Roles of Marine Affairs Programs in Preparing their Graduates to be Marine Affairs Professionals

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Table of contents

List of Tables ..... **v**

List of Figures ..... **vi**

Abstract ..... **vii**

Acknowledgment ..... **viii**

Chapter 1: Introduction **1**

1.1 Overview **1**

1.2 Management issues **1**

1.3 Marine affairs and marine affairs programs at the university level **2**

1.4 Research gaps and research purpose **4**

1.5 An introduction of next chapters **5**

Chapter 2: Literature review **6**

2.1 Introduction **6**

2.2 Before 2000 ..... **6**

2.2.1 General state of marine affairs programs 6

2.2.2 Case studies of marine affairs and related programs 9

2.3 After 2000 ..... **12**

2.3.1 Studies on ocean higher education landscape (not case studies) 12

2.3.2 Case studies 15

2.4 Conclusion **19**

Chapter 3: Methodology **21**

3.1 Introduction **21**

3.2 Literature review **21**

3.2.1 Purpose and function 21

3.2.2 Paper collection....21
3.2.3 Paper classification....22
3.3 Desktop analysis on marine affairs programs....23
3.3.1 Search of marine affairs programs....23
3.3.2 Criteria determination....24
3.3.3 Data collection....24
3.3.4 Data analysis....25
3.4 MAP Alumni survey....25
3.5 Research limitations....27
Chapter 4: Desktop analysis....29
4.1 Introduction....29
4.2 Observations in the search of marine affairs programs....29
4.2.1 Observations on information sources....29
4.2.2 Countries....30
4.2.3 Types of programs....30
4.3 Result of criteria determination....31
4.3.1 Result of criteria identification in similar research....31
4.3.2 Result of criteria determination based on findings from the literature review....32
4.3.3 Result of criteria determination based on websites....32
4.3.4 Result of criteria deletion....33
4.3.5 Result of criteria classification....33
4.4 Result and discussion on the collected data....33
4.4.1 Program overview....34
4.4.2 Program requirements and core courses....36

4.4.3 Subject areas and skills 39

4.4.4 Research 42

4.4.5 Opportunities/advantages 43

4.4.6 Alumni employment status and programs' career development resources ..49

4.4.7 Marine affairs programs' career development resources 49

4.4.8 Summary of the roles of marine affairs programs 50

Chapter 5: Data analysis of MAP's alumni survey data 53

5.1 Introduction 53

5.2 Introduction of MAP 53

5.3 Demographic information 54

5.3.1 Year of graduation 54

5.3.2 Employment status 55

5.3.3 Employment sectors 56

5.3.4 Where the alumni live 58

5.4 Status of alumni's employment organizations 59

5.4.1 Skills/competencies that are desired by alumni's employment organizations 59

5.4.2 Personal attributes that are desired by alumni's employment organizations 60

5.5 Alumni's advice to the current MMM students regarding careers in marine sectors 61

5.6 Discussion 62

Chapter 6: Conclusion 64

Bibliography 68

List of Tables

Table 1. Core courses of bachelor programs in marine affairs. ……37

Table 2. Core courses of master programs in marine affairs. ……...38

Table 3. Subject areas and skills in marine affairs programs. ……...40

Table 4. Research in marine affairs programs. ……..……42

Table 5. Educational strategies and educational resources. …….44

Table 6. Dual-degree programs and external relationships. …….47

Table 7. The references which were represented as numbers in the desktop analysis. .73

List of Figures

Figure 1. The number of alumni in year of graduation time periods (Five years as one period). ……55

Figure 2: The number of alumni in different employment situations. ……...56

Figure 3: The number of alumni employed by sector. ……..…….57

Figure 4: The number of alumni employed in different levels of government. .……58

Figure 5: Skills/competencies that are desired by alumni's employment organizations. ……..59

Figure 6: Personal attributes that are desired by alumni's employment organizations. ……...……...60

Abstract

Coastal and marine environments face increasing challenges from anthropogenic activities and climate change, resulting in an increasing need for professionals to address these complex ocean issues. Marine affairs programs, which play a role in the cultivation of marine affairs professionals, could address this need. The general status of marine affairs programs has not been updated since 1973. Moreover, there is a need for research on the skills/competencies and personal attributes that are desired by alumni's employment sectors. The main topic of my research is to examine the roles of marine affairs programs in preparing marine affairs professionals. The sub-topic of this research is to investigate the skills/competencies and personal attributes that are desired by employment sectors of marine affairs programs' alumni. I first conducted a literature review to identify the gaps in the research on higher education in marine affairs. I then conducted a desktop analysis which aimed to answer the main topic. Finally, I analyzed the data from a MAP (Marine Affair Program) alumni survey in Dalhousie University to investigate the answer for the sub-topic. The current roles of marine affairs programs include setting requirements for students to meet in order to graduate, preparing students in terms of knowledge, skills and abilities, providing favorable study environments, and helping students to find jobs or pursue advanced degrees. Researchers can provide suggestions that are adapted to the new conditions based on an updated status of marine affairs programs, which can promote the development of marine affairs programs. The result of the sub-topic could provide data for marine affair programs for decision-making on how to adapt their education to meet the employment sectors' needs.

Keywords: marine affairs programs; roles; marine affairs professionals, skills/competencies, personal attributes, employment sectors

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Chapter 1: Introduction

1.1 Overview

Oceans not only supply people with freshwater and oxygen, but also provide us with food, minerals, and energy resources (NOAA, 2020). Coastal and marine environments face increasing challenges from anthropogenic activities and climate change (Fujita, 2013; Kelly et al., 2021; Worm et al., 2021). As such, there is an increasing need of professionals to address these complex ocean issues (College of Art and Science, n.d.-a; Rosenstiel School of Marine and Atmospheric Science, 2021). Marine affairs programs, which aim to prepare marine affairs professionals, could address this need. However, there has been no research on the general status of marine affairs programs since 1973 (Mangone & Pedrick, 1973). In this paper, I define the general status as an overview of marine affairs programs. Factors in the overview could include programs' objective, duration, mode of study (part-time/full time), curriculum, research, internship, workshop, students, faculty, funding, relationship with external organizations, employment status, teaching methods, etc. How I chose the factors and the final decisions on which ones to examine will be explained in the methodology and desktop analysis sections respectively. Other than the limited research on general status of marine affairs programs, there is a scarcity of research on the skills/competencies and personal attributes that are desired by potential employment sectors of marine affairs programs' graduates. My research will fill these two identified gaps in the research.

In this chapter, I will outline the management issues in ocean studies, introduce the concept of marine affairs, introduce marine affairs programs and their importance, and present the research gap in marine affairs higher education. Finally, I will also present an introduction of chapters after the introduction chapter.

1.2 Management issues

71% of the earth's surface is covered by ocean which stabilizes the climate, stores carbon, produces oxygen, and provides humans with food, energy, and entertainment (Pendleton, 2020). Anthropogenic activities, including sewage discharge, overfishing, and plastic garbage dumping, continue to have a negative impact on oceans, which not only creates tremendous pressure on the marine ecosystems, but also directly affect

industries and communities that rely on oceans (Worm et al., 2021; Kelly et al., 2021). Moreover, climate change is another stressor that threatens the ocean, which could lead to coral bleaching, drowning wetlands, and ocean acidification (Fujita, 2013). Given all of the challenges facing the oceans, the need for professionals who are able to deal with the complex issues of marine affairs, which involves social, cultural, economic, and legal aspects, is increasingly apparent (CAS, n.d.-a; RSMAS, 2021).

1.3 Marine affairs and marine affairs programs at the university level

Marine affairs are defined by Mangone & Pedrick (1973) as "an application of history, law, political, science, economics and other social science to the oceans, the seabed, and the coastal zone" (Mangone & Pedrick, 1973, p.10). This definition was to distinguish the term marine affairs from the term marine science. Marine affairs have a broad nature, which involves a large field of marine-related topics, including international law and policy, fisheries and aquaculture, marine mineral exploitation, transport, marine pollution control and prevention, ports, and marine security (Ghosh & Chowdhury, 2021). Its concept encompasses an array of different knowledge, perspectives, analyses, ideas, and research (Ghosh & Chowdhury, 2021).

Marine affairs programs are interdisciplinary programs that provide education in marine affairs, and various disciplines such as social science, political science, economy, ocean science, statistics were involved in the programs. Their graduates should be able to apply the knowledge and skills gained in the programs to address real-world marine management problems. The main difference between marine affairs programs and other related programs such fishery management programs, and marine policy programs is that marine affairs programs do not have a focused teaching field. Moreover, marine affairs programs have unique courses in marine affairs such as Marine Management Tools & Techniques, Quantitative Methods in Marine Affairs, and Decision Making & Action Taking in Marine Affairs, which are not found in other related programs (DMA, n.d.; MAP, n.d.-a; SMEA, 2022).

Many universities in the world now have marine affairs programs, such as Dalhousie University in Canada, the University of Washington and the University of Rhode Island in America, and National Sun Yat-sen University in Taiwan. These universities offer undergraduate degrees, master's degrees, and PhDs in marine affairs.

One common characteristic of marine affairs programs is that they are interdisciplinary, which is shown in program subject areas, research, and composition of professors and students. Marine affairs programs offer a wide variety of subject areas and research fields. Taking the marine affairs program in Dalhousie University as an example, its subject areas include marine law and policy, integrated coastal zone management, fishery, coastal tourism, marine spatial planning, marine conservation, shipping management, and ecosystem-based management (Marine Affairs Program, n.d.-a). Meanwhile, its research fields involve coastal zone management, environmental issues, law and policy, living resources management, non-living resources management, socioeconomic issues, and transportation and communications (MAP, n.d.-a). Faculty and students have diverse academic backgrounds in marine affairs programs. For example, the official website of the University of Washington states that their marine affairs program has an interdisciplinary group of faculties which make a variety of expertise available for students, and their students are from around the world and from diverse educational and professional backgrounds (School of Marine and Environmental Affairs, 2022).

Marine affairs programs have been playing an important role in cultivating marine affairs professionals, which indirectly contributes to the sustainable development of the oceans. The marine affairs programs help their students develop interdisciplinary knowledge, skills, and perspectives in marine affairs, so that they are prepared to tackle complex ocean issues in their future careers. The marine affairs professionals who graduated from these programs would contribute to the solutions to complex ocean issues, the proper management strategies of the ocean, outreach to the public about ocean issues and solutions, and eventually, the sustainable development of the oceans (CAS, 2022; CAS, n.d.-a; Department of Marine Affairs, n.d.).

Marine affairs professionals can play their function in diverse areas of marine affairs and in different marine sectors around the world. For example, in the marine affairs program of the University of New Heaven, alumni have diverse careers like marine social scientist, coastal planning specialist, coastal policy maker, fishery managers, environmental marine educator, and research positions (CAS, n.d.-a). Moreover, alumni of marine affairs program in University of Washington pursue jobs around the world in governmental organizations, private sectors, non-profit sectors, international sectors, and schools, colleges & universities (SMEA, 2022).

1.4 Research gaps and research purpose

Considering the importance of marine affairs programs in preparing marine affairs professionals, I will focus my research on the marine affairs programs. There is a need for research on the general status of marine affairs programs due to its scarcity and importance. There was one paper (Mangone & Pedrick, 1973) that presented the general status of marine affairs programs, and it was published in 1973. From 1973 until 2000, papers on marine affairs and ocean-related programs at the university level predominantly aimed at analyzing the characteristics of these programs through case studies. After 2000, there was a trend for studies to focus on recommendations and solutions for marine higher education. It appears that there has not been an update on the general status of marine affairs programs for a long time. An update on the general status would help us understand the current roles of marine affairs programs in preparing future ocean professionals. As noted above, the mission of cultivating ocean professionals of marine affairs programs is crucially important. Researchers who want to conduct research on suggestions and solutions for marine affairs higher education can consult the updated status of marine affairs programs. Therefore, my research will give a general scan of all marine affairs programs at the university level across Canada and America and investigate their roles in preparing marine affairs professionals.

There's also a need for research on the skills/competencies and personal attributes that are desired by the potential employment sectors of marine affairs programs' graduates. Marine affairs programs need to keep informed of the desired skills/competencies and personal attributes in workplace, in order to adapt their education to prepare marine professionals that meet the needs of potential employment sectors. Three papers indicated that there was a mismatch between ocean-related programs' education and the status of careers in marine sectors (Briscoe et al., 2016; Muir & Schwardz, 2009; Schaffner et al., 2016). However, no research on the suitability of higher education in marine affairs and the status of careers in marine sectors was found. I will also focus on Marine Affairs Program (MAP) in Dalhousie University to investigate the skills/competencies and personal attributes that are desired by employment sectors of MAP's alumni. This research will contribute to increasing the understanding of skills/competencies and personal attributes that are desired by potential employment sectors of marine affairs programs' graduates. This research could also provide data that can be referred to by researchers who want to study the gap

between higher education in marine affairs and careers in marine sectors. This will eventually benefit marine affairs programs, as they are provided with more data to make decisions on how to adapt their education to keep pace with the changes in the job market.

To summarize the above statement, my research aims to examine:

1) The roles of marine affairs programs in preparing marine affairs professionals.
2) The skills/competencies and personal attributes that are desired by employment sectors of marine affairs programs' alumni through the MAP's alumni survey.

1.5 An introduction of next chapters

After this chapter, I will first conduct a literature review to identify the gap of research in marine affairs higher education, and to broaden my understanding of characteristics, trends, and recommendations of ocean-related programs. I will then undertake a desktop analysis of marine affairs programs to present the general status of marine affairs in preparing marine affairs professionals. To be more specific, I will collect and analyze information of marine affairs programs by browsing their websites. Lastly, I will use data from the MAP survey to investigate the skills/competencies and personal attributes that are desired by employment sectors of marine affairs programs' alumni.

Chapter 2: Literature review

2.1 Introduction

The purpose of this literature review is to examine what research has been done on marine affairs programs at the university level, so that I can know where my paper can fit or what gap my paper can fill. During the process of searching for related papers, I discovered that only three papers were specifically on marine affairs programs. The limited research is not sufficient to support this literature review. I extended this literature review scope to all papers on ocean-related programs at the university level. After expanding the scope, I extended the search beyond marine affairs education to marine education in general, which expanded the number of papers that this literature review could critique. This enabled me to present the wide variety of research that has been conducted on ocean related programs in the literature review, and to summarize the characteristics, trends, and recommendations of ocean related programs. Based on the result of my search, I can better understand the background knowledge of ocean related programs and identify what is missing in the literature.

To discuss the collected papers in a clear manner, I classified papers as papers that were published before and after 2000. This avoided having so many papers on the same topic discussed together, which may lead to unclear explanations. In each of the two timeframes, papers were classified according to whether they are case studies papers. In this literature review, case study papers were defined as papers that focused on one ocean-related programs to do research, while non-case study papers were defined as papers that either investigated many ocean-related programs or critiqued ocean higher education as a whole. For case study papers after 2000, three themes were identified: (a) description of the role of a marine program, (b) matches between the marine programs and careers, and (c) marine programs' efforts to adapt to societal/educational needs.

2.2 Before 2000

2.2.1 General state of marine affairs programs

The first research on the general status of marine affairs programs can be traced back to 1973. Beginning in the 1960s, America became interested in oceans, which was related to advancements in technology in marine warfare, mineral exploitation and

fishery at that time (Mangone & Pedrick, 1973). In addition, the emerging public interest in the environment, coupled with marine scientists' efforts to gain support for their research, also stimulated a greater emphasis on the oceans in America (Mangone & Pedrick, 1973). Therefore, from the 1960s onwards, a series of political efforts to support the establishment and development of marine-related programs and training at the university level in America were made (Mangone & Pedrick, 1973). However, there was no measurement of higher education's response at that time (Mangone & Pedrick, 1973).

Recognizing this gap in research, Mangone and Pedrick published the first paper that presented the general status of marine affairs education at the university level (Mangone & Pedrick, 1973). The research scope was limited to America and 14 degrees in marine affairs were found. Programs' establishment, history, purpose, curriculum, location, belonged schools, faculty, funding, and research was described in the paper (Mangone & Pedrick, 1973). However, programs were not fully described as there was some missing information for each program. For example, the information on Sea Law program at the University of Houston that was presented in the paper only covered program's establishment, history, location, faculty and courses while other factors like purpose and research were missing. (Mangone & Pedrick, 1973). This may have been related to the difficulty of data collection at that time.

