Humanizing Marine Spatial Planning: A Salutogenic Approach

By

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Abstract

Despite the growing acknowledgement within the academic literature that human well-being is an important aspect of marine spatial planning (MSP), research and practice continue to neglect this concept. Specifically, the consequences of marine development and climate change on human health is largely absent from ocean governance processes and needs to be addressed. This study argues that human health and spatial planning frameworks may be employed in combination to investigate this issue. Guided by the concept of salutogenesis (health promotion), this study utilized online participatory mapping in conjunction with a questionnaire to explore study participants' perceptions of the health benefits of and barriers to participating in coastal activities within Halifax Regional Municipality (HRM), Nova Scotia, Canada. Results from this study indicated that participating in coastal activities in HRM is perceived to be very important for human health. Criteria for salutogenically significant areas (SSAs) were developed by referring to the CBD criteria for biologically and ecologically significant areas, which included uniqueness, diversity, productivity, importance for underserved populations and vulnerability. Recommendations have been made for gathering SSA criteria information while enabling marine managers to make more informed decisions about how to best consider human health objectives within MSP. Further application of this participatory mapping approach to gather human health data, particularly to collaborate or partner with diverse and underserved population groups is recommended.

Keywords: Marine spatial planning (MSP); blue space; salutogenesis; human health; oceans and human health (OHH); health equity; planetary health

List of Abbreviations

CBD	Convention on Biological Diversity
CES	Cultural ecosystem services
CHIAT	Community-Driven Health Impact Assessment Tool
EIA	Environmental Impact Assessment
ES	Ecosystem services
GIS	Geographic information system
HIA	Health Impact Assessment
HiAP	Health in All Polices
HRM	Halifax Regional Municipality
MA	Millennium Ecosystem Assessment
MSP	Marine spatial planning
NS	Nova Scotia
OHH	Oceans and human health
PPGIS	Public participatory geographic information system
SDH	Social determinants of health
SOPHIE	Seas, Oceans & Public Health in Europe
SSA	Salutogenically significant area
WHO	World Health Organization

Acknowledgements

I would like to begin by acknowledging that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People. This territory is covered by the "Treaties of Peace and Friendship" which Mi'kmaq Wəlastəkwiyik (Maliseet), and Passamaquoddy Peoples first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wəlastəkwiyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations.

Dalhousie University sits on the Traditional Territory of the Mi'kmaq. We are all Treaty people.

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To my friends and family, thank you for your love and support during an intense year of projects, interviews, papers, and presentations. I would not have been able to push through it without the hikes, road trips, COVID-19 dine-in suppers, and encouraging conversations. Finally, to my partner, Kaylin Mouland, thank you for being patient as I became fully emersed in my studies, even at times when I forgot about absolutely everything else. You continue to ground me and remind me to take one step at a time, and for that I am grateful.

Positionality Statement: I am a white settler living on the unceded homelands of the Mi'kmaq People. I identify as a female who is not a member of the LGBTQIA2S+ community. I also do not identify as having a disability or of being of low socioeconomic status. I am sharing these facts as these topics are explored throughout this paper and as such, my positionality may influence the discussion and overall research presented.

Chapter 1: Introduction

Oceans and human health (OHH) researchers seek to understand how the health of the ocean influences the social and environmental determinants of human health and well-being (Flemming et al., 2021). OHH has historically focused on climate-driven topics that pose a risk for human health, such as the proliferation of infectious diseases and parasites; impacts on food security and seafood quality (Trtanj, et al., 2016); inland migration; and the overall mental and physical health impacts that may arise from the loss of marine resources (Borja et al., 2020). In order to address these impacts, strategies to promote environmental resilience are necessary but must also reflect the implications of other more direct anthropogenic impacts (Stevens et al., 2020).

Coastal environments are particularly vulnerable to degradation, as in addition to climate change, they face the direct consequences of land-clearing, pollution, and disruptions to habitats that serve many stabilizing functions (Steven et al., 2020). These activities contribute to several negative human health impacts such as the loss of biodiversity and subsequent impacts on livelihoods and fisheries (Fleming et al., 2021); the contamination of marine-source food, impacting food security for Indigenous Peoples in the Arctic (Kenny et al., 2020); and the destruction of habitats that protect communities from the impacts of storms and sea level rise (Steven et al., 2020). The emerging global trend of the blue economy or blue growth will likely amplify the negative impacts of coastal infrastructure development and contribute to the already well-established issues of marine over-exploitation and privatization of coastal spaces (Hadjimichael, 2018; Voyer & van Leeuwen, 2019). “Ocean grabbing” for development purposes is already recognized in some places where powerful actors have secured exclusivity or dominance over a resource, often resulting in disadvantages for other groups, particularly livelihood-dependent local communities, Indigenous Peoples, or those seeking to participate in recreational and cultural activities (Steven et al., 2020). By continuing to prioritize economic gain within coastal environments, despite the cumulative impacts of climate change and other anthropogenic stressors, the ocean will progressively experience worsening health conditions that also pose threats to human health. In supporting a healthy ocean that is accessible for all, opportunities for human health promotion may be prioritized.

Blue spaces (fresh and saltwater surfaces) bring several benefits to public health in coastal environments. Studies have shown that engaging with blue spaces in various ways

contributes to physical, psychological, emotional, and spiritual, health in addition to less studied factors such as sense of belonging (Gould, McLachlan, and McDonald 2020; Moles 2020) and self (Britton & Foley, 2021). Human health benefits of engaging with blue spaces are recognized across cultures, regions, and social identities (Foley & Kristemann 2015; Georgiou et al., 2021; Wheaton et al., 2021). These benefits may be linked with ecosystem services (ES), and cultural ecosystem services (CES), more specifically, as human health is an identified constituent of well-being that is associated with aesthetic, spiritual, educational, and recreational CES (MAa, 2005). By identifying the various health benefits that blue spaces facilitate, blue spaces can be described as a public health resource and thus, accessibility issues must be taken into consideration (Georgiou et al., 2021; Jennings & Gaither, 2015; Jennings, Larson & Yun, 2016; Juster-Horsfield & Bell, 2021).

Yet despite these health promoting properties of the ocean, which can be described as salutogenic, poor ocean health, disasters, and risks of the ocean for humans have received far more attention in the literature (Borja et al., 2020; SOPHIE, 2020). This focus on the negative implications for human health diminishes the conversation around preserving the salutogenic properties that blue spaces do provide. It may also contribute towards public disengagement in supporting conservation strategies, as societal feelings of denial or apathy have been found to be associated with news of overwhelming problems such as climate change (Doherty & Clayton, 2011). Re-framing this issue through a health (and specifically salutogenic) lens may help to humanise environmental crises by providing the opportunity for the public to create meaning through various means of storytelling, such as participatory processes (Britton, Dommegan & Hugh, 2021). Although human health benefits of blue spaces are just beginning to be recognized by the academic community, these places that hold salutogenic properties are already being lost due to increasing pressure from anthropogenic environmental impacts and marine development and will continue to be impacted unless policy can reflect the protection of these places that also serve as a public health resource. Positioning blue spaces as a public health resource can be used to influence policy on multiple levels.

Marine spatial planning (MSP) may serve as an appropriate avenue to facilitate the incorporation of human health objectives within ocean governance. Current MSP objectives include economic, environmental, and social, however social objectives are not clearly defined or adequately reflected in practice (Flannery & McAteer, 2020; Gilek et al., 2021; Saunders et

al., 2020; Tafon, 2018). Approaches to include public knowledge and values within MSP often include stakeholder consultations and sometimes public participatory geographic information system (PPGIS) techniques, that are commonly applied to ES approaches (Brown & Fagerholm, 2015; Brown, Reed & Raymond, 2020; Fagerholm et al., 2020). While these methods have been found to be beneficial, limitations are still apparent such as inconsistencies in ES nomenclature (Brown, Reed, Raymond, 2020; Crossman et al., 2013), and difficulties for engaging with trade-off analysis via monetization schemes within decision-making processes (Brown & Fagerholm, 2015; Cheng et al., 2019; Rall et al., 2017).

Human health is argued to be the ultimate ES as the many components described to facilitate wellbeing in the ES framework offered by the Millennium Assessment (MAa, 2005) reflect the definition of health from the World Health Organization (1946): "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity", and therefore, should be the cornerstone of ES approaches to decision making (Sandifer & Sutton-Grier, 2014). The health concept of salutogenesis can provide the focus for health promotion within MSP. Specifically, identifying health promoting areas or salutogenically significant areas (SSAs), similar to how biologically or ecologically significant areas are identified using the Convention on Biological Diversity (CBD) criteria (UNEP, 2008a), could aid in accounting for human health objectives within MSP. Considering SSAs in MSP has the potential to ensure continued or improved access to blue spaces as a public health resource, while prioritizing health equity through means of community engagement and partnership in realization of the community priorities and the barriers that exist.

1.1 Management Problem and Research Objectives

Coastal space is important for human health but is increasingly becoming harder to access due to anthropogenic pressures. The impacts of poor ocean health such as decreased biodiversity, chemical pollution, habitat loss or coastal erosion (Borja et al., 2020; Steven et al., 2020), for example, may result in additional difficulty in accessing coastal spaces. This may be compounded by marine developments such as coastal infrastructure, aquaculture, non-renewable and renewable energy developments that are expected to increase with the growing international interest in blue economy strategies (Hadjimichael, 2018; Voyer & van Leeuwen, 2019). Meanwhile, coastal inaccessibility is already heightened for people of various demographics or social identities based on numerous factors such as discriminatory or racist social conditions and

policies within society (Phoenix, Bell & Hollenbeck, 2020). This is an issue because if blue spaces are to be perceived as a public health resource, sustaining differing levels of accessibility will contribute to the existing health disparities observed among underserved populations (Bierman, 2007; Bell et al., 2019; Gahagan, 2020; Government of Canada, 2019). Through the ocean governance tool of MSP, human health objectives may be targeted by protecting the areas that facilitate various health benefits, while prioritizing health equity.

This study uses the example of Halifax Regional Municipality (HRM) in Nova Scotia (NS), to investigate how human health can be considered within MSP. Salutogenically significant areas (SSAs) are defined and introduced as a means of accounting for areas that facilitate human health benefits in coastal areas of HRM. By building off of the CBD criteria developed to identify biologically and ecologically significant areas, criteria have been developed for SSAs that include uniqueness, diversity, productivity, importance for underserved populations and vulnerability. The goal of this research is to develop an understanding of how the dimensions of human health can be considered within MSP. This was explored by investigating the human health benefits and barriers of participating in coastal activities in HRM. The research questions that guided this study were:

1. What health-generating coastal activities are people participating in within HRM and what are the spatial, temporal and value attributes attached to such activities?
2. How are these activities perceived to benefit public health?
3. What barriers to participating in these activities do users report, and are there any mitigating methods?

Chapter 2: Context

2.1 Marine Spatial Planning

Perceiving, and navigating the ocean has a long history, possibly beginning with the ancient Minoans, who lived on the Mediterranean island of Crete from 3000 to 1100 BCE, as evidenced by records of using the stars to navigate (Rutledge et al., 2011). Mapping and categorizing the ocean followed with goals of territorialization with Hugo Grotius in the seventh century (Bellamy, 2019; Zaucha & Gee, 2019). This was furthered through extended jurisdiction as part of the United Nations Convention on the Law of the Sea (UNCLOS, 1982) and continues to this day through exploratory science for understanding the biology, chemistry, physics, and human interactions within the ocean environment (Zaucha & Gee, 2019). With observing, protecting, and studying the ocean has come the need for planning. Since the initial emergence of marine spatial planning (MSP) in 1976, the concept has been applied and modified in marine governance in attempts of addressing the increasing anthropogenic pressures on coastal and marine ecosystems (Olsson et al., 2008). MSP is the "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). Over the past 15 years, MSP has become an important process for attempting to achieve various sustainability goals, including economic, biodiversity and social targets, with approximately 70 countries/territories engaged with various stages of MSP as of 2018 (UNESCO, n.d.a).

Characteristics of MSP include ecosystem-based, area-based, integrated, adaptive, strategic, and participatory (UNESCO, n.d.b), and the process includes the steps outlined in Figure 1. Ecosystem based management takes a systems-thinking approach to recognize social-ecological systems within natural resource management (McLeod & Leslie, 2009; O'Higgins, DeWitt & Lago, 2020). Identifying and prioritizing important places within the marine environment for species, ecosystems or processes is a central component of MSP and draws on the Convention on Biodiversity's criteria for identifying ecologically or biologically significant marine areas (Table 1) (UNEP, 2008a). The same level of scrutiny has not been applied when identifying areas of human importance more specifically however, as spatial information regarding human activities seems to be analyzed in terms of compatibility versus conflict (Ehler & Douvere, 2009), lacking methods for prioritization. The integrated, adaptive, and strategic

components for MSP allude to the circular nature of the MSP evaluation process, so that it considers information on a continuous basis rather than within set stages (Ehler & Douvere, 2009). MSP is considered participatory in that determining how marine space should be used occurs through public choice decision-making usually through selected representatives, and the consideration of important societal values such as biodiversity and social justice is expected (Ehler et al., 2019), however the latter is often overlooked (Flannery & Ellis, 2016; Tafon, 2018).

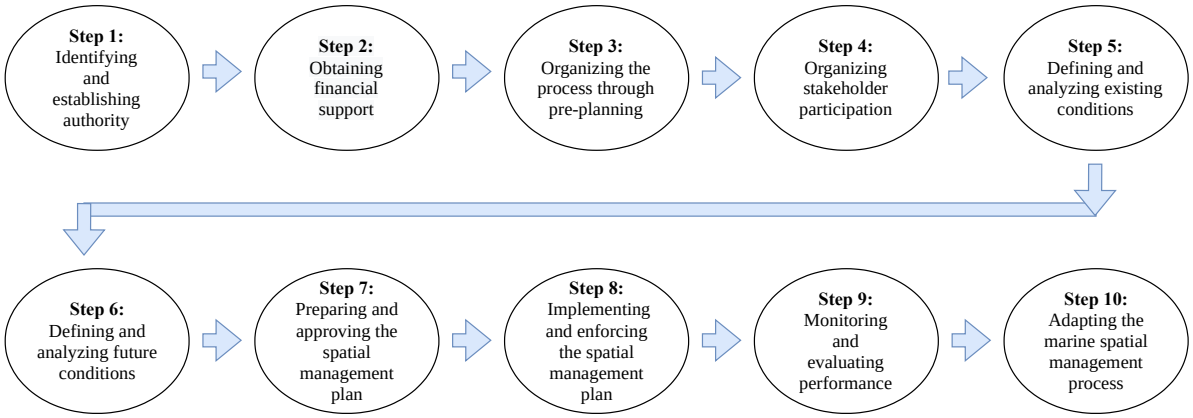

Figure 1. A step-by-step approach for marine spatial planning adopted from Ehler & Douvere (2009).

Table 1. CBD criteria for identifying ecologically or biologically significant marine areas (UNEP, 2008a).

Criteria	Definition	Rationale
Uniqueness or rarity	Areas containing either (i) unique (the only one of its kind), rare (occurs only in few locations) or endemic (unique to a particular geographic location) species, populations or communities, and/ or (ii) unique, rare or distinct habitats or ecosystems; and/or (iii) unique or unusual geomorphologic or oceanographic features.	These areas or species/populations are irreplaceable, and their loss would mean the probable permanent disappearance of diversity/a feature or reduction of the diversity.
Importance for threatened, endangered or declining species and/or habitats	Areas (i) containing habitat(s) for the survival and recovery of endangered, threatened, declining species; or (ii) with significant assemblages of such species.	To ensure the restoration and recovery of such species and habitats.
Vulnerability, fragility, sensitivity or slow recovery	Areas containing a relatively high proportion of sensitive habitats, biotopes (small, uniform environments occupied by a community of organisms) or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.	The criteria indicate the degree of risk that will be incurred if human activities or natural events in the area or component cannot be managed effectively or are pursued at an unsustainable rate.
Biological productivity	Areas containing species, populations or communities with comparatively higher natural biological productivity.	Important role in increasing the growth rates of organisms and their capacity for reproduction, and providing surplus production to adjacent areas.
Biological diversity	Areas: (i) containing comparatively higher diversity of eco- systems, habitats, communities, or species, or (ii) with higher genetic diversity.	Important for evolution and maintaining the resilience of marine species and ecosystems.
Naturalness	Areas with a comparatively higher degree of naturalness as a result of the lack of, or low level of, human-induced disturbance or degradation.	Natural areas can be used as reference sites and will likely safe-guard and enhance ecosystem resilience.

MSP practitioners have the great challenge of advancing an ecosystem-based approach to marine governance to achieve social and ecological objectives in the political climate of economic growth (Ertör & Hadjimichael, 2020; Lombard et al., 2019; Ehler, Zaucha & Gee, 2019). Although many national and international initiatives are calling for strategies to enhance oceans and human health (OHH), with examples including the Biodiversity Strategy (European Commission, 2020), Sustainable Development Goals (United Nations, n.d.), Blue Papers (World Resources Institute, 2019), International Union for Conservation of Nature (IUCN) reports (IUCN, 2021), and Seas, Oceans and Public Health in Europe (SOPHIE) (SOPHIE Consortium 2020), the same emphasis on OHH has not been applied in MSP (Pittman et al., 2019). Meanwhile, economic objectives are being advanced through the development of national blue economy strategies, which are a focus of many marine spatial plans (Lombard et al., 2019).

