COMMUNITY PERCEPTIONS OF MARINE TRAFFIC IMPACTS ON THE ST. LAWRENCE RIVER

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CONTENTS

ABSTRACT

The St. Lawrence River, a critical navigational and ecological artery in North America, plays a dual role in supporting both the economy, through the transport of goods and tourism, and societal well-being with leisure activities. The escalating issue of ships operating at increasing speeds has sparked concerns about the potential for accidents, environmental harm, and adverse socio-economic consequences for local communities in Quebec and Canada. This thesis examines the perceptions of local communities regarding the impacts of marine traffic, including recreational and commercial vessels, along the St. Lawrence River. The study encompasses a wide range of community perspectives gathered through a survey conducted from June to November 2023 in communities near the St. Lawrence waterway. The survey, supported by a conceptual framework, investigates various aspects of perception, including interactions with the river, identified areas of concern, and perceived effects of marine traffic on ecological systems, community well-being, and safety. By employing a mixed-methods approach, this analysis incorporates socio-economic, demographic, and geographic contexts, regression models, spatial analysis, and qualitative coding in order to reveal patterns and perceptual themes within the responses. The study reveals that socio-economic and demographic factors, such as age, income, place of residence, and employment sector(s), play a significant role in shaping individuals' perceptions of the effects of maritime traffic. Perception is also influenced by geography, as evidenced by the variation in responses observed in different administrative regions. Ultimately, analysis of the qualitative data showcases distinct patterns, highlighting the amplification of shipping-induced waves caused by high speeds, resulting in coastal erosion and safety concerns arising from dangerous user behavior. The pivotal role of this work lies in its ability to establish a connection between the broader research community, the shipping industry, and the general public, thereby improving our understanding of perceived impacts of maritime traffic. The findings significantly contribute to the on-going

discussion on St. Lawrence maritime traffic and provides valuable actionable insight for policy makers.

RÉSUMÉ

Le fleuve Saint-Laurent, artère écologique et de navigation essentielle en Amérique du Nord, joue un double rôle en soutenant à la fois l'économie, grâce au transport de marchandises et au tourisme, et le bien-être de la société, grâce aux activités de loisirs. La question de l'augmentation de la vitesse des navires suscite des inquiétudes quant aux risques d'accidents, aux dommages environnementaux et aux conséquences socio-économiques négatives pour les communautés locales au Québec et au Canada. Ce mémoire examine les perceptions des communautés locales concernant les impacts du trafic maritime, y compris les navires de plaisance et les navires commerciaux, le long du fleuve Saint-Laurent. L'étude englobe un large éventail de perspectives communautaires recueillies par le biais d'une enquête menée de juin à novembre 2023 dans les communautés situées à proximité de la voie navigable du Saint-Laurent. L'enquête, construite à l'aide d'un cadre conceptuel, examine divers aspects de la perception, y compris les interactions avec le fleuve, les domaines de préoccupation identifiés et les effets perçus du trafic maritime sur les systèmes écologiques, le bien-être de la communauté et la sécurité. En employant une approche mixte, cette analyse incorpore des contextes socio-économiques, démographiques et géographiques, des modèles de régression, une analyse spatiale et un codage qualitatif afin de révéler des tendances et des thèmes de perception dans les réponses. Les résultats révèlent que les facteurs socio-économiques et démographiques, tels que l'âge, le revenu, le lieu de résidence et le(s) secteur(s) d'emploi, jouent un rôle important dans la perception qu'ont les individus des effets du trafic maritime. La perception est également influencée par la géographie, comme le montre la variation des réponses observée dans les différentes régions administratives. De plus, les données qualitatives mettent en évidence des schémas distincts, soulignant l'amplification des vagues provoquées par la vitesse élevée des navires, ce qui entraîne l'érosion côtière et des préoccupations pour la sécurité face au comportement dangereux des usagers plaisanciers. Le rôle central de ce travail réside dans sa capacité à établir un lien entre les acteurs clés de la recherche, de

l'industrie du transport maritime et du grand public, améliorant ainsi notre compréhension des impacts perçus du trafic maritime. La portée de ce travail contribue de manière significative à la discussion en cours sur le trafic maritime du Saint-Laurent et fournissent des informations utiles aux preneurs de décision.

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CONTRIBUTION OF AUTHORS

All five chapters were written by Clara Féré under the supervision of Professor Grant McKenzie.

The survey was designed by Clara Féré under supervision of Grant McKenzie with input from the larger PLAINE[1] project team, including Cynthia Bluteau, Dany Dumont, Mylène Vallée, Louise Corriveau, Étienne Landry, Jérémy Beaudry, David Didier, and Pascal Matte. The survey was disseminated by the Zones d'Intervention Prioritaire (ZIP), with input from Clara Féré. All analysis and writing were done by Clara Féré with input from supervisor, Grant McKenzie, and limited input from the PLAINE team.

[1] Programme de recherche visant l'atténuation des impacts de la navigation commerciale sur les écosystèmes

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LIST OF ABBREVIATIONS

PLAINE Programme de recherche visant L'atténuation des Impacts de la Navigation commerciale sur les Écosystèmes

ZIP Zone d'Intervention Prioritaire

RQM Réseau Québec Maritime

RQ Research Question

MSP Marine Spatial Planning

CZP Coastal Zone Planning

RH Risk-Hazard

PAR Pressure-and-Response

OBV Organisation de Bassins Versants

OR Odds Ratio

FoP Factor of Perception

FoI Factor of Influence

FoC Factor of Concern

FoS Factor of Spatiality

FoM Factor of Measurement

FSA Forward Sortation Area

1. INTRODUCTION

The St. Lawrence River, spanning 1.6 million square kilometres, serves as a vital economic conduit between Canada and the United States of America. Primarily used for the transportation of goods, individuals also partake in recreational pursuits within this unique maritime setting. The World Economic Forum has estimated that maritime routes transport around 90% of global merchandise (Nagurney & Isenberg, 2021). This is the case in Quebec where 80% of goods are transported through at least one ship before reaching the province (Roy, 2020). Nagurney and Isenberg (2021) predict that as the size of container ships increases, so will their frequency. Indeed, by 2050, global maritime traffic is expected to increase by at least 2-fold, from 240 to 1209% (Sardain et al., 2019). Given the escalating traffic and the escalating demand for goods transported via the river, commercial vessels are likely to increase their speed. The acceleration raises apprehensions regarding the influence of vessels and their waves on the neighbouring communities and ecosystems. Consequently, this discourse has gained significant relevance in society, encompassing community organizations, business entities, and political figures. Various individuals express their opinions and concerns regarding the multiple impacts caused by these activities such as shoreline erosion leading to flood conditions, pollution, loss of fisheries and biodiversity, infrastructure damage, noise and collisions (Bergeron, 2018; Guéricolas, 2012; Radio-Canada, 2019a; Radio-Canada, 2019b; Spector, 2024; Dauphin, 2000; Chion et al., 2018; Lesage et al., 1999; Stolle & Pham-Van-Bang, 2022).

Amid the potential for devastating floodings in the St. Lawrence River coastal region, a growing number of citizens are raising their concerns (Montgomery, 2017; Tumilty, 2019). The complaints specifically pinpoint the government's alleged failure to oversee shipping and boating practices (Bergeron, 2018). This is of particular importance in the region as cumulative exposure is typically at its highest in coastal regions, particularly near coastal cities. These areas experience the greatest intensity of human activities, such as coastal development and shipping, which contribute to

pollution runoff. Additionally, they are also subject to natural disturbances, overlaying an already challenging environment (Feist & Levin, 2016; Micheli et al., 2016). Therefore, the risks associated with cumulative exposure in coastal cities near the St. Lawrence River make the future of their populations highly susceptible to worsened climatic conditions.

In light of this, this research investigates how maritime activities taking place on the St. Lawrence River are perceived by local communities. The objective of this thesis is to identify the interests and concerns of local communities regarding various aspects of the matter, with a specific emphasis on the potential of vessel speed, frequency, and location. When examining the perception of vessel impacts on the St. Lawrence River and its communities, this thesis considers the socio-economic and demographic context of respondents.

The findings of this study will serve as a fundamental building block in providing precise and valuable insight regarding concerns and impacts of marine traffic to the residents and stakeholders of the area. In essence, it will draw attention to areas of concern pertaining to boating and shipping activities.

1.1 STUDY CONTEXT

PORTRAIT OF THE ST. LAWRENCE RIVER

The research delves into the St. Lawrence River, its basin being home to around 60 million inhabitants (Lamberti et al., 2023). Quebec's commercial port infrastructure, intricately linked with rail and road networks, can access a sizable North American market encompassing over 135 million individuals within a 1,000-kilometer radius of Montreal (St. Lawrence 2011-2026 Action Plan, 2017).

The maritime domain along the St. Lawrence River implicates an array of stakeholders encompassing ship operators, port authorities, and maritime service providers (Zins Beauchesne et associés, 2013). This industry mandates exacting standards in pilotage training and deploys advanced technologies like Automatic Identification Systems (AIS) to fortify navigational safety (Zins Beauchesne et associés, 2013). Comprehending the multifaceted involvement of these entities is

pivotal in discerning the river's centrality and envisaging the ramifications of prospective policy alterations.

The economic robustness of the Great Lakes region, boasting a Gross Regional Product of $4.1 trillion USD—twice the magnitude of Canada's—owes much to the St. Lawrence Seaway (Campbell et al., 2015; The St. Lawrence Seaway Management Corporation, 2024). Commencing operations in 1959, the seaway spans 306 kilometers from Montreal to Lake Ontario, harboring 15 locks, five of which fall under Canadian jurisdiction, facilitating navigation through a 168-meter elevation differential (The St. Lawrence Seaway Management Corporation, 2024). Its consequential role is underscored by the transportation of 2.5 billion tons of cargo valued at $375 million since its inauguration, while also furnishing 3.5 million kilowatts of electricity to Canada and the U.S.A. (The St. Lawrence Seaway Management Corporation, 2024.; Olson & Suski, 2020). Moreover, it provides water to approximately 40% of Quebecers (St. Lawrence 2011-2026 Action Plan, 2017). Despite seasonal inclemency, the St. Lawrence system remains operable year-round, bolstered by the vigilance of the Canadian Coast Guard and its fleet of icebreakers, ensuring unimpeded transit. On a daily basis, around twelve vessels navigate the river's expanse.

The St. Lawrence River features 20 ports, of which nine are geared towards facilitating cruise activities, significantly contributing to fiscal revenues for both Canada and Quebec (The St. Lawrence Seaway Management Corporation, 2024; Les Conseillers ADEC, 2012). In the year 2021, the river witnessed the transit of 8,000 vessels conveying 150 million tons of assorted cargo, encompassing dry and liquid bulk commodities (SODES & Innovation Maritime, 2022; Comtois, 2022). Furthermore, Quebec's ferry services annually transport 5.6 million passengers, servicing a network of 30 municipalities and assuaging isolation concerns in remote northern locales (Les Conseillers ADEC, 2012; Société des Traversiers du Québec, 2021). Notably, in the year 2023, 43 vessels berthed at ports along the St. Lawrence, collectively accumulating over 450 days in port and yielding approximately 460,000 passenger-days (Cruise the Saint Lawrence, 2023).

The comprehensive report on the Economic Impacts of Maritime Shipping in the Great Lakes-St. Lawrence Region delineates the substantial cargo throughput and economic activity characterizing the area, fostering the creation of numerous employment opportunities and engendering substantial revenue streams (Martin Associates, 2023). Concurrently, recreational boating pursuits enjoy prominence, evidenced by the presence of over 210 marinas and 15,000 public dock spaces within Quebec (Nautisme Québec, 2024; The St. Lawrence Seaway Management Corporation, 2024). However, these avenues are not devoid of repercussions, with attendant environmental and societal ramifications, inclusive of operational mishaps and ecological degradation (Government of Canada, 2017; Victor, 2021). The St. Lawrence River's ecological richness and cultural import underscore the imperative for conservation efforts, acknowledging its profound significance to indigenous communities and forthcoming generations (Solution Saint-Laurent, 2024).

STUDY AREA

The research project takes place along the coast of the St. Lawrence River, where about 80% of Quebecers live (St. Lawrence 2011-2026 Action Plan, 2017). All of the St. Lawrence Marine Corridor (*Figure 1.1*) is of interest for our study.

FIGURE 1.1: MAP OF THE SAINT LAWRENCE RIVER

This research is part of a PLAINE (Programme de recherche visant L'atténuation des Impacts de la Navigation commerciale sur les Ecosystèmes)[2] program developing a decision support system to help pilots of the Laurentian Pilotage Authority with the management of ships' speeds on the St. Lawrence River (Réseau Québec Maritime, 2022). Scientists, community organizations, and shipping industry workers make up the PLAINE program team. The team undertook a comprehensive data collection effort spanning the region between Deschambault, QC, and Deschaillons-sur-Saint-Laurent, QC. This endeavor involved meticulous measurements and analysis to validate a predictive model crucial for navigating the intricate waterways of the St. Lawrence River.

Prompted by the Lac Saint-Pierre incident (Government of Canada, 2017), which served as a catalyst for heightened scrutiny and proactive measures in the maritime domain, Cynthia Bluteau's team embarked on a preliminary investigation in 2019. Their study (Bluteau et al., 2023) provided valuable insights and groundwork (Bluteau et al., 2022) for the subsequent PLAINE project, underscoring the urgent need for enhanced modelling and risk assessment methodologies in the St. Lawrence River basin.

Central to the PLAINE project's objectives is the exploration of wave dynamics and their implications for maritime operations along the designated stretch of the St. Lawrence River. Recognizing the inherent complexities and challenges associated with predicting wave behavior, the project leverages the proven efficacy of the XBeach model (XBeach, 2024). This advanced computational tool was efficient in simulating wave movements and holds promise for shedding light on the interplay of environmental factors and vessel dynamics.

Expanding on the initial findings obtained from the Lac Saint-Pierre study, which demonstrated a significant relationship between vessel speed and wave generation, the PLAINE program aims to enhance and broaden this foundation of knowledge. Specifically, early observations indicated that vessels traveling within the

[2] Research Program for the Mitigation of Impacts of Commercial Navigation on Ecosystems in English

range of 13.0 to 18.2 knots exhibited significant wave activity, with potential implications for navigation safety and environmental impact. These insights, buttressed by empirical data and scientific rigor, serve as the cornerstone for subsequent analyses and model development efforts within the PLAINE framework.

Securing funding through Réseau Québec Maritime's (RQM) PLAINE program represents a pivotal milestone in advancing maritime safety and environmental stewardship initiatives. Under the leadership of Cynthia Bluteau and her team, the broader project aims to proactively identify and address potential risks and vulnerabilities inherent in maritime activities. The project aims to improve efficiency and reduce negative effects by focusing on important areas between Montreal and Quebec, where environmental conditions and navigation challenges are most significant.

Integral to the PLAINE project's overarching objectives is the alignment of public perceptions with empirical observations and scientific data. By engaging with stakeholders and fostering a collaborative approach to risk assessment and management, the project seeks to bridge the gap between public awareness and scientific understanding of wave dynamics and their implications for maritime safety and environmental sustainability.

In summary, the PLAINE project represents a concerted effort to leverage cutting-edge scientific methodologies and collaborative partnerships to enhance maritime safety and environmental resilience along the St. Lawrence River. The project aims to provide maritime decision-makers, such as the Laurentian Pilotage Authority, with useful information and strategies to address the challenges of wave dynamics and maritime activities in the region. This can be achieved through collecting data, using advanced models, and involving stakeholders.

1.2 RESEARCH QUESTIONS AND TASKS

As previously indicated, the objectives of this thesis entail analyzing the spatially correlated perception of vessel impacts from a demographic and socio-economic

standpoint. In order to formulate this work, five Research Questions (RQs) are proposed:

RQ1. How can we characterize perceptions surrounding shipping and boating practices in the St. Lawrence River environment?

The purpose of this research question is to establish a conceptual framework by means of a conceptual model that allows me to comprehensively analyze themes derived from existing literature and media reports.

RQ2. What are the primary concerns of the population regarding maritime traffic on the St. Lawrence River? Are waves and speeds elements of concerns in maritime traffic related perception?

The inquiry seeks to examine current concerns and perceived impacts to evaluate the extent to which perception emphasizes or moderates. The second part of the question is specifically centred on speeds and waves, which are usual elements of interest related to shipping and boating practices.

RQ3: Are socio-economic and demographic contexts determinant in shaping boat traffic related perception?

The objective of this research question is to identify personal factors among participants that may shed light on differing perceptions. The provided information pertains to socio-economic and demographic contexts, which could drive differential exposure, cultural differences, access to resources and information, psychological factors such as risk perception, and even community dynamics.

RQ4. Does the geography of concern (ie. place of concern) influence other elements of perception?

Geography shapes the way we live and who we are. Due to their function as modes of transportation, shipping and boating practices are inherently connected to geography as they provide avenues of mobility. Hence, the goal of this research question is to

investigate the potential effect of geography and the incorporation of diverse local environments on overall perception. Spatial context, natural environment diversity, cultural and historical contexts, social dynamics, economic considerations, and environmental features are among the elements derived from place-based perception that can play a role in diverging perceptions.

RQ5. What insights can be gained from studying perceptions regarding the coastal issues of navigation?

The present research question stimulates a thoughtful examination of the potential insights obtained through the exploration of perception data, with a specific focus on comprehending the intricate nature of navigation-related challenges along the St. Lawrence River.

As a result, four research tasks, linked to these research questions, are identified. To begin with, I will draw a conceptual framework and model for classifying perception elements and delve into the intricacies of survey design. Subsequently, it will be necessary to conduct quantitative analysis, employing a type of regression model, in order to establish correlations among variables, and perform spatial analysis to determine the impact of geography on perception. Following this, I will conduct an analysis of answer distribution to establish overarching patterns in perceptions, which can then be complemented by themes mentioned in open-ended questions. Ultimately, a discussion examining the utilization of perception in relation to the theme of shipping and boating endeavours within the St. Lawrence environment will shed light on plausible suggestions and the dissemination of information to local stakeholders who may be affected by the matter.

1.3 STUDY SCOPE

With its emphasis on geography, the interconnection between people and places, this research seeks to explore the influence of place and spatial components on perception

of vessel impacts, as well as to identify the relevant areas of concern within the province.

Thus, the thesis portrays the more evident facets of maritime issues to a general public, encompassing regions that are further removed from the river. To ensure a comprehensive analysis of ship-induced waves, I have expanded the focus to include boating activities and vessels beyond those typically associated with the maritime industry and ships of corresponding sizes. Moreover, the inclusion of respondents from diverse regions of Quebec was encouraged to enhance the overall understanding of regional perceptions within the broader river context. I come with the hypothesis that speed is a problem for many people who have expressed concerns regarding maritime traffic, often linked to visible erosion and loss of land. Therefore, it is expected that people think higher speeds mean higher impacts.

This thesis is structured into six chapters, with the opening chapter offering an overview of the study's context and objectives. The second chapter contains a literature review of related studies. The third chapter delves into the process of structuring data collection through survey design with a conceptual model. It also introduces a mixed-method analysis approach that incorporates regression models, spatial analysis, and qualitative coding. Its aim is to identify patterns and perceptual themes among stakeholders along the St. Lawrence River. The fourth chapter comprises the survey responses and results of the analyses performed to address research questions 2, 3, and 4. Chapter 5 will present an overall discussion of the results and comparisons with similar studies to derive lessons to be learned from the work. The final chapter concludes the thesis, mentioning challenges and limitations, elements for future considerations, and key takeaways.

This study not only foregrounds the critical balance between maritime commerce and ecological preservation but also underscores the importance of community voices in shaping sustainable maritime practices on the St. Lawrence River.

2. LITERATURE REVIEW

2.1 INTRODUCTION

The current repercussions of climate change and its implications for flooding are being observed in various locations along the St. Lawrence River (Montgomery, 2017 & Tumilty, 2019). Turner et al. (2003, p.8074) define vulnerability as "the degree to which a system, subsystem, or system component is likely to experience harm due to exposure to a hazard, either a perturbation or stress/stressor". Adger (2006) highlights the vulnerability to negative impacts resulting from environmental and social changes, as well as the limited capacity to adapt. In addition, the author presents a method for assessing social vulnerability. The utilization of vulnerability as a basis enables the construction of frameworks and strategies to foster adaptation and resilience.

Existing research lacks several key components including precise and up-to-date measurements of ship-induced waves, as well as the perspectives and sentiments of the public on this issue. The exploration of perception reveals populations' knowledge, empowering their engagement in regulation debates and the establishment of participatory systems that originate from the bottom-up. The objective of this chapter is to obtain a comprehensive understanding of previous research endeavours along five dimensions. First, it will highlight the study of maritime impact with ongoing research on wave influences. Second, the study will investigate the ramifications of coastal erosion, which are frequently associated with wave impacts, and the vulnerability to this natural hazard. Third, it will explore various studies on perception to integrate commonly used methodologies in qualitative research. Fourth, it will establish a connection between knowledge and action for the socio-ecological system of the St. Lawrence River. Finally, it will elucidate a range of methodologies for capturing and analyzing perception through survey assessment.

2.2 SHIP-INDUCED WAVE MEASUREMENTS AND THE STUDY OF MARITIME IMPACTS

There is a limited amount of research that has focused on assessing wave measurement and its effects on the St. Lawrence River (Bluteau et al., 2023; Matte et al., 2019; Gharbi et al., 2008, 2010; Cloutier et al., 2008). An even smaller number of studies solely concentrate on the effects of ship-induced wave impacts. According to Dauphin's (2000) findings, ship traffic was responsible for 15% of the erosion in the Cornwall to Montmagny transect in 2000. Furthermore, the study unveiled that the transect spanning from Montreal to Sorel accounted for 86% of the total impact. It is of utmost importance to consider as we designate areas of concern for the impacts resulting from ships. In their study, Gharbi et al. (2008, 2010) examined ship-induced wave measurements in Ile-des-Barques, a region located north of Montreal near Lac Saint-Pierre. The study seeks to provide a framework for research on the hydrodynamics of maritime traffic while expanding on the drivers of erosion. Concentrating on larger vessels, the authors employ field data measurements to corroborate the predictions made by their models (Gharbi et al., 2008, 2010). This provides a basis and incentive for further comprehensive research on the effects of ship-induced waves in the St. Lawrence River region. Similarly, Simard et al. (2016) delve deeper into the physical assessment of waves produced by merchant ships. By crafting patterns of spectral source levels (SSL), they effectively measure ship waves with great precision. Additionally, the study emphasizes the importance of evaluating sound propagation properties in the environment, as well as the time series data of ship positions, which typically provide more accurate measurements. The lack of SSL knowledge during measurements is a common issue, causing significant uncertainties in the results. Matte et al. (2017) later proposed a methodological framework for assessing the effects of boats on tidal hydrodynamics in estuary channels. This supports the broader inclusion of boat effects on physical tidal processes. In a similar vein, de Ridder et al. (2021) posited that the use of a two-layer model for non-hydrostatic measurements presents a more precise means of

determining shoaling dispersion in intermediate waters. This approach explains crucial principles for comprehending the dynamics and propagation of waves in a channel. Researchers base their analysis of ship-waves on these methodologies, which involve using models like XBeach (de Ridder et al., 2021). The research community has indeed developed some tools and models to aid in the understanding of vessel impacts on waves. Among these models, XBeach stands out as an open-source numerical model created by Roelvink et al. (2009) with the purpose of investigating the effects of storms on coastlines. Almström et al. (2021) have recently utilized this model to examine ship-induced waves in Sweden. A particular interest in erosion leads to dig deeper into its impacts on the natural environment and populations.

Coastal erosion is not the sole observable consequence of maritime traffic on the river. In a recent report, Beauchesne et al. (2022) conducted an exploration of the cumulative effects of maritime activities on the St. Lawrence River and the Saguenay River. They explore the vulnerability of the region and its *Valued Components*, which are defined as social or ecological elements that environmental stressors can affect. Under the umbrella of maritime activities, both commercial and leisure boating activities are included. The selected environmental stressors and valued components are intricately associated with the fundamental building block of our Factors of Perceptions and will be further explained in a later section. This work not only gathered data to sample the collective effects but also presented the findings in relation to the relative vulnerabilities associated with each stressor and valued component. As noted earlier, this vulnerability is a focal point of interest in this study. Many studies focus on the observation of marine cumulative effects, for example Clarke Murray et al. (2015) in Canada Pacific. This is the study from which Beauchesne et al. (2022) adapted the stressors for the St. Lawrence River environment. The results from the report indicate that the whole region studied was impacted by environmental stressors resulting from maritime activities, especially when it comes to navigation and maritime pollution. They highlight portal cities along with Orléans island, the mouth of the Saguenay River, Rivière-du-Loup,

Rimouski, Matane and Baie-Comeau, and the fluvial transect between Trois-Rivière and Montreal including Lake Saint-Pierre.

The examination of methodologies for measuring ship waves establishes a framework for understanding the research conducted through the PLAINE program under the supervision of Cynthia Bluteau. The study obtained measurements of ship-induced waves in three distinct segments of the river. While it may be tangential to the work conducted for this Master's thesis, it is still vital to recognize its significance in filling the research gap concerning the measurement of shipping impacts resulting from wave movements. The second paragraph introduces a study of utmost importance. One that delves deeper into the crucial elements to establish the foundation of the survey design, subsequently elaborated upon.

2.3 THE IMPACT OF EROSION AND THE VULNERABILITY OF A NATURAL HAZARD

Shipping-related erosion in major waterways is a topic of significant discussion. To grasp the complex circumstances encountered by socio-ecological actors vulnerable to natural hazards, it is crucial to have a solid foundation of frameworks and definitions. Turner et al. (2003) developed a framework for vulnerability analysis in sustainability science. Its purpose is to analyze environmental changes, regardless of whether they are caused by human activity or natural factors, in order to identify individuals who are susceptible to the risks associated with these changes. The identification of patterns and understanding targeting dynamics in vulnerability to hazards is of utmost importance for promoting adaptation and resilience. What matters most is not the exposure per se, but rather the system's sensitivity and resilience when confronted with the hazard (p. 8074). Turner et al. (2003) introduced three distinct vulnerability frameworks. These are *the risk-hazard*, *pressure and response*, and a *comprehensive vulnerability framework* encompassing the processes resulting from exposure, sensitivity and resilience at different geographical scales. The main focal point lies in the interactions between human and environmental

conditions, which serve as the primary catalyst for determining sensitivity to resilience following exposure. A comprehensive examination of place-based vulnerability is essential in order to identify actionable methods for addressing vulnerability within a specific context. By employing this strategy, it becomes possible to formulate concepts and cultivate collective involvement and collaboration. In the process of decision-making, one must acknowledge the interdependence of all system elements, incorporating their differing levels of exposure and vulnerability.

Shoreline erosion, defined as the "loss of land bordering a body of water" (Haddow et al., 2020, p.2), is a challenge for coastal regions and Quebec is no exception. Various studies are dedicated to depicting the extensive repercussions caused by this natural hazard, as erosion imposes heavy burdens on communities. As anthropogenic factors can play a role in the occurrence of this seemingly "natural" hazard, community members are expressing their grievances to the government, urging them to take appropriate action. They argue that erosion from waves presents a direct threat to their wellbeing (Bergeron, 2018 & Guéricolas, 2012).

A thorough examination of the bathymetric variations in the Contrecœur region, spanning from Montreal to Quebec since 1898, was presented by Lapointe (1994). This article represents one of the initial efforts to investigate sedimentary processes within river channels, employing Geographic Information Systems (GIS) data for the visualization of channel expansions relevant to navigation. Lapointe (1994) highlighted concerns regarding the effect of the navigation path on sediment deposition in the nearby region and its extended surroundings. The extension of the navigation path, in regions affected by erosion, poses a hazard to the infrastructures that border the river. This is particularly worrisome given the Port of Montreal's expansion in Contrecœur. However, as urbanization continues to grow, Bernatchez et al. (2011) caution against relying solely on rigid defense structures as a means of protection against storm surges and waves. Instead of this, they advise the integration of local community knowledge and other measurement tools to optimize flood risk management. In a different study, Bernatchez et al. (2015) also anticipates a potential economic loss of about 1.5 billion dollars for Quebec by 2065, attributed to

erosion. The search for appropriate solutions against erosion leads to undesired impacts on the ecosystems as it is seen with coastal squeeze from which about half of coastal ecosystems present in the lower part of the St. Lawrence (estuary and gulf) could suffer from by 2060 (Bernatchez et al., 2016).

