ENGAGING PROFESSIONAL MARINERS IN MARINE MAMMAL CONSERVATION

By

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We accept this thesis as conforming
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Abstract

Due to British Columbia’s expansive coastline and limited funding for marine mammal conservation, research projects rely heavily on citizen scientists, or volunteers who contribute data. Professional mariners are an important target audience for such projects. In an attempt to increase participation by this sector, I designed a workshop using the Analysis, Design, Development, Implementation and Evaluation (ADDIE) process. I worked closely with four marine mammal conservation societies and conducted an analysis phase with the Canadian Coast Guard (CCG) using a combination of questionnaires and semi-structured interviews. I discovered that there is some awareness of existing conservation programs within the CCG but understanding of these programs as well as basic marine mammal knowledge and identification skills are limited. I also learned the importance of consistent feedback for continued participation and was able to relay information to the societies involved as well as use it to guide the development of my workshop.
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Chapter One: Introduction - Working Together for Marine Conservation

I have taken on a project with a double-edged commitment. The first is to gather information about the participation of professional mariners in existing marine mammal conservation programs in order to provide valuable feedback to the organizations that run these programs. The second is to use information gathered to develop a workshop aimed at increasing crew participation in, and knowledge of, these programs.

Although there are extensive aspects of the marine environment which require attention and a plethora of environmental issues affecting our oceans, such as the bioaccumulation of toxins (Cullion et. al, 2009; Hickie, Ross, MacDonald & Ford, 2007; Ross, 2006), climate change (Abdul-Aziz, Mantua, Myers & Bradford, 2011; Dore, Lukas & Sadler, 2003; Finney, Gregory-Eaves, Sweetman, Douglas & Smol, 2000), over-harvesting of species (Finney et. al. 2000; Pautzke, 1996) and exposure to marine debris (Pichel et al., 2007), I chose to focus my research project specifically on marine mammals. One of the main reasons I chose this focus is that there are already well-established conservation programs in place with which I am familiar. The prior experience and knowledge I have of these programs made me uniquely suited to take on such a project. I already had important insights into how the projects are run, what their main goals are, and in some cases where they could be altered to increase their effectiveness. This unique position I hold worked to my benefit during the development of a training workshop. Due to this unique position however, I had to be cautious throughout the process that my prior knowledge and pre-conceived opinions did not get in the way of an accurate analysis of the barriers to participation.

A second reason to focus on marine mammals is that they have the potential to be used as valuable umbrella species. The idea behind the “umbrella species” concept is that by taking steps to protect a particular species, many others that depend upon the same food source and environment as the focal species, will also benefit. This umbrella species concept is often considered when planning protected areas and designating critical habitat (Roberge & Angelstam, 2004). If I am successful in
gaining support for these “charismatic megafauna”, many other oceanic species can in turn benefit from measures taken to improve the quality of their environment.

**Overview - Marine Mammal Diversity in British Columbia.**

There can be no denying that the waters off the West coast of Canada are extremely rich and diverse. There are 31 species of marine mammals that are known to spend time off the coast of BC (Ford, 2011). Although some cetacean (whale, dolphin and porpoise) populations have been rebounding since the ban of commercial whaling, others are still at risk of extinction, and for many, their population sizes are still not well understood (SARA, 2010). Because funding for many of the research and conservation programs is extremely limited in BC, participation by individuals such as professional mariners, who already spend substantial amounts of time on the water, can significantly increase our understanding and protection of these often fragile populations. This is especially true along the 900 km of sparsely (human) populated coast (over 27,000 km of shoreline) in BC (Fig. 1)(Anonymous, 2010).
Fig. 1: Coastline of British Columbia.

Fig. 1A: Johnstone Strait.
The idea for this project arose through conversations with many individuals working within the field of marine mammal conservation. Discussions often took place about the lack of funding to their programs and the importance of spreading the word far and wide to get the public more involved. Each of the organizations involved in this project has an education and outreach component and individuals within these organizations have made serious attempts to work together for many years to spread information as widely as possible with minimal resources. Although this was working in some aspects, these conversations often lead to the conclusion that we could do this even better with more organized collaboration and planning. At that point I decided that if I were to undertake a major thesis project it would have to involve a collaborative approach to achieve the most effective and lasting impacts. I wanted to be sure that the project I took on, for the purpose of my thesis, would have meaningful implications for years to come and would, in the end, be something useful to the education and conservation I pursue in my career on a daily basis.

When discussing the idea of a collaborative project with individuals in other conservation societies, we identified professional mariners as being an important sector on which to focus this
project. Being that we are working to conserve species that live in the ocean, it made sense that individuals who make a living working in this environment would be an important target audience. We all agreed that if we could get this community of individuals more involved in our projects we would be able to access a huge wealth of information and data that is currently beyond our grasp. The challenge was determining the best way to get them involved. We had to acknowledge that we would be asking these individuals to add to their workload and take on tasks that were over and above the jobs they were already doing while at sea.

Not only would a workshop to prepare mariners to help us with marine mammal sightings significantly contribute to the data goals of the organizations involved, but there is evidence to suggest that participation within citizen science projects helps to advance conservation ethics and scientific knowledge within participants as well (Bonney et. al., 2009) Couvet, Jiguet, Julliard, Levrel & Teysseдр, 2008 recognize that “a key asset of citizen science is that participating citizens disseminate the information they gain, thereby increasing the profile of issues being researched” (p. 95). This supports the idea that not only would an appropriate training workshop benefit the data requirements of the organizations, but would also significantly contribute to the education and outreach mandates of each of the projects involved.

In addition to these two important impacts of the workshop, I also very much believe there will be important implications to job satisfaction of those who take part in this training workshop and subsequently take part in the projects underway. Personal experience working within the field of environmental education has taught me that most people are excited to learn about wildlife, especially when it’s wildlife they have the opportunity to observe in natural settings, and when people get excited and care about something, they are much more likely to want to help protect it. I wholeheartedly believe in the quote by Senegalese Poet and Naturalist Baba Dioum, “In the end we will conserve only what we love. We will love only what we understand. We will understand only what we are taught”
This concept is the foundation on which I have built my career and the inspiration behind the idea to create this workshop.

**The Research Audience – The Canadian Coast Guard**

As people who spend a great deal of time on the water along the coast of BC, members of the Canadian Coast Guard (CCG) have the potential to be integral contributors to marine mammal conservation programs. The CCG ships often spend time in areas where few other boats are, making the crew’s sightings and reports of incidents very important for adequate data collection. CCG personnel also have the potential to be positive role models for other boaters on how to behave appropriately around marine mammals. Although this sector of the Canadian government has previously been involved with reporting sightings to both the BC Cetacean Sightings Network (BCCSN) and the BC Marine Mammal Response Network (BCMMRN), two organizations discussed below, they do not seem to be reaching their potential for involvement within them.

I began my research by using a combination of semi-structured interviews and a questionnaire to identify barriers which are inhibiting greater involvement by CCG employees, in these programs. Next, I used the information gathered during my analysis phase to guide the development of a workshop aimed at addressing these barriers and encouraging increased participation among CCG bridge staff. I also used the information gathered to pass along recommendations to each of the organizations about how they can work to encourage greater involvement from the CCG.

**Instructional Design – Using the ADDIE Process**

After settling on the idea of designing a workshop to market to professional mariners, I had to decide on the best method of creating this workshop. Having had previous success with the ADDIE process of instructional design I concluded that this would be the method I would use as I moved forward with the project.

Instructional design can be defined as “a process for helping you to create effective training in an efficient manner” (Piskurich, 2006, p. 1). It is a systematic way of ensuring that you are asking the
right questions and following appropriate steps that will lead to a desired outcome for the program or workshop you are working to create. Arguably a significant disadvantage of instructional design is that it uses much more time and resources to develop than would simply throwing together a training program as you go; however, the benefits of carefully considering each component of your instructional design program will, in most cases, far outweigh those perceived disadvantages and actually save you time and resources down the road (Piskurich, 2006).

ADDIE is an acronym used to describe a method of instructional design in which you move through a series of steps to create your finished product. The steps of the ADDIE process are as follows: Analysis, Design, Development, Implementation and Evaluation. Detailed steps of the ADDIE process will be described below in Chapter 3.

**Marine Mammal Conservation - A Collaborative Approach**

There are many environmental organizations concerned with marine life in BC. I chose to look closely at the mandates and techniques of, and to collaborate with, four organizations which are running conservation programs concerned specifically with marine mammals along the coast of British Columbia. These four organizations are: the British Columbia Cetacean Sightings Network (BCCSN), the British Columbia Marine Mammal Response Network (BCMMRN) Cetus Research and Conservation Society (Cetus) and the Marine Education and Research Society (MERS).

**The British Columbia Cetacean Sightings Network (BCCSN).**

The British Columbia Cetacean Sightings Network (BCCSN) is a research and conservation program run through the Vancouver Aquarium and Marine Sciences Centre’s Whale Research Lab. The purpose of the project is to collect sightings of whales, dolphins and porpoises from citizen scientists (volunteer research participants), along the coast of British Columbia. In the early 1970’s Dr. Michael Bigg of Fisheries and Oceans Canada (DFO) was asked to complete a coast-wide killer whale census to insure that the 20 or so killer whales that were being captured each year for the aquarium industry were not affecting the wild populations. To first get a quick estimate, Dr. Bigg enlisted the
help of coastal residents by passing out a total of 17,000 questionnaires along the coast. After receiving 550 responses to the survey, Dr. Bigg was able to establish that there were approximately 550 killer whales along the coast, an estimate that was later proven to be quite accurate (Vancouver Aquarium, 2011). Not only did these results lead to a ban on the capture of killer whales in Canada and the US (Bigg & Wolman, 1975), the study itself also helped to establish a network of keen observers along the coast who were willing to report their whale, dolphin and porpoise sightings to both the Vancouver Aquarium and the Pacific Biological Station in Nanaimo. In 1999 the BCCSN was established for the purpose of keeping all the data in one place.

The effectiveness of this program relies on participation by people who spend time on or near the water and are willing to report their incidental sightings to the network. Today the BCCSN has a network of over 3,000 observers along the coast including whale watching operators, lighthouse keepers, charter boat operators, tugboat captains, BC Ferries personnel, researchers, government employees, recreational boaters and coastal residents. Observations can be reported using a variety of methods including e-mail, the BCCSN toll free hotline, web report forms and logbooks. The data collected through this program are open to the public upon request and can be used, among other things, to identify critical habitat and distribution patterns of various species of marine mammals.

The British Columbia Marine Mammal Response Network (BCMMRN).

The BC Marine Mammal Response Network (BCMMRN) operates under the Department of Fisheries and Oceans Canada (DFO) and as with the BCCSN, the BCMMRN relies heavily on reports from people who spend time on or near the ocean in BC. This network was officially established in 2008; however, there had been a growing focus on this type of monitoring within DFO for a few years prior to this. The BCMMRN is the Pacific network portion of the national Marine Mammal Response Program and was developed to facilitate responses to dead, injured and distressed marine mammals in BC. This program is led by DFO and “Strives to assist marine mammals in distress, take action in the
case of inappropriate or illegal human activities, and investigate threats that may impact survival at the individual, population and species levels” (Fisheries and Oceans Canada, 2009-2010).