It is argued that this global move towards a blue economy strategy assumes the availability of already overexploited resources (Bax et al., 2021), therefore further contributing to the depletion of ocean resources and influence on ocean health. Evidence of marine development producing negative impacts on human activity has been long documented, with early studies focusing on the impacts of tourism infrastructure. These studies indicate negative environmental impacts to include construction, noise, water contamination, crowding and exploitation of locals (Henry, 1988; Liu, Sheldon & Var, 1987), all of which would have negative implications for human health. It is also suggested that the planet cannot support consumerism and deliver fair and equitable livelihoods for all (Ripple et al., 2017), which is key for assuring human health (World Health Organization, 2021). Utilizing an ecosystem services (ES) approach to MSP has been suggested as a method to address some of these challenges (Bélisle, Wapachee, Asselin, 2021; Bennett et al., 2021; Summers et al., 2012).

2.1.1 Ecosystem Services

The term ecosystem services (ES) has been developed to describe the benefits human populations derive, directly or indirectly from ecosystem functions (Costanza et al., 1997). Ecosystems provide the essentials for human life, such as water, food, and fiber (provisioning services); temperature maintenance, storm protection and control of disease transmission (regulating services); soil formation, primary production, and oxygen generation (supporting services); and recreation, personal security, and mental contentment/stress reduction (cultural services) (Millennium Assessment (MA), 2005b). There are four main classifications for ES

including the Common International Classification of Ecosystem Services (CICES), Millennium Assessment (MA), The Economic of Ecosystems & Biodiversity (TEEB), and Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (CICES, 2021). Cultural ecosystem services (CES) is a category of ES recognized by the four classification systems, which includes the aesthetic, artistic, educational, spiritual and/or scientific values of ecosystems (Pert et al., 2015). The effects of ES on human health are dispersed within the various categories of ES, with spiritual, intellectual, and physical components categorized within CES (Maes et al., 2013). The concept of ES and CES has become an important model for linking the functioning of ecosystems to human welfare (Fisher, Turner & Morling, 2009; Sandifer & Sutton-Grier & Ward, 2015).

Although the ES framework is recognized as a relevant method for measuring human benefits from the environment, an emphasis on human health more specifically, is lacking (Sandifer & Sutton-Grier, 2014). Currently, ES effects on human health are not explicitly prioritized within the ES frameworks, as the dimensions of human health are spread out among multiple categories within the framework rather than having a separate class (Newcomer-Johnson et al., 2021). Health is defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1946). Similarly, well-being, as defined by the MA (2005a), includes multiple components, such as physical and mental health, a clean and supporting physical environment, employment and adequate income, personal and community security, access to education. Based on this definition, Sandifer and Sutton-Grier (2014) assert that "human health and well- being should be considered the ultimate or cumulative ecosystem service and should be a central focus in application of an ES approach to decision-making". While it is still not commonly accepted, other researchers have also embraced this idea (Chen et al., 2019; Higgins et al., 2019; Romagosa, Eagles & Lemieux, 2015).

Public participatory geographic information system (PPGIS) approaches that identify ES/CES are a suggested strategy to advance social objectives within MSP (Gilek et al., 2021). Participatory mapping can describe any process where individuals share in the creation of a map (Brown & Fagerholm, 2015). Systematic efforts to collect and explore public perception of place through mapping began about two decades ago (Brown, Reed & Raymond, 2020). Since then, the concept of mapping ES has become a major focus in the field of PPGIS (Loc et al., 2021). ES PPGIS is especially useful for spatial planning as the concept of ES provides an overall

perspective to account for the social, ecological, and economic values of a space (Longato et al., 2021). For example, such approaches have been utilized to identify CES hotspots and explore the relationships among services in Madrid, Spain (García-Díez et al., 2020); to map the Rainforest Aboriginal Peoples' perceptions of the health of Indigenous CES in the Wet Tropics, Austraila (Pert et al., 2015); and to explore perceptions of CES in Berlin, Germany (Rall et al., 2017). While the ES framework has been accepted by scientists as a useful tool, it is important to acknowledge the complexities that may arise when using an ES/CES framework, as the concept may not be completely compatible with all knowledge systems (Bélisle, Wapachee, Asselin, 2021; Pert et al., 2015).

2.1.2 Blue Spaces

Indigenous cultures from around the world have appreciated the ocean for its cultural, spiritual and sustenance values for millennia (Groesbeck et al., 2014; McGregor, 2012.; Wheaton et al., 2021), and have since promoted its sustainability in various ways (Denny & Fanning, 2016; McMillan & Prosper, 2016; Raymond-Yakoubian, Raymond-Yakoubian & Moncrieff, 2017; Reid et al., 2021). Since the 16th century, there has been scientific interest in the health benefits of various water environments (Juster-Horsfield & Bell, 2021). Western societal interpretations of coastal spaces differed over time, from being a place of pleasure and beauty for the Ancient Greeks and Romans to a place of danger and risk throughout the Middle Ages, and its gradual integration into societal activities from the 1700s onwards (Bell et al., 2015). In academia, the therapeutic landscapes concept was first proposed in 1922 by Wilbert Gesler as a mechanism for exploring why certain environments appear to contribute to a 'healing sense of place' (Bell et al., 2018). Within the marine environment, this took on the notion of 'blue space' environments. Blue space is defined as 'health-enabling places and spaces, where water is at the centre of a range of environments with identifiable potential for the promotion of human wellbeing' (Foley & Kristemann, 2015).

While the potential for green spaces (e.g., forests, parks, gardens, greenways) to serve as health enabling therapeutic environments has been studied extensively (Jennings, Browning & Rigolon, 2019; Jennings & Gaither, 2015; Rall, Hansen & Pauleit, 2019), blue spaces are only recently starting to be explored within academia (Georgiou et al., 2021). Recent studies discuss the health benefits of activities that are known to facilitate human health benefits in blue spaces, including both "risker" activities (e.g., surfing) (Britton & Foley, 2021; White et al., 2020;

Wheaton et al., 2020) and "gentle" activities (e.g., being near blue spaces, immersion/swimming) (Foley, 2017; Foley & Kistemann, 2015; Juster-Horsfield & Bell, 2021). In the most recent systematic literature review on blue spaces and human health, Georgiou et al. (2021) found that there was evidence to indicate that blue spaces can increase physical activity, enhance markers of restoration such as stress, anxiety, depressed mood, and psychological well-being, and improve environmental factors such as air pollution, risk of flooding and heat stress. Blue space was also suggested to have a beneficial effect on social interaction, but the evidence for this was mixed and further research is needed on this topic (Georgiou et al., 2021). Studying the health benefits of blue spaces within the context of geography is important, as the land-sea boundary is where most ocean users engage with the ocean (Elliott et al., 2018; White et al., 2016b), thus having implications for MSP.

2.2 Human Health

Human health can be understood in a variety of ways and is usually centered on pathogenic (disease) or salutogenic (health promoting) concepts, the latter being a central theme throughout this paper. Salutogenesis was termed by Antonovsky (1996) to describe health promotion, not disease (pathogenesis). According to Antonovsky, it was more important to focus on peoples' resources and capacity to create health than the classic focus on risks, ill health, and disease (Lindström & Eriksson, 2005). Salutogenesis has recently been explored in geographic human health literature in attempts to understand the health promoting factors of natural (Cheesbrough, Garvin, & Nykiforuk, 2019) and blue space (Foley & Kistemann, 2015; Gascon et al., 2017) environments. Although some aspects of salutogenesis have been adopted by health geography, a more direct understanding of how particular places are or can become salutogenic is almost completely absent (Foley & Kistemann, 2015). Utilizing salutogenesis as the overarching concept within this paper allows for the integration of relevant concepts that are focused on health promotion, such as the spatial concepts of ES and blue spaces and the human health concepts of the social determinants of health (SDH) and Maslow's Hierarchy of Needs. Considering such concepts in conjunction would be integral to setting the foundations of a holistic human health approach to MSP.

Some of the more common frameworks or lenses to understand human health include the social determinants of health (SDH) or 'structural' determinants of health, and Maslow's Hierarchy of Needs. The SDH were developed to expand perceptions of the factors that influence

human health, with a greater focus on socio-ecological processes rather than bio-medical processes (Braveman & Gottlieb, 2014; Krieger, 2011). That is, health outcomes themselves can be explained and understood through the broader socio-ecological context. For example, the SDH framework acknowledges that multiple factors such as the social and economic environment, physical environment, individual characteristics and behaviours, income and social status, education, social support networks, genetics, health services and gender largely influence human health (WHO, 2021a). Building on the SDH framework, structural determinants of health were identified such as race, immigrant and refugee status, poverty, education, food security, and access to clean air, water, and soil to influence human health (Waldron, 2021). SDH has been applied to human wellness studies (Braveman & Gottlieb, 2014), and utilized within the health impact assessment (HIA) decision support approach which has been explored within the literature since the 1970s, however the extent in its application remains unclear (Browne and Lowe, 2021; Fischer et al., 2021).

Maslow's Hierarchy of Needs takes a different approach in describing human health by providing five sets of goals or needs that includes physiological, safety, love, self-esteem, and self-actualization (Maslow, 1943). The needs are depicted in a hierarchical pyramid as levels that people move through upon completion of each level (from bottom-up), theoretically (Figure 2) (McLeod, 2018). Maslow's Hierarchy of Needs has been utilized as a framework for evaluating human wellness/well-being (Hale et al., 2018), and has been explored in relation to ES for human health (Summers et al., 2012; Watts et al., 2019; White, 2020).

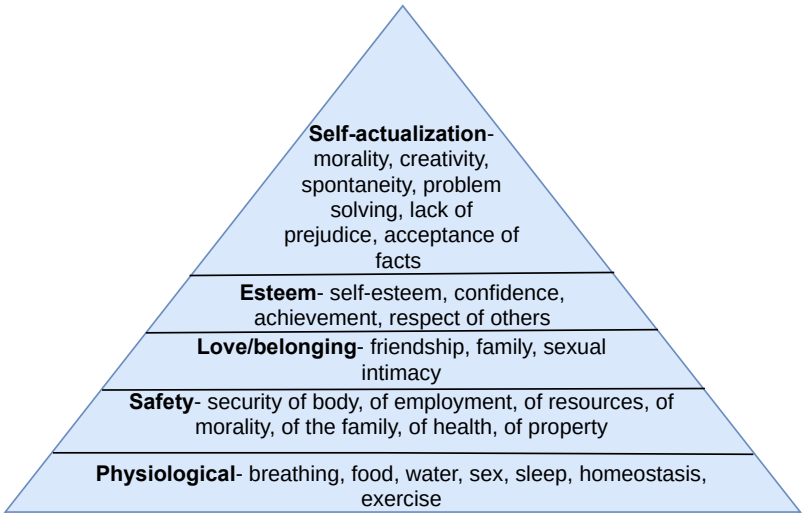

Figure 2. Maslow's Hierarchy of Needs (Maslow, 1943).

Indigenous cultures have held the belief that human health and the natural environment are interlinked for millennia (Berry, 1991; Prescott & Logan, 2019; Iyer et al., 2021), and many exhibit this through their spiritual connections with water environments (Bélisle, Wapachee, Asselin, 2021; Diggon et al., 2018; Durkalec et al., 2015; Ingersoll, 2016; Wheaton et al., 2021). A Western approach to describe the similar phenomenon of the human-nature connection is the biophilia theory. The biophilia theory conceptualized by E.O. Wilson, suggests that the human relationship with the natural world is rooted in genetics (Wilson, 1984). However, other factors such as upbringing and education also play a role in the development of an individual's relationship with nature (Thompson et al., 2008), and thus the biophilia theory must be considered in addition to other human health concepts such as the SDH to gain an accurate and holistic understanding of the human-nature relationship.

Few studies have utilized health and well-being frameworks such as the SDH, Maslow's Hierarchy of Needs, biophilia or salutogenesis frameworks in relation to blue spaces, or linked these with ES more broadly. Components of these frameworks can be found dispersed within the blue spaces literature, however. For example, a sense of belonging (Gould, McLachlan, and McDonald 2020; Moles 2020) and self (Britton & Foley, 2021), perceived safety, and presence of wildlife (Garrett et al., 2019) were identified as benefits of engaging with blue spaces and corresponds with the biophilia theory and Maslow's Hierarchy of Needs. Blue spaces have been examined to have salutogenic potential through surfing (Britton & Foley, 2021), and by being an 'enabling' environment for bodies of various genders, ages, mental capacities and carceral histories (Foley & Kristemann 2015). Therefore, the combination of these frameworks may be useful in providing a holistic approach in understanding the health benefits that people experience from engaging with blue spaces.

2.2.1 Ocean Human Health

One of the most prevalent ways in which human health is being studied within the context of blue spaces is within the emerging scientific discipline of oceans and human health (OHH). OHH seeks to explore the interaction of threats and opportunities the ocean presents to humans (SOPHIE, n.d.). Historically, OHH studies have focused on how the ocean endangers human health by documenting the effects of disease transmission, chemical pollutants, and drowning for example, (Grellier et al., 2017; Gascon et al., 2017). The narrative for OHH is changing however, to include components of positive health benefits or salutogenesis. The

SOPHIE research program was funded by the European Commission to help protect the ocean, harness its health benefits, and reduce its risks (SOPHIE, n.d.). OHH is suggested as a way to increase the understanding of the interrelationships with the ocean, while most importantly, humanizing environmental crises by applying a local and personal lens to complex global issues (Britton, Domegan & McHugh, 2021).

2.2.2 Planetary Health

The discipline of planetary health is another platform where the intersection of human health and blue spaces is explored. Planetary health is a field focused on characterizing the human health impacts of human-caused disruptions of Earth's natural systems (Planetary Health Alliance, n.d.). The field of planetary health is currently undergoing a transition to becoming more 'ecocentric' (i.e., with a focus on Mother Earth), as a group of Indigenous scholars, Elders, practitioners, and land defenders are currently working to apply an Indigenous worldview to current planetary health initiatives (Redvers, 2021). Specific examples of human-led activities that exert unsustainable pressure on natural systems include land use change (deforestation, desertification, wetland loss) and urbanization, resulting in larger scale issues such as climate change, stratospheric ozone depletion, biodiversity loss, freshwater depletion, and damage to coastal reefs and ocean ecosystems (Iyer et al., 2021). Planetary health has the capacity to "shape the future of humanity and the Earth's natural systems that define the safe environmental limits within which humanity can flourish" (Whitmee et al., 2015). Defining these limits through a planetary health lens within an MSP framework may allow for a deeper understanding of how human-caused disruptions within the marine context (i.e., human activities/infrastructure on the coast and at sea), will positively or negatively impact community health and thus, be considered within decision making processes.

2.2.3 Health Equity

One potential component of human health that is essential to study in the context of MSP is related to health equity. Health equity is the condition where all people have a fair and just opportunity to be as healthy as possible (Braveman et al., 2018). As evidenced by the Pan-Canadian Health Inequalities Reporting (HIR) Initiative, significant health inequalities exist for those with lower socioeconomic status, Indigenous peoples, sexual and racial/ethnic minorities, immigrants, and people living with functional limitations (such as physical or mental

impairments) (Government of Canada, 2019). Women and gender non-conforming populations have also been identified to be subjected to health inequalities (Bierman, 2007; Gahagan, 2020).

These issues are starting to be explored within the environmental context, often by utilizing the environmental justice (EJ) literature (Jennings, Browning, Rigolon, 2019). EJ explicitly links the environment to race, class, gender, and social justice, effectively reframing environmental issues as injustice issues (Agyeman et al., 2016). Inequitable distribution of nature-related benefits and the associated health disparities is considered an EJ issue (Jennings & Gaither, 2015). EJ is suggested to have indications for spatial planning as its concepts include addressing physical and psychosocial health while connecting that understanding to place-making, place attachment and identity (community) (Agyeman et al., 2016). The EJ framework has been applied to green space (e.g., forests, parks, gardens, greenways) geographic studies, as inequitable access to urban green spaces often overlaps with race/ethnicity and various measures for socioeconomic status prompting EJ concerns (Jennings, Browning, Rigolon, 2019).

Just like with green spaces (Jennings, Larson & Yun, 2016), stark inequalities to accessing blue spaces across various races, ethnicities, genders, disabilities, and classes exist (Juster-Horsfield & Bell, 2021; Watson 2019; Wheaton et al. 2020) and may continue to prevail if MSP is unable to consider accessibility (Flannery & McAteer, 2020). Phoenix, Bell, and Hollenbeck (2020) examine Black American perceptions and experiences of coastal blue space and the current and historical barriers to access of these blue resources. Their research suggests that the ongoing exclusionary policies and ideologies shaped by segregation continue to create barriers to accessing coastal blue spaces by excluding and at times endangering Black communities. There are also studied differences in blue space uses across genders within coastal environments in England, with men engaging in higher energy activities compared to women, which may suggest barriers to access, or participation are present (Elliott et al., 2018). Ease of access to blue spaces is also important to consider for people of varied abilities or disabilities (Finlay & Rowles, 2021), such as paths and access routes, access to water, facilities, and amenities (Sekhar Mishra et al., 2020). Bell et al. (2019) explores the perceptions of people who are registered as partially blind to having access to coastal spaces and have found that barriers were largely influenced by societal norms, discourses, and sociocultural attitudes around blindness. Lastly, being in a state of financial difficulty has been identified as being a barrier to accessing coastal spaces (Astell-Burt & Feng, 2021).