Research in marine affairs was very necessary to provide guidance for public policy in ocean and coastal zones (Mangone & Pedrick, 1974). Considering that the first paper only briefly described research in some of the marine affairs programs, Mangone & Pedrick, (1974) initiated a more comprehensive study on marine affairs research at the level of higher education across America and divided the marine affairs research into 5 areas: (a) national security policy, (b) merchant marine and port policy, (c) mineral policy, (d) fisheries policy (e) pollution policy, (f) coastal zone and general policy issues.

Based on the findings of the two papers above, it is clear that marine affairs education and research both gave high attention to ocean laws and policies (Mangone & Pedrick, 1973; Mangone & Pedrick, 1974). The discipline of law was the core component of marine affairs programs (Mangone & Pedrick, 1973). Indeed, half of the collected marine affairs programs were offered by law schools in their universities,

while the remaining programs all had the requirements for law courses (Mangone & Pedrick, 1973). In addition, ocean policy and law courses were found in universities that did not offer marine affairs programs (Mangone & Pedrick, 1973). For marine affairs research, ocean policy problems in coastal zones, seabed, and the oceans were given high focus by a community of researchers (Mangone & Pedrick, 1974).

Why were ocean law and policy given high attention at the time? One possible reason is that the development of national oceanic policy at that time requires matching professionals and research to solve the policy problems and to promote ocean law and policy to cover more areas. Moreover, laws and policies are the foundation of ocean development, and with them, other marine affairs fields like resource management and transportation have the direction of development to follow. Therefore, emphasizing law can promote the cultivation of ocean professionals and development of laws and policies, thus alleviating the social problems of professionals' shortage and a potential lack of specific laws and policies. This was why ocean laws and policy were given high focus.

In addition to ocean law and policy, marine resource management has also received significant attention from practitioners within marine affairs education and research (Mangone & Pedrick, 1973; Mangone & Pedrick, 1974). In the curriculum of marine affairs degrees, marine resource economics was increasingly important (Mangone & Pedrick, 1973). Among the five identified research areas in Mangone & Pedrick, 1974, fisheries, one area of marine resource economies, appeared to have been, be more emphasized by researchers. Two potential reasons that marine resource management received significant attention may be that marine resources were benefiting a larger population and could bring greater economic benefits. Moreover, this emphasis may also be that the problems in resource management had come to the forefront and therefore received more attention, and research in marine resource management had more available funding. This did not mean that other areas with less attention, such as marine transportation, maritime history, anthropology, and sociology, were not important or did not have problems. The lack of attention they received at the time may be related to the fact that the development of marine affairs education and research was not yet mature, and practitioners within marine affairs education and research were addressing the most obvious issues first and did not yet have more energy and resources to devote to other issues.

2.2.2 Case studies of marine affairs and related programs

In the period after Mangone & Pedrick's pioneering study in the 20th century, it was clear that the study on marine affairs and related programs focused on analyzing one or several cases (marine programs), instead of general scan of the state of all programs. These case study papers gave more detailed description of the marine affairs and related programs, which was beneficial for me to deduce some characteristics of the programs based on these papers. Neal (1985), Piyakarnchana et al. (1991) and Taussik (1998) gave a description of their selected marine affairs and related programs in Oregon State University (America), Chulalongkorn University (Thailand), and University of Portsmouth (UK) respectively. Factors of the programs discussed in these papers include objective, duration, mode of study (part-time/full time), curriculum, research, internship, workshop, students, faculty, funding, relationship with external organizations, employment status, teaching methods, and accreditation (Piyakarnchana et al., 1991; Taussik, 1998; Neal, 1985). Some common characteristics of their selected programs were recognized, and some difficulties faced by the programs were identified in these papers.

Before the introduction of the characteristics of the selected programs, I would like to explain two terms, multidisciplinary and interdisciplinary education, as they will appear in the next paragraphs. Taussik (1998) explained an interdisciplinary approach as "drawing on the methodologies and concepts of a range of disciplines to integrate economic/evaluative aspects with the principles of resource management in the context of coastal and marine resources" (Taussik, 1998, p. 118). Multidisciplinary and interdisciplinary education are similar in that they both involve multiple disciplines (Choi & Pak, 2007; Skinner, 2001). The difference is that interdisciplinary education involves interaction and integrating of knowledge and methods among different disciplines, and this is barely found in multidisciplinary education (Choi & Pak, 2007; Skinner, 2001).

The first characteristic is that these programs attached high importance to "multidisciplinary" or "interdisciplinary" education. The main concepts shape the Marine Resource Management (MRM) program in Oregon State University, the US recognized that students need a wide base of knowledge, therefore, "multidisciplinary' courses and research were emphasized (Neal, 1985). In the Marine Science and

Environmental Education program at Chulalongkorn University, Thailand, the curriculum contained a "multidisciplinary" approach to cultivate students with the ability to deal with complex issues in environmental management (Piyakarnchana et al. 1991). The University of Portsmouth, England recognized that more integrated approaches were needed to solve real-world coastal resources problems and established its Coastal Management program to promote interdisciplinary training and education in coastal and marine resource management (Taussik, 1998).

A multidisciplinary approach was reflected in the courses, research and the composition of students of the programs. Based on papers from 1985, in the 20th century, courses and research in universities covered a number of fields. Courses that were offered in universities include marine law, marine biology, resource management and many other fields (Neal, 1985; Piyakarnchana et al. 1991). Taking Chulalongkorn University as an example, research covered oceanography, environmental quality, aquaculture, mangrove ecology, coral reef and seagrass bed ecology, coastal environment, and policy (Piyakarnchana et al. 1991). As for composition of students, taking MRM program as an example, one of the main concepts of the program was to recruit students from diverse undergraduate backgrounds (Neal, 1985). Marine affairs themselves have a transboundary nature, it contains many disciplines like law, economy, science, social science, and history. Solving issues in marine affairs requires students to apply knowledge and approaches of multiple disciplines. Admitting students from diverse undergraduate backgrounds could gather different ideas, interests and approaches for group projects and problem solving (Neal, 1985). Involving multiple disciplines in courses, research and recruiting students from multiple academic backgrounds could expand students' knowledge, which helped students to play their function to solve ocean issues after graduation.

It can be observed that the term to describe education approaches used in universities evolved from "multidisciplinary" to "interdisciplinary". It is identified that the programs at that time began to recognize the need to combine different disciplines, instead of simply teaching the knowledge of different disciplines. The reason might be that higher level of interaction of disciplines was required to solve the complex ocean issues in real world.

As the marine affairs and related programs typically have a transboundary nature, students' areas of learning and research can be more flexible and the programs respect student's interest. One of the main concepts in shaping the MRM program was to value and have respect for students' personal interests (Neal, 1985). MSEE at Chulalongkorn University also acknowledge students' interest, therefore, it tried to increase its flexibility of educational provision to fit the need of students with a variety of interests (Taussik, 1998).

One of the other obvious common characteristics of marine affairs and related programs was recognizing the necessity of establishing relationships with external organizations. For example, the MRM program of the Oregon State University recognized that building strong connections with private sectors was necessary as the connections could bring benefits like speakers from private sectors coming to teach in class (Neal, 1985). The speakers could teach students practical knowledge and skills, and skills and bring fresh news about the development of industries related to marine affairs. Moreover, in a 1984 MRA/MA workshop, Oregon State University and some other universities identified that it was important for programs' faculty and administrators to keep in contact with employers to keep informed of the needed changes to the programs (Neal, 1985). The Coastal Management Program in University of Portsmouth as well stated that the interaction with the external units must be continued, as they believed their students had furthered their understanding of maritime resource management by engaging in research programs in external research units (Taussik, 1998).

Moving past characteristics, there are also some identified difficulties faced by marine affairs and related programs. These difficulties appeared to be mainly related to the interdisciplinary approach of the programs. In a pedagogical context where a focus on core disciplines was encouraged and integration of multiple disciplines operated at the margins of traditional disciplines, it was difficult to find funding for multidisciplinary research (Neal, 1985; Taussik, 1998). Moreover, the interdisciplinary nature brought practical problems for students. The students found it difficult to understand the concepts from different disciplines that they were not familiar with (Taussik, 1998). Moreover, the search field of employment for students were too extensive rather than focused, which made it difficult for students to find suitable jobs (Taussik, 1998).

2.3 After 2000

2.3.1 Studies on ocean higher education landscape (not case studies)

After the 21st century, there were several papers analyzing marine higher education which used different methods and with different focus. The methods included analyzing collected data sets, reviewing literature, and doing surveys. The papers' focus includes certain self-set criteria (demographic characteristics, curriculum, etc.), ocean workforce, and ICM courses. However, they all contributed to the understanding of current marine higher education status by presenting the patterns and problems of marine higher education and providing suggestions. As for patterns, these papers recognized the benefit of cross-disciplinary approaches, changes in ocean-related job market, and the advantages of collaboration with peer institutions. The main problem was that ocean-related programs failed to keep pace with changes in the job markets (Briscoe et al., 2016; Schaffner et al., 2016). These collected papers also provided suggestions based on this problem. Other suggestions included standard setting in education programs and suggestion for ICM programs to adapt their content to varying contexts (Briscoe et al., 2016; Schaffner et al., 2016).

Cook et al., (2016) aimed at developing a descriptive snapshot of ocean sciences' graduate education landscape. Drawing from multiple data sets, this paper used data on 73 higher education institutions in America to identify some trends in ocean sciences graduate education including application status, demographic characteristics, curriculum, collaboration with peer institutions, remote course offerings and skills in workplace and in programs. Schaffner et al., (2016) was more targeted, as through literature review and by drawing from authors' personal experiences, it provided some suggestions that could be applied in ocean graduate education to facilitate the preparation of ocean workforce. There was also one paper aiming at presenting the educational efforts in Integrated Coastal Management (ICM) with a focus on courses of ICM (Cicin-Sain et al., 2000). This paper did a survey on ICM Courses (short-term ICM courses and ICM courses as part of academic program) globally (Cicin-Sain et al., 2000). The survey collected data on structure of the courses (like duration, internship, field trip, collaboration) and performed course content analysis (Cicin-Sain et al., 2000).

The first pattern is that papers in the 21st century appeared to be clearer about the benefits of cross-disciplinary approaches (Chircop, 2003; Schaffner et al., 2016).

Chircop (2003) defined marine affairs professions as policy, planning, and management services to sectoral marine activities. It stated that as marine affairs graduates had to consider environmental, economy, and human well-being factors in their positions, it was common that these marine affairs programs had a goal of integration and interdisciplinarity (Chircop, 2003). Schaffner et al., (2016) deduced through reviewing literature that the ideas could be incubated in an environment where multidisciplinary knowledge and diverse perspectives were presented and expanding the curriculum could contribute to the creativity of ocean science research.

As papers had a clearer understanding about the benefits of cross-disciplinary approach, a new term "transdisciplinary" appeared (Chircop, 2003; Schaffner et al., 2016). The root reason why the term appeared was that addressing complex ocean issues required deeper level of collaboration between ocean researchers from diverse fields, however, transdisciplinary approach was not emphasized in current ocean education (Borrego and Newswander, 2010; Ciannelli et al., 2014; McBride et al., 2011; Morse et al., 2007; Schaffner et al., 2016). The commonality of multidisciplinary, interdisciplinary and transdisciplinary educational and research activities is that they all span two or more disciplines (Rosenfield, 1992). However, compared with multidisciplinary and interdisciplinary activities, transdisciplinary activities have the highest level of collaboration between, and integration of, disciplines (Ciannelli et al., 2014; Rosenfield, 1992). In transdisciplinary settings, researchers from diverse fields work collaboratively on the same research under a shared conceptual system, in which cross-fertilization of solutions can be promoted (Ciannelli et al., 2014; Schaffner et al., 2016). "Transdisciplinary" appeared in papers on ocean higher education because there was an increasing need of ocean scientists and managers to work in integrated teams with members from a broader range of disciplines (Ciannelli et al., 2014; Schaffner et al., 2016). However, many papers pointed out that current educational programs did not adequately prepare their graduates with communication and collaboration skills so that they could work in teams to reach transdisciplinary outcomes (Borrego and Newswander, 2010; McBride et al., 2011; Morse et al., 2007).

Moving past the first pattern, the second pattern was related to ocean-related careers. The need for ocean-related programs to prepare a multifaceted ocean workforce in order to keep pace with changes in job market were addressed by two papers (Briscoe et al., 2016; Schaffner et al., 2016). These two papers also provided some suggestions

based on this need. Ocean-related careers were becoming more diverse and more alumni from ocean programs were employed in diverse organizations instead of in academia (Briscoe et al., 2016; Schaffner et al., 2016). For example, more students were employed in government agencies, private sectors, and non-governmental organizations (Schaffner et al., 2016). However, ocean-related programs did not keep pace with these changes. They focused on cultivating researchers without realizing the urgent need of preparing students for different career paths. Based on this problem, Briscoe et al., (2016) and Schaffner et al., (2016) suggested ocean-related programs should expand the breadth of subjects in curriculum and give more attention to the development of soft skills, such as communication skills and collaboration skills rather than research skills. They also suggested programs to keep contact with external organizations to understand the changes of job market and social needs (Briscoe et al., 2016; Schaffner et al., 2016). There was also one paper (case study) talking about the same topic, and I will discuss all these three papers in 3.2.2 Theme 2: Match between the marine programs and careers.

The third pattern is that the advantages of collaboration with peer institutions were recognized in several papers. Cicin-Sain et al., (2000) stated that forming a network among institutions that offered similar programs could facilitate the communication of current educational practices, thereby contributing to the maturation process in this area. The second advantage was that collaboration with peer institutions could maintain the breadth of courses in ocean-related programs. It was mentioned in last paragraph that ocean-related programs need to expand their breadth in subjects in order to prepare students for a variety of different career paths. In the circumstances where some specialized courses were difficult to sustain for institutions as students' interest became more diverse, partnering with peer institutions with similar courses could solve this problem (Cook et al., 2016). Therefore, having collaboration with peer institution could guarantee that these specialized courses were available to students.

One of the important suggestions from these papers was related to standard setting in education programs. The result of the survey from Cicin-Sain et al. (2000) showed that a consensus on ICM concepts, principles and approaches was emerging, and this paper argued that there was a need to reach this consensus for the evolution of, and maturation in ICM education. (Cicin-Sain et al. 2000). In the 21st century when the number of marine affairs programs was growing substantially, Chircop (2003) argued

for academic standardization of these programs on a global basis. Standard setting could better define common core knowledge, skills and attitudes of marine affairs education, and the expectations of graduates who are the future marine managers would be universal and clear (Chircop, 2003). This could strengthen the recognition by employers and increase the flexibility of working locations for the graduates (Chircop, 2003). Currently, the standards of marine affairs programs depend on the universities they belong to.

Cicin-Sain et al., (2000) suggested that ICM programs need to adapt their content to varying contexts. The authors suggested that if education involved the management and protection of resources, then education needed to take into account whether the management measures were culturally acceptable and legally appropriate to the local context (Cicin-Sain et al., 2000). In addition, if governmental settings are involved in ICM education, then the local governmental situations should be considered, in particular the ICM training and education needed to pay attention to both horizontal and vertical institutional arrangements (Cicin-Sain et al., 2000). This paper argues that there is no need for ICM or marine affairs programs to customize the content to the local context first and then teach their students. Since students will be working in different places, it is more appropriate to teach them the skills to make ICM adaptable to different environments.

2.3.2 Case studies

Theme 1: Description of the roles of a marine program

Veitayaki & South, (2001) aimed at outlining the roles that the University of the South Pacific (USP), specifically its Marine Studies Program (MSP), were playing in capacity building in the marine sectors in pacific island countries. The topic of this paper was the closest to that of my paper, which consisted of trying to identify the roles that MMM is playing in preparing ocean stewards. The paper provided a detailed description of the MSP, which concluded the following: its goals and objectives; long-term strategy focusing on post-graduate training and research; short-term strategy targeting at important participants in the coastal management process; the information system (PIMRIS); its research institute (Institute of Marine Resources, Dravuni Island field station); and its constrains and issues (Veitayaki & South, 2001).