Consequently, the populations residing in the affected regions regard the impacts of erosion as significantly detrimental to their well-being. In light of this, Brisson and Richardson (2009) examine the perception of shoreline erosion in the Côte-Nord of Quebec, specifically from a public health standpoint. In their study, they examine how individual social factors, such as income, origins, age, number of children, and physical and mental disabilities, contribute to the vulnerability of communities. To properly assess vulnerability, one must consider a range of social factors, including density, natural resource availability, urbanization, economic development, and the quality and accessibility of infrastructure (Brisson & Richardson, 2009). It is imperative to acknowledge social vulnerability as a key factor in the collection of perceptions. In addition, Boyer-Villemaire et al. (2021) have conducted a study in Quebec on the psychological consequences of coastal hazards, which shows that individuals who have been affected present heightened levels of stress, compromised sleep quality, increased rates of absenteeism, greater financial challenges, and augmented healthcare expenses.

Hence, the St. Lawrence River region is experiencing an increasing influence of coastal erosion, which renders its populations and socio-economic systems highly susceptible to this natural phenomenon. Further exploration of community perspectives can aid in quantifying and illuminating specific issues that require attention for effective mitigation. However, as the impacts of vessels on the river are pondered, erosion may be a concern for the diverse range of river users. In addressing RQ1 regarding the characterization of perceptions concerning shipping and boating practices, the prominence of erosion is expected due to its pivotal role in the vulnerability of coastal communities.

2.4 HUMAN PERCEPTION, A WORLD OF IMAGE AND INTERPRETATION

One of the intriguing aspects of this work, as stated by RQ1, is to understand the methods for capturing and organizing perception elements associated with the potential impacts of the maritime industry and its activities. Through an examination of the existing literature on the analysis of human perception, one can obtain guidance on its application for their specific needs. With my objectives spanning diverse coastal issues associated with shipping, my primary concentration is on capturing the perception within a specific coastal context.

Analyzing human perception can be a challenging task. The implicit and explicit meaning of things and the divergence in 'image' and views of the world based on individual values or cultural and social norms can greatly influence our perception. Definitions and concepts can help in understanding the correlation between perception and behaviors, but the way to approach or interpret surveyed perception can be quite subjective. Gathering human perception is a consequent task that can be lengthy and costly. Diving into literature examples of coastal and fluvial systems perceptions surveying provided techniques for preparing this research.

The study of impact perception in the coastal context is linked to the research of common patterns of vulnerability and resilience in spatial contexts. Considering this, the study presented by Kilper and Thurmann (2011) raises the importance of social resilience as an adaptation strategy to natural hazards, drawing from the close interrelationship between perception and action. This study expands on the handling of threats stemming from the ecological theory of resilience (Holling, 1973) by incorporating the socio-ecological factors of the spatial context (Kilper & Thurmann, 2011), which we will explore in the next section. Perception-based resilience presented by Legaspi et al. (2016) shows all the cognitive, affective, and behavioral processes that go along with building resilience. Drawing from this, we can explore the perception-action model explained by Legaspi et al. (2016) based on empathy between the perceiver and the object. It determines the influence of a system

component's attributes on its resiliency. Another key term is *perceived vulnerability,* which "refers to the perceiver's expectancy or her perceived likelihood of being exposed to the hazard" (Legaspi et al., 2016, p.101). Moreover, they present response efficacy as a factor in evaluating performance (Legaspi et al., 2016). Legaspi et al. (2016) emphasize the importance of comparing common beliefs on discourse, shaped by the perception of social discourse, to objective capacity determined by socio-economic indicators. All of this ties back to why considering vulnerabilities is important when gathering perception.

Narrowing the focus on beach and coastal context perceptions, let us investigate the analysis of public perceptions of beach quality in the Costa Brava with a study by Bosch et al. (2008). Here, Bosch et al. (2008) conducted a survey on different user groups to analyze their perceptions of beach quality in the Costa Brava. The survey focused on four aspects: the geomorphology, environmental aspects, services and facilities, landscape, and comfort perceived by the user. Bosch et al. (2008) conducted an innovative review, advancing the degree of interest of each group, whether it is public, collective, or private. Their method derives user profiles from socio-economic and demographic patterns, habits of use, motivations, and suggestions. For instance, they found that youth prefer urban beaches compared to adults preferring semi-natural beaches, while the elderly do not make preferential distinctions. By investigating accommodation types, they also notice that people who visit urban beaches prefer staying at hostels whereas those visiting semi-natural beaches prefer campings and that most visitors for urban beaches are foreign visitors whereas most visitors for semi-natural beaches are from the Barcelona Metropolitan Area. These distinctions can influence how people *feel about* or *perceive* a place. That approach to group respondents based on their interactions with the river is interesting to the study. Furthermore, Engen et al. (2021) put forward the issues associated with the concept of blue justice and the establishment of the blue economy development. These seek to achieve the sustainable economical use of marine environments (Engen et al., 2021). For this, the authors investigate knowledge-based perception from two key groups: fishers and coastal planners (Engen et al., 2021). They go over the principles

of marine spatial planning (MSP) and integrated coastal zone planning (CZP) while using different justice axes as survey indicators to categorize survey attributes (Engen et al., 2021). Diving into the resilience analysis of coastal solutions, the collection of users' concerns, after introducing the Pleasure Point Seawall in the United States, by Anderson et al. (2022), gives us another understanding of surveying applied to concerns and opinions across user groups. Using the Likert-scale method and qualitative open-ended questions for reflections provides suitable material for the creation of our survey. Linking perception to coastal erosion issues, an interesting local example is the study of the perception of impact from coastal erosion on the Côte-Nord of Quebec (Brisson and Richardson, 2009). It discusses the health impacts of coastal erosion on populations through a citizen forum happening over 3 days with over 150 participants. This method of surveying can be costly and time-consuming but allows for great discussion and educative opportunities. It also increases the obligation for transparency.

Perception also requires background labelling and classification work to propose adequate terms about the study in question. That is how de Groot & de Groot (2009) propose four classifications of the river: one more practical "River as sustenance" and three less pragmatic with "River as tonic", "River as nature", and "River as identity". While the first presents the economic and resource interest in the system, the second focuses on the more spiritual connection of respondents to the river, the third regards its ecological importance and the fourth brings to the internal resonance of the river in participants' minds. These are very subjective and qualitative categorizations of an environmental system but bring light to the importance of this element and its components in someone's life in a more meaningful and less practical way. While the importance of the river encompasses the attachment to the place, the human/nature relationship focuses on the environmental value, which can transfer into a more practical economic value for the respondent, accompanied by safety and the background variables of participants, meaning their socio-economic attributes (de Groot & de Groot, 2009). While exploring qualitative

data, from comment sections, attachment to qualitative coding will draw out such themes and labelling.

Gathering perceptions on local issues can be a way to engage citizen participation. Research by Durán Vian et al. (2018) seeks to create tools for the urban space recovery in Spain. It argues that the successful completion of fluvial planning depends on the performance evaluation of projects based on fluvial space knowledge from local stakeholders. Moreover, when assessing risk potential, Ruz et al. (2020) elaborate on patterns in risk perception and the future of impact assessment with preferred strategies. Again, informing populations will be key when seeking efforts to put pressure on institutions for action and implementing decided measures.

Taking another approach to perceptions, Jensen et al. (2016) presented a study on the perception and image of shipping in order to predict its future employability among pupils. Establishing general opinions of the shipping industry compared to other industries (i.e. train) also relates to its sustainable future in a world of changing climate. As a continuity, looking at feedback from seafarers and correlations between job satisfaction and performance (Yuen et al., 2018) allows for a balance in the relation of perception. Results show that seafarers have an annual turnover of 15 to 35% (Yuen et al., 2018). It leaves the shipping industry subject to instability. Mallam et al. (2020) hoped to bring light to the issues and concerns around autonomous shipping in the field. Crucial for the future of the industry, the exploration of the human element in the autonomous shipping shift is key to understanding the opportunities and challenges of innovation. Here, the use of semi-structured interviews allows for better understanding and communication of the issues. Initially, including semi-structured interviews was contemplated as a complement to the quantitative data. Nevertheless, the substantial amount of qualitative data derived from open-ended questions proved to be sufficient for the scope of this project.

Perception of impact is intricately linked with risk perception which definition's has been debated over time in research (Quintal et al., 2010), but which essentially brings links between the direct stimuli, cognitive and emotional response, diffuse feelings, and cognitive responses associated with perception and concerns

(Yang & Nair, 2014). When examining the risk-perception of shipboard safety in Norway, a positive work mindset with good management practices emphasized better perceptions (Oltedal & Wadsworth, 2010).

It is worth mentioning the survey conducted by the ClearSeas (2022) organization in 2018, 2020, and 2022. Although the intention is comparable to that of this project, the survey primarily concentrated on variances between provinces rather than within Quebec, which is one of the main objectives here. Similar themes are explored by both, including safety, the economic consequences of shipping, and the potential risks associated with pollution. This study is of great relevance to the current project, encompassing both specific and broader aspects.

The gap in the literature that this project seeks to address revolves around the perception of the shipping industry in the specific area of the St. Lawrence River, enabling direct expression of concerns from participants.

2.5 SOCIO-ECOLOGICAL SYSTEMS FOR UNDERSTANDING AND ADAPTING TO ENVIRONMENTAL CHANGE IN A RIVER CONTEXT

It was determined by Alessa et al. (2008) that perception plays a role in establishing resilience and adaptation (Friesinger, 2009). This resilience and adaptation occur in complex socio-ecological systems where many drivers affect environmental change. Hence, here we explore these aspects when relating to the St. Lawrence River for implementing decision-support solutions. Adger (2006, p. 268) states that "In the context of these social-ecological systems, resilience refers to the magnitude of disturbance that can be absorbed before a system changes to a radically different state as well as the capacity to self-organize and the capacity for adaptation to emerging circumstances". Adaptive management and the consideration of unpredictable interactions between humans and ecosystems (Adger, 2006) are fundamental to finding solutions.

Ostrom (2009) defined a framework of a complex socio-ecological system (SES) with four key components: a resource system, resource units, users, and governance systems. Each component should interact for a socio-ecological system to be functional (Ostrom, 2009). In our case, the St. Lawrence River is the resource system, the resource units can be ecological products of the river, the users are the inhabitants of the region, and the governance systems are the local and regional committees in charge of protecting the St. Lawrence such as the Zone d'Intervention Prioritaire (ZIPs) or Organisations de Bassins Versants (OBVs). When considering the shipping industry in the region, one should include its relation to each SES component of the St. Lawrence River. Many drivers of environmental change affect these components, as portrayed by Beauchesne et al. (2020) establishing the St. Lawrence as a pool of resources. Indeed, the system currently sustains 50 species of fish and provides access to 40 ports connecting Quebec to the rest of the world. Out of their 22 drivers, 3 pertain to the marine traffic with invasive species, marine pollution, and the shipping industry itself: the activity and its impact (Beauchesne et al., 2020). Our project is particularly interested in this last driver.

Acknowledging the dynamics of this complex system is key to design solutions, such as implementing a decision-support system to assist the sustainable management of navigation activities in the river put in place by Parrott et al. (2011). Through incorporating different agents, whales, and boats, and the development of interaction rules, this study drafts a comprehensive assessment of the socio-ecological system of the region (Parrott et al., 2011). The adaptive management framework provided gives a great basis for decision-making using a bottom-up approach. Another example is the creation of a voluntary conservation agreement to reduce the risks of lethal collisions between ships and whales in the Estuary. Also adopting an adaptive risk management framework initiative, Chion et al. (2018) brought together different stakeholders of the marine industry along with other community members and representatives.

2.6 MEASURING PERCEPTION

In the realm of designing methodologies to capture and analyze perception, researchers often consider a plethora of techniques, encompassing both quantitative and qualitative approaches. Alongside spatial analysis, which sheds light on the spatial correlation of survey responses (Friesinger, 2009), various other methodologies are employed to delve deeper into statistical insights.

Multivariate analysis is extensively utilized in scrutinizing survey responses (Jensen et al., 2016; Bennett et al., 2020; Bosch et al., 2008; Chambers & Skinners, 2003). Multivariate analysis involves the incorporation of multiple variables across observations for numerous individuals and objects (Chatfield, 1980). Additionally, regression models, particularly effective in delineating the relationships between dependent and independent variables, offer a robust analytical framework (Rogerson, 2001).

McCullagh (1980) introduced the proportional odds model for understanding the odds of being at or below a particular category level of the dependent variable. The method developed is employed in various fields of application, including social sciences, health sciences, and economics. One of the key assumptions of proportional odds logistic regression is proportional odds, which suggests that the odds ratios associated with each predictor variable are constant across different levels of the ordinal response variable. Some academics have brought discussions on the validity and assumptions of the initial model from McCullagh (1980) (Peterson & Harrell, 1990; Agresti, 2010), while others have developed modified versions of it to accommodate to diverse research objectives and datasets (Williams, 2006). Proportional odds logistic regression provides an Odds Ratio (OR) coefficient expanding on the magnitude and the direction of the influence of variables on different elements of perceptions by determining the likelihood of falling into certain categories.

"The odds ratio of outcome $Y = j$ versus outcome $Y = 0$ for covariate values of $x = a$ versus $x = b$ is $\mathrm{OR}_j(a,b) = \dfrac{\Pr(Y = j|x = a)/\Pr(Y = 0|x = a)}{\Pr(Y = j|x = b)/\Pr(Y = 0|x = b)}$." Pr stands

for conditional probability. E.g., Pr(Y=j|x=a) is the conditional probability of Y being j given x is a.

EQUATION 1: FORMULA OF ODDS RATIO (OR) FROM HOSMER ET AL. (2013, P. 273).

Given the qualitative nature of perception, ordinal regression, exemplified by the proportional odds model introduced by McCullagh (1980), proves instrumental in analyzing subjective or objective qualitative data. However, quantifying perception through closed-ended survey questions presents challenges, as the interpretation of subjective terms relies heavily on participants' estimations, blurring the line between objective probability and subjective concern.

Hence, a qualitative approach like coding becomes indispensable, especially considering surveys featuring open-ended questions and comment sections brimming with valuable qualitative insights. Saldaña's (2013) qualitative coding book delineates over 30 qualitative coding methods, offering detailed explanations supplemented by examples from various studies. Coding is essentially a method to organize the qualitative text in order for patterns to emerge (Auerbach and Silverstein, 2003). From these patterns can sometimes emerge *theory*, which is what we call "Grounded Theory". The idea was born with Glaser and Strauss (1967) as a concept which assesses the discovery of theory from data. Grounded theory established itself as the main reference for qualitative coding research (Corbin & Strauss, 2008; Charmaz, 2006). Nonetheless, it is crucial to acknowledge the inherent subjectivity in qualitative studies, particularly in coding, as researchers bring their subjective lenses to the analysis.

Engaging with the wide variety of statistical and qualitative methodologies available for survey analysis can be a challenging endeavor. While my choice for addressing research questions 2 and 3 involved proportional odds regression and qualitative coding, it is important to acknowledge the abundance of alternative techniques that may be of interest.

2.7 CONCLUSION

Many of these papers present interconnected contributions to the study of the perception of shipping impacts. The coastal research literature on perception introduces various valuable methods through qualitative surveying assessments. The challenges posed by shipping and coastal erosion were carefully considered, as they introduce vulnerabilities to the system. Nevertheless, I also examined literature relating to the capacity for resilience and adaptation within the population, taking into account the river system context. Hence, it is of utmost importance to incorporate the viewpoints of communities regarding maritime traffic and its impact on establishing decision-support systems for shipping regulations and speed restrictions. The key to making the St. Lawrence River system resilient lies in the interconnection of its various components, which can be achieved through knowledge-sharing and the development of effective solutions.

3. METHODOLOGY FOR ANALYSIS

3.1 INTRODUCTION

Capturing perception can prove to be a challenging process. Dember et al. (2022) define perception as the process of translating sensory stimulation into organized experience. Based on this understanding, the work presented here aims to collect the experience of community members in the St. Lawrence River coastal region. This closely relates to cognition, which encompasses perceiving, recognizing, conceiving, and reasoning. To understand the cognitive process of perception, it is necessary to consider bias, socio-economic and demographic contexts, geographic locations, exposure, or even limitations in knowledge and information.

In this chapter, I focus on the survey design, which is the building block of the thesis and provide a detailed account of the specific methods selected for the three types of analyzes. The PLAINE program group mentioned in Chapter 1 was consulted to develop this survey. As scientific experts or community actors, the team's input proved beneficial when targeting specific issues associated with ships and waves. By examining the literature, I aimed to gather a wide spectrum of possibilities and the challenges faced while designing a survey analysis in the coastal context of perception. Approaching the structure of the survey, the links with the topics of vulnerability, adaptation, and resilience emerge. To address the third research question, I performed a quantitative analysis using regression models. In order to investigate the potential impact of geography, the intersection between people and places, on perception, a spatial analysis was conducted to address the fourth research question. The process of qualitatively coding open-ended survey questions enables the identification of emergent themes in perception and facilitates the analysis of answer components for the second research question. A total of 251 people interacted with the survey, out of which 127 completed it. After checking responses to Q1 (attention-check), only 115 participants were considered for the analysis.

Although this study aims to address aspects of the issue connected to maritime traffic waves, the researchers acknowledge that a master's thesis cannot fully delve

into the complexity of the socio-ecological system presented here with depth and thoroughness. By approaching with a selective overview, I aim to present the current state of knowledge from a community-based approach.

3.2 CONCEPTUAL MODEL: FACTORS OF PERCEPTION

In this section I present the conceptual model behind the creation of the survey. Through examination of the existing literature, I developed the Factors of Perception (FoPs) as they relate to perception of the impact of vessels on the St. Lawrence River. I identified four categories that compose these FoPs: Factors of Influence (FoIs), Factors of Concern (FoCs), Factors of Measurement (FoMs), and Factors of Spatiality (FoSs). The two latter provided more diversity in factors as they can measure and spatially relate the anthropogenic activities leading to the involuntary anthropogenic and natural outcomes on the global socio-ecological system of the St. Lawrence River. *Figure 3.1* presents the FoPs selected within each category.

Elements raised from sources mentioned previously, news reports and the report on cumulative effects of marine activities by Beauchesne et al. (2022) were all substantial for the determination of the following factors.

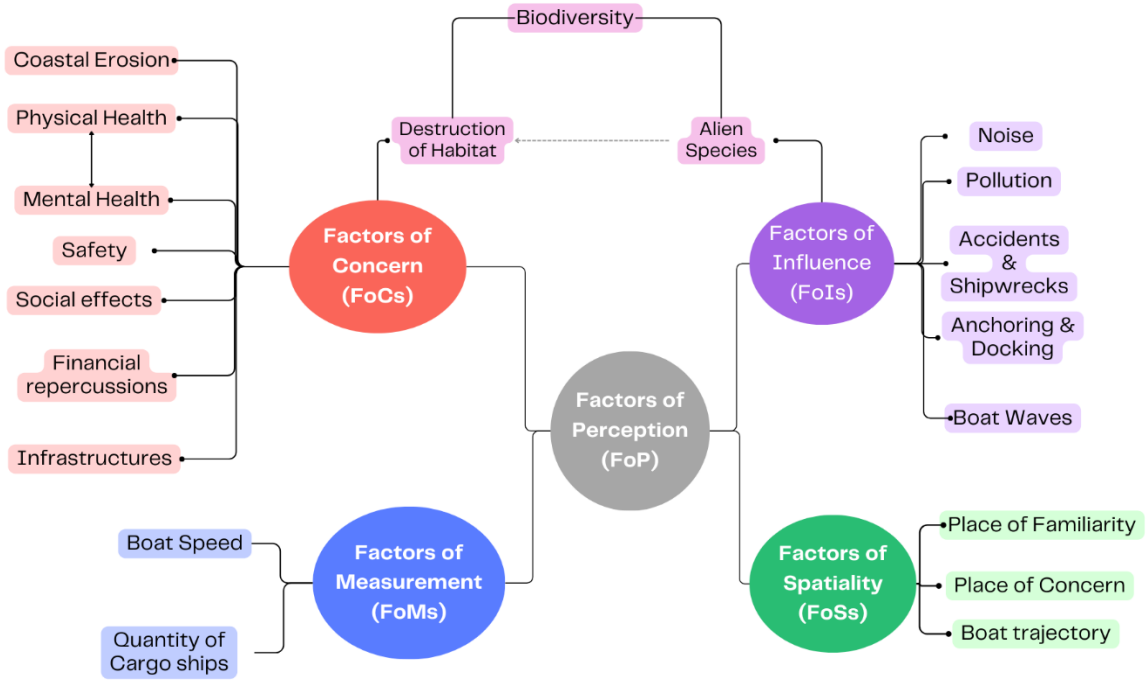

FIGURE 3.1: CONCEPTUAL MODEL OF FACTORS OF PERCEPTION

3.2.1 FACTORS OF INFLUENCE

The Factors of Influence (FoIs) can be defined as the actions performed by maritime users (commercial or leisure), which can have consequences on the socio-ecological system of the St. Lawrence River and are remotely controllable. A total of six FoIs were established prior to the survey design as to provide basis of potential elements targeted by stakeholders composing our participant pool.

- Biodiversity

The first element that can be characterized as an FoI is the potential for the contamination with invasive species. Commercial vessels often collect ballast water, which is used to stabilize the ship's weight during cargo operations. The presence of ballast water and the capacity of certain species to adhere to ships' structures have resulted in shipping being accountable for 60% of invasions in the St. Lawrence basin (Pagnucco et al., 2015). Overall, there are 10 billion tonnes of ballast water transported globally by ship each year (World Health Organization, 2011). Despite the controls and new regulations elaborated to prevent the dispersion of alien species that can harm the local biodiversity (Government of Canada, 2024; International Maritime Organization, 2024), there are still invasions occurring. Many events can result such as the loss of fisheries and economic resources along with harm for human and ecosystems health which strengthens the need for reparative investments (Chapin et al., 2000; Mack et al., 2000; Raaymakers, 2002; Lo et al., 2012). The evaluation of the global cost of invasive species reaches $US 1.28 trillion, from which $US 528 million are in Canada (Diagne et al., 2020). Outside of antifouling painting, solutions include filtration systems, magnetic field treatment, chemical disinfection, ultra-violet treatment, deoxygenation, heat treatment, ultrasonic treatment, or even electric pulse (Raunek, 2021).

- Noise

Coastal communities have declared noise disruption caused by boating activities as an annoyance (Velandia, 2015), and the production of underwater acoustic noise

poses a threat to some species (Chion et al., 2018). Tools have been developed to study the risk of acoustic noise[3].

- Maritime Pollution

Maritime Pollution encapsulates many forms of contamination of the St. Lawrence River system through maritime activities. This includes, but is not limited to, petrol spills, hydro-carbon spills, or oils spills; residual matter; wastewater (what we call 'grey' or 'black' waters, which are contaminated by domestic and sewage activities) (Clear Seas, 2024; World Wildlife Fund, 2020; Government of Canada, 2021a); and the effects on water and air quality in the region which can cause harm to some species' habitats (Rioux et al., 2023). Even though shipping transportation saves on Greenhouse Gas emissions compared to other modes of goods' transportation, it still accounts for 3% of the world's total emissions in 2018 (International Maritime Organization, 2020), a number expected to increase in the future. In 10 years (2010 to 2020), the volume of marine pollution spills increased by 10-fold and before it reached 17 651 litres in 2021, almost doubling the numbers of 2020. Most of these spills occur in coastal areas rather than offshore (Environment and Climate Change Canada, 2021). This can be particular threats to coastal communities.

- Accidents and Shipwrecks

Shipping traffic can be dangerous. According to the International Maritime Organization (2008, p.8), a marine incident corresponds to "an event or sequence of events, other than a marine casualty, which has occurred directly in connection with the ship, its occupants, or any other person in the environment". Especially given the rough conditions that the St. Lawrence River system holds, accidents and shipwrecks can occur. Even if the occasions are rare, it still needs to be accounted as a risk of the activity for the socio-ecological system. As the study places speed as a major element of focus for determining shipping's potential impacts, some incidents are indeed attributable to ships' speeds (Government of Canada, 2017). Clear Seas

[3] https://soundscape-atlas.uqar.ca/

has created a dashboard aggregating marine accidents and incidents from commercial boats in Canada and the United States[4].

- Anchoring

The *Canada Shipping Act, 2001*, specifies the regulations regarding anchoring, which Transport Canada enforces (Government of Canada, 2023a). Most efforts of regulations are located on the West Coast (Government of Canada, 2021b). However, anchoring and docking can have repercussions for nearby ecosystems and communities as it can lead ships to stay at a given place for multiple days, which can include light and noise pollution on top of sewage or other waste deliveries in the water. Considering if and where people are concerned with that aspect of the activity could also bring light on a not-so-evident impact from boat circulation.

- Batillage

Batillage is a French term used to describe water movements following the passage of a ship, or more simply put, boat waves. Shipping activity, as evidenced in the literature review, emphasizes the wave effects produced at certain places along the river shores which can sometimes act as a greater stressor in coastal environments with erosion (Sorensen, 1974; Dauphin, 2000). That is why some might be concerned with boat waves as a factor of influence. It is debatable as to whether waves are measurable. Given that water movement is emphasized by many elements which can fluctuate depending on the boat type, its size, or load. Some argue that speed can also play a role in different water movements (Sorensen, 1974).

3.2.2 Factors of Concerns

Having examined the ways in which the shipping industry and boating leisure activities could impact the well-being of the St. Lawrence socio-ecological system, we can now identify the Factors of Concern (FoCs): the (in)direct repercussions of these influences.

- Biodiversity

[4] https://experience.arcgis.com/experience/49bbdd14769646f69cc80cabcb5ac5d5

Here again, biodiversity is of interest as shipping activities produce harm to suitable habitats for some species. It is visible in the Estuary and Gulf regions with belugas (Government of Canada, 2019) and whales (Parrot et al., 2011) or with the Copper Redhorse more upstream (Gouvernement du Québec, 2024). Authorities have implemented certain measures, such as reducing speed in areas prone to collisions (Chion et al., 2018). Nonetheless, these efforts are not completely effective in averting accidents, which frequently lead to the loss of wildlife or degradation of the environment. In an official statement, the government has declared its commitment to invest $CAD 1.48 million in order to preserve 30% of the St. Lawrence environment. In addition, the allocation of these funds will ensure the preservation of 21 species facing extinction (Boisclair, 2023). The St. Lawrence boasts an impressive array of biodiversity, encompassing 19 species of marine mammals, 230 species of birds, 37 species of amphibians and reptiles, 200 species of fish, over 2214 species of invertebrates, and more than 2000 vascular plants (Fondation David Suzuki, 2024). Various types of environments exist, each creating distinct habitats, such as intertidal swamps, which are safeguarded through conservation initiatives (Nature Conservacy Canada, 2024). Beauchesne et al. (2022) highlight the species in the St. Lawrence environment that necessitate special attention, based on the Centre des données sur le patrimoine naturel du Québec (Centre de données sur le patrimoine naturel du Québec, 2021).

- Coastal Erosion

Coastal erosion represents the primary source of concern associated with any boating endeavor, whether commercial or otherwise. Dauphin (2000) provides evidence that shipping activities in the St. Lawrence River region have led to a significant increase in coastal erosion.

- Physical and Mental Health

In the wake of the scientific revolution, scientists have placed notable emphasis on physical health, while the significance of mental health has grown in the 21st century. Many issues perceived by populations show interconnections between the two. However, when relating to the perception of risk and vulnerability, mental

health focus is crucial to determine the extent of that said vulnerability. The presence of financial stress and other factors can significantly jeopardize the well-being of communities. In their research, Boyer-Villemaire et al. (2021) explored the consequences of coastal hazards in Quebec on the health of individuals, both mentally and physically. According to the research findings, those who were affected reported a heightened level of stress impacts, with these effects exerting a more substantial influence on their mental health as opposed to their physical well-being.

