thus, they should be included for future research initiatives (Stetson & Mumme, 2016). This form of engagement is an essential next step for further research and collaboration on this topic for Canada.

Lastly, due to the specificity of each stakeholder and their specific experience and role within the industry, it was common for some questions to be left unanswered. Furthermore, some participants would give a brief response to the question without much elaboration. Stakeholder position within a company may also play a role in their ability to divulge information. Therefore, some responses were brief and generalized.

#### **4.5 Additional Insights**

As per a semi-structured interview format, on occasion, participants would expand their thoughts and responses beyond the confines of the established interview questions. Some common thematic areas emerged and are briefly explored below.

##### **Atlantic vs. Pacific**

Canada holds the world's longest coastline, measuring 243,042 km in length (Statistics Canada, 2016). As a result, marine activities have a substantial economic impact on the country.

Interestingly, two-thirds of the gross value economic output for Canada originate in Atlantic Canada and one-third is generated in Pacific Canada (Pinfeld, n.d.). Despite this difference, marine transportation output in Atlantic Canada was valued at 1.9 billion in 2005, versus 4.4 billion in Pacific Canada. Thus, there is a significant quantity of economic output occurring in Atlantic Canada, although marine transportation does not match the output.

Through conversations with stakeholders for this project, the disparity between Atlantic and Pacific Canada in terms of support and resources became apparent. Despite Atlantic Canada having lower marine transportation output, the resource production output for Canada is substantial. If resources to tackle GHG mitigation are allocated based on population, this would ultimately result in Pacific Canada acquiring greater support. Atlantic Canada however is responsible for a significant economic output for the rest of the country and perhaps support and resources should be allocated based on impact, as opposed to population.

### **Consumer Impact**

Approximately 80% of the world's goods are transported via ship (Bullock et al., 2020). In addition to looking at the maritime shipping industry for solutions and change, it would be beneficial to also assess our individual impacts on emissions outputs. This can start by greater awareness on account of all consumers. As such, the emissions resultant of the global shipping is borne by everyone, so greater awareness and understanding would be critical to bolster change for the industry and further mitigate GHGs from shipping. In general, it may not be apparent to all, the impact that global shipping industry plays in facilitating emissions and furthering the climate crisis. Many populations exist physically distanced from coastlines and the trade that

occurs in these spaces. Carbon labelling is one mechanism that has been explored in recent years but will require more development to aid in consumer understanding. Awareness building for the widespread impacts of carbon emissions and global transport/consumerism will be critical.

## 5. Recommendations and Conclusions

### 5.1 Management Recommendations

To effectively mitigate the emissions resultant of maritime transport and shipping activity in Canada, regulations for ship owners, operators, and ports must be established, implemented, and enforced as soon as possible. The IMO has established an IS to guide the reduction of GHGs from ships globally, whereby various short-term measures are to be finalized and agreed upon before 2023 (IMO, 2019). These measures have been scrutinized by experts as they are not anticipated to accomplish decarbonization targets that align with the goals of the Paris Agreement (Comer & Rutherford, 2018). Emissions from this sector will remain on the current trajectory, contributing to the global climate crisis, if no further measures are taken (Gritsenko, 2017). To generate effective policy for regulating shipping emissions in Canada, collaboration amongst a greater number of shipping-related stakeholders must occur. There exists a wealth of shipping industry stakeholders, all of which are essential in providing input to guide policy needed for the industry growth and innovation in Canada. The next step would be to engage with as many players in the sector as possible to best inform regulatory plans to improve operations and technical standards to reduce GHGs from ships.

In terms of the revised IMO Strategy to come in future years, as recommended by one of the participants in this study, it would be beneficial to see revisions that include stronger measures associated with target years sooner than 2050. Measures of a greater caliber should also be found with Canadas National Action Plan when it is established. The terminology used within the IMO

IS such as “considering” and “developing”, do not produce a sense of urgency on part of Member States. The revised strategy should encompass directions and guidelines that are clear, unambiguous, and emphasize the importance in expediting the pathway to reduced emissions in the shipping sector.