The paper ended after describing MSP without explicitly stating what its roles were, and it only mentioned that MSP was playing a leading role in capacity building in marine sectors (Veitayaki & South, 2001). A few paragraphs to summarize the roles of MSP while also explaining why MSP could have contributed to capacity building of marine sectors were missing. This article was the only article found in the 21st century that provides a detailed description of a marine program. It could give me a general understanding of the possible contribution of a marine studies program at the university level to marine sector in capacity building. Therefore, in the next paragraph, I summarized the roles of MSP.

The main role was to provide education and training (Veitayaki & South, 2001). Education focused on the graduate level to address the shortage of professionals in marine sectors, while training helped current ocean managers and local community members to build skills and knowledge, so that they could have better performance in management of ocean resources within their realm (Veitayaki & South, 2001). MSP also had two research stations named Institute of Marine Resources (IMR), Dravuni Island field station and many research activities, for example, atoll research activities (Veitayaki & South, 2001). Even though the significance of the research activities was not mentioned, they could contribute to the solution of local ocean problems and the development of better ocean plans and policies. MSP also had a role in consulting (Veitayaki & South, 2001). For example, MSP was extensively involved in Council of Regional Organizations of the Pacific (CROP) which was in charge of developing the Ocean Policy for Pacific Region (Veitayaki & South, 2001). From this brief summary, we can give a clearer picture of the possible roles of MSP.

Theme 2: Match between the marine programs and careers

One of the main themes in papers on ocean-related programs at the university level concerned the match between marine programs and possible careers for their graduates. In particular, these papers illustrated there was a mismatch especially in skills' training through surveys, interviews, literature review and personal experience (Briscoe et al., 2016; Muir & Schwardz, 2009). For instance, the result of Muir & Schwardz, (2009) demonstrated that the ecology program in University of California did not fit the need of the conservation job positions outside of university. Based on the survey on alumni, two skills, decision making and policy implementation skills, were crucial for their

workplaces (Muir & Schwardz, 2009). However, the program did not put adequate attention on supporting the development of these two skills, and instead it put too much emphasis on research skills (Muir & Schwardz, 2009). Briscoe et al., (2016) and Schaffner et al., (2016) likewise identified that fewer graduates stayed in academia and more students chose careers that were more interdisciplinary and deemed socially relevant. Some of these careers include jobs in private sectors, governmental agencies, and NGOs in diverse fields like policy, fishery, conservation, ocean engineering (Briscoe et al., 2016; Schaffner et al., 2016). However, the ocean science programs did not adapt well to these changes. The ocean science programs appeared to be stuck in the mindset of "training graduates for research" and did not see the urgent need of education and training of graduates for different career paths (Briscoe et al., 2016; Schaffner et al., 2016). Many PhD programs placed too much emphasis on research skills, however, other employer-recognized important skills, such as problem solving and teamwork skills, were not supported by the fundamental reward system which was based solely on the thesis (Briscoe et al., 2016).

As programs were trying to adapt to the changes of job market, the problem of students facing excessive academic pressure was identified in several papers, had been identified by several papers. A case in point was Muir & Schwardz's research on the field of conservation. According to these authors, the required skill set would vary according to more specific profession in the field (Muir & Schwardz, 2009). However, if all of these skills were to be taught to students, not only would "super-human graduates" be needed, but also "super-human faculty" (Muir & Schwardz, 2009, p.1365). Moreover, for ocean students who did not choose to follow a research path, they may become cross students who needed courses from more than one department, which could bring extra course burdens for those students if every department required them to complete its course requirement (Briscoe et al., 2016).

Some suggestions were proposed in several papers to mitigate the problem of potentially excessive academic pressure on students. It was obvious that adding training into the curriculum was very unattractive for both students and faculty, as people's time and energy was limited (Briscoe et al., 2016; Muir & Schwardz, 2009). One possible way was to support each student to design his/her own education track (Briscoe et al., 2016; Muir & Schwardz, 2009). To do this, programs should provide career counselling at the early stage of the programs' education, as students could be informed of all the

possible career opportunities in jobs related to ocean (Briscoe et al., 2016). In addition, programs should be more flexible about the course selection of cross students, as students' burdens can be reduced if programs can recognize students can have different training (Briscoe et al., 2016). Students should also take advantage of the internship opportunities in their graduate career, think about what they want to do early and intentionally seek out related internship opportunities to enhance the specific knowledge and skills needed for their desired job positions (Muir & Schwardz, 2009). At the same time, university programs should maintain the communication with external organizations about the skill sets they wanted for students to be qualified for their job positions and adjust the curriculum to adapt new changes (Muir & Schwardz, 2009; Schaffner et al., 2016).

Despite these suggestions, for ocean-related programs, the trade-offs of courses and skills were still a challenge. Decisions on what new courses and skills needed to be added to adapt to the changes in the job market require more data. Muir & Schwardz, (2009) and Briscoe et al., (2016) both focused on identifying the gap between program education and career opportunities, however, the collected data from Briscoe et al., (2016) was very sparse and unpersuasive while Muir & Schwardz, 2009 only focused on one case study. Therefore, in order to attain better decision making for these programs, there was an urgent need to collect data on programs' curriculum revision and the state of ocean science careers (Briscoe et al., 2016; Schaffner et al., 2016). My paper will address this imperative.

There were several benefits of collecting data from alumni. Firstly, alumni could provide employment information that can assist evaluating employment trends, and the MMM program could make adjustments to adapt to the changes according to its own situation (Schaffner et al., 2016). Moreover, the updated information on career possibilities from alumni could help current students make more informed decisions when choosing their career paths (Briscoe et al., 2016). In addition, the collected information on the skills, knowledge and qualities wanted by the employers from alumni could give students a sense of the required competencies of the professional pathways they choose (Schaffner et al., 2016). Based on the benefits, I decided to focus on analyzing data collected from MAP's alumni. I will talk about this in details in the conclusion part.

Theme 3: Marine programs' effort to adapt to educational needs

Two papers proposed cross-disciplinary educational strategies at the university level to meet the need of ocean professionals who can perform interdisciplinary skills in order to solve complex ocean issues in real world (Strang et al., 2004; Ciannelli et al., 2014). Ciannelli et al., (2014) proposed an intensive training course for marine science doctoral programs in which students would work with peers from different disciplines and stakeholders as a team to address a real-word problem. This course could not only enable students to develop interdisciplinary knowledge by letting them learn from each other, but also help them build collaboration and communication skills (Ciannelli et al., 2014). This short course has now been adopted by several universities and the number of students has been increasing (Ciannelli et al., 2014). Nejad et al., (2019) presented research-based learning (RBL) and team-based learning (TBL) methods, and through the experiment in Ocean Engineering Summer School program, Norwegian University, it proved that these two methods were effective and could be educational solutions for delivering multidisciplinary education.

There was also one paper that attempted to find a solution in university-level education on the need of K-12 ocean education (Nejad et al., 2019). Identifying that ocean concepts and topics were barely taught in grades K-12, Nejad et al. (2019) proposed a Communicating Ocean Sciences course. The course was designed to teach undergraduate and graduate science students the instructional strategies for teaching and communicating ocean concepts and issues (Nejad et al., 2019). Although the outcome had not been evaluated, the courses had been taken by around 100 students and had substantial potential to promote K-12 ocean education (Nejad et al., 2019).

2.4 Conclusion

This literature review did have various important findings. There were three trends of marine affairs and related programs identified in the literature review. The marine affairs and related programs typically have a transboundary nature, and the most discussed characteristic of ocean-related programs was their cross-disciplinary approaches. The first pattern was that 21st century papers appeared to be more aware of the benefits of cross-disciplinary approaches (Chircop, 2003; Schaffner et al., 2016). The three terms to describe cross-disciplinary educational and research approaches in ocean-related programs, "multidisciplinary", "interdisciplinary" and

"transdisciplinary", appeared in papers in chronological order. The reason for this phenomenon might be that higher level of integration of disciplines was required to solve the complex real-world ocean issues. For the second trend, marine programs failed to keep pace with the changes in the job market, especially in skill training (Briscoe et al., 2016; Muir & Schwardz, 2009). Several suggestions were proposed for marine programs, including giving more attention to the development of soft skills such as like collaboration skills and keeping updated on the changes of job market and social needs (Briscoe et al., 2016; Muir & Schwardz, 2009; Schaffner et al., 2016). The third trend was that the advantages and necessity of collaborating with external organizations and peer institutions were recognized by ocean-related programs and papers (Cicin-Sain et al., 2000; Cook et al., 2016; Taussik, 1998; Neal, 1985).

This literature review indicated an urgent need for research on general status of marine affairs programs because of its scarcity and importance. There was only one paper (Mangone & Pedrick, 1973) that presented the general status of marine affairs programs, and it was published in 1973. After 1973 in the 20th century, papers mainly focused on ocean-related programs' characteristics through the analysis of case studies. After the 21st century, the trend was to focus on suggestions and solutions for ocean higher education. Therefore, this paper will investigate the current roles that marine affairs programs are playing, so that researchers can provide suggestions to marine affairs programs that are adapted to the new conditions.

As indicated by this literature review, there is a lack of research on the suitability of ocean-related programs' education when compared to the status of careers in marine sectors (Briscoe et al., 2016; Schaffner et al., 2016). Identifying the gap between education and workplace status is crucial for marine affairs programs to adapt to changes in the job market and cultivate graduates who are equipped with knowledge and skills that are desired by potential employers. Therefore, this paper will also focus on the status of workplace and investigate the skills/competencies and personal attributes that are desired by the alumni's employment sectors. The result could provide for future research on the gap between higher education in marine affairs and careers in marine sectors.

Chapter 3: Methodology

3.1 Introduction

In this chapter, I presented the methodology for my research. To conduct my research, I firstly undertook a literature review of papers on ocean-related programs, and then conducted a desktop analysis of marine affairs programs. Lastly, I used and analyzed data from a survey that had been designed for the MAP alumni and was managed by the MAP administrator. I described and justified the methods adopted for the literature review, desktop analysis, and MAP Alumni survey and case study, and then discuss the limitations of my methods.

3.2 Literature review

3.2.1 Purpose and function

The purpose of this literature review was to examine what was missing in the literature of marine affairs programs, so that I could find out the gap in research.

This literature review contributed to the programs' collection and criteria determination process in the desktop analysis. Two papers collected in the literature review provided lists of marine affairs programs, which served as a supplement and validation of the Google search of marine affairs programs. Moreover, I wrote out the first draft of criteria by identifying criteria in six papers collected in the literature review, and by also developing criteria based on several insights deduced from the literature review. Details of how the literature review contributed to collection and criteria determination processes will be discussed in the desktop analysis chapter.

3.2.2 Paper collection

In order to assemble the papers, three search engines—Google Scholar, Web of Science, and Scopus—were used. Keywords were applied when searching for papers in each of these three engines. There were two groups of keywords: group one included marine affairs, marine management, marine education, ocean education and ocean science while group two included program, degree, and university. When using these key words, I selected one item from each of the two groups. Therefore, there were 15 combinations of keywords applied in each of the three engines.

Due to a scarcity of papers on marine affairs programs, I extended the search scope to all papers on ocean-related programs. After I applied the 15 combinations of keywords in the three searching engines, only three of these papers specifically focused on marine affairs programs. Therefore, I also included papers on ocean-related programs and ocean higher education in my collection of papers for analysis. The reasons to do so, as it was mentioned in literature review, were to have a better understanding of background knowledge of ocean related programs and identify the gap of research through literature review.

3.2.3 Paper classification

Eighteen papers that conducted research on ocean-related programs and ocean higher education were collected. These papers were firstly classified as papers published before and after 2000. Then in each of the two timeframes, the papers were classified as case study papers and non-case study papers. In case study papers after 2000, the papers were grouped into three themes.

Case study papers and non-case study papers had their own definitions in this literature review chapter. The former were defined as papers that focused on one ocean-related program to do research, and the topics included description of the program, roles of the program, match between program education and careers, and program's effort to improve education. The latter were defined as papers that either investigated many ocean-related programs or critiqued ocean higher education as a whole. Mangone & Pedrick's paper in 1973 and Schaffner's paper were examples. Mangone & Pedrick (1973) collected and examined 14 marine affairs programs, and Schaffner et al., (2016) discussed some trends in ocean higher education and provided suggestions for ocean programs to prepare future ocean professionals.

The reason for classifying papers based on timeframe was to provide convenience for analysis. After papers were classified, papers in the same group were discussed together. Analyzing too many papers at one time may make it hard to identify patterns of papers, and lead to omission of important findings and result in unclear explanations. Classifying papers based on timeframe then research method could avoid these possible results.

For case study papers after 2000, three themes were generated based on topics of the papers. There was one paper describing the roles of a Marine Studies Program, so

the first theme was “Description of the roles of a marine program”. There was also one paper investigating the match between marine programs and possible careers, and there were two papers classified as non-case study papers after 2000 which had the same topic. Therefore, the second theme was “Match between the marine programs and careers”, and these three papers were discussed together under this theme. The remaining papers focused on different educational methods, and they all contributed to meet the needs in ocean education. Therefore, the third theme was “Marine programs’ efforts to adapt to educational needs”.

3.3 Desktop analysis on marine affairs programs

The purpose of this desktop analysis was to present the general status of marine affairs programs at the university level in Canada and America. By conducting the desktop analysis, I could deduce the roles that the marine affairs programs are playing based on the collected data. This desktop analysis was composed of four parts: search of marine affairs programs, criteria determination, data collection, and data analysis.

3.3.1 Search of marine affairs programs

The first part was the search of marine affairs programs. The methods of collecting programs included the Google search and identifying marine affairs programs through papers and websites. The main method to find marine affairs programs was searching through Google, using three combinations of key words: **“**marine affairs program”, “marine management program”, and “ocean affairs program”. Another method was to identify marine affairs programs from papers and websites that had already collected marine affairs programs or educational institutions that concerned marine affairs. Two papers that provided lists of marine affairs programs were found in the literature review.

There were three websites which provided lists of educational institutions which concerned marine affairs, and they were found in the process of the Google search of marine affairs programs. The three websites were the websites of United Nations’ Division for Ocean Affairs and Law of the Sea, Hamilton Shirley Amerasinghe Memorial Fellowship on the Law of the Sea, and Great Lakes Maritime Career. However, this method of using already collected lists of programs could only serve as a supplement to the Google search, as it could not be guaranteed that the papers and websites collected all the marine affairs programs in Canada and the US. Moreover, it

turned out that all of the marine affair's programs found through papers and websites had already been collected by the Google search.

3.3.2 Criteria determination

The second part was criteria determination. Criteria were defined as factors used to examine the marine affairs programs, for example, criteria can be programs' mission, core courses, subject areas, faculty, and funding. In the desktop analysis, I aimed to develop a comprehensive understanding of marine affairs programs, but the limited time did not allow me to collect all the information of marine affairs programs. Determining criteria wisely could help to collect the information in a comprehensive and effective manner. This criteria determination process had five parts: criteria identification in similar research, criteria determination based on important finding in the literature review, criteria determination based on official websites of the marine affairs programs, criteria deletion based on sufficiency of the information, and criteria classification. I classified the criteria into six groups named program overview, program structure, subject areas & skills, research, opportunities/advantages, and alumni employment status and programs' employment resources.

3.3.3 Data collection

The third part was data collection. I collected the data into an excel. Most of the information was directly extracted from the websites, however, to collect data for some criteria, I needed to analyze the descriptions or selectively extract information in the programs' websites. Below are those criteria:

- Skills. Information collection on skills focused on program level and the skills were identified by analyzing programs' objectives, vision, mission statement, values and learning outcomes. Moreover, for some programs that had course descriptions in their websites, several skills were identified by analyzing the course descriptions of core courses.

- Courses. I only recorded core courses but not elective courses. Marine affairs programs generally required students to take a certain number of elective courses. However, I did not record the elective courses here because the number of elective courses was relatively large compared with core courses.

- Subjects: Information on subjects was not obtained by analyzing the courses description, but by the direct description of subject areas on the websites.
- Research: Information collected on research was the focused research fields of the programs while more detailed information like research topics under each field, number of published papers was not collected.
- Opportunities: Opportunities referred to any factor that could benefit the programs' education, which could be educational resources, educational strategies etc.