The BCMMRN has been working to establish a coast-wide network of responders including Non-Governmental Organizations (NGO’s), researchers and interested members of the public. They offer training programs to ensure that responders know what types of information to collect and host a toll free hotline where anyone can report incidents involving marine mammals in British Columbia. These incidents can include “injured, sick, dead, distressed/disturbed, out of habitat (whales on land) and causes such as human interactions (vessel strikes, entanglement, physical and noise disturbance, shootings, toxins) and natural causes (disease, predatory attack)” (Spaven, L. Personal Communication, November 27, 2011). When incidents are reported to the network, responders in the identified area are notified and asked to assist in various ways (confirming species, taking photos, taking measurements, collecting carcasses etc.) depending on their training and level of expertise.

One of the most serious incidents marine mammals may experience along the coast is entanglement in fishing gear which can cause serious injury and death (Knowlton & Kraus, 2001; Moore & Clarke, 2002; Robbins, Landry & Mattila, 2009). Currently reports that come in are handled by DFO and the BCMMRN; however, studies from the east coast of the United States indicate that many whale entanglements are never reported (Robbins, et. al. 2009). There is some ambition to establish a more sophisticated disentanglement program along the coast of British Columbia and the success of this program will depend largely on the BCMMRN’s success in soliciting reports of entanglement events.

**Cetus Research & Conservation Society (Cetus).**

Cetus Research & Conservation Society (Cetus) is a non-profit organization which, was established in 2005 to operate *Straitwatch* Robson Bight Marine Warden Program (RBMWP). Straitwatch began in 2002 in Johnstone Strait (Fig. 1A). It was established to monitor vessel activities
around marine mammals (in particular killer whales) and to educate boaters on the ‘Be Whale Wise’ marine mammal viewing guidelines in British Columbia.

There is abundant evidence suggesting that boats approaching too closely or too quickly or blocking the path of travel can cause whales to be disturbed, often disrupting their feeding and resting behaviours (Erbe, 2002; Williams, Bain, Ford & Trites, 2002a; Williams, Trites & Bain, 2002b). Cetus is responsible for making sure all types of boaters are aware of the ‘Be Whale Wise’ marine mammal viewing guidelines in British Columbia and that they understand why it’s important to follow them. In 2007, Cetus expanded to operate in the area of the Juan De Fuca Strait and Haro Strait (Fig. 1B).

The RBMWP has been operating since 1987 following the establishment of the Robson Bight (Michael Bigg) Ecological Reserve in 1982. It was previously operated by Bion Research Inc., Beaveridge Contracting and the Johnstone Strait Killer Whale Interpretive Society before being moved to operate under Cetus Research & Conservation Society in 2005 (www.cetussociety.org). Cetus is now based in Victoria BC, but still runs the Straitwatch and RBMWP in Johnstone Strait as well, and has recently expanded to include a year-round education and outreach program. Cetus has also been involved in local large whale entanglement responses and was recently awarded a Mountain Equipment Co-op grant for disentanglement gear and training.

**The Marine Education and Research Society (MERS).**

The Marine Education and Research Society (MERS) was established in 2010 in an effort to better understand the marine ecosystem surrounding Northern Vancouver Island, and to house a couple of projects already underway in this area. These projects revolve around photo identification of humpback and minke whale populations in and around Johnstone Strait. MERS has put together an extensive humpback whale catalogue to keep track of individual animals photographed and has also established a similar minke whale catalogue. The next project MERS hopes to undertake is a scar study of humpback whales along the coast of BC in an attempt to determine the extent of the entanglement
problem. Research on the Eastern coast of the United States suggests that only 10% of humpback whale entanglements are ever witnessed (Robbins et. al., 2009).

The four organizations outlined above, although different in many ways, work collaboratively on various different projects to ensure the maximum distribution of educational materials and information regarding each of the programs. Along with the development of a workshop to increase professional mariner involvement in the projects run by these organizations, one of the main objectives of this thesis project was to further this collaboration and to provide information that would contribute to the success of all involved.

**Workshop Design**

The main objective of the workshop that I have developed has been to encourage greater participation by the professional mariner community within the Marine mammal conservation programs outlined above. Because each of these programs relies heavily on participation from the public, they can all be considered to have components of citizen science within their mandates. Although the target audiences of the workshop are people employed in positions which have them spending significant amounts of time on or near the ocean, the tasks we are requesting their assistance with do not normally fit into their specific job descriptions. Because of this, participation within these various conservation programs relies on voluntary work. In order to create a workshop that had a high probability of being successful in enlisting the help of these citizen scientists, and also to be able to provide useful feedback to the organizations involved, it was important to look into some such projects which have enjoyed a high level of success throughout their implementation.

**Research Questions - What Did I Need to Know?**

In order to develop an appropriate and effective workshop to achieve my goals of increasing participation within the existing programs I had to address the following questions:

- *How much does the Canadian Coast Guard currently participate within marine mammal conservation programs such as the BCCSN and the BCMMRN?*
What are some of the barriers to increased CCG participation within these existing programs?

What kind of incentives would help to increase CCG participation?

What is the existing level of background marine mammal knowledge held by the bridge crew members in the CCG Pacific Fleet?

**Delimitations - Narrowing the Scope**

Although the workshop and title of my project are designed to include professional mariners across various different professions in British Columbia, to keep the scope of this project manageable I chose to focus my analysis phase on one specific sector of the professional mariner community. I chose to work with the CCG for a couple of reasons. For one, I had contacts within the CCG who were extremely helpful and willing to assist my research initiatives from the very beginning. The second important reason I chose to focus on the CCG was that this sector spends a great deal of time in remote areas along the coast and has the potential to contribute important information concerning areas of the coast where few, if any, other observers have a chance to be. Because of this, the CCG will be an important target audience for the final workshop implementation.

I chose to direct my questionnaire to the crew members who work on the bridge, specifically because they are the ones most likely to have the opportunity to observe marine mammals while at sea. This helped to keep the number of questionnaires distributed at a manageable level. Participants ranged across all age categories, were 90% male and had a wide range of at-sea experience and educational backgrounds. I obtained a 75% return rate on my surveys giving me 60 respondents in total. I also chose to conduct semi-structured interviews with four different CCG captains and based this on who was available to chat during the week in which I wanted to complete these interviews.

**Significance - Lasting Implications**

Because I am currently the education and outreach coordinator for Cetus, this workshop has the potential to be an excellent new way for the organization I work for to further our outreach and
education efforts. Other intended consequences which have already begun to be realized include the strengthening of existing partnerships between the four organizations involved and the development of new relationships between these organizations and various professional mariner communities along the coast.

Having professional mariners significantly involved with research and conservation issues concerning marine life will not only help with existing programs but will also help to foster a greater appreciation for the marine environment on the part of the individuals involved. As Stern, et. al (1999) recognized “Individuals who accept a movement’s basic values, believe that valued objects are threatened, and believe that their actions can help restore those values, experience an obligation… for pro-movement action” (p. 81). Because these personnel spend much of their time on the water, this change in perspective has the potential to have significant implications for the health of our oceans ecosystems.

Some of the specific factors that can be improved by increased participation include, knowledge of species abundance and distribution, significance of whale entanglement on the west coast of Canada, increased awareness of and compliance with whale watching guidelines, and increased reporting of incidents involving marine mammals.

Another benefit of this study is that I am able to provide valuable feedback to the organizations involved and suggest further research that may aid other organizations that are involved in citizen science projects on this level. Some of my findings, such as confidence levels of CCG employees vs. their actual knowledge levels, may be very important to organizations relying on self-determination of confidence estimates from their citizen scientists. The types of incentives people are looking for when participating in these citizen science projects can also be useful information for projects hoping to maintain enthusiasm from active participants.
Chapter Two: Review of Related Literature

British Columbia – A Journey from Whaling to Conservation

Commercial whaling took place in British Columbia from 1905 to 1967 (Ford, Trites, Ellis, Gregr & Nichol, 2000; Nichol et. al. 2002) and records show that during this time 24,862 whales were harvested by whaling stations along the coast. This led to a severe depletion of many populations (Trites, Deecke, Gregr, Ford & Olesiuk, 2007). The last whaling station to close down in British Columbia was the Coal Harbour whaling station, located on North-Western Vancouver Island, near Quatsino Sound. This station was in operation from 1948 to 1967 (Nicol et. al., 2002). Today, several of the large whale populations that were targeted, such as blue whales, sei whales and North Pacific right whales, are still listed as endangered in Canada (COSEWIC, 2005). In December of 1946 the International Whaling Commission (IWC) was established with the purpose of regulating the harvest of whale species worldwide (Weeks, 2009) and in 1986 an international moratorium on commercial whaling officially came into effect (Caron, 1995).

In 2002 Canada passed its Species At Risk Act (SARA), which strengthened the role of science in the listing of threatened species (Findlay, Elgie, Giles, & Burr, 2009). Under SARA, a government-appointed group of experts known as the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), assesses the status of species and groups them into categories that range from “extinct” to “special concern” (Findlay et. al., 2009).

The Role of Citizen Science

Marine mammal conservation has come a long way since whaling subsided in Canada in 1967 and many organizations concerned with the conservation of these animals have been established. Unfortunately, funding is still limited and these organizations often have to use creative techniques to maximize the resources they have access to. One such technique which is used in an incredible diversity of projects around the globe is what is referred to as “citizen science”. Citizen science is a research technique in which members of the public are utilized for the collection of scientific
information (Bonney, Cooper & Dickenson, 2009) and citizen scientists can be defined as “volunteers who participate as field assistants in scientific studies” (Cohn, 2008, p. 193).

Early citizen science projects were designed as educational tools to help get the public involved and interested in conservation; however, citizen scientists now play an active role in a plethora of projects worldwide and their participation has allowed for the collection of large amounts of important data with minimal resources and funding required (Braschler, 2009; Cohn, 2008). Data collected through citizen science projects has been used to track population trends, to identify range changes and to inform population management decisions (Bonney et. al. 2009).

Citizen science has been successful in a variety of study areas including the reporting of invasive species (Gallo and Waitt, 2011), the mapping of human-wildlife interactions (Weckel, Mack, Nagy, Christie & Wincorn 2010), addressing biodiversity issues (Couvet, Jiguet, Julliard, Levrel & Teyssedre, 2008), and even measuring the effects a damaged ozone layer has on native wildflowers (Bricker, Sachs and Binkey, 2010).