- Safety

Various regulations, such as the *Pilotage Act (1985)* (Government of Canada, 2023b), establish the framework for overseeing and facilitating the activities of pilots operating on the St. Lawrence River and other shipping routes within Canada. Nonetheless, the industry remains subjected to the challenging conditions imposed by the river (Radio-Canada, 2023; Clear Seas, 2020). Safer navigation is guaranteed by comprehensive training and certifications provided by the Laurentian Pilotage Authority. Despite the existence of regulations governing commercial shipping traffic, safety concerns persist among communities. Furthermore, there is a scarcity of regulations pertaining to boating for recreational purposes. A license for leisure navigation can be obtained via an online test, even without any prior experience in navigation.

- Social consequences

When it comes to personal well-being, both mental and physical health are important factors to consider. However, it is important to also consider the social repercussions that result from the influence of maritime traffic on a community. Exploring the social consequences, such as isolation and division, is crucial in understanding how distressing perceptions affect mental well-being. In their study, Boyer-Villemaire et al. (2021) examined the sensation of isolation among local residents and how it is affected by climatic events, such as storms. The study also revealed that a mere 15% of individuals reported having the assurance that they could rely on the support of at least one family member or friend to accommodate them in case of an evacuation. This observation is of great importance to our study, as it recognizes the potential

social consequences of shipping, particularly in terms of the impact of climate change and erosion processes on communities in the region. Environmental factors resulting from shipping can have an impact on people's surroundings, potentially resulting in the displacement of individuals or their loved ones (Black et al., 2011). Hence, it is of utmost importance to investigate the social consequences, such as isolation or division, within the context of this study.

- Financial repercussions

As previously stated, the consequences of mental health, which significantly impact perception, can arise from the financial stress resulting from damages caused by shipping operations. As Bernatchez et al. (2015) elicited, shipping not only represents a cost to the environment but also poses a cost to the community and the region. With an estimated (2012) CAD $1.5 billion cost of reparations from coastal hazards by 2065 (Bernatchez et al., 2015), concerns for financial repercussions are under the evaluated consequences of the activity. Especially when the maritime industry represents such a financial asset for the country and the region with about CAD $1 billion in salaries and CAD $681 in revenues for governments (2010 numbers) spent by the industry each year (Les Conseillers ADEC, 2012). Although the government may cover some of the costs associated with these reparations, individuals are ultimately responsible for investing their own resources to safeguard their personal surroundings.

- Infrastructure

Directly related to financial repercussions is the impact of the activity on coastal infrastructures. There are two types of coastal infrastructures: directly related to maritime activities (e.g. ports, marinas, docks, ...) and non-related ones (e.g. houses near the shores, ...). These can suffer from physical repercussions of the activity even though the maritime and leisure boating industries can be essential sources of revenues to maintain these infrastructures and their purpose. In connection with the preceding point, this can have adverse effects not only on industrial and community infrastructures, but also on personal infrastructures and properties.

3.2.3 FACTORS OF MEASUREMENTS

Studies suggest that numbers have a complex nature, simultaneously existing as abstract ideas and tangible phenomena, and our connection with them is intimately connected to our sensory experiences. According to Lakoff and Núñez (2000), our understanding of numbers is rooted in embodied cognition, shaped by our real-world experiences. Numbers infiltrate multiple aspects of human life, serving as a means to measure intangible concepts and translate them into concrete units. Additionally, our perception, shaped by the way we recreate bodily sensations and observe our surroundings, is heavily impacted by our information-processing capabilities (Barsalou, 2008).

Particularly in the context of cargo shipping, where size is a measurable characteristic, the numerical values we use to describe magnitude have a direct impact on how we perceive and interpret our experiences (Johnson & Montello, 2017). This perspective emphasizes the significance of clarifying the additional intuitive or observational components in our analysis.

In order to tackle this issue, I incorporate Factors of Measurements (FoMs) as measurable variables that bridge the gap between subjective perceptions of visual experience and objective realities (Gilchrist, 2012). When comparing observational data with perceptual insights, two key factors stand out as crucial: the abundance of cargo ships in maritime traffic and vessel speeds.

3.2.4 FACTORS OF SPATIALITY

When pondering the geographical aspects of perception, three elements quickly become apparent. From the participant's viewpoint, the first element evokes a sense of familiarity, a place where they feel a strong sense of belonging. The second element, however, represents a place of concern, raising worries and apprehension. By visually mapping the distribution of knowledge and concern, these tools effectively pinpoint the location of each element. Do these two places exhibit variations in both individual experiences and group perceptions? Are there any particular areas that raise

concerns or catch attention? By utilizing these elements of perceptions, those questions can be answered.

To delve into these questions, an interdisciplinary approach is taken, drawing upon literature on the sense of place, the idea of a place of concern, and the complex dynamics of feeling safe. Relph (1976) explores the concept of sense of place, highlighting its importance in comprehending how humans experience and perceive their surroundings. The concept of place-identity, as introduced by Proshansky, Fabian, and Kaminoff (1983), delves into the process of individuals forging their sense of self by interacting with the physical spaces around them. In addition, Devine-Wright (2009) explores the relationship between place attachment, place identity, and how residents perceive environmental issues, providing valuable perspectives on the notion of a "place of concern." Kasperson et al. (1988) introduced a conceptual framework in their work that explores the social amplification of risk, capturing the intricacies of location-specific concerns.

Boat trajectories present another appropriate element. More precisely, the availability of AIS data for commercial ships enables us to get trajectories for select vessels, with platforms like MarineTraffic[5] serving as valuable resources. To better understand the relationship between familiarity with certain places and the perception of concern, it is important to analyze locations of concern and compare them to boat trajectories, including the St. Lawrence Seaway, port locations, and protected areas for biodiversity.

3.3 SURVEY DESIGN

3.3.1 INTRODUCTION

A survey was designed in order to capture the perception of Quebecers on the issues related to shipping and boating activities in the St. Lawrence. A series of 23 questions were created and divided into four sections. Those sections included a *Familiarity* section assessing common interactions with the river, familiarity with the geography

[5] https://www.marinetraffic.com/en/ais/home/centerx:-68.4/centery:47.2/zoom:6

of the river, the speed of vessels and the quantity of cargo vessels going through their most familiar place. A second section, named *Concerns & Impacts*, dives into the building-block of concern and impact perception questions, it first asks for a place of concern (if one there is), selection of general concerns related with the issue of shipping, the perceived level of impact from maritime traffic on different elements derived from the conceptual model, the level of concern on different vessels, and whether an evolution was observed in shipping practices. The third section, *Exploring the issue*, is more specific to some issues approached in the model: boat speeds and waves. It contains four questions asking specifically whether individuals perceive impacts on certain elements which were previously evoked in the more general questions. It also proposes a reflection on the potential consequences from a speed reduction. The final section centers on collecting socio-economic and demographic data on participants.

3.3.2 FAMILIARITY

The Familiarity section of the survey comprises four questions (from Q2 to Q5). This section aims to gauge participants' familiarity with the spatial and quantitative aspects of shipping and boat movements in the region, while also establishing their level of interaction with the St. Lawrence environment. It essentially adds another layer of context for understanding the perception.

Consequently, Q2 is a Multiple-Choice Question (MCQ) that presents eight potential interactions with the St. Lawrence River, besides options for "no interaction" and "other". I classified the interactions into four categories: Leisure (with two options), Professional (with four options), Financial (with one option), and Personal (with one option). The aim of this question is to evaluate and classify respondents into different user groups. This is essential when examining patterns of perception and relating them to vulnerability. Investigating diversification in uses of the river acts on how people relate to impacts.

The second question (**Q3**) of this section documents the first FoS, Place of Familiarity. Establishing a connection between this element and the Place of Concern

(Q6) or even the Place of Living with the Forward Sortation Area (Q15) could prove valuable in determining proximity of concern. In order to complete questions 3 and 6, participants must click on a specific point on a map, which will then record the corresponding coordinates.

After Q3, participants are encouraged to provide qualitative details about the meaning of the place in a comment section. Different individuals may subjectively interpret and represent a place in their minds in various ways. The collection of this information serves the purpose of establishing connections with the interactions mentioned in Q2 and identifying patterns in familiar locations. The respondent is at liberty to provide supplementary information in their response.

Q4 holds significant importance in the evaluation of Familiarity**.** When evaluating potential strategies to minimize shipping impacts by utilizing speed as a leverage, it is important to consider the respondents' knowledge of average speeds across various types of boats, including those used for recreational purposes. The chosen design for this question includes a Likert-scale displaying nine different vessels. The available choices for response are groupings of speeds. Two forms of assistance are provided: a conversion of each answer into knots and a visual guide that includes pictures of each boat type in both French and English.

The last question in this section (**Q5**) pertains to estimating the frequency of large cargo vessels traversing the designated familiar region mentioned in Q3. Gaging a numerical estimate of cargo ships could render an additional insight on the perception of quantity. Q4 and Q5 hold importance to evaluate the two FoMs: quantity and speed.

3.3.3 CONCERNS & IMPACTS

The survey's focus on gathering perception data lies in the **Concerns & Impacts** section, which contains five questions (Q6 to Q10) that delve into concerns and perceived impacts.

Initiated with **Q6,** it inquires about the specific geographical area of concern, another FoS, in relation to the circulation of boats. This should establish a contrast

with the familiar location (Q3) and identify specific clusters of concerns that require regulatory attention. Just like in Q3, the comment box enables participants to provide additional context and insights about the place's significance. Including this qualitative information can be beneficial with the identification of patterns in the selection of areas of concern.

Q7 plays a crucial role in the analysis of concern, making it a central element. By collecting the specific elements of concerns derived from FoPs mentioned in the Conceptual Model, we can examine their distribution across participants looking at the frequency of selection. Participants can select multiple concerns. There are a total of 10 options available for participants to choose from, in addition to an 'other' option. Participants have the liberty to provide precise information regarding each respective category of concern.

Subsequently, **Q8** sheds light on the perceived level of impact caused by boat traffic on the aforementioned FoCs. This plays a crucial role in quantifying and arranging these FoCs. The question adopts a Likert-scale format to ease evaluation of impact with magnitude selection. Following this question, there is a comment section available for participants to provide further details on their perceived impacts. This will supplement the existing qualitative data on perceived impacts, to examine common themes emerging from each element of concern.

Q9, on the other hand, relates to the level of concern expressed by specific marine vessels**.** Presented as a Likert-scale question, it features the vessels mentioned in Q4. The survey provides participants with a visual guide for boats, which offers them a picture of the different vessels. In addition, there is a comment section where users can include specific details or express any general concerns they may have or gather specific observations. Although the element of *boat type* is not explicitly addressed in relation to perception, one could speculate that perception may vary across different types of vessels.

The last question in this section, **Q10**, is discretionary and exclusively qualitative. Its aim is to provide a place for sharing any evolution observations

regarding shipping and boating practices. In the qualitative coding analysis, this question is further scrutinized for additional insights.

3.3.4 EXPLORING THE ISSUE

The specific aspects of boat speeds and waves are explored in the subsequent part of the survey. It can be partitioned into two distinct segments. The first section, with **Q11** and **Q12**, pertains to the project's initial motivations to investigate how local actors and stakeholders perceive the impact of boat movement on their lives, focusing on the waves generated and the influence of speed on these effects. The two questions are designed as Likert-scales with nine sub-questions of different FoPs relating back to factors mentioned in the more general concern questions.

The succeeding segment of this section aims to adopt a wider perspective on the classification of repercussions arising from a decline in boat speed, examining both local and regional/provincial levels. The ensuing portion, **Q13** and **Q14**, classifies the potential repercussions into three groups based on the three pillars of sustainability, namely economic, social, and environmental factors. This method assists in comprehension of other FoPs without excessive detail.

3.3.5 COLLECTING SOCIO-ECONOMIC AND DEMOGRAPHIC DATA

In the survey I also collected the socio-economic and demographic background of respondents. There are nine questions. The initial question (**Q15**) pertains to the Forward Sortation Area (FSA), which enables the comparison of familiar areas, concerns, and access to relevant census data. Secondly, an MCQ (**Q16**) helps to assess the duration of residency in the designated FSA to uncover the potential influence of time spent in a particular location. **Q17, Q18,** and **Q19** are frequently asked multiple-choice questions pertaining to census data, specifically focusing on age group, gender, and marital status. **Q20** determines the number of individuals in a household and organizing them based on their age. The objective is to establish whether participants have children (under 18) and/or older (over 65) vulnerable populations in their household. **Questions 21 to 23** pertain to participants' financial and professional

information, including household income, highest degree obtained, and occupation sector(s) in the past year.

3.4 SURVEY DISSEMINATION

Different distribution channels such as ZIPs (Zones d'Intervention Prioritaire) and OBVs (Organisations de Bassins Versants), were used to distribute the survey. The survey was initially distributed on June 13th, 2023, and subsequently concluded on November 17th, 2023. The Research Ethics Board of McGill University granted approval for both the study and survey, as per the university's requirements. The survey was distributed on the LimeSurvey[6] platform.

Participants must first agree to a consent form before addressing any questions, with the option to withdraw consent at any stage of or after the survey, provided their responses have not been anonymized. The consent form can be found in *Appendix A*.

Furthermore, a question (Q1) was designed to evaluate the respondents' attentiveness and determine their inclination to actively partake in the survey process, rather than merely entering for the purpose of being included in the prize draw. The assignment entails the selection of the smallest maritime vessel among a group of four alternatives. To offer a visual representation, images of the proposed choices are available.

In an effort to include as much contextual information as possible, I made the deliberate choice to include specific places where respondents can share any additional thoughts or information pertaining to the matter. In order to gather additional insights on the issue of shipping, speeds, and waves in the St. Lawrence, a comment box was appended at the end of the survey to allow respondents to share stories, suggestions, or any further concerns.

In addition, the compensation offered for this study entailed a 1 in 10 probability of winning an Amazon gift card with values of CAD$25 if they provided

[6] https://mcgill.service-now.com/itportal?id=kb_article&sysparm_article=KB0010818

at least their email address. In adherence to Canadian Law, they had to answer a mathematical question. In total, 11 participants were drawn to receive the amazon gift cards.

3.5 QUANTITATIVE ANALYSIS

The following section examines the process of generating results using quantitative analysis, with specific emphasis placed on statistically analyzing the relationships among the variables surveyed[7]. The employment of statistics in survey analysis permits the formulation of researched inferences using data parameters (Chamber & Skinner, 2003). Given the nature of our data, an ordinal regression type of model was chosen to perform the quantitative analysis.

3.5.1 DATA PREPARATION

As mentioned earlier, the data was collected through the LimeSurvey[8] platform. Only the responses from participants who correctly answered the attention question (Q1) were kept. Nonetheless, additional "data cleaning" was required to collect the relevant information. Scripts were generated to rearrange the variables as the initial file downloaded from LimeSurvey was not adequate for the ordinal regression models. Hence, I reframed the variables and compiled them together into appropriate ordinal variables. The outcome of this data cleaning process resulted in a single data frame containing 62 response variables linked to each of the 115 participants' unique identifiers. The 62 variables are listed in *Appendix B*. Apart from 'Gender', 'Marital', 'distance', and 'distance_t', all variables were stored as integers used for the ordinal regressions.

To assign essential ordinal values to the model, I performed quantitative coding on two variables: interaction groups and sector groups. Interaction groups were categorized into three ordinal levels: 1) exclusive leisure, 2) exclusive professional, and 3) a combination of leisure and professional, reflecting the

[7] The task was carried out using the *polr* function from the MASS package in RStudio (https://rdrr.io/cran/MASS/man/polr.html)
[8] https://mcgill.service-now.com/itportal?id=kb_article&sysparm_article=KB0010818

increasing diversity of interactions. Those engaged in river-related work demonstrate heightened comprehension of the river, while those combining work and leisure tend to experience a broader array of river environments. Sector groups were classified into five ordinal levels: 0) retired or unemployed, 1) students, 2) others (all other sectors), 3) environmental or agriculture, and 4) maritime and/or transport industry. This classification assumes individuals in environmentally related fields exhibit higher awareness of river issues, and those in maritime and transportation sectors possess considerable expertise due to the study's focus on shipping and maritime industries. Retired and unemployed individuals, though potentially knowledgeable, were given the lowest rank as their previous sector affiliations were not considered, while students were ranked slightly higher as they are active learners. The general population, represented by other sectors, received a moderate rank of 2, reflecting general knowledge of the river.

3.5.2 ORDINAL REGRESSION MODELS

The survey used scaling questions with Likert-scales for 7 out of 11 perception questions, where responses are organized into orders of magnitude. Therefore, ordinal regression models are the most appropriate for this application. Indeed, ordinal regression models assume an ordinal relationship between the response variable and predictors (Harrell, 2001). Proportional odds logistic regression, part of ordinal logistic regression, is used to perform ordinal outcome variables analysis. It allows to model the relationship between an ordinal dependent variable with ordered categories and different independent variables by deriving Odds Ratio (OR).

All variables used for the quantitative analysis are ordinal, with ordered categories (Lenz, 2013). The classification can vary between different questions. Specific ordered categories of variables are shown in *Appendix B*. It should be noted that the model did not incorporate independent variables from other types, such as categorical/nominal and numerical/continuous. The fundamental aim of utilizing this regression model is to gather insights into the influence of independent variables on

the dependent variables. *Appendix C* contains a thorough presentation of the models, listing the dependent and independent variables for each model.

In order to interpret the results of the ordinal logistic regression, indications from the UCLA Statistical Methods and Data Analytics were followed (UCLA: Statistical Consulting Group, 2024). In order to evaluate significance of the model results, p-values were generated from the t-values derived from the t-tests according to principles of statistical hypothesis testing (Dahiru, 2008; Wilcox, 2012; Taeger & Kuhnt, 2014; Piegorsch, 2002). Additionally, OR coefficients are generated using the exponential of coefficients given by the model.

3.6 SPATIAL ANALYSIS

The spatial analysis seeks to answer the following research question (RQ4): does the geography of concern (ie. place of concern) influence other elements of perception? For instance, would someone who place their highest degree of concern towards the Gulf place the same levels of concerns for specific elements than someone who would think more impact occurs upstream?

3.6.1 DATA

This analysis involves the use of geographical data from the two survey questions: Q3, which asks about familiarity with a place, and Q6, which inquires about concerns regarding a place. There are a total of 102 points (out of the total 115 participants) for both familiarity and concern places.

3.6.2 METHOD

After gathering the points of concerns into the map, a spatial join to administrative regions was performed to get mean perception values and count of respondents for each question within each administrative region.

Figure 3.2 presents the administrative regions used for the spatial analysis.

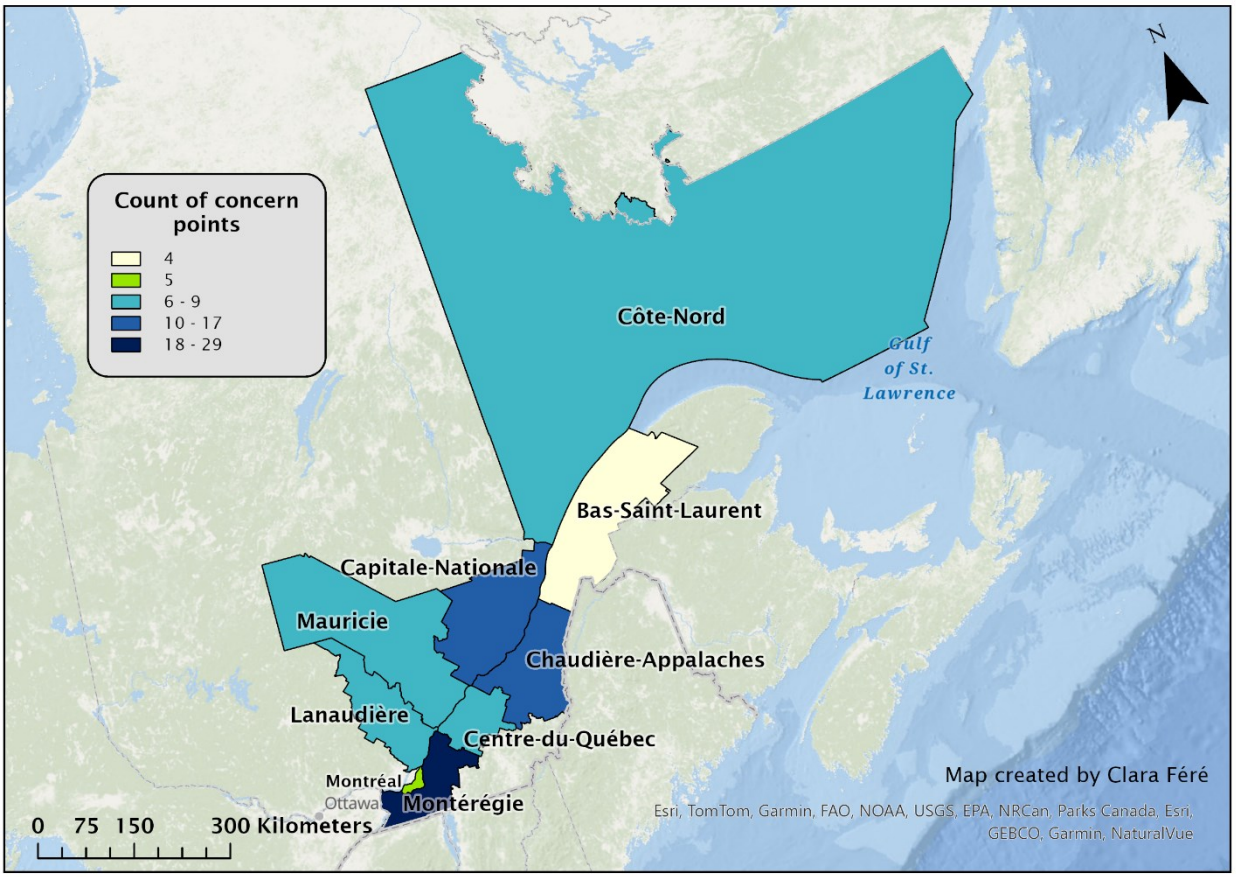

FIGURE 2.2: MAP OF ADMINISTRATIVE REGIONS WHERE THERE WERE RESPONSES.

Another part of the spatial analysis was the consideration of a distance variable between familiarity and concern points. Distance bins were used as an independent variable for the ordinal regression models along with the socio-economic and demographic variables to assess whether proximity between familiarity and concern might correlate with patterns in perception. The distance (ordered into bins) between the provided Forward Sortation Area (FSA) in Q15 and the concern place (Q6) is also considered as an independent variable for the ordinal regression models. If different patterns emerge, this could be a sign that place of familiarity and place of residence are not necessarily the same and that would mean that familiarity is an important element to consider outside of traditional socio-economic and demographic variables.

3.7 QUALITATIVE ANALYSIS

For this part of the analysis, the principles drawn from qualitative coding methods (Saldaña, 2013) were used. Specifically, I used *inductive coding*, grounded in the data

and not pre-determined. Descriptive codes are organized into categories based on the conceptual model previously elicited. My other approaches included the *iterative* nature of coding which gets more purposeful as the process is repeated and there is need for *constant comparison* as coding should stay consistent across all segments. The *holistic* nature of coding is also an important principle, taking the whole value of the data into account to enrich the themes portrayed and make links. The idea of *analytic memos* is also an interesting item discussed by Saldaña which is useful for reporting ideas and reflections during the coding process and could be basis for further discussion. The final principle approached is *saturation* which means that the coding would lead to a definite overview of all themes derivable from the data. No *theory* is derived from the data. Hence, we cannot call this grounded theory as per the practices outlined by numerous qualitative researchers (Glaser & Strauss, 1967; Corbin & Strauss, 2008; Charmaz, 2006). However, the emergence of *themes* which is the element of interest for concerns here still makes the use of guidance from those qualitative researchers interesting to guide one's process of coding.

There are a few purposes of the Qualitative Analysis. First, by going through the qualitative data with first round coding, emergent themes occur. These are prescribed in analytic memos which derive from impromptu observations. Later on, second round coding harbours more specific categorisation of the data. Qualitative analysis is crucial to have a comprehensive understanding of participants' responses. Indeed, quantitative data often misses much of the nuance in responses and the rationale behind one's specific response. For instance, some participants mentioned that they declared low perceived impacts on safety as accidents are rare in their occurrence but could be highly detrimental to the river in the case they happened.

3.7.1 DATA PREPARATION

All qualitative data variables, available in *Appendix D* were extracted from the survey into a document. The analysis process consisted of highlighting specific keywords associated with codes, categories, and themes.

3.7.2 QUALITATIVE CODING

Based on the enunciated definitions and examples provided by Saldaña (2013), the following types of codes were employed:

Descriptive coding (Miles & Huberman, 1994; Saldaña, 2003; Wolcott, 1994; Tesch, 1990; Gibbs, 2007) was used to retain the main topics elicited by participants with regards to each of their statements. Groupings within descriptive codes were applied as to fit with concepts mentioned as Factors of Perception. Therefore, most descriptive codes have one or more of the following before the concept coded: FOI, FOC, FOS, and FOM. These acronyms refer to the four categories of Factors of Perception previously enounced: Factor of Influence (FoI), Factor of Concern (FoC), Factor of Spatiality (FoS), Factor of Measurement (FoM). Non-categorized descriptive codes also benefit the analysis by adding more contextual information to the evoked issues.

In Vivo coding (Charmaz, 2006; Corbin & Strauss, 2008; Glaser, 1978; Glaser & Strauss, 1967; Strauss, 1987; Strauss & Corbin, 1998) can supply descriptive codes with more information regarding the concept mentioned, especially for FOS when they are mentioning a precise place but are also used as stand alone to showcase personal experiences or opinions beneficial to the analysis.

Evaluation coding (Patton, 2002, 2008; Rallis & Rossman, 2003) is used for statements of judgment about specific situations evoked by the participant. It can range from personal suggestions of actions to put in place to clear statements with opinions on current systems.

Magnitude coding (Miles & Huberman, 1994; Weston et al. 2001) brings out the quantitative expression of observations. You can get multiple outputs from qualitative coding after analysis of the codes. Essentially, just looking at the codebook is central information for the purpose of this project.

Analytic memos

As mentioned, while coding, analytical memos were helpful to determine emergent themes from the data. Saldaña (2013) extensively promotes the use of analytical memos in qualitative coding for detailing on the coding process and coding choices.

3.8 CONCLUSION

In addressing RQ1, namely how one can characterize the perceptions surrounding shipping and boating practices in the St. Lawrence River environment, I discussed my approach to addressing the challenges related to shipping and boating activities. While one of the main focus centres around boat waves and the potential influence of speed, this project deserved more diversity in the observation of factors of perception related to the aforementioned issue. I decided to make clear distinctions between perceived elements emerging from the practices (Factors of Influence) and the resulting effects on independent elements (Factors of Concerns) while keeping room for other perceptive venues with a focus on geographical aspects of the maritime activities (Factors of Spatiality) and their magnitude (Factors of Measurement). The rationales for all components of perception are derived from academic and grey literature. A model was derived from the conceptual framework, which provided the framework for designing a survey comprising 23 questions. This survey addressed different mediums for extracting perception, such as knowledge, observation, judgment, intuition, and sentiments.

This chapter also elicited the methodologies chosen for the analysis. Quantitative, spatial, and qualitative methods each form a building block to answer the research questions pertaining to the perception of boats on the river. While the responses to the survey will situate the state of perception, the quantitative analysis, using a proportional odds logistic regression model, will uncover the links and the potential influences on patterns of perception. Moreover, the spatial analysis will be useful in acknowledging the sense of place when relating to perception and the qualitative analysis will bring the nuance and additional insights needed to comprehend the issue.

4. RESULTS

This section presents the results of the study. After presenting the participants, results are explored under four axes of interest: vessel-specific concern, the perception of concern and impacts, the relationship with waves and speeds, and the potentials of speed reduction. For each of these axes, the distribution of responses and key results from the quantitative, spatial, and qualitative analyses are exposed. A final section adds qualitative insights from participants, approaching contrasting avenues, recommendations, and personal opinions to enrich the study content. The results presented in the following tables are partial results. The full set of results from the quantitative proportional odds logistic regression models are available in *Appendix E*.