3.3.4 Data analysis

The fourth part was data analysis, and I applied several analysis methods in this part. Generally, I analyzed the data by identifying the trends and what programs had done differently or additionally in each criterion. I selected several criteria and put them into tables to visualize the collected data. Those criteria included core courses, subject areas, skills, research, and opportunities/advantages. These criteria were chosen to be included in the table because they were important factors in presenting the general status of marine affairs programs. Other than presenting data with tables, I also highlighted things that programs did that stood out, like the listservs of the Marine Affairs Department in the University of Rhode Island. In addition, I compared the result of desktop analysis with the findings from the literature review, to check if the problems identified in the literature still exist, if the suggestions from literature review papers had been adopted, and if the programs still have similar characteristics in the current marine affairs programs. Lastly, in certain criteria in which the difference between marine affairs programs in Canada and America was obvious, I also compared the MMM program in Canada and programs in America.

3.4 MAP Alumni survey

The sub-topic was to investigate the skills/competencies and personal attributes that are desired by employment sectors of marine affairs programs' alumni. To answer the sub-topic, I focused on the MAP in Dalhousie University. I participated in a survey designed for MAP's alumni and used and analyzed the data from the survey.

The MAP in Dalhousie University has more than 500 alumni who come from different countries with a wide diversity of disciplines, including science, social science,

law, policy, political science, engineering, planning, economics, and business (MAP, n.d.-a). The alumni are now contributing to the development of marine management in 60 countries and 10 Canadian provinces & territories (MAP, n.d.-a).

The survey was designed for MAP alumni and administered by MAP administrators. It was conducted as program evaluation, which did not require research ethics. The objectives of it were to assist the MAP by gathering information on the a) experiences of the alumni during the program, b) skills/competencies expected of graduates by employers in the coastal and marine sectors, c) engagement strategies, and d) outreach and service actions being practiced that could lead to ocean stewardship. My contribution to the survey was first to suggest the questions relating to skills, specifically communication skills and then build the survey in Opinio (online survey software, where the data is hosted on Dalhousie servers) using the MAP account.

The survey consisted of 30 questions and a demographic section. It would take participants around 20-30mins to complete. It was tested by four alumni volunteers before it was launched. Several questions and survey structure were amended by the MAP administration based on the four alumni's suggestion. The survey was launched on December 3rd, 2021, and closed February 10, 2022. Three reminders were sent to participants during this period. The survey was sent to 381 alumni of MAP, and 61 of them completed the survey (~16% response rate). Even if the survey did not require ethics, participants were asked to provide consent in order to facilitate the use of aggregated data from the alumni (e.g., demographics). All 61 participants who completed the survey provided consent.

I selected several questions that were related to my sub-topic and an additional one that asked advice from the alumni for the current MMM (Master of Marine Management) students. Alumni could provide valuable guidance on employment, which was the reason that additional question was selected.

I presented the result with bar charts and described and analyzed the data according to the graphs. To analyze the data of year of graduation, I used five years as one period, and present the number of alumni in year of graduation time periods. The period was chosen to see the distribution of the alumni in each time period, as the year of graduation may influence the answers for other questions. A five-year period was probably the most appropriate, as MAP internal and external environments may change substantially

over five-year period, while less than five-year period may not. A period of five years is probably the best representation of a group of similarly situated alumni. To analyze the data on the desired skills/competencies and personal attributes, I calculated the number of votes of score 5 for each skill/competency and personal attribute, and then presented the result in bar graphs.

3.5 Research limitations

There were several additional methods that could have been pursued for a more in-depth analysis. In the desktop analysis, I could have expanded the search scope and included programs related to marine affairs, performed interviews and surveys to collect information on marine affairs programs, and conducted course content analysis. In the analysis of MAP's alumni survey data, I could have conducted interviews with the alumni for more information and included more questions for analysis. However, due to time limits, all the methods mentioned above were not taken. I will explain these missed methods in the next few paragraphs.

My research scope was narrowed to focus on marine affairs programs. However, I could attain a more thorough understanding of the marine affairs education if I included programs related to marine affairs, like Marine Policy program, Fishery Management program, Coastal Zone management program. However, including these programs would significantly increase the workload, therefore, I didn't include these programs considering the time limit.

Moreover, the method to collect information on marine affairs programs was single, which was browsing the programs' websites. There were two problems with collecting data only from programs' websites. Firstly, the information in the websites could be outdated if the marine affairs programs didn't update their websites in a timely manner. Secondly, people who prepare websites' information may add subjective ideas and may leave out important facts, as a result, the descriptions on the website may not accurately reflect the reality of the situation of the marine affairs programs. If time allowed, I could have performed interviews or conducted surveys students, faculty, and staff in these programs. By doing this, I can get information that is missing in their websites or get more details on the criteria.

Other than limitations in search scope and method to collect information, I also made trade-offs in the criteria determination process. Course content analysis was not

included in desktop analysis. In the paper “Education and training in integrated coastal management: Lessons from the International Arena”, the authors conducted a course content analysis of coastal zone management courses offered by universities around the world. Its method indicated there were various criteria to examine, including major subjects, conceptual approaches, natural processes and social issues covered in courses, and disciplines covered in courses (Cicin-Sain et al., 2000). Considering the time constraints and the fact that normally detailed syllabi of courses were not available on programs’ websites, I only collected data on core courses and general subjects covered in curriculum.

I used the data collected from the MAP’s alumni survey, however, I could have conducted interviews with alumni to learn from their insights and experiences regarding my research question, which may not be gained from the survey. However, due to time constrains, I chose not to pursue this method. Moreover, there were some questions about alumni’s evaluation on the skill development of MAP. I could have analyzed those questions and then compare the result of those questions with questions about the desired skills/competencies in marine sectors. In this way I could investigate the suitability of MAP’s education and status of marine sectors in terms of skills. However, due to time limit, I only analyzed questions on desired skills/competencies in marine sectors.

Chapter 4: Desktop analysis

4.1 Introduction

This chapter presented and analyzed the result from the desktop analysis on marine affairs programs. It consisted of three parts: observations in the search of marine affairs programs, result of criteria determination, and result and discussion on the collected data. In the first part, I described several observations in the search of marine affairs programs. Based on these observations, I determined the scope of the search (only in America and Canada) and the type of programs (only marine affairs programs). The second part showed the result of criteria determination. The third part showed the findings on the determined criteria based on marine affairs programs' websites. It was the most important part in this chapter, as it served to answer the main question of my paper—the general status of marine affair programs.

In this section, in-text citations for contents extracted from marine affairs programs' official websites were represented as numbers. Table 7 was made to show the references which the numbers correspond to. This section was cited differently because sentences in part 4.4 usually have numerous references, which made it difficult for readers to read. Representing in-text citations with numbers could alleviate this problem.

4.2 Observations in the search of marine affairs programs

4.2.1 Observations on information sources

Two of the collected papers in the literature review provided lists of marine affairs programs in America. In the paper "Marine Affairs and Ocean Higher Education", the authors identified 14 degrees in marine affairs and in the paper "Education and Training in Integrated Coastal Management: Lessons from the International Arena", the authors provided a list of 8 programs in marine affairs and policy. Some of the listed programs are marine affairs programs while others are relevant programs of marine affairs. I only checked the listed marine affairs programs to see if I had missed any of these programs in Google search.

When searching marine affairs programs using google, I found the official website of United Nations' Division for Ocean Affairs and Law of the Sea. In this website, it provided a list of educational institutions around the world addressing ocean issues and

law of the sea. In this website, I also discovered a link which led me to the website of Hamilton Shirley Amerasinghe Memorial Fellowship on the Law of the Sea. The fellowship aims at enhancing knowledge of participants including government officials, research fellows and lecturers in ocean law or maritime affairs or related disciplines on the Law of the sea, to facilitate the wider application of this law (United Nations, 2021). This website provided a list of institutions which participated in this fellowship. In the two lists mentioned above, I filtered out the U.S. and Canadian educational institutions and went to each of their websites to check if they offered marine affairs programs.

When searching marine affairs programs using google, I also found the website of Great Lakes Maritime Career. This website also listed a dozen of educational institutions that offered maritime training. Considering these institutions offered maritime training, I assumed there was possibility that these institutions offered ocean-related programs including marine affairs programs. Therefore, I went to each of these institutions' website to check if it offered marine affairs programs.

4.2.2 Countries

My search of marine affairs programs only focused on Canada and America. When searching for marine affairs programs through Google, I found that marine affairs programs in America appeared most frequently. While browsing their official websites, I found that many of the official websites provided me with information on most of the criteria I identified through the literature review. In addition, the information was very informative and detailed. All of these allowed me to base my analysis on a richer data base, thus making the result of the analysis more convincing. Therefore, America was one of my searched countries. Canada was another country I focused on. This graduate project focused on MAP in Dalhousie University to investigate my sub-topic. I set my search scope in Canada to facilitate my examination of the entire marine affairs programs in Canada. Because of time constraints, the search scope was limited to these two countries.

4.2.3 Types of programs

In the process of searching online for marine affairs programs, I found various relevant programs of marine affairs, like Master of Marine Policy in University of Delaware, Master of Maritime management in Maine Maritime Academy, Master of Marine Studies (Fishery Resource Management) in Memorial University of

Newfoundland. The main difference of these programs and marine affairs programs is these programs have a focused teaching field while marine affairs programs do not give any one field special focus. Taking Master of Marine Policy in University of Delaware as an example, even though many subjects like ports and shipping, marine minerals, ocean and coastal zone management, and fisheries are involved in its education, the program gives emphasis on ocean policy and governance [11]. The emphasis can be reflected in its educational objective, which is developing students' expertise in ocean policy and governance [11]. The emphasis is also reflected in its core courses, most of which are related to ocean policy [11]. Marine affairs programs also covered many subject areas including coastal zone management, sea use planning, fisheries management, marine law and policy, and maritime transport, however, there's no focus on any subject based on analyzing the programs' objectives, core courses and research. Moreover, there are some courses specifically for developing skills in marine affaires in core courses of marine affairs programs, which are not found in relevant programs. Examples of these courses includes Marine Management Tools & Techniques course in Master of Marine Management in Dalhousie University, Quantitative Methods in Marine Affairs course in Bachelor of Science in Marine Affairs in The University of Rhode Island, Decision Making & Action Taking in Marine Affairs course in Master of Marine Affairs University of Washington [4,7,10]. Including relevant programs of marine affairs in the scope of my research would significantly increase the time and effort spent on searching for these programs and collecting and analyzing data from them. Considering the time limit, I only focused on marine affairs programs.

4.3 Result of criteria determination

As it was mentioned in the methodology, the criteria determination process was done by identifying the criteria from similar research, determining criteria based on findings from literature review, browsing the official websites of the marine affairs programs, and deleting criteria based on sufficiency of the information. Below showed the result of this process.

4.3.1 Result of criteria identification in similar research

In collected papers from the literature review, six papers investigated their selected ocean related programs. I firstly recorded all the criteria these papers used to investigate their programs, these criteria included the universities and schools to which the marine

affairs programs belonged, location and country, objective, program size, duration, mode of study (full time or part time), program structure (courses, thesis, internship, etc.), funding, employment, research, extra curriculum activities, diversity of students, diversity of faculty, difficulties/weaknesses.

4.3.2 Result of criteria determination based on findings from the literature review

Four criteria, collaboration with external organizations, collaboration with peer institutions, skills emphasized, and resources for employment were included based on insights from the literature review. Several papers in the literature review gave an emphasis on the benefits of collaborating with external organizations and peer institutions, therefore, I included "collaboration with external organizations" and "collaboration with peer institutions" as criteria (Cicin-Sain et al., 2000; Cook et al., 2016; Taussik, 1998; Neal, 1985). Briscoe et al., (2016) suggested that ocean-related programs should provide students with career counselling at the early stage of their education in the programs. Providing this service could help students to learn about career opportunities (Briscoe et al., 2016). Moreover, this could also facilitate students who did not choose to follow a research path to determine their career directions as early as possible, which could reduce the students' study burden by focusing on their career field (Briscoe et al., 2016). The problem I worried about here was whether the programs "provide career counselling at the early stage of education" may be hard to investigate in websites of the programs. However, I did find various programs present their resources for career opportunities. Therefore, I included "resources for employment" as a criterion, and whether the career services were provided at the early stage of education was no longer the question I aimed to examine. Briscoe et al., (2016) and Muir & Schwardz (2009) illustrated there was a mismatch between marine programs and possible careers opportunities, particularly in skills. Therefore, I included skills as a criterion to get a general understanding of the skills that the collected marine affairs programs emphasized on.

4.3.3 Result of criteria determination based on websites

I also identified some criteria by browsing the programs' official websites and identifying the frequently appeared criteria. These criteria included resources for employment, value, vision, mission and learning outcome, subject areas, relationships

with stakeholders, relationships with same university's programs, opportunities/advantages.

4.3.4 Result of criteria deletion

I found that for some collected criteria, the information corresponding to them could hardly be found on the official websites of the programs or was only mentioned in one or two programs' websites. These criteria included program size, mode of study (full-time/part time), accreditation, program challenges, history, and number of applications. Therefore, I removed these criteria.

4.3.5 Result of criteria classification

I classified the remaining criteria into six groups:

a) Program overview, which included programs' values, missions, educational objectives and learning outcomes.

b) Programs' structure, which referred to what students needed to complete to graduate, and it could include core courses, credit hour, internship, thesis or non-thesis, exam.

c) Subject areas and skills. Subject information was obtained by the description of the subject areas on the website, and skills focused on program level and explored programs' objectives, vision, mission statement, values and learning outcomes.

d) Research, which focused on main research fields.

e) Opportunities/advantages, which referred to any factor that could benefit the programs' education, including educational strategies, educational resources, dual-degree programs, external relationships, funding, diversity of students and faculty, and educational tracks.

f) Alumni employment status and programs' employment resources.

4.4 Result and discussion on the collected data

There were 17 marine affairs programs found, including 6 bachelor programs, 5 master programs, 1 PhD program, and 5 dual-degree programs. In this section, I mainly

focused on the single-degree programs because of time limits, and I presented the findings on the criteria based on the programs' websites.

4.4.1 Program overview

Values

The three universities which mention the program's values in their website all state that they value diversity, equity, and inclusion, with the University of Rhode Island emphasizing their commitment to diversity, equity, and inclusion in multiple aspects, including the classroom, scholarship, and action [1,4,10].

Missions

The missions of marine affairs programs predominantly consist of three types: education, research, and outreach mission [1,4,7,9]. Four universities state their mission, and the main commonality is that they all have the education mission to train future professionals to contribute to the sustainable development of ocean [1,4,7,9]. They have different expressions for explaining their education mission, for example, the University of Rhode Island's educational mission is to equip students with the ability to contribute to "human-environment interactions associated with coastal and marine systems", and the University of New England's education mission is to allow their graduates to "improve the health of people, communities, and our planet [1,4]. Two other missions mentioned by universities include research and outreach. Dalhousie University, the University of Rhode Island and the University of Miami all mention their mission to advance research [4,7,9]. Moreover, the University of Miami state that they want to transfer the knowledge gained through their cutting-edge research to students, scientific communities, policy makers, and the public, which indicates their mission of outreach [9]. Dalhousie University has a more obvious outreach mission statement, which states they will "share marine management expertise, and related skills, within the Dalhousie community and worldwide, through a network of faculty, graduates, associates, and institutions" (MAP 2017, p.2).

Educational objectives

Generally, the common learning objective of all of the marine affairs programs is to prepare students for their future careers in marine management [4,7,9,10]. Moreover, the PhD program in the University of Rhode Island and the bachelor program in the

University of Miami also state that they prepare students for their further education [4,9]. In addition, two universities, Dalhousie University and the University of Rhode Island, state their interdisciplinary education strategy in their objectives [4,7]. Dalhousie University states they prepare professionals by promoting synergies among disciplines while the University of Rhode Island aims at developing the interdisciplinary analysis ability of students [4,7].