The industry is also in serious need of financial support to transition towards cleaner emissions practices. Without funding, current methods will continue the same course and little progress will be made to reduce GHGs from maritime shipping. Action on behalf of the Federal Government of Canada is essential in facilitating green solutions for the sector. Through conversations with stakeholders from this study, it was evident that organizational ability to make changes to reduce GHG impacts was highly variable. Thus, it would be recommended that economic support be allocated appropriately based on capability, when available. This should occur following a comprehensive analysis of needs for each organization relative to their operations. Overall, a scaled approach to the implementation of regulatory measures for the industry could address differences in abilities amongst organizations in Canada.

## **5.2 Conclusion**

The shipping industry is a major facilitator of global trade and is responsible for a notable chunk of anthropogenic emissions. The adoption of the Paris Agreement in 2015 has set a new course for environmental action in the wake of a challenging battle against alterations in climate across the globe. The IMO guidelines are critical in establishing effective change to the operations and practices within the maritime shipping industry. Direction established by the IMO as a global regulatory body will facilitate the policy and regulatory practices held by other countries, such as Canada. The motivation for this study was to better understand the perceptions amongst industry

stakeholders on some of the early measures established by the IMO Initial Strategy. A sample of shipping industry stakeholders provided an exploratory view on the short-term measures from this Strategy. Overall, stakeholders were supportive towards the introduction of GHG mitigation strategies for the industry but expressed concern for effective implementation, feasibility and cost to owners/operators, and support from the federal government to facilitate a future with reduced emissions from the sector.

As there is an abundance of stakeholder roles within the shipping sector in Canada, many more of these perspectives should be explored to enhance the understanding of what the industry seeks for specific structure and support. It is also imperative to recognize the range of transitional ability within the sector as changes become introduced. Overall, the shipping industry cannot bare the weight of shifting practices to reduce GHGs from ships on their own. With appropriate guidance, collaboration, and funding, these critical alterations to the maritime shipping industry can make an impactful change.

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## 7. Appendices

### **Appendix A: Interview guide/script**

Project: The Canadian maritime sector's perception of the International Maritime Organization's (IMOs) short-term measures for greenhouse gas (GHG) emissions

Name & Title:

Organization:

Date:

Interviewer:

Interview number:

#### **Introduction**

Hello, my name is Tianna, and I am a student at Dalhousie University and a research intern at WWF Canada. I am calling today to conduct our scheduled interview.

We are conducting interviews with organizations like yours about their perspectives on the IMO's Initial Strategy for reduction of GHGs from shipping. We would like you to share your thoughts and insights.

The interview will take approximately 30-45 minutes to complete, depending on your responses.

Your responses will not be linked to your name or organization.

I am a layperson/not an expert in shipping, so I may ask you to explain terms etc.

Do you have any questions for me before we begin?



## Profile:

First, I have a couple of questions to better understand your organization.

1. Can you describe the role of this organization in the context of the broader shipping industry?
2. If organization is a port:
  - a. What is the approximate size of your port?
  - b. What is the storage capacity?
  - c. What type of operations exist?
3. If organization is a shipping operator:
  - a. Size of fleet: How many vessels are in your fleet?
  - b. Makeup of fleet: What types of vessels are in your fleet? (Cruise, cargo, tankers, tug/towing, etc.)
  - c. Fuel: How many of your vessels are capable of using heavy fuel oil?
  - d. Fuel: How many of your vessels are capable of utilizing shore power?
  - e. Fuel: How many of these vessels have exhaust gas cleaning systems (AKA “scrubbers”)?
  - f. What region(s) do your vessels service and what are their main ports of call?
4. Can you describe the organizations strategy and actions on greenhouse gas emissions reduction?
5. Do you have any knowledge on the efforts of the Marine Environmental Protection Committee (MEPC) that operates through the International Maritime Organization?
  - a. What is your knowledge of the document created by the Marine Environment Protection Committee (MEPC) named: “Initial IMO Strategy on the Reduction of GHG from ships?”