One notable field in which citizen science is widely used today is in projects involving studies of bird distribution and abundances (Bonney et. al. 2009; Gorman, 2001; Greenwood, 2007 Lõhmus, 2011). In fact, in ornithology (the study of birds), amateur participants have not only assisted but have always outnumbered professional scientists (Lõhmus, 2011). One of the original citizen science projects that is still considered to be highly successful is the Christmas bird count. Despite the busyness of the season and the cold, biting weather, Christmas bird counts continue to be successful year after year (Stoner & Hacket-Stoner, 2007). The counts began in 1900 as a protest to the annual bird shoot and over the years they have continued to grow in scope and popularity. Today the counts are much more widespread and organized and results are published by the Audubon Society each year. Anyone can participate and they have become fun social activities which many people enjoy taking part in year after year. One of the major contributors to the success of these bird counts has been the perceived incentives. Participants list some of these incentives as having fun, meeting new people and
finding rare or exciting species. These are the aspects that seem to keep participants returning year after year (Stoner & Hacket-Stoner, 2007). The data collected during these counts has contributed to knowledge about species abundance, distribution, expansion of range and various other aspects of bird biology and natural history. Results have also revealed alarming declines, and the value of these counts increases each year. The continuation of the Christmas bird counts is important for maintaining the 107-year database, energizing and bringing together people interested in birds and for generating publicity and funding for bird conservation projects.

Another example of a citizen science project that has been successful is a project aimed at determining the migration routes of monarch butterflies. Monarch butterflies (*Danaus plexippus*) in Eastern North America embark upon the longest known migration route of any insect in the world. They can travel up to 3000 km from their breeding grounds in eastern Canada to their over-wintering grounds in Mexico (Howard & Davis, 2009). Although the migration distance is well understood, determining the routes of this migration has been extremely challenging due to the large scale of it. Some insights have been gained previously through mark-recapture studies (Urquhart & Urquhart, 1977; Urquhart & Urquhart, 1978); however, what has really provided important information is a citizen science program initiated in 2005 called Journey North (Howard & Davis, 2009).

Participants in the Journey North program were asked to record overnight roost sites of monarch butterflies during their fall migration. They were directed to a website where there was a description of what they were looking for and a section for them to enter their sightings and any notes they wished to include. Information was then plotted online so that participants could see the results visually represented. From data acquired during this program, researchers were able to identify a main ‘central’ flyway as well as a separate smaller flyway, making the program a great success.

Some of the reasons that this program was successful include the ease of which the data could be entered and the immediate gratification participants received from having contributed. A clear, well-designed website, which allowed participants to enter their sightings immediately and also to see the
graphical representation of data they had contributed, helped encourage continued participation. The use of identification guides on the website seemed to be a useful way to minimize species identification errors.

When reading through the trials and successes of these citizen science projects I began to notice particular aspects of the projects that seemed to be essential for the successes achieved. One aspect that was addressed was the importance of providing citizen scientists with adequate training (Gallo & Waitt, 2011; Howard & Davis, 2009). This training took various forms, from simple online ID guides that participants were asked to read through, to more complex training programs that were required to be completed before participants could join the projects as citizen scientists.

Another important element that each of the successful citizen science projects shared was that each of them had a web-based component, which allowed participants, not only to enter their data efficiently, but also to learn more about the projects they were contributing to and what the data was being used for. Newman et al. (2010) recognize that “citizen science websites must be easy to use, result in positive overall satisfaction for many different users, support many different tasks, and ensure data quality” (p. 1851).

In addition to proper training and well-designed websites, another factor that appears to be vital to the success of citizen science projects is the existence of worthwhile incentives (Cooper, Dickinson, Phillips & Bonney, 2007). Incentives for the various projects included everything from having fun and meeting new people, to learning new skills and finding rare and exciting species. Although the target audiences for each unique project would likely have different expectations in terms of incentives, one thing that seemed consistent throughout was the desire for feedback about the project participants were contributing to. People seem to want to feel that they are an important part of the project they are working on. Even simple feedback about what they are contributing to and what their data is being used for provides adequate incentive for continued participation in many cases (Cooper et al. 2007).
Chapter Three: Methodology and Research Design

Action Research

Something that I identified as being very important to me from the beginning of this project was that I end up with something tangible that could be used within my career goals of furthering participation within marine mammal conservation. Because this aspect was essential, I elected to undertake an action research project.

Many view action research as having origins in the work of Kurt Lewin with his group-dynamics movement which took place during the 1940’s (Herr and Anderson, 2005). Although he may not have been the first to promote this form of inquiry, he was the first to make a compelling case for its place within social sciences research. “Lewin believed that knowledge should be created from problem solving in real-life situations” (Herr & Anderson, 2005, p. 11).

Action research can take on many different formats. Herr and Anderson (2005) use McKernan’s definition to describe it as “a form of self-reflective problem solving, which enables practitioners to better understand and solve pressing problems in social settings” (p. 6). Herr and Anderson (2005) further describe Action Research as an “inquiry that is done by or with insiders to an organization or community” (p. 3). Although for my analysis phase I am doing research on subjects that are considered a target audience for the organizations and community involved, I am also using this research to take a closer look at what the organizations themselves are doing and how effective the current strategies are.

Furthermore, Herr and Anderson (2005) identify that “action research is best done in collaboration with others who have a stake in the problem under investigation” (p. 4). Throughout this process I have ensured very close collaboration with the other organizations directly involved in this subject and have used the insights gathered to provide valuable feedback to all of these organizations, including the one that I am employed with.
ADDIE – Method of Instructional Design

ADDIE is a process for instructional design in which you follow a series of steps in a “cyclical process that evolves over time and continues throughout the instructional planning and implementation process” (Peterson, 2003. p. 227). The five stages of the ADDIE process are Analysis, Design, Development, Implementation and Evaluation.

During the analysis phase, the main concern of the designer is the target audience for the final workshop (Peterson, 2003). The designer will begin by conducting a needs analysis in order to determine what the prospective students know and what they need to know. The next step is to conduct a task analysis about what the students should learn from the course or workshop that is being designed.

Once the needs and task analyses have been completed, the designer uses this information within the design phase. It is during this phase that learning outcomes are identified, as are methods for reaching them effectively. After a comprehensive design phase has taken place, the designer can then move on and begin to develop the necessary components of the workshop.

Next comes the implementation phase. Before implementing your workshop or training course with your target audience, it is extremely useful to conduct Beta or pilot tests (Piskurich, 2006). Pilot tests should use the same exact parameters as the workshop itself, (i.e., same type of audience, same class size, same length of workshop etc.). Beta tests, conversely, can be conducted with different audiences to evaluate all or a portion of the workshop you have designed (Piskurich, 2006). Once you have completed your Beta and/or pilot tests and feel confident with the feedback you have received, you can move on to implement your workshop to your desired audience.

The final phase of the ADDIE process is the evaluation phase. This phase is very important for determining whether or not your workshop is producing the intended results and also for ensuring that you can increase its efficacy, if necessary, in future implementations. The four most common types of
evaluation involve observing the reaction of your audience, testing for learning of concepts or skills, examining changes in behaviour and looking for returns on investments or results (Piskurich, 2006).

For the purpose of my MAEEC thesis, I worked through the analysis and design phases and began to work on the development phase. The implementation and evaluation stages will follow when I am able to present this workshop in the CCG training week, a week of various training courses for CCG employees which takes place every October; I have, however, done some preliminary implementation and informal evaluation of portions of the workshop with other professional mariner audiences. I was able to present a portion of my workshop to a group of fishing guides at a lodge near Campbell River, BC and I also had the opportunity to present part of this workshop to a kayaking club near Nanaimo BC. This gave me the chance to get a feel for the implementation of the workshop and to gather feedback about how it was received. I will discuss this further in Chapter 5 below.

**Mixed Methods Research**

During my undergraduate degree in university, I was often immersed in projects that utilized hypothesis driven research and relied heavily upon quantitative data analysis. I learned all about the scientific method and the perceived importance of using statistical analysis to determine the significance of the data being processed. As I made my way into the workforce after university however, I began to see the world more in shades of grey rather than strictly black and white, or significant and not significant. I began to believe in the value of simple observations and the ability to draw important conclusions based on various different methods of gathering information. Although I can still appreciate the importance of gathering quantitative data and being able to statistically analyze the results, I also believe very strongly in the value of qualitative data. For this reason, I chose to use a mixed methods approach for gathering information for the analysis phase of my project, which would help to shape the development of my workshop and to inform the recommendations I have passed along to the organizations involved.
Mixed methods research is widely considered one of three main research paradigms in which both qualitative and quantitative methods are used for data collection within the same study (Johnson, Onwuegbuzi & Turner, 2007; Lopez-Fernandez & Molina-Azorin, 2011). The purpose of using mixed methods research is to draw upon the strengths of each method, while at the same time diminishing the weaknesses present when each stands alone (Johnson & Onwuegbuzi, 2004).

Participants – The Canadian Coast Guard

For the analysis phase of my ADDIE program design, I chose to focus on members of the Canadian Coast Guard (CCG). Initially I had hoped to include both the CCG and the Department of National Defence (DND) personnel in my analysis phase, but after speaking with DND personnel I was informed that, due to lengthy approval processes, distributing surveys would not be an option within the limited time frame of my project. I chose to work with the CCG for several reasons. The first was that they seemed to have the potential to be extremely useful resources for the programs we were hoping to increase involvement with. CCG ships spend a great deal of time on the water and often travel along remote areas of the coast where few other boats spend time. Because there are so many areas of the coast in British Columbia where there are few, if any inhabitants, there are many gaps in data of marine mammal knowledge within these regions. Professional mariners in general and CCG employees in particular have the opportunity to see wildlife on a regular basis and are able to observe things that most members of the public would not have the opportunity to observe. This means that sightings of marine mammals (whether alive and healthy or dead or distressed) by the CCG ships would likely not be reported by other sources. Increasing participation by this particular group of professional mariners would mean increased information for all of the marine mammal conservation programs involved.

The second reason I chose CCG employees as my target research participants was that it seemed like a great way to get an abundance of information, while still keeping the project at a manageable level. By making one important contact within the CCG, I was able to organize
distribution of my survey to 80 individuals on 12 different CCG ships within the Pacific Fleet. The CCG was also very willing to participate in my research project and there were no major roadblocks to overcome before pursuing this avenue.

Data Collection – Sampling Techniques and Questionnaire and Interview Design

Questionnaire.

Before beginning the design of my questionnaire and interviews, I first organized a series of meetings with personnel within each of the marine mammal conservation organizations I wished to involve in my project. The purpose of these meetings was to determine what types of information would be most useful to gather not only for the design of my workshop, but also for providing useful feedback on program implementation and participant recruitment. Collectively we decided on four main sections for the questionnaire. First, we wanted to know about the respondent’s general interest in boating and how much of their free time they spend on the water. Secondly, we wanted to gather information about past and current participation within the conservation programs in place. Thirdly, we wished to get a better idea of what the level of general marine mammal knowledge is within the CCG and finally, we wished to gather information on demographics such as age, sex, educational background and years spent working at sea.

Once we had reached consensus on the type of information we wished to obtain, I set to work on designing the questionnaire. I used the suggestions in Rea and Parker (2005) to determine effective structures for each of the questions I wished to ask and to ensure there was no confusion on the information I was requesting.