Learning outcomes

The marine affairs programs describe their learning outcomes mainly in terms of students' knowledge, abilities, and skills [1,2,3,4,9]. All of the programs which have their outcomes stated in their websites claim that their students will demonstrate an overall knowledge related to marine affairs [1,2,3,4,9]. The ability of students to apply knowledge to address real-world marine management problems is emphasized by all the programs [1,2,3,4,9]. The programs mention in their websites that their students will be able to apply skills, insights, management strategies gained from their education, and outcomes from research and literature, to address complex problems in marine management [1,2,3,4,9]. Problem-solving skills, analytical skills, and critical-thinking skills are the skills that frequently appear in the outcome section of the programs' websites [1,2,3,4,9]. Other than the above skills, communication skills are emphasized by almost all the programs [1,2,3,4,9]. Programs state that their students will be able to communicate effectively, and two universities also state that their students will communicate effectively in both written and oral formats [1,2,3,4,9]. Other skills that appear in several programs' websites include research skills, data analysis skills, collaboration skills, and the skills to evaluate published information [1,2,3,4,9].

Based on the literature review of my paper, one of the problems with ocean-related programs was the overemphasis on research skills (Briscoe et al., 2016; Muir & Schwardz, 2009; Schaffner et al., 2016). Briscoe et al., (2016) and Schaffner et al., (2016) also suggested that ocean-related programs should give more attention to the development of soft skills, such as communication skills. Based on the above analysis of the learning outcomes of marine affairs programs, programs aim to develop a variety of skills [1,2,3,4,9]. Moreover, communication skills appear to be among the most emphasized by the programs [1,2,3,4,9]. Therefore, my inference is that the problem

identified in the literature review is no longer a problem for the current marine affairs programs.

4.4.2 Program requirements and core courses

Six bachelor programs in marine affairs were found [1,2,4,5,9]. In general, the credit hours of bachelor programs in marine affairs are around 120 credits, and the composition of courses varies in different programs [1,2,4,5,9]. For example, the courses for the B.A in Marine Affairs in the University of Rhode Island are composed of courses in general education, MAF core courses, social science & humanities, coastal & marine policy & management, supporting requirements, and supporting electives, while the courses for the B.A in Marine Affairs in the University of Miami are composed of courses in marine affairs, other required courses, courses in approved minor, and electives [4,9]. Only two programs in the University of Rhode Island provide core course lists in their websites [4]. The B.A in Marine Affairs in the University of New England requires students to take an internship while also taking the Marine Affairs Capstone course [1]. However, whether a written report or thesis is required in this program is not mentioned [1]. There's also one program (Hawaii Pacific University) requiring students to take a research practicum or internship, and one program (University of New Haven) requiring students to write a thesis to graduate [2,5].

Five master programs and one PhD program in marine affairs were found [3,4,7,10]. The Master of Marine Management (MMM) program in Dalhousie University is the only marine affairs program found in Canada while the remainder of the programs are in America [3,4,7,10]. There are some differences between the MMM program in Dalhousie University and the Master programs in marine affairs in America [3,4,7,10].

The first identified difference is that the numbers of required courses are usually higher in programs in America [3,4,7,10]. For example, the MMM program of Dalhousie University requires students to take 8 courses while the M.A in Marine Affairs in the University of Rhode Island requires 13 courses to graduate [4,7]. Secondly, the core course compositions of Canada's MMM program and America's master programs in Marine Affairs are quite distinct [3,4,7,10]. While they all require one course in marine science, American programs appear to give emphasis to courses

in ocean law, economy, and research methods, while Canada's MMM program focuses on courses in ocean management issues, marine management tools & techniques, and coastal zone management [3,4,7,10]. Three master programs in America list their core courses in their websites [4.10]. These three programs all offer courses in marine science, ocean law, and economics of marine resources [4,10]. Two of these three programs also require one research method course [4,10]. Except for the marine science course, the MMM's core course list does not have the other courses mentioned above [7]. Moreover, MMM's core courses which include Contemporary Issues in Ocean and Coastal Management, Marine Management Tools & Techniques, and Coastal Zone Management are not found in America's Master programs' core course lists [3, 4,10]. Thirdly, the MMM program in Dalhousie requires students to take an internship of at least four weeks while the internship is not required in all America Master programs [3,4,7,10]. Finally, America's Master programs offer two tracks—thesis and non-thesis tracks—for students while MMM program in Dalhousie only have one option: a written research paper [3,4,7,10]. The thesis track in America's master programs requires students to complete a master thesis and the requirements for non-thesis track vary in different programs [3,4,7,10]. For example, the non-thesis track of the M.A in Marine Affairs program in the University of Rhode Island requires students to write a major paper and pass a comprehensive examination, while the requirement in the Master of Marine Affairs in the University of Washington is to complete a team capstone project [4,10].

The major differences between bachelor and master programs in marine affairs are in courses and thesis/report [1,2,3,4,5,7,9,10]. The number of required courses in bachelor programs is significantly higher than that of master programs [1,2,3,4,5,7,9,10]. The master programs usually require a thesis or a written report to graduate, while only one bachelor program requires students to complete a thesis [1,2,3,4,5,7,9,10]. The major differences between master programs and a PhD program are that the PhD program requires more courses than master programs and it requires students to pass a comprehensive exam [3,4,7,10].

Table 1. Core courses of bachelor programs in marine affairs.

Programs	**Universities**	**Core courses**
B.S in Marine Affairs	The University of Rhode Island	Five core courses (15 credits)

		- Human Use and Management of the Marine Environment - New England and the Sea - Introduction to Marine and Coastal Law - Senior Seminar in Marine Affairs - Quantitative Methods in Marine Affairs
B.A in Marine Affairs	The University of Rhode Island	Four core courses (12 credits) - Human Use and Management of the Marine Environment - New England and the Sea - Introduction to Marine and Coastal Law - Senior Seminar in Marine Affairs
B.A in Marine Affairs	University of Miami	N/A
B.A in Marine Affairs	The University of New England	N/A
B.A in Marine Affairs	Hawaii Pacific University	N/A
B.A in Marine Affairs	University of New Haven	N/A

Table 2. Core courses of master programs in marine affairs.

Programs	**Universities**	**Core courses**
Master of Marine Management program	Dalhousie University	Five core courses (2.5 credits) - Contemporary Issues in Ocean and Coastal Management Part 1 - Marine Management Tools & Techniques - Contemporary Issues in Ocean and Coastal Management Part 2 - Marine Science and Technology - Coastal Zone Management
M.A in Marine Affairs	The University of Rhode Island	Six core courses (18 credits) - Quantitative Methods in Marine Affairs - Research Methods in Marine Affairs - Marine Science and Ocean Uses - International Ocean Law

		- Marine Affairs Seminar - Economics of Marine Resources
Master of Marine Affairs	The University of Rhode Island	Four core courses (12 credits) - Ocean Uses and Marine Science - Economics of Marine Resources - International Ocean Law - Marine Affairs Seminar
Master of Marine Affairs	University of Washington	- Introduction to The Human Dimensions of Global Change - Decision Making & Action Taking in Marine Affairs - Environmental Equity & Justice - Marine Law - Policy Analysis - Economics - Policy Process - Marine Science - Research Methods - First Year Advising
M.A in Marine Policy and Management	University of New Haven	N/A
Marine Affairs PH. D Program	The University of Rhode Island	Six core courses (18 credits) - Quantitative Methods in Marine Affairs - Research Methods in Marine Affairs - Marine Science and Ocean Uses - International Ocean Law - Marine Affairs Seminar - Economics of Marine Resources

4.4.3 Subject areas and skills

Based on the description of the programs' websites, the marine affairs programs develop a wide variety of skills for students [1,2,3,4,5,7,9,10]. The skills that appear most frequently in programs' websites include interdisciplinary skills, problem

identification and problem-solving skills, analytical skills, acquisition and data analysis skills, research skills, communication skills, and collaboration skills [1,2,3,4,5,7,9,10].

Generally, marine affairs programs cover a wide diversity of subject areas [1,2,3,4,5,7,9,10]. The subject areas in the marine affairs programs are not the same but there is a lot of overlap, and most of the programs cover subject areas such as fishery management, resource management, ocean law and policy, and environmental protection [1,2,3,4,5,7,9,10]. The MMM program in Dalhousie University has some subject areas that are not included in America's marine affairs programs, which include arctic environmental knowledge, community-based co-management, and indigenous knowledge systems [7].

Table 3. Subject areas and skills in marine affairs programs.

Programs	**Universities**	**Subject areas**	**Skills**
B.S in Marine Affairs/B. A in Marine Affairs	The University of Rhode Island	Management of living and non-living resources in the exclusive economic zone, environmental protection in the coastal zone, the interplay of marine science and public policy in areas such as ocean pollution and fisheries management, developments in international ocean law, and the role of governments and international organizations in Marine Affairs.	Interdisciplinary skills, decision-making skills, writing skills, data acquisition and data analysis skills, research skills, critical-thinking skills, problem-solving skills, communication skills, interpersonal skills, self-evaluation skills, analytical skills, collaboration skills, leadership skills
B.A in Marine Affairs	University of Miami	N/A	Interdisciplinary skills, communication skills, problem-solving skills statistics skills
B.A in Marine Affairs	The University of New England	Coastal and marine science, resource use, marine governance systems, management, policy, ecosystems ecology, conservation, and sustainable development.	Critical thinking skills, problem solving skills, collaboration skills, communication skills, interdisciplinary skills
B.A in Marine Affairs	Hawaii Pacific University	Marine science, the nature of the changing systems, sustainability of ocean resources, and social and environmental justice	Communication skills, data acquisition skills, data analysis skills, problem identification skills, problem solving skills

B.A in Marine Affairs	University of New Haven	N/A	Interdisciplinary skills, analytical skills, problem solving skills, communication skills, collaboration skills, data acquisition skills, data analysis skills, research skills, communication skills, presentation skills
Master of Marine Management program	Dalhousie University	Arctic environmental knowledge, climate change adaptation, coastal tourism, community-based co-management, development of non-living resources, ecolabelling and seafood certification, ecosystem-based management, fisheries management, indigenous knowledge systems, integrated coastal zone management, marine conservation, marine law and policy, marine protected areas, marine spatial planning, maritime enforcement, maritime transport, risk management, ocean governance.	Decision-making skills, problem-solving skills, skills to evaluate reliability of information, risk assessment skills, risk management skills, GIS skills, negotiation skills, collaboration skills, data analysis skills, research skills, project management skills, budgeting and fundraising skills, event planning and scheduling skills, media and marketing capabilities, oral and written communication skills, presentation skills, creative problem solving skills, networking skills
M.A in Marine Affairs/ Master of Marine Affairs	The University of Rhode Island	Management of living and non-living resources in the exclusive economic zone, environmental protection in the coastal zone, the interplay of marine science and public policy in areas such as ocean pollution and fisheries management, developments in international ocean law, and the role of governments and international organizations in Marine Affairs.	Interdisciplinary skills, decision-making skill, writing skills, data acquisition and data analysis skills, research skills, critical-thinking skills, problem-solving skills, communication skills, interpersonal skills, self-evaluation skills, analytical skills, collaboration skills, leadership skills
Master of Marine Affairs	University of Washington	Marine science, marine law, economics, environment equity & justice, etc.	Interdisciplinary skills, research skills, critical thinking skills, analytical thinking skills, decision-making skills, cost-benefit analysis skills, quantitative analysis skills, communication skills
M.A in Marine Policy and Management	University of New Haven	Many subjects in the natural and social sciences, humanities, business, and engineering	Critical thinking skills, analytical skills, communication skills, collaboration skills, writing skills, interdisciplinary skills, problem identification and problem-solving skills, research skills, data analysis skills, presentation skills, teaching skills

Marine Affairs PH. D Program	The University of Rhode Island	Coastal management, fisheries management, marine ecosystem management, maritime transportation and ports, national and international ocean policy, marine human ecology	Interdisciplinary skills, decision-making skills, writing skills, data acquisition and data analysis skills, research skills, critical-thinking skills, problem-solving skills, communication skills, interpersonal skills, self-evaluation skills, analytical skills, collaboration skills, leadership skills

4.4.4 Research

Generally, marine affairs programs have research activities on various of fields [1,2,3,4,5,7,9,10]. The research topics that marine affairs programs research typically have include ocean law and policy, resource management, conservation, climate change, and fishery management [1,2,3,4,5,7,9,10]. Other research topics that several programs have include environmental justice, marine spatial planning, and coastal zone management [4,7,9,10].

Table 4. Research in marine affairs programs.

Programs	**Universities**	**Research**
B.S in Marine Affairs/B. A in Marine Affairs	The University of Rhode Island	Conservation, ocean policy and law, climate adaption and resilience, energy resources, coastal communities, justice, ports and shipping, fisheries and marine ecosystems, spatial planning and management
B.A in Marine Affairs	University of Miami	Aquaculture fisheries management, political ecology, natural resource economics, coastal zone management, marine spatial planning, marine protected areas, coastal and ocean law, marine cultural resources
B.A in Marine Affairs	The University of New England	Climate change, marine pollution, conservation and restoration, fisheries and aquaculture management, marine business and entrepreneurship
B.A in Marine Affairs	Hawaii Pacific University	N/A
B.A in Marine Affairs	University of New Haven	N/A
Master of Marine Management program	Dalhousie University	Coastal zone management, environmental issues, law and policy, living resources management, non-living resources management, socioeconomic issues, transportation and communications

M.A in Marine Affairs/ Master of Marine Affairs	The University of Rhode Island	Conservation, ocean policy and law, climate adaption and resilience, energy resources, coastal communities, justice, ports and shipping, fisheries and marine ecosystems, spatial planning and management
Master of Marine Affairs	University of Washington	Climate change and ocean acidification, coastal zone, ecosystem, resource management, environmental law and policy, environmental protection and restoration, equity & environmental justice, marine tourism, policy process and analysis, sustainability science
M.A in Marine Policy and Management	University of New Haven	N/A
Marine Affairs PH. D Program	The University of Rhode Island	Conservation, ocean policy and law, climate adaption and resilience, energy resources, coastal communities, justice, ports and shipping, fisheries and marine ecosystems, spatial planning and management

4.4.5 Opportunities/advantages

Opportunities/advantages in educational strategies and educational resources.

Two educational strategies—interdisciplinary and experiential learning—are adopted by the marine affairs programs according to their websites [1,2,3,4,5,7,9,10]. Most of the programs indicate that they adopt an interdisciplinary strategy in their websites [3,4,7,9,10]. They have various expressions about their interdisciplinary education strategies. For example, University of Miami states they educate students through integration of different perspectives include scientific, economic, and social perspectives, while Dalhousie University directly state they provide an interdisciplinary learning environment for students [6,7,9]. The reason that the interdisciplinary education strategy is widely adopted among marine affairs programs may because that the ability to integrate knowledge and approaches from diverse disciplines is required to understand and solve complex problems related to marine affairs (Chircop, 2003). Even though several programs do not explicitly state that they use an interdisciplinary education strategy on their websites, considering the transboundary nature of marine affairs, here I assume that all marine affairs programs have adopted this strategy.

Another strategy is the experiential learning strategy, which is highlighted by three programs in their websites [1,2,5]. Experiential learning enables students to learn from real life experience. For example, based on the University of New Haven's description, their experiential learning strategy provides opportunity for students to learn about

challenges faced by society and the environment, ocean policy, and sustainability through real life experience like visiting ecosystems, interacting with stakeholders [2]. It is worth mentioning here that there may be more than three programs which are adopting this strategy, as there may be programs that adopt this strategy but do not spell it out on their websites.

It appears that each university has its own characteristics regarding advantages in educational resources. The marine affairs programs in University of Rhode Island benefit from the ample course resources [4]. The University of Rhode Island has a wide range of graduate marine programs, and students in marine affairs programs can get access to a wide variety of courses in diverse disciplines to meet their learning needs [4]. The University of New England has two flow-through seawater teaching labs, boasting top-notch seawater facilities, the university owned island, and university owned research vessels, which enhance experiential learning experience for students [1]. Hawaii Pacific University has Oceanic Institute of Hawai'i Pacific University (OI), which is a research and development organization [5]. Students can benefit from the OI by participating in its research activities [5]. In addition, the MAP in Dalhousie University has a variety of long-term research projects in diverse fields, and students can engage in these projects for their internships and graduate projects [7]. Students in the MAP also have the opportunity to organize the Sustainable Ocean Conference [8]. The conference is the only student-led conference on ocean in Nova Scotia, in which students are able to develop various skills such as project management skills and communication skills [8].

Table 5. Educational strategies and educational resources.