4.1 PRESENTATION OF PARTICIPANTS

Regarding the **spatial distribution of participants**, the sample of 115 individuals is spread across 56 Forward Sortation Areas (FSA) within the Quebec region. The four primary FSAs, which account for over 5% of participants, are G0S (13%) in the southwest of Quebec City, J0K (10%) in the northwest of Montreal near Joliette, J0L (8%) west of Montreal Island and Longueil (extending north and south), and G0A (8%) west of Quebec City, including Ile d'Orleans and Isle-aux-Coudres.

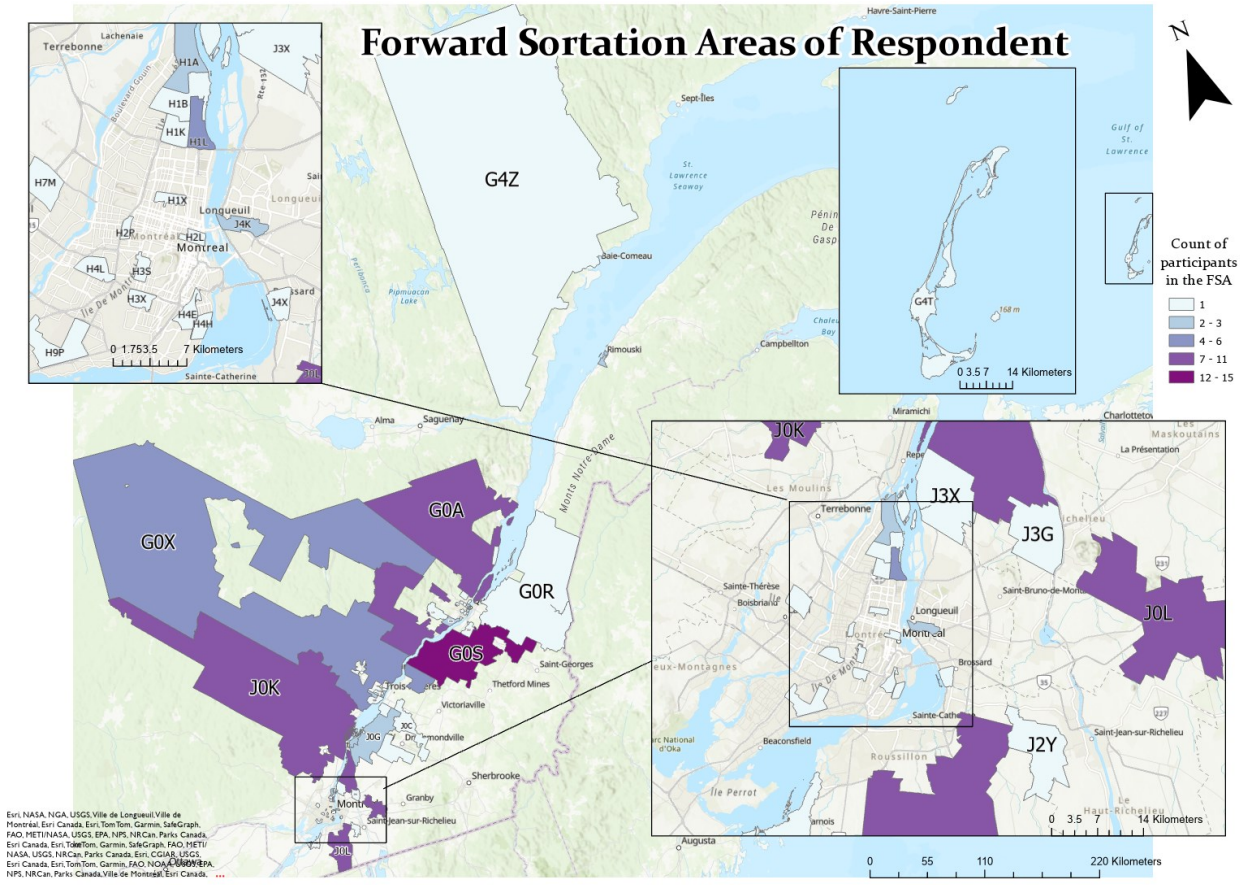

FIGURE 4.1: MAP OF THE COUNT OF PARTICIPANTS FOR EACH FORWARD SORTATION AREA (FSA) MENTIONED BY THE 115 PARTICIPANTS

The participants only identified with two **genders**: men and women. There was a close to even split with 53% of participants identifying as "Man" and 47% identifying as "Woman". By comparison, the 2021 gender distribution in Quebec was 49% men and 51% women (Statistics Canada, 2023). The averages for the FSAs of our participants showed the same proportions (Statistics Canada, 2023).

The data reveals that the majority of participants belong to the 55+ **age** group (47.8%), while approximately one third of participants are divided between the 25-34 (15.7%) and 45-54 (16.5%) age groups. Furthermore, the age range of 35-44 encompasses 20% of the participants. There were no recorded participants falling within the age range of 18 to 24. According to the latest census conducted in 2021 by Statistics Canada (2023), the proportion of the population aged 55 and above stands at 35.2% for Quebec (14.6% between 55 and 64, and 20.6% aged 65 and older) and at

45% for the FSAs of our participants (18% between 55 and 64, and 27% over 65 years old). Furthermore, the demographic between the ages of 25-34 constitutes 12.5% of the total Quebec population (13% for the FSAs), while individuals aged 35-44 make up 13.2% of that population, and 12.3% for those aged 45-54 (12% for FSAs). The data indicates that most of our respondents belong to the older age groups, as opposed to other represented age categories. Regarding our survey, the age group 35-44 emerges as the most prevalent among others.

The married population makes up the majority of our participants, accounting for 68.7%, whereas approximately 20.9% of respondents are single. According to the 2021 census figures for populations aged over 15, 55.8% of them are married or in a common-law relationship, 30.4% have never been married, 7% are divorced, and 5.3% are widowed (Statistics Canada, 2023). Despite varying proportions, the Quebec population exhibits a majority of individuals who are married or in common-law relationships, with nearly one-third having never been married. There is an equal representation of divorced individuals, coupled with a larger proportion of widowed individuals. Hence, the survey respondents exhibit a greater representation of married or common law individuals compared to the Quebec population, resulting in a decrease in the percentage of never married and widowed individuals.

With respect to the level of **education**, the overwhelming majority of participants possesses a university degree (78.3%). As per the 2021 census conducted by Statistics Canada (2023), in Quebec, 23.5% (average of 27.8% for our FSAs) of the individuals over 15 and 29.5% (average of 32% for our FSAs) of the ones between 25 and 64, have a university degree as their highest earned degree. While there is a decrease in contrast among the other groups, there are still discernible variations in their representations. Among our participants, 12.2% selected the "CEGEP or College" highest degree. In the census, this is 17.4% of Quebecers over 15 (average of 18% in our FSAs) and 18.9% (average of 19.6% in our FSAs) of those aged 25 to 64 identifying within that category. There is a significant disparity in educational attainment between different age groups in the Quebec population. Specifically, for trade certificates where 15.8% of individuals aged over 15 (average of 15.4% in our

FSAs) and 18.9% (average of 18.3% in our FSAs) of those aged 25 to 64 hold this credential as their highest degree. This is a considerable variation between this proportion and the 4.3% identified within our study sample. Furthermore, the percentage (3.5%) of participants with the highest level of education attainment from high school does not accurately reflect the data provided by Statistics Canada (2023) in their 2021 census. The census reports a significantly higher percentage of 21.4% for individuals over 15 years old (average of 20.7% in our FSAs) and 17% (average of 16% in our FSAs) for individuals aged 25 to 64 in Quebec.

Regarding household **income**, most participants earn an annual income exceeding $50,000 within their household. It is worth mentioning that a significant portion, specifically 13%, of participants expressed their reluctance in sharing details regarding their household income. Accordingly, our rationale is built upon 87% of the participants (n=100). A mere 1.7% reported a household income ranging from $10,000 to $24,999, significantly lower than the 9.4% of Québecois facing a similar circumstance (similar average in our FSAs). Regarding the household income group of $25,000 to $49,999, its representation is significantly lower than the overall Quebec population. The percentage of participants who opted for this group was only 5.7%, which is four times lower than the 21.5% of households that fall into that category (average of 12.36% in our FSAs). Focusing on the skewed portion of the distribution, 17.4% of participants reported a household income ranging from $50,000 to $74,999, which is slightly lower compared to the 19.2% of individuals in Quebec (similar average in our FSAs) who fall within this income bracket. When examining the upper echelons of household income groups, there is a noticeable disparity compared to census figures. In fact, a notable 20.9% of respondents reported a household income ranging from $75,000 to $99,000, surpassing the census figure of 15.3% (average of 15.2% in our FSAs). Additionally, 25.3% declared a household income between $100,000 and $149,999, compared to the census proportion of 18.6% (average of 18.7% in our FSAs). Finally, 18.3% reported an annual household income exceeding $150,000, in contrast to the census data of 14.6% for Quebec residents (average of 14.5% in our FSAs) (Statistics Canada, 2023).

The majority of participants (59.1%) have **lived at their current location** for over a decade. It appears that, in general, the participants have been living in their current location for a few years. 15.7% of people have lived for a duration of 5 to 10 years, while 8.7% have lived between 3 and 5 years, and 7.8% have resided for 1 to 3 years. The group with the lowest number of selections is the 6 months to 1 year range, chosen by only 1.7% of participants, which is in contrast to the shortest term, less than 6 months, selected by 6.1% of participants.

4.2 VESSEL-SPECIFIC CONCERN

The results indicate a notable differentiation between motorized and unmotorized vessels, with motorized vessels, specifically industry cargo ships, eliciting significant levels of concern in comparison to sailboats (often unmotorized) and rowboats, which generate low levels of concern. The levels of concern for cargo ships are followed by leisure boats, with jet skis and yachts expressing high levels of concern, and smaller motorboats (including cigarette boats, jet boats, wake boats, etc.) showing some level of concern. Cruise ships are ranked just below yachts in terms of concern, whereas tugboats and ferries are not a significant source of concern.

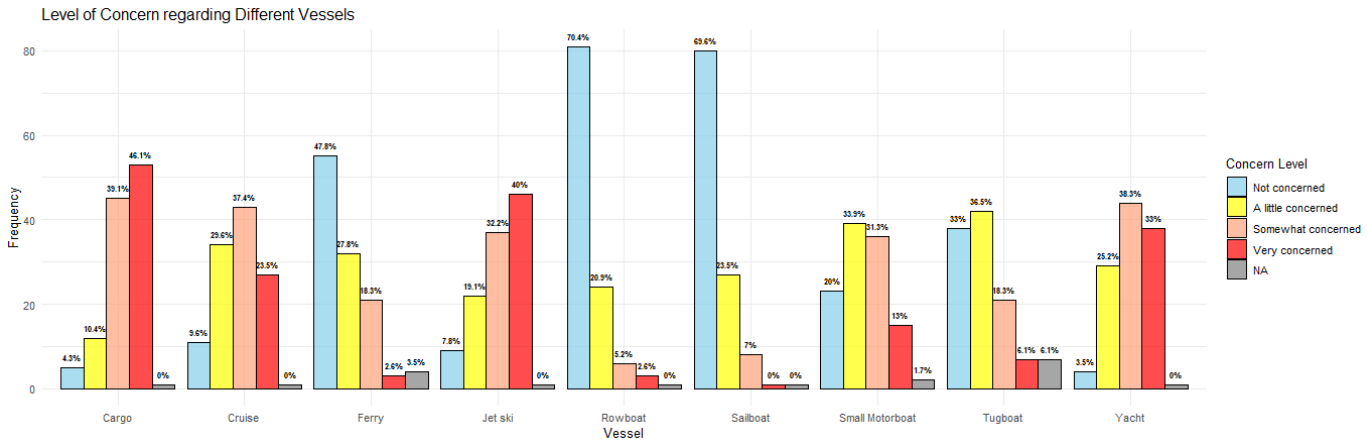

FIGURE 4.2: BAR PLOT OF THE RESPONSES TO Q9 OF THE SURVEY-LEVEL OF CONCERN REGARDING DIFFERENT VESSELS ON THE RIVER.

As indicated earlier, speed is perceived as a variable that could potentially influence the level of concerns for various vessels. Upon examining the estimations of speeds, one can observe notable high-speed predictions for jet skis and yachts.

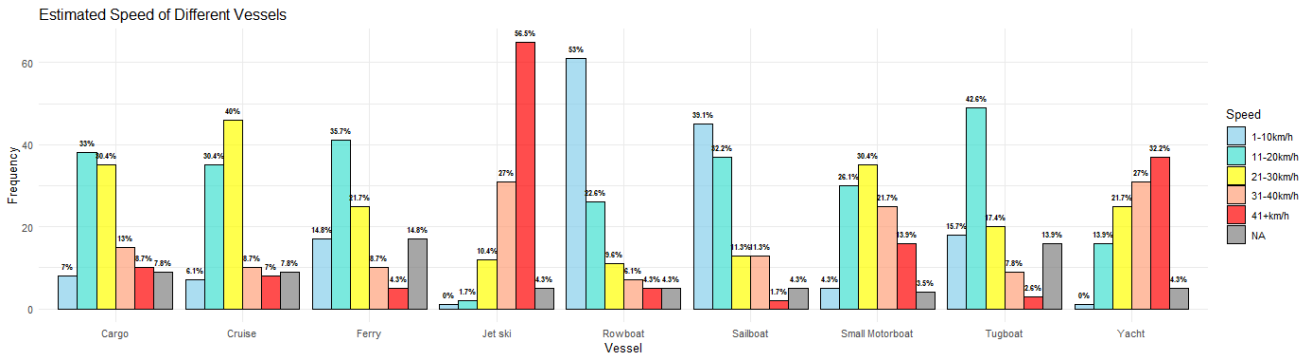

FIGURE 4.3: BAR PLOT OF THE RESPONSES TO Q4 OF THE SURVEY-ESTIMATION OF AVERAGE BOAT SPEEDS ON THE RIVER.

Statistical analysis reveals that speeds play a crucial role in the concerns surrounding sailboats, ferries, small motorboats, and rowboats with a greater likelihood of concern as the speeds escalate. Moreover, looking at speed estimates, jet-skis and yachts have strikingly high-speed estimates.

TABLE 4.1: INFLUENCES OF SPEED ON VESSEL-SPECIFIC CONCERN (PARTIAL RESULTS FROM PROPORTIONAL ODDS LOGISTIC REGRESSION MODELS) [FOR FULL RESULTS, REFER TO TABLE 8.4]

INDEPENDENT VARIABLE	DEPENDENT VARIABLE	P-VALUE	COEFFICIENT
CARGO SHIP SPEED	cargo ship concern	0.297	1.31
YACHT SPEED	yacht concern	0.896	0.97
JET SKI SPEED	jet ski concern	0.559	1.18
SAILBOAT SPEED	sailboat concern	0.011**	2.36**
FERRY SPEED	ferry concern	0.021**	2.05**
CRUISE SHIP SPEED	cruise ship concern	0.666	1.12
SMALL MOTORBOAT SPEED	small motorboat concern	0.086*	1.46*
TUGBOAT SPEED	tugboat concern	0.004	2.19
ROWBOAT SPEED	rowboat concern	0.077*	1.54*

[*P<0.1; **P<0.05]

Various other factors play a role in determining the levels of concern for vessels, including age and income. This is notable in the context of sailboats, as older and/or more affluent individuals tend to exhibit a diminished likelihood of expressing concerns for this vessel. Older individuals also tend to have decreased concern for ferries, while affluent individuals often have decreased concerns for rowboats.

Furthermore, engaging in a wider range of interactions with the river is likely to result in increased levels of concern regarding yachts. Conversely, individuals employed in transportation and/or maritime industries are less likely to be concerned about yachts. In addition, individuals who are more familiar with their place of concern tend to display increased levels of concern towards cargo ships and ferries.

TABLE 4.2: OTHER INFLUENCES ON VESSEL-SPECIFIC CONCERN (PARTIAL RESULTS FROM PROPORTIONAL ODDS LOGISTIC REGRESSION MODELS) [FOR FULL RESULTS, REFER TO TABLE 8.4]

INDEPENDENT VARIABLE	DEPENDENT VARIABLE	P-VALUE	COEFFICIENT
AGE	Sailboat concern	0.093*	0.57*
AGE	Ferry concern	0.085*	0.56*
INCOME	Sailboat concern	0.089*	0.58*
INCOME	Yacht concern	0.734	1.07
INCOME	Cruise concern	0.482	0.86
INCOME	Rowboat concern	0.070*	0.64*
TIME LIVED AT CURRENT LOCATION	Cargo concern	0.442	0.88
TIME LIVED AT CURRENT LOCATION	Jet ski concern	0.148	1.26
TIME LIVED AT CURRENT LOCATION	Small motorboat concern	0.219	1.23
DISTANCE FAMILIARITY TO CONCERN	Cargo concern	0.023**	0.80**
DISTANCE FAMILIARITY TO CONCERN	Yacht concern	0.356	1.16
DISTANCE FAMILIARITY TO CONCERN	Ferry concern	0.088*	1.17*
DISTANCE FAMILIARITY TO CONCERN	Small motorboat concern	0.585	0.96
INTERACTION LEVEL	Yacht concern	0.099*	1.65*
INTERACTION LEVEL	Cargo concern	0.366	1.37
INTERACTION LEVEL	Jet ski concern	0.731	0.90
INTERACTION LEVEL	Small motorboat concern	0.447	0.80
ACTIVITY SECTOR	Yacht concern	0.085*	0.63*
ACTIVITY SECTOR	Cargo concern	0.992	1.00
ACTIVITY SECTOR	Ferry concern	0.276	0.66
ACTIVITY SECTOR	Cruise ship concern	0.676	0.89
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Yacht concern	0.025**	0.65**
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Cargo concern	0.227	1.28

[*P<0.1; **P<0.05]

Participants highlight that the most significant impacts on wave amplifications are caused by the fluctuation of speed, rather than its magnitude. Furthermore, the design of boats, particularly the hull, can also exert an influence on this accentuation of wave motion. The role of vessel size in wave movement is a topic of dispute. While certain participants assert that larger boats primarily generate larger waves, others concur that smaller boats possess a greater potential for amplifying wave motion, particularly due to the irresponsible behavior of leisure users.

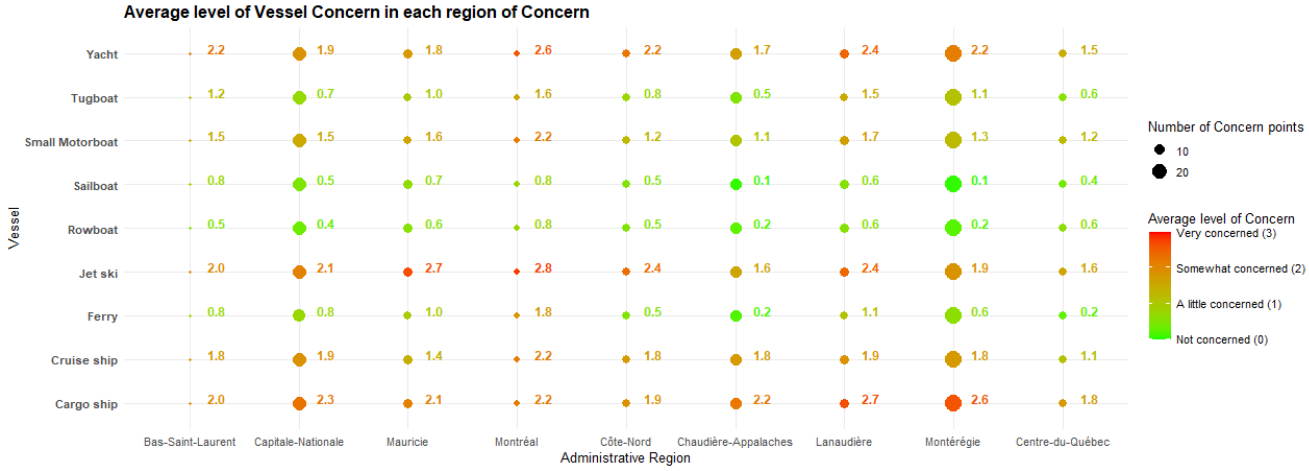

FIGURE 4.4: AVERAGE VALUES OF VESSEL CONCERN IN EACH ADMINISTRATIVE REGION WHERE THERE IS CONCERN RELATED TO BOAT MOVEMENT. THE COLOR OF THE POINTS REPRESENT THE MAGNITUDE OF THE PERCEPTION VALUE WHILE THE SIZE OF THE POINTS ACCOUNT FOR THE COUNT OF CONCERN POINTS.

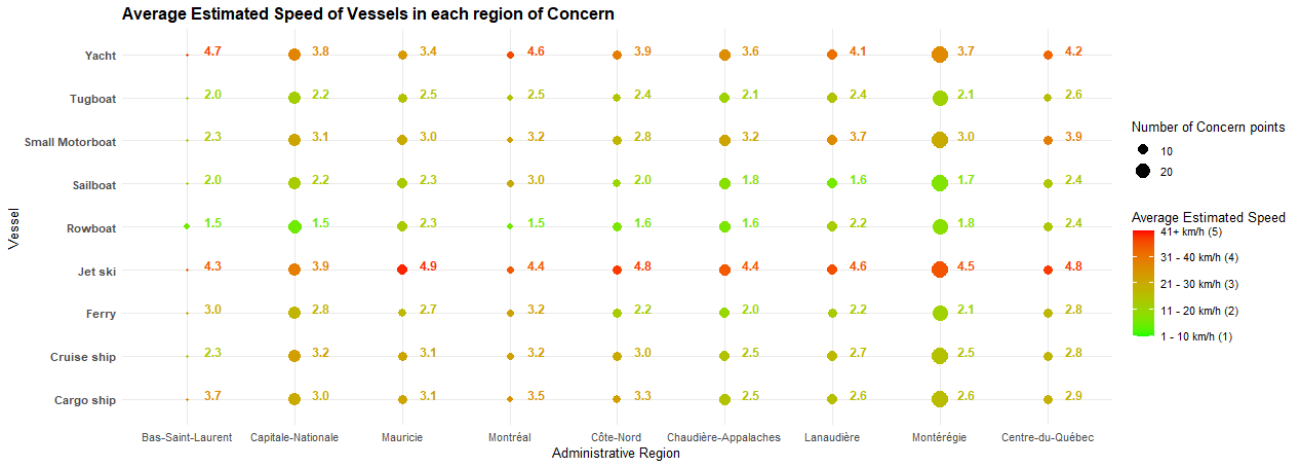

FIGURE 4.5: AVERAGE VALUES OF ESTIMATED SPEEDS IN EACH ADMINISTRATIVE REGION WHERE THERE IS CONCERN RELATED TO BOAT MOVEMENT. THE COLOR OF THE POINTS

REPRESENT THE MAGNITUDE OF THE PERCEPTION VALUE WHILE THE SIZE OF THE POINTS ACCOUNT FOR THE COUNT OF CONCERN POINTS.

From a spatial perspective, the concerns specific to individual vessels vary across different areas of concern. I compared concern levels between regions. A higher degree of concern is not an exact synonym for high concern, but rather slightly higher when compared to other regions where concern is expressed. Particularly in Montreal where the magnitude of concern is magnified compared to other regions, with the exception of cargo ships which exhibit heightened concern levels in Lanaudière. Nevertheless, Montreal's level of concern remains primarily focused on yachts and jet skis. When compared to other regions, Lanaudière displays notable concerns regarding yachts and tugboats. Chaudière-Appalaches exhibits relatively low levels of concern compared to other regions, particularly for tugboats, small motorboats, jet skis, and ferries, where it has the lowest level of concern among all regions. Although sailboats and rowboats pose minimal concern, cargo ships are of great concern in Montérégie. Vessels such as yachts, jet skis, cargo ships, and cruise ships face minimal concerns in the Centre-du-Québec area. Overall, the regions of Bas-Saint-Laurent, Capitale-Nationale, Mauricie, and Cote-Nord show a similar pattern of concerns with minimal differences in average values.

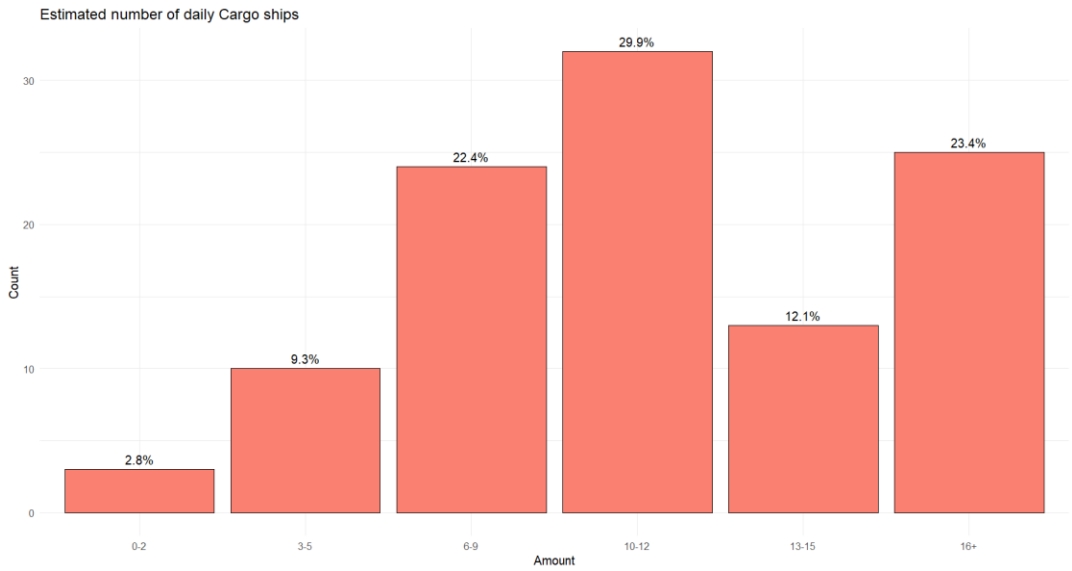

FIGURE 4.6: ESTIMATED NUMBER OF DAILY CARGO SHIPS SELECTION

An additional insight to understand this emphasis of cargo ships concerns could be quantity. The distribution of selected cargo ship quantities is depicted in *Figure 4.6*, with the majority perceiving it to be no less than 10 vessels per day. The increase in cargo ship numbers coincides with a decrease in concern for yachts, along with a growing consensus on the impact of waves and speeds on environmental and socio-economic factors, including vegetation, wildlife, land, physical health, and personal finances. This suggests that the volume of cargo ship traffic influences public perceptions of maritime-related risks and impacts. Moreover, heightened estimated daily cargo ships lead to higher likelihood of expected negative effects from speed reduction.

4.3 PERCEPTION OF CONCERN AND IMPACTS

General concerns regarding maritime traffic demonstrate an emphasis on selection of *waves* as an element of concern, selected by 76.5% of participants, followed by *biodiversity*, selected by 68.7% of participants, *speed*, selected by 60% of participants, and *pollution*, selected by 52.2% of participants. Out of the nine proposed elements, these four stand as selected by more than half of participants and can be considered as general concerns related to boat movements on the river. Other elements of concerns include *quantity*, selected by 37.4%, *noise*, selected by 35.7%, *safety*, selected by 28.7%, *trajectories*, selected by 13%, and *anchoring*, selected by 7.8%.

TABLE 4.3: RESPONSES TO Q7-SELECTION OF CONCERNS IN RELATION TO BOAT MOVEMENTS ON THE RIVER

CONCERN	COUNT	% OF PARTICIPANTS
WAVE	88	76.5
BIODIVERSITY	79	68.7
SPEED	69	60
POLLUTION	60	52.2
QUANTITY	43	37.4
NOISE	41	35.7
SAFETY	33	28.7
TRAJECTORIES	15	13
ANCHORING	9	7.8

Drawing from qualitative data, the prevailing concerns are similar and encompass elements such as waves, speeds, erosion, safety, pollution, noise (e.g., fog horns or recreational activities like music and motors), river infrastructures, loss of personal land, anxiety, stress stemming from biodiversity threats, and financial consequences. Moreover, river communities have various concerns regarding the maintenance of waterways during winter and the occasional dredging activities.