## IMO’s Ambitions

6. The IMO established three levels of ambition in its Initial Strategy for reducing greenhouse gases (GHGs) within the shipping industry. Can you rank your perception of the efforts taken by your organization to contribute to achieving the ambition of?

- a. Reduce carbon intensity of new ships through implementation of further phases of the energy efficiency

<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>	<b>Very Poor</b>
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- If possible, can you provide any further comments to your selections?

Can you rank your perception of the efforts taken by your organization to contribute to achieving the ambition of?

- b. Reducing carbon intensity for international shipping by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008

<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>	<b>Very Poor</b>
------------------	-------------	-------------	-------------	------------------

- If possible, can you provide any further comments to your selections?

Can you rank your perception of the efforts taken by your organization to contribute to achieving the ambition of?

- c. Reducing the total annual GHG emissions by at least 50% by 2050 compared to 2008 whilst pursuing efforts towards phasing them out

<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>	<b>Very Poor</b>
------------------	-------------	-------------	-------------	------------------

- If possible, can you provide any further comments to your selections?

- 7. Following our discussion on the ambitions established by the IMO for reduction of GHGs, can you now rank your perception of the efforts taken by the Canadian maritime shipping industry to contribute to achieving the ambition of:

- a. Reduce carbon intensity of new ships through implementation of further phases of the energy efficiency

<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>	<b>Very Poor</b>
------------------	-------------	-------------	-------------	------------------

- If possible, can you provide any further comments to your selections?

Can you rank your perception of the efforts taken by the Canadian maritime shipping industry to contribute to achieving the ambition of?

- b. Reducing carbon intensity for international shipping by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008

<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>	<b>Very Poor</b>
------------------	-------------	-------------	-------------	------------------

- If possible, can you provide any further comments to your selections?

Can you rank your perception of the efforts taken by the Canadian maritime shipping industry to contribute to achieving the ambition of?

- c. Reducing the total annual GHG emissions by at least 50% by 2050 compared to 2008 whilst pursuing efforts towards phasing them out

<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>	<b>Very Poor</b>
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- If possible, can you provide any further comments to your selections?

### Short-term Measures

8. How accomplishable do you think these measures will be in their designated timeline (2018-2023) for the shipping industry?
  - a. Develop technical and operational energy efficiency measures for both new and existing ships
  - b. Greater focus on speed optimization and speed reduction
  - c. Update/development of National Action plans
  - d. Consider and analyze measures to encourage port developments and activities globally to facilitate reduction of GHG emissions from shipping
  - e. Develop robust lifecycle GHG/carbon intensity guidelines for all types of fuels

9. When the short-term measures become implemented, do you anticipate any significant challenges to your organization's operations?
10. To what extent do you believe your organization is aligned with the short-term measures outlined by the IMO's Initial Strategy in achieving lowered emissions?

<b>Highly Aligned</b>	<b>Somewhat Aligned</b>	<b>Hardly Aligned</b>	<b>Not aligned</b>	<b>Uncertain</b>
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- a. If possible, can you provide any further explanation to your selection?
11. If you could make recommendations to alter any of these short-term measures, what would they be?
12. Which one of these measures do you think will be most effective in reducing GHG emissions in Canada and why?
13. Do you believe that your organization is capable of handling stronger measures for GHG reductions than what has been outlined with the short-term measures?
- a. Is it desirable for your organization to possibly go beyond the short-term measures?
14. Can you rank your perception on the importance of Canada introducing a National Action plan that will generate policies and strategies to enable decarbonization of the shipping industry?

<b>Not at all important</b>	<b>Slightly important</b>	<b>Moderately important</b>	<b>Very important</b>	<b>Extremely important</b>
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- a. If possible, can you provide any further explanation to your selection?
- b. The UK and Norwegian maritime decarbonization plans are more ambitious than the IMO Strategy (zero emissions by 2050). What targets and timelines would you expect to see on a Canadian national plan for the maritime industry?

c. What kind of support measures would you like to see from the government?