2.3 Health Impact Assessment

For MSP to effectively integrate the above human health frameworks, a mechanism designed to account for human health specifically, is required, such as the Health Impact Assessment (HIA) tool. The HIA is a decision support tool used to scrutinize how a policy or project may impact the health of a population and the distribution of those impacts within the population (WHO, 2021b). The HIA steps include screening, scoping, appraisal, reporting and monitoring (WHO, 2021b) (Table 2). The development of the HIA was influenced by the Environmental Impact Assessment (EIA) that was established in the 1970s to evaluate the likely environmental impacts of a proposed policy accounting for beneficial or harmful socioeconomic, cultural, and less consistently, human health impacts (United States Environmental Protection Agency (US EPA, 2013)). Currently, different countries are utilizing these assessments when discussing business activities, land use politics and transportation projects in various and inconsistent ways (Iyer et al., 2021). For example, in European and Canadian settings, HIA is often considered together with EIA, but in the United States, EIA conducted at the federal level often does not include human health impacts (Iyer et al., 2021). It is suggested that legislation requiring the adoption of the HIA in addition to the EIA would incentivize policymakers to consider both human health and environmental impacts when making decisions (Iyer et al., 2021).

Table 2. Steps for conducting a HIA (WHO, 2021b).

HIA Step	Step Tasks
Screening	Determine whether an HIA is required by determining potential health implications of a policy, programme, or project.
Scoping	Identify key health issues and public concerns to be covered in the assessment. Potential health determinants may include factors such as the social and physical environment (i.e., housing quality, crime rates and social networks), personal or family circumstances (i.e., diet, exercise, risk-taking behaviour, and employment) and access to public services.
Appraisal	Estimate potential health gains or losses, including assessment of population groups affected, baseline health status and predictions about likely changes of health status through the programme, policy, or intervention and from possible strategies to prevent negative health impacts.
Reporting	Draw conclusions and make recommendations.
Monitoring	Monitor the actual health impacts.

Calls for a more consistent and thorough approach for considering the health implications of cross-sectoral government policies has taken the form of the Health in All Policies (HiAP) approach (Tonelli, Tang & Forest, 2020). This is a critical opportunity for public health policy as many of the influences for human health outcomes, including risk factors for disease, inequitable access to care, and other SDH are determined by policies outside of the health sector (Marmot, 2005). There are many examples of how the HiAP approach and intersectoral action have been used to improve population health such as within Australia and China (Tonelli, Tang & Forest, 2020). Recently, the HiAP approach has been advocated for when addressing improved access to green spaces in England (Ridgley et al., 2020), which may suggest its relevance for blue spaces as well. In Canada, however, the HiAP approach has been neglected despite the nation's commitments at the Pan American Health Organization Directing Council, which in 2014 outlined its Plan of Action on Health in All Policies (Pan American Health Organization, 2014). When evaluating the effectiveness of the HiAP approach, studies have indicated its successes at initiating actions across sectors that should lead to improved population health (Baum et al., 2019). The HiAP approach has also been framed as having the potential to support planning and development decisions that promote health equity by considering the distribution of health effects and redressing historic spatial inequities (Corburn, 2017).

In order to implement by the HiAP approach, marine spatial planners would be required to comprehensively investigate the health impacts of proposed marine spatial plans within the communities that they will impact. It is hypothesized in this study that modifying the Convention on Biological Diversity (CBD) criteria for biologically and ecologically significant areas to reflect those of salutogenic importance or salutogenically significant areas (SSAs) is one way this could be achieved. SSAs, can be defined as places which facilitate various components of human health including physical (clean air, exercise), emotional (wellbeing, mood, coping, rest), psychological (mental health, sense of belonging/identity), self-fulfilment (achieving one's full potential, being creative), spiritual (connection with nature or other), social (friends, family, community), cultural (customs, traditions, beliefs), food/sustenance, medicinal, security and safety, through different means of engagement, or activity. The salutogenically significant areas (SSAs) criteria that are influenced by multiple health and spatial concepts and frameworks, can then be incorporated into the HIA which then influences other steps for MSP.

2.4 Chapter Conclusions

As the human health benefits of blue spaces are being increasingly supported by research, calls for its recognition within decision-making processes have been widespread (Gascon et al., 2017; Garrett et al., 2019; Hooyberg et al., 2020). Salutogenic benefits of the coast need to be reflected within coastal management policy and practice, both nationally and internationally (Bell et a., 2015). These benefits have not presently been discussed as such with an ES framework, however, the integration of ES within the decision-making process is being increasingly endorsed by various policies and initiatives, with spatial planning targeted as one of the most relevant fields (Longato et al., 2021). Increased pressures on coastal spaces both from human activity and climate change requires the deliberate planning for the protection and promotion of natural spaces to ensure continued access to coastal salutogenic resources (Hooyberg et al., 2020). This is particularly important for spatial planning as research has demonstrated the importance of place for participants of coastal activities (Foley, 2017; Wheaton et al., 2020; White et al., 2016) and should be prioritized (Bell et al., 2015; Wheaton et al., 2020). By utilizing the HiAP approach and adapting the MSP process to include the HIA tool, spatial planning implications for human health may be considered while prioritizing health equity.

Chapter 3: Methods

3.1 Study Area

This study will identify the health-related benefits of participating in coastal activities and the associated current and potential barriers to access to better inform marine spatial planning (MSP), within the context of K'jipuktuk (Halifax Regional Municipality (HRM)). K'jipuktuk, or Halifax, is the capital of the Canadian province of Nova Scotia (NS), occupying 5,577 square kilometers, with a population of 448,544 (Munro, 2021). The study region of HRM is comprised of sixteen polling districts that includes the dense city center of Halifax, with smaller surrounding suburban, coastal and rural communities (HRM, 2021) (Figure 3). Within HRM, the coastline expands approximately 400 kilometers, and hosts a variety of coastal activities such as surfing, boating, sunbathing, snorkeling, and scuba diving (Green, 2004). Gathering information about the salutogenic coastal activities occurring in HRM and those who participate in them allows for a greater understanding of why the preservation of such areas are important and how access to the spaces that facilitates these activities can be supported.

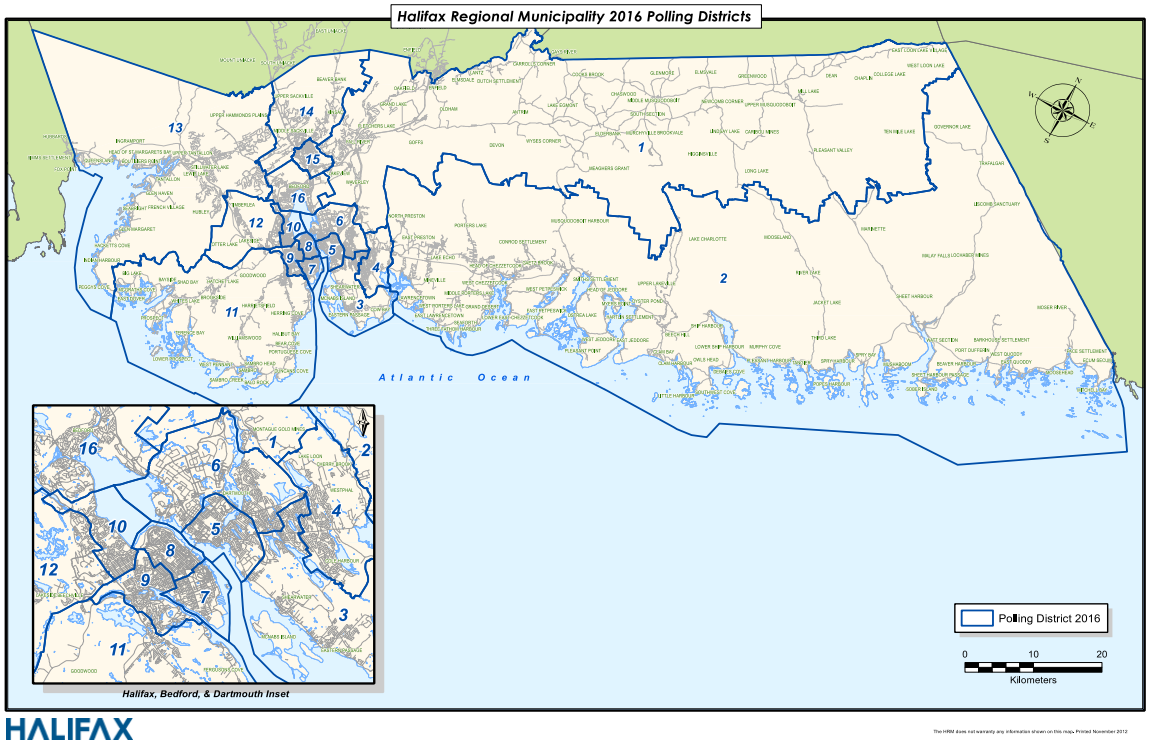

Figure 3. Halifax Regional Municipality 2016 Polling Districts (HRM, 2021).

This study also examines barriers to accessing coastal spaces that may be influenced by six sociodemographic quality categories including race, ethnicity, gender, sexual orientation, class, and disability. The province of NS including HRM has a complex colonial history involving European settlers and Indigenous Mi'kmaq, to whom this land traditionally belongs, as they did not give up their land rights through treaty, voluntary cession, or otherwise (Province of Nova Scotia, 2018). African or Black Nova Scotians also share a prominent past in HRM and NS, as descendants arrived here as settlers, refugees, or slaves (Province of Nova Scotia, 2021). Presently, HRM is considered one of the most diverse municipalities in the Atlantic region (HRM, 2021). The municipality promotes working to support a variety of community initiatives including those in the African Nova Scotian, Acadian/ Francophone, Urban Indigenous, LGBTQ+ and Newcomer communities, as well as with persons with disabilities (HRM, 2021).

Government initiatives to support underserved populations is grossly lacking in cases of spatial planning and development polices in Indigenous and Black communities throughout NS (Waldron, 2021). The Northern Pulp mill development in Pictou Landing First Nation is one coastal example (outside of HRM) of where these initiatives could have proved useful. Under a provincial agreement, the Northern Pulp mill was approved for development in 1967, and its effluents have since disrupted the once salutogenic activities of hunting, fishing, canoeing, and swimming, once enjoyed by the Mi'kmaq community in Boat Harbour (Googoo et al., 2018). Not only has the development impacted the salutogenic properties of the area but is argued to have created pathogenic (disease causing) states within the community such as cancer and respiratory disease (Hoffman et al., 2017). If decision makers continue to fail to understand and address the ways that environmental racism has shaped the current conditions of underserved communities in NS, health equity cannot be recognized (Waldron, 2021). This scenario serves as an example of how a Health Impact Assessment (HIA) could have been beneficial in assessing the projected community health impacts of a hazardous development. The participatory methods employed in this study and associated recommendations may serve as a means to address some of these issues.

Spatial planning in NS is further complicated by the marine development goals posed by ocean industries. While NS is known as "Canada's ocean playground" for the diversity of coastal activities available for public participation (Develop Nova Scotia, 2021), Halifax has been termed "Canada's ocean city" for the immense economic opportunities that are provided by the

sea (Halifax Partnership, n.d.). Ocean industries in NS are comprised of fisheries and aquaculture, tourism, shipbuilding, offshore oil and gas, transportation, marine defense and security, life sciences, renewable energy, ocean technology and marine sciences research (Nova Scotia Business Inc., 2021). Although NS and Halifax, are positioned as opportunistic places for the development of the blue economy, they are subjected to the impacts of climate change such as coastal erosion and flooding (Province of Nova Scotia, 2014), in addition to the other anthropogenic impacts of marine development (Drius et al., 2019). In 2021, the Department of Fisheries and Oceans launched a Blue Economy Strategy for Canada that aims to support the 296,180 marine-related jobs currently in the work force, while emphasising the growth of employment opportunities within a sustainable environment (Fisheries and Oceans Canada, 2021). Ensuring coastal development that prioritizes the preservation of marine environments is a complex issue that will require collaborative and comprehensive planning measures.

3.2 Study Design

This research utilized a mix-methods approach consisting of a combined online participatory mapping and questionnaire survey. This research received approval from the Marine Affairs Program Ethics Review Standing Committee (MAPERSC #: 2021-03). The study population included residents of NS who were 18 years of age and older who participate in coastal activities in HRM. Recruitment strategies targeted residents of HRM and included distributing a poster advertisement (Appendix I) through email, posting to the project's social media accounts (Halifax Ocean Project), and physical copy distribution to recreation centres, sporting goods stores, public libraries, cafes, farmer's markets, and public bulletin boards within the sixteen districts of HRM (Figure 3). The Halifax Ocean Project social media account was created with the goal of increasing the public understanding of the research objectives while generating interest and participant recruitment for the mapping and questionnaire survey. In attempts of enhancing representation, diversity groups were targeted through social media by distributing the survey advertisement to social media accounts known to engage with underserved population groups within HRM. Sample targeting approaches have been used in previous studies in attempts of achieving greater socio-cultural representation within the study sample (Rall et al., 2017; Rall, Hansen & Pauleit, 2019). All survey responses were anonymous. An incentive for the chance of winning one of five $50 Visa gift cards was included in the survey promotion.

3.2.1 Participatory Mapping

This study utilized a participatory mapping approach using Maptionnaire software. Maptionnaire is a community engagement platform that allows for individuals to design and implement a digital public participatory geographic information system (PPGIS) mapping survey (Brown & Fagerholm, 2015). The technology allows for the gathering of spatial and questionnaire type data all in one online tool (García-Díez et al., 2020; Maptionnaire, n.d.; Rall et al., 2017). Maptionnaire is very intuitive as information specific to each mapped item can be gathered from pop-up boxes containing closed or open-ended questions that appear after plotting (Figure 4) (Fagerholm et al., 2020; García-Díez et al., 2020; Rall et al., 2017). The platform has been mostly used for mapping and exploring perceptions of cultural ecosystem services (CES), as demonstrated in studies such as in Berlin (Rall et al., 2017; Rall, Hansen & Pauleit, 2019), Madrid (García-Díez et al., 2020) and within a broader human well-being study across Europe (Fagerholm et al., 2019).

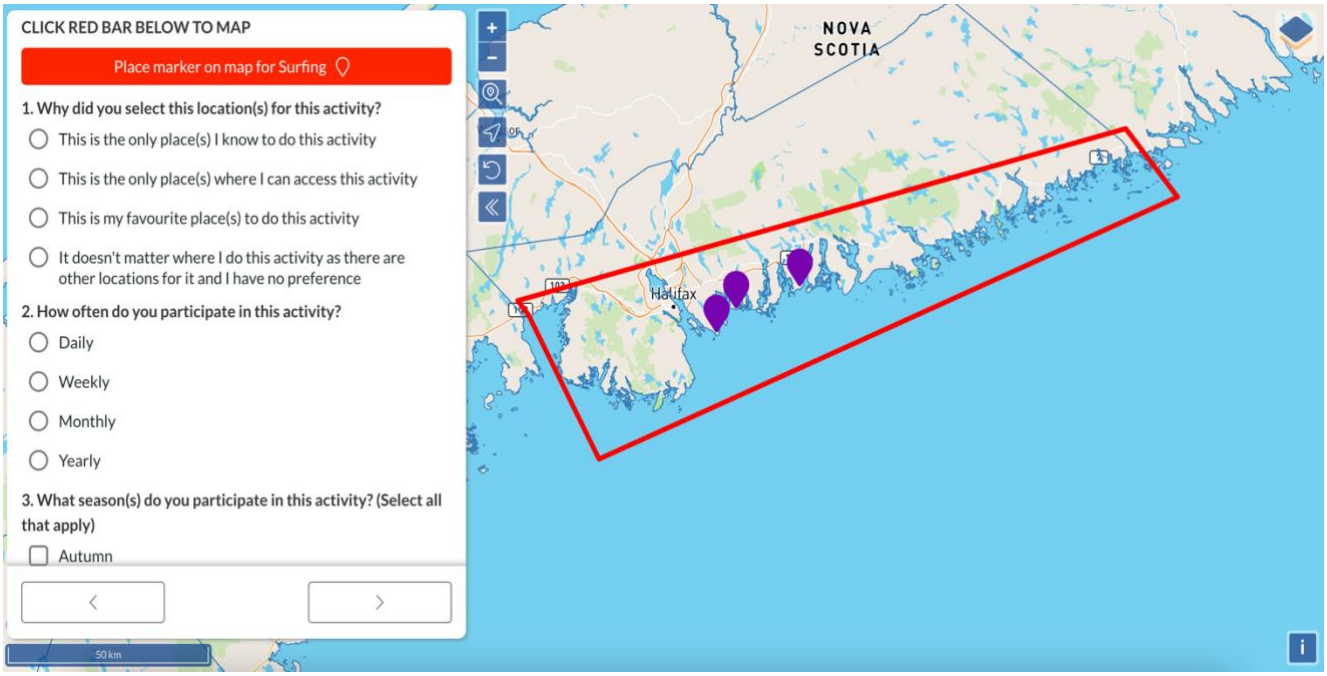

Figure 4. Screenshot of activity specific questions within the mapping and questionnaire survey created with Maptionnaire. Plotting points (purple) for the activity of surfing are demonstrated within the HRM boundary (red box).