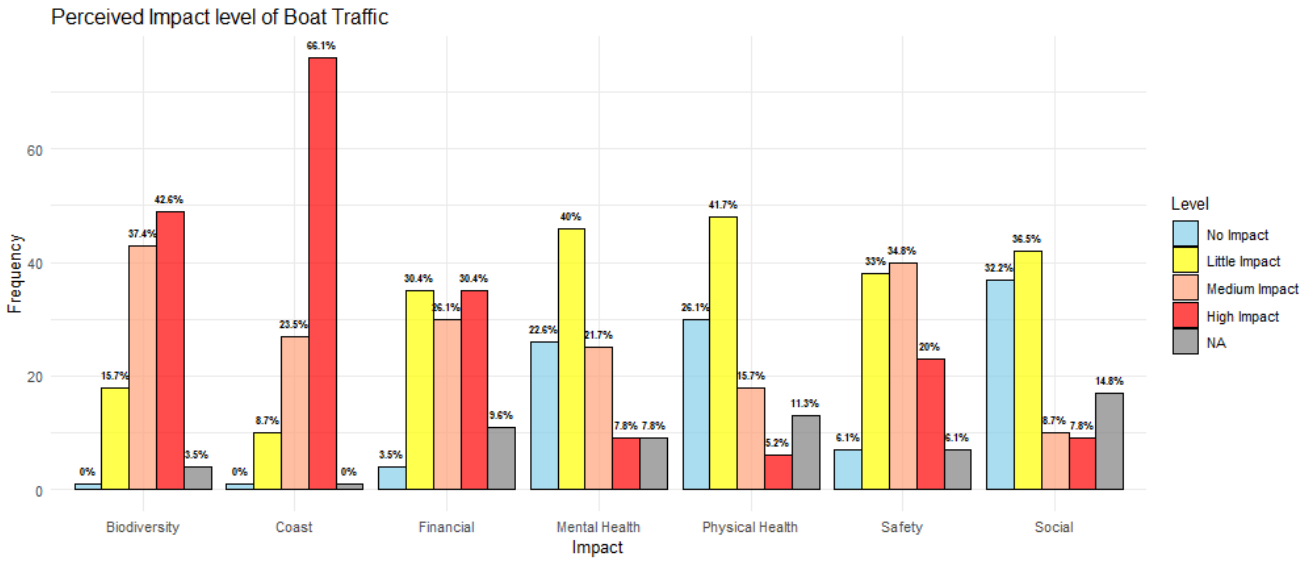

FIGURE 4.7: BAR PLOT OF THE RESPONSES TO Q8 OF THE SURVEY-PERCEIVED LEVEL OF IMPACT OF BOAT TRAFFIC ON DIFFERENT FACTORS OF PERCEPTION.

As one could expect, perceived impacts on the *coast* have the highest share of high level (66.1%) of all impacts, followed by *biodiversity* (42.6%). *Financial* impacts are also perceived as substantial with an even distribution of little and high levels (30.4%) and almost similar share of medium level (26.1%). *Safety* impacts are also perceived as consequential with 20% of selection of high level for 34.8% of medium and 33% of little levels. *Social* impacts, on the other hand, get the highest share of no impact (32.2%) but still majorly perceived with little impact (36.5%). They also have the highest share of NA (14.8%) which means that participants seem uncertain about their perceptions regarding social situations in relation to shipping and boating activities. Lastly, health related impacts have similar distributions with *mental health* impact displaying overall higher levels than *physical health* impacts with a higher share of high (7.8% compared to 5.2% for physical) and medium (21.7%

compared to 15.7% for physical) impacts and less uncertainty. If a classification was to be done of those impact levels, one could say that environmental impacts are the most felt overall with *coast* and *biodiversity* having the highest levels, followed by impacts on the personal sphere, namely *financial* and *safety* impacts, and finally community impacts, with *social*, *mental* and *physical health* impacts gathering less emphasis on perception.

TABLE 4.4: INFLUENCES ON PERCEPTION OF IMPACT (PARTIAL RESULTS FROM PROPORTIONAL ODDS LOGISTIC REGRESSION MODELS) [FOR FULL RESULTS, REFER TO TABLE 8.5]

INDEPENDENT VARIABLE	DEPENDENT VARIABLE	P-VALUE	COEFFICIENT
AGE	Perceived impacts on Physical Health	0.167	1.44
AGE	Perceived Social impacts	0.583	0.87
INCOME	Perceived Financial impacts	0.662	1.11
INCOME	Perceived impacts on Mental Health	0.831	0.95
INCOME	Perceived impacts on Physical Health	0.188	0.74
EDUCATION	Perceived Financial impacts	0.448	0.72
TIME LIVED AT CURRENT LOCATION	Perceived impacts on the Coast	0.089*	1.32*
TIME LIVED AT CURRENT LOCATION	Perceived impacts on Biodiversity	0.422	1.14
TIME LIVED AT CURRENT LOCATION	Perceived impacts on Mental Health	0.252	1.21
TIME LIVED AT CURRENT LOCATION	Perceived impacts on Physical Health	0.248	1.22
TIME LIVED AT CURRENT LOCATION	Perceived Social impacts	0.235	1.23
TIME LIVED AT CURRENT LOCATION	Perceived Safety impacts	0.079*	1.34*
DISTANCE FAMILIARITY TO CONCERN	Perceived Financial impacts	0.008***	0.78***
DISTANCE FAMILIARITY TO CONCERN	Perceived impacts on Mental Health	0.526	1.05
DISTANCE FSA TO CONCERN	Perceived Financial impacts	0.086*	1.15*
INTERACTION LEVEL	Perceived impacts on Biodiversity	0.193	1.50
INTERACTION LEVEL	Perceived impacts on Mental Health	0.104	1.69
INTERACTION LEVEL	Perceived impacts on Physical Health	0.148	1.64
INTERACTION LEVEL	Perceived Social impacts	0.179	1.60
INTERACTION LEVEL	Perceived impacts on Safety	0.336	1.34
ACTIVITY SECTOR(S)	Perceived impacts on Biodiversity	0.454	0.82
ACTIVITY SECTOR(S)	Perceived Financial impacts	0.496	0.82

ESTIMATED NUMBER OF DAILY CARGO SHIPS	Perceived Financial impacts	0.101	1.35

[*p<0.1; ***p<0.01]

Here, the length of time lived at current locations tends to increase the likelihood of greater perceived levels of impacts on the coast, and safety. Secondly, spatial positioning also plays a role as the placement of one's concern place compared to their familiar place or residence FSA can lead to different outcomes. Indeed, as the concern points get closer to the familiar point but further from the residence FSA, the likelihood of higher level of perceived financial impacts will increase.

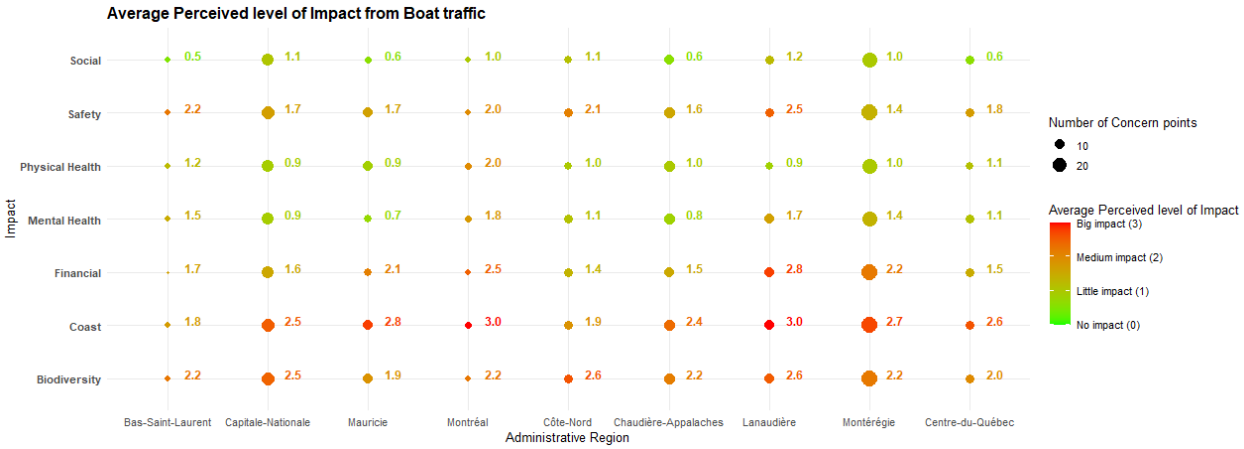

FIGURE 4.8: AVERAGE VALUES OF PERCEIVED IMPACTS IN EACH ADMINISTRATIVE REGION WHERE THERE IS CONCERN RELATED TO BOAT MOVEMENT. THE COLOR OF THE POINTS REPRESENT THE MAGNITUDE OF THE PERCEPTION VALUE WHILE THE SIZE OF THE POINTS ACCOUNT FOR THE COUNT OF CONCERN POINTS.

When examining the spatial dispersion of the perceived impacts, it becomes evident that the highest levels of perceived impacts are concentrated in Lanaudière for *social*, *safety*, *financial*, and *coastal* impacts. Furthermore, these perceptions remain at the higher end of the spectrum for *mental health* and *biodiversity* impacts. However, Lanaudière demonstrates the lowest perceived impact on *physical health* among all the regions of concern. In terms of perceived *coastal* impacts, Montreal is on par with Lanaudière, both reaching the highest level. Furthermore, Montreal experiences notable impacts on *physical and mental health* and falls towards the upper end in terms of *financial* impacts. Conversely, Côte-Nord is characterized by minimal *financial* impacts compared to other regions, with low relative levels of impact on the *coast*. Nonetheless, it exhibits the highest relative level of perceived

impacts on *biodiversity* and significant *social* impacts. As expected, regions all exhibit substantial levels of perceived *coastal* impacts, with Bas-Saint-Laurent standing out as having the lowest levels. Furthermore, Bas-Saint-Laurent demonstrates relatively minor *social* impacts while being positioned towards the upper range in terms of *safety* impacts. The region of Montérégie exhibits the highest concentration of overall concern yet reports the lowest levels of perceived impacts on *safety*. When compared to other regions, Mauricie shows the lowest relative levels of perceived *mental health* and *biodiversity* impacts. Despite not displaying extreme levels of maximum or minimum impacts, Capitale-Nationale shows notable strength in terms of relatively low perceived impacts on *physical health* and high impacts on *coastal* and *biodiversity* aspects. Chaudière-Appalaches and Centre-du-Quebec do not display significant extremes in perceptions for any type of impact. Nevertheless, Chaudière-Appalaches shows relatively low impacts on *social* and *mental health*, whereas Centre-du-Quebec experiences relatively low *financial* impacts and relatively high *coastal* impacts.

4.4 THE RELATIONSHIP WITH WAVES AND SPEEDS

As previously mentioned, waves and speeds are intrinsically linked when observing the issues of shipping and boating practices. While one (speed) is somewhat measurable and controllable, the other (waves) can be totally independent from determined actions of users. Analyzing the variations in agreements regarding both these factors and their consequences for certain FoPs will provide insight into the ascription of impacts on anthropogenic processes or their potential enhancer.

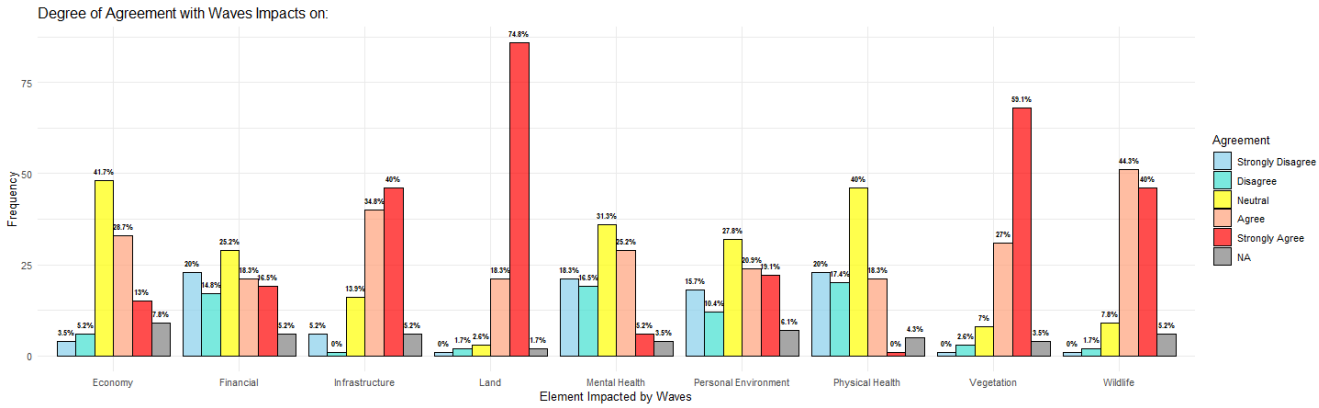

FIGURE 4.9: BAR PLOT OF THE RESPONSES TO Q11 OF THE SURVEY-AGREEMENT WITH WAVES IMPACTS

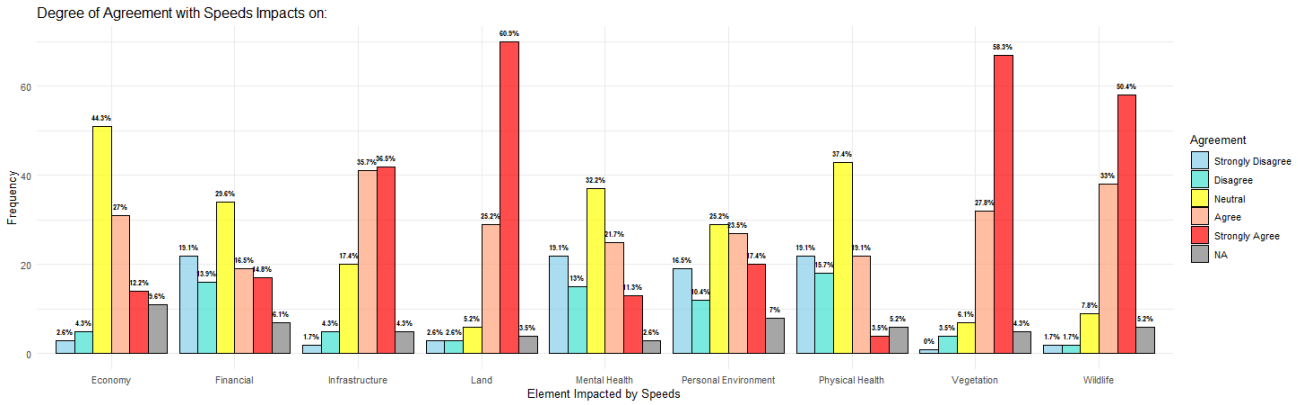

FIGURE 4.10: BAR PLOT OF THE RESPONSES TO Q12 OF THE SURVEY-AGREEMENT WITH BOAT SPEEDS IMPACTS

Four elements have particularly high levels of agreements for both waves and speeds: impacts on the *land* (74.8% of strong agreement for waves and 60.9% for speeds), on the *vegetation* (59.1% of strong agreement for waves and 58.3% for speeds), on *wildlife* (40% of strong agreement and 44.3% of agreement for waves and 50.4% of strong agreement and 33% of agreement for speeds), and on the *infrastructure* (40% of strong agreement and 34.8% of agreement for waves and 36.5% of strong agreement and 35.7% of agreement for speeds). There is a general consensus, with a combined 40% of strong and regular agreement, regarding the effects on the *personal environment*. Although both waves and speeds show similar overall agreements regarding *financial* impacts, the levels of overall disagreements align with these agreements. However, when it comes to *mental health* impacts, speeds exhibit a higher prevalence than waves. Waves have an overall agreement of

30.4%, whereas speeds have an agreement of 33%, with double the share of strong agreement. While the overall disagreement stays under the overall agreement for speeds, it overcomes the level of agreement for waves. Regarding, impacts on the *economy*, participants are overall neutral (44.3% for speeds) and equate in neutrality and overall agreement for waves (41.7%). Finally, *physical health* impacts present overall disagreements, particularly for waves with 37.4% against 34.8% for speeds.

TABLE 4.5: INFLUENCES ON AGREEMENTS WITH WAVES IMPACTS (PARTIAL RESULTS FROM PROPORTIONAL ODDS LOGISTIC REGRESSION MODELS) [FOR FULL RESULTS, REFER TO TABLE 8.6]

INDEPENDENT VARIABLE	DEPENDENT VARIABLE	P-VALUE	COEFFICIENT
AGE	Impacts of Waves on Physical Health	0.348	1.24
INCOME	Impacts of Waves on the Economy	0.006***	0.54***
INCOME	Impacts of Waves on personal Finances	0.958	1.01
INCOME	Impacts of Waves on Mental Health	0.139	0.75
INCOME	Impacts of Waves on the Personal Environment	0.810	0.95
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on the Economy	0.037**	1.41**
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on the Infrastructure	0.009***	1.45***
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Wildlife	0.624	0.92
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Vegetation	0.957	0.99
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on the Land	0.797	1.05
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on the Personal Environment	0.715	1.06
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on the Infrastructure	0.809	1.02
INTERACTION LEVEL	Impacts of Waves on Vegetation	0.127	1.70
INTERACTION LEVEL	Impacts of Waves on Wildlife	0.135	1.59
INTERACTION LEVEL	Impacts of Waves on Land	0.999	1.00
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Vegetation	0.063*	1.41*
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Wildlife	0.479	1.13
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Land	0.005****	1.86****
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Mental Health	0.155	1.27
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Physical Health	0.074*	1.38*
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on personal Finances	0.052*	1.40*

[*p<0.1; **p<0.05; ***p<0.01; ****p<0.005]

TABLE 4.6: INFLUENCES ON AGREEMENTS WITH SPEEDS IMPACTS (PARTIAL RESULTS FROM PROPORTIONAL ODDS LOGISTIC REGRESSION MODELS) [FOR FULL RESULTS, REFER TO TABLE 8.7]

INDEPENDENT VARIABLE	DEPENDENT VARIABLE	P-VALUE	COEFFI-CIENT
AGE	Speeds impacts on Physical Health	0.756	0.94
INCOME	Speeds impacts on Vegetation	0.073*	0.63*
INCOME	Speeds impacts on the Economy	0.405	0.85
INCOME	Speeds impacts on personal Finances	0.769	1.06
INCOME	Speeds impacts on Mental Health	0.554	0.89
INCOME	Speeds impacts on the Personal Environment	0.814	0.96
TIME LIVED AT CURRENT LOCATION	Speeds impacts on Vegetation	0.477	1.14
TIME LIVED AT CURRENT LOCATION	Speeds impacts on Wildlife	0.893	1.02
TIME LIVED AT CURRENT LOCATION	Speeds impacts on Land	0.744	1.06
TIME LIVED AT CURRENT LOCATION	Speeds impacts on the Infrastructure	0.145	1.29
TIME LIVED AT CURRENT LOCATION	Speeds impacts on the Personal Environment	0.598	1.09
DISTANCE FAMILIARITY TO CONCERN	Speeds impacts on Vegetation	0.077*	0.82*
DISTANCE FAMILIARITY TO CONCERN	Speeds impacts on Wildlife	0.033**	0.80**
DISTANCE FAMILIARITY TO CONCERN	Speeds impacts on Land	0.034**	0.79**
DISTANCE FAMILIARITY TO CONCERN	Speeds impacts on the Infrastructure	0.261	0.92
DISTANCE FSA TO CONCERN	Speeds impacts on Wildlife	0.007***	1.29***
INTERACTION LEVEL	Speeds impacts on Vegetation	0.388	1.32
INTERACTION LEVEL	Speeds impacts on Wildlife	0.236	1.47
INTERACTION LEVEL	Speeds impacts on Land	0.750	1.11
INTERACTION LEVEL	Speeds impacts on the Infrastructure	0.771	0.92
ACTIVITY SECTOR(S)	Speeds impacts on Wildlife	0.028**	0.61**
ACTIVITY SECTOR(S)	Speeds impacts on Mental Health	0.074*	0.64*
ACTIVITY SECTOR(S)	Speeds impacts on Physical Health	0.041**	0.59**
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Speeds impacts on Vegetation	0.084*	1.39*
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Speeds impacts on Wildlife	0.037**	1.46**
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Speeds impacts on Land	0.016**	1.60**
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Speeds impacts on the Economy	0.152	1.28

[*P<0.1; **P<0.05; ***P<0.01]

Several factors contribute to the determination of agreement with wave and speed impacts, in addition to the effects of the predetermined daily cargo ship quantity mentioned previously. First, individuals who have resided for a longer duration in their present location demonstrate a higher tendency to agree with the impacts of waves on *infrastructure* and the *economy*. Moreover, those with elevated incomes exhibit a reduced tendency to align with the notion of waves affecting the *economy* and speeds impacting *vegetation*. The sector(s) of activity also contributes to the varying perspectives on the impact of speeds on *health* and *wildlife*, with individuals in maritime and/or transport-related sectors displaying a lower tendency to agree. In terms of spatial relationships, a greater level of familiarity with the

location of concern generally correlates with a higher likelihood of agreeing on the impacts of speed on *vegetation*, *wildlife*, and *land*. Conversely, as the distance between the concern place and the FSA increases, there is also a higher likelihood of agreeing on the impacts of speed on *wildlife*. Additionally, it should be highlighted that there is often a negative correlation between the estimated speeds of sailboats and small motorboats and the level of concurrence regarding the impacts of speed. However, it is worth noting that in certain cases, a positive correlation exists between the estimated speed of jet skis, cargo ships, and cruise ships, and the likelihood of agreeing with speed impacts.

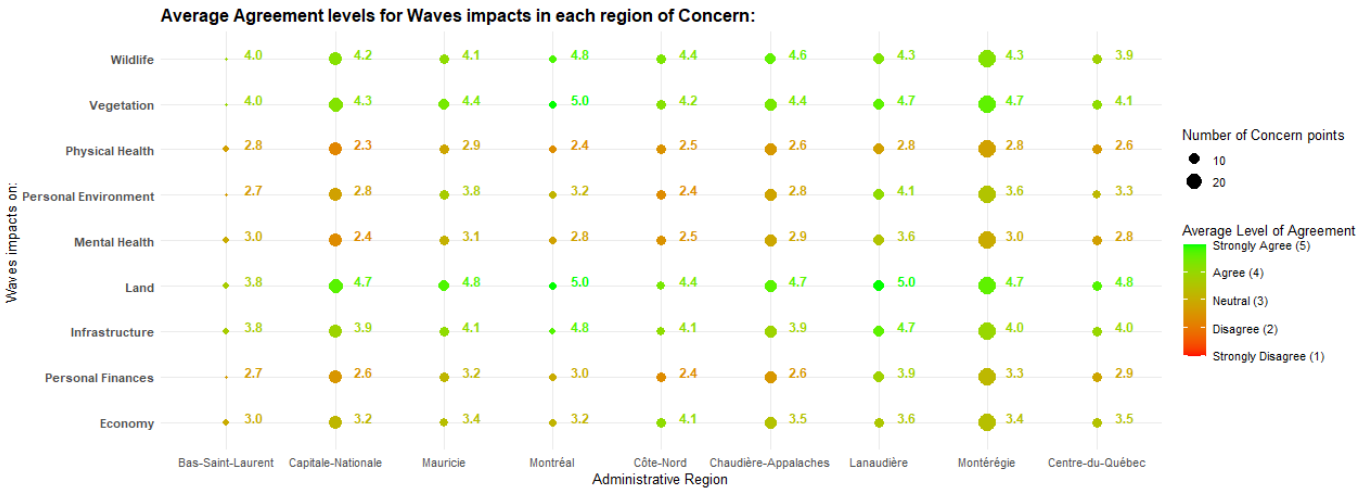

FIGURE 4.11: AVERAGE VALUES OF AGREEMENTS WITH WAVES IMPACTS IN EACH ADMINISTRATIVE REGION WHERE THERE IS CONCERN RELATED TO BOAT MOVEMENT. THE COLOR OF THE POINTS REPRESENT THE MAGNITUDE OF THE PERCEPTION VALUE WHILE THE SIZE OF THE POINTS ACCOUNT FOR THE COUNT OF CONCERN POINTS.

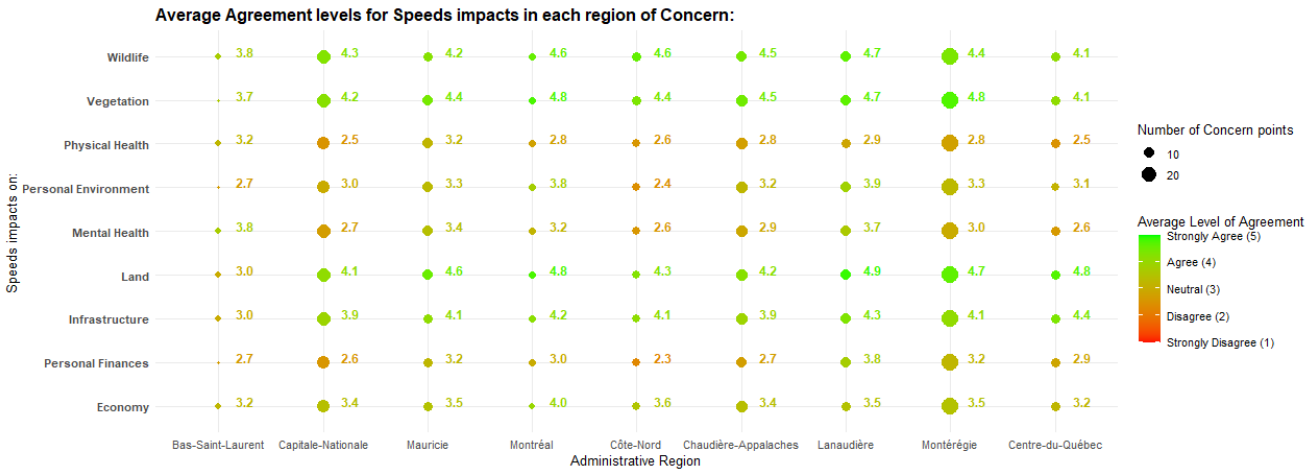

FIGURE 4.12: AVERAGE VALUES OF AGREEMENTS WITH SPEEDS IMPACTS IN EACH ADMINISTRATIVE REGION WHERE THERE IS CONCERN RELATED TO BOAT MOVEMENT. THE COLOR OF THE POINTS REPRESENT THE MAGNITUDE OF THE PERCEPTION VALUE WHILE THE SIZE OF THE POINTS ACCOUNT FOR THE COUNT OF CONCERN POINTS.

Lanaudière and Montreal stand out as the concern regions with most agreements for waves (Lanaudière: *personal environment*, *mental health*, *land*, and *financial* impacts; Montreal: *wildlife*, *vegetation*, *land* and *infrastructure* impacts) and speeds (Lanaudière: *wildlife*, *personal environment*, *land*, *infrastructure*, and *economy* impacts; Montreal: *vegetation*, and *economy* impacts) impacts. Côte-Nord contains multiple minimal values of agreement: waves on *personal environment* and *financial* impacts, and speeds on *personal environment*, *mental health*, and *financial* impacts. Bas-Saint-Laurent also gets minimal values for both waves and speeds on *land*, *infrastructure*, and *economy* and maximal values for speeds impacts on *wildlife* and *health*. Capitale-Nationale and Mauricie present the minimal and maximal relative levels of agreements for waves impacts on *physical health*, the only one that does not reach the highest in Montreal or Lanaudière. Mauricie also has quite high relative agreement for speeds impacts on *physical health*. Waves impacts on *mental health* reach the relative lowest agreement in Capitale-Nationale as well. Montérégie and Chaudière-Appalaches do not have striking relative extreme values but reach high agreements in Chaudière-Appalaches for waves impacts on *wildlife* and in Montérégie for speeds impacts on *vegetation* and *land*. Finally, Centre-du-Quebec also reaches maximal relative level of agreement for speeds impacts on the

infrastructure while reaching relative minimal levels of agreement for waves on *wildlife* and speeds on physical *health* and *economy*.

