Developing an Ocean Literacy Framework: Lesson from an Analysis of Ocean Week Canada

By

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ABSTRACT

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The UN Decade of Ocean Science and the Canadian Ocean Literacy Strategy (the 'Strategy') have led to increased recognition of the need for ocean education at all levels to increase ocean literacy. According to the Strategy, ocean literacy in Canada is multi-dimensional and includes ocean knowledge, values, and actions. This research project focuses on developing a multidimensional Framework using a multidisciplinary literature review and discussions with subject experts to better understand and evaluate ocean literacy. It applies the Framework through online anonymous surveys with Ocean Week Canada participants. The results indicate that this annual ocean celebration is crucial to fostering ocean connections. However, the event currently draws a non-random audience who are mostly young highly educated females and are already engaged with the ocean. Results demonstrate that other than measuring the ocean literacy levels of the respondents, the Framework and surveys can provide feedback to identify deficiencies and enhance ocean literacy initiatives. The author recommends that ocean literacy researchers and educators use the results as a tool to systematically evaluate ocean literacy initiatives while considering the interconnectedness between ocean knowledge, values, and actions. Ocean literacy initiatives should use an adaptive, collaborative, and integrated approach to ocean education to ensure that they are accessible, diverse, equitable, and inclusive.

Keywords: ocean literacy, framework, evaluation, case study, Ocean Week, UN Ocean Decade, survey

LIST OF ABBREVIATIONS

COLC – Canadian Ocean Literacy Coalition

COVID-19 – Coronavirus Disease 2019

ICZM – Integrated Coastal Zone Management

IOC – Intergovernmental Oceanographic Commission

KPI – Key Performance Indicator

MAPERSC – Marine Affairs Program Ethics Review Standing Committee

MSP – Marine Spatial Planning

OWC – Ocean Week Canada

SWOT – Strengths, Weaknesses, Opportunities, and Threats

UN – United Nations

UNEP – United Nations Environment Programme

UNESCO – United Nations Educational, Scientific and Cultural Organization

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CHAPTER 1: INTRODUCTION

1.1 Ocean Literacy

The ocean is vital to life on the blue planet. Other than covering 71% of the planet, the ocean contains diverse ecosystems that support rich biodiversity (Fauville et al., 2019; Claudet et al., 2020). The ocean regulates weather and climate, supports nutrients cycle and photosynthesis, and provides humans various cultural, social, economic, and environmental benefits (Weinstein et al., 2007; Fauville et al., 2019; Claudet et al., 2020; UNESCO-IOC, 2021). However, the development of anthropogenic marine activities has caused severe changes to the marine environment. Overfishing, marine debris, ocean acidification, deep-sea mining, ocean noise, habitat loss, and climate change are a few examples of human impact on the ocean which threatens marine biodiversity and ocean health (Fauville et al., 2019; Ryabinin et al., 2019; Claudet et al., 2020; UNESCO-IOC, 2021). As the ocean is indispensable to human lives, ocean conservation and protection require civil society, industries, communities, and governments to become ocean literate to make meaningful decisions to collectively tackle these global ocean issues (Fauville et al., 2019; Ryabinin et al., 2019; Claudet et al., 2020).

Ocean literacy is defined as "an understanding of the ocean's influence on you and your influence on the ocean" (Cava et al., 2005, p.5). To elaborate the interdependencies of these influences on one another, Fauville et al. (2019) have defined an ocean literate person as someone who has ocean knowledge, is able to communicate it in a meaningful way, and make informed decisions regarding ocean sustainability. As ocean knowledge is considered to be the foundation of ocean literacy, in 2004, a two-week extensive workshop between ocean science and education stakeholders in the United States resulted in seven essential principles of ocean literacy (Cava et al., 2005; Table 1.1). These principles have become the 'ocean literacy framework' of subsequent ocean literacy initiatives (Cava et al., 2005). However, the seven principles were built upon science literacy of the ocean and what American educators expect students to have mastered by the end of the American Grade 12 curriculum (Schoedinger et al., 2010; Fauville et al., 2019). Subsequently, ocean literacy efforts and research to date that use the principles as a guiding blueprint have predominantly focused on ocean science (Schoedinger et al., 2005; Fauville et al., 2019; Kopke et al., 2019). Furthermore, as curricula vary greatly around

the world, it is unclear whether different countries can incorporate the principles into their local curricula. Finally, the one-dimensional focus of the principles on ocean science could only serve to partially meet the definition of an ocean literate person as outlined by Fauville et al. (2019). As ocean knowledge alone would rarely promote behavioural changes (McCrossan & Molloy, 2019; Stoll-Kleemann, 2019; McKinley & Burdon, 2020), ocean literacy needs to be studied beyond measuring ocean science knowledge.

Table 1.1 The seven essential principles of ocean literacy (adapted from Cava et al., 2005)

1	The Earth has one big ocean with many features.
2	The ocean and life in the ocean shape the features of the Earth.
3	The ocean is a major influence on weather and climate.
4	The ocean makes the Earth habitable.
5	The ocean supports a great diversity of life and ecosystems.
6	The ocean and humans are inextricably interconnected.
7	The ocean is largely unexplored.

In recent years, several initiatives and research projects have begun to describe the multi-dimensional nature of ocean literacy. The ResponSEAble project and Brennan et al. (2019) have defined ocean literacy as having six dimensions: awareness, knowledge, attitude, communication, behaviour, and activism. Each of these dimensions is measured independently and individuals can score differently on each of these dimensions. While the recognition of the multidimensional nature of ocean literacy can be considered as a great advancement in ocean literacy efforts and research, a literature review conducted by McKinley & Burdon (2020) found that majority of ocean literacy surveys focused on attitude, knowledge, and awareness, with limited studies on communication, behaviour, and activism. Further, this review found very few studies addressed all six dimensions of ocean literacy (McKinley & Burdon, 2020). It has been pointed out that additional social science dimensions are indispensable to the understanding of ocean literacy (McKinley & Burdon, 2020). As such, a holistic and multi-dimensional ocean literacy approach is needed to explore these additional dimensions of ocean literacy, guide future ocean literacy efforts, and assess their success in raising ocean literacy levels. The development and application of a novel multidimension ocean literacy framework is the main focus of this research project.

1.2 Canadian Ocean Literacy Strategy

In March 2021, the Canadian Ocean Literacy Coalition (COLC) launched the Canadian Ocean Literacy Strategy (hereafter: 'the Strategy'). It is the first national ocean literacy strategy in the world and aims to address the multi-dimensional nature of ocean literacy in Canada (COLC, 2021a). Unlike the work in Europe and the United States as illustrated above, the Strategy identified ocean literacy as three-dimensional: knowledge, values, and actions. While Canada is considered an ocean nation with the longest coastline in the world, the Strategy recognizes many Canadians may not associate themselves directly with the ocean (COLC, 2021a). Therefore, the Strategy highlights the ocean continuum and the interconnectedness of "land, freshwater, coastal areas, sea ice, and the open ocean" (COLC, 2021a, p. 6). As such, the definition of ocean literacy as outlined by the Strategy encompasses water and climate literacy (COLC, 2021a). Finally, beyond the ocean literacy principles, the Strategy also recognizes the important Indigenous dimensions of stories, relationships, cultural communication, arts, social science, and other avenues of education in raising ocean literacy (COLC, 2021a). Due to the inclusion of these new and holistic concepts in defining ocean literacy, the Strategy is considered a cutting-edge blueprint for raising ocean literacy in Canada.

Based on the input from thousands of Canadians and hundreds of organizations, the Strategy identified ten ocean literacy priorities in Canada, which will be achieved by nine action streams (COLC, 2021a,b; Figure 1.1). The Strategy seeks to raise ocean literacy in Canada through a multitude of collaborations and initiatives to improve ocean knowledge, establish ocean values, and encourage ocean actions.

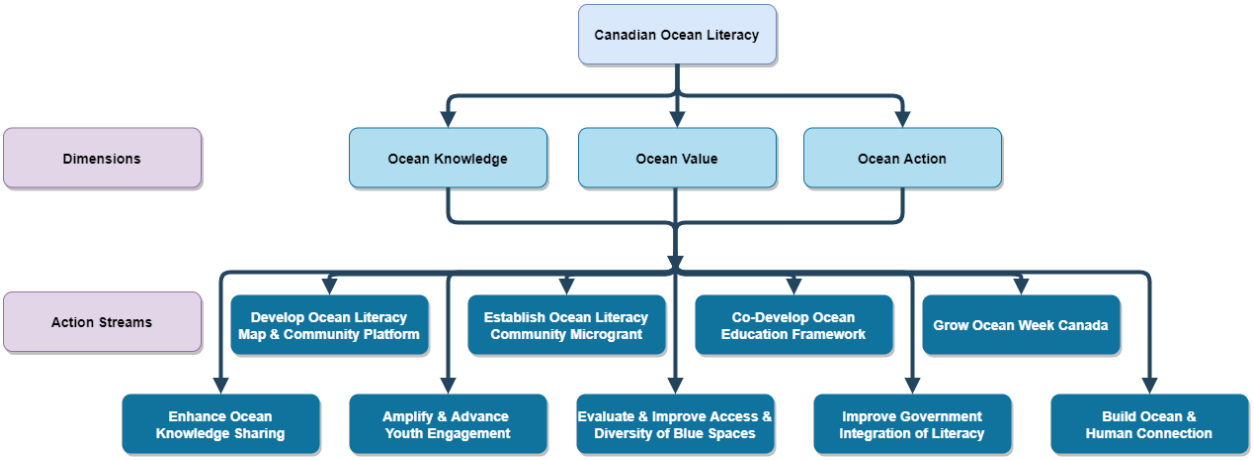

Figure 1.1: Ocean literacy dimensions and action streams of the Canadian Ocean Literacy Strategy, adapted from COLC (2021a,b).

1.3 Management Problem and Research Questions

As the Strategy outlined multiple ways to raise ocean literacy in Canada, each of these efforts would require an evaluation framework to track its effectiveness in raising ocean literacy. The Strategy has identified Key Performance Indicators (KPIs) to measure the progress of each stream, but there has yet to be an evaluation framework to track the progress of each of these KPIs in raising ocean literacy (Diz Glithero, personal communication, February 8, 2021). As such, the development of an ocean literacy evaluation framework is a critical missing piece to guide the implementation of the Strategy. A multi-dimensional evaluation framework can illustrate the effectiveness of different ocean literacy initiatives while demonstrating ways to engage with the public to enhance ocean literacy. This research project seeks to address the research question: “what is a multi-dimensional framework that can be used to guide the development and evaluation of different initiatives in raising ocean literacy?”

This research developed a framework to guide the implementation of the Strategy by being applicable in evaluating the effectiveness of different ocean literacy initiatives. This project defines ocean literacy initiatives as any efforts in raising ocean-related awareness, exchanging ocean knowledge, connecting with the ocean or with other individuals or communities, and performing any actions towards ocean sustainability and conservation.

The United Nations Decade of Ocean Science for Sustainable Development (2021-2030) (hereafter: the 'Ocean Decade') identifies ocean literacy as one of the key pillars of the decade (Intergovernmental Oceanographic Commission, 2018; Ryabinin et al., 2019; Claudet et al., 2020; Worm et al., 2021). Having an ocean literacy evaluation framework will not only aid educators, governments, and organizations understand where and what kind of targeted education is needed, a more ocean literate and engaged society can also foster meaningful collaborations needed for sustainable ocean governance (Santoro et al., 2017).

1.4 Research Paper Overview

Chapter 1 (present chapter) outlines the history and definition of ocean literacy, the Canadian Ocean Literacy Strategy, the management objectives, and the research questions of this research project. Chapter 2 provides a literature review of environmental and ocean literacy, citizenship, social marketing, psychology, and public perceptions literature which supported the development of a novel ocean literacy framework. Chapter 3 presents a case study on Ocean Week Canada using the Framework from Chapter 2 while evaluating how Ocean Week events can serve to raise ocean literacy in Canada. Finally, Chapter 4 concludes with management recommendations by bringing together findings from Chapters 2 and 3 and proposing new ways to define and evaluate ocean literacy initiatives.

CHAPTER 2: LITERATURE REVIEW AND DEVELOPMENT OF OCEAN LITERACY FRAMEWORK

2.1 Literature Review of Ocean and Environmental Literacy Evaluation

"Literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society" (UNESCO, 2020). While ocean literacy is a relatively new concept, the idea of literacy where citizens need to better understand the ecology to care about the environment and act more sustainably is not new (Roth, 1992; Hollweg et al., 2011). As early as the Tbilisi Declaration in 1977, the United Nations Education, Scientific, and Cultural Organization (UNESCO) and the U.N. Environment Programme (UNEP) have identified the "important role of environmental education in the preservation and improvement of the world's environment" (UNESCO-UNEP, 1977). Consequently, the concept of environmental literacy was born as an end goal of environmental education (Roth, 2012; North American Association for Environmental Education, 2017; Szczytko et al., 2019). As environmental education and literacy is a more mature field of research compared to ocean education and literacy, a literature review on environmental literacy can be expected to aid in the development of the ocean literacy framework.

The initial approach to literature review was to carry out a systematic literature search of title, abstract, and keywords on Scopus using search strings listed in Table 2.1 and import them into Covidence for review. However, the author quickly found that the results were either broad in scope and have a lot of irrelevant literature associated with the present project, or they were rather narrow and do not capture the entire scope of the project. Furthermore, several ocean literacy researchers have shared with the author published and unpublished peer-reviewed and grey literature relevant to the project. To account for these types of literature and input from experts, the author opted for a snowballing review of the publications identified in Searches 4-6 (see Table 2.1), and complemented with the additional discussion and literature identified and collected from experts. Literature review topics included ocean, climate, and environmental literacy, citizenship, and stewardship, social marketing, psychology, and public perceptions.

Table 2.1: Summary of literature searches on Scopus in May 2021

Search #	Search String	Number of Articles
1	"Environmental literacy"	561
2	"Environmental literacy" assessment	79
3	"Ocean literacy"	143
4	Ocean AND literacy AND evaluation	17
5	"Ocean literacy" assessment	15
6	"Environmental literacy" evaluation AND framework	6

This interdisciplinary literature review indicated that ocean literacy needs to incorporate the strengths and key concepts of each discipline to provide a more holistic and comprehensive understanding of ocean literacy. The review highlighted the need to move beyond the knowledge deficit model, where more knowledge equates to more concern and/or behavioural change towards more sustainable actions (Jefferson et al., 2015; McKinley & Burdon, 2020). Social marketing, psychology, and public perceptions research highlighted factors such as emotions, perceptions, and social norms can all have an impact on behaviours (Kellert, 1983; Kollmuss & Agyeman, 2002; Jefferson et al., 2015; Brennan et al., 2019; McKinley & Burdon, 2020). Further, the literature review illustrated the need to move away from the natural science-centric approach to ocean literacy and incorporate social science concepts. Finally, this review also revealed the need for integrated and collaborative learning between disciplines, cultures, and individuals to collectively create an ocean literate society.

2.2 Evaluation Framework Development

Due to the complex multidimensional nature of ocean literacy, a framework was needed to help visualize and conceptualize the relationship of the different ocean literacy dimensions. Based on the literature review, the author found that the diagram developed by Hollweg et al. (2011) and subsequently simplified by Szczytko et al. (2019) was the most suitable representation of the different dimensions of ocean literacy and its interconnectedness (Figure 2.1). This diagram is then used as a base for the ocean literacy framework development. The domains of the diagram will be referred to as dimensions for the rest of the study.

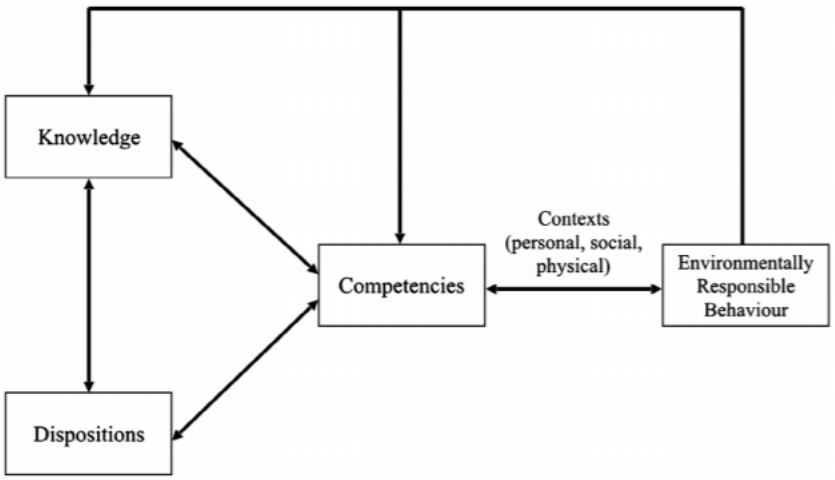

Figure 2.1: Conceptual basis for ocean literacy evaluation framework development which shows major domains of environmental literacy (Hollweg et al. (2011); Szczytko et al. (2018)).

Unlike the majority of the literature where dimensions of ocean literacy were portrayed as individual dimensions, this conceptual diagram shows that the dimensions are interdependent and illustrates the continuum of learning and development associated with literacy (UNESCO, 2004; Hollweg et al., 2011). For example, as one gains more ocean knowledge, their disposition toward the ocean will change, and potentially leading to higher competency and more or better sustainable actions which may include seeking additional ocean knowledge or skills (Hollweg et al., 2011). Alternatively, changes to one's disposition through a direct emotional experience of marine issues may lead the desire to enhance their ocean knowledge and competency to take ocean actions and may include further changes to their knowledge, disposition, and competency

(Kollmuss & Agyeman, 2002; Hollweg et al., 2011; Jefferson et al., 2015). To build the ocean literacy framework (hereafter 'the Framework'), while conducting the literature review, components and sub-components were added to the conceptual diagram to further explain each dimension. Arrows were used to connect the different dimensions, components, and sub-components, where the direction indicates the causal influence of a dimension or component (Figure 2.2).