The online mapping and questionnaire survey guided participants through the plotting of points on a map of their favourite or most frequently participated coastal activities based on the

list of 28 activities provided and answering questions related to each activity chosen (Appendix II). The list of activities was generated by combining those identified in various PPGIS and blue space studies that explored ecosystem services (ES) (Bell et al., 2015; Diggon et al., 2019; Johnson et al., 2019; García-Díez et al., 2020), in addition to activities that were deemed as being important for Mi'kmaq communities (Moore, 2009). Participants had the option to plot a maximum of five different activities. The option of "other" was also provided within the list of activities which has been recommended to allow for the mapping of participant-defined items (Brown, 2004). Participants could map a maximum of 10 plotted locations for each activity.

Plotting of locations occurred by dragging the map to the relative location of the activity, utilizing the zoom function if desired and placing a point on the map. Point plotting has been determined as the most common method for ES value plotting (Brown & Fagerholm, 2015) and appears less cognitively challenging for participants compared to other methods (Brown & Pullar, 2012). The map view was centered on HRM at 44.676384 latitude and -63.45507 longitude with a zoom level of 11.5, which allowed for the visibility of major highways, wilderness areas and communities. Adjusting the zoom level was permitted, as this allowed for additional map details such as road names and provincial parks to be displayed. Ensuring these features were available was important as it is suggested that the inclusion of more landscape features on the map provides participants with greater recognition of the area when plotting values (Brown, 2004). The study region of HRM was identified within a red box on the map and was conveyed to participants through the mapping instructions (Figure 4.). Once all points were plotted for the activity the participant is directed to answer questions regarding that specific activity. Next, the participant has the option to return to the list of activities to continue mapping or to proceed to the next part of the survey. The Maptionnaire survey was made accessible through desktop and mobile devices.

3.2.2 Questionnaire

During and after the activity plotting process, participants were guided through the questionnaire portion of the Maptionnaire survey. The questionnaire had three sections of multiple choice and open-ended questions that were: activity-specific which appeared after the plotting of each activity; general that were answered after the plotting of all activities; and demographic-related which were provided at the end of the survey. The activity specific section included 16 questions that were answered for each activity that the participant mapped

(Appendix II). These included questions about the activity that were guided by oceans and human health (OHH) and health equity themes which explored spatial and temporal attributes, benefits for human health, impacts of ocean health, financial qualities, identity/social barriers, and impacts of marine developments/ infrastructure (Appendix II). Answer options for the multiple-choice questions were derived from a variety of sources: health related answer options from question four were influenced by Maslow's Hierarchy of Needs (Maslow, 1943), the social determinants of health (World Health Organization, 2021) and the Millennium Assessment for Ecosystem Services (Millennium Ecosystem Assessment, 2005); ocean health answer options from question six were influenced by the Ocean Health Indicators (Ocean Health Index, 2021) and Knapp et al. (2002); sociodemographic quality barrier categories from question 10 were derived from Juster-Horsfield & Bell (2021); and marine development/infrastructure answer options from questions 14 and 15 were based on Canada's Blue Economy Strategy (Fisheries and Oceans Canada, 2021).

Questions were formatted as multiple choice (choose all that apply), multiple choice (single response), and open-ended (via text box). Multiple choice questions included the option of "other" where applicable. Providing open ended questions was important in facilitating participant self-expression (Brown, 2004; Brown, Reed & Raymond, 2020; Fagerholm et al., 2019; Rall et al., 2017). In questions where the sequence of the answers did not have numerical or sequential significance, randomization was applied to reduce respondent bias. Participants were also assured that they did not have to answer any questions that they were not comfortable answering in the beginning and throughout the survey.

3.3 Analysis

3.3.1 Questionnaire Analysis

The Maptionnaire questionnaire data were exported to Microsoft Excel for further analysis. Surveys were then filtered to only include those that had at least one question answered. The responses were then sorted by question where statistical analysis could be executed. Selective data were generated into graphs to provide a visual representation of the survey responses. The data were conveyed in a way to increase the understanding of the salutogenic significant areas (SSAs) that occur and what barriers may be present in obtaining access to these places.

3.3.2 GIS Analysis

To identify SSAs in HRM, geographic information system (GIS) analysis was conducted using Maptionnaire and ArcGIS software. First, Convention on Biological Diversity (CBD) criteria for ecologically and biologically significant areas for MSP were modified to apply to SSAs (Table 3). SSAs were established by finding similarities between the definitions for CBD criteria (Table 1), and the OHH and health equity themes that guided the development of the questionnaire (Appendix II). Initial analysis was then conducted with Maptionnaire to filter for mapped activities that were associated with the questionnaire responses (in bold) that had correlations with each SSA criterion (excluding the diversity criterion) as shown in Table 3. The shapefiles or layers for each map representing the SSA criteria were then downloaded to ArcGIS where further analysis could be conducted. Both coloured dots and symbols representing the different activities plotted were used to achieve a greater visual distinction between activities. Map points that were plotted inland or outside of HRM were removed.

Areas of high density based on each SSA criteria were determined by applying the ArcGIS heat map feature on all maps except for the diversity map as other tools were applied. The density of the points for the heat map were calculated using the kernel density method, as a function of the ArcGIS heat map application. Hot spots were then qualitatively identified based on the application of the heat map. The density map did not undergo initial filtering within the Maptionnaire software as the other maps had, as this map included all activities regardless of their association with the questionnaire responses that influenced the other SSA criteria maps. The diversity map (Figure 7) was created by applying an overlay of 2km-by-2km squares and colour coding them based the number on different activities occurring within each square. This allowed for the visualization of the areas that contained the highest concentration of diverse activities.

Lastly, SSA priority areas were determined by merging the plot points associated with each SSA criteria and applying the ArcGIS heat map function. An overlay of the diversity map was then applied. This allowed for the visualization of the areas containing the highest density of SAA criteria. A similar approach in prioritizing areas based on criteria/ target representation is utilized in MSP when allocating for conservation priorities. In MSP, this often occurs through the application of decision support tools such as Marxan. Marxan is a commonly applied decision support tool that aims at achieving some minimum representation of biodiversity

features in spatial planning for the smallest possible, usually socioeconomic costs (Janßen, Göke & Luttmann, 2019).

Table 3. CBD modifications and questionnaire responses for the development of SSA criteria. The questionnaire answers in bold were those that were selected for when filtering for activities to represent the associated SSA criterion.

CBD Criteria Name	SSA Criteria Name	SSA Questionnaire/GIS Analysis
Uniqueness or rarity	Uniqueness	Why did you select this location(s) for this activity? **a. This is the only place(s) I know to do this activity** **b. This is the only place(s) where I can access this activity** c. This is my favourite place(s) to do this activity d. It doesn't matter where I do this activity as there are other locations for it and I have no preference
Biological diversity	Diversity	GIS analysis
Biological productivity	Productivity	How important do you think this activity is for your health? a. **Very important** b. Important c. A bit important d. Not at all important
Importance for threatened, endangered or declining species and/or habitats	Importance for underserved populations	Do you (or have you) experience(d) any barriers associated with your identity/qualities when participating in this activity? (Select all that apply) **a. Race** **b. Ethnicity** **c. Gender** **d. Sexual orientation** **e. Disability** **f. Class/ financial status** g. I have not experienced barriers
Vulnerability, fragility, sensitivity, or slow recovery	Vulnerability	How concerned are you for having access to this activity in the future based on these issues or developments? **a. Very concerned** b. Concerned c. A bit concerned d. Not at all concerned

Chapter 4: Results

The online participatory mapping and questionnaire survey was active from June 15, 2021, to August 15, 2021. As described in Chapter 3, the survey was designed to reflect the health benefits and barriers of participating in coastal activities in Halifax Regional Municipality (HRM) to better inform marine spatial planning (MSP). The survey generated 194 responses, of which 74 were blank (participants chose an activity but did not complete any questions), resulting in 120 responses selected for further analysis. Each question of the survey had a different number of people who responded, as there were no mandatory questions, and therefore, was reflected in the statistical analysis for each question, resulting in "n" being varied. In addition, it is important to note that "n" equals the number of responses rather than respondents for the activity specific questions, as respondents were free to answer the same questions for a number of different activities. After acknowledging that the demographics for this study did not reflect those of HRM, the aim of this chapter was altered to not be representative of all people and coastal activities in HRM, but to provide an example of how human health data can be collected and considered within MSP and to present some findings from the particular group of respondents that participated in the survey.

4.1 Participant Demographics

A sample size of 120 for a population of 448,544 has a margin of error of 8.94 per cent at the 95% confidence level (American Research Group, 2017). The following demographics were explored to gain an understanding of how representative the study sample was in relation to the study population of HRM (Table 4), more specifically based on the social/identity barriers of race, ethnicity, gender, class, sexual orientation, and disability that are suggested to influence an individual's access to blue spaces (Juster-Horsfield & Bell, 2021; Watson 2019; Wheaton et al. 2020). While women were adequately represented in the study population in comparison with the population of Canada, racial and ethnic minorities, people of low socioeconomic status, and people living with disability were not adequately represented (Table 4).

Table 4. Study population and HRM population comparison using information from Statistics Canada.

Demographic Quality	Study Population	Statistics Canada
Racial/ethnic minorities	7.5%	11.39%[1]
Women and gender minorities	54% (women); 0.8% (gender minority)	51.5%[2]
Low socioeconomic status (household total annual income during an average year < $25,000)	9.2%	14.3%[3]
People living with disability	15%	28.5%[4]

4.2 Spatial/Temporal Values and Activity Preferences

A total of 210 selections were made for 25 different activities from the list of 28 activities that were provided and were mapped a total of 591 times (Table 5; Figure 5). The most popular places to participate in coastal activities were along the shoreline of Halifax Harbour and the Northwest Arm between Districts 5, 7 and 9 and within Cow Bay and Lawrencetown of Districts 2 and 3 (Figure 5). The activity option of "other" was also provided and can represent the activity of "R/C Slope Soaring" or "Flying RC Aircraft/Drone", as this was indicated by all respondents who chose this option. Walking, hiking, or running was the most popular choice with 45% (n=120) of respondents choosing that option, followed by swimming (25.8%). Walking, hiking, or running was also the most plotted activity on the map with 169 points or locations out of the total 591. Most respondents indicated that they participate in their selected activities frequently as the majority chose weekly (42%, n=202), followed by monthly (35.6%), yearly (16.3%) and daily (5.9%). Respondents also indicated to participate in activities throughout the year with summer being most popular (38%, n=529), followed by autumn (27%), spring (22.9%), and winter (12%).

Most respondents indicated that the locations they chose to map were their favourite place to do the activity (58.7%, n=201), while 29.4% of respondents reported that it did not

[1] Statistics Canada (2016)
[2] Statistics for women in NS, data insufficient for gender minorities. Data obtained from Statistics Canada (2010)
[3] Statistics Canada (2016)
[4] Statistics Canada (2017)

matter where they participated in the activity. Only 7% of respondents stated that their mapped location was the only place(s) that they had access in order to participate in their activities of choice, and 5% reported that their mapped location was the only place(s) where they knew to do the activity. Using the salutogenically significant area (SSA) criterion of uniqueness, locations where respondents indicated that they could only do the activity in that location were mapped (Figure 6). Unique SSAs were most common in Halifax between Districts 7 and 9; Head of St. Margret's Bay in District 13; and Sambro in District 11, respectively (Figure 6). Halifax Harbour and the Northwest Arm between Districts 5, 7 and 9; and Lawrencetown in District 2 contained the SSAs of greatest diversity (Figure 7).

Table 5. Number of respondents and points mapped for each coastal activity within the online mapping and questionnaire survey.

Activity	Number of respondents	Number of points	Percentage of Responses
Walking/Hiking	54	169	25.70%
Swimming	31	74	14.76%
Kayaking	14	44	6.67%
Picnic/SunBathing	14	21	6.67%
Snorkeling	13	30	6.20%
Surfing	11	29	5.24%
Scuba Diving	8	35	3.80%
Biking	8	23	3.80%
Appreciating Scenery from	7	23	3.33%
Appreciating Scenery fron	7	22	3.33%
Camping	6	6	2.86%
Sailing	6	11	2.86%
Fishing	5	15	2.38%
Creative Activities	5	23	2.38%
Wildlife Viewing	4	26	1.90%
SUP	3	11	1.42%
Other- R/C Slope Soaring/	3	4	1.42%
Kite Flying	2	11	0.95%
Boating	2	2	0.95%
Educational Activities	2	6	0.95%
Wind Surfing	1	3	0.48%
Jet Skiing	1	1	0.48%
Foraging for Food	1	1	0.48%
Foraging for Medicinal	1	0	0.48%
Games	1	1	0.48%
Traditional/ Ceremonial A	0	0	0
Beach Yoga/ Meditation	0	0	0
Canoeing	0	0	0
Horse Riding	0	0	0
Total Selections	210	591	

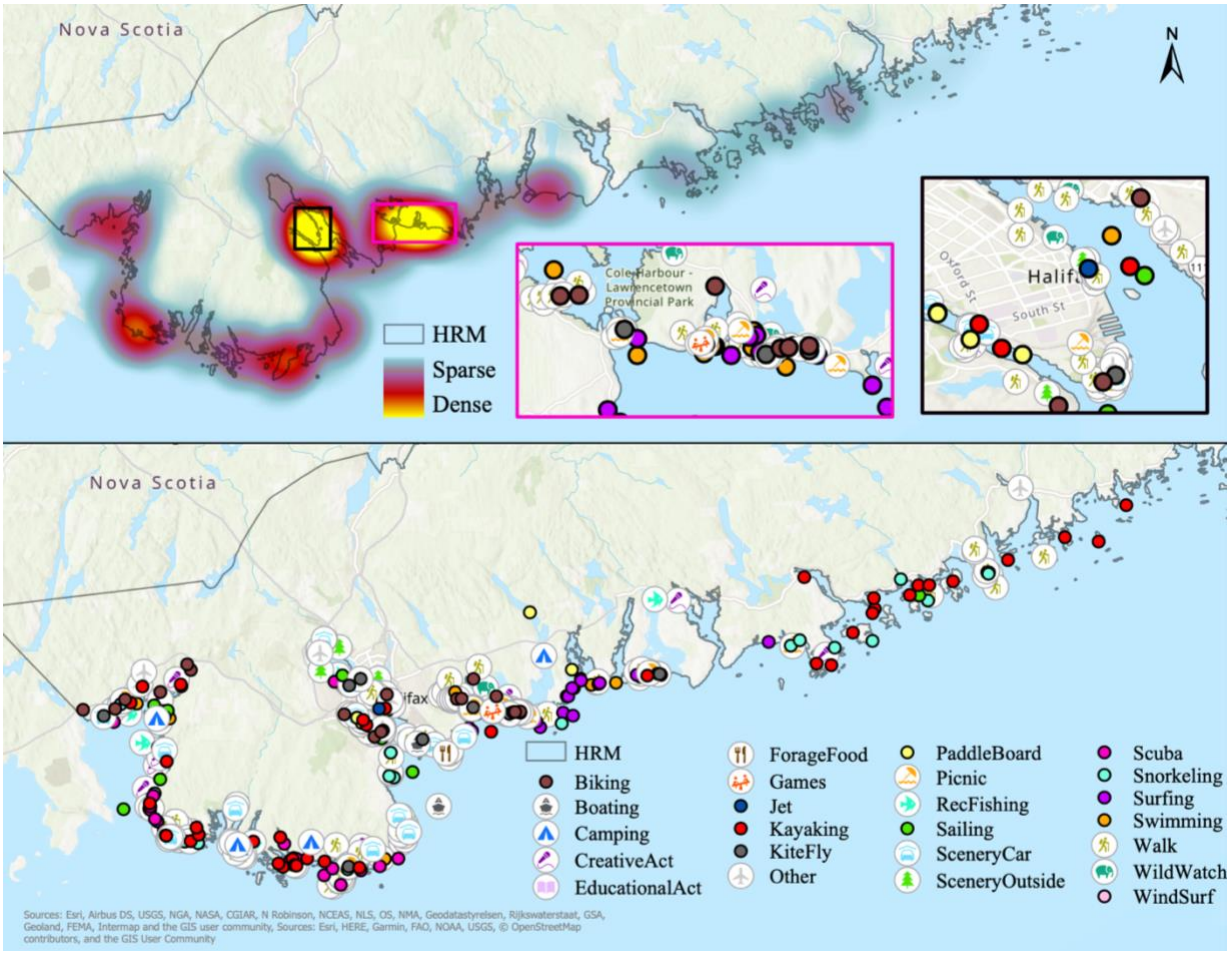

Figure 5. Map of all coastal activities plotted in HRM within the mapping and questionnaire survey (bottom). Heat map applied to all coastal activities with zoomed in areas of highest density (top). Data downloaded from Maptionnaire and translated to ArcGIS Pro format.