4.5 POTENTIALS OF SPEED REDUCTION

As seen through other perceptual elements, speed is considered, in most cases, as attributable to shipping and boating impacts on many factors of concern (e.g., land with erosion, biodiversity, infrastructures, or even the economy and personal environments). With the intention of delving into the relationship between speed and its effects on the socio-ecological system of the river, the survey encompassed questions that sought the perspectives of respondents on the potential for speed reduction. It looks at both the local and Quebec scales, across the three pillars of sustainability: social, economic, and environmental.

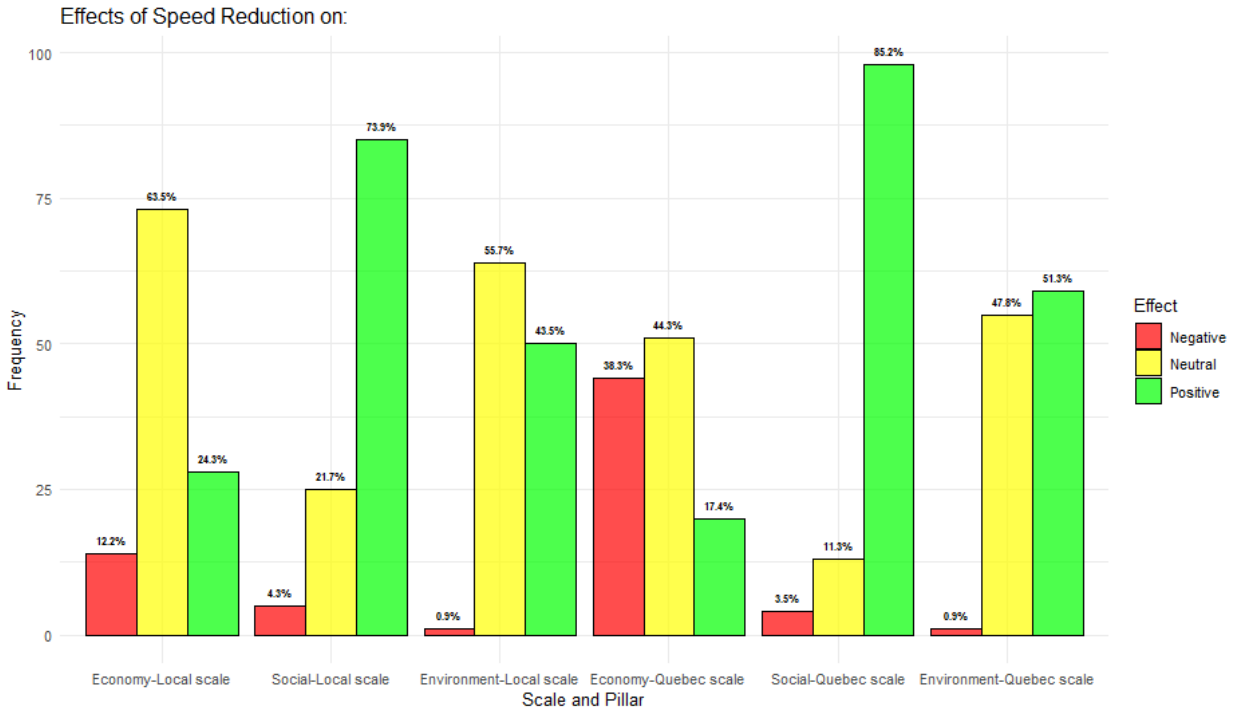

FIGURE 4.13: BAR PLOT OF THE RESPONSES TO Q13 AND Q14 OF THE SURVEY-EFFECTS OF SPEED REDUCTION ON THE THREE PILLARS OF SUSTAINABILITY AT THE LOCAL AND PROVINCIAL SCALE.

Participants across both scales believe that reducing speed could result in positive social impacts, with a particularly high percentage of 85.2% selecting Quebec

compared to 73.9% for the local scale. Regarding the environmental consequences of reducing speed, participants appear to believe that Quebec would benefit more than their own local area. Specifically, 51.3% selected positive impacts for Quebec, while 43.5% selected positive effects for their local scale. Nonetheless, there is consensus that this would not result in any adverse effects at either scale. Furthermore, the economic implications of speed reduction would primarily be neutral (selected by 44.3% at the provincial level in Quebec and 63.5% at the local level). Nevertheless, the distribution of expected negative *economic* consequences is considerably higher at the provincial scale of Quebec (38.3%) in contrast to the local scale (12.2%), which exhibits a twofold increase in positive expected local effects (24.3%), a proportion that is less than half the one for expected positive impacts in Quebec (17.4%).

TABLE 4.7: INFLUENCES ON EXPECTED EFFECTS OF SPEED REDUCTION (PARTIAL RESULTS FROM PROPORTIONAL ODDS LOGISTIC REGRESSION MODELS) [FOR FULL RESULTS, REFER TO TABLE 8.8]

INDEPENDENT VARIABLE	DEPENDENT VARIABLE	P-VALUE	COEFFICIENT
AGE	Effect on Local Economic pillar	0.817	0.95
AGE	Effect on Local Social pillar	0.035**	0.56**
AGE	Effect on Local Environmental pillar	0.829	1.05
AGE	Effect on Quebec Economic pillar	0.065*	0.65*
AGE	Effect on Quebec Social pillar	0.078*	0.62*
AGE	Effect on Quebec Environmental pillar	0.425	0.62
INCOME	Effect on Local Economic pillar	0.399	0.83
INCOME	Effect on Quebec Economic pillar	0.044**	0.65**
TIME LIVED AT CURRENT LOCATION	Effect on Local Environmental pillar	0.394	1.15
INTERACTION LEVEL	Effect on Quebec Social pillar	0.095*	1.79*
INTERACTION LEVEL	Effect on Quebec Environmental pillar	0.972	0.97
ACTIVITY SECTOR(S)	Effect on Local Environmental pillar	0.749	1.09
ACTIVITY SECTOR(S)	Effect on Quebec Social pillar	0.042**	0.53**
ACTIVITY SECTOR(S)	Effect on Quebec Environmental pillar	0.666	0.80
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Effect on Local Social pillar	0.071*	0.68*
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Effect on Quebec Economic pillar	0.600	1.10

ESTIMATED NUMBER OF DAILY CARGO SHIPS	Effect on Quebec Environmental pillar	0.620	1.23

[*p<0.1; **p<0.05]

As participants age, their inclination to select positive impacts decreases for the local and Quebec social pillar, as well as the Quebec economic pillar. Participants with higher income levels also demonstrate a reduced inclination to believe that Quebec will experience positive economic effects as a result of speed reduction. Interestingly, sectors of the industry that are more closely related will have a lower likelihood of expecting positive social impacts for Quebec. On the other hand, individuals who engage in a wider range of interactions with the river are more likely to anticipate positive effects from reducing speed. In addition, individuals who express agreement regarding the effects of speed on mental health and infrastructure are also more likely to expect positive social impacts of speed reduction for Quebec.

FIGURE 4.14: AVERAGE VALUES OF EXPECTED EFFECTS FROM SPEED REDUCTIONS IN EACH ADMINISTRATIVE REGION WHERE THERE IS CONCERN RELATED TO BOAT MOVEMENT. THE COLOR OF THE POINTS REPRESENTS THE MAGNITUDE OF THE PERCEPTION VALUE WHILE THE SIZE OF THE POINTS ACCOUNT FOR THE COUNT OF CONCERN POINTS.

Lanaudière and Montreal both reach the highest levels of expected positive impacts for both local and Quebec scales, Lanaudière for *social* and *economic* impacts and Montreal for *environmental* impacts. However, Montreal does showcase the lowest relative score for expected impacts on the local *economy*, leaning towards negative when that lowest score for Quebec is in Centre-du-Quebec also leaning towards negative. Chaudière-Appalaches presents the lowest relative scores for

expected social impacts on both scales, but still those score stays above 2/3, suggesting mostly neutral impacts with some inclining towards positive impacts. Even Bas-Saint-Laurent gathering the lowest scores at both scales for expected environmental impacts gather a score of 2.75/3 for positive impacts at Quebec scale and a score of 2.5/3.

4.6 OTHER PERCEPTUAL INSIGHTS

Additional elements emerged from the qualitative data. Participants express concerns regarding the protection of specific biodiversity, notably the shore swallow (*hirondelles de rivage*) and the copper redhorse (*chevalier cuivré*), from the adverse effects of boat traffic. They also mention the threats for beluga whales, whether it be on their communication (with noise) or regarding the risk of lethal collisions. Other species, from whose habitats are threatened by the activities, are mentioned: geese, snow gees, whales, or even seagrass beds. The state of intertidal swamps was also a matter of discussion. The threats of invasive species, such as silver buckthorn, zebra mussels, gobi, Asian carps, or even sticky sponges are non-negligible. Pollution is also a big factor of concern mentioned with mentions of oil spills, waste disposal, mazout, smoke, diesel combustion, contaminations, lack of sanitary equipments, lack of proper maintenance, cleaning process linked with marine activities affecting habitats, water and air quality in the region.

Waterway maintenance is a factor of influence for many, especially during winter months, the dredging of the river accused of exacerbating erosion with sedimentation. Discourse surrounding the artificialization of shores underscores the need for informed decision-making regarding shoreline preservation measures. While some advocate for the installation of infrastructures such as riprap, others caution against their environmental and financial ramifications (Bernatchez et al., 2011). The debate extends to the responsibility for funding such initiatives, with considerations of government intervention versus private investment. Participant advocate for federal support for shoreline infrastructure projects funded by revenues from river activities. Moreover, the argument of economic benefits for the communities and the

region as a whole emerges. Positive economic impacts from tourism which should be redistributed properly based on the impacts perceived from the activity.

There's also this idea of belonging to the river, it being a part of you and you being a part of it. This is also why people mention the mental toll of potential and visible impacts from shipping, eco-anxiety and stress for your surroundings are mentioned by participants. The majority of participants complain about the safety linked to leisure boating, especially when it comes to jet ski, pointing the finger on users' reckless behaviors.

Attention is drawn to the impact of navigation on isolated communities, with concerns raised regarding the disproportionate focus on urban areas compared to remote locales. Some people don't think there's enough bridging between isolated communities and big cities. Still, shipping is recognized for its role in reducing isolation in remote communities and offering an alternative to terrestrial transportation, albeit with concerns regarding safety implications, as it reduces terrestrial accidental risks. This brings on the importance of marine transportation as a way to bridge social isolation of some Quebec communities which could be more susceptible to the risks associated with coastal erosion (Pelletier Boily, 2022; Kramer, 2009).

Another point of focus involves the Covid-19 pandemic which prompted a reduction in navigational activity, which many believed to be beneficial for the wellbeing of the river seeing "nature's comeback". While some believe the levels of navigation returned to pre-pandemic levels, others affirm that they've increased. Besides, apprehensions regarding the Contrecoeur projects to expand the Port of Montreal are voiced. The infrastructure, which could handle 1.15 million containers (Port of Montreal, 2024), has also potential for impacts on navigational patterns and associated environmental consequences. While infrastructure and maintenance (ie. dredging) linked to the activity are specified as threats to the local environment, some do make suggestions for improved conditions and less reliance on the waterways: a participant suggested the building of a bridge over the Saguenay River as a way to palliate against over-use of river services.

Lastly, concerns persist regarding public misunderstandings of the relationship between speed, waves, and safety, particularly regarding the misconception that lower speeds always equate to reduced risk. Some even say that speed should be adjusted depending on the direction of navigation as currents play a big part in speeds' emphasis of waves. Additionally, discussions surrounding cruise ships highlight perceptions of lower environmental impact compared to other vessel types. Overall, there is consensus on the evolving landscape of navigational activity, characterized by increases in both quantity and vessel size, albeit with localized variations. Participants are aware that regulations are in place for commercial vessels whereas very little is administered for leisure boats which involves hardly measurable risks. For safer use of the river, more checks should be implemented for instance: lifejackets, sanitary facilities, hull and ballast inspections, and instore fines in case of non-respect. While, as we have seen, some regulations obligate ships to discharge their ballast water in proper zones, participants feel as if this is still an issue.

Specific places mentioned involve : *Pointe-aux-Trembles, Iles de Sorel, the fluvial transect near Trois-Riviere, Ile St-Ignace-de-Loyola, Berthierville, Iles de Grace, Lapierre, Iles des barques, Pointe-à-Platon, rive sud, La Prairie, Brossard, St-Lambert, Longueuil, Boucherville, iles de Berthier, Iles de la Paix, Lac Saint-Pierre, Deschaillons, Richelieu, Ile Saint Ours, Ile Duval, Ille Bouchard, quai de Portneuf, Sorel-Tracy, embouchure du St-Maurice, Côte-Nord, travers Tadoussac et Baie-Comeau/Matane, Canal Rideau, Canal Trent-Severn, Island canals.*

A quote from one of the participants shows how diverse is the understanding of activities' impacts on the river socio-ecological system (translated from French):

> "It's important to make the residents understand that they can't control the river. Yes, boats generate waves, and yes, these waves must be limited, but not necessarily for the benefit of the residents. Too often, people settle on the water's edge or in flood-prone areas and build a wall or riprap. These infrastructures have many negative consequences from an ecological point of view. According to

a river characterization study published a few years ago, a terrifying 48% of river banks are artificial. So yes, let's limit the waves, but let's work on improving boats and reducing their speeds, not concreting over the jewel that is the St. Lawrence River." (Translated by Author)

5. DISCUSSION

The results reveal comprehensive aspects of discourse regarding shipping issues and the possibilities for mitigating impacts. In this segment, I delve deeper into the interpretation of the results to enhance the understanding of the potential impact on communities and their perceptions regarding shipping, boating, waves, and erosion within the socio-ecological system of the St. Lawrence River.

5.1 PUBLIC OPINIONS AND SHIPPING (RQ1)

The initial research question primarily focused on the strategies employed in developing a survey that comprehensively captures perception. In order to fulfill this objective, I decided to employ a conceptual model that is based on four axes of Factors of Perceptions. *Factors of Influence* from the users' boating and shipping activities lead to *Factors of Concern*, externalities on the socio-ecological system. These factors of influence are complemented by *Factors of Measurement*, which incorporate factual quantifiable elements to put in perspective the magnitude of perception. As the consideration of *place* is essential to contextualize perception, *Factors of Spatiality* pertain to place-based perception. There are a total of 18 factors of perception which are described in Chapter 3.

As a researcher, I constructed a conceptual framework informed by extant studies to generate novel insights and address specific research intents. Nonetheless, my own conceptualizations and research motivations also informed this endeavor. While quantitative and spatial analyses facilitated direct associations between variables, qualitative coding aimed to elucidate perceptions on the issues delineated in this thesis through participants' narratives. For this research, adding qualitative insights with coding proved valuable as it led to detect potential recommendations. That is the case when participants recommend the building of a bridge over the Saguenay River to lessen maritime use of the river for traversing or when they

mention strategies for the redistribution of economic revenues from touristic activities for instance.

Clear Seas, a not-for-profit organization, conducted three surveys in 2018, 2020, and 2022 capturing the public opinion on the shipping industry (Clear Seas, 2022). Distributed throughout Canada, these surveys offer temporal layers to perception and facilitate comparisons between provinces, situating Quebec's opinions within the broader context of Canada. With the growing recognition of shipping's significance in everyday life, the favourable perception of it has declined, especially in Quebec and British Columbia. The significance for the Canadian economy is given less consideration compared to the advantages for coastal communities. Indeed, despite the general belief in a 50/50 balance between economic benefits and environmental risks, a larger percentage of individuals think that the economic benefits outweigh the environmental risks, rather than the environmental risks outweighing the economic benefits. Upon examining the previously presented findings, perceptions evidence that the decrease in speed would yield predominantly favourable outcomes for the environment, with minimal adverse effects on the economy. Moreover, the Clear Seas survey presents the noticeable effect of the pandemic on shipping levels which were observed by 70% of participants affirming that they became more aware of the workings of the global supply chain during the Covid-19 pandemic. This echoes the multiple mentions of shipping affluence decrease during the pandemic in our results. Additionally, individuals from the Clear Seas survey have a perception of an increase in shipping; however, a small subset maintains the belief that there was a decrease, mirroring our qualitative findings. Furthermore, it is widely agreed upon by more than 90% of Canadians (from the Clear Seas survey) that shipping is a safe practice. It is worth mentioning the contrast between this point and the data here compiled on leisure boating. Numerous individuals have expressed concerns regarding the lack of safety associated with these vessels. It is crucial to consider the safety implications of such vessels, particularly due to the existence of more stringent regulations in the shipping industry.

5.2 ELEMENTS OF CONCERN: PERCEPTUAL THEMES (RQ2 & RQ3)

Analysis of the population's main concerns reveals that both waves and speeds are recognized as significant factors contributing to the perceived impacts of boating and shipping activities. In other words, it is the interplay of these factors that heightens apprehension, frequently invoking the idea of coastal erosion, the invasion of personal environments, and the depletion of a significant river that has meaning for individuals. Individuals have indeed identified waves as the main concern, with biodiversity and speed ranking second and third, respectively. The association between waves and erosion leads to a strong focus on impacts on the coast or land in people's responses. The concern for waves and speeds tends to be heightened in the Montreal or Lanaudière regions. These regions align with the Cornwall to Montmagny transect, the major part (86%) of the region fluvial transect impacted by shipping-induced erosion (Dauphin, 2000).

Less tangible elements of concern within the personal sphere (health, social and financial aspects) usually denote less attribution to waves and speeds impacts. In general, those elements also portray less concern and perceived level of impacts. One intriguing observation, however, is the considerable positive effect that a reduction in speed is anticipated to have on the social dimension of sustainability, despite the relatively limited influence of speed on personal domains and social ramifications. Additionally, the expectation for positive social impacts from speed reduction is seen to rise alongside the increasing agreement on the influence of speed on mental health, showing the interconnection of personal sphere and social impacts.

The estimated speeds of vessels directly impact the perceived level of concern among respondents, particularly concerning sailboats, ferries, small motorboats, tugboats, and rowboats. This underscores the importance of considering vessel speeds as a key determinant of public concern regarding maritime activities (RQ2). However, the influence of speed varies across different vessel types, indicating nuanced perceptions among respondents regarding the potential impacts of speed on maritime

environments. Indeed, while jet skis, cargo ships, and cruise ships speeds are thought as proportional with the impacts of speeds on maritime environments, those of sailboats, and in some cases small motorboats, are not. It is worth mentioning that, despite the prevalence of reports regarding the reckless behavior of jet ski users, no significant association was discovered between speeds and concern for jet skis. Such significance is visible for small motorboats, a type of vessel also mentioned as being problematic due to user behavior, showing an emphasis of concern as the estimated speed increases. While not necessarily centred around their speeds, these perceptions encompass a somewhat broad spectrum.

The significance of speed as a matter of concern is also demonstrated in the anticipated outcomes of speed reduction, which notably benefit the intangible social aspect of sustainability. Besides, it is essential to consider that the impact on the environment in Quebec, rather than the participants' local environment, suggests that the collective expression of concern is what determines the levels of perceived concern, rather than individual observations. This intriguing cognitive process of peer and global anxiety influences individuals' levels of concern. Concerning the economic pillar, it is plausible that the coordination of industrial operations on a larger scale and the distribution of tax revenue to provincial governments contribute to the perception. This is the rationale behind the perception that the Quebec scale would be more adversely affected by speed reduction than the local scale, as the local economy, sometimes independent of maritime activities, would not experience any direct impact.

Other common concerns include pollution which reoccurs in the qualitative segments as many mention the risks of spills and waste discharge. Moreover, the assessment of coastal and biodiversity impacts holds considerable importance, alongside financial and safety concerns. People have expressed significant concerns regarding cargo ships, jet skis, as well as yachts and cruise ships. The study also highlighted concerns raised by participants regarding recreational boating activities, specifically referring to *small motorboats*. These recrudesce in participants' words

demonstrate the overwhelming apprehensions regarding leisure users and the overall concern for industry activities.

In exploring RQ3, it is crucial to investigate how socio-economic and demographic factors shape individuals' perceptions of boat traffic. It is apparent that various factors, including age, income, activity sectors, and duration of residence at the current location, have an impact on specific aspects of perception. Unexpectedly, the variable of education level showed no discernable effect. Additional perceptual elements, such as the speed of vessels and volume of daily cargo ships, have demonstrated their impact on perception. As quantity and speed are often associated with heightened impacts on the socio-ecological system of the river, results show that people do not necessarily believe that speed reduction will have positive repercussions if there are higher daily cargo ships passing through the river. Furthermore, there were slight influences observed across various interaction types. Different river users perceiving in different ways.

Age and income have some connections as it can influence the level of concern (ie. sailboats) or the expectations from speed reduction (ie. less likely to expect positive economic impacts for Quebec). The agreement for waves impacts on the economy is also influenced by income as higher earners are less likely to agree. It can be hypothesized that individuals with higher incomes may be less susceptible to perceiving detrimental financial and economic consequences resulting from boat activities and their speeds due to their reduced vulnerability. Nonetheless, when considering that older individuals are also less likely to perceive the positive social effects resulting from speed reduction, it prompts one to wonder whether speed truly plays a role in bridging social issues, especially considering the heightened vulnerability of older individuals.

Another influential factor relates to extended periods of residency, which are associated with increased awareness of coastal, mental health, and safety impacts, again highlighting the influence of socio-economic and demographic factors on public perceptions of maritime activities. Boyer-Villemaire et al. (2021) have demonstrated that the repercussions of coastal hazards can have a distressing effect on individuals.

Furthermore, those who have resided longer at their current residence are also more likely to acknowledge the impact of waves on infrastructure and the economy. Presumably, those individuals have had the opportunity to observe those changes as they occur.

The correlation between individuals employed in maritime and transport sectors and their decreased likelihood to concur with the effects of speed and anticipate favorable social consequences from speed reduction implies that they offer a contrasting perspective, possibly due to their deeper understanding of the intricate processes involved. This finding challenges the idea that people who have a variety of interactions with the river (both professionally and recreationally) are more prone to perceiving positive effects resulting from speed reductions. It is possible that individuals in sectors pertaining to river activities may have less diverse interactions with the river compared to individuals in less related sectors. Different groups exhibit varying concerns with regards to vessels. The presence of diverse interactions is positively correlated with a heightened concern in yachts, while individuals in related sectors are less likely to exhibit such concern, potentially due to their involvement with different types of vessels or their specialized knowledge being focused on alternative areas.

5.3 GEOGRAPHY OF CONCERN (RQ4)

Geography of concern does influence perception (RQ4). It has been observed that locations like Montreal, where there is generally less concentration of concern, still perceive it at significantly high levels. Montérégie, despite being the region with most concern, did not consistently demonstrate the highest levels of agreement or concern regarding perceived impacts. Nevertheless, Lanaudière appeared to align with Montreal on the upper end of the perception spectrum. Côte-Nord, among other isolated regions, exhibited more pronounced diverging influences. Given that the spatial findings were obtained from points of concern, it is possible that individuals' concerns may not be grounded in personal observation but rather on hearsay evidence. Upon examining the FSAs of all participants, it was observed that none of

them originated from Côte-Nord. However, some level of concern was expressed regarding the region. Beauchesne et al. (2022) presented a comprehensive analysis of vulnerability indicators for valued components, focusing on the cumulative effects of maritime activities within administrative regions. They observed that Montérégie experiences the greatest impact from these cumulative effects, justifying the concentration of concern points in this region. Moreover, they carefully consider the amplification of effects as vessels travel upstream, a logical approach considering the considerable occurrence of high values in Montreal. They also acknowledge that boats passing through Montreal cannot be equated to boats passing through Quebec City. They also denote the vulnerability of Centre-du-Québec, Lanaudière and Mauricie regions which is also observed in our analysis. It should be emphasized that the fluvial sector exhibited higher vulnerability to marine pollution, which is consistent with our focal areas of concern.

The quantitative analysis further indicated that the extent to which individuals assess impacts from speeds and waves is influenced by the proximity of familiarity and concern. Notably, this influence is more pronounced when the distance between familiarity and concern is smaller. Specifically, individuals who are more familiar with their areas of concern tend to exhibit heightened concern for cargo ships but diminished concern for ferries. The survey showed that more than 80% of participants placed their concern within 10 kilometres of their familiarity place, so in the vast majority of cases, participants are familiar with their places of concern. The lack of a consistent pattern in FSA is unexpected and challenges the notion that familiarity and residence are always equivalent. Indeed, when people are more familiar with their place of concern, the likelihood for higher perceived financial impacts from maritime traffic is higher than when their home FSA is closer to their place of concern.

The observation of Montreal experiencing the most detrimental economic consequences of speed reduction (towards the negative) at the local level can be rationalized by considering its status as a pivotal economic hub in Quebec. Considering the frequent association between speed and profitability, this correlation

may have an impact in a region where individuals may hold concerns about the potential consequences of a reduction. Alternatively, it is possible that their ratings are excessively extreme, resulting in a similar outcome. The proximity between individuals' familiar locations and areas of concern significantly influences their level of apprehension regarding maritime traffic.

5.4 VULNERABILITY AND RESILIENCE FOR THE ISSUE OF SHIPPING (RQ5)

When reflecting on the Literature Review pertaining to the vulnerability of natural hazards, it is worth considering the two frameworks introduced by Tuner et al. (2003): Risk-Hazard (RH) and Pressure and Response (PAR). These are complemented by the importance of place-based assessment of vulnerability to detect strategies of resilience. In the context of incorporating various levels of exposure and vulnerability, it is apparent that participants who express greater concerns or perceived impacts on personal elements (such as mental health, personal financial situation, and personal environment) display a greater degree of vulnerability as opposed to those who emphasize more global aspects of shipping (e.g., biodiversity and economy). Furthermore, the longevity of one's residence correlates with a heightened awareness of the impact on their mental health, rendering them more susceptible. This susceptibility is especially notable in terms of mental well-being, as their heightened sensitivity to observable shifts in proximate coastal environments over time increases their vulnerability to potential hazards. The exposure of entities does not automatically imply vulnerability, and the extent of vulnerability varies across different entities. Consequently, it is imperative to examine social vulnerability.

Boyer-Villemaire et al. (2021) indicated that individuals who experience exposure and heightened vulnerability may manifest mental health challenges, including stress, anxiety, depression, insomnia, and burnout, which are often accompanied by financial and healthcare concerns. Indeed, 30% of participants from their survey indicated having experienced mental health impacts from coastal hazards, 14% for physical health. There is also a clear difference in that perception

depending on the level of exposure as these numbers raise to 50% and 23.9% for affected populations. The research conducted by Brisson and Richardson (2009) highlights how the resilience to extreme climatic events can affect the social and economic conditions of individuals influencing their health. These elements, such as income, origins, age, time lived in current region, number of children, and physical and mental disabilities can affect the vulnerability of communities (Wilkinson & Marmot, 2004). In this work, through a community forum, they found that erosion has impacts on property, essence of well-being, which impacts financial investments and personal environments and can lead people to feel unsafe. The idea of home being taken away creates huge vulnerabilities emphasizing stress and anxiety, the river is vital to them. Some participants shared psychological consequences but also physical consequences (e.g., cardiovascular) on their health. Our results indeed show that 69.5% of participants perceived some level of impacts on mental health and 62.6% perceived some level of impacts on physical health from maritime traffic. A little level of impact on health are perceived for those with concerns in Cote-Nord. Moreover, 30% and 32% agree with waves and speeds impacts on mental health, respectively, whereas 18% and 22% agree with waves and speeds impacts on physical health, respectively.

In terms of social impacts, the fact that only 15% of participants from Boyer-Villemaire et al.'s survey (2021) admitted being able to count on a relative in case of emergency showcases the importance of including social impacts in the matter of shipping as isolation can add to the vulnerability of populations and their likelihood to experience other types of impacts (such as mental health). This can have financial (for 55% of their participants) and economic (11% of their participants had to stop working following a coastal event) repercussions as it can lead people to stop working and incur additional expenses for their personal environment protections and the resulting health expenditures from the stress incurred.