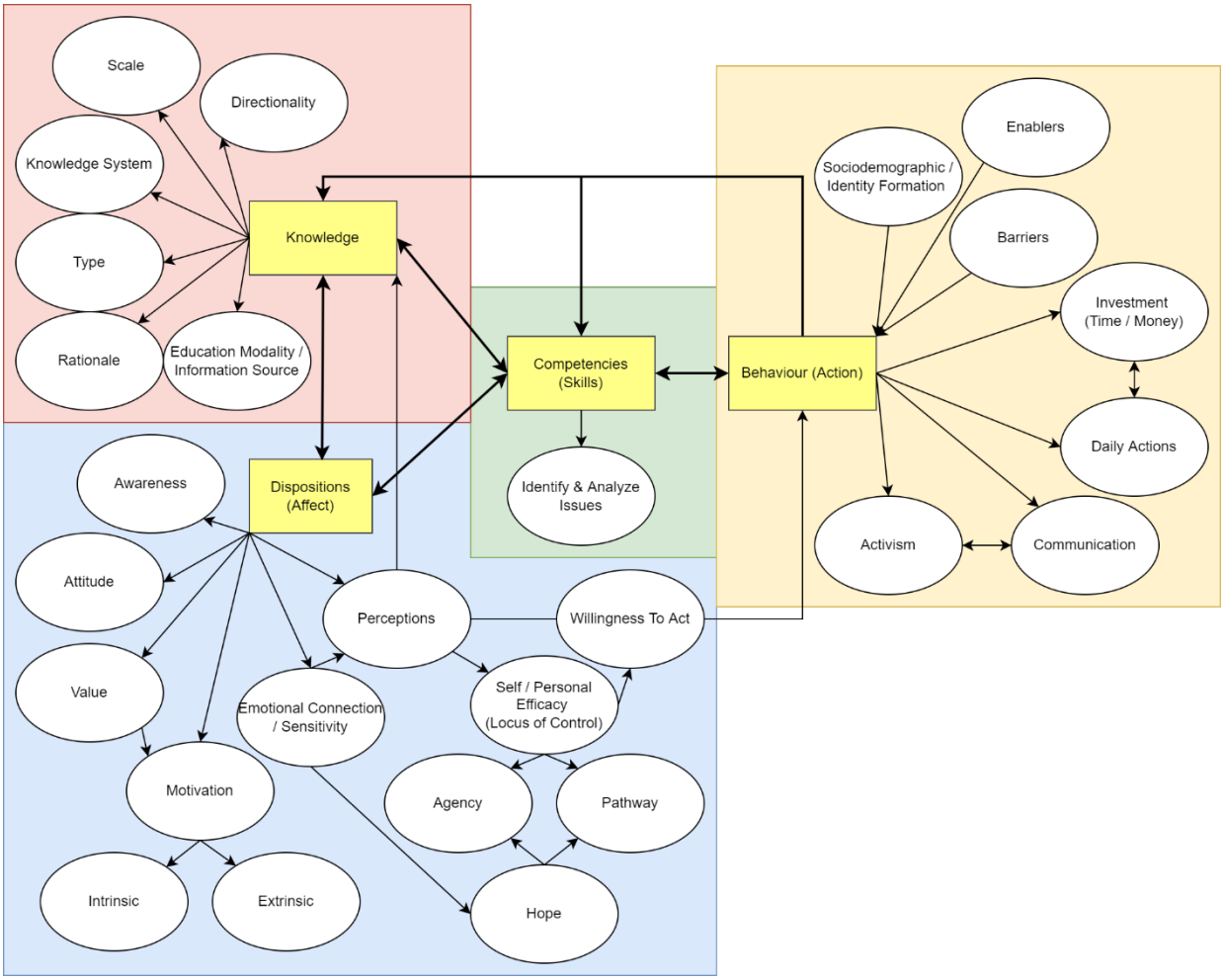

Figure 2.2: Ocean literacy framework developed through literature review. (Yellow rectangle = Dimensions; Ovals = Components of each dimension; Red = Knowledge dimension; Blue = Disposition dimension; Green = Skills dimension; Yellow = Behaviour dimension; Arrow = Causal influence and interrelations of a dimension or component).

2.3 Ocean Knowledge

Ocean knowledge can be described by its type, scale, knowledge system, education type, modality, source, directionality, and rationale (Figure 2.3).

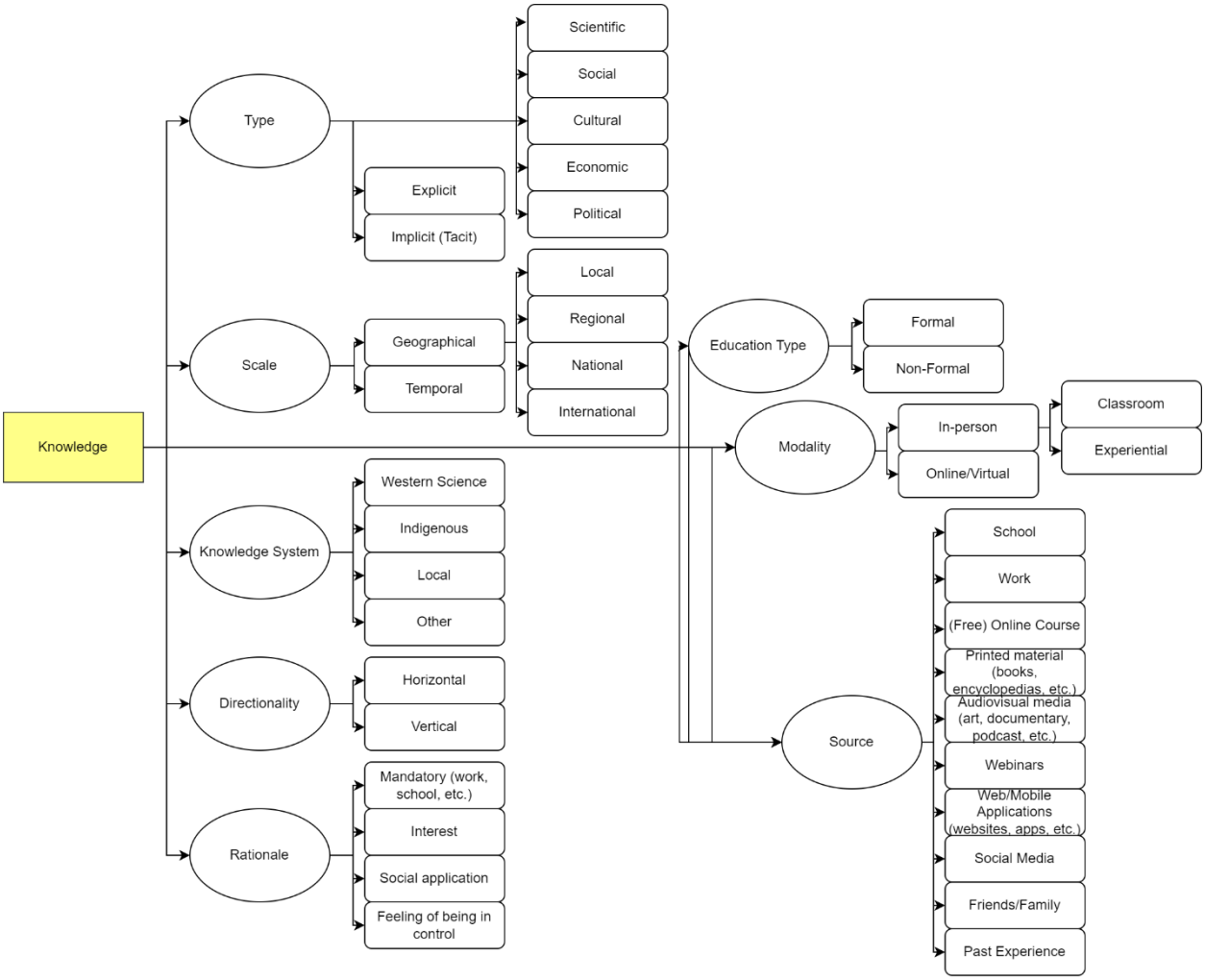

Figure 2.3: Framework for the ocean knowledge dimension. (Yellow rectangle = Dimensions; Ovals = Components of each dimension; White rounded rectangle = Sub-components which explains each component).

2.3.1 Knowledge Type

Beyond the usual natural science approach to ocean literacy, social, economic, political, and cultural knowledge are also needed to provide a more holistic understanding of our relationship to the ocean (Roth, 1992; Hollweg et al., 2011; Szczytko et al., 2019; McKinley et al., 2020). Science knowledge could allow for a better understanding of biodiversity and

ecosystems, whereas social, economic, and cultural knowledge can educate individuals about the interdependency and co-evolution of society and culture with the ocean (Roth, 1992; Hollweg et al., 2011; Fauville et al., 2019; Marouli & Duroy, 2019; McKinley et al., 2020). Finally, political ocean knowledge would illustrate the impact of specific policies or the lack of required policies on the ocean (Steel et al., 2005; McKinley & Fletcher, 2010; McKinley et al., 2020). An integrated and interdisciplinary approach to raising ocean knowledge is needed for individuals to have a holistic perspective of ocean sustainability (Marouli & Duroy, 2019).

Knowledge type can also be defined as explicit or tacit (Calo, 2008). Explicit knowledge can be documented and easily transferred whereas tacit knowledge is intangible knowledge that cannot be described using words or easily transferred (Calo, 2008; Stevens et al., 2010; McHugh & Domegan, 2017). An individual could obtain both types of ocean knowledge through different educational types, modalities, and sources (Chapter 2.3.4-6).

2.3.2. Knowledge Scale

The geographical scale of the knowledge can be defined as local, regional, national, and international (National Research Council, 2010; Hollweg et al., 2011; Marouli & Duroy, 2019; UNESCO-IOC, 2021). Although national and international can be geographically defined by lines on a map, the Framework does not clearly define local and regional as their definitions may vary depending on the spatial organization of individuals, communities, and cultures.

Ocean knowledge also has temporal dimensions. There are personal and collective historical dimensions that include the timeframes over which human culture has evolved. The current state of marine cultural, political, and socioeconomic knowledge may be viewed as contemporary (Ghosh, 2011; Benway et al., 2019), but it is also fluid and changing over time. Therefore, it is difficult to attach an explicit categorization of temporal scale to this Framework.

2.3.3 Knowledge Systems

"Knowledge systems are made up of agents, practices and institutions that organize the production, transfer and use of knowledge" (Cornell et al., 2013, p. 61). In western societies, Western science is the dominant knowledge system in understanding the ocean. However, in recent years, there has been an increase in recognition of local and Indigenous knowledge systems in understanding the environment (UNESCO, 2018; UNESCO-IOC, 2021). Further, there can be other knowledge systems that have not been identified or named. As such,

knowledge systems can be divided into Western science, Indigenous, local, and other. Finally, individuals can rely on more than one knowledge system to obtain a more holistic view of the world (Bartlett et al., 2012; Reid et al., 2020).

2.3.4 Educational Type

Educators have generally divided education into formal, non-formal, and informal (Roth, 1992; Government of Alberta, 2016; Council of Europe, 2021). For simplicity and ease of interpretation, the Framework broadly defined educational type as formal and non-formal (Roth, 1992). Formal education is considered to be any form of mandatory education and/or training that is done in a structured way (National Research Council, 2010). Conversely, non-formal education is any voluntary and/or non-structured education such as visits to aquaria or watching documentaries (National Research Council, 2010).

2.3.5 Modality

While education is traditionally done in-person, online or virtual education has become more common due to the COVID-19 pandemic. In-person education can be further broken down into classroom and experiential learning (e.g., field trips) (Kellert, 1983). However, with the advancement of technology and the COVID-19 pandemic, virtual field trips or immersive experience have also become more common (Stanford, 2018; National Marine Educators Association, 2019; Walcutt et al., 2019). As such, the modality to obtain ocean knowledge was broadly divided into in-person and online or virtual; in-person and virtual experiential learning were grouped under past experience and web or mobile applications in Chapter 2.3.6 respectively and are considered as a form of non-formal education in Chapter 2.3.4.

2.3.6 Sources

The combination of educational types and modalities has led to a large variety of sources where individuals can obtain ocean knowledge. These sources are broadly grouped as school, work, web or mobile applications (including virtual immersive experience), webinars, online courses, social media, audiovisual media, printed material, past experience (including field trips), or through friends and/or family (Roth, 1992; Steel et al., 2005; National Research Council, 2010; Government of Alberta, 2016).

2.3.7 Directionality

Ocean knowledge can be obtained either horizontally or vertically. Vertical attainment of knowledge is authoritative through hierarchical structures such as between government and educators or educators and students (Marouli & Duroy, 2019). Conversely, the horizontal acquisition of knowledge is the participatory sharing of knowledge between peers to facilitate collective and collaborative learning (Marouli & Duroy, 2019).

2.3.8 Rationale

Various factors drive individuals to obtain ocean knowledge. These factors are broadly grouped into four categories which are mandatory (e.g., work and school), interest, social application, or the feeling of being in control. Social application is any form of learning that would help with the learner's everyday life (Kollmuss & Agyeman, 2002; van der Linden et al., 2015). Similarly, individuals are also driven to obtain knowledge for the feeling of being in control (also known as the 'locus of control') (Szczytko et al., 2019). While not directly related to ocean literacy, these two rationales were particularly evident during the COVID-19 pandemic where individuals research safety measures and vaccine types to help with their everyday lives and feeling of being in control during this pandemic.

2.4 Ocean Disposition

Disposition, also known as affect, can be described using awareness, value, attitude, perceptions, emotional connection or sensitivity, and motivation (Kellert, 1983; Kollmuss & Agyeman, 2002; Jefferson et al., 2015; Brennan et al., 2019). These components are imperative to understanding ocean behaviours (Brennan et al., 2019).

2.4.1 Awareness

Awareness in the Framework is defined as a basic knowledge of the existence of an ocean concept or issue (Government of Alberta, 2016; McKinley & Burdon, 2020). While some researchers have classified awareness as its own dimension and a precursor to knowledge, it was placed under the disposition dimension in the Framework due to the subjectiveness of its evaluation which is based upon how questions are asked and interpreted (O'Brien, 2007; Brennan et al., 2019; Devenport et al., 2021). Further, while awareness can lead to a desire to

obtain more knowledge, the original goal of ocean education is to raise awareness by addressing the knowledge deficit, so knowledge and awareness should have a reciprocal impact on each other (Elder, 2003; Guest et al., 2015; McKinley & Burdon, 2020).

2.4.2 Value

The Strategy considers ocean values as a unique dimension of ocean literacy, but value in the Framework was placed under disposition by defining it as what individuals considered as important (COLC, 2021a). Value can be broken down into personal, social, and cultural values depending on the context (McClaren, 1989; Guest et al., 2015; Jefferson et al., 2015). Values can also be broken into egoistic (self), altruistic (social), biospheric (nature and environment), and hedonic (pleasure and comfort) that can be distinguished and measured independently (Hansla et al., 2008; Steg et al., 2014).

2.4.3 Attitude

Attitude is the way individuals think or feel about the ocean and its issues in the form of appreciation or concerns (Brennan et al., 2019; Ashley et al., 2019; McKinley & Burdon, 2020). Similar to awareness, attitude is classified as its own dimension in some ocean literacy research (Brennan et al., 2019; McKinley & Burdon, 2020). However, environmental literacy literature has grouped attitude under disposition as it directly reflects individuals' inclination toward different aspects of the environment and environmental issues (Hogwell et al., 2011; Szczytko et al., 2018). As this Framework used Hogwell et al. (2011) as a blueprint, attitude was considered a component of disposition and can impact both knowledge (e.g., attitude towards knowledge attainment and sharing) and behaviour (e.g., attitude towards pro-ocean sustainability behaviour) (McHugh & Domegan, 2017; Szczytko et al., 2018). While attitude does not directly impact behaviour, individuals with strong pro-environmental sustainability attitudes are more likely to engage in sustainable actions (Kollmuss & Agyeman, 2002).

2.4.4 Perceptions

Perceptions are another indispensable component of ocean literacy and would also directly impact the knowledge and behaviour dimensions. An individual's perceptions of ocean issues and whether they can help address the problem is directly linked to their self or personal efficacy of perceived control over their behaviour or outcome (Kollmuss & Agyeman, 2002; Jefferson et al., 2015; Stoll-Kleemann, 2019; Jefferson et al., 2021). Individuals who feel that

their actions can have an impact on ocean sustainability (agency) and that they can carry out these actions (pathway) will be more likely and willing to act sustainably than those who perceive themselves as lacking efficacy (Snyder et al., 1991; Jefferson et al., 2015; Ashley, 2019; Stoll-Kleemann, 2019). Similarly, an individual's perceptions of a certain knowledge type or source can encourage or deter them from pursuit more knowledge of the same type or source.

Hope may be one of the most important attitudes and perceptions in ocean literacy research and initiatives. Hope creates a sense of successful agency that difficult issues can be solved and that there is a pathway in solving the issues (Snyder et al., 1991; Snyder et al., 2017; Cantell et al., 2019; Szczytko et al., 2019). As such, hope would encourage sustainability actions even in the face of challenges (Snyder et al., 2017; Cantell et al., 2019; Szczytko et al., 2019).

2.4.5 Emotional Connection and Sensitivity

Emotions play a key role in marine conservation engagement. Environmental education that involves strong emotional reactions tends to evoke pro-environmental behaviours by "talking to the heart, not to the mind" (Jefferson et al., 2015, p. 64; Kellert, 1983; Kollmuss & Agyeman, 2002; National Research Council, 2010; Stoll-Kleenmann, 2019). Orams (1996) also described emotion as "an effective 'short-cut' to inducing behavioural change" (p. 89), which shows that emotion would be indispensable when studying ocean literacy. Negative emotions such as fear and despair can lead to apathy or disengagement with ocean issues; conversely, positive emotions associated with nature can inspire individuals and thus catalyze societal shift towards taking sustainable ocean actions (Kellert, 1983; McKinly & Burdon, 2020; Jefferson et al., 2021).

2.4.6 Motivation

Motivation is a final key component of ocean literacy in the disposition dimension. Psychologists have generally classified motivation as intrinsic and extrinsic (van der Linden et al., 2015; Ouariachi et al., 2020). Personal interests are considered intrinsic motivations, whereas financial or career-advancement incentives are considered extrinsic motivations (Kollmuss & Agyeman, 2002; van der Linden et al., 2015; Ouariachi et al., 2020). Extrinsic motivations are only sustained for as long as the incentive is present and they need to be associated with intrinsic personal values and priorities to encourage long-term sustainable ocean actions (Kollmuss & Agyeman, 2002; van der Linden et al., 2015; Ouariachi et al., 2020).

2.5 Ocean Competencies and Skills

Competencies and Skills are defined as one's ability to identify and analyze issues (Roth, 1992; National Research Council, 2010; Government of Alberta, 2016). This dimension is crucial to translate one's knowledge and disposition into behaviour. By being able to identify and analyze ocean issues, the individual will be able to decide whether they will be acting upon the issues and if they will need to obtain or develop additional knowledge or skills to act (Roth, 1992; National Research Council, 2010; Government of Alberta, 2016; Cantell, 2019).

2.6 Ocean Behaviour and Action

Behaviour and action are considered another dimension of ocean literacy. Sustainable ocean behaviours are broadly divided into four categories: investment, daily actions, communication, and activism. However, ocean knowledge does not translate directly to sustainable ocean behaviours (McClaren, 1989; Orams, 1996; Stoll-Kleemann, 2019). Behavioural changes or lack of changes are influenced by sociodemographic and identity formation, enablers, and barriers (National Research Council, 2010).

2.6.1 Categories of Ocean Behaviour

Investment in ocean behaviour can be either by given financial resources or time (Stern, 2000). Financial investment is defined as donations to support organizations (e.g., environmental non-governmental organizations) to take sustainable ocean actions or money spent directly towards sustainability (e.g., purchasing more expensive but eco-certified seafood) (Stern, 2000). Similarly, volunteering, participating in citizen science, and spending time obtaining more knowledge or skills to help perform sustainable behaviour can all be considered different forms of time investment (Fletcher et al., 2012). Due to barriers identified in Chapter 2.6.2.2, individuals may only be invested financially or in time, and they can have different levels of investments in each category.

Daily actions are defined as an individual's everyday actions which would minimize their impacts on the marine environment (Stern, 2000). Some examples of daily actions include decreasing plastic usage, reducing carbon footprint, and composting. Daily actions can

sometimes be coupled with investment. For example, reducing carbon footprint by walking instead of driving can lead to an increase in travel time but a decrease in money spent on gas.

Unlike daily action and investment where ocean behaviours have a personal impact, communication and activism have a community-level impact (Stern, 2000). Exchanging and sharing information with peers, friends, and family or via all forms of media including social media, blogs, and newspapers, are all considered to be forms of communication. The Framework has broadly defined activism as taking political action (e.g., writing letters to ministers) and initiating new ocean protection initiatives (e.g., organizing beach cleanups or starting educational campaigns) (Stern, 2000). Behaviour, activism, and communication are often considered their own dimension in ocean literacy (Brennan et al., 2019; McKinley & Burdon, 2020). The Framework groups activism and communication into behaviour because both dimensions involve taking action and have an interpersonal impact. Further, activism and communication could be considered as being highly interconnected. For example, an individual conducting an ocean-related campaign will likely be communicating the ocean issues through their preferred channels (e.g., social media, petitions, letters to ministers).