Each section of the questionnaire had specific aspects that required careful consideration. To obtain information about general interest and experience with boating, I asked questions about whether or not they owned their own boat and how much of their free time they spend, or would like to spend, boating. In order to assess awareness of, and participation within, existing programs I asked a variety of questions about each of the programs. For example, not only did I ask about respondent’s knowledge of
the ‘Be Whale Wise’ guidelines, I also tested that knowledge with a few specific questions about what the guidelines are. I also asked whether they had heard of programs such as the BCCSN and BCMMRN, and about their past participation within each of these programs. In order to assess the identification skills and confidence levels of respondents, I compiled a series of photographs of five different cetacean species using a combination of commonly seen, and not-so-commonly seen species, to assess whether seeing a species more often lead to increased confidence in identification of that species. Aside from asking respondents to identify each species, I also asked them to rate how confident they felt in their identifications. The purpose of this was to be able to determine if their confidence was related to their skill level, or if they were actually feeling certain about what they were seeing, when they may have been seeing something quite different.

When I was satisfied with the design and flow of my questionnaire, my next step was to send a copy of it to my supervisor as well as to one representative from each of the four organizations involved in the project and ask for their input and critiques. After compiling the feedback I received, and adjusting the questionnaire accordingly, I then sent it out to each individual again and asked for additional feedback. I repeated this process several times until each participant was satisfied with the final questionnaire.

Once the six of us involved in the questionnaire development process were satisfied with what we had, I conducted a pilot study to identify any issues that had been overlooked. For the pilot study I sent the questionnaire to six cadets who were, at the time, attending Canadian Coast Guard College in Sidney, Nova Scotia. I asked each of them to complete the questionnaire and also to write any comments they had about the overall design and to identify any questions that may have been unclear or awkwardly worded. The cadets then mailed hard-copies of the questionnaire back to me and I used their comments and suggestions to develop the final version of the questionnaire that I would use for my survey.
Because the CCG employees would have to answer my questionnaire while at sea, where they often do not have reliable internet access, they had to stipulate that I would use a paper copy of the questionnaire to gather my data, rather than an online version. Throughout this process I had been communicating with a CCG employee who was stationed at the Regional Operations Centre (ROC) who helped me to determine which ships would be the best to send the questionnaire to. We settled on 12 different ships within the Pacific fleet which covered a wide range of duties and home ports. After obtaining a list of the number of bridge crew members on each ship I put together packages for each of the captains. These packages included one questionnaire for each member of the bridge crew and a letter for all participants to read explaining that the questionnaire was completely voluntary and they were in no way obligated to complete it (Appendix 1). I chose to focus specifically on members of the bridge crew since they would be the ones most likely to observe marine mammals while on shift. As an added incentive for completing the questionnaire, I also included entry forms for a prize draw, which everyone who answered the questionnaire would be eligible for.

Interviews.

I chose to conduct semi-structured interviews with CCG captains as a way to gather more in depth information and insights into possible barriers to, and incentives for, participation. Semi-structured interviews can be defined as verbal exchanges where an interviewer asks questions of an interviewee in order to draw out information. Although the interviewer prepares questions to guide the exchange, the interview takes the form of a conversation which allows for a greater exploration into issues that are deemed important (Longhurst, 2003). I chose to use semi-structured interviews for the qualitative portion of my mixed-methods research because they are “well suited for the exploration of the perceptions and opinions of respondents regarding complex and sometimes sensitive issues and enable probing for more information and clarification of answers” (Barriball & While, 1994, p. 330).

I once again worked with my contact at the ROC to determine which captains would be the best to conduct these interviews with. Captains were chosen based on availability during the time frame in
which I was able to conduct the interviews. I sent an e-mail out to all the eligible captains that were working during this time and the four that were willing and available to participate were the ones I conducted interviews with. I developed an interview guide which I used to direct the interview when it lulled or shifted off topic (Appendix 2)

**Data Analysis and Compilation**

It took a little over a month for me to receive the completed questionnaires from all 12 of the CCG ships. Because I had to conduct the questionnaires in a paper format rather than using an online survey engine, I needed to convert them into an electronic format before I could begin analysis. A co-worker at Cetus was kind enough to work with me to build a Microsoft Access database to house my data. We set up the database in such a way that each questionnaire could be entered as a separate form and queries could be run to look at relationships between the various respondents and their responses.

For the section regarding identification skills, I chose to run some simple statistics to analyze whether or not confidence levels were significantly correlated to correct responses. In order to do this, I exported my data from Microsoft Access into Microsoft Excel, assigned values of 0 for incorrect responses and 1 for correct responses. I also assigned a value of 0 for respondents who were not confident in the identifications and 1 for those who were. I then used simple t-tests in VassarStats (http://faculty.vassar.edu) to compare the mean value of correct responses with those who were confident and those who were not confident.

**Anonymity**

In order to allow participants to feel comfortable with answering the survey questions without fear of ridicule or embarrassment, it was essential that the surveys remain anonymous. I ensured anonymity by asking my contact at the ROC to collect the prize draw ballots and compile them before passing them along to me. This ensured that there was no way for me to know who was on each ship and therefore no way for me to piece together who answered which questionnaire. I explained this
process in detail within the letter each respondent was asked to read before completing the questionnaire. (Appendix 1)

Because it was important to me that the captains felt free to speak candidly about their experiences I felt it was important to ensure the published interviews would remain anonymous within the text of my thesis. There obviously could not be complete anonymity within the interviews since I wished to conduct the interviews face to face or over the phone and would therefore know who I was speaking with; however, I felt that ensuring that the captain’s names would not be published within the final product would allow for a much more open and candid discussion.

**Reliability and Validity**

Reliability was achieved in this study by triangulating the results of several different methods of data collection (questionnaires, interviews, and conversations with those involved in the marine mammal conservation programs), transcribing interviews, encouraging member-checks and reviewing related academic literature.

With permission from the captains, I used a digital voice recorder to record the conversations we had. I then transcribed each of the interviews and e-mailed them to the captains thereby allowing them to perform member-checks to correct any potential misrepresentations of their thoughts and opinions, as well as giving them the opportunity to add any important points they felt may have been missed.

I ensured validity of this study by comparing the results of the questionnaires and interviews with existing related academic literature and also with conversations with those most intimately involved with running the programs.

**Limitations**

Although my final workshop has been designed so that it can be adapted for various audiences, there are limitations to the applications of my research. Since my questionnaires and interviews were conducted within one particular sector of professional mariners, the results can only give me specific
insights into this particular group. For example, I cannot say that based on my results, all professional mariners have a particular level of interest in this subject matter or that all professional mariners have a certain level of familiarity with existing conservation programs. What I can do with this information however, is use it to guide my analysis phases with other audiences of interest. Results obtained from this sector have given me a better idea of what kinds of questions will be important to ask of other prospective participants.
Chapter Four: Results and Discussion

Throughout this process, I have explored a number of questions concerning barriers to participation, incentives to encourage increased participation, and the audience for which I should tailor a workshop. I have used the information that I have gathered to design and develop many of the workshop components. Along the way, I have had the opportunity to try out various components of the workshop and acquire informal feedback from participants. In addition, I have not only provided useful feedback to the organizations involved about how they can work to increase participation within their programs, but have also been a part of a collaborative one-page document which we have put together to increase our outreach potential.

This final chapter will be devoted to exploring the findings of my analysis phase and discussing how the information has been used within the workshop development and for feedback to the various organizations involved. The chapter has been divided into sections that correspond with the information that was sought within the questionnaire and captain interviews. The first section will explore the interest in boating and the marine environment. The second will delve into the knowledge and history of participation for each of the established programs. Section three will examine background marine mammal knowledge and identification skills and the final section will discuss the demographics of the research audience. For each of these sections I will consider the implications of the information obtained for each of the organizations involved. I will also discuss how the finding helped to shape the design and development of my workshop. Finally I will consider the further-reaching implications of my study. I will look at how these findings can be applied to other similar projects and what type of further research should be undertaken within this field.

I received a total of 60 completed questionnaires back out of the 80 that I distributed, giving me a 75% response rate. I also conducted interviews with four different captains working within the CCG. Unfortunately one of the captains was unable to answer most of my questions due to time constraints,
so I will only be considering the interviews of three of the subjects. I have chosen to identify them as captains A, B and C.

**General Interest in Boating and the Marine Environment**

The questionnaire showed that almost half (49%) of respondents do not own their own boat (Fig. 2); however, many of them still spend portions of their free time boating or expressed that they would like to do so (Fig. 3), indicating that there is obviously a high level of boating interest within this crew.

![Image of bar chart showing boat ownership](image-url)

**Fig. 2: Do you own your own boat?**
Fig. 3: How much of your free time do you spend boating?

One might assume that people who spend four weeks at a time at sea, as these employees often do, would not want to be at sea during their time off as well; however, the participants seem to be people who really enjoy being on, or near, the ocean, whether it’s for work or recreational purposes. Only five% of respondents expressed that they do not like to spend time at sea when they are not working. When asked about what they found most interesting about working at sea, both getting to see new areas of the coast and seeing wildlife on a regular basis were more popular responses than learning to use equipment on board the ships. Other reasons for enjoying work at sea included working in an environment that most people don’t get to, the challenge of the job, meeting people, protecting our coastal resources, experiencing the ever-changing nature of the environment, getting to work outside and getting lots of time off.

Overall, they seem adventurous and are eager to continue this exploration within their free time when possible. This is important information for many of the organizations involved because it indicates that participation in these programs, while on the job, has the potential to carry over into their personal lives as well.
One example of this is the collection of cetacean sightings for the BCCSN database. If participants understand why it’s important to collect this information and what it is used for, they may be inclined to contribute to it even more. As we are asking these employees to do shipboard “volunteer work” that goes above and beyond their regular duties anyway, if we are successful in getting them to help out with these programs while at work there is no reason to think they would be disinterested in helping out during their personal time as well. If, for example, they are receiving positive feedback and feeling like they are a part of something important while on the job, they may be more inclined to seek this type of feedback and feelings of inclusion when they are out boating with their friends and family.

Although this research was targeted towards CCG bridge employees, since they are the ones most likely to observe marine mammals while on shift, this potential for continued support may be a compelling reason to include other CCG employees in the workshop as well. It would be very interesting to further this research by presenting other members of the CCG, who do not work on the bridge, with the same survey to determine whether there is a significant difference in their answers. In my interview with Captain A, he indicated that receiving the map showing all the sightings collected by the ship he was on over the last ten years was exciting, not only for the bridge crew, but also for the rest of the crew. Although many employees spend much of their time below deck, according to Captain A, they were still interested in knowing what kinds of marine mammals had been observed by their ship. If they are excited simply to know what has been seen, chances are good that they would also be excited to learn more about the animals that they are sharing their environment with.

**The Role of Marine Mammal Scientists.**

My research indicates that contact with marine mammal scientists is an effective way to encourage excitement among crews regarding marine mammals. When I asked Captains A, B and C about their most memorable encounters with marine mammals, all three of them mentioned the names of two prominent marine mammal scientists within DFO, who were present during these interactions. Of course, this is likely in part due to the fact that when there are marine mammal scientists on board,
the ship is taking part in marine mammal research and will therefore be more likely to encounter these animals; however, there was also some indication that having people who know a lot about these animals on the ship, made it that much more exciting to see them. All three captains indicated that they see marine mammals regularly while on the job, but Captain B said that having a marine mammal scientist on board makes the crew very keen. He said “it’s amazing how many whales you see when you actually look for them!”

Seventy percent of questionnaire respondents indicated that there had been a marine mammal scientist on board a ship they had sailed on at least once before, but only 33% indicated that they had experienced this many times (Fig. 4).