In relation to lessons learned (RQ5), the absence of suitable informational resources, regulations, and resolution of usage conflicts prompts participants to call

for policy makers to take appropriate measures in exploring restrictions on leisure boating for the sake of safer and more sustainable practices. The inclination to localize spheres of action is also significant in order to enhance information and evaluate localized issues more accurately. The concerns surrounding biodiversity and pollution have the potential to induce *eco-anxiety*, which can permeate various aspects of an individual's personal sphere. There is a growing demand for measures to address erosion, with an emphasis on fostering greater cohesion between river systems and community environments, rather than resorting to artificialization of the shorelines. Even though people like the idea of riprap, it is not suggested by experts and people from our survey seem to have recognized its threats.

People from the forum conducted by Brisson & Richardson in 2009 also recognized how they would want concertation in decision-making. This echoes with the feelings of belonging to the river, it being the home of its communities and any threat to its safety and well-being is a direct threat to its coastal inhabitants, feeling the peril of their survival. Exposure is not vulnerability. There is questioning in whether more vulnerable people (in this case, those living near the river) should receive subventions from the government. Those subventions eventually come from tax money making all pay for the price of others' choices to live close to the river, something that is also mentioned by some participants in our survey. People want to be part of the scientific process, something that this study seeks. The lack of listening, of empathy, of solidarity is dividing for actors of the river, using a bottom-up approach is in the interest of all.

Referring to the study carried out by Legaspi et al. (2016), which investigates the relationship between perception-based resilience and its cognitive, affective, and behavioral processes, as well as the effectiveness of response in contrast to prevalent beliefs on social discourse, considering socio-economic indicators. This is relevant to the prevalent beliefs that have emerged in relation to the interrelationship between ships, waves, and their velocities, highlighting the need to gain a comprehensive understanding of the resulting impacts and condition them in order to enhance resilience strategies. This involves the development of models and the dissemination

of popularized information to the broader audience within the socio-ecological system, encompassing both exposure and vulnerability spectrums. This is especially relevant given the current discussions regarding the necessity of reliable information resources on wave formation. Broad accessibility and enhanced user understanding of the consequences of different actions are essential for effectively mitigating their impacts.

The river's socio-ecological system has a finite capacity to absorb disturbances before its resilience is compromised (Adger, 2006). Therefore, the concept of local management is a rational strategy, taking into account the ever-changing nature of the river and its varying levels of susceptibility. Initiatives like the ZIPs implemented by Stratégies Saint-Laurent, a provincial organization, are commendable examples of local development efforts. The utilization of adaptive management frameworks should be employed on a localized scale of action with bottom-up approaches to decision-making (Parrott et al., 2011; Adger, 2006; Chion et al., 2018). It has been proposed that the issue be addressed on a local scale, with the government delegating more power to municipalities for the regulation of their water bodies Additionally, the tourism industry has a positive economic effect that should be equitably redistributed based on the perceived impacts of the activity.

The excessive utilization of recreational vessels can lead to conflicts of use that deserve greater consideration by policymakers in order to promote safer practices. In an effort to support the protection of marine areas, 90% of Canadians agree that at least 30% of the oceans should be protected by 2030 (Environics Research, 2019), that is why organizations such as Fondation David Suzuki (2024) want to place 30% as part of Marine Protected Areas by 2030. Other propositions such as following One Health (World Health Organization, 2024) frameworks are interesting to consider for policymakers.

5.5 CHALLENGES AND LIMITATIONS

It is crucial to acknowledge the possibility of participant bias due to the highly specific nature of the questions. This can cause participants to prioritize concerns that may

not carry the same weight in a conventional setting as they do in the context of the questioning. The rationale behind asking more general concern questions before delving into specifics was to discern and counteract any potential bias in the responses. Additionally, the inclusion of comment sections, which capture qualitative data, provide additional information and broader explanations regarding the decisions made by the participants. It is important to note that qualitative coding, even though it derives from explained methods, stays subjective all throughout the analysis. Coding could differ from one researcher to another. Additionally, participants may have experienced confusion regarding the distinction between *speed* and *waves* due to a common assumption that larger waves can only be achieved through higher speeds. The lack of attention given to factors like bathymetry and hull shape is frequently cited as the reason for this oversight. A larger number of participants might also impact the results and, while every attempt was made to include people from diverse backgrounds, a lack of diversity in the sample population could bias the results.

6. CONCLUSION

Climate change, escalating maritime activity, and competing demands for water resources have cast doubt on the future of the St. Lawrence River. These pose significant challenges to the river ecosystem, including flooding, erosion, and habitat loss with the expected increase of magnitude of extreme weather events. The river's strategic significance as a waterway, freshwater source, and habitat highlights its importance for human well-being and ecological integrity.

The results presented in this thesis show that the stress emerging from maritime activities is elicited in community perceptions. Environmental repercussions are clearly assessed, especially when it comes to the coast, the land, the biodiversity, the vegetation, and wildlife. Participants are also aware on the toll of those effects on their personal sphere, including their mental and physical health. Another level of impacts pertains to economic and financial ramifications, which are directly connected to the personal and social effects perceived from maritime traffic.

Multiple elements distinctly influence and shape perceptions. Income, age, activity sector(s), and interactions with the river are primary influences on those expressions of concern. For instance, as people get older or richer they are less likely to express concern over some vessels. Similarly, people with different experiences of the river, whether professional or recreational, will consider the effects of speeds differently.

One aspect of this work was the focus on the geography of perception, in particular for the expression of concern. By exploring locational selection of concern, the thesis elicited the major allocation to the region of Montérégie. However, when concerns were raised in the regions of Montreal and Lanaudière, people tended to place more emphasis on the magnitude of perception.

A thorough investigation in this research focuses on the relationship between speed magnitude and perceptions in boating and shipping activities, and its effect on wave movements. Given that participants identified speeds and waves as the top 3 concerns, there is compelling evidence to suggest that these elements should be

regarded as central to perceptions of maritime traffic. Participants often agreed with the action of speed on the amplifications of wave movements and the impacts of both those factors on environmental, social, and economic spheres. There was a clear consensus regarding the potential for positive social effects resulting from the reduction in speed. Additionally, it is evident to most participants that speed reduction would be advantageous for the environment, particularly in the context of Quebec. However, some individuals hold the view that this could result in negative impacts on Quebec's economy. This anticipation is justified, considering the conventional association between speed, productivity, and the quantity of cargo ships. A noteworthy aspect revealed by the qualitative analysis was the requirement for contrasting viewpoints in arguments that position speed as the primary catalyst for impact. Participants emphasize that the impacts are not solely attributed to a single aspect of influence, but rather the comprehensive intersection of actions and conditions.

Efficiency in shipping has evolved consequently in the last couple of decades and there is increasing developments of regulations (e.g., MARPOL's index collecting fuel oil consumption data) to find the best ways for reducing emissions (Hinchliffe, 2020). Still, pollution is a matter of concern as shipping can lead to spills and waste discharge contaminating habitats. Additionally, aging infrastructure and capacity constraints need to be addressed through investments and maintenance (Bongarts Lebbe et al., 2021). Participants have raised concerns about the financial implications of these infrastructural impacts, both on their immediate surroundings and on the allocation of tax income for the benefit of others' properties. However, the allocation of funds towards tourism infrastructure and recreational amenities along the riverfront can yield advantages for the tourism sector and cultivate an appreciation for the region's natural and cultural heritage (Mtapuri et al., 2022).

Decision-makers are confronted with challenges when it comes to making well-informed decisions that benefit both the river and its communities. Scientists warn that citizens need to understand that research processes are complex and therefore take time (Brisson & Richardson, 2009). Nevertheless, including public opinions in

research endeavors, valuing local knowledge, even involving citizens in the research could satisfy the needs of communities for better inclusion in the discussions and resilience and increase social acceptability. Understanding the future trajectory of the river is vital for informing policy decisions and guiding sustainable development. Collaborative initiatives involving various stakeholders, through community-based approaches, are underway to improve the river's ability to withstand environmental stresses (Ruz et al., 2020).

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8. APPENDIX

8.1 APPENDIX A: CONSENT FORM

McGill

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Participant Consent Form

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Title of Project: Measuring the perceived impact of vessels on the Saint Lawrence River

Sponsor: Réseau Québec Maritime (RQM)

Purpose of the Study: You are invited to participate in a research study on the perception of impact from boats on the Saint Lawrence River. Through this survey we hope to gather the knowledge, apprehension, and concerns of stakeholders in connection with environments potentially impacted by ship-induced waves. We hope to include anyone who wishes to participate to the debate around shipping regulations and/or speed restrictions.

Study Procedures: Your participation will include filling out an online survey. Questions will ask about your knowledge and familiarity of different characteristics of the maritime traffic such as the speed and quantity of boats passing through the identified sector of familiarity. It will also determine your relation to the Saint Lawrence and your concerns on the impacts of boats in the region, particularly relating to speed and waves. You will be able to communicate your level of concern on the economy, environment, and local community. The survey should take you around 10 minutes to complete and you can be entered in a draw for 1 in 10 chances of winning an amazon gift card worth 25$.

Voluntary Participation: You must be over the age of 18 to participate in this study. Participation is voluntary, and you may refuse to participate in any part of the study. You may decline to answer any question and may withdraw from the study at any time, for any reason. Your responses will be kept confidential and will only be associated with a unique identifier. If you decide to withdraw from the survey, your participant data will be deleted. Two years after the completion of data collection, data will be de-identified. Once de-identified, data can no longer be withdrawn.

Potential Risks: This study represents minimal risk. You might need to mention impacts of ship-induced waves on your environment and potentially your life. This could result in some psychological or emotional discomfort

from answering the questions from the survey.

Potential Benefits: Through this study, we hope to include your views and concerns and facilitate a debate around speed restrictions and shipping regulations in the region.

Compensation: You are eligible to receive 1 in 10 chances of winning an Amazon gift card of a value of $25 upon the completion of the survey. This is conditional on whether you decide to provide us with your email address at the end of the survey. If so, you will be automatically included in the draw.

Confidentiality: We plan to use coded information for the survey. At the end of the survey, you will be asked to enter your name. You will also be asked your email address to participate in the draw for an Amazon gift card of $25. You will be attributed a unique identifier code and all your identifiable information (name and email address) will be kept in Professor Grant McKenzie's password protected computer while survey responses will be kept on a McGill server accessible to both researchers. Your gender, age group, postal code, as well as your job sector are also required. This is simply in order to assess the correlation between demographic information and knowledge and perception on the studied issue. You can choose not to answer these questions. None of this demographic information will be associated to you as an individual when performing the analysis. The Lime Survey platform on which you answer is verified by McGill University and serves as a cloud-based platform used in the collection and storage of identifiable study materials. Your answers will only be accessible to the researchers, Ms. Clara Féré and Professor Grant McKenzie.

Dissemination of Results: The results of the survey will be analyzed and presented to the communities bordering the Saint Lawrence through the local Zone d'Intervention Prioritaires (ZIPs). This could be through the form of an interactive map and/or a policy brief. We will also produce a peer-reviewed academic publication and a conference presentation. Finally, the study will be used as part of a Master's thesis.

Questions: For any questions/clarifications, please contact Ms. Clara Féré at clara.fere@mail.mcgill.ca.

If you have any ethical concerns or complaints about your participation in this study, and want to speak with someone not on the research team, please contact the Associate Director, Research Ethics at 514-398-6831 or lynda.mcneil@mcgill.ca citing REB file number #23-01-011

Please read this document before continuing on to the survey. Submitting your study responses indicates that you consent to participate in this study. Please save or print a copy of this document to keep for your own reference.

8.2 APPENDIX B: VARIABLES

TABLE 8.1: VARIABLES USED FOR THE QUANTITATIVE ANALYSIS

name	description	variable	order
id	id of participant	integer	
Gender	Gender of participant	categorical	
distance	distance between X,Y coordinates of the place of familiarity and the place of concern	continuous	
distance_group	group made from the 'distance' variable-20 groups	ordered	bin_edges <- c(0, 10000, 20000, 30000, 40000, 50000, 60000, 70000, 80000, 90000, 100000, 150000, 200000, 250000, 300000, 350000, 400000, 500000, 600000, 700000, 800000)
distance_t	distance between X,Y coordinates of the place of concern and the nearest border of their FSA	continuous	
distance_group_FSA	group made from the 'distance_t' variable-20 groups	ordered	bin_edges <- c(0, 10000, 20000, 30000, 40000, 50000, 60000, 70000, 80000, 90000, 100000, 150000, 200000, 250000, 300000, 350000, 400000, 500000, 600000, 700000, 800000)
Marital	Marital Status of the participant	categorical	
income	income group of respondents	ordered	0-No income; 1-$1 - $9,999; 2-$10,000 - $24,999; 3-$25,000 - $49,999; 4-$50,000 - $74,999; 5-$75,000 - $99,999; 6-$100,000 - $149,999; 7-+$150,000; NA-Prefer not to answer
Age	age group of respondents	ordered	0-Under 18; 1-18 to 24; 2-25 to 34; 3-35 to 44; 4-45 to 54; 5-55 to 64; 6-65+; NA-Prefer not to answer
timeliving	amount of time lived at current location	ordered	1-<6m; 2-<1y; 3-<3y; 4-<5y; 5-<10y; 6-10y+; NA-Prefer not to answer
education	highest earned degree	ordered	0-Less than highschool; 1-high school diploma; 2-trade certificate; 3-CEGEP/College; 4-University diploma; NA-Prefer not to answer
amount	approximated average quantity of cargo ships going through familiar location each day	ordered	1-0 to 2; 2-3 to 5; 3-6 to 9; 4-10 to 12; 5-13 to 15; 6-16+; NA-I do not know
speed_cargo	estimated average speed of cargo ships	ordered	1-1 to 10km/h; 2-11 to 20km/h; 3-21 to 30km/h; 4-31 to 40km/h; 5-41+km/h; NA-I do not know
speed_yacht	estimated average speed of yachts	ordered	1-1 to 10km/h; 2-11 to 20km/h; 3-21 to 30km/h; 4-31 to 40km/h; 5-41+km/h; NA-I do not know
speed_jetski	estimated average speed of jetskis	ordered	1-1 to 10km/h; 2-11 to 20km/h; 3-21 to 30km/h; 4-31 to 40km/h; 5-41+km/h; NA-I do not know
speed_sailboat	estimated average speed of sailboats	ordered	1-1 to 10km/h; 2-11 to 20km/h; 3-21 to 30km/h; 4-31 to 40km/h; 5-41+km/h; NA-I do not know
speed_ferry	estimated average speed of ferries	ordered	1-1 to 10km/h; 2-11 to 20km/h; 3-21 to 30km/h; 4-31 to 40km/h; 5-41+km/h; NA-I do not know
speed_cruise	estimated average speed of cruise ships (with passengers)	ordered	1-1 to 10km/h; 2-11 to 20km/h; 3-21 to 30km/h; 4-31 to 40km/h; 5-41+km/h; NA-I do not know
speed_smallmotor	estimated average speed of small motorboats	ordered	1-1 to 10km/h; 2-11 to 20km/h; 3-21 to 30km/h; 4-31 to 40km/h; 5-41+km/h; NA-I do not know
speed_tugboat	estimated average speed of tugboats	ordered	1-1 to 10km/h; 2-11 to 20km/h; 3-21 to 30km/h; 4-31 to 40km/h; 5-41+km/h; NA-I do not know
speed_rowboat	estimated average speed of rowboats	ordered	1-1 to 10km/h; 2-11 to 20km/h; 3-21 to 30km/h; 4-31 to 40km/h; 5-41+km/h; NA-I do not know
impactlevel_coast	perceived impact of boat trafic on the coast	ordered	0-No impact; 1-Little impact; 2-Medium impact; 3-Big impact; NA-I do not know
impactlevel_biodiversity	perceived impact of boat trafic on biodiversity	ordered	0-No impact; 1-Little impact; 2-Medium impact; 3-Big impact; NA-I do not know
inpactlevel_financial	perceived impact of boat trafic on financial situation	ordered	0-No impact; 1-Little impact; 2-Medium impact; 3-Big impact; NA-I do not know
impactlevel_PH	perceived impact of boat trafic on Physical Health	ordered	0-No impact; 1-Little impact; 2-Medium impact; 3-Big impact; NA-I do not know
impactlevel_MH	perceived impact of boat trafic on Mental Health	ordered	0-No impact; 1-Little impact; 2-Medium impact; 3-Big impact; NA-I do not know
impactlevel_social	perceived impact of boat trafic on social consequences	ordered	0-No impact; 1-Little impact; 2-Medium impact; 3-Big impact; NA-I do not know
impactlevel_safety	perceived impact of boat trafic on safety	ordered	0-No impact; 1-Little impact; 2-Medium impact; 3-Big impact; NA-I do not know
vesselconcern_cargo	level of concern regarding cargo ships	ordered	0-Not concerned; 1-A little concerned; 2-Somewhat concerned; 3-Very concerned; NA-I do not know
vesselconcern_yacht	level of concern regarding yachts	ordered	0-Not concerned; 1-A little concerned; 2-Somewhat concerned; 3-Very concerned; NA-I do not know

vesselconcern_jetski	level of concern regarding jetskis	ordered	0-Not concerned; 1-A little concerned; 2-Somewhat concerned; 3-Very concerned; NA-I do not know
vesselconcern_sailboat	level of concern regarding sailboats	ordered	0-Not concerned; 1-A little concerned; 2-Somewhat concerned; 3-Very concerned; NA-I do not know
vesselconcern_ferry	level of concern regarding ferries	ordered	0-Not concerned; 1-A little concerned; 2-Somewhat concerned; 3-Very concerned; NA-I do not know
vesselconcern_cruise	level of concern regarding cruise ships (with passengers)	ordered	0-Not concerned; 1-A little concerned; 2-Somewhat concerned; 3-Very concerned; NA-I do not know
vesselconcern_smallmotor	level of concern regarding small motorboats	ordered	0-Not concerned; 1-A little concerned; 2-Somewhat concerned; 3-Very concerned; NA-I do not know
vesselconcern_tugboat	level of concern regarding tugboats	ordered	0-Not concerned; 1-A little concerned; 2-Somewhat concerned; 3-Very concerned; NA-I do not know
vesselconcern_rowboat	level of concern regarding rowboats	ordered	0-Not concerned; 1-A little concerned; 2-Somewhat concerned; 3-Very concerned; NA-I do not know
waves_vegetation	degree of agreement: waves have an impact on vegetation	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
waves_wildlife	degree of agreement: waves have an impact on wildlife	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
waves_land	degree of agreement: waves have an impact on land	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
waves_infrastructure	degree of agreement: waves have an impact on infrastructure	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
waves_economy	degree of agreement: waves have an impact on economy	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
waves_MH	degree of agreement: waves have an impact on mental health	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
waves_PH	degree of agreement: waves have an impact on physical health	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
waves_financial	degree of agreement: waves have an impact on personal financial situation	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
waves_personal	degree of agreement: waves have an impact on personal environment	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
speeds_vegetation	degree of agreement: speeds have an impact on vegetation	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
speeds_wildlife	degree of agreement: speeds have an impact on wildlife	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
speeds_land	degree of agreement: speeds have an impact on land	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
speeds_infrastructure	degree of agreement: speeds have an impact on infrastructure	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
speeds_economy	degree of agreement: speeds have an impact on economy	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
speeds_MH	degree of agreement: speeds have an impact on mental health	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
speeds_PH	degree of agreement: speeds have an impact on physical health	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
speeds_financial	degree of agreement: speeds have an impact on personal financial situation	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
speeds_personal	degree of agreement: speeds have an impact on personal environment	ordered	1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree; NA-I do not know
local_economic	estimated effects from speed reduction on the local economic situation	ordered	1-Negative; 2-Neutral; 3-Positive
local_social	estimated effects from speed reduction on the local social situation	ordered	1-Negative; 2-Neutral; 3-Positive
local_environmental	estimated effects from speed reduction on the local environmental situation	ordered	1-Negative; 2-Neutral; 3-Positive
quebec_economic	estimated effects from speed reduction on the provincial economic situation	ordered	1-Negative; 2-Neutral; 3-Positive
quebec_social	estimated effects from speed reduction on the provincial social situation	ordered	1-Negative; 2-Neutral; 3-Positive
quebec_environmental	estimated effects from speed reduction on the provincial environmental situation	ordered	1-Negative; 2-Neutral; 3-Positive
interaction_group	group based on nature of interactions with the river's environment	ordered	1-Leisure only; 2-Professional only; 3-Both leisure and professional
sector_group	group based on relation of activity sector to maritime and transport activities	ordered	0-Retired OR Unemployed; 1-Student; 2-Others; 3-Environmental or agriculture; 4-Transport OR Maritime; NA-Prefer not to answer

8.3 APPENDIX C: ORDINAL REGRESSION MODELS

TABLE 8.2: LIST OF REGRESSION MODELS WITH DEPENDENT AND INDEPENDENT VARIABLES

REGRESSION MODEL	DEPENDENT VARIABLE	INDEPENDENT VARIABLES
VESSEL CONCERN		
	cargo	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount+speed_cargo
	yacht	nteraction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount+speed_yacht
	jetski	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount+speed_jetski
	sailboat	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount+speed_sailboat
	ferry	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount+speed_ferry
	cruise	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount+speed_cruise
	smallmotor	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount+speed_smallmotor
	tugboat	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount+speed_tugboat
	rowboat	Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount+speed_rowboat
IMPACT LEVEL		
	coast	Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	biodiversity	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	financial	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	PH	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	MH	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	social	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	safety	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
WAVES IMPACTS		
	vegetation	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	wildlife	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+sector_group+amount
	land	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+amount
	infrastructure	Age+timeliving+distance_group+distance_group_FSA+education+sector_group+amount
	economy	Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	MH	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	PH	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	financial	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	personal	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
SPEEDS IMPACTS		
	vegetation	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	wildlife	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+sector_group+amount
	land	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	infrastructure	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	economy	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+amount
	MH	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	PH	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	financial	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	personal	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount

SPEED REDUCTION EFFECTS (LOCAL)		
	economic	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	social	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	environmental	Age+timeliving+education+income+sector_group+amount
SPEED REDUCTION EFFECTS (QUEBEC)		
	economic	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	social	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
	environmental	interaction_group+Age+timeliving+distance_group+distance_group_FSA+education+income+sector_group+amount
VESSEL CONCERN	*Other vessel concern*	
	cargo	vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	yacht	vesselconcern_cargo+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	jetski	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	sailboat	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	ferry	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	cruise	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	smallmotor	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_tugboat+vesselconcern_rowboat
	tugboat	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_rowboat
	rowboat	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat
SPEEDS IMPACTS	*Estimated speeds*	
	vegetation	speed_cargo+speed_yacht+speed_jetski+speed_sailboat+speed_ferry+speed_cruise+speed_smallmotor+speed_tugboat+speed_rowboat
	wildlife	speed_cargo+speed_yacht+speed_jetski+speed_sailboat+speed_ferry+speed_cruise+speed_smallmotor+speed_tugboat+speed_rowboat
	land	speed_cargo+speed_yacht+speed_jetski+speed_sailboat+speed_ferry+speed_cruise+speed_smallmotor+speed_tugboat+speed_rowboat
	infrastructure	speed_cargo+speed_yacht+speed_jetski+speed_sailboat+speed_ferry+speed_cruise+speed_smallmotor+speed_tugboat+speed_rowboat
	economy	speed_cargo+speed_yacht+speed_jetski+speed_sailboat+speed_ferry+speed_cruise+speed_smallmotor+speed_tugboat+speed_rowboat
	MH	speed_cargo+speed_yacht+speed_jetski+speed_sailboat+speed_ferry+speed_cruise+speed_smallmotor+speed_tugboat+speed_rowboat
	PH	speed_cargo+speed_yacht+speed_jetski+speed_sailboat+speed_ferry+speed_cruise+speed_smallmotor+speed_tugboat+speed_rowboat
	financial	speed_cargo+speed_yacht+speed_jetski+speed_sailboat+speed_ferry+speed_cruise+speed_smallmotor+speed_tugboat+speed_rowboat
	personal	speed_cargo+speed_yacht+speed_jetski+speed_sailboat+speed_ferry+speed_cruise+speed_smallmotor+speed_tugboat+speed_rowboat
IMPACT LEVEL	*Other impact levels*	
	coast	impactlevel_biodiversity+impactlevel_financial+impactlevel_PH+impactlevel_MH+impactlevel_social+impactlevel_safety
	biodiversity	impactlevel_coast+impactlevel_financial+impactlevel_PH+impactlevel_MH+impactlevel_social+impactlevel_safety
	financial	impactlevel_coast+impactlevel_biodiversity+impactlevel_PH+impactlevel_MH+impactlevel_social+impactlevel_safety
	PH	impactlevel_coast+impactlevel_biodiversity+impactlevel_financial+impactlevel_MH+impactlevel_social+impactlevel_safety
	MH	impactlevel_coast+impactlevel_biodiversity+impactlevel_financial+impactlevel_PH+impactlevel_social+impactlevel_safety
	social	impactlevel_coast+impactlevel_biodiversity+impactlevel_financial+impactlevel_PH+impactlevel_MH+impactlevel_safety
	safety	impactlevel_coast+impactlevel_biodiversity+impactlevel_financial+impactlevel_PH+impactlevel_MH+impactlevel_social
SPEEDS IMPACTS	*Vessel concerns*	

	vegetation	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	wildlife	vesselconcern_cargo+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	land	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	infrastructure	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	economy	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	MH	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	PH	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	financial	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
	personal	vesselconcern_cargo+vesselconcern_yacht+vesselconcern_jetski+vesselconcern_sailboat+vesselconcern_ferry+vesselconcern_cruise+vesselconcern_smallmotor+vesselconcern_tugboat+vesselconcern_rowboat
VESSEL CONCERN	*Speeds impacts*	
	cargo	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
	yacht	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
	jetski	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
	sailboat	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
	ferry	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
	cruise	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
	smallmotor	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
	tugboat	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
	rowboat	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
SPEED REDUCTION EFFECTS (LOCAL)	*Speeds impacts*	
	economic	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
	social	speeds_vegetation+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
	environmental	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
SPEED REDUCTION EFFECTS (QUEBEC)		
	economic	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
	social	speeds_vegetation+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal
	environmental	speeds_vegetation+speeds_wildlife+speeds_land+speeds_infrastructure+speeds_economy+speeds_MH+speeds_PH+speeds_financial+speeds_personal

8.4 APPENDIX D: QUALITATIVE SECTIONS

TABLE 8.3: LIST OF QUALITATIVE OPEN-ENDED SECTIONS IN THE SURVEY USED FOR THE QUALITATIVE ANALYSIS

NAME	QUESTION	DESCRIPTION	PLACEMENT
PLACEMEANING	What does this place represent for you?	Reason for place of familiarity selection.	after Q3

COMMENTSECTION1	Please explain your concerns for the specified place above. If you have no place of concern, please write "No concern place" below.	Specification of concern regarding place of concern selection.	after Q6
CONCERNS_SQ001COMMENT	*Boat speeds*	[if selected] Explain why this is a concern.	in Q7
CONCERNS_SQ002COMMENT	*Boat waves*	[if selected] Explain why this is a concern.	in Q7
CONCERNS_SQ003COMMENT	*Boat trajectories*	[if selected] Explain why this is a concern.	in Q7
CONCERNS_SQ004COMMENT	*Number of boats in the identified region*	[if selected] Explain why this is a concern.	in Q7
CONCERNS_SQ005COMMENT	*Number of boats in other regions*	[if selected] Explain why this is a concern.	in Q7
CONCERNS_SQ006COMMENT	*Pollution caused by boats*	[if selected] Explain why this is a concern.	in Q7
CONCERNS_SQ007COMMENT	*Boat noise*	[if selected] Explain why this is a concern.	in Q7
CONCERNS_SQ008COMMENT	*Boat disruption of biodiversity (ex. importing of alien species, effects on environmental conditions,..)*	[if selected] Explain why this is a concern.	in Q7
CONCERNS_SQ009COMMENT	*Boat safety (ex. Accidents)*	[if selected] Explain why this is a concern.	in Q7
CONCERNS_SQ010COMMENT	*Boat anchoring/docking*	[if selected] Explain why this is a concern.	in Q7
CONCERNS_OTHER	*Other*	Fill if other concern not listed.	in Q7
CONCERNS_OTHERCOMMENT	*Other*	[if filled] Explain why this is a concern.	in Q7
COMMENTSECTION2	Please enter any comment here.	Comments regarding the level of impact of boat traffic on different elements.	after Q8
EXPLAINCONCERNS	Please enter more details about the specific concerns related to each boat.	Specification of impact regarding level of impact from different boats.	after Q9
EVOLUTION	Q10. Have you noticed any change in boat traffic in recent years? Please feel free to provide more details.	Mention the evolution of boat traffic activity.	Q10
SECTOR_OTHER	*Other*	[if selected] Mention sector.	in Q23
COMMENTS	Please enter any additional comments. These can be your personal reflections, experiences, or opinions on this issue of waves and boat circulation for the Saint Lawrence River region. These will remain confidential.		end of survey