2.6.2 Behaviour Influencers

Sociodemographic and identity formation, and multiple enablers and barriers all act in concert to influence behaviour (Figure 2.4).

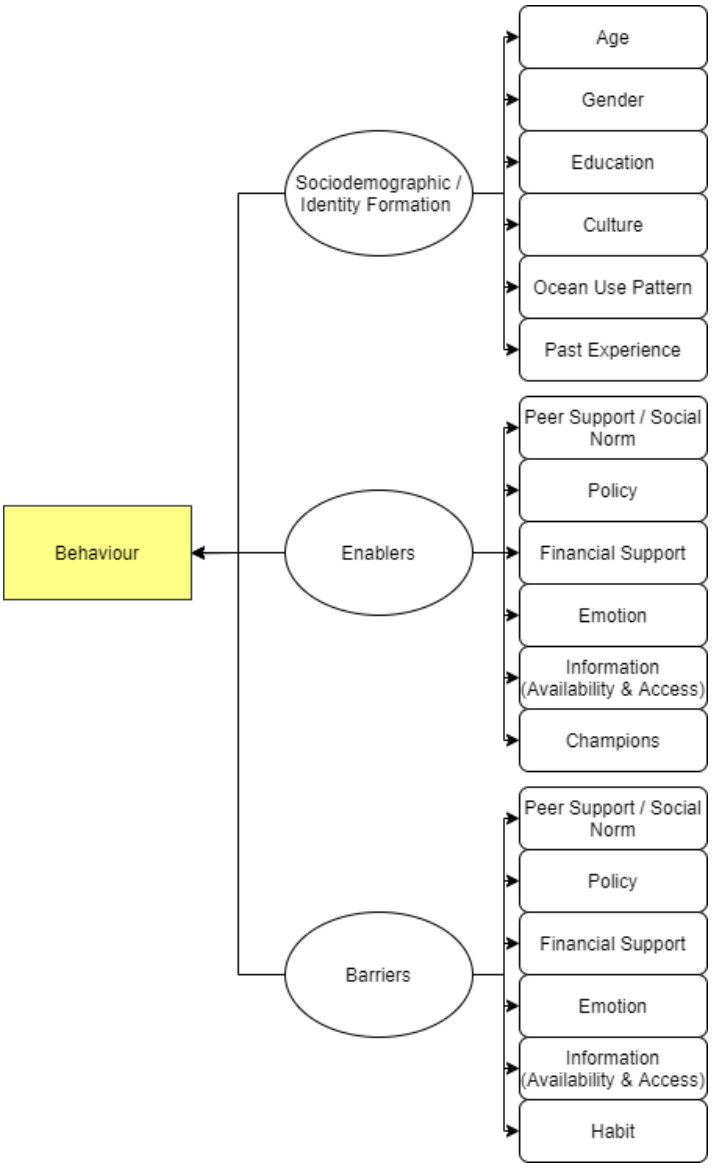

Figure 2.4: Influencers of behaviour. (Yellow rectangle = Dimensions; Ovals = Components of each dimension; White rounded rectangle = Sub-components which explains each component).

2.6.2.1 Sociodemographic and Identity Formation

Sociodemographic and identity formation has a strong influence on ocean behaviour. Factors such as age, gender, education, culture, ocean use pattern, and past experience can all impact behaviour (Stern, 2000; Kollmuss & Agyeman, 2002; Stoll-Kleemann, 2019). Studies have shown that younger and more educated women are more likely to undertake sustainable actions (Kollmuss & Agyeman, 2002). Further, education, culture, ocean use, and experience can influence how an individual understands (knowledge) and interacts (disposition) with the ocean,

which would have downstream effects on ocean behaviour (Kollmuss & Agyeman, 2002; Cantell, 2019; Stoll-Kleemann, 2019). Unlike the Western worldview, the Indigenous cultures emphasize the interconnectedness of humans and nature and the importance of living in harmony with each other (Joseph, 2016; Government of Alberta, 2021). As such, their cultures discourage waste and overexploitation (Government of Alberta, 2021). Another example can be seen in the hobby-driven culture of surfing. Surfers are found to be highly supportive of ocean conservation efforts (Scheske et al., 2019).

2.6.2.2 Barriers and Enablers to Ocean Behaviour

Human behaviours are highly dictated by social norms and peer support where individuals are most likely to follow the behaviour and actions of their family, peers, and community as the normative behaviour accepted by the society (McKenzie-Mohr, 2000; Kollmuss & Agyeman, 2002; Goldstein et al., 2008; van der Linden et al., 2015; Stoll-Kleemann, 2019). This ingrained human behaviour can be considered as both a barrier and enabler in ocean behaviour. While unsustainable lifestyles can lead a community to resist changes, as more individuals adopt sustainable ocean actions, the power of social networks can have ripple effects leading to community-level changes (Kollmuss & Agyeman, 2002; van der Linden et al., 2015; Stoll-Kleemann, 2019).

Governmental policies have an interacting effect with social norms where individuals can pressure politicians for sustainable ocean policies; similarly, top-down policy measures can be an authoritative way to reshape social norms (McClaren, 1989; Stern, 2000; Stoll-Kleemann, 2019; Ouariachi et al., 2020). For example, the Canada-wide single-use plastic ban, which included checkout bags, cutlery, and straws, has led Canadians to consider non-plastic alternatives of these products to be the norm compared to the previous single-used plastic norm (Government of Canada, 2021).

Financial support in the form of economic incentives and an individual's access to resources (e.g., food and money) can also be both a barrier and enabler to sustainable ocean action (Stern, 2000; Cantell, 2019). Carbon tax, a form of economic incentive, has encouraged individuals and industries to switch to non-carbon-based fuels to reduce greenhouse gas emissions (Caron et al., 2018; Dushime, 2021). Similarly, Maslow's Hierarchy of Needs indicates that individuals will need to satisfy their immediate personal needs before caring about

social or environmental issues (Kollmuss & Agyeman, 2002; McLeod, 2020). For example, individuals may care about ocean sustainability but not be able to afford eco-certified seafood. Therefore, the presence or absence of financial support can have a major impact on sustainable ocean behaviour.

Directly related to disposition, emotion plays a major role in behaviour. Emotional involvement can shape awareness and attitude leading to an increased likelihood of taking sustainable ocean actions (Kollmuss & Agyeman, 2002; Stoll-Kleemann, 2019). Conversely, apathy or empathy fatigue can lead to a sense of hopelessness and discourage individuals from taking action (Jefferson et al., 2015; Stoll-Kleemann, 2019). Consequently, depending on the context and the individual's emotion associated with the ocean, emotion can be either an enabler or barrier to sustainable ocean behaviour.

Although ocean knowledge does not directly translate to ocean action, the availability or access to accurate ocean knowledge can also facilitate or obstruct ocean action (McClaren, 1989; Kollmuss & Agyeman, 2002; Stoll-Kleemann, 2019). Accurate and efficient delivery of ocean knowledge can raise awareness on marine issues to encourage sustainable ocean actions (Steel et al., 2005; McKinley & Fletcher, 2010). For example, the recent increase in microplastics research has led to anti-microbead movements and the subsequent microbead ban in any personal care products (5 Gyres Institute, 2021). As such, while ocean knowledge can encourage ocean action, the lack of access or availability of information is considered a barrier to action.

Champions, such as environmental non-governmental organizations, politicians, and celebrities, can also inspire ocean action (Chawla, 1998; Kollmuss & Agyeman, 2002). Greta Thunberg, a youth climate activist, started the Fridays for Future movement to protest the lack of climate action by the government which has now encouraged over 14 million people in 7,500 cities to join the movement around the world (Fridays for Future, 2021). Similarly, having ocean champions, such as the Cousteaus, Rachel Carson, Sylvia Earle, and Sir David Attenborough, can be a powerful enabler for sustainable ocean action and behaviour.

Finally, as habits are highly unconscious and difficult to change, they are a major barrier to sustainable ocean behavioural change (Hobson, 2003; Southerton, 2013; Stoll-Kleemann, 2019). Habits are often convenient and rewarding because they tend to result in predictive results leading to saving time and energy when making decisions (Stern, 2000; Southerton, 2012;

O'Riordan & Stoll-Kleemann, 2015). Extrapolating to ocean literacy, an educated individual that has a habit of eating unsustainably sourced seafood may continue to consume this type of seafood and leading to the unconscious ocean illiterate choice of supporting unsustainable fisheries (Stoll-Kleemann, 2019).

2.7 Comparing and Contrasting the Framework and the Strategy

Despite the Framework and the Strategy having a different number of dimensions with different names, the Framework is highly applicable to the Strategy (Table 2.2). The ocean knowledge goal of the Strategy is to "increase understanding of how the ocean influences us and how our behaviours, decisions, and actions impact the ocean" (COLC, 2021a, p.10). To have a holistic understanding of different influences and impacts requires an interdisciplinary understanding of ocean knowledge through various sources as outlined by the knowledge dimension of the Framework. The ocean values goal of "strengthen positive public and organizational perceptions of the ocean and promote a greater ethic of care" (COLC, 2021a, p.10) also matches with the disposition dimension of the Framework as the latter has demonstrated different ways for individuals to connect with the ocean to shape their perceptions and encourage sustainable ocean action. Finally, the ocean actions goal of "reduce barriers and increase engagement to contribute to systemic change, individually and institutionally, that supports ocean, water, and community health" (COLC, 2021a, p.10) matches with the skills and behaviour dimensions of the Framework. Skills development, barriers reduction while strengthening enablers, and diversification of ocean actions are needed for the systematic change towards an ocean literate society. As such, the dimensions of the Framework are highly correlative with those of Strategy.

Conversely, the essence of the Framework and the Strategy differs significantly (Table 2.2). The Strategy was created using a bottom-up community-driven consultative approach (COLC, 2021a), whereas the Framework was based upon a review and synthesis of the literature. Therefore, while the Strategy is Canadian-centric and action-oriented (COLC, 2021a), the Framework is conceptual and not geographically specific. However, due to the strong correlation between the Strategy's goals and the Framework, the Framework can be used as a tool to guide the implementation of the Strategy.

Table 2.2 Similarities and differences between the Framework and the Strategy

	Strategy	**Framework**
Dimensions	Knowledge	Knowledge
	Value	Disposition
	Action	Skills
		Behaviour
Development Process	Community Consultation	Literature Synthesis
Geography	Canadian-centric	Not geographically specific
Orientation	Action	Conceptual

2.8 Looking Global

While the Framework was developed to guide the implementation of the Strategy, it is not specific to the Canadian context. Based on the literature review, there is currently no simple comprehensive framework that can guide future ocean literacy research and evaluation of different initiatives. Publications that outline the different dimensions of ocean literacy illustrate them as separate entities (Brennan et., 2019; COLC, 2021a). However, as demonstrated by the literature review and Framework development, the dimensions are highly interconnected. Existing conceptual models on sustainable behaviours illustrate different interdependent factors that influence behaviour, but they do not define the types of knowledge and skills that are needed to perform these behaviours (Kollmuss & Agyeman, 2002; Stoll-Kleeman, 2019). Currently, few studies assess all dimensions of ocean literacy (McKinley & Burdon, 2020). While a multitude of factors, such as time, research focus, and capacity, could cause this fragmented approach to ocean literacy research, the Framework could be a systematic guide for future ocean literacy research by being a visual reference tool when developing ocean literacy evaluation surveys.

CHAPTER 3: CASE STUDY OF OCEAN WEEK CANADA 2021

3.1 Context

World Ocean(s) Day[1] is an internationally recognized annual celebration of the ocean and its connection to humans while raising awareness on ocean conservation and sustainability (UNESCO, 2008; COLC, 2021b). This initiative was first proposed in Halifax, Nova Scotia, in 1991, and was officially launched internationally at the Earth Summit in Rio de Janeiro, Brazil, in 1992 (UNESCO, 2008; OWC Action Team, 2021). In 2008, it was officially recognized as an International Day of Celebration by the United Nations (UNESCO, 2008; OWC Action Team, 2021). Since its inception, each year on June 8, volunteers and organizations around the world have mobilized communities to come together to learn and connect with the ocean and raise awareness on the importance of ocean sustainability (UNESCO, 2008; COLC, 2021b). This global social movement is crucial to ocean education and literacy (Amaratunga, 2019; COLC, 2021b).

In Canada, the Canadian Ocean Literacy Coalition (COLC) has initiated a pilot Ocean Week Canada (OWC) program in 2020 to encourage the collaboration between different organizations and communities that are hosting World Ocean(s) Day events in Canada (COLC, 2021b; OWC Action Team, 2021). Led by the OWC Action Team, OWC aims to grow and coordinate local, regional, and national virtual and in-person events to maximize their reach and impact during Ocean Week (COLC, 2021b; OWC Action Team, 2021). "Grow Ocean Week Canada" is also one of the nine action streams identified in the newly launched Strategy which would be crucial in raising ocean literacy in Canada (COLC, 2021a,b). While OWC events are meant to be a series of educational and social events that are hosted virtually and in-person, due to the COVID-19 pandemic, the majority of the OWC events in 2021 were virtual (OWC Action Team, 2021). Due to the alignment of timelines associated with OWC and this research project, OWC was used as a case study to test the comprehensiveness of the Framework developed in

[1] The official United Nations designation of this annual celebration is 'World Oceans Day' (UNESCO, 2008). However, some countries and/or organizations (including the Canadian Ocean Literacy Coalition) recognize that "the Earth has one big ocean with many features" (Ocean Literacy Principle 1, Cava et al., 2005, p. 9) and refer to the event as 'World Ocean Day' (COLC, 2021b).

Chapter 2. Finally, this field research component of the project can help guide the future planning and implementation of the OWC action stream.

3.2 Methodology

3.2.1 Online Surveys

Due to the broad geographical reach of Ocean Week Canada events and the COVID-19 pandemic health and safety restrictions in 2021, this case study was conducted using online anonymous surveys. Other than eliminating COVID-19 health concerns, this approach allowed the author to survey a large geographical and demographic range of participants (e.g., including both anglophone and francophone Canadians). Further, the anonymous nature of the surveys can promote a higher disclosure rate of individuals' ocean literacy levels leading to a more accurate representation of the population (Freeman et al., 2006; Murdoch et al., 2014).

Based on the Framework designed in Chapter 2, each component or sub-component of the Framework was translated into multiple-choice, rating scale, matrix, or open-ended questions with some reference survey wording to McKinley (2010), Szczytko et al. (2019), Ashley et al. (2019), and COLC (2020). Each question represents at least one component of the Framework. For example, the question "to what extent do you feel the marine environment impacts your everyday activities? [Awareness/Attitude/Perceptions]" would measure the awareness, attitude, and perceptions of the respondents. All multiple-choice or matrix questions were given an "Other" option, which was designed for respondents to enter their own thoughts or comments regarding the questions to potentially capture components or sub-components of ocean literacy that are not currently part of the Framework.

The survey questions were then divided into two surveys. The Ocean Week Canada Pilot Survey (hereafter 'pre-OWC survey') was a short survey conducted prior to OWC participation to measure respondents' baseline (pre-OWC) motivation and willingness to act and engage with the ocean. Conversely, the longer Ocean Week Canada Pilot Follow-Up Survey (hereafter 'post-OWC survey'), distributed after OWC, measures the knowledge, awareness, attitude, perceptions, value, efficacy, motivation, investment, daily actions, activism, barriers, and enablers components of the Framework. While the surveys were conducted before and after

OWC, they were not designed to be a longitudinal comparison but rather complement each other. Other than having similar demographic questions, the surveys asked different ocean literacy questions, and the results were collated to provide a more holistic view of the multi-dimensional nature of ocean literacy. The two-survey design was also meant to capture OWC respondents who may not be interested in a long extensive ocean literacy survey. Either survey could be used to assist with the "Growth of Ocean Week Canada" action stream of the Strategy.

Finally, the questions were grouped into ocean literacy dimensions where questions from each dimension were presented on their own page. This step was taken to balance survey fatigue with completion time (Mavletova & Couper, 2014). To further reduce completion time, options were grouped into broad categories for the multiple-choice questions to limit the number of options to a maximum of 6. The pre-OWC survey is composed of 6 demographic and 2 Framework-related questions. The post-OWC survey had 9 demographics, 4 knowledge, 6 disposition, 5 behaviour, and 1 open-ended question. To maximize the accessibility of the surveys, both surveys were displayed bilingually in both English and French. The surveys were created and hosted on Opinio, the Dalhousie University approved surveying software with a secured server. They were then distributed electronically through email and social media via the author and COLC's networks. The intended population of the surveys were any individuals above the age of 18 who were planning to attend or have attended at least one OWC event. Both surveys seek voluntary completion by OWC participants and respondents were allowed to skip questions if they desire. As such, due to several respondents having skipped several questions of the surveys, results are presented using only percentages of the survey population.

No monetary compensations were provided to any respondents. A detailed version of the surveys can be found in Appendix A and B. The surveys and survey methodology were approved by the Marine Affairs Ethics Review Standing Committee in May 2021 (MAPERSC#: MAP2021-01).

3.2.2 Survey Method Limitations

While the intended survey population was described as a survey requirement in the introductions of the surveys, due to the anonymous nature of the surveys, the author was not able to validate whether respondents were above 18 and were participating or have participated in an OWC event. Finally, the author acknowledges that the survey distribution method of using only

the author and COLC's networks may have only reached certain geographic or demographic groups that participated in OWC.

3.2.3 Data Analysis

The survey results were exported as CSV files and analyzed and visualized using Microsoft Excel. Chi-square tests were conducted on the demographic questions by comparing survey participants' demographics with demographic data from Statistics Canada (2017, 2021a,b). Open-ended answers were manually compared to the Framework to evaluate the comprehensiveness of the Framework and were collated to help formulate management recommendations in Chapter 4.

3.3 Results

3.3.1 Demographics of the Surveys

3.3.1.1 Pre-OWC Survey

The Pre-OWC Survey had a total of 80 respondents with 13 from British Columbia (BC), 2 from Manitoba (MB), 1 from New Brunswick (NB), 2 from Newfoundland and Labrador (NL), 34 from Nova Scotia (NS), 25 from Ontario (ON), 2 from Prince Edward Island (PEI), and 1 from Quebec (QC). The majority of the respondents were between 30 to 64 years old (53.75%), live within 100 km of the coast (66.25%) and were first-time participants of Ocean(s) Day/Week activities (66.25%). To minimize completion time, gender and education information was not collected in this survey (Table 3.1). The median completion time for this survey was 1 minute and 41 seconds.

3.3.1.2 Post-OWC Survey

The Post-OWC Survey received 42 responses where 6 were from BC, 1 from NB, 2 from NL, 26 from NS, 6 from ON, and 1 from QC. The majority of the respondents were young adults (18-29) (54.76%), female (69.05%), have a graduate degree (73.81%), live within 100 km of the coast (85.71%), and first-time participants of Ocean(s) Day/Week activities (73.81%) (Table 3.1). Finally, most of the survey respondents engage with the ocean through work or school (85.71%), media (76.19%), proximity to the ocean (80.95%), and when they are on vacation (66.67%). Most of them engage with the ocean using three or more of these engagement avenues

(88.1%) (Figure 3.1). Twelve respondents completed both surveys. The median completion time for this survey was 5 minutes and 21 seconds.