Fig. 4: Have you ever had a marine mammal scientist on board a ship you were working on?

During my interviews with the captains I asked them to tell me about their most memorable encounter with marine mammals. All three of the captains enthusiastically recounted stories of encounters they had when there were marine mammal scientists on board the ship and they were able to
launch their Fast Rescue Crafts (FRC’s) to get a closer look at what the animals were doing. Captain A told me about a day when he was out with one of the lead marine mammal scientists at DFO.

We were trying to get skin samples from humpbacks off the Queen Charlottes. It was the end of the day. We had been out on patrol for about two weeks doing mostly a humpback whale survey. I had a very competent chief officer who was capable of taking over command of the ship so I went out with John and Graeme in one of the little aluminum boats and I spent the day as the boat driver. It was an awesome time to be able to see the whales up close, watching them feeding around the boats so that we could get our samples. So we were on our way back to the boat at the end of the day, we had had a marvellous day, and we saw two whales in transit away from the island so we thought we would go see if we could get a picture of their tails and get skin samples. We were running up behind them and they were taking turns breathing and going back down. As the boat operator I had to run ahead and drop back depending on what whale we had coming to the surface. We were trying to get a tail shot. One of the whales decided it was going to breach and it breached right in front of us so the spray came down on the boat and on us. That picture the next day made it on to the cover of I think the Province Newspaper. I felt quite invigorated by the fact that I had been there to see that. It gave me a real sense of their size and of how maneuverable they are. For an animal that big to be able to move in around the boat freely and feel quite comfortable was amazing. For some of the feeding processes they were basically right alongside the boat. They were bubble feeding and they would come up right beside the boat. It was almost like they were looking right at you as they went by and I know that's not the norm and it shouldn’t be the norm but for research purposes and trying to understand them better that was part of the process. So it was a very exciting time and that’s definitely my most memorable experience.

Captain B also enthusiastically recounted a day off the coast of the Queen Charlotte Islands when he had a marine mammal scientist on board. He recalled:
It started with transients and then we got surrounded by humpbacks and then a shark came. I can’t remember what kind of shark it was. We couldn’t move the ship for about an hour because the whales were rubbing their backs on us. The ship stunk from the whales. I guess they were using the ship for protection. We have about a half hour video of that and it’s astonishing. I’ve never seen anything like it. We were looking down at them and they were just staring at us. It was endless. Every time I tried to leave with the ship everyone would scream that they were still there.

Furthermore, Captain C explained to me that his most memorable experience took place when he was out on a trip with two prominent marine mammal scientists within DFO. He stated:

There were a group of transients [killer whales] and they had a seal trapped between them. They were kicking it with their tails and playing with it. They played with it for probably about 10 minutes while we were watching and then they were splashing their tails and seemed quite angry and Graeme thought that they might have lost the seal…There was also another memorable time when we were up in Haida Gwaii and there were so many Humpbacks that it was actually difficult to navigate around them.

These interactions were all indicated to be extremely positive and exciting experiences. Based on these findings, a role of marine mammal scientists might be to maintain contact with CCG staff as much as possible. It is clear that their presence on the ship and the enthusiasm they bring, encourages excitement among CCG employees and their feedback can lead to increased ship-board participation in the conservation initiatives.

**Familiarity with Existing Programs and Organizations**

**The BC Cetacean Sightings Network.**

The BC Cetacean Sightings Network has previously done some work with the Canadian Coast Guard. For the last several years, the CCG ships on the Pacific coast have had BCCSN log books on board that they are asked to use to record their whale, dolphin and porpoise sightings. The purpose of
the books is to make it a little easier for these individuals to record their sightings. Because the internet is not always reliable at sea, having a centralized location where observers can record what they see in paper format is intended to streamline the sightings collection process. The idea is for captains of each ship to send the log books in to the sightings network approximately every year. Some ships do this, while others do not.

More than half of the questionnaire respondents (58%) indicated that they had heard of the BC Cetacean Sighting Network (BCCSN) and had at least a basic understanding of what they do; but, 28% admitted to never having heard of the BCCSN. Only 13% claimed that they record every single sighting of whales, dolphins and porpoises along the coast of BC; however, 37% claimed that they record most of their sightings as long as there is nothing else that they are supposed to be doing at the time. Overall, 76% of respondents claimed that they do record sightings at least occasionally (Fig. 5).

![Frequency of Recording Sightings](image)

Fig. 5: Frequency of recording sightings

There were some interesting comments on the surveys from respondents who wished to include a little bit more information about why they were not reporting their sightings. One individual
expressed that she did not record sightings because she does not want “to provide erroneous information if [her] identification is not correct”. Another respondent expressed that he would record what he saw more often if he felt more confident in his ability to identify different species. Others indicated that they were simply not aware that this was something that they should be doing and it had never crossed their minds to write down what they were seeing.

All three of the captains interviewed had previously heard of the BCCSN and were aware of the log books that they had on board the ship. Captain C indicated that he was aware that sightings had “fallen off” recently and that they “record sightings more often if [they] see a group of animals” but that they rarely record single animals anymore.

The fact that 76% of respondents claim to record sightings but only 58% indicated that they had heard of the BCCSN before, suggests to me that many respondents likely do not understand why they are reporting those sightings and what the data is being used for. When speaking with the captains, they expressed to me the way the system works with the bridge crew. It seems that employees are taught to follow the captain’s suggestions at all times. When speaking with Captain A, I expressed my surprise that every single individual on his bridge crew had completed the questionnaire and had done so very quickly despite the fact that it was completely optional. Captain A explained to me that “usually within the Coast Guard, if your captain asks you to do something, you do it”. This is likely why we are seeing sightings reported from individuals who have never heard of the BCCSN and have no idea what the purpose of the data collection is. Knowing how much of an influence the captains have within the CCG is important information when attempting to encourage participation from the crew. When I heard this, I began to wonder if targeting the captains specifically as my workshop audience was likely to be the most effective strategy for increasing participation. This is certainly something to consider within the marketing of the workshop; however, I believe it’s important to include the rest of the CCG employees as well for several reasons.
The first reason I believe it’s important to offer this workshop to all the crew is that, as discussed above, the more people we can get on board with these programs, the greater chance we will receive information from these individuals during their off time as well. Another reason I believe it’s important to include various levels of employees in the workshop is that there seems to be a great deal of movement within the CCG to different roles and different ships. If one captain goes through the workshop for example, and gets his/her crew to record sightings without them really understanding why, and is then transferred to a land-based position, the chances of that crew continuing to collect sightings will likely be diminished. Thirdly, I strongly believe that getting CCG employees involved and excited about marine mammal conservation will greatly enrich their jobs. These are people who spend immense amounts of time on the ocean and have the opportunity to see amazing things that few people will ever have the chance to experience. Knowing more about what they are seeing and how incredible it is, will surely add considerably to the levels of contentment these employees experience while at work.

Overall, it seems that the majority of bridge crew employees within the CCG are aware that there is some interest in what they are seeing out on the water and they make an effort to record sightings at least occasionally. It seems the greatest barriers to recording these observations are lack of knowledge about the sightings network and lack of confidence in ability to distinguish various species of marine mammals. When asked about what types of resources they would be most likely to use to find out more information about marine mammals, 63% of respondents indicated that they would choose books on board the ship if they were available (Fig. 6) and 84% of respondents indicated that they, at least occasionally, use ID guides to determine what they are looking at if they are unsure (Fig. 7). These results indicate that it would be useful to distribute ID guides and other reference books to the CCG ships as a way to increase participation.
Fig. 6: What resource would you be most likely to use for information on marine mammals?

![Bar chart showing resource usage]

1) An internet search engine  
2) Books on the ship  
3) A particular website  
4) A friend or co-worker  
5) Personal resources

Fig. 7: Frequency of field guide usage for marine mammal identification.

![Bar chart showing field guide usage]

1) Always use field guides  
2) Whenever I can if time allows  
3) Occasionally if something seems rare  
4) Almost never  
5) I have never used one

The BC Marine Mammal Response Network.

The BCMMRN has been operating since 2008 and was set up as a way to ensure that all incidents involving marine mammals are reported to a centralized location that can then mobilize an appropriate response dependent upon the details of each individual case. My results showed that 62% of questionnaire respondents had heard of the BCMMRN and had at least a basic understanding of what it was (Fig. 8) and all three of the captain’s interviewed knew about the BCMMRN and all had
previously been involved in responses to marine mammal incidents while on duty; however, many CCG employees are still reporting such incidents to a wide variety of organizations and individuals.

![Graph showing understanding of the Marine Mammal Response Network]

Fig. 8: Understanding of the Marine Mammal Response Network.

Only 15% of respondents claimed to have reported incidents to the BCMMRN but 29% stated that they had called in incidents to other sources. These sources included the Pacific Biological Station in Nanaimo (which is where the MMRN is located), Local Department of Fisheries and Oceans (DFO) offices, the Strawberry Isle Marine Research Society, The Queen Charlotte Conservation and Protection Office, The Vancouver Aquarium, and even direct contact with marine mammal scientists such as Graeme Ellis and John Ford. This tells me that there is still some work to be done in getting the BCMMRN well known within this sector of government. Because the BCMMRN has worked with most of these organizations and ensured that they are aware of the network, it is likely that many of these reports eventually made their way to the BCMMRN coordinator (L. Spaven, Personal Communication, November 27, 2011). Although many of these sightings likely do end up going through the BCMMRN eventually, having them reported directly would help to streamline the process and ensure efficient response procedures where possible.

One thing I found very surprising was that 88% of employees surveyed declared that they had seen dead marine mammals in BC at least once before but only 44% indicated that they had contacted
the BCMMRN or another organization or individual. This suggests that less than half of all sightings have been reported. This seems shocking; however, it is very possible that many of these animals were called in by other individuals present at the time. There can be several employees involved when dead marine mammals are observed and only one person would be likely to call it in. I noticed within the survey that several individuals made reference to responding to the same cases. It seems plausible that in these instances, although many people may have witnessed the event, only one person in charge would have phoned to report it.

**Cetus, Straitwatch and Be Whale Wise.**

Straitwatch has been operating in Johnstone Strait since 2002 and in the Juan de Fuca Strait and Haro Strait since 2007. The primary goal of Straitwatch is to educate boaters about the ‘Be Whale Wise’ marine mammal viewing guidelines in British Columbia and the Washington State marine mammal viewing regulations when in US waters. According to the questionnaire results, most CCG bridge crew employees do not know about Straitwatch. 47% had never heard of Straitwatch and only 5% felt they had a clear understanding of what this program is all about (Fig 9).
This is not too surprising considering the areas in which the CCG ships spend time. Much of their time at sea is in remote areas of the coast where they are engaged in search and rescue, marine navigation services, conservation and protection, fisheries management and ocean science responsibilities. Straitwatch operates in areas of high vessel traffic within the critical habitat of both the Northern and Southern resident killer whales. Because of this, chances of CCG ships encountering our boat on the water are fairly slim. Although it would be useful for CCG employees to know about Straitwatch and what we do so that they could direct private boaters to our website for more information, the most important thing is that they are aware of the ‘Be Whale Wise’ guidelines. 97% of respondents were aware that there are marine mammal viewing guidelines in BC. (Fig. 10)

![Perceived Knowledge of Be Whale Wise](image)

Fig. 10: Perceived knowledge of Be Whale Wise.