Programs	**Universities**	**Educational strategy**	**Educational resources**
B.S in Marine Affairs/B. A in Marine Affairs/ M.A in Marine Affairs/ Master of Marine Affairs/ Marine Affairs PH. D Program	The University of Rhode Island	Interdisciplinary strategy	- The opportunity to collaborate and learn from today's leading experts - Availability of a wide variety of courses due to a wide breadth of graduate marine programs in the university
B.A in Marine Affairs	University of Miami	Interdisciplinary strategy	N/A

B.A in Marine Affairs	The University of New England	Experiential learning education strategy	- The Arthur P. Girard Marine Science Center (APGMSC) - Ram island: UNE's own research island - Two flow-through seawater teaching labs - UNE research vessels - Students can access to 3,500 miles of Maine coastline
B.A in Marine Affairs	Hawaii Pacific University	Experiential learning education strategy	- Oceanic Institute of Hawai'i Pacific University (OI), a non-profit research and development organization - Students can easily access to ocean due to location of the university
B.A in Marine Affairs/ M.A in Marine Policy and Management	University of New Haven	B.A in Marine Affairs: Experiential learning education strategy Master of Arts in Marine Policy and Management: Interdisciplinary strategy	N/A
Master of Marine Management program	Dalhousie University	Interdisciplinary strategy	- MAP conduct timely and interdisciplinary research by working with other educational, governmental, NGO and private sector organizations. - A variety of long-term research projects in diverse fields. - Annual Sustainable Oceans Conference
Master of Marine Affairs	University of Washington	Interdisciplinary strategy	N/A

Opportunities/advantages in Dual-degree programs and external relationships

Two master programs and one bachelor program in America offer dual-degree programs by collaborating with their own universities' programs or other universities' programs [1,4,10]. Generally, in these dual-degree programs, students are obligated to meet the requirements of both programs that collaborate to form the dual-degree program [1,4,10]. There are several advantages of dual-degree programs that are

deduced from the description these programs' websites. Firstly, students in dual-degree programs can develop a foundation of multidisciplinary knowledge by receiving education from two programs [1,4,10]. For example, in the dual-degree program, which is developed through the collaboration of Master of Landscape Architecture and Master of Marine Affairs at the University of Rhode Island, students can develop knowledge in design as well as coastal and marine social science, economics, policy, planning and law [4]. The benefit of having a foundation of multidisciplinary knowledge may be that when students tackle real-world problems which involve multiple disciplines in the future, they have developed the needed knowledge and have the potential to apply that knowledge to solve the problem [4]. Secondly, students can conduct interdisciplinary research with topics related to both programs they are engaged in, which could help them to develop interdisciplinary skills [1,4,10]. For example, in the dual degree program, which is developed through the collaboration of Master of Marine Affairs at the University of Rhode Island and Juris Doctor at the Roger Williams University, students can conduct research in social science and traditional legal studies [4]. Finally, the dual-degree programs reduce the amount of time students need to take to complete both programs [1,4,10]. For example, students in the UNE Marine Affairs – Maine Law 3+3 Pathways Program can complete the two degrees—B.A. in Marine Affairs at the University of New England and Law Degree (J.D.) at the University of Maine in six years, while it will normally take seven years if they take these two degrees separately [9].

Marine affairs programs usually have external relationships with professional governmental, NGO, and private sector organizations according to the description of most marine programs' websites [1,2,3,4,5,7,9,10]. In the literature review chapter, I mentioned that the benefits of establishing external relationships include expanding education resources, enabling programs to keep pace with the changes in job market. There are two additional advantages which I deduce from two programs' websites. Firstly, based on the University of New Haven's description, students could use the network developed by the programs to gain hands-on experience and employment opportunities [3]. Moreover, establishing external relationships could allow the research of the programs to keep pace with the changes in marine affairs [7]. For example, Dalhousie University states that they promote and conduct timely research by working with other educational, governmental, NGO and private sector organizations,

which indicates that the external relationships enable Dalhousie University to exchange information with the external world [7]. From this exchange, the university is able to identify the current research needs [7].

Table 6. Dual-degree programs and external relationships.

Programs	**Universities**	**Dual-degree programs**	**External relationships**
B.S in Marine Affairs/B. A in Marine Affairs/ M.A in Marine Affairs/ Master of Marine Affairs/ Marine Affairs PH. D Program	The University of Rhode Island	Juris Doctor/Master of Marine Affairs - A Roger Williams University School of Law and University of Rhode Island Department of Marine Affairs Partnership Master of Landscape Architecture/Master of Marine Affairs - A Rhode Island School of Design and Department of Marine Affairs Partnership Oceanography Ph.D./Master of Marine Affairs - A Rhode Island Graduate School of Oceanography and Department of Marine Affairs Partnership	Government, business, professional groups, local communities, historically underrepresented groups, resource users and non-governmental organizations.
B.A in Marine Affairs	University of Miami	A 5-year B.A. in Marine Affairs/Master of Professional Science (MPS) Program in Marine Ecosystems and Society	N/A
B.A in Marine Affairs	The University of New England	The UNE Marine Affairs – Maine Law 3+3 Pathways Program	N/A
B.A in Marine Affairs	Hawaii Pacific University	N/A	N/A
B.A in Marine Affairs/ M.A in Marine Policy and Management	University of New Haven	N/A	Other educational, governmental, international, and professional organizations.
Master of Marine Management program	Dalhousie University	N/A	Other educational, governmental, NGO and private sector organizations
Master of Marine Affairs	University of Washington	Informal concurrent degrees of an M.M.A. and one of the following:	Certain tribal communities (like Indian tribes)

		Master of Mechanical Engineering Master of Public Administration Master of Urban Planning M.Sc. in School of Aquatic and. Fishery Sciences M.Sc. in Oceanography Juris Doctor of Law Formal concurrent degree with the Jackson International School: M.A in International Studies	

Other opportunities/advantages: Funding, diversity of students and faculty, and educational tracks

The opportunities/advantages that are represented by funding, diversity of students and faculty, and educational tracks are similar among marine affairs programs; therefore, I did not put them into chart. Funding can provide financial support for students, and based on the programs' websites, all programs have funding for students [1,2,3,4,5,7,9,10]. Moreover, most of the programs provide a variety of scholarship opportunities for students, and several programs state that they also provide research assistantships, teaching assistantships, and student loans [1,2,3,4,5,7,9,10].

It is quite beneficial for programs to involve diverse students and faculty. Involving students from different countries and diverse disciplines could create a melting-pot environment where students can learn knowledge and skills of diverse disciplines, and different perspectives from each other (Neal, 1985; Taussik, 1998). Students can also benefit from a well-rounded curriculum if faculty are an interdisciplinary group [10]. All the programs that provide information on the diversity of students state that they accept students from countries around the world who are composed of diverse educational backgrounds [4,7,10]. Moreover, the programs also state that their faculty are from diverse academic backgrounds and do research in multiple fields [4,7,10].

Having two educational tracks can increase the flexibility of the programs, and students can choose the educational track that can best fit their needs. All of America's master programs provide thesis and non-thesis tracks for students [3,4,10]. Usually, students who would like to pursue a career in marine affairs would choose the non-thesis track, and those who give emphasis on research or would like further their study in academia would choose the thesis track [3,4,10]. However, in the MMM program in Canada, there is only one track, which is the non-thesis graduate project track [7]. Therefore, the MMM program might consider adding a thesis track to increase the program's flexibility.

4.4.6 Alumni employment status and programs' career development resources

Alumni employment status

Alumni from marine affairs programs are employed in different organizations and pursue a wide range of careers [1,2,3,4,5,7,9,10]. Based on the description in the programs' websites, alumni are employed in public sectors, including governmental organizations at different levels, private sectors such as environmental consulting companies, non-profit sectors, international sectors, and higher education organizations [2,3,4,7,10]. Jobs that alumni pursue include coastal management specialist, fisheries manager, marine policy specialist, marine environmental planner, outreach manager, marine social scientist, marine educator, conservation manager, environmental journalist, research positions, and marine economist [1,2,3,7].

Another pathway for alumni is to pursue advanced degrees [2,3,4,5,10]. Because of the interdisciplinary nature of marine affairs, students are equipped with interdisciplinary knowledge and skills in the marine affairs programs [4]. This allows them to further their education in a variety of degrees, including marine affairs, marine policy, resource management, ocean law, science education, fishery management, and coastal zone management [2,3,4,5].

4.4.7 Marine affairs programs' career development resources

Four universities present information on their career development resources in their websites [3,4,9,10]. Generally, programs provide students with access to career opportunities through their networks, including the programs' connection with external organizations, faculty, and alumni [3,4,10]. The external organizations include

educational, governmental, international, and professional organizations [3,4,10]. For example, the University of New Haven states that they have networks, such as NOAA National Marine Fisheries Service and the Gerace Research Center, which allow their students to have access to full-time employment [3]. The networks can also be faculty networks and alumni networks [4,10]. For example, in University of Washington, faculty networks are often the source of internship or job opportunities for their current students [10]. Moreover, the university also has alumni networks in an active LinkedIn group and Facebook pages where alumni and current students share career opportunities and information [10].

Regarding the program keeping pace with changes in the job markets, it is worth mentioning the listservs of the Marine Affairs Department in the University of Rhode Island [4]. The listservs serve as platforms for information exchange on job opportunities and current development in the marine affairs, and for suggestion collection from alumni, faculty, and students [4]. These listservs are multifunctional which allow the department to keep inform of the new changes in marine affairs and job market and to improve itself based on the new changes and suggestions from alumni, faculty, and students [4].

Only four universities list their career development resources in their websites. It's necessary to state here that it does not mean that only four universities offer career development resources to students. Based on my experience of studying in MMM program of Dalhousie University, there are lots of career development resources being provided in the program. The program's administrator would regularly send emails related to career positions. Moreover, numerous guest speakers are invited to the classes to give presentations about the situation and job opportunities of their employed organizations. In addition, lots of students identify their internships through the networks of the program and the faculty. Therefore, it's very likely that programs other than those four also have career development resources, but they have not posted the resources online.

4.4.8 Summary of the roles of marine affairs programs

Here I briefly summarize the roles of marine affairs programs in preparing marine affairs professionals. The first role of marine affairs programs is that they prepare their students by setting graduation requirements for students to meet. The requirements can

include courses, thesis/non-thesis, exams, and internships. The second role is that they prepare students in terms of knowledge, skills, and abilities. The third role is that they provide students with favorable study environments. Factors contribute to the favorable study environments include research, dual-degree programs, external relationships, funding opportunities, diversity of students and faculty, and advantages in educational resources. The last role is helping students to find jobs or pursue advanced degrees.

Compared with Mangone & Pedrick's papers that were published in 1973 and 1974, the update of marine affairs programs' status is mainly observed in curriculum and research. It is observed that curriculum of marine affairs programs has moved towards multidisciplinarity. Mangone & Pedrick (1973) examined 14 marine affairs programs in America, and it discovered that the discipline of law was the core component and marine resource economics was increasingly important in the curriculum of marine affairs programs. Based on the core courses of current American marine affairs programs, the emphasis on the ocean law appears to be lessened by the programs now. Moreover, while courses on ocean law and economy are still important components in the curriculum of American marine affairs programs, courses on marine science and research methods are also emphasized by the programs. In addition, all current American marine affairs programs offer elective courses and students can choose courses from a wide diversity of disciplines.

There have been several changes in the research fields of marine affairs and now marine affairs programs have more various research fields. Mangone & Pedrick (1974) divided the marine affairs research into 5 areas, including national security policy, merchant marine and port policy, mineral policy, fisheries policy, and pollution policy. Based on the desktop analysis, national security and mineral policy barely appear in the marine affairs programs research fields. This may indicate that there has been less research in these areas in marine affairs programs. Moreover, marine affairs programs now have a wider variety of research fields. Except for research fields in merchant marine and port, fishery, and pollution management that were mentioned in Mangone & Pedrick's paper, emerging research areas include climate change, environmental justice, marine spatial planning, restoration and conservation, marine business and entrepreneurship, and marine tourism.

Except for updating on the already examined criteria, I also examined additional criteria in this desktop analysis. Criteria adopted in Mangone & Pedrick (1973) to present the general status of marine affairs programs were limited. In this desktop analysis, I also examined additional criteria to give a more comprehensive overview of marine affairs programs, including programs' value, mission, learning outcomes, graduation requirements, subject areas, educational strategies, educational resources, dual-degree programs, external relationships, educational tracks, alumni employment status, programs' employment resources.

Chapter 5: Data analysis of MAP's alumni survey data

5.1 Introduction

The main purpose of this data analysis of survey questions was to investigate the skills/competencies and personal attributes that MAP's alumni's employment organizations looked for. This chapter consisted of five parts: an introduction of MAP, demographic information of the alumni who completed the MAP's survey, status of alumni's employment organizations, alumni's advice to the current MMM students, and discussion of the findings.

I first gave an introduction of MAP and demographic information of the alumni, including their year of graduation, employment status, employment sectors, and location. Moreover, collecting demographic information on MAP's alumni could enable the MAP to keep pace with the status of the alumni, especially their employment status. The "status of alumni's employment organizations" part was the core of this chapter, which analyzed the skills/competencies and personal attributes wanted by alumni's employment sectors and answered the sub-topic of my research. This survey analysis also summarized the alumni's advice to current MMM students on careers, which provided valuable guidance on how to prepare for future careers and identify suitable careers upon graduation for the current MMM students. The last section was a discussion which aimed to discuss the findings in this chapter in relation to the findings in the literature review and desktop analysis chapters.

5.2 Introduction of MAP

The MAP's vision is to develop outstanding marine affairs professionals through its interdisciplinary education, thereby contributing to the sustainable use of the world's coastal and ocean environments (MAP, 2017). The MMM program offered in MAP is one way for it to fulfill its vision (MAP, n.d.-a).

The MMM program is a professional and interdisciplinary program, and a brief description of the educational effort of MMM to prepare marine affairs professionals is provided here (MAP, n.d.-a). Its education focuses on core courses, elective courses and research projects (MAP, n.d.-a). Students must take 2.5 credits of core courses, 1.5 credits of elective courses and 1 credit in graduate project (MAP, n.d.-a). Its core courses include Contemporary Issues in Ocean and Coastal Management (Part 1 and 2),

Marine Management Tools & Techniques, Marine Science and Technology and Coastal Zone Management (MAP, n.d.-a). Other than a graduate project, an internship is another strategy for the program to promote students' research (MAP, n.d.-a). An internship of at least four weeks is required for students (MAP, n.d.-a). The internship could contribute to the preparation work of the graduate project if topic of the internship and the graduate project is related, and it could also help a student gain professional experience for their future careers (MAP, n.d.-a). The most mentionable extracurricular activity is the Sustainable Ocean Conference, which is organized and planned by students in MMM program annually since 2012 (MAP, n.d.-a). The conference not only inspires interdisciplinary approaches for sustainable management of ocean, but also create opportunities for students to build networks for internships and careers and gain valuable project management skills (Marine Affairs Program, n.d.-b).

Beneficial factors for education include programs' research projects, relationships with peer institution and external organizations, and scholarship opportunities (MAP, n.d.-a). The MAP has a variety of long-term research projects, and research fields include fishery management, western and indigenous knowledge systems, marine piracy, marine resources management and coastal zone management (MAP, n.d.-a). Students may take the advantage of this by involving in these projects when having internships or doing their graduate projects (MAP, n.d.-a). MAP has established relationships with other educational, governmental, NGO and private sector organizations for research, which could bring more research opportunities for students (MAP, n.d.-a). There are numerous scholarship opportunities for students in MAP, including internal and external scholarships, which provide financial support for MAP students (MAP, n.d.-a).

5.3 Demographic information

5.3.1 Year of graduation

In total, 61 alumni gave answers to my selected questions, and 59 of which provided the information on year of graduation. Based on the response of the alumni, the year of graduation was spread over 1990-2021 (Figure 1).