3.3.1.3 Representativeness of Sample

Chi-square tests indicated that the survey populations by gender (post-OWC survey $p < 0.0001$), highest education (post-OWC survey $p < 0.0001$), province (pre-OWC survey $p < 0.0001$; post-OWC survey $p < 0.0001$), and age (pre-OWC survey $p < 0.0001$; post-OWC survey $p < 0.0001$) were not representative of the Canadian population. Participants were younger and more likely to be female with graduate degrees and live within 100 km of the coast.

Table 3.1: Respondent demographics of Pre-OWC and Post-OWC surveys

	Pre-OWC		**Post-OWC**	
Sample Size	80		42	
Provinces	Count	Percentage	Count	Percentage
BC	13	16.25	6	14.29
MB	2	2.5	0	0.00
NB	1	1.25	1	2.38
NL	2	2.5	2	4.76
NS	34	42.5	26	61.90
ON	25	31.25	6	14.29
PEI	2	2.5	0	0.00
QC	1	1.25	1	2.38
Age				
18-29	31	38.75	23	54.76
30-64	43	53.75	15	35.71
65+	6	7.5	4	9.52
Gender				
Male	N/A	N/A	11	26.19
Female	N/A	N/A	29	69.05
Non-Binary	N/A	N/A	1	2.38
Other	N/A	N/A	1	2.38
Highest education				
High School	N/A	N/A	2	4.76
Undergraduate	N/A	N/A	9	21.43
Graduate	N/A	N/A	31	73.81
Live within 100 km of coast				
Yes	53	66.25	36	85.71
No	27	33.75	6	14.29
First time participation in Ocean(s) Day/Week				
Yes	46	57.5	31	73.81
No	32	40	11	26.19

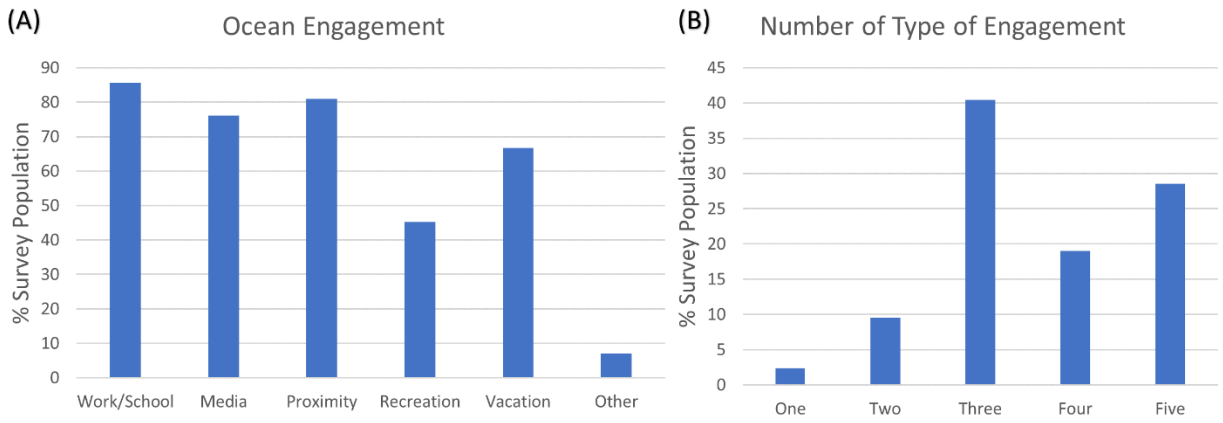

Figure 3.1: Post-OWC Survey respondents' ocean engagement by categories (A) and the number of avenues used to engage with the ocean (B).

3.3.1.4 OWC Event Participation

Due to the COVID-19 pandemic, more respondents participated in online events than in-person events and 21.43% of respondents indicated that they did not participate in any Ocean(s) Day/Week events (Figure 3.2A). Most of the respondents joined OWC events as an individual (75%) (Figure 3.2B), due to personal interest (73.75%), and to connect with the ocean (51.25%) (Figure 3.2C). Some respondents (18.75%) participated in OWC with their students and/or school (Figure 3.2B) which is echoed by common responses, such as "for students", "class trip", and "classroom education", written under the "Other" option for motivations to participate in OWC. Finally, OWC participants are hoping to gain ocean knowledge (58.75%), learn about daily actions to tackle ocean issues (43.75%), network (41.25%), and have fun (43.75%) during the events.

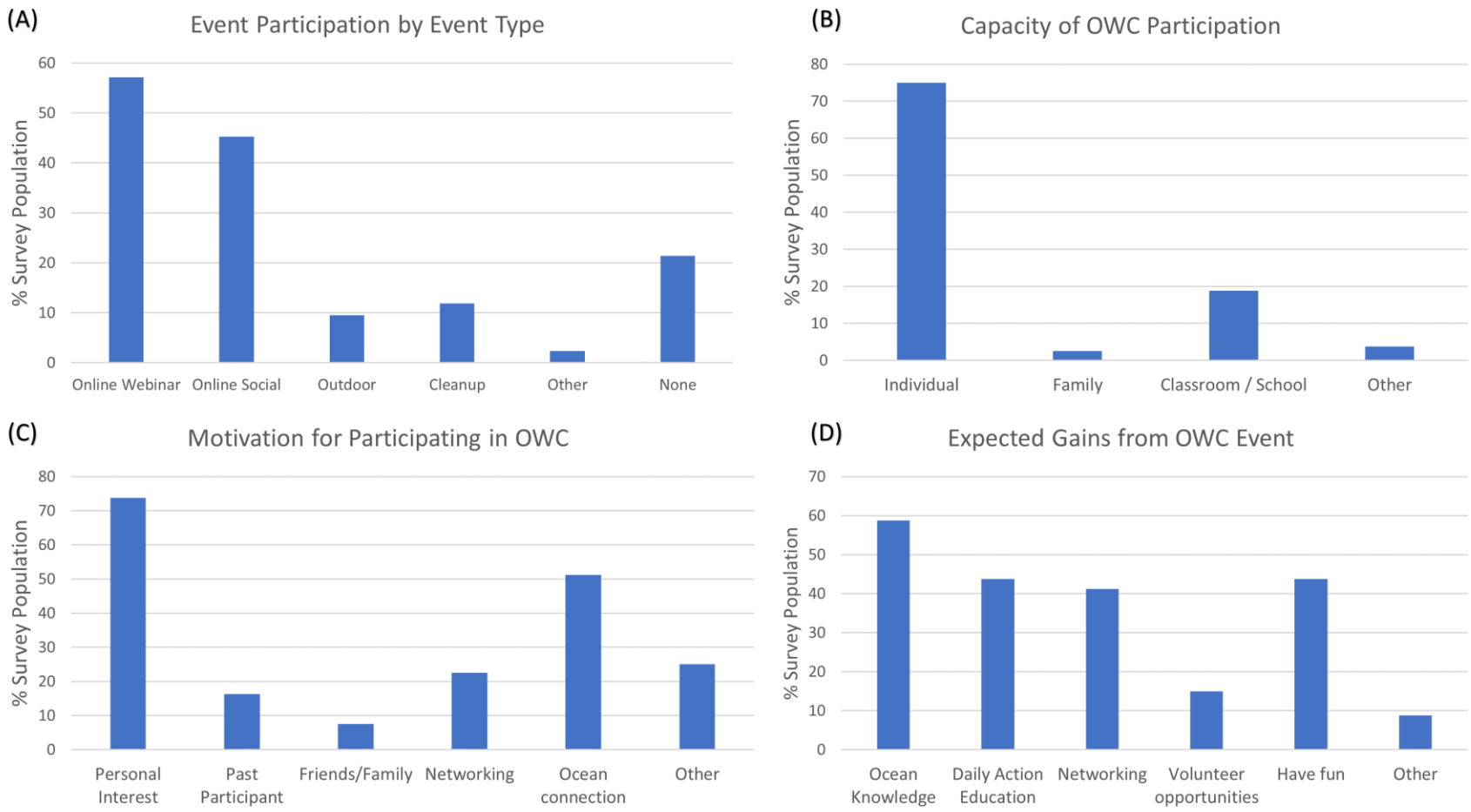

Figure 3.2: Event participation (A) (Post-OWC Survey), the capacity of event participation (B), motivation (C), and expected gains (D) (Post-OWC Survey) from participating in OWC activities.

3.3.2 Ocean Knowledge

3.3.2.1 Ocean Knowledge Systems

The most common knowledge system used by respondents to obtain ocean knowledge is Western science (97.56%), followed by local (78.05%), and Indigenous knowledge (58.54%) (Figure 3.3A). Thus, most of the respondents use more than one knowledge system as their ocean knowledge source with 35% using two knowledge systems and 52.5% using all three knowledge systems (Figure 3.3B). One respondent also wrote "*I don't personally have Indigenous knowledge, but I like to learn from Indigenous peoples*", which indicated a desire to use multiple knowledge systems to learn about the ocean. While respondents were given the option to enter "Other" knowledge systems, no new knowledge systems were captured.

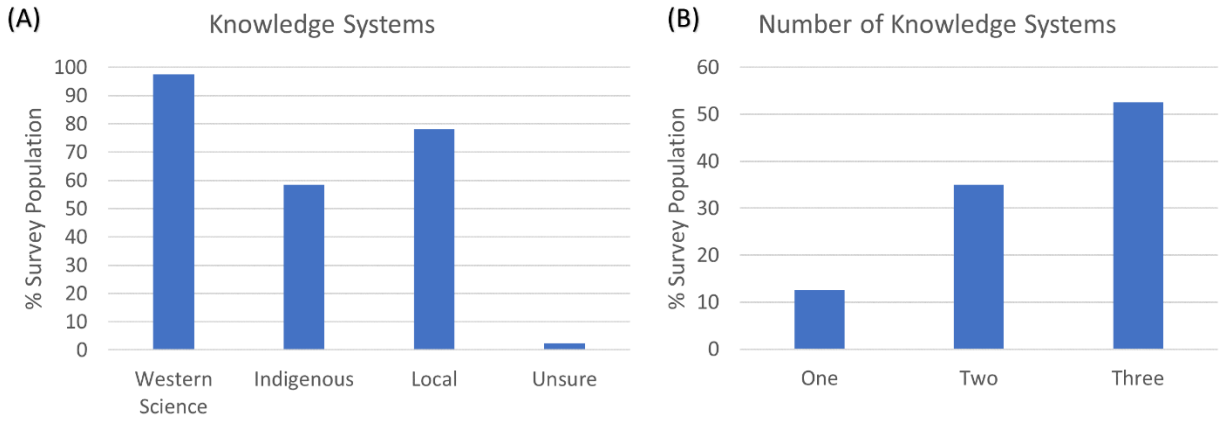

Figure 3.3: Knowledge systems (A) and the number of knowledge systems (B) used by Post-OWC Survey's respondents for ocean knowledge.

3.3.2.2 Ocean Knowledge Sources

Ocean knowledge sources are broadly categorized by four sources: formal education, relationship, non-formal education, and media. Almost all the respondents rely on formal education (97.5%) for ocean knowledge, which is followed by media (92.5%), non-formal education (82.5%), and relationship (55%) (Figure 3.4A). A majority of respondents used more than one knowledge source where 17.5% of respondents use two sources, 30% used three, and 50% used four (Figure 3.4B). The "Other" knowledge source option in the survey did not capture additional knowledge sources beyond these four categories.

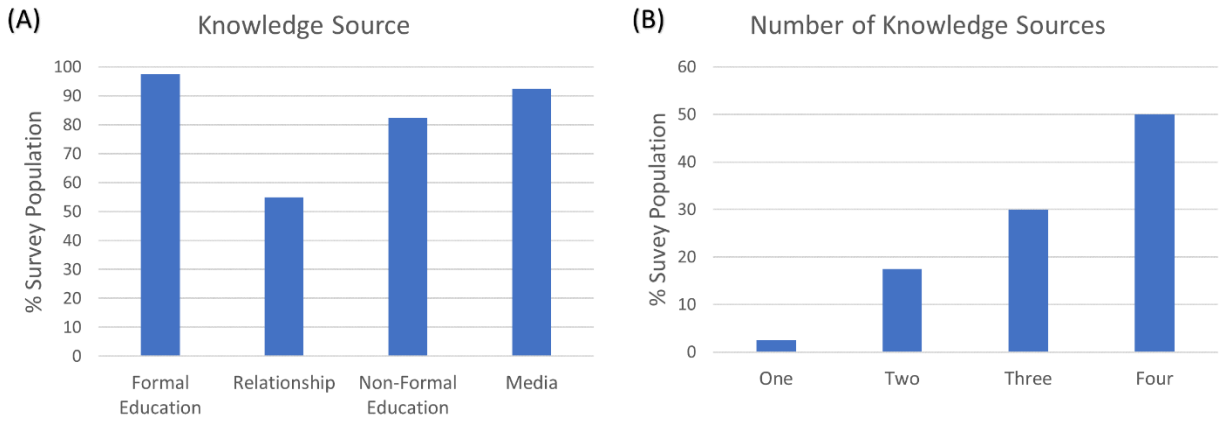

Figure 3.4: Knowledge source (A) and the number of knowledge sources (B) used by Post-OWC Survey's respondents to obtain ocean knowledge.

3.3.2.3 Ocean Knowledge Type Interests

Ocean knowledge types were divided into 5 categories: scientific, social, cultural, economic, and political. Respondents were asked to rate their relative interests in each type of knowledge on a scale of 1 to 5 with 1 being not at all interested and 5 being very interested. The average rating for scientific knowledge is 4.65, social knowledge is 4.13, cultural knowledge is 4.38, economic is 3.49, and political is 3.58. Other than receiving lower average rating scores, economic and political knowledge both exhibited different rating distributions compared to the other three knowledge types. Scientific, social, and cultural knowledge are all skewed towards the highest score (5). Conversely, economic and political knowledge types followed a more normal distribution with 4 being the most common rating (Figure 3.5). The "Other" knowledge type option in the survey did not capture any additional knowledge types.

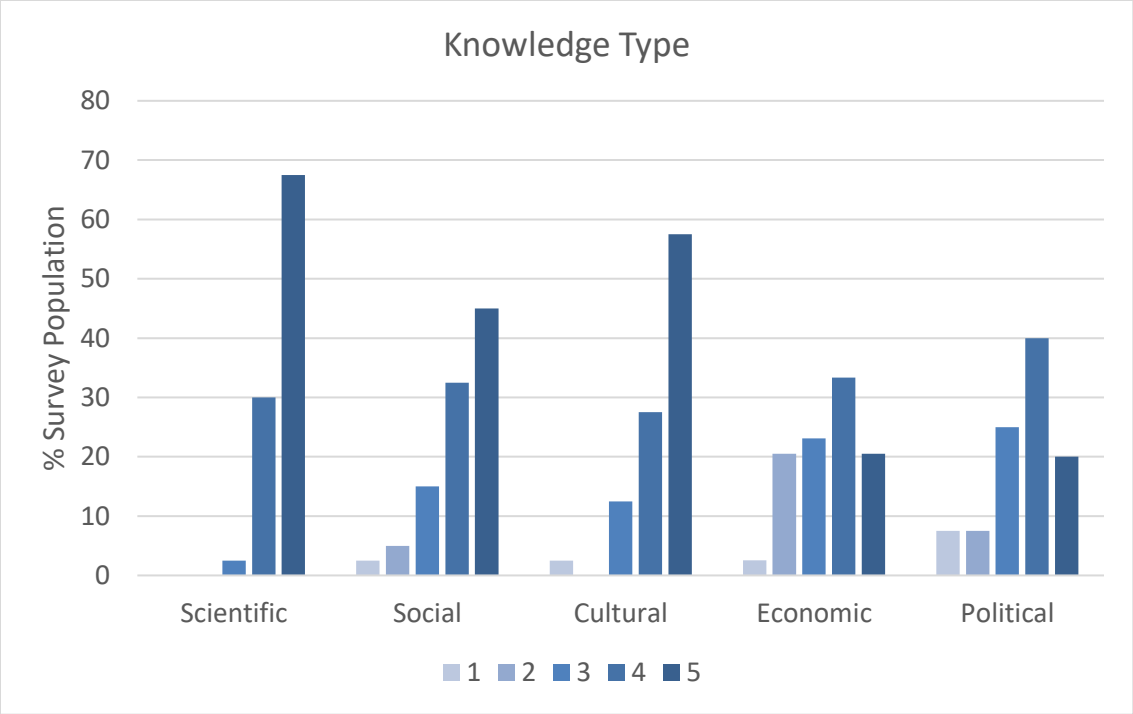

Figure 3.5: Post-OWC Survey respondents' rating of relative interest level to different ocean knowledge types on a scale of 1 to 5 (1 = not at all interested; 5 = very interested).

3.3.2.4 Ocean Knowledge Scale Interests

Similarly, respondents were asked to rate their relative interest to four geographical levels of ocean knowledge which are local, regional, national, and international. Unlike other questions, the exact definition of each of these levels was left up to each respondent's interpretation. The average respondents rating for local knowledge is 4.45, regional is 4.3, national is 4.2, and international is 4.13. All knowledge levels followed similar distribution where the most common ratings are either 4 or 5 (Figure 3.6). The progressive decrease in average scores with an increase in geographical scale indicated that respondents are more interested in ocean knowledge and issues that are closer to home. No additional geographical levels were captured using the "Other" option, but one respondent did indicate that they were confused by the wording of the question.

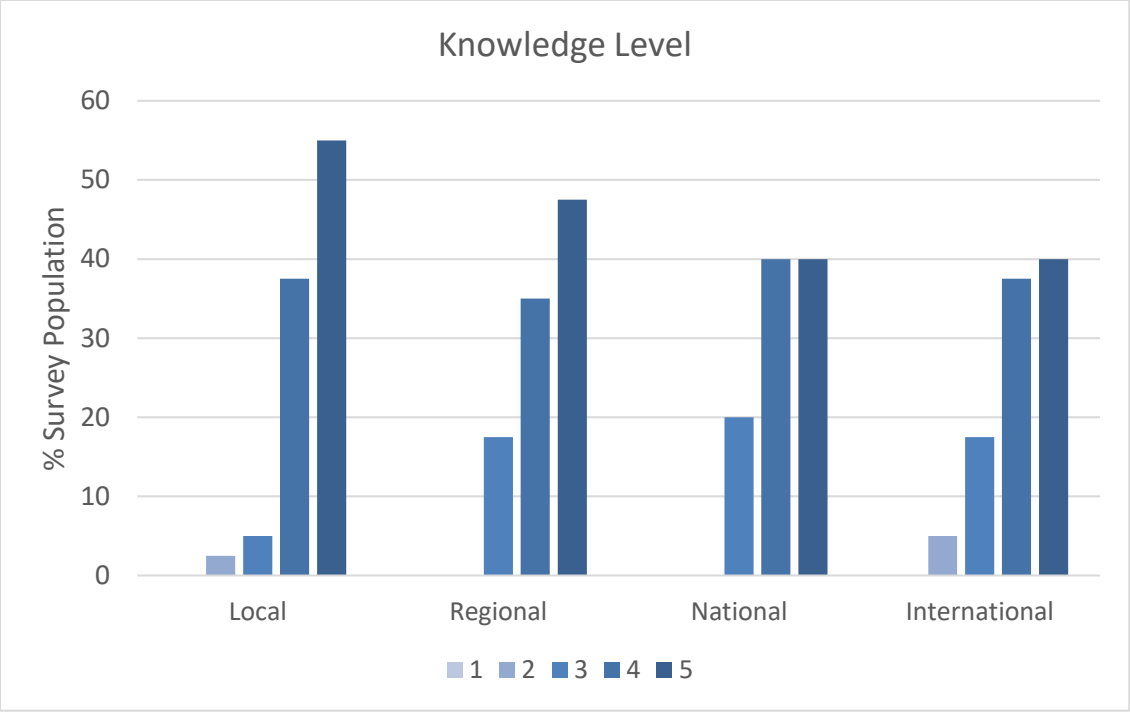

Figure 3.6: Post-OWC Survey respondents' rating of relative interest level to different geographical levels of ocean knowledge on a scale of 1 to 5 (1 = not at all interested; 5 = very interested).