It is encouraging to know that CCG employees know the guidelines exist; however, only 20% felt confident that they knew all of the guidelines (Fig. 10) and only 7% actually got all the questions pertaining to the guidelines correct (Fig. 11).
This information tells me that we still have a long way to go in terms of educating this particular group about the guidelines they should be following when operating their ships in the vicinity of marine mammals.

All four captains indicated that they knew about the Straitwatch program and the ‘Be Whale Wise’ guidelines. I was able to ask three of them if they had previously seen boats behaving poorly around marine mammals. Captain A indicated that he had observed inappropriate behaviour before but that he “wouldn’t say it happens often”. Captains B and C both stated that they could not think of any particular times when they had observed anything that concerned them. When asked if they would be comfortable contacting boats if they did witness inappropriate behaviour around marine mammals, Captains A and C said they would be, but that it was not part of their mandate. Captain B said he had never before contacted a vessel about this type of thing “mostly because it is not specifically within our mandate to do so and we don’t want to leave the perception that we have a duty or responsibility in an area where we do not have authority to do that type of thing”.

Fig. 11: Be whale wise guidelines

Be Whale Wise Guidelines

<table>
<thead>
<tr>
<th>% of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>7</td>
</tr>
</tbody>
</table>

1) All 3 Correct
2) 2 of 3 Correct
3) 1 of 3 Correct
4) None Correct
The Marine Education and Research Society (MERS).

Because this is a new organization, I did not ask any questions pertaining to familiarity with this society. The main purpose of including this organization as one of the four within this project was to ensure we are all working together as we move forward. The projects that MERS are planning to undertake are very closely related to many of the projects underway within the other three organizations and I truly believe each one of these groups can only benefit by working closely together. Because much of the work that is currently being done within MERS is related to photo identification, attempting to encourage CCG employees to take and send in photos whenever possible, will be an important aspect of my workshop.

Cetacean Identification Skills and General Marine Mammal Knowledge

One aspect of CCG knowledge that I felt was important to examine was their ability to identify different species of marine mammals that they are likely to encounter off the coast of B.C. This knowledge would help to ensure that I was able to develop a workshop at the appropriate level for this audience and that I wasn’t assuming they had, or did not have, a particular level of identification skills. It would be easy to assume that because they see many of these animals on a regular basis, they must be familiar with certain species, when that may, in fact, not be the case. I also opted to examine whether or not the identification skills they presented matched their level of confidence in knowing what they were looking at. This would be useful information to pass along the BCCSN to give them an idea of the confidence they could put in sightings reported by this particular sector.

I chose to design the identification questions in such a way that I would be able to gain insights into their ability to identify both commonly seen, and not-so-commonly seen, species. Some of the most commonly encountered cetacean species along the west coast of Vancouver Island include the Gray whale, the Humpback whale and the Dall’s porpoise. All three of these species have distinguishing characteristics that make them relatively simple to identify, provided you know the specific features to look for. If you are not aware of those tell-tale features, they can be quite tricky.
One example of this is that Dall’s porpoises have a small, triangular black fin which can be easily confused with harbor porpoises, and they kick up a distinctive splash when they swim at fast speeds. This splash however can be confused with that of Pacific white-sided dolphins. Dolphins do not have triangular fins though and harbor porpoises do not kick up the distinctive splash, so I chose to use a photo that showed both the triangular fin and the distinctive splash (Fig. 12).

![Dall’s Porpoises](image)

Fig. 12: Dall’s Porpoises.

I did this knowing that if they didn’t know specific features to look for, they would have a difficult time determining what they were looking at in the photo. 47% of respondents got this particular question correct which indicates that almost half of the bridge crew employees know what they are looking for to identify a Dall’s porpoise.

For the Gray whale and humpback whale, I chose to use photos that were not of great quality, but that showed the distinctive features necessary for positive identification. Humpback whales have a distinct chunky dorsal fin (Fig. 13) and gray whales do not have dorsal fins at all. Instead they have a series of knuckle shaped bumps along their spinal ridge (Fig. 14).
Fig. 13: Humpback Whale.

Fig. 14: Gray Whale.

64% of respondents were able to correctly identify the humpback whale and 58% were able to correctly identify the gray whale. One interesting finding was that several people (35% of respondents) mistook the Gray whale as being a Humpback whale. It seems that they may be confusing the two most commonly observed large whale species off the west coast of Vancouver Island. This is potentially very important information for the BCCSN and may contribute to the error estimates within their data.
When it came to the two less common species, the results of the identification tests were quite different from each other. Again, both Risso’s dolphins and Northern right whale dolphins are extremely distinctive, if you know what specific features to look for. Risso’s dolphins are light to dark gray in colour and have lots of scratches covering their backs and dorsal fins (Fig. 15). There is really nothing else in this area that looks like these animals do. Northern right whale dolphins are almost entirely black and have absolutely no dorsal fin (Fig. 16).

Fig. 15: Risso’s Dolphin.

Fig. 16: Northern Right Whale Dolphins.
When it came to identifying the Risso’s dolphin 68% of respondents did this correctly. Out of the five cetacean species presented, respondents scored the highest on this particular species. It is interesting that they would score so high on a species that is so rarely observed; however, it is extremely distinct. In the case of the Northern right whale dolphins however, the results were quite different; only 27% of respondents were able to correctly identify this species, the lowest proportion of correct responses. Many people got this one confused with Dall’s porpoises and Harbour porpoises, both of which have triangular dorsal fins and neither of which jump clear out of the water as the Northern right whale dolphins are doing in the picture presented (Fig. 16). It is not too surprising that a large number of respondents did not get this identification correct as it is not a commonly seen animal and I would therefore not expect most CCG employees to know what distinctive features to look for.

In addition to testing respondent’s abilities to correctly identify cetacean species, I also wanted to determine whether or not there was a significant relationship between the respondent’s confidence and their likelihood of correctly identifying a species. In order to do this, I used VassarStats (http://faculty.vassar.edu) to run a series of t-tests. A t-test is one of the most commonly used statistical tests for comparing two samples (Xue & Titterington, 2011). With these t-tests I was able to compare the mean values of correct responses in those who were confident that they got the question correct and those who were not confident.

The null hypothesis, that there was no difference in correct responses between those who were confident and those who were not confident, was rejected for two identification questions but was not rejected for three (Table. 1).

<table>
<thead>
<tr>
<th>Species</th>
<th>Confident (Mean score)</th>
<th>Not Confident (Mean score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humpback whale</td>
<td>0.75</td>
<td>0.39 **</td>
</tr>
<tr>
<td>Dall’s porpoises</td>
<td>0.59</td>
<td>0.33 *</td>
</tr>
<tr>
<td>Risso’s dolphin</td>
<td>0.68</td>
<td>0.68</td>
</tr>
<tr>
<td>N. right whale dolphin</td>
<td>0.30</td>
<td>0.20</td>
</tr>
<tr>
<td>Gray Whale</td>
<td>0.61</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Table 1: Comparison of correct responses for confident and not confident respondents.  
** = p< 0.01, * = p< 0.05
This indicates that when it comes to humpback whales and Dall’s porpoises (two commonly seen species in British Columbia) respondents who are confident are more likely to correctly identify the species than those who are not; however, for Risso’s dolphins, Northern right whale dolphins and Gray whales, respondents who are confident in their identifications are no more likely to get the correct answer than those who were not confident.

It is interesting to note that for two of the most commonly observed species on the coast of BC (Humpback whales and Dall’s porpoises), confidence does increase probability of a correct response and that for two of the very rare species on the coast (Risso’s dolphins and Northern right whale dolphins), it does not. What is also very interesting is that for the gray whale, which is a species commonly seen along the coast as well, confidence is not related to a correct response.

This has been interesting information to pass along to the BCCSN since they ask people to include a confidence rating when they submit their sightings. It will be useful for them to know that when members of the CCG bridge crew indicate they are confident about reporting these species, that does not mean they are any more likely to be correct than those who are not confident about their identifications.

In addition to the questions pertaining to species identification, I also included a few questions within my survey that were designed to examine the general marine mammal knowledge level of the CCG crew. The rationale behind asking questions concerning general marine mammal knowledge was that it would give me an idea of the background knowledge level at which to gear my workshop. It is important to have a clear idea of a starting point when developing a workshop such as this one. I did not want to forge ahead with marine mammal education if my audience was not aware of what a mammal even was. I also did not want to assume that my audience already knew the differences between resident and transient killer whales or what the largest whale in BC waters is; however, I also didn’t want to assume they didn’t, as this might be taken as an insult.
I asked questions about the diet of transient and resident Killer whales (the two most commonly observed types in BC), the largest species of marine mammal encountered in BC waters, as well as a question about the characteristics of mammals in general. What I found was that 67% of respondents did not know what the defining characteristics of a mammal were (Fig. 17) and 42% were not aware that the Blue whale is the largest cetacean species encountered in BC waters (Fig. 18).

Fig. 17: Which of the following is not a characteristic that all mammals share? (Correct answer in red).

Fig. 18: What is the largest whale in BC? (Correct answer in red).
It was not too surprising that many of the respondents didn’t realize that having hair at some point during development was a characteristic that all mammals shared. This is something that would be easy to overlook when talking about marine mammals, many of which have little or no hair as adults. It did surprise me however, to see that only a little over half of respondents were aware that blue whales are the largest species to be found off our coast, although since they are quite rare in this area and difficult to find, the fact that most crew members have likely never seen a blue whale may be a contributing factor to this. What is really surprising is that not a single respondent chose Fin whales for the largest species. If they had known that blue whales were the largest in the world, but simply were not aware that they were found off our coast, I would have expected a higher rate of Fin whale responses to my questions, being that they are the second largest whale in the world and considered to be quite common along the coast of BC.

I also found that 53% of respondents did not know what the most common prey source was for resident Killer whales (Fig. 19) and 52% did not know what the most common prey source was for transient Killer whales (Fig. 20).

Fig. 19: What is the main food source of resident killer whales? (Correct answer in red).
It surprised me that less than half of respondents were able to correctly identify the main diet of resident and transient Killer whales. Since diet is the main feature that separates residents from transients, this information leads me to believe that over half of the participants are not sure of the differences between these two killer whale ecotypes.

**Demographics of the Research Audience**

The demographics section of my questionnaire allowed me to determine that 90% of my research audience was male (Fig. 21), the majority of them (85%) have at least some college or university education (Fig. 22) and 73% of them have spent upwards of ten years at sea (Fig. 23). All three captains that I interviewed were male and all of them had been working for the coast guard for more than 20 years.
Fig. 21: Gender

Fig. 22: Highest level of education completed.
I was also able to get an idea of the range in ages of my target audience. I found that there is quite a large range in ages of the crew, but the majority of them (92%) are over the age of 25 (Fig. 24).