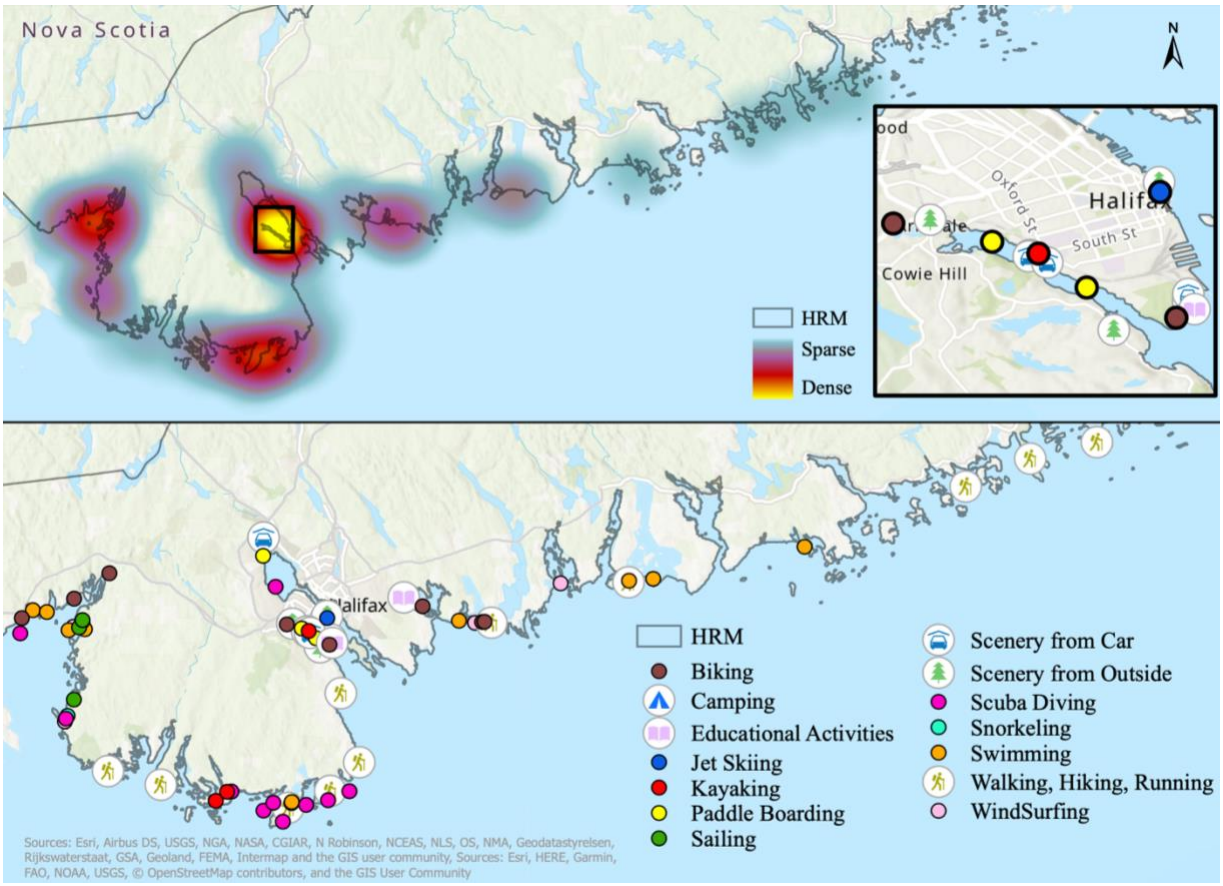

Figure 6. Map of coastal activities representing unique SSAs (bottom). Heat map applied to unique SSAs with zoomed in areas of highest density (top). Data downloaded from Maptionnaire and translated to ArcGIS Pro format.

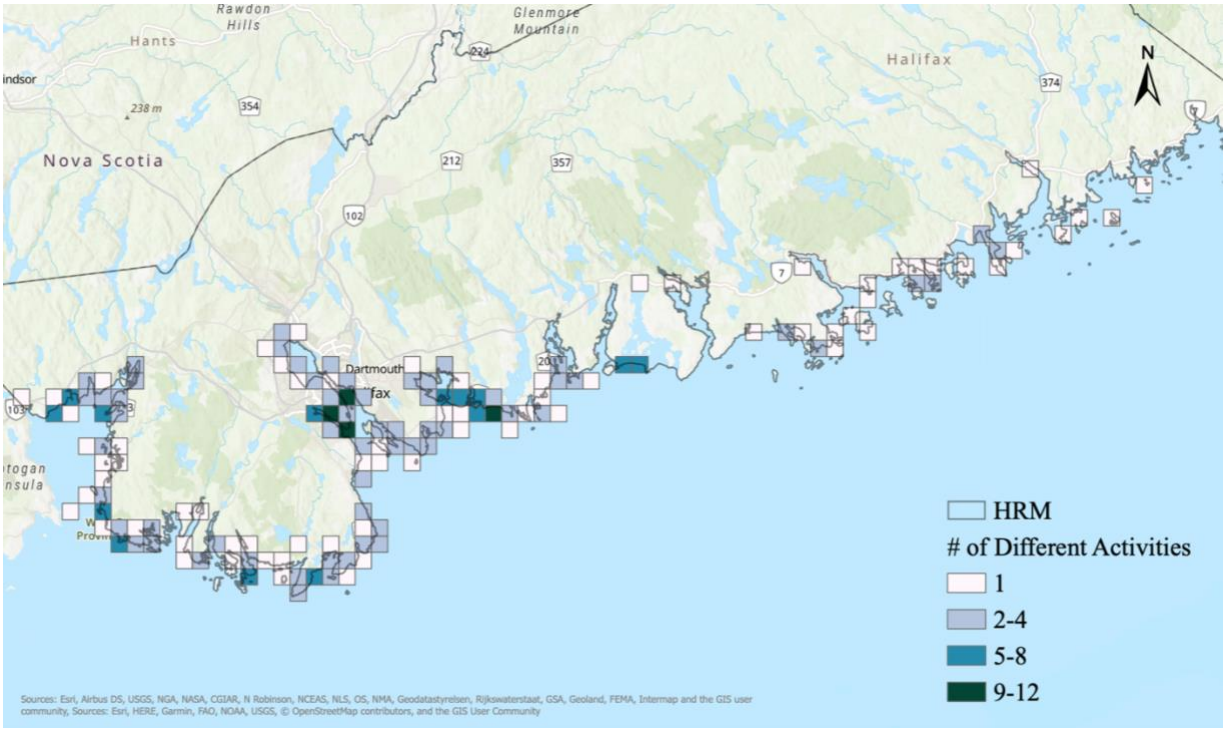

Figure 7. Map of coastal activities representing the diverse SSAs. The squares represent areas that are 2kmx2km and contains at least one activity. Data downloaded from Maptionnaire and translated to ArcGIS Pro format.

4.3 Human Health

The perceived health benefits of participating in coastal activities were investigated by asking respondents to select the health benefits that are associated with their participation in their chosen activity (Table 6). Physical, psychological, and emotional health benefits were those most reported (n=881) and at almost equal frequency (18.7%, 18.6%, and 18.3%, respectively). About half (53%) of respondents (n=358) reported participation in the activity was very important for their health, followed by 31% being important, 14.8% a bit important and 1.1% not at all important. SSAs associated with activities that were most productive in generating health outcomes were located in areas near Halifax Harbour and the Northwest Arm between Districts 5, 7 and 9 and Lawrencetown in District 2 (Figure 8).

Table 6. Frequency of health benefits chosen for all coastal activities that were mapped in the mapping and questionnaire survey.

Health Benefit	Number of responses
Physical (clean air, exercise)	165
Psychological (mental health, sense of belonging/identity)	164
Emotional (wellbeing, mood, coping, rest)	161
Social (friends, family, community)	153
Spiritual (connection with nature or other)	106
Self-fulfilment (achieving one's full potential, being creative)	94
Culture (customs, traditions, beliefs)	12
Food/sustenance	11
Medicinal	7
Security and safety	7
I do not think there is a health benefit	1

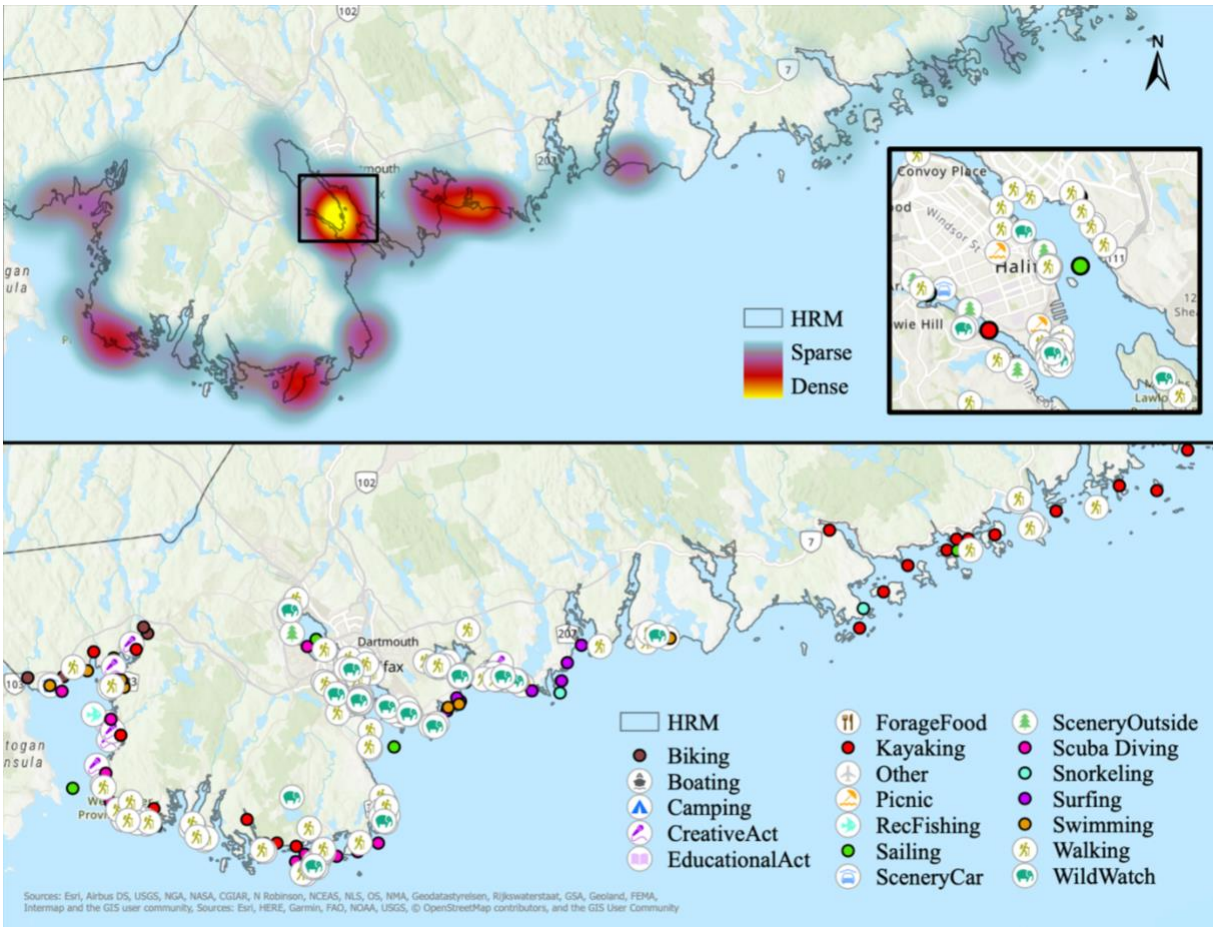

Figure 8. Map of coastal activities representing productive SSAs (bottom). Heat map applied to productive SSAs with zoomed in areas of highest density (top). Data downloaded from Maptionnaire and translated to ArcGIS Pro format.

4.4 Barriers

4.4.1 Environmental

To gauge awareness of how the health of the ocean is perceived to impact the respondent's participation in their chosen coastal activity, a question was asked regarding the ocean health indicators and perceptions of negative impact (Table 7). The responses (n=682) were varied, with most common answers being plastic/litter pollution, chemical pollution, and coastal erosion (19.6%, 14.7%, 12.2%, respectively). Only 11 respondents (1.6%) of respondents did not think the health of the ocean had an impact on their participation in the chosen coastal activity, while 2.1% was unsure.

Table 7. Frequency of ocean health indicators chosen for all coastal activities that were mapped in the mapping and questionnaire survey.

Ocean Health Indicators	Number of Responses
Plastic/litter pollution	134
Chemical pollution (ex. sewage, industrial waste, agricultural run-off)	100
Coastal erosion	83
Marine toxins (ex. Algae, paralytic shellfish poisons (PSPs))	71
Habitat loss	66
Decrease in biodiversity (loss of species or sea life)	55
Water-borne diseases	54
Ocean warming	37
Increase in jellyfish numbers	33
Acidification	24
Unsure	14
I do not think the health of the ocean impacts my participation	11

4.4.2 Identity/ Social

Identity/social barriers to participating in coastal activities were investigated through class, race, ethnicity, gender, sexual orientation, and disability identifiers. Class or financial security was first explored when asking respondents questions regarding start-up and going costs (Figure 9), along with cost types (Table 8). Just less than one third of respondents (n=182) indicated no start-up costs (28.6%), while 15.4% selected $200-800, 14.3% chose $10-50 and 14.3% chose greater than $1000. Ongoing costs were less varied with 47.2% (n=180) of respondents choosing $10-50, and 35% choosing no ongoing costs. Transportation costs were the most reported activity cost, representing 39.9% of responses (n=316), while gear costs were second representing 26.9% of responses.

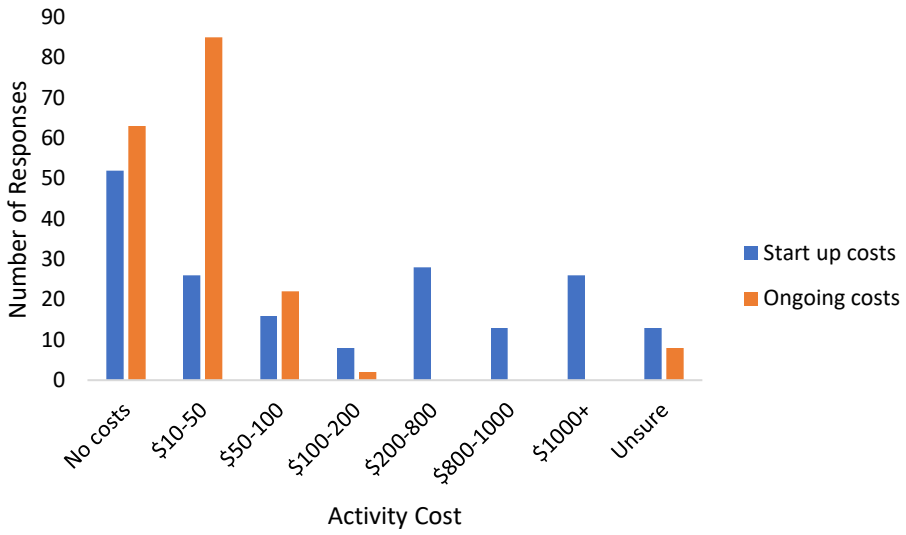

Figure 9. Frequency of start-up and ongoing costs associated with the coastal activities that were mapped in the mapping and questionnaire survey.

Table 8. Frequency of cost types chosen for all coastal activities that were mapped in the mapping and questionnaire survey.

Cost Type	Number of Respondents
Transportation	126
Gear	85
Does not cost anything	49
License	28
Paid education/ lessons	19
Membership/subscription	9

Next, respondents were asked if they had experienced barriers associated with their race, ethnicity, gender, sexual orientation, class, and/or disability identifiers when participating in the chosen activity. The majority (76.9%) of respondents (n=195) reported to have not experienced barriers, while 10.3% reported class barriers, 9.2% reported gender barriers, 3.1% reported disability barriers and 0.5% reported race barriers, however it is important to note that the study sample was under-representative of underserved demographic groups. Ethnicity and sexual orientation barriers were not selected by any participants. The underserved populations SSA criterion was investigated here, as areas that included activities associated with the identity/social

barriers were highlighted (Figure 10). Areas most associated with social/identity barriers included Halifax Harbour and the Northwest Arm between Districts 5, 7 and 9 and within Cow Bay and Lawrencetown of Districts 2 and 3 (Figure 10).