3.3.3 Ocean Disposition

3.3.3.1 Awareness, Attitude, Perceptions, Value, and Efficacy

The respondents' ocean dispositions were assessed using 5 rating questions to evaluate the respondents' awareness, attitude, perceptions, value, and efficacy. Designed in a similar structure to Likert scale questions, the rating questions used a numeric scale of 1 to 5 based on different wording of the questions to capture different aspects of disposition. A rating of 5 represents strong awareness, attitude, perceptions, value, and efficacy towards ocean sustainability and 1 represents weak disposition. The mean rating score of awareness of ocean issue is 4.45, the importance of ocean health is 4.88, extent that respondents feel their lifestyle has an impact on the marine environment is 3.83, extent that respondents feel the marine environment impact their everyday activities is 3.88, and extent of respondents' belief that changes to everyday activities can lead to a healthier ocean is 4 (Figure 3.7). This discrepancy in the rating of the five different aspects of disposition may offer unique insights to encourage ocean actions (see Chapter 3.4.2).

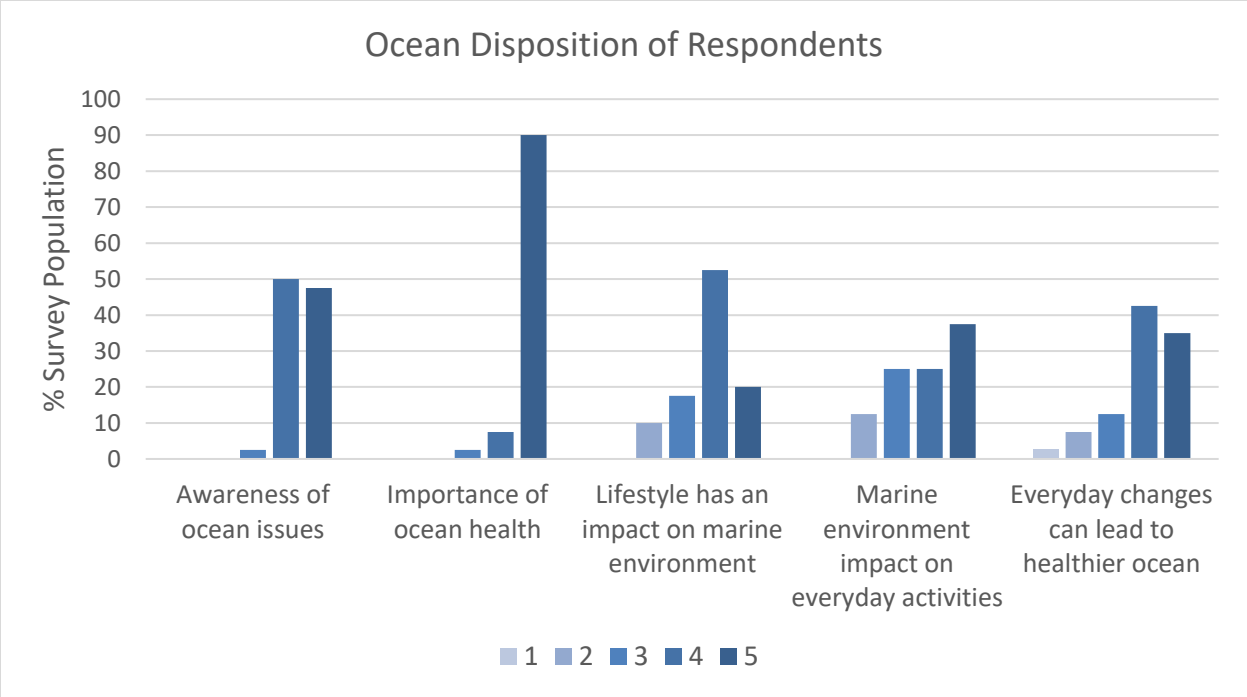

Figure 3.7: Post-OWC Survey respondents' rating of their disposition towards ocean issues on a scale of 1 to 5 (1 = not at all; 5 = extremely).

3.3.3.2 Motivation

The strongest motivation for ocean engagement and/or education is personal interest (97.5%), followed by the sustainability of current lifestyle and/or for future generations (90%), physical, mental, and emotional health (72.5%), and livelihood (42.5%) (Figure 3.8A). The "Other" option captured "community well-being" and "international peace and security" as other motivators. These additional motivators could be incorporated into the "health" or "sustainability" categories by expanding their definitions from a personal level to community and/or international levels. All respondents identified between two to four motivators for ocean engagement and education (Figure 3.8B).

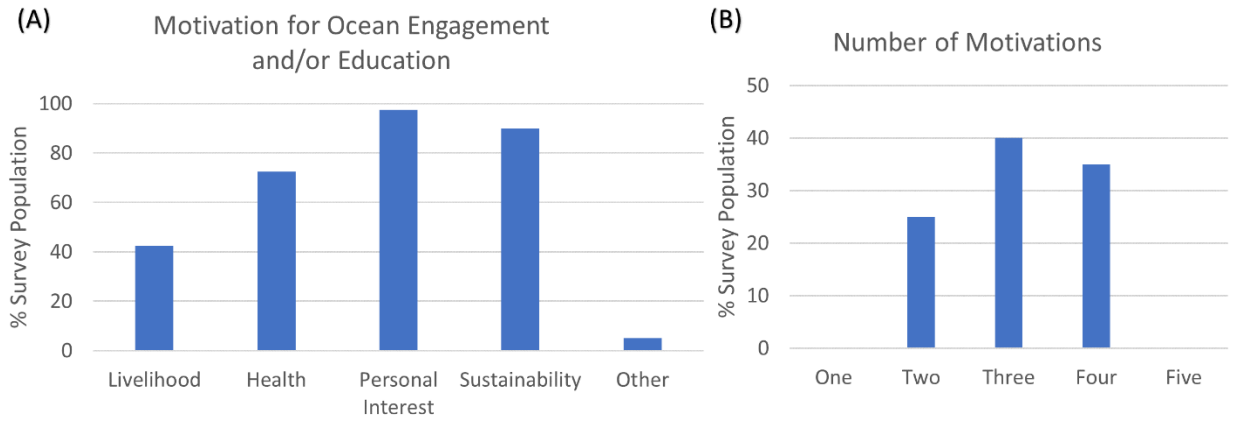

Figure 3.8: Motivation for ocean engagement and/or education of respondents (A) and the number of motivations for ocean engagement and education (B) (Post-OWC Survey).

3.3.4 Ocean Behaviour

3.3.4.1 Ocean Investments

Similar to disposition, respondents were asked to rate their personal investment in ocean issues on a scale of 1 to 5. All respondents considered themselves highly invested in ocean issues where 63.16% rated a 5, 21.05% rated a 4, and 13.16% rated a 3 on their investment. The average score for personal investment on ocean issues was 4.39 on a 5-point scale.

3.3.4.2 Ocean Actions

All respondents are taking or would like to take between one to five different forms of action to address ocean issues. The majority of the population is currently minimizing marine impacts through daily actions (94.74%), obtaining, exchanging, or sharing ocean knowledge (89.47%), and supporting ocean protection initiatives (52.63%). Similarly, most of the respondents would like to support ocean protection initiatives (81.58%), followed by daily actions (73.68%), and obtaining and sharing knowledge (71.05%). Finally, Figure 3.9 also showed that more respondents would like to support ocean protection initiatives, take political action, and initiate new projects compared to what they are currently doing. The “Other” option captured “work” and “career” as other actions that respondents are currently doing.

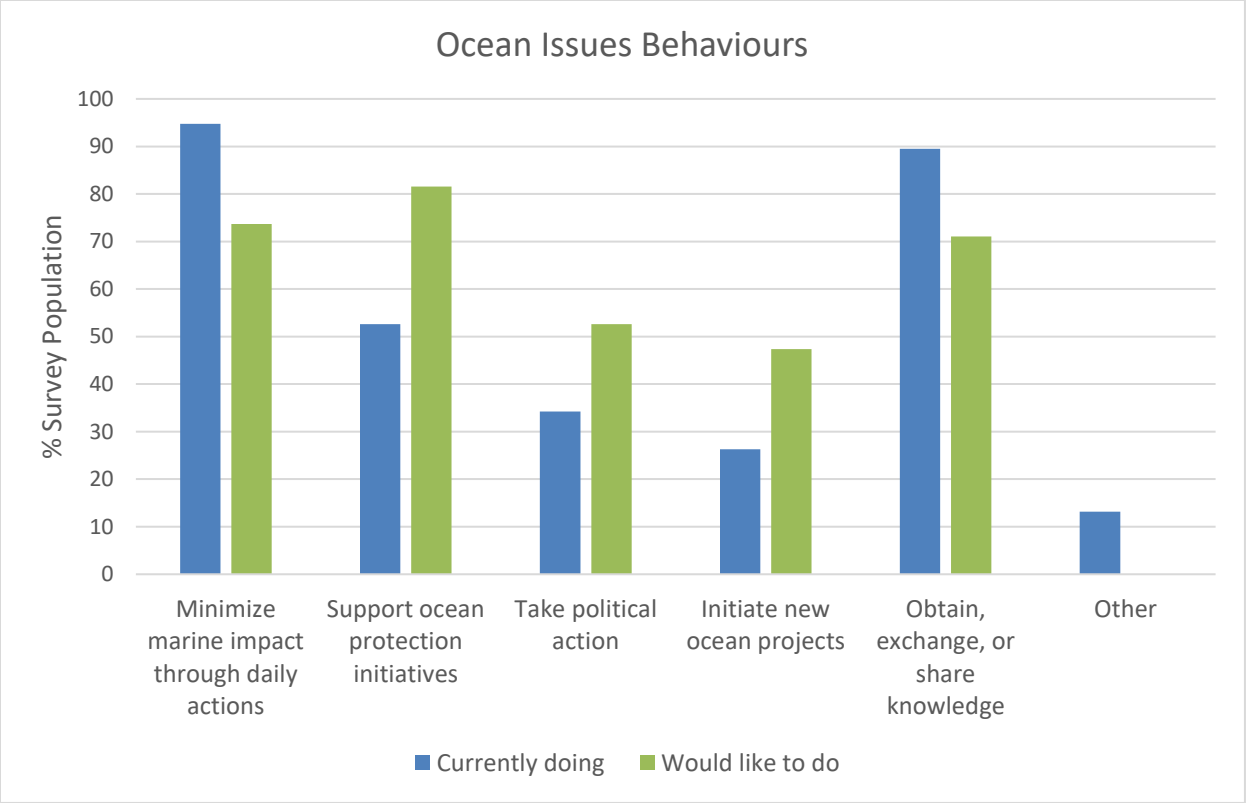

Figure 3.9: Different ocean behaviours currently performed (blue) or preferred (green) by respondents (Post-OWC Survey).

3.3.4.3 Barriers and Enablers

The respondents identified a median of 3 enables and 2 barriers for ocean actions. Access to information was identified as the biggest enabler (84.21%), followed by peer support (78.95%), governmental policy (52.63%), and financial support (42.1%). "Personal commitment" was also identified as an "Other" enabler. Conversely, lack of time was considered to be the biggest barrier (78.95%), followed by lack of sound governmental policy (50%), lack of financial support (47.37%), and habit (44.74%). "Empathy fatigue", "personal choice", and "lack of political mechanism to 'take ocean action'" were identified as "Other" barriers (Figure 3.10).

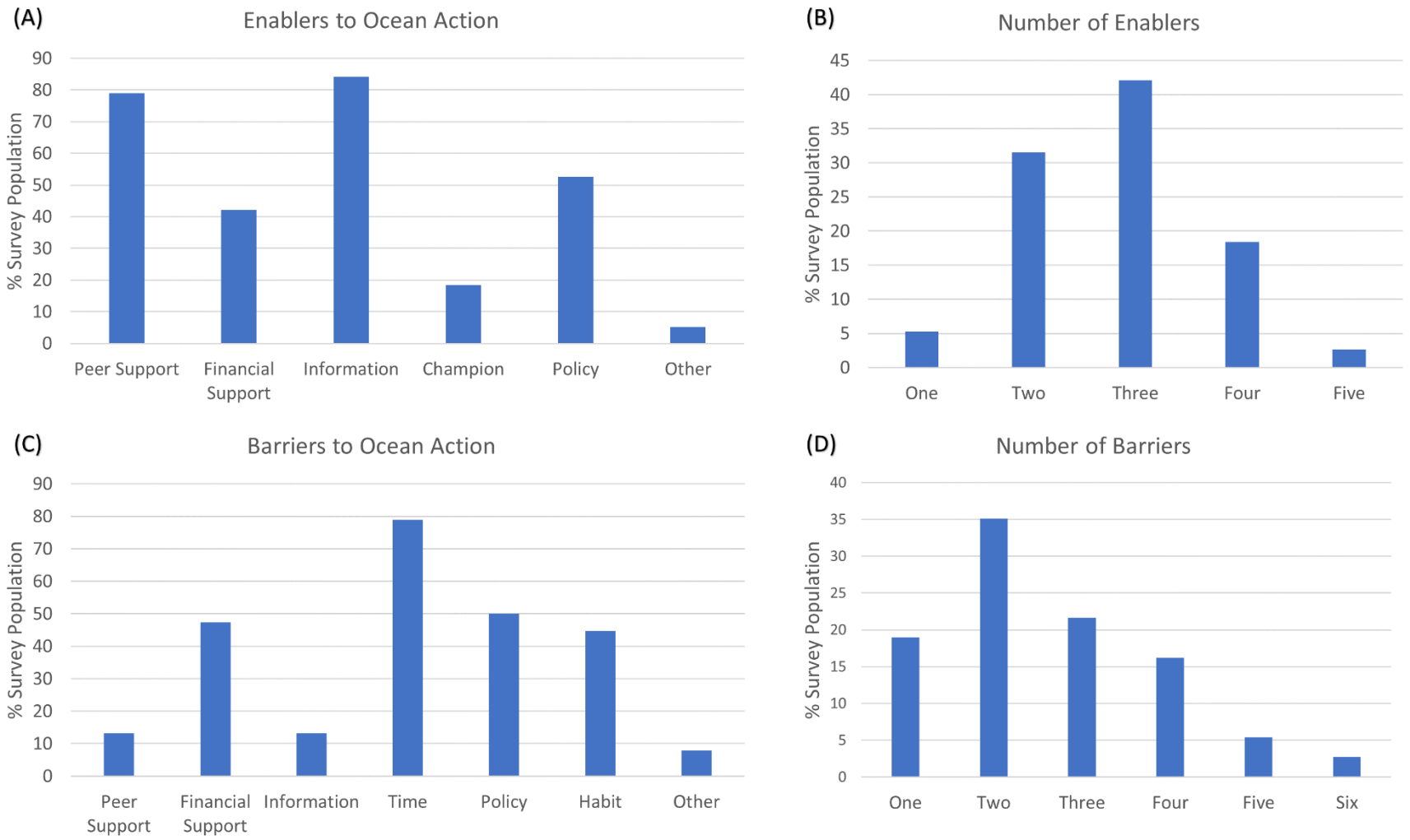

Figure 3.10: Enablers (A), barriers (C), number of enablers (B) and barriers (D) of ocean actions according to Post-OWC Survey's respondents.

3.3.5 Open-Ended Answers

While only 8 respondents provided answers for the open-ended question, they provided important qualitative insights to OWC and ocean literacy. These questions were qualitatively grouped as Connection and Recommendation.

3.3.5.1 Connection

The open-ended answers highlighted the importance of connection in fostering ocean literacy. Based on individual's responses of "*I very much like and appreciate the idea of ocean week. It recognizes our direct and indirect connections to the ocean ecosystem and the importance of sustainable practices in our daily lives to ensure the protection of it*" and "*it is very gratifying to see the implementation of Ocean Week Canada and the many ocean literacy events that take place annually across Canada and the planet, including the ongoing continued interest of the NGO [non-governmental organizations], academic, private and government sectors*," Ocean(s) Day/Week is indispensable to connect individuals from different sectors with the ocean.

The open-ended answers also highlighted the key role of OWC in fostering direct connections between humans and with nature. A couple of respondents indicated that, "*despite my passion for the ocean, I didn't really participate in OWC this week. I am more motivated to do experiential things in person, so the virtual nature of the event discouraged me from participating*," and "*I found I was less engaged this year with Ocean Week given the virtual nature of events due to the pandemic*." They underscore that the importance of in-person experiential learning which cannot be replaced by virtual engagements.

Finally, the respondents emphasized thatartistic expressions are also indispensable in fostering connections. A respondent wrote, "*my connection to the ocean is also enriched by the arts. I live far from the ocean, but I feel connected to it when I add coastal arts in my home and share homemade marine art pieces with my friends*." This answer illustrated that the arts would be crucial to help connecting the non-coastal population to the ocean.

3.3.5.2 Recommendations

While none of the open-ended answers provided directed recommendations to OWC or ocean literacy, they served as some key foundation blocks to the recommendations in Chapter 4.

3.4 Discussion

3.4.1 New Perspective on Ocean Education

As many ocean literacy efforts are currently guided by the seven principles of ocean literacy which focus predominantly on ocean science delivered using Western science (Schoedinger et al., 2005; Fauville et al., 2019), it was unsurprising that scientific knowledge was rated the highest of all knowledge categories in terms of relative interest. However, the interest in cultural, social, economic, and political knowledge with diverse worldviews illustrated the need for ocean education to move beyond the current science-centric approach and the need to embrace the interdisciplinary and intercultural need of ocean conservation (Kollmuss & Agyeman, 2002; Jefferson et al., 2015; Worm et al., 2021). This is further echoed by the ocean actions questions where 34.2% of respondents indicated that they are currently taking political action, but 52.6% of them would like to get involved politically. Further, the surveys have shown that policy is both an enabler and a barrier, which further illustrated the need for interdisciplinary knowledge to create comprehensive ocean policies that would balance sociocultural and economic needs with environmental protection (Jefferson et al., 2015; Stoll-Kleemann, 2019; Worm et al., 2021). A respondent further illustrated the need for multidisciplinary knowledge by writing "*I don't think addressing ocean literacy—at least in a purely scientific way—is the path to political action on ocean issues.*" As such, for individuals to participate meaningfully in ocean activism, an understanding of cultural, social, economic, and political knowledge is needed to ensure new policies are holistic and inclusive of all communities (Jefferson et al., 2015; Worm et al., 2021).