These questions could be used to analyze whether or not factors such as age, educational background, gender and years at sea influence an employee’s marine mammal knowledge, their ability to identify different animals, and their awareness of existing conservation programs. This information,
however, would be irrelevant to the design of this workshop since I will not have the opportunity to tailor the workshop to different audiences within the CCG. Instead, the purpose of the demographics section was to allow me to get to know my audience better before beginning the workshop design.

This type of information is very important when putting together a workshop and attempting to determine what type of approach my audience is most likely to respond to. Bentley, Tinney & Chia (2004) recognize that “When people's educational values match those embedded in the course, the match-up contributes to their perception of it being a quality educational experience” (p. 19). In this particular situation it will be important for me to acknowledge that these are people who have a great deal of experience in the marine environment and although they may not have extensive marine mammal knowledge, I will need to respect what they do know. It will also be important to keep in mind that these are educated people who understand at least the basics of science.

Based on the information gathered about the demographics of my audience, I determined that the best way to approach the workshop was to frame it as the organizations involved wanting to tap into their immense knowledge of this environment. I felt the best strategy would be to attempt to make them feel empowered to use their unique knowledge and experience to contribute to important initiatives that will help protect the environment that they are so connected to and dependent upon.

**Interest in Workshop Participation**

Because the overall intent of this project was that I would end up with a workshop that I could offer to professional mariners, an important part of my research was to assess whether or not there would be a high level of interest in this final course I was developing. There would be no point in spending time and resources to put together such a workshop, if there was no interest on the part of the CCG in participating in it. Due to previous discussions with CCG personnel I was aware that the Pacific Fleet has a CCG training week every year in October where each individual is able to choose different courses that they wish to take. Because of this, it was important for me to get an idea of not
only management’s interest in offering this course during training week but also to determine whether individuals would opt to take it if offered.

In order to assess this level of interest, I included the question “If there was an opportunity to take a one day training course to learn more about marine mammals in British Columbia, how interested would you be in participating?” within my survey. I also asked the captains, during our interviews, how interested they thought their crews would be and if they would recommend that their crews participate in such a workshop.

Overwhelmingly, I received a positive and encouraging response to this question. 95% of survey participants indicated that they would be interested in taking such a course (Fig. 25) and all four captains indicated that they felt there would be a high level of interest from their crews.

Not only was this information encouraging as I continued to design and develop the workshop, but it will also be useful information to have when attempting to get my course added to the training week schedule. I am hopeful that I will be able to offer this workshop next October and having these results to indicate level of interest to the training week organizers will likely be helpful for implementation.
In order to give myself the best possible chance for implementation, I asked each of the captains I interviewed if they could give me some insights into how training week works and how I might go about getting this workshop added to the list of choices. Through this process I learned that there are some courses that individuals have to take each year, for renewal of essential certificates etc.; however, once they have met the requirements, they are then just able to take whatever interests them the most. One captain suggested to me that I should try to do a lunch time presentation at one of the training week sessions in order to fuel interest in the workshop. He indicated that lunch time would be a time when there would be a captive audience and that by piquing their interest during this period, I would be more likely to get a high enrollment rate in the workshop I was offering. I found this to be an excellent suggestion and something I will certainly bring forward when discussing my workshop with training week organizers next year.

Workshop Design

Once I had gathered and analyzed all the information from my questionnaire and interviews and completed a needs analysis and task analysis (important steps in the ADDIE process), it was time to get to complete the design phase of my workshop (Appendix 3). I used the information gathered to help me identify some important learning outcomes and from here I was able to launch into a concept plan for how the workshop would look. The concept plan carefully followed each of the learning objectives and I tried to include PowerPoint presentations and local stories, combined with interactive activities for each section of the workshop. My overall design allowed for each component of the workshop to work as a stand-alone presentation that could be easily adapted when added to other components. The reason for designing the workshop this way was that it will make it easier to use components for various different workshops and presentations for a variety of audiences. For example, if a group asks me to come and do an hour long presentation for them about marine mammal identification specifically, I can use this single component of the workshop; however, if someone wants me to come and do a half day
workshop about marine mammals in BC, I can combine several components to create this half day workshop.

**Recommendations to Organizations Involved**

In addition to helping to guide my workshop design, a major objective of this research project was to provide the organizations involved with feedback about what they can do to increase interest and participation within their programs. The questionnaire responses, the interviews with captains and my background research on effective citizen science projects all provided me with some interesting insights that I was able to pass along to these organizations.

The first significant lesson that I learned during my literature review was how important it is to have a good website available for prospective participants. Websites that allow participants to enter their data efficiently, learn about the projects they are contributing to and see what their data was being used for, are shown to be the most effective (Bonney et. al. 2009).

Because the CCG is often in areas where there is not reliable internet access (hence the requirement of a paper survey), simply having a great website set-up will likely not be enough to adequately encourage participation. I still recommended that these organizations work on effective websites that meet these requirements, due to the fact that there will be several other target audiences who would likely appreciate such a website, and because there are many times when the CCG does have internet access while at sea. The BCCSN has a comprehensive and informative website that allows participants to report their sightings and learn all about the animals they are reporting ([www.wildwhales.org](http://www.wildwhales.org)). They also have a system in place to provide participants with timely feedback about the sightings that they contribute; however, often within the CCG, employees will record their sightings in the log book which does not allow for any kind of timely feedback on what they have reported. If logbooks are only turned in once a year, participants may have been transferred to a different ship before the ship gets confirmation or thank you notes about the information they have contributed. This is the type of thing that should be considered when thinking about incentives to
encourage participation. Perhaps there is a way that the sightings logs could be set up as a type of competition where individuals were recognized for their contributions rather than just the ship being recognized.

Another enlightening bit of information that I came across during my research was that interactions with marine mammal scientists can really spark enthusiasm within this sector. During my interviews with Captains A, B and C, all three of them mentioned having worked with the two prominent scientists from the Department of Fisheries and Oceans (DFO) on marine mammal work and all three of them indicated that these were the times when they had their most memorable encounters with marine mammals. Captain B also mentioned how much more interesting his time at sea is when there are people on board who have a keen interest in marine mammals and Captain C told me that he felt re-energized and excited to get involved again just by talking to me during the interview. This is very important information that I was able to share with the organizations involved. Based on the information obtained during the interview process, I believe that if our organizations and the marine mammal scientists are able to maintain regular contact with the CCG crews, we are more likely to get continued participation within our programs. This contact could be in the form of presentations to crew members, mail out packages with new and exciting information or even periodic phone calls to the ships captains.

Furthermore, my research indicated the importance of appropriate feedback to participants. In the examples of successful citizen science projects, one thing they shared was that participants were able to see exactly where their information was going to and what types of things it was being used for. This is something that could be greatly improved within marine mammal conservation programs. This may require some creative considerations to achieve, especially with crews such as the CCG, who do not always have a reliable internet source. Thinking about how to get them involved and to provide the feedback necessary to hold their interest will be an interesting challenge. After speaking with the captains, I believe the best way that we can go about this is to make them feel like they are involved in
what is happening with the data and that they feel like they are ‘in the loop’. Captain C mentioned to me that he was once tasked to respond to a dead humpback whale and to collect blubber and skin samples as well as photographs to send to the DFO. He indicated to me that he and his crew were somewhat disappointed that they never found out what the results were from tests done on those samples. This is something that would be easy to overlook, especially in circumstances where the results of the tests are inconclusive or do not show anything dramatic. This is where I think having a system in place to ensure the details are forwarded along to those involved in the response would be very useful. It could be something as simple as an e-mail that thanks them for responding and explains where the samples were sent, what kinds of tests were run and what the results were. Based on my discussions with these captains, I believe that this type of feedback would make it seem more worthwhile for people to participate.

In terms of encouraging participation in following the ‘Be Whale Wise’ guidelines, things are a little trickier. This is one area where I feel the workshop can provide extremely relevant information. Research shows that people are more likely to follow rules if they understand the reasoning behind them and believe the rules are moral and just (Tyler, 2006). My job within the workshop will be to explain the reasoning behind the current guidelines and convince my audiences that this reasoning is just. There is ample research to suggest there are negative impacts on the whales when these guidelines are not followed (Erbe, 2002; Williams, et. al., 2002a; Williams, et. al., 2002b). If I am able to get these messages across within the workshop and make a powerful case for why it’s important to give them their space, my audiences will likely be much more willing to comply.

One final recommendation that I was able to make to the organizations involved was that it would be useful to provide these CCG ships with reference guides and other visual resources that would allow the crew to learn more about the animals that they are seeing. Since the majority of respondents indicated that they would be most likely to use books on board the ship to find information about wildlife, I think providing them with a series of such references that they could use would
increase their participation and interest in these animals. I recommended that we work together to
develop a resource package that can be given to each ship when they participate in my training
workshop, which could include things such as ID guides, a dichotomous key to help identify species,
photos and stories about local animals and information about the programs we are hoping for them to
contribute to.

**Implications and Final Thoughts**

The implications of this project have been, and will continue to be, far reaching within the
marine mammal conservation community in British Columbia. As a result of this project, existing
relationships have been strengthened and more distinctly defined, and new relationships have begun to
be established. The four organizations outlined in this document have worked closely together to
ensure the success of this project and to collaborate on how best to combine our resources to reach the
widest audiences possible. As I began this project and began asking members of the participating
organizations to contribute to what I was attempting to do, a meeting was organized between the
BCCSN, the BCMMRN and Cetus to discuss our outreach efforts and how we could make them more
effective. As a result of this meeting, and collaborative work from all three of the organizations, we
were able to develop a one-page (double-sided) document which combines the essential information
from each of the organizations in a single paper that we have already begun to distribute to coastal
communities across BC.

In addition to the strengthening of relationships and collaborations, I have also been able to
provide valuable feedback to the organizations involved, about how to work towards increasing
participation within their programs. Some of these recommendations have already begun to be put into
place and the organizations all seem keen to work with me further regarding my findings.

The implication of this project of which I am most proud, is that I was able to use the
information I collected to design and begin to develop on a two-day workshop that can be used and
adapted for various audiences wanting to learn more about marine mammals on the coast of BC.
In addition to the effects this project has on the conservation organizations and the environment they are working to protect, there will also be significant implications for the CCG employees. The crews of these ships spend great portions of their working hours on or near the ocean and, as such, have an incredible opportunity to observe marine wildlife on a regular basis. Having a better understanding of what they are seeing and knowing that they are contributing to the protection of these animals is sure to enrich their on-the-job experiences.

**Future Research**

Although this research was able to shed some light on barriers inhibiting greater CCG participation within these programs, incentives that could lead to increased participation and the level of marine mammal knowledge within this sector, further studies could help to illuminate other important aspects of professional mariner contributions. It would be interesting to replicate this type of study within various different professional mariner communities to determine what, if any, differences exist in knowledge, participation and perceived incentives.

In addition to this, I would recommend that further research delve into this issue of confidence versus accuracy when identifying species. It was interesting to discover that with certain species, confidence does not indicate a greater probability of a correct response and further research into this phenomenon may help organizations concerned with citizen science to develop more effective error models and overall more effective citizen science projects.
References


Appendix 1

Dear Survey Participant,

My name is Leah Thorpe. I would like to invite you to participate in a research project that I am conducting as part of the requirement for a Master’s Degree in Environmental Education and Communication at Royal Roads University, Victoria, Canada. My credentials with Royal Roads University can be established by contacting the Director of the School of Environment and Sustainability at Royal Roads University, Dr. Tony Boydell. Further questions can also be directed to my thesis supervisor Rod MacVicar.