Interestingly, participants selected strategies to address these barriers almost twice as often (82 times) as identifying the barriers themselves (45 times) for identity/social barriers (Table 9). The identity/social barrier question was asked first with the solution question positioned as a follow up if the participant had indicated yes to having barriers. Having access to the activity closer to home or within public transport limits (reducing transportation costs) was the most reported (n=82) strategy (30.5%) to overcome barriers, 24.4% did not think there were effective strategies, 21.9% indicated safety measures as a strategy and 7.3% reported having the activity closer to community to lessen the probability of being subjected to racism/discrimination as a strategy.

Table 9. Frequency of identity/social barrier mitigation strategies chosen for all coastal activities that were mapped in the mapping and questionnaire survey.

Strategies	Number of Respondents
Having access to this activity closer to home or within public transport limits (reducing transportation costs)	25
I do not think there are any strategies that could do to help this issue	20
Inclusive mobility systems (wheelchair ramps, boardwalks)	18
Safety measures (surveillance, within public view, frequently trafficked area)	11
Having access to this activity within your community (lessens probability of being subjected to racism/discrimination)	6
Prefer not to answer	2

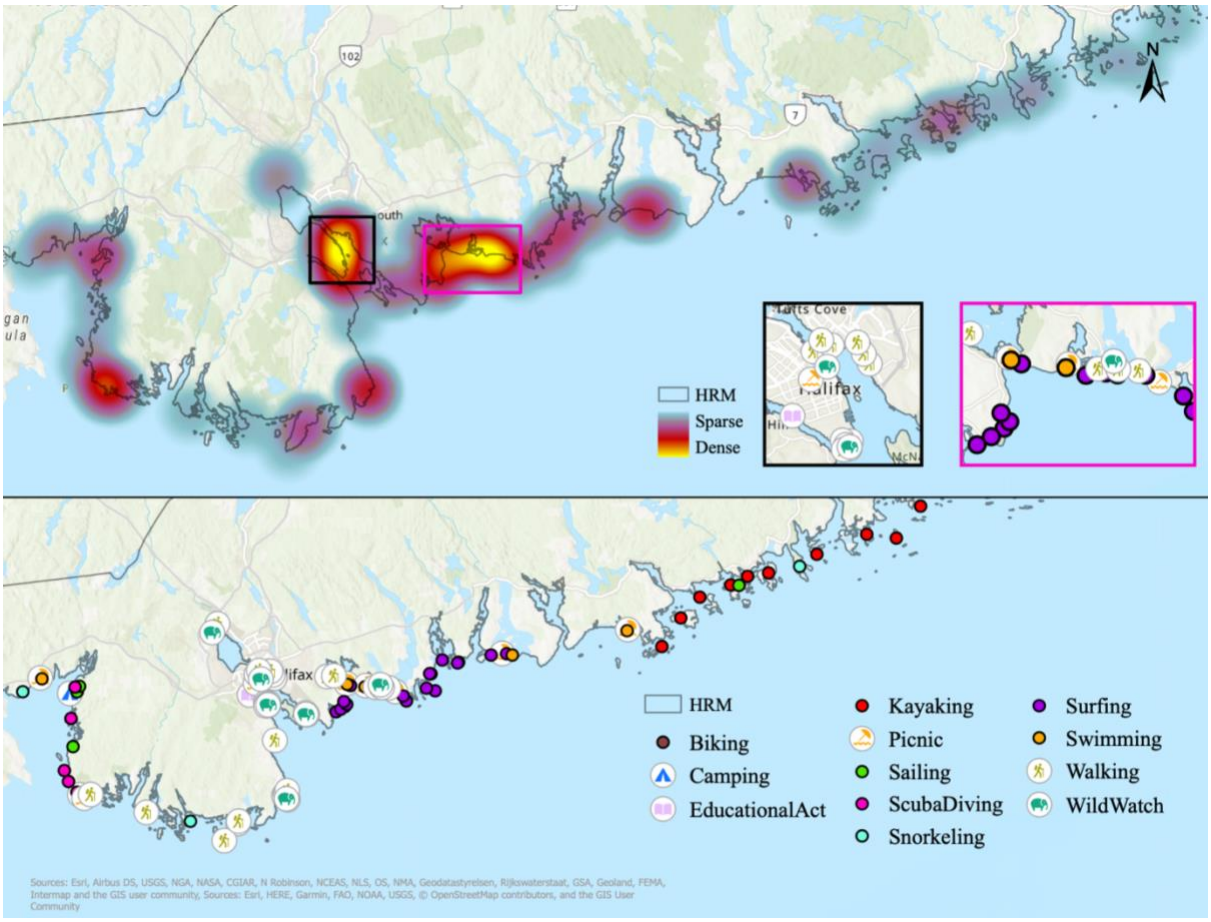

Figure 10. Map of coastal activities representing SSAs that are associated with social/identity barriers related to the importance for underserved population SSA criteria (bottom). Heat map applied to underserved population SSAs with zoomed in areas of highest density (top). Data downloaded from Maptionnaire to and translated to ArcGIS Pro format.

In the last section of the survey, participants were asked if there were other activities that they wanted to participate in but were inaccessible due to certain barriers. Almost half (47.8%,) of respondents (n=92) reported that there were no barriers preventing them from participating in other activities that they were interested in, however 39.1% reported that there were and 13% were unsure. Sailing was the most popular activity that respondents wanted to participate in but could not access due to certain barriers, representing 21.1% of responses (n=71), followed by other gear intensive coastal activities (Figure 11). The open-ended question responses regarding reasons for the activity barriers included cost, transportation, general accessibility, lack of knowledge in where and how to participate, disability, private vs public land accessibility, lack of time, safety concerns, and social acceptance.

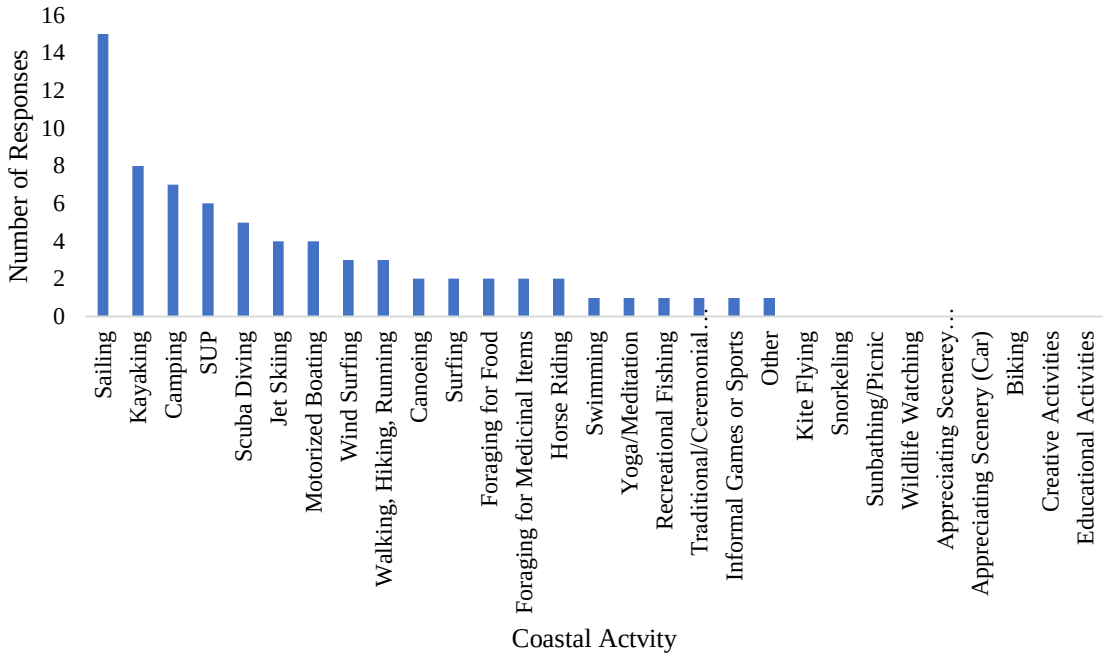

Figure 11. Frequency of coastal activities that respondents identified as wanting to participate in but are inaccessible.

4.4.3 Marine Development

Lastly, marine development impacts on current or future access to coastal activities were investigated by asking respondents to select all of the developments that may have an impact (represented by "concerned") and the most impactful development related to the chosen activity (represented by "most concerned") (Figure 12). Answers varied with the most common responses (n=554) for concern being coastal infrastructure (21.5%) and climate change (20.4%) and the most concern (n=183) being coastal infrastructure (44.3%,). The level of concern for having access to the chosen activity in the future was varied, with most respondents (n=182) being a bit concerned (39%,), followed by concerned (24.7%), very concerned (20.3%) and not concerned at all (15.9%). Peggy's Cove/West Dover between Districts 11 and 13 was the area most associated with activities that were perceived as being vulnerable to anthropogenic threats (Figure 13). Of the respondents that indicated that they were very concerned for a particular activity (n=37), coastal walking, hiking, running was the most reported (27%), followed by snorkeling (16%) and swimming (13.5%).

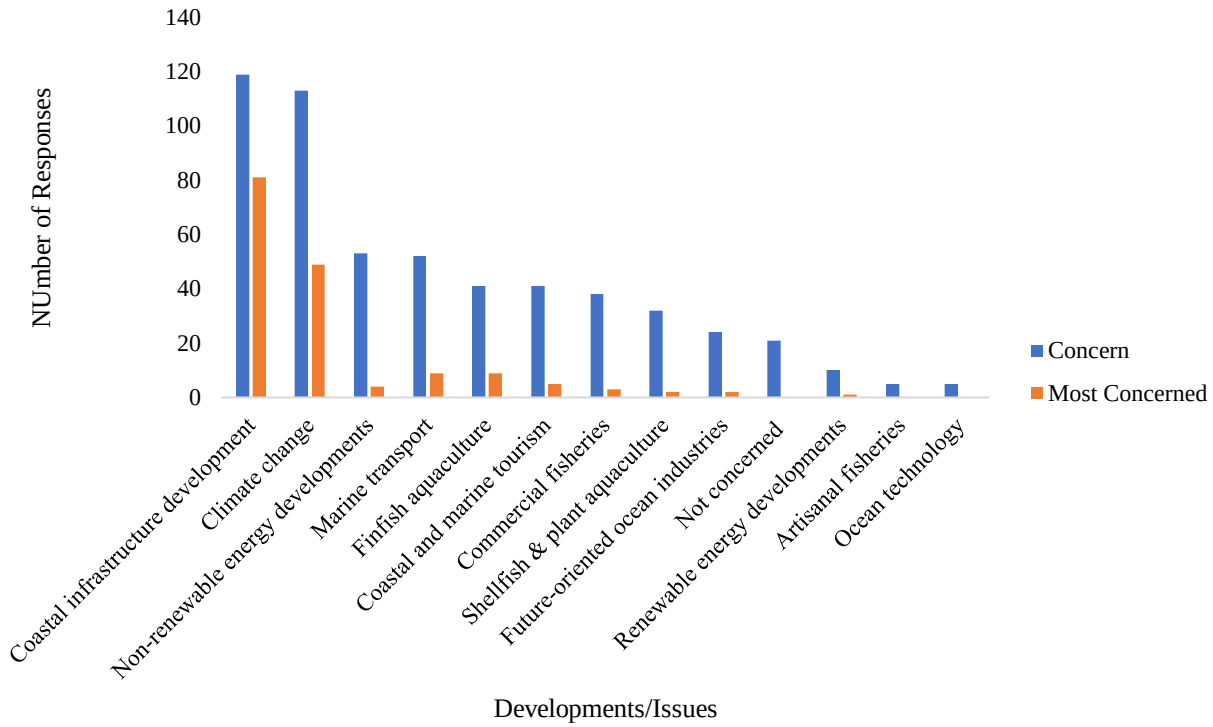

Figure 12. Frequency of marine development/issue concerns related to obtaining future access for all coastal activities that were mapped in the mapping and questionnaire survey.

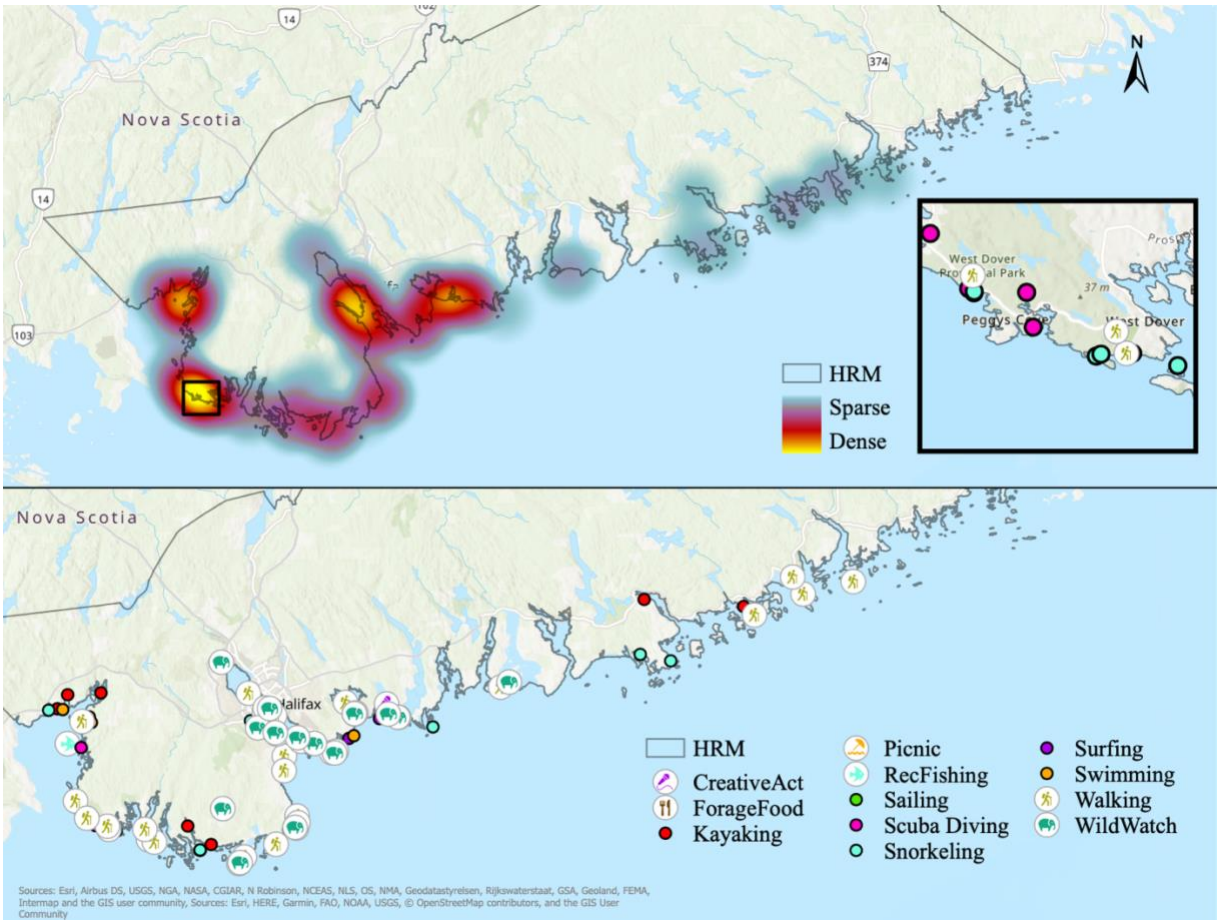

Figure 13. Map of coastal activities representing vulnerable SSAs (top). Heat map applied to vulnerable SSAs with zoomed in areas of highest density (top). Data downloaded from Maptionnaire and translated to ArcGIS Pro format.

4.5 SSA Priority Areas

By integrating all five SSA criteria maps into one and applying the heat map tool, priority SSAs can be identified and considered within decision making processes (Figure 14). In this study, priority areas are defined as those that are most representative of the five SSA criteria which resulted in two SSA priority areas: the shores of Halifax Harbour and the Northwest Arm between Districts 5, 7 and 9; and within Cow Bay and Lawrencetown of Districts 2 and 3 (Figure 14).