The surveys also demonstrated a need to move away from traditional authoritative education to more collaborative and collective learning (Stoll-Kleemann, 2019; Worm et al., 2021). While the surveys have illustrated formal education as the primary source of information, they have also demonstrated the importance of non-formal education, relationship, and media. Unlike formal education, other than delivering ocean knowledge, these three knowledge sources also tackle the disposition component of ocean literacy and encourage the sharing and exchange of knowledge (Worm et al., 2021). This horizontal exchange of ocean knowledge offers a unique opportunity to raise ocean literacy beyond a personal or individual level. An ocean literate individual could have ripple effects on the ocean literacy levels of their community by actively

exchanging knowledge and promoting ocean action (Stoll-Kleemann, 2019). However, it may also facilitate the propagation of misinformation. Considering a respondent indicated "*scattered resources make it hard to create better awareness*", centralized and reliable access to information is needed to promote information sharing. This collective learning approach can enhance the delivery of interdisciplinary and intercultural knowledge "to improving reconciliation efforts between Indigenous and settler societies" (COLC, 2021a, p. 6; Worm et al., 2021). This approach can further encourage the development of 'Two-Eyed Seeing', whereas the strength of Western science is combined with Indigenous knowledge for more holistic and robust education and management efforts (Bartlett et al., 2012; Reid et al., 2020).

3.4.2 Ocean Connection

"An understanding of the ocean's influence on you and your influence on the ocean" (Cava et al., 2005, p.5) is the definition of ocean literacy, but survey results indicated a disconnect of this interdependence between ocean and humans. While the respondents rated ocean health as being highly important and that they are highly aware of ocean issues, the extent to which respondents rated the interconnected impact of ocean health on their everyday activities and the potential impact of everyday activities on ocean sustainability were relatively low. This discrepancy can be attributed to the empathy fatigue of feeling "*so many problems in this world*" as one respondent indicated (Kollmuss & Agyeman, 2002; Stoll-Kleemann, 2019). Another respondent indicated "*pushing for individual lifestyle changes like lowering your 'carbon footprint' and reducing plastic waste can be a part of [sustainable ocean action], but only as part of a broader movement towards decarbonization and the elimination of harmful single-use plastics at the national and global level*," which illustrated the importance of both personal and collective action (Roth, 1991; Kollmuss & Agyeman, 2002; Jefferson et al., 2015; Ashley et al., 2019; Stoll-Kleemann, 2019).

The results of the surveys also demonstrated the important role of Ocean(s) Day/Week in fostering this connection. Based on survey results, respondents value the fun and networking opportunities offered by the celebration which further stresses the need for collective learning and ocean connections. Given that only 16.25% of respondents were past participants of Ocean(s) Day/Week, this annual celebration is expected to grow in the coming years, especially after COVID-19 pandemic health and safety restrictions are lifted. Several respondents indicated

that they were not as active during Ocean(s) Day/Week events this year as they prefer in-person events, which emphasizes the importance of personal connection with the ocean and the value of the "Grow Ocean Week Canada" action stream of the Strategy (Kellert, 1983; Kollmuss & Agyeman, 2002; Jefferson et al., 2015; Stoll-Kleemann, 2019; COLC, 2021a,b).

3.4.3 Ocean Week Sustainability

As mentioned in Chapter 3.1, Ocean Week Canada is a relatively new event. The movement from a day-long celebration to a week-, and in some cases, a month-long celebration serves to further highlight the importance of ocean sustainability in Canada (COLC, 2021a,b). However, the "Grow Ocean Week Canada" action stream should also consider the sustainability of lengthening this annual celebration. "Festivals are universal and occupy a special place in society and culture" (Getz et al., 2010, p.30), but they also accompany various logistical challenges and financial and human resource needs. As survey respondents identified empathy fatigue as one of the major barriers of ocean literacy, a prolonged celebration can turn this special celebration mundane while causing a potentially excessive burden on organizers, speakers, and participants. A multitude of factors could affect the response rate of the two surveys of this case study, but they offer a snapshot of potential risks to OWC. The pre-OWC survey was launched on June 7 to accompany the first OWC events; contrastingly, to account for the last Ocean(s) Week/Month events, the post-OWC survey was launched three weeks later on June 29. While it was not directly reflected on the number of respondents for each survey, the link for the pre-OWC survey received nearly four times the number of clicks compared to the post-OWC survey. This discrepancy illustrates the potential of participant fatigue and disengagement in an extended celebration. However, the author recognizes that this inference based on click numbers may be incorrect. Multiple factors, such as the potential perception of both surveys as being the same or the longer estimated survey completion time of the post-OWC survey, can also impact click rates.

3.4.4 Limitations and Next Steps

While this case study has demonstrated great growth potential in Ocean Week Canada, it also illustrated the potential of "preaching to the choir" (Jefferson et al., 2015; Stoll-Kleemann, 2019; Worm et al., 2021). Based on survey results, it was evident that most respondents are highly educated and are part of the existing ocean community. Due to the anonymous nature of

the surveys, the author was not able to determine whether the respondents were representative of the OWC participants' demographics. However, while survey demographics may have been affected by the distribution method, it should still have some level of representation of OWC participants. This demographical limit of OWC should be addressed for future events to reach a broader audience.

Financial support and time were identified as major barriers to ocean actions. Due to the survey priority of keeping the surveys as short as possible, the case study was not able to capture whether these barriers would correlate with individuals' sociodemographic status and accessibility (Kollmuss & Agyeman, 2002; Stoll-Kleemann, 2019). Based on survey methods and OWC event delivery, it is unlikely that individuals with limited access to the internet or blue space (i.e. rivers, lakes, and the ocean), or limited proficiency in English or French have participated in any OWC events (Haeffner et al., 2017; Kabisch, 2019). Therefore, accessibility should be considered a top priority in future OWC events to ensure the inclusive and equitable growth of ocean literacy in Canada (COLC, 2021a,b; Worm et al., 2021).

Due to time constraints and the case study's focus being testing the comprehensiveness of the Framework, only basic data visualization was completed. A more thorough analysis of the data with a larger sample size may reveal different ocean literacy priorities for different age groups or genders (Kollmuss & Agyeman, 2002). The differences caused by the generational gap and emotional sensitivity between the gender can guide future targeted ocean literacy efforts.

Finally, the initial two-survey design of the case study was meant to capture respondents that may not be interested in completing a long and extensive ocean literacy survey. This goal appears to have been achieved by the pre-OWC survey having a higher click rate. However, as multiple factors can influence the number of clicks to the survey link. It is worth exploring the effectiveness of the two-survey design in future research to determine whether the survey timing and/or length impact response rate and whether the benefits of the two-survey design would outweigh the additional efforts associated with survey design and distribution.

3.5 Case Study Summary

This Ocean Week Canada case study has illustrated the importance of the event in raising ocean literacy. The results provided a snapshot of ocean literacy deficiency areas in Canada. Based on the short surveys, it was identified that efforts should be put into raising economic and political ocean knowledge by incorporating different worldviews and diversity and inclusion principles. Ocean education needs to move away from an ocean knowledge deficit model and consider other dimensions of ocean literacy. As demonstrated by this case study, there is no shortage of knowledge on ocean solutions; instead, ocean literacy efforts need to also focus on establishing ocean connections and breaking down barriers to encourage sustainable ocean behaviours on all levels. These findings should be incorporated into the planning of future ocean events.

CHAPTER 4: CONCLUSION AND RECOMMENDATIONS

4.1 Ocean Literacy Framework and the Canadian Ocean Literacy Strategy

4.1.1 Outputs versus Outcomes

To meet the research objective of evaluating the effectiveness of ocean literacy initiatives, outputs and outcomes should both be considered. In the context of this research, output is defined as "direct products of ocean literacy initiatives," and outcome is "describable and measurable changes as a result of outputs" (Global Affairs Canada, 2017). To track changes in ocean literacy and the delivery of different action streams, the Canadian Ocean Literacy Strategy Implementation Plan has outlined various Key Performance Indicators (KPIs) for each action stream (COLC, 2021b). However, while outputs can be easily evaluated using the KPIs, outcomes are much more difficult to measure. The purpose of this research project is to develop a framework to help guide the systematic evaluation of ocean literacy outcomes.

Under the "Grow Ocean Week Canada" action stream, the KPIs of "annual # of OWC events and Canadian reach" and "# of cross-sectoral partnerships in organizing and supporting OWC events" (COLC, 2021b, p.10) are outputs of OWC. The third KPI of this action stream, "responses to a repeated poll…to see how Canadians' ocean perceptions and values have changed" (COLC, 2021b, p.10) attempts to measure the outcome of OWC, but it focuses on the overall impact of all COLC's initiatives on Canadians and does not generate meaningful feedback specific to OWC initiatives. As "excellent environmental education programs involve a cycle of continual improvement that includes the processes of design, delivery, evaluation, and redesign" (Thomson et al., 2010, p.10), the implementation of the Strategy needs a better evaluation tool to provide meaningful feedback for each action stream. These feedbacks would allow for the identification of strengths and weaknesses in ocean literacy efforts leading to subsequent improvements of these initiatives. As such, while the goal of this research is to systematically evaluate ocean literacy initiatives, subsequent sections of this research paper focus on the application and management recommendations based on the evaluation outcomes of the Framework and case study.

4.1.2 Application and Recommendations for the Strategy

The Strategy needs a more systematic way to provide feedback to the "Grow Ocean Week Canada" action stream. While the KPI of "repeated poll" can be effective in measuring the overall outcome of different COLC activities during a year, it will not provide specific feedback to OWC activities. Further, the "repeated poll" tracks changes in perceptions and values, which may not translate into sustainable ocean actions that are needed to tackle ocean issues. As discussed in Chapter 3, the surveys developed using the Framework from Chapter 2 were effective in providing meaningful insights into ocean literacy and feedback to ocean literacy initiatives. As the "Other" option in the surveys captured very few additional components and sub-components of ocean literacy, both the Framework and surveys were considered comprehensive in addressing different aspects of ocean literacy. The surveys identified the current OWC-engaged audience as being mostly highly educated young females while illustrating deficiencies in ocean education in delivering economic and political knowledge, the need for collaborative learning, and the importance of ocean connections. These areas might form the focus areas for OWC event planning in the coming years.

OWC can also serve as a unique platform for the implementation of the other action streams. The surveys highlighted lack of time, policy, and financial support as major barriers to ocean action and the need to attract non-ocean-engaged audiences during OWC. As interests in economic and political knowledge are rated relatively poorly compared to other knowledge types, the policy barrier can potentially be reduced or eliminated by facilitating meaningful dialogues between policymakers, industries, and civil society during OWC. These dialogues can promote the identification of strengths, weaknesses, threats, and opportunities (SWOT) of Canada's ocean policies for different stakeholders while meeting the Strategy's "improve government integration of water-ocean-climate literacy in policy & public engagement" (COLC, 2021, p.4) action stream. The demographical limits of OWC and the financial barrier can be addressed by the "establish the Canadian ocean literacy community microgrant program" and "evaluate and improve the current state of access and diversity within Canada's blue spaces & ocean-related sectors" (COLC, 2021b, p.4) action streams. Providing financial and logistical supports to less ocean-engaged communities to plan OWC events could be a crucial first step to establishing ocean connections and raising ocean literacy. For instance, based on the author's personal experience, an ocean literate individual may want to start a community ocean education

project, but do not have the experience or financial means for the project. The OWC and microgrants action teams can break down this barrier by providing financial and technical support to the individual in planning a targeted OWC event. In doing so, not only will the individual feel supported throughout the process, the small concrete goal of planning an event will have a much less emotional strain on the individual (Getz et al., 2010). Moreover, as the individual will have a good understanding of their community, the resultant OWC event would be tailored to their community demography to ensure diversity and accessibility. Subsequently, as discussed in Chapter 2.6, this single OWC event can rely on social networks to have a ripple effect on community-level ocean literacy and encourage other community-run ocean literacy initiatives. As such, the OWC action stream should be implemented in conjunction with other action streams of the Strategy. OWC events should focus on establishing connections and facilitating meaningful dialogues between different sectors, individuals, and the ocean while providing financial assistance to underserved communities to participate in OWC. Although this is not an exhaustive list of recommendations for OWC, these recommendations do serve as a guide to breaking down some systematic barriers to engage a broader audience during OWC. Finally, as demonstrated by this discussion, while the focus of this research was on the OWC action stream, the results can also be applied to other action streams of the Strategy.

The case study results indicated that the Framework could serve as a tool for the development of evaluation and feedback surveys for different action streams. Using the Framework as a guide, the OWC survey questions developed in Chapter 3 provided feedback on different aspects of ocean knowledge, disposition, skills, and behaviours while identifying barriers and enablers. This result shows that the Framework can serve as a guide for the action teams to consider different components of each ocean literacy dimension when designing ocean literacy initiatives and/or evaluation measures. As the Framework was developed based on multidisciplinary literature drawing on concepts including ocean, climate, and environmental literacy, citizenship, and stewardship, social marketing, psychology, and public perceptions, action teams will benefit from a holistic and interdisciplinary understanding of ocean literacy. Further, longitudinal surveys can aid in tracking changes in ocean literacy. However, as discussed in Chapter 3.4, having repeated surveys may lead to a lower response rate due to the perception of having previously completed the survey. Therefore, the author recommends for the

action teams to use the Framework and case study results as a guide to developing future surveys and to use a different survey title and/or wordings to each question.

4.2 Ocean Literacy and Marine Management

4.2.1 Links Between Ocean Literacy and Marine Management

There are multiple parallels between ocean literacy and marine management that are worth considering in future ocean literacy efforts. This research underscores the imperative for greater dialogue between the disciplines of marine management and ocean literacy studies.

4.2.1.1 Integration

The need for integration is a common theme between marine management and ocean literacy. Integrated coastal zone management (ICZM) "uses the informed participation and cooperation of all stakeholders…to balance environmental, economic, social, cultural and recreational objectives…[using] the integration of the many instruments…[at] all relevant policy areas, sectors, and levels of administration…in both time and space" (European Environment Agency, 2000). Similarly, Marine Spatial Planning (MSP) is defined as "a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process" (Ehler & Douvere, 2009, p.1). Based on these definitions, marine management integrates governmental levels, agencies, sectors, disciplines, and instruments. Similarly, this research has illustrated the need to move beyond the natural science-centric model and integrate multidisciplinary knowledge, diverse worldviews and tools in ocean literacy efforts (Kollmuss & Agyeman, 2002; Fauville et al., 2019; McKinley et al., 2020; Worm et al., 2021). Further, instead of considering each of ocean literacy's dimensions as being independent, ocean literacy efforts should be evaluated using integrated methods such as the Framework and surveys developed in this research. The survey respondents of this project also highlighted the need for integrated access to reliable ocean knowledge to facilitate ocean conservation and encourage sustainable ocean actions. Both findings demonstrate the need to utilize multiple instruments as outlined by ICZM. Similarly, both ocean literacy and marine management should integrate accessibility, diversity, equity, and inclusion principles to ensure that different knowledge systems, cultures, and sociodemographic groups are considered in all ocean literacy and

management efforts (UNESCO-IOC, 2021; Worm et al., 2021). Finally, based on the literature review in Chapter 2, it was evident that ocean literacy research to date has had a rather limited scope and should integrate concepts of marine citizenship, stewardship, social marketing, psychology, and public perceptions (McKinley & Burdon, 2020).

4.2.1.2 Adaptability

Adaptive management is the foundation of successful marine management under environmental change (Holling, 1989). Adaptive management involves constant evaluation feedback to adjust management actions (Holling, 1989). The same concept should be applied to ocean literacy efforts. The Strategy has set the stage for evaluation with the annual "repeated polls" to measure changes in ocean literacy (COLC, 2021b). However, as outlined in Chapter 4.1, it did not include the provision for regular feedback for each action stream to improve and enhance their delivery and reach in subsequent years (COLC, 2021b). Similarly, much ocean literacy research is based on one-off surveys with limited management recommendations for future ocean literacy initiatives (McKinley & Burdon, 2020). Therefore, instead of simply tracking outputs and outcomes of ocean education (Thomson et al. 2010), the author recommends ocean educators adopt the concept of "adaptive management" and regularly evaluate the ocean literacy initiatives and adaptively update content and delivery methods to fill remaining gaps in ocean literacy.

The COVID-19 pandemic serves as a great example of adaptive management. Due to health and safety restrictions, education and engagement have shifted to virtual settings, where technology such as video conferencing, interactive books and websites have emerged to help support ocean education and events. With the gradual lift of health restrictions, educators and researchers are in a unique position to conduct a SWOT analysis of both in-person and virtual education. While there is no replacement for direct interaction with nature to foster emotional connections (Kellert, 1983; Worm et al., 2021), virtual events allow for a wider international audience and engage individuals with no local access to ocean education. As such, a thorough SWOT analysis can help guide the planning and implementation of ocean literacy initiatives to determine whether a hybrid model would be the most suitable for future initiatives.

4.2.1.3 Collaboration

Another parallel between ocean literacy and marine management is collaboration. Based on the definition in Chapter 4.3.1.1, MSP is participatory by actively involving stakeholders interactively and democratically to plan and balance human uses with environmental conservation (Ehler & Douvere, 2009; Frazão Santos et al., 2019). Similarly, this research found that ocean education needs to occur at all levels to increase ocean literacy (Santoro et al. 2017; Ryabinin et al. 2019; Claudet et al. 2020). As illustrated by the Framework, while it is imperative for curricula to include the ocean as a study topic, it is also crucial to equip educators with the necessary knowledge or tools to deliver ocean education (Santoro et al. 2017; Gough 2017). Other than increasing ocean literacy through authoritative means, this research also highlighted the importance of collaborative and collective learning through the sharing and exchanging of knowledge, stories, and other media to foster ocean connections beyond ocean knowledge (Worm et al., 2021). Therefore, collaboration is the cornerstone in both ocean literacy and marine management.

4.2.2 Challenging the Status Quo

With the continued exacerbation of ocean issues, it is evident that the status quo of ocean education and policy is insufficient to solve this global issue. The survey respondents in Chapter 3 illustrated that having sound policies can be a great enabler to ocean action, whereas the lack of these policies can be a major barrier. As ocean policies are created by marine managers and based on the parallels between ocean literacy and marine management, the author recommends the integration of these two seemingly separate disciplines. On one hand, policymakers can benefit from having a knowledge base of diverse ocean-related disciplines, an understanding of different channels to disseminate policy information and engaging with different audiences. On the other hand, educators, researchers, and civil society can also benefit from an increase in political knowledge, be actively involved in policy development, and feel greater ownership and empowerment by the policies. Using ocean literacy efforts and concepts to foster citizen engagement in policymaking can ensure that the resultant ocean policies are equitable and holistic in reflecting socio-cultural and economic needs while achieving conservation objectives (Ehler & Douvere, 2009; Bennett et al., 2021). As such, the author recommends “challenge the status quo” of viewing marine management and ocean literacy as two distinct disciplines, and for the integration of marine management and ocean literacy. Marine managers should adopt ocean

literacy concepts to encourage citizen engagement and create more representative and holistic policies; ocean educators should adopt integrated, adaptive, and collaborative marine management concepts to empower individuals with the political knowledge needed to engage in meaningful action while adaptively improving the ocean literacy initiatives.

4.3 Global Application and Recommendations for the Ocean Decade

A review of the implementation plan of the Ocean Decade illustrated strong synergies between the above-mentioned recommendations and the Ocean Decade's goals. The Ocean Decade champions the collaboration between natural and social sciences, the inclusion of diverse knowledge systems, and the integration of science and policy at all levels while promoting co-design and co-delivery of solutions and adhering to diversity and inclusion principles (UNESCO-IOC, 2021). These goals have also been recommended throughout this research project. The implementation plan of the Ocean Decade also states, "ocean literacy will play a key role in promoting sound public marine policy, fostering more responsible behaviours, encouraging more ocean-aware corporate practices and stimulating young people to start a career in the sustainable ocean economy, ocean science, marine policy or ocean conservation and management" (UNESCO-IOC, 2021, p.32). This projection of ocean literacy playing a key role in marine policy during the Ocean Decade further reinforces the need to consider ocean literacy and marine management in conjunction with each other.