Every day Canadian Coast Guard ships spend time off the Pacific coast of Canada, often in areas where there are few other ships present. In the course of their regular duties, many crew members have opportunities to observe marine mammals (whales, dolphins, porpoises, seals, sea lions and otters). These observations, if regularly reported, can form important additions to scientific knowledge of these animals and their distributions. In addition to this, crew members also have a unique opportunity to be involved with other marine mammal conservation programs along the Pacific coast.

The objective of my project is to better understand the current participation level of Canadian Coast Guard personnel in existing marine mammal conservation programs and also to assess basic knowledge of these animals and their ecosystems. The purpose of this assessment is strictly to aid me in developing an appropriate workshop aimed at increasing knowledge and participation of professional mariners within these important programs. Your assistance with my research would be very much appreciated!

If you are willing to participate in this study, please complete the following survey. This survey will take approximately 15-20 minutes. Upon completion please return your survey to your captain. At this point you may also enter to win a one day sailing trip around Newcastle Island (including lunch) or a $50 Mountain Equipment Coop gift card! To enter please detach the section on the last page of the survey, fill it out with your name and contact information and return it to your captain. As these entry slips will be collected separately there will be no way to connect the information given for the draw to your particular survey. Surveys will remain anonymous.

By participating in this survey you are indicating that you give free and informed consent to participate in the project. If at any time you wish to withdraw from the survey you may do so freely.

Please feel free to contact me at any time if you have additional questions regarding the project and its outcomes.

Sincerely,

Leah Thorpe.
Appendix 2

Interview Guide:

1) What is your position within the CCG?
2) Can you give a brief overview of what your position entails?
3) Have you ever taken a course or attended a workshop or seminar related to marine mammals?
4) If so was this through work or something separate?
5) If so can you give me some details? When was it? Who put it on? Did you enjoy it? Etc…
6) What type of marine mammal training is normally given to CCG employees?
7) Is this training dependent upon their position on the ship or does everyone get the same training?
8) How often do you see marine mammals while working?
9) Tell me about your most memorable encounter with a marine mammal. This doesn’t necessarily have to be during work time.
10) How familiar would you say you are with marine mammal conservation programs along the coast? Eg. BCCSN, Cetus, MMRN etc.
11) Do you have a cetacean sightings log book on board?
12) If so, how often does it get used?
13) What, in your opinion is the biggest challenge to getting involved with some of these programs? Is it a lack of time, a case of people not feeling like they know enough about the subject etc…?
14) What do you think could be changed to help get employees more involved? For example would incentives help? workshops to teach people about these animals and how to identify them, interesting stories about individual animals…? Etc..?
15) Have you ever been involved with a marine mammal rescue of any type?
16) If so please explain what happened. Did you make the call? Who did you call etc…?
17) Have you ever seen whales that were entangled in fishing gear?
18) Have you ever experienced marine mammals stealing fish off lines etc?
19) If it was up to you and there was a one day workshop available to teach you and your colleagues about these animals and how to get involved with the programs would you be interested in attending?
Appendix 3

Analysis Phase:

Needs Analysis:

- **Who is the target audience?**
  - Professional Mariners
    - Canadian Coast Guard
    - Canadian Navy
    - BC Ferries employees
    - Fisheries officers
    - Kayaking guides
    - Whale watching guides
    - Marine RCMP

- **What is the problem or challenge?**
  - There are several organizations in BC focused on marine mammal conservation; however, funding within these organizations is often limited making programs challenging to maintain. Professional mariners spend a great deal of time on the water and have the potential to be important contributors to these efforts. Because they are on ships which are sharing the waters with marine mammals, these professionals also have the ability cause disturbances to these animals. By participating within conservation efforts, professional mariners can lessen their impacts and contribute to the preservation of these species.
  - Many individuals within these sectors and organizations do currently participate in several of these conservation initiatives; however this participation, overall could be much better. The problem seems to lie in the fact that knowledge and understanding of marine mammals and the threats facing them is limited.
  - Many marine mammal populations on the coast of BC are threatened or endangered.

Task Analysis:

- **What can be done to address this problem?**
  - Increase education about marine mammals.
  - Two day workshop could help to address gaps in knowledge and understanding and increase interest in participation within marine mammal conservation programs.
  - First I must attempt to identify current barriers to participation and also what aspects of the work environment are successful in fostering this kind of participation.
  - This program will need to incorporate different learning styles as we are targeting individuals from a variety of backgrounds, education levels etc.
  - Should use a combination of audio/visual, hands on, and presentation style activities.
- This program will need to be sensitive to the fact that the audience is composed of people who have important jobs that take precedence over participation within marine mammal programs.
- This program should incorporate a sense of place to help the audience connect to the particular environment in which they work.
- The program will need to address concrete actions that audience members can take to protect these species and their environment (i.e. convince them it is worth their time to participate).
- It will have to give mariners a sense of empowerment and will have to capture their interest and attention.
- It will be important to explain why their unique position makes them particularly important to this type of work.

• **Details:**
  - Final product = 2 day workshop with separate-able/adjustable components which will allow for it to be adapted into 1 day or half day workshop as well.
  - Designed for group size of 10-30 people.
  - 1 instructor.
  - Potential for 1-2 guest speakers depending on time frame of workshop and audience involved.

• **Survey and Interviews for Analysis:**
  - Will help to assess prior knowledge of the specific target audience.
  - Will help to identify where there are gaps and what some of the perceived challenges are.
  - Will help to understand the demographics of the target audience.

**Design Phase:**

**Learning Outcomes:**

1. Students will be able to identify different species of marine mammals commonly seen off the coast of BC from memory. Students will be able to identify less common species using ID guides.
2. Students will understand Be Whale Wise marine mammal viewing guidelines and understand the science behind the development of them.
3. Students will understand how their unique position makes them important assets to these programs.
4. Students will learn about the history of ID work and understand its merits.
5. Students will understand the threats associated with entanglement of marine mammals and how to recognize signs of it.
6. Students will understand other major threats to marine mammals and how they can help with these issues.
7. Students will understand marine ecosystem dynamics and how everything is connected and affected by everything else.

**Concept Plan:**

**Intro:**
- Introduction to myself, who I work for and why I am doing this.
  - Brief into to Cetus and how long I have been working for them for.
- Introduction to world’s oceans
  - 70% of earth’s surface is covered by water
  - 97% of that is fresh water
  - Algae supplies the earth with 50% of total oxygen.
  - Etc.
  - Know more about the moon than we do about our own oceans. Final frontier…
- Overview of what the workshop will include and timeline.
- What I hope for them to have learned by the end of it and what they should expect to get out of it.

1. **Students will learn to ID different species.**
   - Presentation on the variety of species present off the coast of BC.
   - Slides explaining how to tell marine mammals apart using different features.
     - Blows
     - Tails
     - Surfacing patterns
     - Seal vs. sea lion differences
     - Dolphin vs. porpoise differences.
     - Baleen whales vs toothed whales.
   - Hand out ID guides and play the “What species am I” game.
   - End the session with a quiz. Hand out blank pieces of paper. Play clips and show photos of different animals and have them write down answers. Go through clips and photos one more time and have them mark their papers and hand them in. Can remain anonymous.

2. **Students will understand Be Whale Wise guidelines and recognize their importance.**
   - Play Andrew’s video. (youtube video we are working on addressing the struggles whales have with “paparazzi” type boaters.)
   - Sound demonstration of whale calls and boat noise underwater.
   - Discuss unique behaviours such as prey sharing.
   - Discussion about depredation, what it is, why it’s a problem, how we can help avoid this.
   - Review of Straitwatch statistics (# of incidents etc.) to show how it is a cumulative impact issue.
- Slide show of animals that have been struck by boats, stories of individuals (A60, X22’s calf from 2006) and the outcomes. How can we help avoid this.
- Introduction of the whale watching flag.
- Distance activity using tape measures and/or laser range finders

3. **Students will understand why they are in a unique position to help out.**
   - Draw attention to the fact that they are often in areas where there are no other boats present.
   - Next time you see something interesting like a whale, look around and see if there is any other boat nearby that is likely to report this sighting. If not, researchers have no idea the animal was there.
   - Go through Caitlin’s and Lisa’s stats about total sightings of rare animals and that the coast guard has contributed the largest number of leatherback sea turtle observations as an organization.
   - Stress how little we know about some of these rare animals because of how rarely they are observed.

4. **Students will learn about the history of ID work and understand its importance.**
   - Start with presentation on Mike Bigg and how his ID work likely saved killer whales on the coast of BC.
   - Discuss what we have learned since then about killer whales from this work.
     - Family structure
     - Diet
     - Stories about Springer and Luna
     - Story of A12 and the 36 boys!
   - Current work on Humpback ID.
     - Story of Houdini and other HB’s in the area. What we are starting to learn about them.
   - Hand out humpback fluke ID worksheet or have them play the “Who Am I” matching game.

5. **Students will understand the threat of entanglement and learn how to recognize signs of it.**
   - Powerpoint presentation
     - Overview of the threat
     - Stress how little we understand about the problem but possibilities of consequences at the population level.
     - Discuss research being done on the east coast.
     - Show slides that illustrate how something that looks minimal from the surface can be so much worse viewed from underneath.
     - Discuss the importance of reporting incidents, even if it is unlikely that anything can be done.
     - Tell the story of Twister and other HB’s disentangled on the coast.
- Discuss the proposed scar study and how this can help.

6. **Students will understand other major threats to marine mammals and how they can help reduce these threats.**
   - **Presentation**
     - Discuss concept of “death by a thousand cuts”. These animals face challenges at every turn. Let’s work on addressing some of the ones that we can most easily tackle.
     - Overview of threatened/ endangered marine mammal populations in BC.
     - Discuss pollution problem.
       - Bioaccumulation
       - Garbage (plastics)
       - Pesticides and Fertilizers (PCB’s, PBDE’s)
       - Invasive Species
       - Exhaust (Cara’s Thesis)
     - Strandings
       - Not sure why they happen
       - Discuss the importance of the MMRN
     - Food Supply
       - Overfishing- Seafood watch program, Oceanwise.
     - Ship Strikes, Noise pollution (distraction from important activities)
       - Photos and stories of animals that have been hit
         a. A60 (Importance of photo ID)
         b. Houdini’s 2006 calf.
         c. Fin Whales (Finny etc.)
         d. UBC Blue Whale.

7. **Students will understand marine ecosystem dynamics and how everything is connected.**
   - Web and string activity
   - Idea of iron fertilization of the oceans.
   - Presentation about Steller’s Sea Cow, sea otter, urchin, kelp relationship and how quickly the sea cows became extinct.
   - End with the idea of telling our grandchildren about amazing animals called killer whales that used to exist.
   - Finish off the day with a three minute slide show of marine mammals and beautiful scenery in BC to music (powerful song of some sort.)