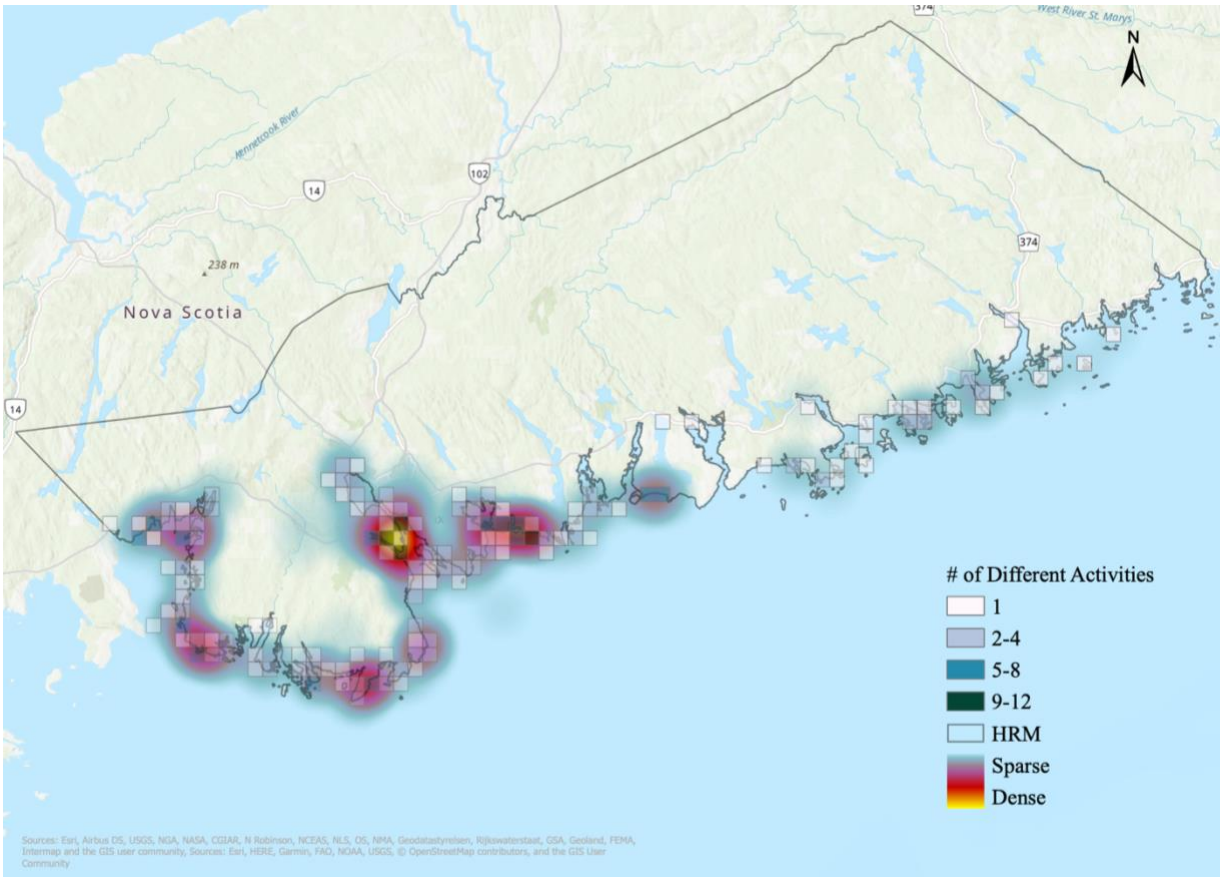

Figure 14. Salutogenically significant priority areas. Created by merging four SSA criteria maps and applying the heat map tool to highlight areas of greatest density. The fifth SSA criteria, "diversity" was included as an overlay.

Chapter 5: Discussion

The results of this study demonstrated that the majority of those who participate in coastal activities in Halifax Regional Municipality (HRM) perceive the activities to be very important for their health. Barriers stemming from concepts of oceans and human health (OHH), and health equity were identified in addition to mitigating strategies or solutions for these barriers. This case study serves as an example of how human health information can be gathered while considering the impacts of climate change, marine development/infrastructure, and harmful social constructions to inform marine spatial planning (MSP). The establishment of salutogenically significant areas (SSAs) and associated criteria (uniqueness, diversity, productivity, importance for underserved populations and vulnerability) allowed for this data to be translated into a form that is useful for spatial planning and therefore has the potential to be reflected in marine policy. In addition to the methods executed in this study, other approaches for collecting SSA criteria information must be taken into consideration, however, as will be discussed in this chapter.

5.1 Uniqueness

Prioritizing uniqueness or rarity in terms of salutogenic coastal activities has many similarities with how this criterion is traditionally conceptualized for biological or ecological significance. Areas of uniqueness in the biological or ecological sense are important to preserve as they are irreplaceable, and the loss would mean a reduction of the diversity at any level (UNEP, 2008a). Areas of uniqueness are important in terms of salutogenic significance as individuals or communities may rely on the activities that occur there in order to fulfill certain health benefits that may not be obtained elsewhere, as demonstrated by the current study and others (Chakraborty & Gasparatos 2019; Gee et al., 2017; Zarandian et al., 2016). For example, Chakraborty and Gasparatos (2019) indicate that unique non-monetary coastal ES such as traditional food culture, recreation and tourism, and spiritual and religious values, were associated with specific places in Japan and were deemed to contribute to the well-being of the local community. Another example is the unique area of the Masset Inlet in Haida Gwaii, as this area holds Indigenous values such as various traditional uses (Marine Planning Partnership Initiative, 2015). These cases emphasize the importance of accounting for uniqueness in determining SSAs.

A component of uniqueness that is likely not included within the Convention on Biological Diversity (CBD) criteria, is that of access. In this study, areas deemed as being unique not only included areas where an activity is not known to occur elsewhere, but also places where access to an activity was limited to that location. Reasons for only having access to a particular activity in the chosen location(s) was not explored in this context. However, such reasons could relate to the landscape of the place (Zarandian et al., 2016) or to the barriers discussed in this study, as respondents who identified access as the reason for choosing the location(s) also identified environmental, social/identity, and/or marine development related barriers to activity participation. As discussed in Chapter 2, social/identity barriers are known to exist when accessing coastal spaces, and evidence of coastal spaces being more difficult to access or inaccessible due to environmental (Hernández-Delgado, 2015; Mehvar et al., 2018) and/or marine development issues (Aguilera et al., 2020; Rao et al., 2015) are also apparent due to their contributions to coastal habitat fragmentation or loss, which may help to explain unique places in terms of access.

Like the gathering of information to meet the CBD uniqueness criterion, salutogenic information can be collected by marine planners to identify areas of significance by having discussions with other government agencies, industry (companies, trade, and governing bodies), charities, environmental groups and research institutes. However, a greater focus should be placed on public bodies, businesses, sport governing bodies, clubs, and sea users, as these groups have been identified as being important in obtaining information on other immaterial values, such as cultural ecosystem services (CES) (Shucksmith & Kelly, 2014). Specifically, the focus on local knowledge and traditional knowledge in identifying unique SSAs may be particularly insightful, as demonstrated in relation to ecosystem services (ES) in numerous studies (Elwell et al., 2018; Fagerholm et al., 2020; Gilliand & Laffoley, 2008; Thornton & Sheeler, 2012). This is because local or traditional knowledge is adapted to the local culture and environment that may be based on experiences within the area that are tested over centuries of use (FAO, 2004), thus having potential for identifying unique places within the area of inquiry.

Those areas that are determined to enable unique activities may be known to or reported by few people, as was demonstrated in this study. Purposeful local community engagement is necessary to account for places that may otherwise be overlooked (Shucksmoth & Kelly, 2014), which may include public participatory geographic information system (PPGIS) approaches

(Brown, Weber & de Bie, 2014; Gilek et al., 2021; Kobryn et al., 2018) and partnering with key informants (Elwell et al., 2018; Mugari et al., 2019). Indigenous communities hold vast amounts of knowledge in relation to the coastal environment (Durkalec et al., 2015) and have guided various ES research to date (Bélisle, Wapachee, Asseilin, 2021; Harmsworth, Garth, and Shaun Awatere, 2013; Pert et al., 2015) which may serve useful for identifying unique places.

There are calls in the literature to further focus on Indigenous knowledge, such as in terms of planetary health (Redvers, 2021). However, in pursuing this research, respect must be given to the polices that individual Nations have developed to ensure an equitably beneficial research process between researchers and First Nation stewardship staff, as such engagements have a long history of being extractive, non-consensual, and damaging (Kitasoo/Xai'xais Stewardship Authority, 2021; The First Nations Information Governance Centre; 2021). Of note is that many Indigenous communities, groups, and representative organizations have developed guides to facilitate this process, see for example "Informing First Nations Stewardship with Applied Research", and should be consulted when considering such engagements (Kitasoo/Xai'xais Stewardship Authority, 2021).

5.2 Diversity

Reasons for ensuring the availability of diverse marine areas in the ecological and biological sense is similar to that of diverse SSAs. The prime aim and justification of conservation research is to benefit biological diversity (Sutherland et al., 2009), due to the numerous life sustaining services that many different species, functions, ecosystems, and environments provide (UNEP, 2008b) and for its contribution to the overall well-being of the ecological system (Magurran, 1988). Preserving a variety of species is important for maintaining the resilience of ecosystems as various species contribute functional components to that ecosystem, that are not shared with other species (Dalerum et al., 2012). Although we, as humans, are of the same species, similarities can be drawn in this case, as preserving diverse SSAs may enable different activities to occur that may appeal or be accessible to specific demographic groups. For example, having access to activities that are of low or no cost, such as swimming or coastal hiking, may be important for people of lower socioeconomic status, as was indicated by various studies (Boyd et al., 2018; Kim, Lyu & Song, 2019; Wolch & Zhang, 2004). Similarly, if ecosystems were to experience biodiversity loss, a reduction of the availability of a variety of activities would result in negative implications for human or environmental health.

Identifying diverse SSAs also requires extensive community engagement, just as was indicated for uniqueness, however, an emphasis on representation is indicated here, where identifying unique places relies on forming trust and relationships with local communities. To achieve a good understanding of the diverse SSAs in a particular place, many coastal users would need to be involved. Best practices for identifying diverse stakeholder/community priorities within natural resource management scenarios have been thoroughly documented throughout the literature (Ehler & Douvere, 2009; Gopnik et al., 2012; Reed et al., 2009). Recommendations include early stakeholder engagement that is meaningful, transparent (Gopnik et al., 2012; Ritchie & Ellis, 2010) and acknowledges power imbalances (Tafon, 2018; Tafon, Saunders & Gilek, 2019).

Conducting a stakeholder analysis that improves stakeholder representation is a suggested initial approach in gaining a greater understanding of the power dynamics within the group and enhancing the transparency and equity within MSP (Saunders et al., 2020; Reed et al., 2009). A stakeholder analysis, also known as a diversity analysis, is a process that involves identifying the natural or social phenomenon that is affected by a decision or action, that includes individuals, groups and organisations, non-human, and non-living entities (e.g., future generations) (Reed et al., 2009). Early stakeholder analysis is suggested as way to empower underserved groups, such as women, by enabling researchers to build their understanding of the needs of the underserved groups so that they are reflected in all stages of the decision-making process (Johnson, 2004). It is with these considerations that diverse SSAs, that are representative of various groups, may be identified and prioritized within MSP.

5.3 Productivity

A productive SSA is important in a similar way that pertains to biological and ecological purposes. A healthy ecosystem is one that is measured by its activity capacity and metabolism, known as productivity, as these factors influences a system's ability to recover from stress and to promote growth (Costanza & Mageau, 1999). Similarly, SSAs are considered to be productive if they are perceived to be associated with being highly important for human health. Areas of high productivity in this study, were associated with various components of human health such as physical, psychological and emotional, which are reflected in the social determinants of health (SDH) (WHO, 2021a), Maslow's Hierarchy of Needs (Maslow, 1943), Millennium Ecosystem Assessment (MA, 2005a) and in numerous ES studies as being important for overall health

(Jennings & Gaither, 2015; Jennings, Larson & Yun, 2016; Sandifer, Sutton-Grier & Ward, 2015; Summers & Vivian, 2018). Other components such as spiritual, which was proposed in the survey as a connection with nature or other, was also highly reported and is the cornerstone of the biophilia theory (Wilson, 1984). There is clear evidence of the range of health benefits that are influenced by engaging with blue spaces that positions them as a potentially underutilized public health resource. Juster-Horsfield and Bell (2021) advocates for the literal prescribing of blue spaces to promote physical activity, enhanced mental health and social wellbeing. Planning for productive SSAs in MSP, is crucial to maintaining and supporting access to this public health resource.

The concept of biological or ecological productivity contains knowledge and theories that have been developed across academic disciplines (Costanza & Mageau, 1999), as is the case with the human health information required for productive SSAs. Identifying what geographic areas are associated with human health, first requires a thorough understanding of what constitutes the various facets of human health, followed by the identification of such activities that are associated with human health. An interdisciplinary and comprehensive approach is necessary to adequately address this issue and would include professionals from different roles in health care such as physicians, nurses, psychologists, physiotherapists, occupational therapists, and social workers. Physicians and nurses could serve a similar role in being involved with providing input for SSAs, which includes having the knowledge of the specific pathogenic and salutogenic processes (Canadian Nurses Association, 2021; Zboralski et al., 2008) that influences benefits derived from coastal activities. Psychologists could contribute knowledge regarding mental health and the promotion of healthy behaviour (Wahass, 2005), while physiotherapists and occupational therapists could contribute knowledge on anatomy, physiology, biomechanics, ergonomics, and kinesiology (Brown & Greenwood, 1999) that would be relevant for the physical participation in the various coastal activities. Social workers could play a role as well, by determining the community resources that are available to support accessibility to SSAs among people of various demographics and identity qualities (Lesser, 2000). Cross-disciplinary engagement of health care professionals is required for producing a comprehensive, and holistic framework for planning and supporting SSAs within MSP.

5.4 Underserved Populations

In the CBD conceptualization, this criterion applies to threatened or endangered species, however, the criterion has been significantly modified for this study to be applicable for SSAs. In the CBD criteria sense, the importance of prioritizing the health of threatened or endangered species relates to the role that each species has within their ecosystem, as they all support the overall health and functioning of their environment (NOAA, n.d.). In both the CBD conceptualization and for SSAs, the health of a specific community is prioritized, but that is the only similarity with the definition as all humans are of the same species and are not considered endangered or threatened. Prioritizing SSAs and providing greater representation for individuals and communities who experience social/identity barriers, specifically those who identify with qualities determined to be associated with an underserved population group, is key to ensuring an equitable approach to MSP (Johnson, 2004; Tafon, 2018; Tafon, Saunders & Gilek, 2019) and public health in general (WHO, 2021). While barriers may still exist for people who do not belong to an underserved population group, needs identified by those who do belong to underserved groups should be prioritized as they are at a higher risk of experiencing greater health challenges due to the structural and SDH (CDC, 2021; Waldron, 2021). Therefore, prioritizing SSAs that are deemed as important for underserved populations is essential in ensuring an equitable approach to MSP.

Prioritizing areas that are important for endangered or threatened species would require utilizing information from the scientific community, research, and academic institutions, which differs from what would be required for SSAs that are deemed as important for underserved populations. Understanding and effectively addressing health disparities in underserved populations requires a clear comprehension of members' concerns and priorities, which may be achieved through a community-engaged research strategy (Bernhard et al., 2013). Waldron, Price, and Eghan, (2014) utilizes this approach when conducting a study with a Black community in North End, Halifax concerning the social and structural determinants of health that are impacting the community. In their study, a Community-Driven Health Impact Assessment Tool (CHIAT) was developed to enable citizens to evaluate how a proposed policy or project would affect the health and well-being of their community (Waldron, Price & Eghan, 2014). Public participatory tools such as the CHIAT, can assist with empowering communities to represent their values and concerns within the decision-making process. This is important as

representation has been identified as a key component of inclusion within decision-making processes for underserved populations (Pratt, 2019). Utilizing these approaches can better position MSP for achieving health equity within the local communities that the plan may impact.

5.5 Vulnerable Places

The original definition for the vulnerability CBD criterion strongly correlates with what is considered for vulnerable SSAs. Vulnerable places are important to prioritize in terms of the CBD criteria, to ensure that the health of a habitat, biotope or species is not at risk due to anthropogenic impacts or natural events (UNEP, 2008a), as conserving these areas supports the maintenance of biodiversity (Phair et al., 2020). Similarly, preserving vulnerable SSAs is important for ensuring the continued availability of these places that facilitates human health. Indicators of ocean health and impacts of marine developments/issues were identified by most of the respondents in this study as currently or potentially having an impact on their participation in coastal activities. Similar findings have been identified in Evers (2019) as ocean pollution, toxins, chemicals, and radiation are known to influence how humans engage with blue spaces, such as people deciding to surf among raw sewage or plastic. Coastal developments such as infrastructure have also been studied to have negative impacts on human activities occurring on the coast as the exploitation of natural resources degrades and depletes the coastal habitats in which these activities also occur (Drius et al., 2019). As the anthropogenic pressures on coastal spaces are predicted to worsen (IPCC, 2021), protecting vulnerable SSAs will be increasingly important as more and more places will gain the status of vulnerability.

Strengthening and supporting oceans and human health (OHH) against the impacts of marine development and other anthropogenic factors in vulnerable SSAs would involve an interdisciplinary approach across sectors, similar to meeting the CBD criteria for vulnerability. Both cases, would require efforts from professionals in different disciplines such as the natural sciences to understand biological and ecological status; social sciences for understanding human behaviour; economics/engineering to provide insight on marine development types and economic importance; and human health sciences for considering salutogenesis specifically. OHH issues are embedded within different political, social, economic, and environmental systems across multiple scales of time, space, and location, involving a diversity of stakeholders (Britton, Dommegan & Hugh, 2021). Cases where the availability of natural resources are threatened are

often thought of as “wicked problems” as they are intrinsically diverse, complex, dynamic, and lack a clearly defined solution (Jentoft & Chuenpagdee, 2009).