8.5 APPENDIX E: REGRESSION RESULTS

TABLE 8.4: FULL PROPORTIONAL ODDS LOGISTIC REGRESSION RESULTS WITH VESSEL CONCERN AS THE DEPENDENT VARIABLE

INDEPENDENT VARIABLE	DEPENDENT VARIABLE	P-VALUE	COEFFICIENT
INTERACTION LEVEL	Cargo concern	0.366	1.37
AGE	Cargo concern	0.186	1.43
TIME LIVED AT CURRENT LOCATION	Cargo concern	0.442	0.88
DISTANCE FAMILIARITY TO CONCERN	Cargo concern	0.023**	0.80**

DISTANCE FSA TO CONCERN	Cargo concern	0.106	1.15
EDUCATION LEVEL	Cargo concern	0.174	1.54
INCOME	Cargo concern	0.122	1.4
ACTIVITY SECTOR(S)	Cargo concern	0.992	1
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Cargo concern	0.227	1.28
CARGO SPEED	Cargo concern	0.297	1.31
INTERACTION LEVEL	Yacht concern	0.099*	1.65*
AGE	Yacht concern	0.447	0.83
TIME LIVED AT CURRENT LOCATION	Yacht concern	0.356	1.16
DISTANCE FAMILIARITY TO CONCERN	Yacht concern	0.19	1.1
DISTANCE FSA TO CONCERN	Yacht concern	0.87	0.99
EDUCATION LEVEL	Yacht concern	0.152	1.56
INCOME	Yacht concern	0.734	1.07
ACTIVITY SECTOR(S)	Yacht concern	0.085*	0.63*
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Yacht concern	0.025**	0.65**
YACHT SPEED	Yacht concern	0.896	0.97
INTERACTION LEVEL	Jet Ski concern	0.731	0.9
AGE	Jet Ski concern	0.289	1.27
TIME LIVED AT CURRENT LOCATION	Jet Ski concern	0.148	1.26
DISTANCE FAMILIARITY TO CONCERN	Jet Ski concern	0.722	1.03
DISTANCE FSA TO CONCERN	Jet Ski concern	0.511	1.05
EDUCATION LEVEL	Jet Ski concern	0.891	1.05
INCOME	Jet Ski concern	0.347	0.82
ACTIVITY SECTOR(S)	Jet Ski concern	0.909	0.97
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Jet Ski concern	0.183	0.79
JET SKI SPEED	Jet Ski concern	0.559	1.18
INTERACTION LEVEL	Sailboat concern	0.189	0.59
AGE	Sailboat concern	0.093*	0.57*
TIME LIVED AT CURRENT LOCATION	Sailboat concern	0.191	1.39
DISTANCE FAMILIARITY TO CONCERN	Sailboat concern	0.22	1.15
DISTANCE FSA TO CONCERN	Sailboat concern	0.198	0.87
EDUCATION LEVEL	Sailboat concern	0.243	0.59
INCOME	Sailboat concern	0.089*	0.58*
ACTIVITY SECTOR(S)	Sailboat concern	0.162	1.72
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Sailboat concern	0.36	0.79
SAILBOAT SPEED	Sailboat concern	0.011**	2.36**
INTERACTION LEVEL	Ferry concern	0.344	1.4
AGE	Ferry concern	0.085*	0.56*
TIME LIVED AT CURRENT LOCATION	Ferry concern	0.329	0.84
DISTANCE FAMILIARITY TO CONCERN	Ferry concern	0.088*	1.17*

DISTANCE FSA TO CONCERN	Ferry concern	0.113	0.87
EDUCATION LEVEL	Ferry concern	0.175	0.59
INCOME	Ferry concern	0.708	0.91
ACTIVITY SECTOR(S)	Ferry concern	0.276	0.66
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Ferry concern	0.613	1.12
FERRY SPEED	Ferry concern	0.021**	2.05**
INTERACTION LEVEL	Cruise ship concern	0.732	1.11
AGE	Cruise ship concern	0.667	0.9
TIME LIVED AT CURRENT LOCATION	Cruise ship concern	0.978	1
DISTANCE FAMILIARITY TO CONCERN	Cruise ship concern	0.188	1.09
DISTANCE FSA TO CONCERN	Cruise ship concern	0.201	0.92
EDUCATION LEVEL	Cruise ship concern	0.589	1.18
INCOME	Cruise ship concern	0.482	0.86
ACTIVITY SECTOR(S)	Cruise ship concern	0.676	0.89
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Cruise ship concern	0.883	0.97
CRUISE SHIP SPEED	Cruise ship concern	0.666	1.12
INTERACTION LEVEL	Small motorboat concern	0.447	0.8
AGE	Small motorboat concern	0.336	0.8
TIME LIVED AT CURRENT LOCATION	Small motorboat concern	0.219	1.23
DISTANCE FAMILIARITY TO CONCERN	Small motorboat concern	0.585	0.96
DISTANCE FSA TO CONCERN	Small motorboat concern	0.363	1.06
EDUCATION LEVEL	Small motorboat concern	0.507	1.23
INCOME	Small motorboat concern	0.301	0.81
ACTIVITY SECTOR(S)	Small motorboat concern	0.477	0.83
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Small motorboat concern	0.875	1.03
SMALL MOTORBOAT SPEED	Small motorboat concern	0.086*	1.46*
INTERACTION LEVEL	Tugboat concern	0.533	0.82
AGE	Tugboat concern	0.571	0.85
TIME LIVED AT CURRENT LOCATION	Tugboat concern	0.969	0.99
DISTANCE FAMILIARITY TO CONCERN	Tugboat concern	0.299	1.09
DISTANCE FSA TO CONCERN	Tugboat concern	0.251	0.92
EDUCATION LEVEL	Tugboat concern	0.803	0.92
INCOME	Tugboat concern	0.287	1.29
ACTIVITY SECTOR(S)	Tugboat concern	0.557	0.83
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Tugboat concern	0.258	0.79
TUGBOAT SPEED	Tugboat concern	0.004	2.19
AGE	Rowboat concern	0.999	1
TIME LIVED AT CURRENT LOCATION	Rowboat concern	0.955	0.99
DISTANCE FAMILIARITY TO CONCERN	Rowboat concern	0.156	0.89
DISTANCE FSA TO CONCERN	Rowboat concern	0.34	1.07

EDUCATION LEVEL	Rowboat concern	0.523	0.77
INCOME	Rowboat concern	0.070*	0.64*
ACTIVITY SECTOR(S)	Rowboat concern	0.164	1.55
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Rowboat concern	0.826	0.96
ROWBOAT SPEED	Rowboat concern	0.077*	1.54*

TABLE 8.5: FULL PROPORTIONAL ODDS LOGISTIC REGRESSION RESULTS WITH PERCEIVED LEVEL OF IMPACT FROM MARITIME TRAFFIC AS THE DEPENDENT VARIABLE

INDEPENDENT VARIABLE	DEPENDENT VARIABLE	P-VALUE	COEFFICIENT
AGE	Perceived impacts on the Coast	0.29	1.3
TIME LIVED AT CURRENT LOCATION	Perceived impacts on the Coast	0.089*	1.32*
DISTANCE FAMILIARITY TO CONCERN	Perceived impacts on the Coast	0.594	0.96
DISTANCE FSA TO CONCERN	Perceived impacts on the Coast	0.374	0.94
EDUCATION LEVEL	Perceived impacts on the Coast	0.96	1.02
INCOME	Perceived impacts on the Coast	0.805	0.94
ACTIVITY SECTOR(S)	Perceived impacts on the Coast	0.788	1.09
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Perceived impacts on the Coast	0.147	1.31
INTERACTION LEVEL	Perceived impacts on the Biodiversity	0.193	1.5
AGE	Perceived impacts on the Biodiversity	0.761	0.93
TIME LIVED AT CURRENT LOCATION	Perceived impacts on the Biodiversity	0.422	1.14
DISTANCE FAMILIARITY TO CONCERN	Perceived impacts on the Biodiversity	0.295	1.09
DISTANCE FSA TO CONCERN	Perceived impacts on the Biodiversity	0.72	1.02
EDUCATION LEVEL	Perceived impacts on the Biodiversity	0.198	0.62
INCOME	Perceived impacts on the Biodiversity	0.389	1.2
ACTIVITY SECTOR(S)	Perceived impacts on the Biodiversity	0.454	0.82
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Perceived impacts on the Biodiversity	0.213	1.25
INTERACTION LEVEL	Perceived Financial impacts	0.556	0.82
AGE	Perceived Financial impacts	0.63	1.13
TIME LIVED AT CURRENT LOCATION	Perceived Financial impacts	0.833	1.04
DISTANCE FAMILIARITY TO CONCERN	Perceived Financial impacts	0.008***	0.78***
DISTANCE FSA TO CONCERN	Perceived Financial impacts	0.086*	1.15*
EDUCATION LEVEL	Perceived Financial impacts	0.448	0.72
INCOME	Perceived Financial impacts	0.662	1.11
ACTIVITY SECTOR(S)	Perceived Financial impacts	0.496	0.82
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Perceived Financial impacts	0.101	1.35
INTERACTION LEVEL	Perceived impacts on Physical Health	0.148	1.64
AGE	Perceived impacts on Physical Health	0.167	1.44
TIME LIVED AT CURRENT LOCATION	Perceived impacts on Physical Health	0.248	1.22
DISTANCE FAMILIARITY TO CONCERN	Perceived impacts on Physical Health	0.187	1.11
DISTANCE FSA TO CONCERN	Perceived impacts on Physical Health	0.806	0.98

EDUCATION LEVEL	Perceived impacts on Physical Health	0.958	0.98
INCOME	Perceived impacts on Physical Health	0.188	0.74
ACTIVITY SECTOR(S)	Perceived impacts on Physical Health	0.608	1.16
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Perceived impacts on Physical Health	0.856	0.97
INTERACTION LEVEL	Perceived impacts on Mental Health	0.104	1.69
AGE	Perceived impacts on Mental Health	0.319	0.78
TIME LIVED AT CURRENT LOCATION	Perceived impacts on Mental Health	0.252	1.21
DISTANCE FAMILIARITY TO CONCERN	Perceived impacts on Mental Health	0.526	1.05
DISTANCE FSA TO CONCERN	Perceived impacts on Mental Health	0.35	0.94
EDUCATION LEVEL	Perceived impacts on Mental Health	0.9	0.96
INCOME	Perceived impacts on Mental Health	0.831	0.95
ACTIVITY SECTOR(S)	Perceived impacts on Mental Health	0.199	0.7
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Perceived impacts on Mental Health	0.874	1.03
INTERACTION LEVEL	Perceived Social impacts	0.179	1.6
AGE	Perceived Social impacts	0.583	0.87
TIME LIVED AT CURRENT LOCATION	Perceived Social impacts	0.235	1.23
DISTANCE FAMILIARITY TO CONCERN	Perceived Social impacts	0.499	1.05
DISTANCE FSA TO CONCERN	Perceived Social impacts	0.644	0.97
EDUCATION LEVEL	Perceived Social impacts	0.396	0.71
INCOME	Perceived Social impacts	0.717	0.92
ACTIVITY SECTOR(S)	Perceived Social impacts	0.254	0.73
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Perceived Social impacts	0.284	1.22
INTERACTION LEVEL	Perceived impacts on Safety	0.336	1.34
AGE	Perceived impacts on Safety	0.816	0.94
TIME LIVED AT CURRENT LOCATION	Perceived impacts on Safety	0.079*	1.34*
DISTANCE FAMILIARITY TO CONCERN	Perceived impacts on Safety	0.39	1.07
DISTANCE FSA TO CONCERN	Perceived impacts on Safety	0.98	1
EDUCATION LEVEL	Perceived impacts on Safety	0.289	1.44
INCOME	Perceived impacts on Safety	0.126	0.71
ACTIVITY SECTOR(S)	Perceived impacts on Safety	0.18	1.44
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Perceived impacts on Safety	0.64	1.09

TABLE 8.6: FULL PROPORTIONAL ODDS LOGISTIC REGRESSION RESULTS WITH THE DEGREE OF AGREEMENT WITH WAVES IMPACTS AS THE DEPENDENT VARIABLE

INDEPENDENT VARIABLE	DEPENDENT VARIABLE	P-VALUE	COEFFICIENT
INTERACTION LEVEL	Impacts of Waves on Vegetation	0.127	1.7
AGE	Impacts of Waves on Vegetation	0.159	0.71
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Vegetation	0.957	0.99
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on Vegetation	0.101	0.84
DISTANCE FSA TO CONCERN	Impacts of Waves on Vegetation	0.321	1.1

EDUCATION LEVEL	Impacts of Waves on Vegetation	0.521	0.78
INCOME	Impacts of Waves on Vegetation	0.881	1.04
ACTIVITY SECTOR(S)	Impacts of Waves on Vegetation	0.242	0.71
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Vegetation	0.063*	1.41*
INTERACTION LEVEL	Impacts of Waves on Wildlife	0.135	1.59
AGE	Impacts of Waves on Wildlife	0.633	0.91
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Wildlife	0.624	0.92
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on Wildlife	0.13	0.88
DISTANCE FSA TO CONCERN	Impacts of Waves on Wildlife	0.223	1.1
EDUCATION LEVEL	Impacts of Waves on Wildlife	0.469	0.8
ACTIVITY SECTOR(S)	Impacts of Waves on Wildlife	0.668	0.91
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Wildlife	0.479	1.13
INTERACTION LEVEL	Impacts of Waves on Land	0.999	1
AGE	Impacts of Waves on Land	0.261	1.28
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Land	0.797	1.05
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on Land	0.155	0.86
DISTANCE FSA TO CONCERN	Impacts of Waves on Land	0.85	1.02
EDUCATION LEVEL	Impacts of Waves on Land	0.611	1.24
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Land	0.005****	1.86****
AGE	Impacts of Waves on Infrastructure	0.547	0.9
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Infrastructure	0.009***	1.45***
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on Infrastructure	0.809	1.02
DISTANCE FSA TO CONCERN	Impacts of Waves on Infrastructure	0.89	1.01
EDUCATION LEVEL	Impacts of Waves on Infrastructure	0.395	0.75
ACTIVITY SECTOR(S)	Impacts of Waves on Infrastructure	0.376	0.83
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Infrastructure	0.403	1.13
AGE	Impacts of Waves on the Economy	0.323	1.23
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on the Economy	0.037**	1.41**
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on the Economy	0.568	1.04
DISTANCE FSA TO CONCERN	Impacts of Waves on the Economy	0.971	1
EDUCATION LEVEL	Impacts of Waves on the Economy	0.462	1.31
INCOME	Impacts of Waves on the Economy	0.006***	0.54***
ACTIVITY SECTOR(S)	Impacts of Waves on the Economy	0.124	1.45
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on the Economy	0.175	1.25
INTERACTION LEVEL	Impacts of Waves on Mental Health	0.824	0.93
AGE	Impacts of Waves on Mental Health	0.781	1.06
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Mental Health	0.804	1.04
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on Mental Health	0.236	0.92
DISTANCE FSA TO CONCERN	Impacts of Waves on Mental Health	0.98	1

EDUCATION LEVEL	Impacts of Waves on Mental Health	0.336	0.75
INCOME	Impacts of Waves on Mental Health	0.139	0.75
ACTIVITY SECTOR(S)	Impacts of Waves on Mental Health	0.406	0.82
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Mental Health	0.155	1.27
INTERACTION LEVEL	Impacts of Waves on Physical Health	0.966	0.99
AGE	Impacts of Waves on Physical Health	0.348	1.24
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Physical Health	0.545	0.91
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on Physical Health	0.345	0.94
DISTANCE FSA TO CONCERN	Impacts of Waves on Physical Health	0.574	1.04
EDUCATION LEVEL	Impacts of Waves on Physical Health	0.528	0.82
INCOME	Impacts of Waves on Physical Health	0.295	0.79
ACTIVITY SECTOR(S)	Impacts of Waves on Physical Health	0.402	0.81
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Physical Health	0.074*	1.38*
INTERACTION LEVEL	Impacts of Waves on personal Finances	0.734	0.9
AGE	Impacts of Waves on personal Finances	0.894	0.97
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on personal Finances	0.85	0.97
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on personal Finances	0.232	0.92
DISTANCE FSA TO CONCERN	Impacts of Waves on personal Finances	0.799	0.98
EDUCATION LEVEL	Impacts of Waves on personal Finances	0.131	0.61
INCOME	Impacts of Waves on personal Finances	0.958	1.01
ACTIVITY SECTOR(S)	Impacts of Waves on personal Finances	0.187	0.73
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on personal Finances	0.052*	1.40*
INTERACTION LEVEL	Impacts of Waves of the Personal Environment	0.593	0.85
AGE	Impacts of Waves of the Personal Environment	0.589	0.89
TIME LIVED AT CURRENT LOCATION	Impacts of Waves of the Personal Environment	0.715	1.06
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves of the Personal Environment	0.736	0.98
DISTANCE FSA TO CONCERN	Impacts of Waves of the Personal Environment	0.189	0.92
EDUCATION LEVEL	Impacts of Waves of the Personal Environment	0.176	0.65
INCOME	Impacts of Waves of the Personal Environment	0.81	0.95
ACTIVITY SECTOR(S)	Impacts of Waves of the Personal Environment	0.257	0.75
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves of the Personal Environment	0.256	1.21

TABLE 8.7: FULL PROPORTIONAL ODDS LOGISTIC REGRESSION RESULTS WITH THE DEGREE OF AGREEMENT WITH SPEEDS IMPACTS AS THE DEPENDENT VARIABLE

INDEPENDENT VARIABLE	DEPENDENT VARIABLE	P-VALUE	COEFFICIENT
INTERACTION LEVEL	Impacts of Waves on Vegetation	0.388	1.32
AGE	Impacts of Waves on Vegetation	0.453	0.83
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Vegetation	0.477	1.14
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on Vegetation	0.077*	0.82*
DISTANCE FSA TO CONCERN	Impacts of Waves on Vegetation	0.248	1.12

EDUCATION LEVEL	Impacts of Waves on Vegetation	0.132	1.75
INCOME	Impacts of Waves on Vegetation	0.073*	0.63*
ACTIVITY SECTOR(S)	Impacts of Waves on Vegetation	0.134	0.64
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Vegetation	0.084*	1.39*
INTERACTION LEVEL	Impacts of Waves on Wildlife	0.236	1.47
AGE	Impacts of Waves on Wildlife	0.358	0.82
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Wildlife	0.893	1.02
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on Wildlife	0.033**	0.80**
DISTANCE FSA TO CONCERN	Impacts of Waves on Wildlife	0.007***	1.29***
EDUCATION LEVEL	Impacts of Waves on Wildlife	0.362	0.73
ACTIVITY SECTOR(S)	Impacts of Waves on Wildlife	0.028**	0.61**
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Wildlife	0.037**	1.46**
INTERACTION LEVEL	Impacts of Waves on Land	0.75	1.11
AGE	Impacts of Waves on Land	0.671	1.11
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Land	0.744	1.06
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on Land	0.034**	0.79**
DISTANCE FSA TO CONCERN	Impacts of Waves on Land	0.109	1.17
EDUCATION LEVEL	Impacts of Waves on Land	0.225	1.62
INCOME	Impacts of Waves on Land	0.387	0.8
ACTIVITY SECTOR(S)	Impacts of Waves on Land	0.148	0.63
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Land	0.016**	1.60**
INTERACTION LEVEL	Impacts of Waves on Infrastructure	0.771	0.92
AGE	Impacts of Waves on Infrastructure	0.624	0.9
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Infrastructure	0.145	1.29
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on Infrastructure	0.261	0.92
DISTANCE FSA TO CONCERN	Impacts of Waves on Infrastructure	0.299	1.07
EDUCATION LEVEL	Impacts of Waves on Infrastructure	0.995	1
INCOME	Impacts of Waves on Infrastructure	0.288	0.8
ACTIVITY SECTOR(S)	Impacts of Waves on Infrastructure	0.908	1.03
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Infrastructure	0.172	1.26
INTERACTION LEVEL	Impacts of Waves on the Economy	0.67	0.89
AGE	Impacts of Waves on the Economy	0.334	0.83
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on the Economy	0.297	1.19
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on the Economy	0.674	1.03
DISTANCE FSA TO CONCERN	Impacts of Waves on the Economy	0.63	0.96
EDUCATION LEVEL	Impacts of Waves on the Economy	0.525	0.79
INCOME	Impacts of Waves on the Economy	0.405	0.85
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on the Economy	0.152	1.28
INTERACTION LEVEL	Impacts of Waves on Mental Health	0.723	1.11

AGE	Impacts of Waves on Mental Health	0.456	0.86
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Mental Health	0.298	1.17
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on Mental Health	0.922	0.99
DISTANCE FSA TO CONCERN	Impacts of Waves on Mental Health	0.714	0.98
EDUCATION LEVEL	Impacts of Waves on Mental Health	0.871	0.95
INCOME	Impacts of Waves on Mental Health	0.554	0.89
ACTIVITY SECTOR(S)	Impacts of Waves on Mental Health	0.074*	0.64*
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Mental Health	0.489	1.12
INTERACTION LEVEL	Impacts of Waves on Physical Health	0.631	1.17
AGE	Impacts of Waves on Physical Health	0.756	0.94
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on Physical Health	0.88	0.98
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on Physical Health	0.43	0.94
DISTANCE FSA TO CONCERN	Impacts of Waves on Physical Health	0.771	1.02
EDUCATION LEVEL	Impacts of Waves on Physical Health	0.663	1.15
INCOME	Impacts of Waves on Physical Health	0.493	0.87
ACTIVITY SECTOR(S)	Impacts of Waves on Physical Health	0.041**	0.59**
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on Physical Health	0.603	1.1
INTERACTION LEVEL	Impacts of Waves on personal Finances	0.837	1.07
AGE	Impacts of Waves on personal Finances	0.84	0.96
TIME LIVED AT CURRENT LOCATION	Impacts of Waves on personal Finances	0.678	0.94
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves on personal Finances	0.151	0.9
DISTANCE FSA TO CONCERN	Impacts of Waves on personal Finances	0.61	0.97
EDUCATION LEVEL	Impacts of Waves on personal Finances	0.268	0.7
INCOME	Impacts of Waves on personal Finances	0.769	1.06
ACTIVITY SECTOR(S)	Impacts of Waves on personal Finances	0.101	0.66
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves on personal Finances	0.158	1.27
INTERACTION LEVEL	Impacts of Waves of the Personal Environment	0.716	0.9
AGE	Impacts of Waves of the Personal Environment	0.462	0.85
TIME LIVED AT CURRENT LOCATION	Impacts of Waves of the Personal Environment	0.598	1.09
DISTANCE FAMILIARITY TO CONCERN	Impacts of Waves of the Personal Environment	0.633	0.97
DISTANCE FSA TO CONCERN	Impacts of Waves of the Personal Environment	0.162	0.91
EDUCATION LEVEL	Impacts of Waves of the Personal Environment	0.768	0.91
INCOME	Impacts of Waves of the Personal Environment	0.814	0.96
ACTIVITY SECTOR(S)	Impacts of Waves of the Personal Environment	0.165	0.71
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Impacts of Waves of the Personal Environment	0.589	1.09

TABLE 8.8: FULL PROPORTIONAL ODDS LOGISTIC REGRESSION RESULTS WITH THE EXPECTED EFFECTS FROM SPEED REDUCTION ON THE THREE PILLARS OF SUSTAINABILITY AT LOCAL AND QUEBEC SCALES AS THE DEPENDENT VARIABLE (SCALE-PILLAR)

INDEPENDENT VARIABLE	DEPENDENT VARIABLE	P-VALUE	COEFFICIENT

INTERACTION LEVEL	Local-Economy	0.866	1.06
AGE	Local-Economy	0.817	0.95
TIME LIVED AT CURRENT LOCATION	Local-Economy	0.105	0.74
DISTANCE FAMILIARITY TO CONCERN	Local-Economy	0.126	0.88
DISTANCE FSA TO CONCERN	Local-Economy	0.455	1.06
EDUCATION LEVEL	Local-Economy	0.432	0.76
INCOME	Local-Economy	0.399	0.83
ACTIVITY SECTOR(S)	Local-Economy	0.809	0.93
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Local-Economy	0.633	0.91
INTERACTION LEVEL	Local-Social	0.139	1.66
AGE	Local-Social	0.035**	0.56**
TIME LIVED AT CURRENT LOCATION	Local-Social	0.694	1.08
DISTANCE FAMILIARITY TO CONCERN	Local-Social	0.769	0.98
DISTANCE FSA TO CONCERN	Local-Social	0.797	0.98
EDUCATION LEVEL	Local-Social	0.54	0.81
INCOME	Local-Social	0.763	1.08
ACTIVITY SECTOR(S)	Local-Social	0.137	0.63
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Local-Social	0.071*	0.68*
AGE	Local-Environmental	0.829	1.05
TIME LIVED AT CURRENT LOCATION	Local-Environmental	0.394	1.15
DISTANCE FAMILIARITY TO CONCERN	Local-Environmental	0.404	1.34
INCOME	Local-Environmental	0.613	0.88
ACTIVITY SECTOR(S)	Local-Environmental	0.749	1.09
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Local-Environmental	0.107	0.73
INTERACTION LEVEL	Quebec-Economy	0.21	1.47
AGE	Quebec-Economy	0.065*	0.65*
TIME LIVED AT CURRENT LOCATION	Quebec-Economy	0.978	0.99
DISTANCE FAMILIARITY TO CONCERN	Quebec-Economy	0.343	0.92
DISTANCE FSA TO CONCERN	Quebec-Economy	0.64	1.04
EDUCATION LEVEL	Quebec-Economy	0.516	0.82
INCOME	Quebec-Economy	0.044**	0.65**
ACTIVITY SECTOR(S)	Quebec-Economy	0.498	0.83
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Quebec-Economy	0.6	1.1
INTERACTION LEVEL	Quebec-Social	0.095*	1.79*
AGE	Quebec-Social	0.078*	0.62*
TIME LIVED AT CURRENT LOCATION	Quebec-Social	0.784	1.05
DISTANCE FAMILIARITY TO CONCERN	Quebec-Social	0.936	1.01
DISTANCE FSA TO CONCERN	Quebec-Social	0.987	1
EDUCATION LEVEL	Quebec-Social	0.221	0.61
INCOME	Quebec-Social	0.584	1.14

ACTIVITY SECTOR(S)	Quebec-Social	0.042**	0.53**
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Quebec-Social	0.124	0.72
INTERACTION LEVEL	Quebec-Environmental	0.972	0.97
AGE	Quebec-Environmental	0.425	0.62
TIME LIVED AT CURRENT LOCATION	Quebec-Environmental	0.792	1.14
DISTANCE FAMILIARITY TO CONCERN	Quebec-Environmental	0.726	0.9
DISTANCE FSA TO CONCERN	Quebec-Environmental	0.416	1.34
EDUCATION LEVEL	Quebec-Environmental	0.325	1.63
INCOME	Quebec-Environmental	0.635	0.77
ACTIVITY SECTOR(S)	Quebec-Environmental	0.666	0.8
ESTIMATED NUMBER OF DAILY CARGO SHIPS	Quebec-Environmental	0.62	1.23