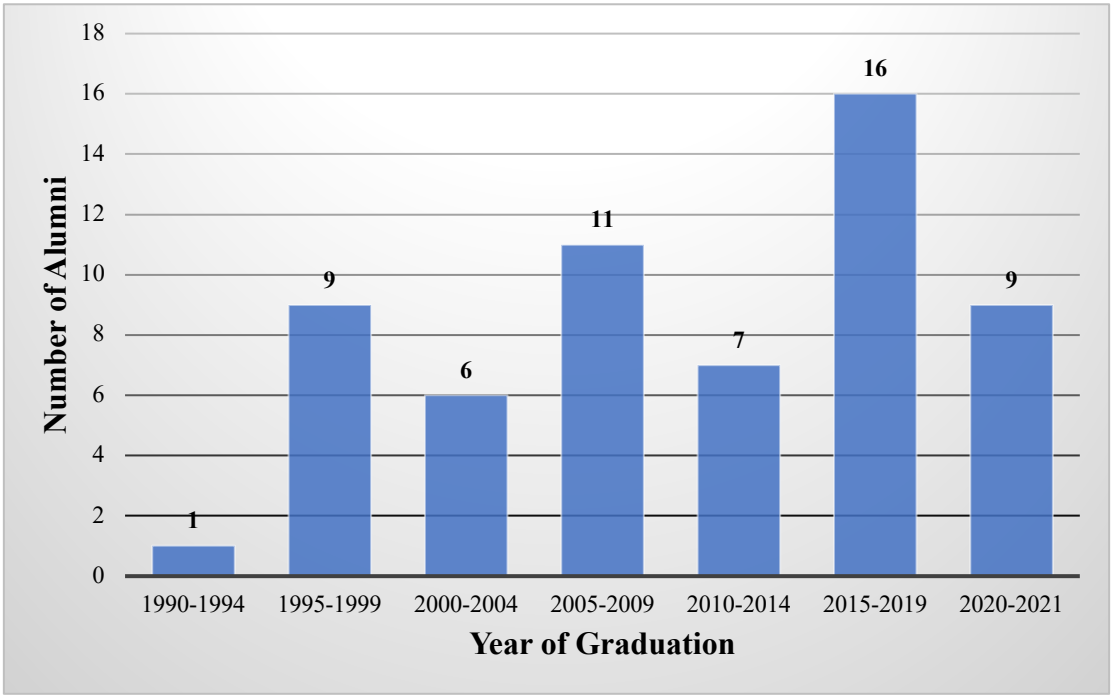

Figure 1. The number of alumni in year of graduation time periods (Five years as one period).

5.3.2 Employment status

All of the 61 alumni provided information on their employment status (Figure 2). It was notable that no one indicated employment status as "unemployed" or "underemployed" in these 61 alumni, which indicated that the employment status of the MMM program's alumni might be promising. 50 alumni were employed full-time, accounting for 82%. Other alumni who were part-time employed, self-employed, student and retired accounted for a small percentage, and their number spread from 1-4.

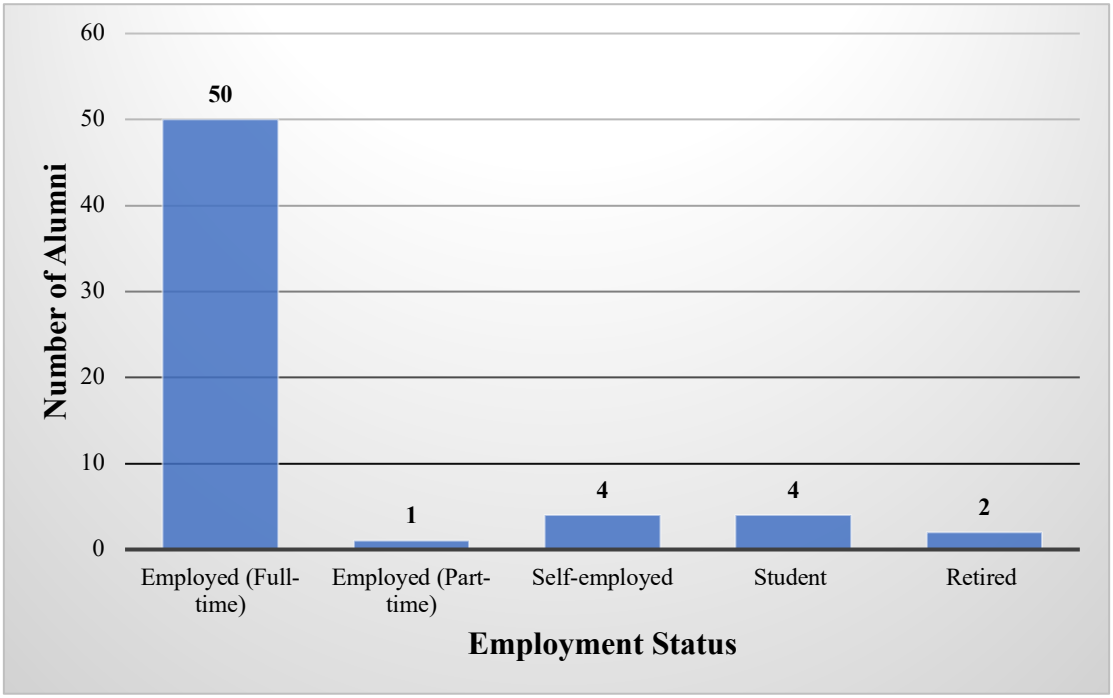

Figure 2: The number of alumni in different employment situations.

Six alumni who had full-time jobs provided information on their current careers which showed the diversity of careers pursued by the alumni in the MMM. Jobs they held included university faculty, coastal and marine specialist, researcher, diplomat, environmental consultant, and self-employed writer. The self-employed writer stated that he/she was a full-time, self-employed writer and worked in international maritime confidence and cooperation building. Moreover, two alumni who were students stated they were pursuing PhD degrees.

5.3.3 Employment sectors

All the alumni who were employed full-time, employed part-time and self-employed (n= 55) answered the question about their employment sectors (Figure 3). An alumni's employment sector can be of multiple types, for example, it can be both research and academia sector, or government and academia sector. Therefore, alumni could have multiple choices when selecting sectors that aligned with their jobs. This explained why the total number of alumni shown in the Figure 3 was more than the number of alumni who participated in answering the question about employment sectors.

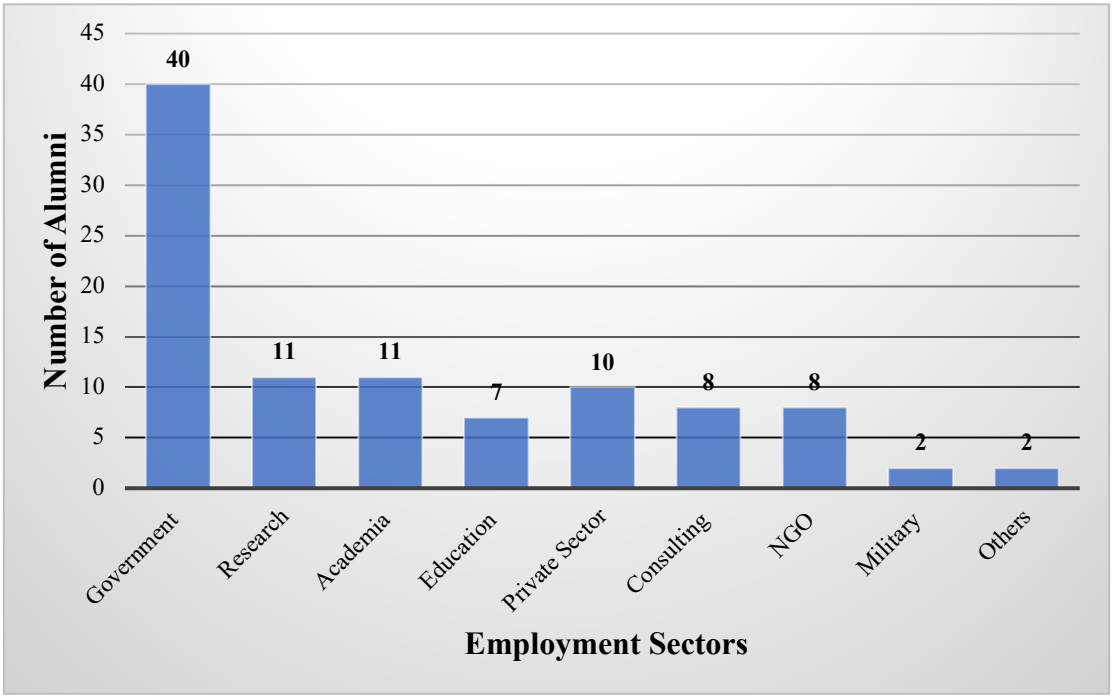

Figure 3: The number of alumni employed by sector.

There were substantially less alumni working in other sectors compared with government sectors. The number of people working in research, academia, education, private sectors, consulting, and NGOs spread from 7-11. Only 2 alumni worked in military. Moreover, 2 alumni chose others, and one of them worked as self-employed writer and another one worked in charity.

Government Sectors

The number of alumni working in government was 40 (accounting for 40%), which was considerably higher than the number of alumni working in all other sectors. Of all the alumni working in government, the largest number of them worked in federal/national government (Figure 4). The number of them was 23 and it accounted for 57% of the total number of alumni working in government. The number of alumni working in provincial/state government was 7 and it ranked the second. The number of alumni working in first nations/indigenous, regional/intergovernmental, and municipal/local government were 3, 4, and 3 respectively.

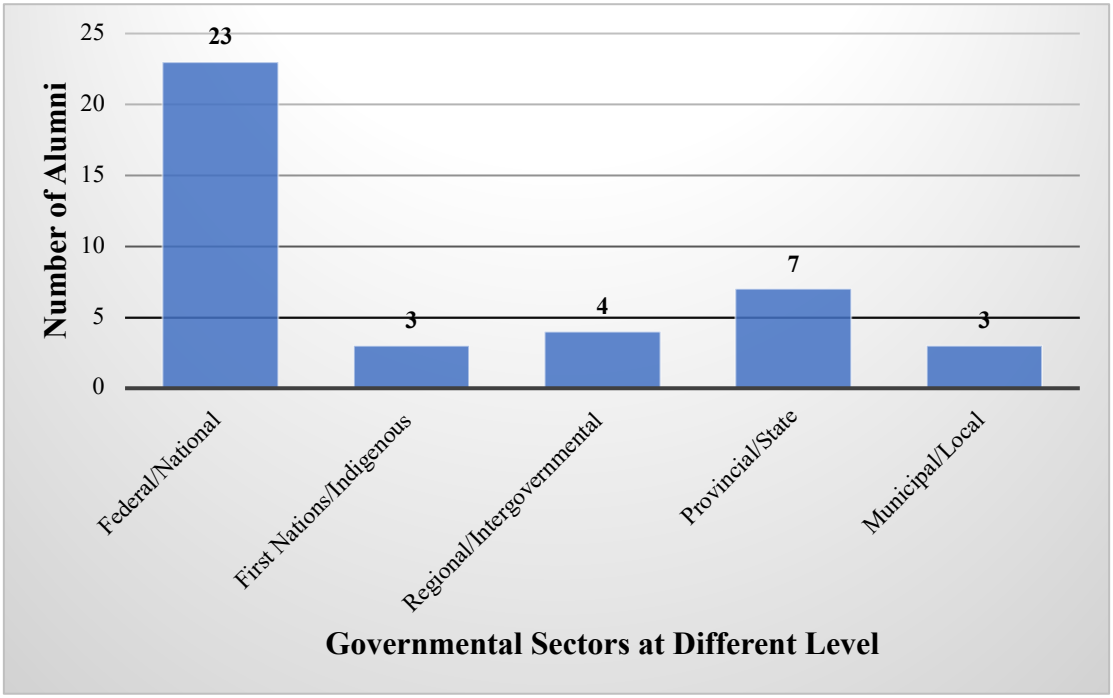

Figure 4: The number of alumni employed in different levels of government.

5.3.4 Where the alumni live

A total of 58 alumni provided information on where they lived. Based on the survey result, the alumni lived in a wide variety of countries included Canada, Bangladesh, United Kingdom, Philippines, Antigua and Barbuda, Mexico, Sweden, New Zealand, Vietnam, USA, and Malaysia. Most of the alumni (76%) lived in Canada, while the number of them lived in other countries spread from 1-3.

For those living in Canada, 52% of them lived in Halifax, Nova Scotia where Dalhousie University was located. Moreover, 74% of them lived in Nova Scotia while others lived in other regions include Alberta, British Columbia, Ontario, New Brunswick, Quebec, Manitoba, Ottawa, and Nunavut. However, the numbers of alumni living in each of those regions was very small and they spread from 1-2.

The reason that most alumni living in Canada chose to live in Nova Scotia may be that they used the program's resources such as internship opportunities to establish networks in local areas during their studies at the MMM program, which helped them find jobs in Nova Scotia. Because having jobs in Nova Scotia, it was logical for these alumni to stay in this province. This data may be slightly different from reality because two alumni only stated that they lived in Canada and did not state a specific province.

Moreover, three other alumni only stated that they lived in Nova Scotia and did not state a specific city.

5.4 Status of alumni's employment organizations

5.4.1 Skills/competencies that are desired by alumni's employment organizations

Question 22 aimed to understand the desired skills/competencies by alumni's employment organizations, in which the alumni were asked to select top three skills/competencies that they looked for in a given list when considering a graduate for employment with their organizations (Figure 5).

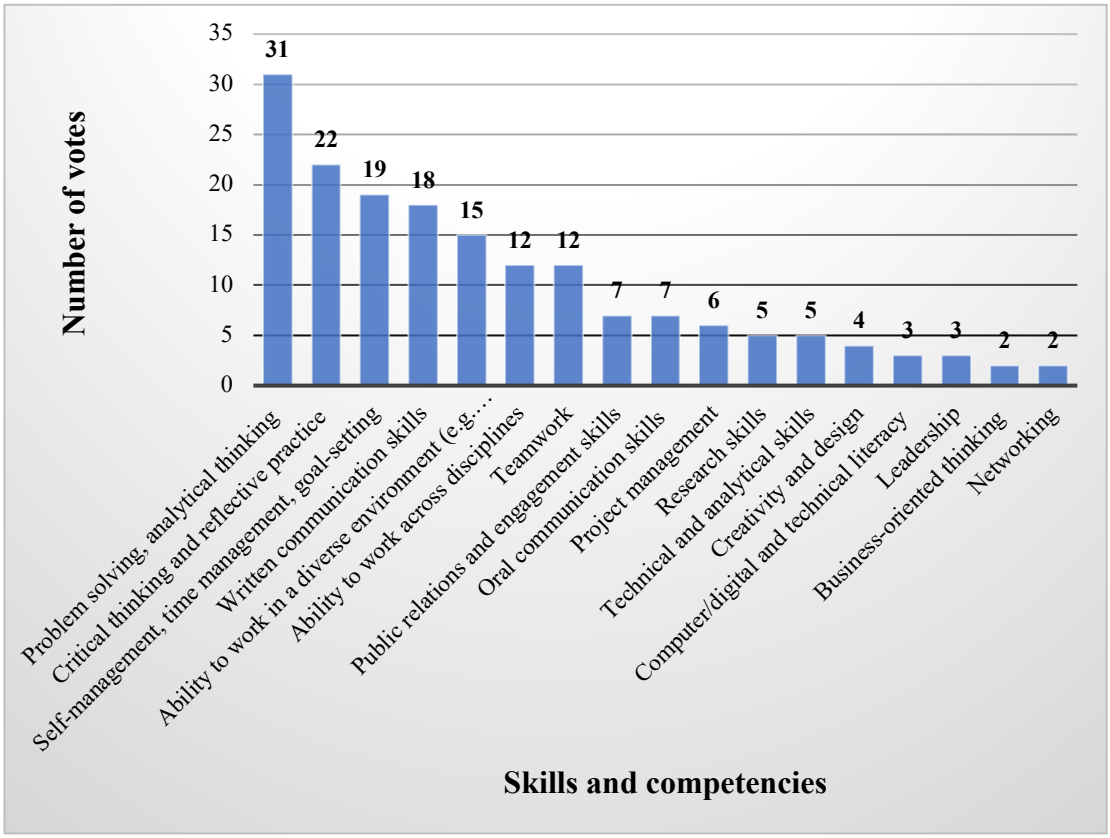

Figure 5: Skills/competencies that are desired by alumni's employment organizations.