The Ocean Decade implementation plan also outlines the need to "increas[e] research, monitoring and evaluation of the impacts of ocean literacy" (UNESCO-IOC, 2021, p.32). However, while other targets of the Ocean Decade, such as protecting 30 percent of the world's ocean by 2030 and supporting the development of innovative ocean technology (UNESCO-IOC, 2021; Fisheries and Oceans Canada, 2021), can be easily evaluated, the social science aspect of ocean literacy is difficult to assess. This challenge was outlined by this project's research question: "what is a multi-dimensional framework that can be used to guide the development and evaluation of different initiatives in raising ocean literacy?" While this research has illustrated the complex nature of ocean literacy, it has also highlighted a potential solution to systematically evaluate ocean literacy. Although the Framework was developed to guide the implementation of the Strategy, it is not specific to the Strategy or Canada. The Framework was developed based on

a review of multidisciplinary international literature and could be applied to any ocean literacy efforts. The surveys used in Chapter 3 also demonstrated that anonymous online surveys created and distributed using free online tools were effective in identifying areas of improvement of different ocean literacy initiatives. Currently, ocean literacy research is commonly based upon interviews and/or questionnaires that are long or expensive (Szczytko et al., 2019; Fauville et al., 2019; McKinley & Burdon, 2020). There were limitations with the distribution methods of this research, but the open-ended answers, cost-effectiveness, and efficiency of this project's surveys in generating a large amount of valuable data should be considered in future ocean literacy research.

Current ocean literacy research often considered the different dimensions of ocean literacy as distinct entities (Brennan et al., 2019; COLC, 2021a,b). As demonstrated throughout this research project, the dimensions are highly interconnected and interdependent and should be evaluated in conjunction with each other to encourage sustainable ocean actions (Kollmuss & Agyeman, 2002; Hollweg et al., 2011; Szczytko et al., 2019). In this respect, this compilation of different components and sub-components of ocean literacy dimensions using interdisciplinary literature can serve as a guide to evaluate ocean literacy efforts. As such, the author recommends for educators and researchers refer to the Framework when designing or evaluating ocean literacy initiatives. In doing so, they can quickly and systematically identify areas of ocean literacy that should be considered in their initiatives with future efforts.

The evaluation of ocean literacy successes during the Ocean Decade should consider both outputs and outcomes of the initiatives. As discussed in Chapter 4.1, outputs can be easily evaluated using indicator numbers, such as the number of educational events and people reached, but the evaluation of outcomes, such as meaningful engagement and change in ocean literacy level, is difficult to achieve. As such, the longitudinal application of the Framework offers a systematic way to evaluate changes in ocean knowledge, disposition, skills, and behaviour, while providing feedback to the initiatives. For instance, respondents in this study rated their interests in ocean political knowledge as relatively low. If ocean literacy efforts in the coming months focus on creating meaningful dialogues between policymakers and the civil society leading to the same respondents giving a higher rating to their interest in political knowledge, then the initiative should be considered a success. In this example, beyond examining the changes in the

knowledge dimension, a longitudinal change in interest rating can also reflect the change in disposition towards ocean policies and the perceptions of them being either barriers or enablers to ocean actions. This example further highlights this project's recommendation to view ocean literacy as interactive, instead of distinctive, dimensions.

4.4 Conclusion

Ocean literacy is a key pillar of the UN Decade of Ocean Science. Based on an interdisciplinary literature review, while referencing the Canadian Ocean Literacy Strategy, a new ocean literacy framework was created to demonstrate the complexities and connections of ocean knowledge, disposition, skills, and behaviour. The Framework also broke these four dimensions of ocean literacy into components and sub-components which can be used as a guide to create survey questions to evaluate ocean literacy initiatives. Using the Framework as a guidance tool, two surveys were created for Ocean Week Canada as a case study to apply aspects of the Framework in evaluating the event outcomes. The survey results demonstrated that other than measuring the respondents' multi-dimensional ocean literacy levels, the surveys were effective in identifying areas of improvement for future ocean literacy initiatives. Ocean education should focus on delivering multidisciplinary knowledge that incorporates diverse worldviews. Due to parallels of this research to marine management, the author recommended for marine managers and ocean literacy researchers to increase dialogues between their disciplines to foster active citizen engagement in the development of ocean policies and enhance their ocean knowledge. Further, the author recommends for ocean literacy researchers use the Framework as a guidance tool to develop surveys that can systematically evaluate changes in ocean literacy over time while providing feedback to ocean literacy initiatives. As there were strong synergies between the Strategy and the Framework, the Framework would be particularly useful to guide the implementation of the Strategy. Finally, the author recommends for ocean literacy initiatives to use an adaptive, collaborative, and integrated approach to ocean education to ensure that they are accessible, diverse, equitable, and inclusive in creating an ocean literate community.

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APPENDICES

Appendix A: Ocean Week Canada Pilot Survey Questions

Introduction

The Ocean Week Canada Pilot Survey accompanies events taking place during Ocean Week Canada 2021 (June 7 – 11). This short research survey is led by Dalhousie University graduate student Lisa Chen, supported by Dr. Boris Worm at the Ocean Frontier Institute in partnership with Dr. Lisa (Diz) Glithero of the Canadian Ocean Literacy Coalition. It will take less than 5 minutes to complete. Thank you for participating in this research!

L'enquête pilote de la Semaine de l'océan Canada accompagne les événements qui se déroulent pendant la Semaine de l'océan Canada 2021 (du 7 au 11 juin). Cette courte enquête est menée par Lisa Chen, une candidate à la Maîtrise en gestion marine à l'Université Dalhousie, soutenue par Boris Worm du Ocean Frontier Institute, en partenariat avec Lisa (Diz) Glithero de la Coalition canadienne de la connaissance de l'océan. Il vous faudra moins de 5 minutes pour le remplir. Merci de participer à cette recherche !

Would you like to read more about the study? | Vous souhaitez en savoir plus sur l'étude ?

- ☐ Yes | Oui
- ☐ No, let's start survey | Non, commençons l'enquête

Survey Information | Informations sur l'enquête

Project/Projet: Developing a Canadian Ocean Literacy Evaluation Framework/Développement d'un cadre canadien d'évaluation de la connaissance de l'océan

Overview and Purpose of the Project/Aperçu et objectif du projet

You are invited to take part in a research study being conducted by Lisa Chen, a graduate student in Marine Affairs at Dalhousie University under the supervision of Dr. Boris Worm and Dr. Jerry Bannister. The purpose of this research is to assess an ocean literacy evaluation framework developed as part of Lisa's graduate project by using Ocean Week Canada as a case

study. You can participate in this research if you are 18 years of age or older and have participated in any Ocean Week Canada 2021 activities. / Vous êtes invité à participer à une recherche menée par Lisa Chen, une étudiante à la Maîtrise dans le programme *Marine Affairs* à l'Université Dalhousie, sous la supervision de Boris Worm et Jerry Bannister. L'objectif de cette recherche est de créer un cadre d'évaluation de la connaissance de l'océan élaboré dans le cadre du projet d'études supérieures de Lisa en utilisant la Semaine de l'océan Canada comme étude de cas. Vous pouvez participer à cette recherche si vous êtes âgé de 18 ans ou plus et si vous avez participé à l'une des activités de la Semaine de l'océan Canada 2021.

The study is funded through the laboratory of Dr. Boris Worm. / L'étude est financée par le laboratoire de Boris Worm.

What you will be asked to do / Ce que l'on vous demandera de faire

If you choose to participate in this research, you will be asked to answer a series of questions measuring the different dimensions of ocean literacy. The survey should take approximately 10-15 minutes. / Si vous choisissez de participer à cette recherche, il vous sera demandé de répondre à une série de questions mesurant les différentes dimensions de la connaissance de l'océan. L'enquête devrait prendre environ 10 à 15 minutes.

Your participation in this research is entirely voluntary. You do not have to answer questions that you do not want to answer. You are welcome to stop the survey at any time if you no longer want to participate by submitting an incomplete survey or by closing your internet browser. Incomplete surveys may also be included in the analyses. As surveys are completed anonymously, the researcher will not be able to withdraw your survey as she will not know which responses are yours. / Votre participation à cette recherche est entièrement volontaire. Vous n'êtes pas obligé de répondre aux questions auxquelles vous ne voulez pas répondre. Vous pouvez interrompre l'enquête à tout moment si vous ne souhaitez plus y participer en soumettant une enquête incomplète ou en fermant votre navigateur Internet. Les enquêtes incomplètes peuvent également être incluses dans les analyses. Comme les enquêtes sont remplies de manière anonyme, la chercheuse ne pourra pas retirer votre enquête car elle ne saura pas quelles réponses sont les vôtres.

Confidentiality / Confidentialité

Your responses to the survey will be anonymous. This means that there will be no questions in the survey that asks for identifying details such as your name or email address. All responses will be saved on a secure Dalhousie server. / Vos réponses à l'enquête seront anonymes. Cela signifie qu'aucune question de l'enquête ne demandera de détails permettant de vous identifier, comme votre nom ou votre adresse électronique. Toutes les réponses seront enregistrées sur un serveur Dalhousie sécurisé.

Data Use / Utilisation des données

The results of our findings through this research will be shared during the Sustainable Ocean Conference 2021, Making Waves 2021, as well as in writing as a thesis and possible a journal article. Due to the anonymous nature of the study, you will not be identified during any form of dissemination of results, but your quotes may be used and identified using codenames. / Les résultats de cette recherche seront partagés lors de la Sustainable Ocean Conference 2021, Making Waves 2021, ainsi que sous forme de thèse et éventuellement d'article de journal. En raison de la nature anonyme de l'étude, vous ne serez pas identifié lors de la diffusion des résultats, mais vos citations pourront être utilisées et identifiées à l'aide de noms de code.

Risks / Risques

The risks associated with this study are minimal and are no greater than those you encounter in your everyday life. / Les risques associés à cette étude sont minimes et ne sont pas supérieurs à ceux que vous rencontrez dans votre vie quotidienne.

Benefits / Avantages

There will be no direct benefit to you in participating in this research. The research, however, might contribute to new knowledge on evaluating ocean literacy in Canada and how Ocean Week Canada programming can aid in increasing ocean literacy. If you would like to see how your information is used, please feel free to visit the Dalhousie University 'DalSpace' website [https://dalspace.library.dal.ca/handle/10222/13001] after February 2022. / Vous ne tirerez aucun avantage direct de votre participation à cette recherche. Cependant, la recherche

pourrait contribuer à l'acquisition de nouvelles connaissances sur l'évaluation de la connaissance de l'océan au Canada et sur la façon dont la programmation de la Semaine de l'océan peut Canada aider à accroître la connaissance de l'océan. Si vous voulez savoir comment vos renseignements sont utilisés, n'hésitez pas à visiter le site Web DalSpace de l'Université Dalhousie [https://dalspace.library.dal.ca/handle/10222/13001] après février 2022.

Questions

Please contact the primary researcher, Lisa Chen, who can answer any questions that you may have about the study or your participation in it. She can be reached at your convenience at lisa.chen@dal.ca. You can also contact the Marine Affairs Program Research Ethics Review Standing Committee, Dalhousie University, by email at marine.affairs@dal.ca (and reference MAPERSC file # 2021-01). / Veuillez contacter la chercheuse principale, Lisa Chen, qui pourra répondre à toutes vos questions concernant l'étude ou votre participation à celle-ci. Vous pouvez la joindre à votre convenance à l'adresse suivante lisa.chen@dal.ca. Vous pouvez également le Comité permanent d'examen de l'éthique en recherche du programme *Marine Affairs* à l'Université Dalhousie, par courriel à marine.affairs@dal.ca (et mentionner le numéro de dossier MAPERSC 2021-01).

Would you like to complete the survey? | Souhaitez-vous répondre à l'enquête ?

☐ Yes | Oui ☐ No | Non

Survey Questions | Questions de l'enquête

Age / âge

☐ Under 30 / moins de 30 ans ☐ 30-65 ☐ Over 65 / 65 ans ou plus

In what capacity are you participating? | À quel titre participez-vous ?

☐ Individual | Individuel

☐ Family | Famille

☐ Classroom / School | Salle de classe / école

☐ Other (please explain) | Autre (veuillez expliquer)

Which province or territory are you joining from? / À partir de quelle province ou territoire vous vous joignez?

- ☐ Alberta
- ☐ British Columbia / Colombie-britannique
- ☐ Manitoba
- ☐ New Brunswick / Nouveau-Brunswick
- ☐ Newfoundland and Labrador / Terre Neuve et Labrador
- ☐ Northwest Territories / Territoires du Nord-Ouest
- ☐ Nova Scotia / Nouvelle-Écosse
- ☐ Nunavut
- ☐ Ontario
- ☐ Prince Edward Island / Île-du-Prince-Édouard
- ☐ Quebec / Québec
- ☐ Saskatchewan
- ☐ Yukon

Do you live within 100 km of the coast? / Habitez-vous à moins de 100 km de la côte ?

☐ Yes / Oui ☐ No / Non

What is the name of the event you are attending? / Quel est le nom de l'événement auquel vous participez ? _____

Have you participated in any World Ocean(s) Day (or 'Ocean Week') events before this year? / Avez-vous déjà participé à des événements dans le cadre de la Journée mondiale de(s) (l')océan(s) (ou de la "Semaine de l'océan") cette année ?

☐ Yes / Oui ☐ No / Non

What is your motivation for participating in this event? (Check all that apply) / Qu'est-ce qui motive votre participation à cet événement ? (Cochez toutes les cases qui s'appliquent) [Motivation/Emotional Connection]

- ☐ Personal interest / Intérêt personnel
- ☐ Past participant / Ancien participant
- ☐ Friends/Family are participating / Amis/Famille participent
- ☐ Networking / Réseautage
- ☐ Ocean connection / Connexion à l'océan
- ☐ Other (please explain) / Autre (veuillez expliquer):

What are you hoping to gain by participating in this event? (Check all that apply) / Qu'espérez-vous obtenir en participant à cet événement ? (Cochez toutes les cases qui s'appliquent)

- ☐ To learn more about the ocean | Pour en savoir plus sur l'océan
- ☐ Daily actions that can help with ocean conservation / Des actions quotidiennes qui peuvent contribuer à la conservation de(s) (l')océan(s)
- ☐ To network with others doing ocean-related work | Pour créer un réseau avec d'autres personnes travaillant dans le domaine de l'océan
- ☐ Finding new volunteer opportunities / Trouver de nouvelles opportunités de bénévolat
- ☐ Have fun / S'amuser
- ☐ Other (please explain) / Autre (veuillez expliquer):

(OPTIONAL) If you would like contribute to a 10-15-minute Ocean Week Canada Follow-up survey, please enter your email below. Your email will be kept confidentially on a secured Dalhousie server and will only be used to distribute the post-Ocean Week Canada survey. It will not be shared with any organizations and will be erased after distributing the survey. If you change your mind, please discard our follow-up Email. / (FACULTATIF) Si vous souhaitez être contacté pour un sondage de 10-15 minutes après la Semaine de l'océan Canada, veuillez inscrire votre courriel ci-dessous. Votre courriel sera conservé de façon confidentielle sur un serveur sécurisé de Dalhousie et ne sera utilisé que

pour distribuer le sondage post-Semaine de l'océan Canada. Il ne sera partagé avec aucune organisation et sera effacé de nos ordinateurs et serveurs après la distribution du sondage. Si vous changez d'avis, veuillez ne pas tenir compte de notre courriel de suivi.

Thank you for participating in the survey! | Merci de participer à l'enquête!

Your response will help better understand the development of an ocean literacy evaluation framework. | Votre réponse nous aidera à mieux comprendre l'élaboration d'un cadre d'évaluation de la connaissance de l’océan.

If you would like to learn about the study, please contact the primary researcher, Lisa Chen, at lisa.chen@dal.ca. | Si vous souhaitez en savoir plus sur cette étude, veuillez contacter la chercheuse principale, Lisa Chen, à l'adresse lisa.chen@dal.ca.

Appendix B : Ocean Week Canada Pilot Follow-Up Survey Questions

Introduction

The Ocean Week Canada Pilot Follow-Up Survey polls any interested participant of Ocean Week Canada 2021 (June 7 – 11). This short research survey is led by Dalhousie University graduate student Lisa Chen, supported by Dr. Boris Worm at the Ocean Frontier Institute in partnership with Dr. Lisa (Diz) Glithero of the Canadian Ocean Literacy Coalition. It will take approximately 10-12 minutes to complete. Thank you for participating in this research!

L'enquête pilote de suivi de la Semaine de l'océan au Canada s'adresse à tout participant intéressé par la Semaine de l'océan Canada 2021 (du 7 au 11 juin). Cette courte enquête de recherche est menée par Lisa Chen, étudiante à la maîtrise de l'Université Dalhousie, soutenue par Boris Worm de l'Ocean Frontier Institute, en partenariat avec Lisa (Diz) Glithero de la Coalition canadienne de la connaissance de l'océan. Il vous faudra environ 10 à 12 minutes pour le remplir. Merci de participer à cette recherche !

Would you like to read more about the study? | Vous souhaitez en savoir plus sur l'étude ?

- ☐ Yes | Oui
- ☐ No, let's start survey | Non, commençons l'enquête

Survey Information | Informations sur l'enquête

Project | Projet: Developing a Canadian Ocean Literacy Evaluation Framework | Développement d'un cadre canadien d'évaluation de la connaissance de l'océan

Overview and Purpose of the Project | Aperçu et objectif du projet

You are invited to take part in a research study being conducted by Lisa Chen, a graduate student in Marine Affairs at Dalhousie University under the supervision of Dr. Boris Worm and Dr. Jerry Bannister. The purpose of this research is to assess an initial ocean literacy evaluation framework developed as part of Lisa's graduate project by using Ocean Week Canada as a case study. You can participate in this research if you are 18 years of age or older and have participated in any Ocean Week Canada 2021 activities. | Vous êtes invité à participer à une

recherche menée par Lisa Chen, une étudiante à la maîtrise dans le programme *Marine Affairs* à l'Université Dalhousie, sous la supervision de Boris Worm et Jerry Bannister. L'objectif de cette recherche est de créer un cadre d'évaluation de la connaissance de l'océan élaboré dans le cadre du projet d'études supérieures de Lisa en utilisant la Semaine de l'océan Canada comme étude de cas. Vous pouvez participer à cette recherche si vous êtes âgé de 18 ans ou plus et si vous avez participé à l'une des activités de la Semaine de l'océan Canada 2021.

The study is funded through the laboratory of Dr. Boris Worm. | L'étude est financée par le laboratoire de Boris Worm.

What you will be asked to do | Ce que l'on vous demandera de faire

If you choose to participate in this research, you will be asked to answer a series of questions measuring the different dimensions of ocean literacy. | Si vous choisissez de participer à cette recherche, il vous sera demandé de répondre à une série de questions mesurant les différentes dimensions de la connaissance de l'océan.