In dealing with these wicked problems, technical approaches will not suffice, as the issue is of institutional, political, and philosophical nature (Jentoft & Chuenpagdee, 2009), and must consider the dual mandate of society’s desire to preserve natural environments while meeting economic demands (Weinstein et al., 2007). It is then argued that wicked problems require interventions at all orders of governance including investigating the basic values, norms and principles making up the very foundations of the governing institutions (Kooiman, 2003). Furthermore, identifying salutogenic services could provide means for monetizing the nonmaterial ES that are currently difficult to value, such as cultural, spiritual, and recreational services (Chan et al., 2012), as valuation could be measured in terms of savings for the health care sector. This would be important for preserving vulnerable SSAs, as they are often in competition with exploitative anthropogenic activities and would need a mechanism for integration within a trade-off analysis where management priorities are often determined (Brown, Thompkins & Adger, 2001). In addition, wicked problems would benefit from participatory and communicative approaches such as stakeholder partnerships and co-management arrangements, as these may allow for the issue to be approached from various angles (Jentoft & Chuenpagdee, 2009). Therefore, to effectively protect vulnerable SSAs, a wicked problem approach would be required involving diverse perspectives across disciplines, sectors, and overarching governing systems.

5.6 Summary of Recommendations

5.6.1 Human Health Approach to MSP

As coastal spaces are predicted to become more difficult to access due to anthropogenic impacts, planning for and protecting SSAs will be crucial for maintaining the coast as a public health resource. MSP can serve as an ocean governance tool that can facilitate these human health objectives. Figure 15 summarizes the preceding discussion on human health and spatial concepts, frameworks and tools that can influence human health objectives within MSP. By drawing on the spatial and human health concepts that demonstrate salutogenic qualities and using the CBD criteria for biologically and ecologically significant areas, SSA criteria were developed. SSA criteria then shape the Health Impact Assessment (HIA) that is conducted within

the overarching Health in All Policies (HiAP) approach as determined by the disciplines of planetary health or OHH. Collaboration between marine spatial planners and professionals within the planetary health or OHH fields would then be required for integrating the steps of the HIA within the steps for MSP. As Figure 15 demonstrates, the steps for the HIA correlate well with most of the steps for MSP. By utilizing this process within MSP, opportunities for human health promotion can be maintained and improved while prioritizing goals for health equity.

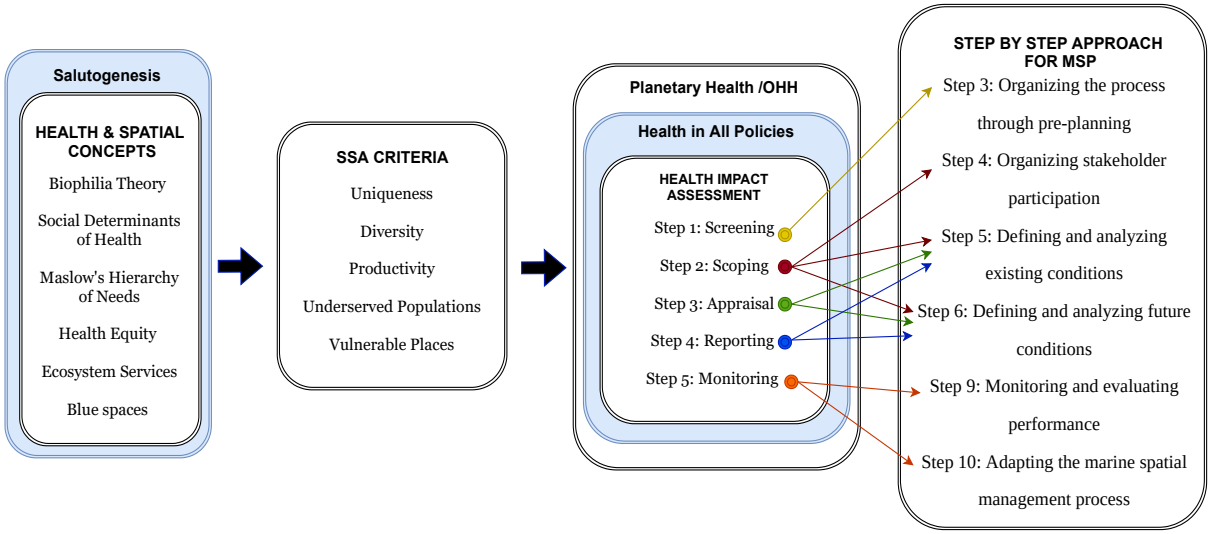

Figure 15. Integrating a salutogenic approach within marine spatial planning (MSP). By utilizing health and spatial concepts of salutogenic quality, criteria for salutogenically significant areas (SSAs) can be developed and used to guide planetary health and oceans and human health (OHH) professionals to conduct a salutogenically informed Health Impact Assessment (HIA) that could shape MSP. Each HIA step is represented by a different coloured arrow, which points to the MSP step where that HIA step would apply.

5.6.2 SSA Criteria Recommendations

Prioritizing human health in marine policy may be achieved by referring to criteria that has both human health and spatial components. The CBD criteria for identifying biologically and ecologically significant areas was used as a guide for developing the criteria for SSAs. By adopting an approach that is already utilized within MSP, a more seamless integration of human health objectives may be more achievable in the future. While the following recommendations may apply to multiple SSA criteria, specific associations between the SSA criterion and recommendation were made, as the associations were thought to be especially applicable and

important for consideration. The following recommendations have been made when accounting for each of the SSA criteria within MSP:

1. Engage with a diverse set of stakeholders with a focus on local or traditional knowledge through a mutually beneficial process when accounting for **unique** places;
2. Consider conducting a thorough stakeholder analysis using methods that facilitate representation when accounting for **diverse** places;
3. Utilize knowledge from health care professionals across disciplines to ensure a good understanding of the various components of human health and the activities that promote health when accounting for **productive** places;
4. Recognize community empowerment in decision making by utilizing a community engaged research strategy or partnership when accounting for places of **importance for underserved populations**;
5. Develop policies that reflect different political, social, economic, and environmental systems across multiple scales of time and space, while scrutinizing the governing bodies responsible for its implementation when accounting for **vulnerable** places.

5.7 Limitations & Implications for Future Research

There are various limitations that were identified within this study. The first considers how participation in a PPGIS survey requires a certain degree of familiarity with maps and of the study region itself (Brown, 2004). This was somewhat accounted for in this study as determining the exact locations of the activities was not a priority, and thus additional methods to ensure precise map plotting were not taken. For example, the survey could have been designed to potentially generate more precise activity locations by restricting the zoom level during the mapping exercise; however, it was thought that differing zoom levels may assist in orientating participants on the map, and therefore that approach was not applied. Mapping challenges may have been overcome by conducting in-person workshops for the mapping portion of the survey but was restricted to online participation due to the circumstances of COVID-19.

Another limitation of utilizing this methodology considers how this study was based on Western ideologies and may not be compatible with other ways of knowing. First Nations communities and researchers in Quebec acknowledged this barrier when developing an ES valuation framework to use within a participatory mapping approach (Bélisle, Wapachee, Asselin, 2021). Through collaboration, researchers and community participants attempted to

overcome this barrier by designing a study that was consistent with the community's Indigenous values (Bélisle, Wapachee, Asselin, 2021). Pert et al. (2015) uses similar concepts, when exploring CES mapping in the Wet Tropics of Australia. Their methods emphasize a co-research approach by partnering with 'Rainforest Aboriginal Peoples' to produce research outcomes that reflect rightsholders' perceptions (Pert et al., 2015). Co-research is a transdisciplinary approach that involves scientists and practitioners working together throughout the entire research process, including setting common research goals, development of methods, analysis of results and co-delivery of policy relevant findings (Tress et al.,2005). The co-research approach is recommended for future research within this field.

When considering the results of this study, the sample was not representative of the demographics of HRM. Without a representative study population, further demographic analysis was not conducted as the results may have been misleading. In addition, the CBD criterion of "importance for life stages" could have been developed into a SSA criterion but would have also relied on representative demographic information. The importance for life stages CBD criterion is important in the biological and ecological sense as various environmental conditions coupled with species-specific physiological constraints and preferences tend to make some regions more suitable to particular life-stages and functions than others (UNEP, 2008a). The same reasoning can be applied to SSAs, as certain places or the activities that the places facilitate may be more accessible/preferrable to people of different age groups. By utilizing a community engaged research strategy or partnership a more representative study sample that is inclusive of underserved population groups may be achieved (Fowles, 2007; Walton et al., 2012) and further analysis could then be conducted. However, if considering this approach, it is important to be mindful of the underlying premise of systemic oppression within underserved communities and the challenges this may create for a truly collaborative process (Harrington, Erete & Piper 2019).

Chapter 6: Conclusion

Introducing SSAs within MSP has the potential to bring a much-needed focus for achieving social objectives that are often neglected. While this study did not investigate the potential for human health to be the ultimate or cumulative ecosystem service as Sandifer and Sutton-Grier (2014) suggests, it has determined that various benefits for human health are common among those who participate in coastal activities in HRM. By considering the criteria that were developed in this study for SSAs, coastal areas that are unique, diverse, productive, important for underserved populations and vulnerable may be identified and reflected within MSP. Five recommendations were given for gathering data in support of the SAA criteria which included collaboration among various stakeholders, disciplines, and sectors, while considering mutually beneficial and respectful community engagements. The HIA was a suggested tool to support the advancement of human health objectives within ocean governance and demonstrates compatibility with the steps already utilized for MSP. An interdisciplinary approach across sectors that includes professionals in health care and ocean governance will be key for reflecting the complexity of the intertwined issues of planetary health and OHH.

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APPENDIX I: Recruitment Poster

APPENDIX II: Questionnaire

Map the coastal activities that you participate in from the following list (you will have the option to choose multiple locations for each activity and can choose a **maximum of 10** activities to map)

Activities (28)

1. Kayaking
2. Canoeing
3. Camping
4. Sailing
5. Stand up paddle boarding
6. Surfing
7. Wind surfing
8. Kite-flying
9. Jet skiing, water skiing or other motorized water sport
10. Motorized boating
11. Swimming
12. Beach/coastal walking, hiking or running
13. Beach yoga/ meditation
14. Recreational fishing
15. Foraging for food ex. clam digging, periwinkles
16. Foraging for medicinal items
17. Traditional/ceremonial activity
18. Scuba diving
19. Snorkeling
20. Sun-bathing/picnics
21. Wildlife watching
22. Appreciating scenery from outside
23. Appreciating scenery from a car
24. Horse riding
25. Biking
26. Informal games or sports
27. Creative activities (photography, art, music)
28. Educational
29. Other:

Activity Questions (temporal/spatial)

1. Why did you select this location(s) for this activity?

a. This is the only place(s) I know to do this activity
b. This is the only place(s) where I can access this activity
c. This is my favourite place(s) to do this activity
d. It doesn't matter where I do this activity as there are other locations for it and I have no preference

2. How often do you participate in this activity?

a. Daily
b. Weekly
c. Monthly
d. Yearly

3. What season(s) do you participate in this activity? (**Select all that apply**)

a. Spring
b. Summer
c. Autumn
d. Winter

Ocean Human Health Questions

4. Do you think participation in this activity benefits your health? If so, what aspects of your health? (**Choose all that apply**)

a. Physical (clean air, exercise)
b. Emotional (wellbeing, mood, coping, rest)
c. Psychological (mental health, sense of belonging/identity)
d. Self-fulfilment (achieving one's full potential, being creative)
e. Spiritual (connection with nature or other)
f. Social (friends, family, community)
g. Culture (customs, traditions, beliefs)
h. Food/sustenance
i. Medicinal
j. Security and safety
k. I do not think there is a health benefit

5. How important do you think this activity is for your health?

a. Very important
b. Important
c. A bit important
d. Not at all important

6. Which of the following factors have a negative impact on your participation in this activity (**Choose all that apply**)

a. Decrease in biodiversity (loss of species or sea life)
b. Habitat loss
c. Plastic/litter pollution
d. Chemical pollution (ex. sewage, industrial waste, agricultural run-off)
e. Marine toxins (ex. Algae, paralytic shellfish poisons (PSPs))
f. Ocean warming

g. Acidification
h. Increase in jellyfish numbers
i. Water-borne diseases
j. Coastal erosion
k. Unsure
l. I do not think the health of the ocean impacts my participation

Socioeconomic Barrier Questions

7. Does this activity come with associated costs? (**choose all that apply**)

a. License
b. Gear
c. Paid education/ lessons
d. Transportation
e. Membership/subscription
f. Does **not** cost anything

8. **If yes**, what are the **start-up costs (one-time expenses)** for the activity approximately?

a. $10-50
b. $50-100
c. $100-200
d. $200-800
e. $800-1000
f. $1000+
g. Unsure
h. No start-up costs

9. **If yes**, what are the **costs for each time you participate (ongoing expenses)** in the activity approximately?

a. $10-50
b. $50-100
c. $100-200
d. $200-800
e. $800-1000
f. $1000+
g. Unsure
h. No ongoing expenses

10. Do you (or have you) experience(d) any barriers associated with your identity/qualities when participating in this activity? (**choose all that apply**)

a. Race
b. Ethnicity
c. Gender

d. Sexual orientation
e. Disability
f. Class/ financial status
g. I have not experienced barriers

11. **If yes**, please describe what these barriers are **(optional)**

12. **If yes**, choose any strategies related to your activity that you think may help this issue **(optional)**

a. Having access to this activity within your community (lessens probability of being subjected to racism/discrimination)
b. Safety measures (surveillance, within public view, frequently trafficked area)
c. Inclusive mobility systems (wheelchair ramps, boardwalks)
d. Having access to this activity closer to home or within public transport limits (reducing transportation costs)
e. I do not think there are any strategies that could do to help this issue
f. Prefer not to answer

13. If yes, please describe **(optional)**

Development Questions

14. Which of the following developments or issues do you think **may** impact your ability to participate in your preferred coastal activities? (**Select all that apply**)

a. Coastal infrastructure development (homes, businesses)
b. Non-renewable energy developments (offshore oil and gas)
c. Renewable energy developments (offshore wind, tidal and hydro energy)
d. Marine transport, ports and shipbuilding developments
e. Finfish aquaculture (ex. salmon)
f. Shellfish & plant aquaculture (ex. oysters, mussels, seaweed)
g. Artisanal fisheries (traditional, household fishery)
h. Commercial fisheries
i. Coastal and marine tourism (boating tours, recreational fishing, scuba diving)
j. Ocean technology (sensor technology, subsea vehicles/robotics)
k. Future-oriented ocean industries (marine biotechnology, offshore aquaculture, seabed mining)
l. Climate change (including sea level rise, biodiversity loss)
m. Not concerned

15. Which developments or issues do you think would have the **most** impact on the activity?

a. Coastal infrastructure development (homes, businesses)
b. Non-renewable energy developments (offshore oil and gas)
c. Renewable energy developments (offshore wind, tidal and hydro energy)
d. Marine transport, ports and shipbuilding developments

e. Finfish aquaculture (salmon)
f. Shellfish & plant aquaculture (oysters, mussels, seaweed)
g. Artisanal fisheries (traditional, household fishery)
h. Commercial fisheries
i. Coastal and marine tourism (boating tours, recreational fishing, scuba diving)
j. Ocean technology (sensor technology, subsea vehicles/robotics)
k. Future-oriented ocean industries (marine biotechnology, offshore aquaculture, seabed mining)
l. Climate change (including sea level rise, biodiversity loss)
m. Not concerned

16. How concerned are you for having access to this activity in the future based on these issues or developments?

a. Very concerned
b. Concerned
c. A bit concerned
d. Not at all concerned

SECTION 3: Post Mapping Survey

1. Are there any other coastal activities that you would like to participate in but that are impossible or difficult because of certain barriers?

a. Yes
b. No
c. Unsure

2. **If yes**, please select all activities that apply and indicate how or why you cannot currently access them:

a. Kayaking
b. Canoeing
c. Camping
d. Sailing
e. Stand up paddle boarding
f. Surfing
g. Wind surfing
h. Kite-flying
i. Jet skiing, water skiing or other motorized water sport
j. Motorized boating
k. Swimming
l. Beach/coastal walking, hiking or running
m. Beach yoga/ meditation
n. Recreational fishing
o. Foraging for food ex. clam digging, periwinkles
p. Foraging for medicinal items
q. Traditional/ceremonial activity

r. Scuba diving
s. Snorkeling
t. Sun-bathing/picnics
u. Wildlife watching
v. Appreciating scenery from outside
w. Appreciating scenery from a car
x. Horse riding
y. Biking
z. Informal games or sports
aa. Creative activities (photography, art, music)
bb. Educational
cc. Other:

End of Survey:

*Is there anything else you would like to share? Please send an email to Kaitlyn.curran@dal.ca with any questions, comments, concerns or suggestions regarding this survey.

*Follow the link to provide your email if you would like to be entered in a **contest** for a chance of winning **1 of 10 $50 Visa gift cards** AND/OR to receive the **results of this study** that will be presented in the graduate project. Your email address will not be linked to your responses in anyway.

*If you would like your coastal activity to be featured on **@HalifaxOceanProject** on Instagram or Facebook, send us your photos of participating in the activity, the activity itself or barriers