The top three skills/competencies were the "problem solving and analytical thinking skills", "critical thinking and reflective practice skills", and "self-management, time management, goal-setting skills", and their number of votes were 31, 22, and 19, respectively. Beyond these three skills, other higher scoring skills/competencies (in descending order) included written communication skills, ability to work in a diverse environment, ability to work across disciplines, and teamwork skills, with scores falling between 12 and 18. This indicated that these skills/competencies may also be highly desired by alumni's employment organizations.

5.4.2 Personal attributes that are desired by alumni's employment organizations

Question 23 in the survey aimed to understand the personal attributes that are desired by alumni's employed organizations, in which it asked the alumni to select the top three attribute they looked for when considering a graduate for employment with your organization (Figure 6).

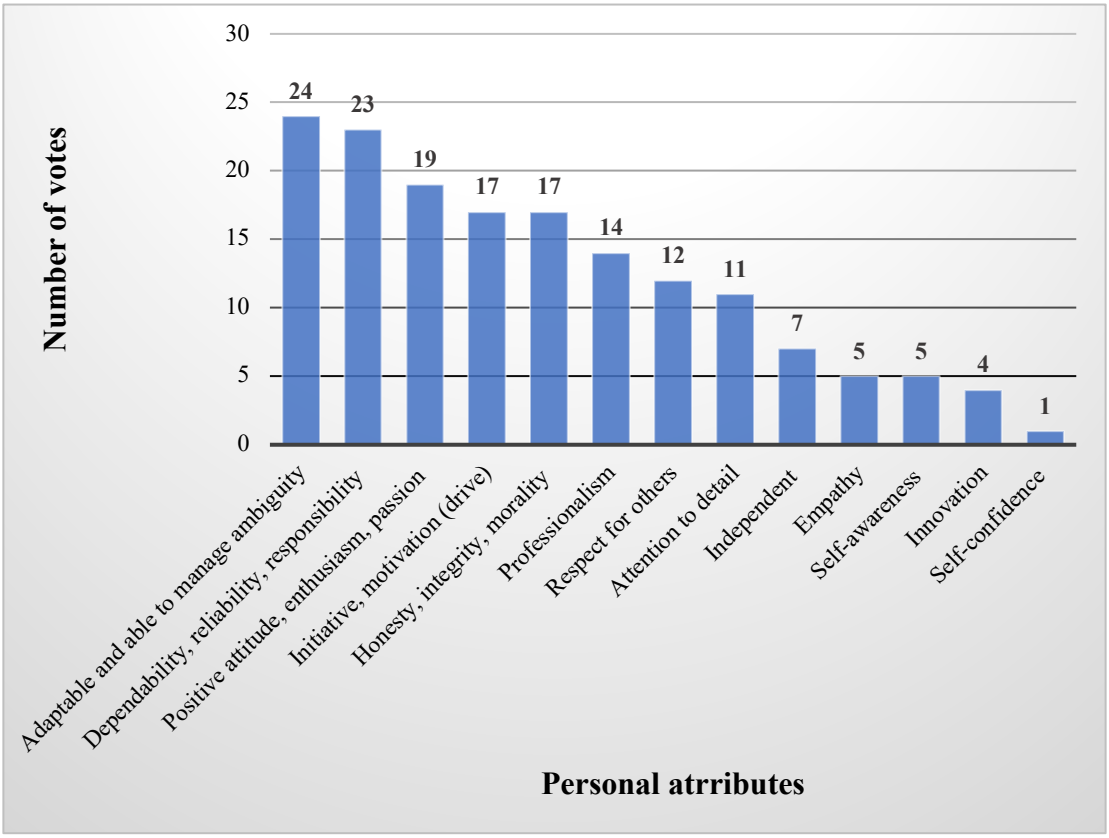

Figure 6: Personal attributes that are desired by alumni's employed organizations.

Based on the results shown in Figure 6, the top three desired personal attributes by alumni's employment organizations were being “adaptable and able to manage ambiguity”, “dependability, reliability, responsibility”, and “positive attitude, enthusiasm, passion”. Their number of votes spread from 19 to 24. Beyond these three attributes, other higher scoring attributes included “initiative, motivation (drive)”, “honesty, integrity, morality”, and “professionalism” with the number of votes spreading from 14 to 17. This indicated that these three attributes may also be strongly desired by employment organizations.

5.5 Alumni's advice to the current MMM students regarding careers in marine sectors

In question 18 of the survey, the alumni were asked to provide advice to the current MMM students aspiring towards a career in the marine sector. Alumni offered advice to the current MMM students on how to prepare for future careers and how to identify suitable careers. They also provided advice that could be used in the workplace. Finally, they encouraged students to keep learning and improving themselves.

Advice to students on preparing for future careers

The alumni recommended several useful suggestions on how to prepare for future employment, including determining career direction early, taking internships, being proactive, preparing well for interviews, and establishing and using networks. Firstly, the alumni encouraged the current MMM students to determine the career direction early and then build their own education around it, which included taking courses that were beneficial to the future employment of the desired career. Secondly, seven alumni strongly recommended students to take internships. They suggested students to search for internships that were related to their interests and do their best in the internships, because internship host organizations could be their potential employment organizations.

Thirdly, students needed to be proactive when seeking for jobs. The alumni encouraged students to actively seek job opportunities instead of waiting for them to arise. Fourthly, students should be well prepared to explain their interests, skills, and experiences to potential employers in the job interviews. It was also helpful to link what they can contribute, and the employment organizations' needs when having interviews for jobs. Finally, four alumni stated network was key to identify a job. They suggested students to develop and maintain the networks with their peer students, alumni, professors, and use the networks to meet with people to understand the available job opportunities.

Advice to students on suitable careers

Alumni also provided advice on how to identify suitable careers for students. Alumni suggested students to be open-minded and do not limit themselves to one specific filed in marine affairs. Marine sectors are large, as student acquiring more

knowledge and experience, their understanding of and pursuit in the marine sectors will also change. Therefore, alumni suggested students to get outside of comfort zones, try new things, and be open to more opportunities. However, this does not mean that students can try different fields at will in marine sectors. Alumni also suggested that students should think carefully about their interests and values before making a career choice to avoid spreading themselves too thinly over too many jobs.

Advice that can be used in the workplace

Alumni also offered advice that can be used in the workplace. Firstly, they suggested that graduates needed to establish a goal for their career development. Second, they recommended graduates to develop adaptability and the ability to work independently in the workplace, as these abilities were required for many jobs in marine sectors. In addition, they indicated that students should be patient with what they are doing (e.g., political will) because sometimes incremental, long-term changes could be the most rewarding.

Advice on keeping learning

Alumni also advised students to keep learning and improve themselves. They suggested students to keep updated with the contemporary issues in marine affairs. They encouraged students to step out of the comfort zone and expand horizon and views by learning unfamiliar subjects. Moreover, alumni also indicated that students should keep learning and diversify their skills such as statistics skills, graphic skills, and technical skills.

5.6 Discussion

The distribution of graduation years of the alumni was 1990-2021. Most of the alumni (82%) were full-time employed. The alumni worked in different sectors and pursued diverse careers, which was consistent with the results of the desktop analysis in terms of employment sectors and alumni pursued careers. The alumni lived in a wide variety of countries around the world, most of which (76%) lived in Canada.

The top three skills/competencies that were desired by alumni's employment organizations were the "problem solving and analytical thinking skills", "critical thinking and reflective practice skills", and "self-management, time management, goal-setting skills". To compare the result of top three desired skills with the findings from

the desktop analysis, problem-solving skills, analytical skills, and critical-thinking skills are the skills that frequently appear in the learning outcome statements of the marine affairs programs' websites (CAS, 2022; CAS, n.d.-a; CAS n.d.-b; DMA, n.d.; RSMAS, 2021). This indicates that at least these skills have been brought to the attention of marine affairs programs. However, reflective practice skills, self-management skills, time management skills, and goal-setting skills were barely found in the descriptions of the marine affairs programs' websites. One possible reason might be that these skills have been developed among students, but they are not presented in the programs' websites. However, there is possibility that these skills are not given emphasis by the programs.

The top three desired personal attributes by alumni's employment organizations were being "adaptable and able to manage ambiguity", "dependability, reliability, responsibility", and "positive attitude, enthusiasm, passion". The top one most desired personal attribute was "adaptable and able to manage ambiguity". There is limited description for personal attribute development on the programs' websites, but the importance of adaptability was explained in one alumnus's advice in the MAP survey. The alumnus indicated that workplaces were a dynamic environment where graduates had to deal with conflicting schedules and demands while also meet the tight deadlines, which may explain why the personal attribute of adaptability was required.

The alumni suggested the current MMM students to determine the career direction early and then build their own education around it. Two papers (Briscoe et al., 2016; Muir & Schwardz, 2009) in the literature review also proposed the similar suggestion, which was to let students design their own educational tracks based on their career interests. These suggestions are reasonable and important, because marine affairs involve diverse fields, but students have limited time and energy. Focusing on things that will directly benefit students' future careers can avoid a situation where students do not learn anything well because their energy is distracted.

Chapter 6: Conclusion

Marine affairs programs prepare marine affairs professionals, which addresses the increasing need of professionals to tackle complex ocean issues. Despite the importance of marine affairs programs, research on them was limited. There has been limited research presenting the general status of marine affairs programs since 1973 (Mangone & Pedrick, 1973). The need for research to update the general status of marine affairs programs and investigate the current roles of marine affairs programs in preparing marine affairs professionals is urgent. Moreover, the understanding of the suitability of higher education in marine affairs and status of careers in marine sectors need to be improved (Briscoe et al., 2016; Muir & Schwardz, 2009; Schaffner et al., 2016). There is a need to investigate the skills/competencies and personal attributes that are desired by marine employment sectors of marine affairs programs' graduates.

The research consisted of three parts. A literature review was first conducted. The major outcome of the literature review was identifying the two gaps in research. Through this literature review, I also identified several important characteristics, trends, and problems of ocean-related programs. The marine affairs and related programs typically have a transboundary nature, and they think highly of cross-disciplinary educational strategies. Moreover, it was a general trend for ocean-related programs to recognize the importance to collaborate with peer institutions and other external organizations (Cicin-Sain et al., 2000; Cook et al., 2016; Taussik, 1998; Neal, 1985). In addition, the problem of ocean-related programs was that ocean-related programs failed to keep pace with changes in the job market, especially in skills training (Briscoe et al., 2016; Muir & Schwardz, 2009; Schaffner et al., 2016). Ocean-related programs placed excessive effort on the development of research skill, while underestimating the skills that are desired in the workplace like decision-making and teamwork skills (Briscoe et al., 2016; Muir & Schwardz, 2009; Schaffner et al., 2016).

To investigate the various roles of marine affairs programs in preparing marine affairs professionals, I undertook a desktop analysis in which I collected and analyzed the data from official websites of marine affairs programs. The identified roles include the role of setting graduation requirements, the role of preparing students in terms of knowledge, skills and abilities, the role of providing favorable study environments for students, and the role of helping students to find jobs or pursue advanced degrees.

Marine affairs programs prepare their students by setting requirements to meet which can include courses, thesis/non-thesis, exams, and internships. Students have to meet these requirements in order to graduate. The master programs in marine affairs in Canada and America differ in their requirements. Firstly, the MMM program in Canada requires students to undertake an internship whereas the American programs do not. In addition, there are two tracks—thesis and non-thesis tracks—for students to choose from based on their needs in America's master programs. However, the MMM program in Dalhousie University, which is the only marine affairs program found in Canada, only offers a research paper option for students.

Marine affairs programs prepare their students in terms of knowledge, skills, and abilities. Marine affairs programs state in their websites that one of their learning outcomes is to install students an overall knowledge related to marine affairs. They offer a wide diversity of subject areas in their education, including fishery management, resource management, ocean law and policy, and environmental protection. Moreover, based on the information on their websites, the marine affairs programs also develop a wide variety of skills for students. The skills that appear most frequently in programs' websites include interdisciplinary skill, problem identification and problem-solving skill, analytical skill, acquisition and data analysis skill, research skill, communication skill, and collaboration skill. Other than knowledge and skills, the ability of students to apply knowledge to address real-world marine management problems is emphasized by all the programs based on their statement in the learning outcomes.

Marine affairs programs also have a role in providing favorable study environments for students. They provide favorable study environments through various means, including research, dual-degree programs, external relationships, funding opportunities, diversity of students and faculty, and advantages in educational resources. Generally, marine affairs programs have research activities on various of fields. The research topics that the marine affairs programs research typically have include ocean law and policy, resource management, conservation, climate change, and fishery management. Students can participate in the research activities and gain knowledge and research skills from them. Several universities offer dual-degree programs which enable their students to use educational resources in two programs and complete two programs in a shorter time. Programs also develop relationships with external organizations to expand the educational resources for students. For example, students

can use the network to gain hands-on experience in external organizations. Most of the programs provide a variety of scholarship opportunities for students, which provide financial support for students. Marine affairs programs also state that they involve students and faculty from diverse educational backgrounds, which creates an interdisciplinary learning environment for students. Advantages in educational resources vary across different programs, but overall, they include ample course resources, teaching labs, facilities such as research vessels, research institutes, beneficial geographic location, and long-term research projects.

The last role of marine affairs programs that is identified is helping students to find jobs or pursue advanced degrees. One pathway for graduates from marine affairs programs is to join the workforce. Graduates are employed in different organizations and pursue a wide range of careers. Marine affairs programs provide their graduates with access to career opportunities through their networks, including the programs' connection with external organizations, faculty, and alumni. Another pathway for graduates is to pursue advanced degrees. Graduates pursue a variety of degrees due to the benefits of interdisciplinary knowledge and skills developed in the marine affairs programs.

I analyzed the data from the MAP's alumni survey to investigate the skills/competencies and personal attributes that are desired by alumni's employment sectors. The top three skills/competencies that were most desired by alumni's employment organizations were the "problem solving and analytical thinking skills", "critical thinking and reflective practice skills", and "self-management, time management, goal-setting skills". The top three most desired personal attributes by alumni's employment organizations were "adaptable and able to manage ambiguity", "dependability, reliability, responsibility", and "positive attitude, enthusiasm, passion".

The research updated the understanding on marine affairs programs' roles in preparing marine affairs professionals. Researchers who want to conduct research on marine affairs programs or marine affairs education can develop their research based on the new status of marine affairs programs presented by my paper. Investigating the skills/competencies and personal attributes desired in the marine sectors contributes to the understanding of the demand in the marine sectors. This provides data for future research on the gap between marine affairs education and the status of careers marine

sectors. Marine affairs programs can then benefit from the research by adapting their education based on the findings.

Given the scarcity of research on marine affairs programs, here I suggest some future directions for research. In this research, I only focused on marine affairs programs in Canada and America. However, there are marine affairs programs around the world. Therefore, I suggest future research to present the status of marine affairs programs from other countries. Moreover, there are a wide variety of programs related to marine affairs that contribute to marine affairs higher education, like programs in marine policy, coastal zone management, and fishery management. To develop a more comprehensive understanding of higher education in marine affairs, I suggest future research to examine the status of this programs as well. Lastly, there is a dearth of research on how well the skills developed in marine affairs programs align with the demand in marine sectors. My research can contribute to the understanding of the desired skills/competencies and personal attributes that are desired in the workplace. However, it did not conduct research on evaluation of the skill/competency development and personal attribute development in marine affairs education, therefore, it could not identify the gap. Therefore, more research on the suitability of higher education in marine affairs when compared to the status of careers in marine sectors is needed for the improvement of marine affairs higher education.

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Table 7. The references which were represented as numbers in the desktop analysis.

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3	University of New Haven	College of Art and Science (CAS). (n.d.-b). *Master of Arts in Marine Policy and Management.* University of New Haven. https://www.newhaven.edu/arts-sciences/graduate-programs/marine-policy-management/index.php
4	The University of Rhode Island	Department of Marine Affairs (DMA). (n.d.). *Home.* The University of Rhode Island. https://web.uri.edu/maf/
5	Hawaii Pacific University	Department of Natural Science (DMS) (n.d.). *Marine Affairs.* Hawaii Pacific University. https://www.hpu.edu/cncs/natural-science/marine-affairs.html

6	Dalhousie University	Marine Affair Program (MAP). (2017). *MAP over the 30 years.* Unpublished manuscript. Marine Affair Program, Dalhousie University.
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