Your participation in this research is entirely voluntary. You do not have to answer questions that you do not want to answer. You are welcome to stop the survey at any time if you no longer want to participate by submitting an incomplete survey or by closing your internet browser. Incomplete surveys may also be included in the analyses. As surveys are completed anonymously, the researcher will not be able to withdraw your survey as she will not know which responses are yours. | Votre participation à cette recherche est entièrement volontaire. Vous n'êtes pas obligé de répondre aux questions auxquelles vous ne voulez pas répondre. Vous pouvez interrompre l'enquête à tout moment si vous ne souhaitez plus y participer en soumettant une enquête incomplète ou en fermant votre navigateur Internet. Les enquêtes incomplètes peuvent également être incluses dans les analyses. Comme les enquêtes sont remplies de manière anonyme, la chercheuse ne pourra pas retirer votre enquête car elle ne saura pas quelles réponses sont les vôtres.

Confidentiality | Confidentialité

Your responses to the survey will be anonymous. This means that there will be no questions in the survey that asks for identifying details such as your name or email address. All responses will be saved on a secure Dalhousie server. | Vos réponses à l'enquête seront anonymes. Cela signifie qu'aucune question de l'enquête ne demandera de détails permettant de vous identifier, comme votre nom ou votre adresse électronique. Toutes les réponses seront enregistrées sur un serveur Dalhousie sécurisé.

Data Use | Utilisation des données

The results of our findings through this research will be shared during the Sustainable Ocean Conference 2021, Making Waves 2021, as well as in writing as a thesis and possible a journal article. Due to the anonymous nature of the study, you will not be identified during any form of dissemination of results, but your quotes may be used and identified using codenames. | Les résultats de cette recherche seront partagés lors de la Sustainable Ocean Conference 2021, Making Waves 2021, ainsi que sous forme de mémoire et éventuellement d'article de journal. En raison de la nature anonyme de l'étude, vous ne serez pas identifié lors de la diffusion des résultats, mais vos citations pourront être utilisées et identifiées à l'aide de noms de code.

Risks | Risques

The risks associated with this study are minimal and are no greater than those you encounter in your everyday life. | Les risques associés à cette étude sont minimes et ne sont pas supérieurs à ceux que vous rencontrez dans votre vie quotidienne.

Benefits | Avantages

There will be no direct benefit to you in participating in this research. The research, however, might contribute to new knowledge on evaluating ocean literacy in Canada and how Ocean Week Canada programming can aid in increasing ocean literacy. If you would like to see how your information is used, please feel free to visit the Dalhousie University 'DalSpace' website [https://dalspace.library.dal.ca/handle/10222/13001] after February 2022. | Vous ne tirerez aucun avantage direct de votre participation à cette recherche. Cependant, la recherche

pourrait contribuer à l'acquisition de nouvelles connaissances sur l'évaluation de la connaissance de l'océan au Canada et sur la façon dont la programmation de la Semaine de l'océan Canada peut aider à accroître la connaissance de l'océan. Si vous voulez savoir comment vos renseignements sont utilisés, n'hésitez pas à visiter le site Web DalSpace de l'Université Dalhousie [https://dalspace.library.dal.ca/handle/10222/13001] après février 2022.

Questions

Please contact the primary researcher, Lisa Chen, who can answer any questions that you may have about the study or your participation in it. She can be reached at your convenience at lisa.chen@dal.ca. You can also contact the Marine Affairs Program Research Ethics Review Standing Committee, Dalhousie University, by email at marine.affairs@dal.ca (and reference MAPERSC file # 2021-01). | Veuillez contacter la chercheuse principale, Lisa Chen, qui pourra répondre à toutes vos questions concernant l'étude ou votre participation à celle-ci. Vous pouvez la joindre à l'adresse lisa.chen@dal.ca. Vous pouvez également contacter le Comité permanent d'examen de l'éthique en recherche du programme *Marine Affairs* à l'Université Dalhousie par courriel à marine.affairs@dal.ca (et mentionner le numéro de dossier MAPERSC 2021-01).

Would you like to complete the survey? | Souhaitez-vous répondre à l'enquête ?

☐ Yes | Oui ☐ No | Non

Section 1 Demographic | Démographie:

Age | Âge [Demographic]

☐ Under 30 | moins de 30 ans ☐ 30-65 ☐ Over 65 | 65 ans ou plus

Gender | Genre [Demographic]

☐ Male | Homme ☐ Female| Femme ☐ Non-Binary | Non-Binaire ☐ Other | Autre

Which province or territory are you joining from? | À partir de quelle province ou territoire vous vous joignez? [Demographic]

- ☐ Alberta
- ☐ British Columbia | Colombie-Britannique
- ☐ Manitoba
- ☐ New Brunswick / Nouveau-Brunswick
- ☐ Newfoundland and Labrador | Terre Neuve et Labrador
- ☐ Northwest Territories | Territoires du Nord-Ouest
- ☐ Nova Scotia | Nouvelle-Écosse
- ☐ Nunavut
- ☐ Ontario
- ☐ Prince Edward Island | Île-du-Prince-Édouard
- ☐ Quebec | Québec
- ☐ Saskatchewan
- ☐ Yukon

Do you live within 100 km of the coast? | Habitez-vous dans un rayon de 100 km du littoral ? [Demographic]

☐ Yes | Oui ☐ No | Non

What is your highest level of education? | Quel est votre plus haut niveau d'éducation ? [Demographic]

- ☐ High School | L'école secondaire
- ☐ Undergraduate| Premier cycle universitaire
- ☐ Graduate | Cycles supérieurs
- ☐ Other (please explain) | Autre (veuillez expliquer):

Have you participated in any World Ocean(s) Day (or 'Ocean Week') events before this year? | Avez-vous déjà participé à des événements dans le cadre de la Journée mondiale de(s) (l')océan(s) (ou de la "Semaine de l'océan") avant cette année ? [Demographic]

☐ Yes | Oui ☐ No | Non

Did you complete the short Ocean Week Canada Pilot Survey? | Avez-vous répondu à la courte enquête pilote de la Semaine de l'océan Canada ? [Demographic]

☐ Yes | Oui ☐ No | Non ☐ Unsure | Incertain

What type of World Ocean(s) Day (or 'Ocean Week') events did you participate in this year? (Check all that apply) | À quels types d'événements de la Journée mondiale de l'océan (ou de la "Semaine de l'océan") avez-vous participé cette année ? (Cochez toutes les cases qui s'appliquent) [Demographic]

- ☐ Online webinar / presentation| Webinaire / présentation
- ☐ Online social events (networking, concert, movie screening, trivia, etc.) | Événements sociaux en ligne (réseautage, concert, projection de film, trivia, etc.)
- ☐ Outdoor activities (kayaking, paddleboarding, etc.) | Activités de plein air (kayak, planche à pagaie, etc.)
- ☐ Cleanups | Nettoyages de berges
- ☐ Other (please explain) | Autre (veuillez expliquer):

How are you currently connected or engaged with the ocean? (Check all that apply) | Comment êtes-vous actuellement connecté à l'océan ? (Cochez toutes les cases qui s'appliquent) [Connection/Ocean Use/Demographic]

- ☐ Work or school | Travail ou école
- ☐ Through media (social media, podcast, documentary, etc.) | Par les médias (médias sociaux, balado, documentaire, etc.)
- ☐ Living close to the ocean | Vivre près de l'océan
- ☐ Recreation at home | Loisirs à domicile
- ☐ Vacation | Vacances
- ☐ Other (please explain) | Autre (veuillez expliquer):

Section 2 Ocean Knowledge | Connaître l'océan:

Which knowledge system(s) do you rely on to obtain ocean knowledge? (Check all that apply) | Sur quel(s) système(s) de connaissance vous appuyez-vous pour obtenir mieux connaître l'océan ? (Cochez toutes les cases qui s'appliquent) [Knowledge]

- ☐ Western Science | Science occidentale
- ☐ Indigenous | Autochtone
- ☐ Local, place-based knowledge | Connaissance locale, axée sur le lieu
- ☐ I don't know | Je ne sais pas
- ☐ Other (please explain) | Autre (veuillez expliquer):

Where do you obtain your ocean knowledge? (Check all that apply) | Où obtenez-vous vos connaissances liées à l'océan ? (Cochez toutes qui s'appliquent) [Knowledge]

- ☐ Formal education (school, training at work, etc.) | Éducation formelle (école, formation au travail, etc.)
- ☐ Through close relationship (friends, family, living close to the ocean, etc.) | Grâce à une relation étroite (amis, famille, vivre près de l'océan, etc.)
- ☐ Non-formal education (webinars, workshops, visits to aquaria, etc.) | Éducation non-formelle (webinaires, ateliers, visites d'aquariums, etc.)
- ☐ Media (news, social media, documentaries, podcasts, etc.) | Médias (actualités, médias sociaux, documentaires, balados, etc.)
- ☐ Other (Please explain) | Autre (veuillez expliquer):

On a scale of 1 to 5, please rank your relative interest level in the following types of ocean knowledge with 1 being not at all interested and 5 being very interested. | Sur une échelle de 1 à 5, veuillez classer votre niveau d'intérêt relatif pour les types de connaissances océaniques suivants, 1 étant pas du tout intéressé et 5 étant très intéressé. [Knowledge]

Knowledge Type | Type de connaissances	1	2	3	4	5
Scientific | Scientifique	◯	◯	◯	◯	◯
Social | Sociale	◯	◯	◯	◯	◯
Cultural | Culturelle	◯	◯	◯	◯	◯
Economic | Économique	◯	◯	◯	◯	◯
Political | Politique	◯	◯	◯	◯	◯
	◯	◯	◯	◯	◯

On a scale of 1 to 5, please rank your relative interest level in the following scales of ocean knowledge with 1 being not at all interested and 5 being very interested. | Sur une échelle de 1 à 5, veuillez classer votre niveau d'intérêt relatif pour les échelles suivantes de connaissance de l'océan, 1 étant pas du tout intéressé et 5 étant très intéressé. [Knowledge]

Knowledge Scale | Échelle de connaissances	1	2	3	4	5
Local | Locale	◯	◯	◯	◯	◯
Regional | Régionale	◯	◯	◯	◯	◯
National | Nationale	◯	◯	◯	◯	◯
International | Internationale	◯	◯	◯	◯	◯
	◯	◯	◯	◯	◯

Section 3: Ocean Disposition | Disposition de l'océan

How would you rank your awareness to ocean issues? | Comment évaluez-vous votre degré de sensibilisation aux enjeux liés à l'océan ? [Awareness]

	1	2	3	4	5	
Not at all aware | Pas du tout au courant	◯	◯	◯	◯	◯	Extremely aware | Extrêmement conscient

To what extent do you feel your lifestyle has an impact on the marine environment? | Dans quelle mesure pensez-vous que votre mode de vie a un impact sur l'environnement marin ? [Awareness/Attitude/Perceptions]

	1	2	3	4	5	
Not at all | Pas du tout	◯	◯	◯	◯	◯	Extremely | Extrêmement

To what extent do you feel the marine environment impacts your everyday activities? | Dans quelle mesure pensez-vous que l'environnement marin a un impact sur vos activités quotidiennes ? [Awareness/Attitude/Perceptions]

	1	2	3	4	5	
Not at all | Pas du tout	◯	◯	◯	◯	◯	Extremely | Extrêmement

How important is ocean health to you? | Quelle importance accordez-vous à la santé de l'océan ? [Value/Perceptions]

	1	2	3	4	5	
Not at all | Pas du tout important	◯	◯	◯	◯	◯	Extremely | Extrêmement important

To what extent do you believe that changes to your everyday activities can lead to a healthier ocean? | Dans quelle mesure pensez-vous que des changements dans vos activités quotidiennes peuvent conduire à un océan plus sain ? [Efficacy/Perceptions]

	1	2	3	4	5	
Not at all | Pas du tout important	◯	◯	◯	◯	◯	Absolutely | Absolument

What motivates you to engage with and/or learn about the ocean? (Check all that apply) | Qu'est-ce qui vous motive à vous engager et/ou à vous renseigner sur l'océan ? (Cochez toutes qui s'appliquent) [Motivation]

- ☐ Livelihood | Moyens de subsistance
- ☐ Health (physical, mental, and emotional) | Santé (physique, mentale et émotionnelle)
- ☐ Personal interest | Intérêt personnel
- ☐ Sustainability (of current lifestyle, for future generations) | Durabilité (du mode de vie actuel, pour les générations futures)
- ☐ Other (please explain) | Autre (veuillez expliquer):

Section 4: Ocean Behaviour | Le comportement envers l'océan

How personally invested are you to address ocean issues in your life? | Dans quelle mesure vous investissez-vous personnellement dans la résolution des problèmes liés à l'océan dans votre vie ? [Investment]

	1	2	3	4	5	
Not at all | Pas du tout important	◯	◯	◯	◯	◯	A lot | Beaucoup

Which of the following are you currently doing to help address ocean issues? (Check all that apply) | Parmi les actions suivantes, lesquelles menez-vous actuellement pour aider à résoudre les problèmes liés à l'océan ? (Cochez toutes qui s'appliquent) [Investment/Daily Action/Activism]

- ☐ Minimize marine impact through daily actions (decrease plastic usage, carbon footprint, etc.) | Réduire l'impact sur le milieu marin par des actions quotidiennes (diminution de l'utilisation de plastique, de l'empreinte carbone, etc.)
- ☐ Support ocean protection initiatives (financial donation, volunteering, citizen science, etc.) | Soutenir les initiatives de protection de l'océan (dons financiers, bénévolat, science citoyenne, etc.)
- ☐ Take political action | Agir sur le plan politique
- ☐ Initiate new ocean projects (social media groups, podcast, innovation, etc.) | Lancez de nouveaux projets liés à l'océan (groupes de médias sociaux, balados, innovation, etc.)
- ☐ Obtain, exchange, or share ocean knowledge | Obtenir, échanger ou partager des connaissances sur l'océan
- ☐ Other (please explain) | Autre (veuillez expliquer):

Which of the following would you like to do? (Check all that apply) | Parmi les activités suivantes, lesquelles aimeriez-vous faire ? (Cochez toutes qui s'appliquent) [Investment/Daily Action/Activism]

- ☐ Minimize marine impact through daily actions (decrease plastic usage, carbon footprint, etc.) | Réduire l'impact sur le milieu marin par des actions quotidiennes (diminution de l'utilisation de plastique, de l'empreinte carbone, etc.)
- ☐ Support ocean initiatives (financial donation, volunteering, citizen science, etc.) | Soutenez les initiatives en faveur de l'océan (dons financiers, bénévolat, science citoyenne, etc.)
- ☐ Take political action | Agir sur le plan politique
- ☐ Initiate new ocean projects (social media groups, podcast, innovation, etc.) | Lancez de nouveaux projets liés à l'océan (groupes de médias sociaux, balados, innovation, etc.)
- ☐ Obtain, exchange, or share ocean knowledge | Obtenir, échanger ou partager des connaissances sur l'océan
- ☐ Other (please explain) | Autre (veuillez expliquer):

Which of the following enables you to take ocean action? (Check all that apply) | Lequel des éléments suivants vous permet d'entreprendre une action pour l'océan ? (Cochez toutes qui s'appliquent) [Enablers]

- ☐ Peer support (including family, friends, community, school, work, etc.) | Soutien par les pairs (famille, amis, communauté, école, travail, etc.)
- ☐ Financial support | Soutien financier
- ☐ Access to information | Accès à l'information
- ☐ Celebrity and/or non-governmental organization call to action | Appel à l'action d'une célébrité et/ou d'une organisation non gouvernementale
- ☐ Governmental policy | Politique gouvernementale
- ☐ Other (please explain) | Autre (veuillez expliquer):

Which of the following prevents you from taking ocean action? (Check all that apply) | Laquelle des situations suivantes vous empêche d'entreprendre une action pour l'océan ? (Cochez toutes qui s'appliquent) [Barriers]

- ☐ Lack of peer support (including family, friends, community, school, work, etc.) | Manque de soutien de la part des pairs (famille, amis, communauté, école, travail, etc.)
- ☐ Lack of financial support | Manque de soutien financier
- ☐ Lack of information or access to information (including language, technology, etc.) | Manque d'information ou d'accès à l'information (y compris la langue, la technologie,
- ☐ etc.)
- ☐ Lack of time | Manque de temps
- ☐ Lack of sound governmental policy | Absence de politique gouvernementale saine
- ☐ Habit | Habitude

  Other (please explain) | Autre (veuillez expliquer):

Section 5: Open response | Réponse ouverte

If you wish to include any comments about Ocean Week Canada or ocean literacy evaluation that were not captured in this survey, please write your comments below | Si vous souhaitez inclure des commentaires sur la Semaine de l'océan Canada ou l'évaluation de la connaissance de l'océan qui n'ont pas été saisis dans ce sondage, veuillez écrire vos commentaires ci-dessous. _____

Thank you for participating in the survey! | Merci de participer à l'enquête!

Your responses will help better understand the development of an ocean literacy evaluation framework. | Vos réponses nous aiderons à mieux comprendre l'élaboration d'un cadre d'évaluation de la connaissance de l'océan.

If you would like to learn about the study, please contact the primary researcher, Lisa Chen, at lisa.chen@dal.ca. | Si vous souhaitez en savoir plus sur cette étude, veuillez contacter la chercheuse principale, Lisa Chen, à l'adresse lisa.chen@dal.ca.

Appendix C : Ocean Week Canada Case Study Recruitment Email

(le français suit)

Dear friends and colleagues,

My name is Lisa Chen and I am a Master of Marine Management candidate at Dalhousie University. I am testing a newly developed ocean literacy evaluation framework using Ocean Week Canada as a case study. I am reaching out to see if you would be interested in helping to distribute and/or complete a short anonymous online survey to Ocean Day/Week participants. This survey is a follow-up to the Ocean Week Canada Pilot Survey that was distributed during Ocean Week (June 7-11). The purpose of this second follow-up survey is to evaluate how Ocean Week participants are engaging with the different dimensions of ocean literacy. The survey has a total of 27 short multiple-choice questions and should take approximately 10-12 minutes to complete. It was designed with support by Dr. Boris Worm at the Ocean Frontier Institute and in partnership with Dr. Lisa (Diz) Glithero of the Canadian Ocean Literacy Coalition.

If you are interested in helping with distribution, the survey can be accessed at https://surveys.dal.ca/opinio/s?s=63374 until July 16, 2021, at 11:59 pm EDT.

Thank you for supporting ocean literacy research and I hope you had a fantastic Ocean Week!

Chers ami(e)s et collègues,

Je m'appelle Lisa Chen et je suis candidate à une maîtrise en gestion marine à l'Université Dalhousie. Je teste un nouveau cadre d'évaluation de la connaissance de l’océan en utilisant la Semaine de l'océan Canada comme étude de cas. J'aimerais savoir si vous seriez intéressé à distribuer et/ou à remplir un court sondage anonyme en ligne auprès des participants aux activités de la Journée et de la Semaine de l'océan. Cette enquête est un suivi de l'enquête pilote de la Semaine de l'océan Canada qui a été distribuée pendant la Semaine de l'océan (du 7 au 11 juin). L'objectif de cette deuxième enquête de suivi est d'évaluer comment les participants à la Semaine de l'océan s'engagent dans les différentes dimensions de la connaissance de l’océan.

L'enquête comporte un total de 27 questions courtes à choix multiples et devrait prendre environ 10 à 12 minutes à remplir. Elle a été conçue avec l'aide de Boris Worm de l'Ocean Frontier Institute et en partenariat avec Lisa (Diz) Glithero de la Coalition canadienne de la connaissance de l'océan.

Si vous souhaitez aider à la distribution, l'enquête est accessible à l'adresse https://surveys.dal.ca/opinio/s?s=63374 jusqu'au 16 juillet 2021 à 23 h 59 HAE.

Merci de soutenir la recherche sur la connaissance de l'océan et j'espère que vous avez passé une fantastique Semaine de l'océan !