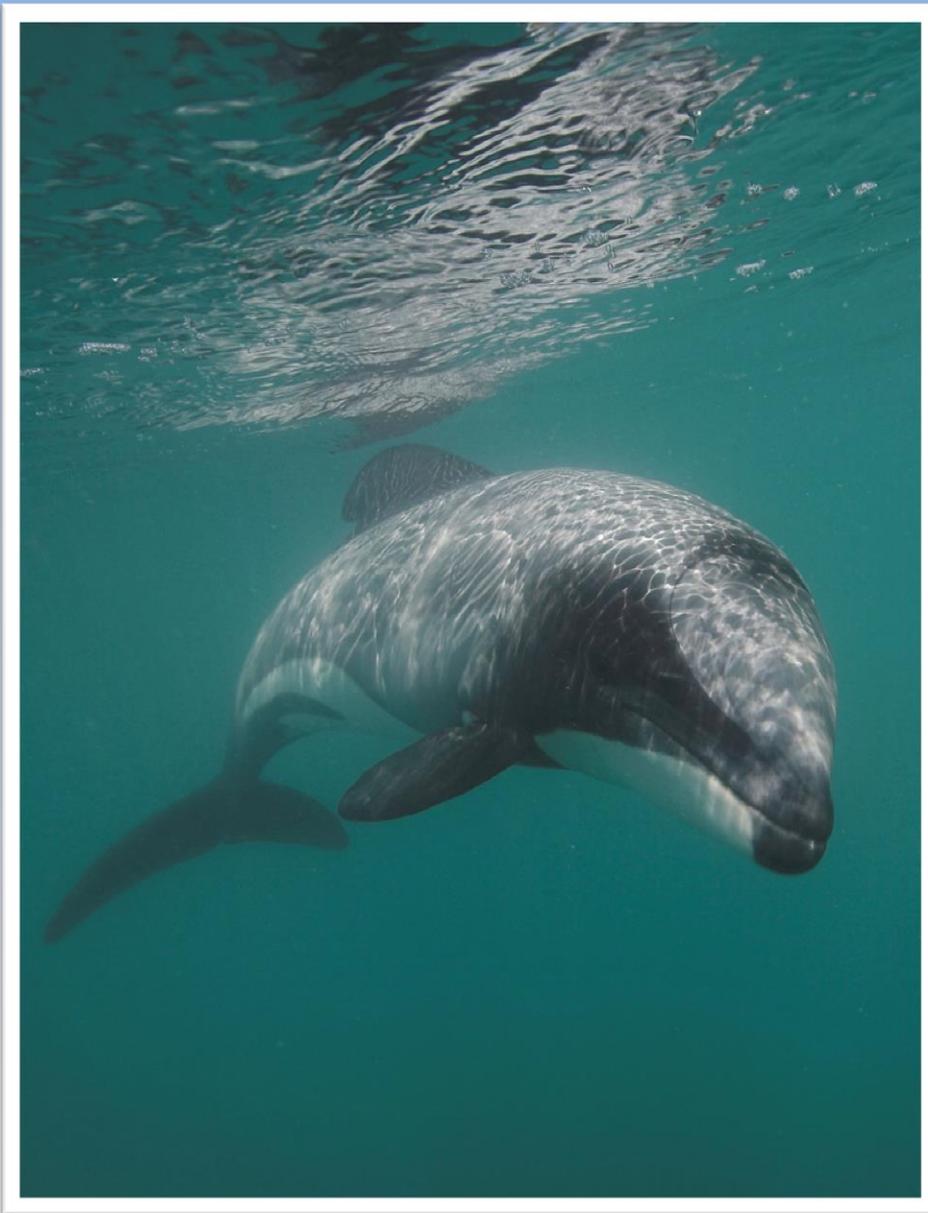


A Species at Risk:

Raising Awareness About the Critically Endangered Maui's Dolphin



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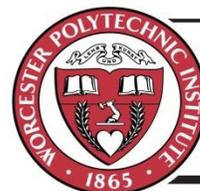
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March 7th, 2014

Project Sponsors:



Department of
Conservation
Te Papa Atawhai



WPI

A Species at Risk:

Raising Awareness about the Critically Endangered Maui's Dolphin

An Interactive Qualifying Project Report

submitted to the Faculty of

Worcester Polytechnic Institute

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

in cooperation with

The New Zealand Department of Conservation

Submitted on March 7th, 2014

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This report represents the work of four WPI undergraduate students submitted to the faculty as evidence of completion of a degree requirement. WPI routinely publishes these reports on its website without editorial or peer review. For more information about the projects, please see <http://www.wpi.edu/Academics/Project>

Abstract

The New Zealand Department of Conservation's protection of the critically endangered Maui's dolphin (*Cephalorhynchus hectori maui*) depends heavily upon citizens reporting sightings. Our surveys established that lack of knowledge about the dolphin prevents all but 5% of residents from reporting sightings. To correct this deficiency, we drew on those findings to design improved educational materials and a conceptual smartphone application design. We produced two posters, a bumper sticker, and a tackle box sticker promoting the Maui's dolphin and DOC's reporting services. We evaluated them at Seaweek in Auckland.

Executive Summary

Background

The Maui's dolphin is one of the many critically endangered species endemic to New Zealand with only 55 adults remaining in the wild. The species' population can only sustain one human-induced death every 10-23 years, but the current rate is 5.27 human-induced deaths per year (Currey et al., 2012). If the number of Maui's dolphin deaths caused by human interactions does not decrease, it is likely that the species will be extinct by 2025.

Since trawl fishing and set net fishing are the primary threats to Maui's dolphins, the species' population will not be sustainable until the extent of the dolphins' range is protected. In 2003, the first ban on set net fishing was placed on the west coast of the North Island. Since then, the original ban has been extended and most recently, in November of 2013, the New Zealand Government extended the fishing ban under the Maui's dolphin Threat Management Plan. Extensions to existing fishing bans are controversial because conservationists urge more protected areas, while fishermen argue that fishing bans affect their livelihoods. With the controversy surrounding protected areas, Conservation Minister Nick Smith is hesitant to extend the fishing bans without evidence of the species' range.

DOC has been working to protect the Maui's dolphin since it was discovered as a subspecies of the endangered Hector's dolphin in 2002. A concrete understanding of the species' range would allow DOC to recommend effective legislation aimed at protecting the species' entire range. DOC relies heavily on publicly reported sightings to learn more about the extent of the Maui's dolphin's range. DOC's system is undermined by the low frequency of sighting report submissions, in part because of the small population size of the dolphin, but also because of a lack of public knowledge about the Maui's dolphin and related reporting services.

Goals, Objectives, and Methods

The ultimate goal of this project is to help the New Zealand Department of Conservation raise awareness about conservation efforts to protect the Maui's dolphin (*Cephalorhynchus hectori maui*) through providing recommendations for creating effective educational resources and by utilizing available technology to increase the frequency of

sighting reports. In order to accomplish this, our team conducted background research and surveyed 384 respondents at several locations in Whanganui and Wellington. Our surveys established that lack of knowledge about the dolphin prevents all but 5% of residents from reporting sightings. Figure i outlines the process by which we progressed from objectives to data collection and analysis to recommendations.

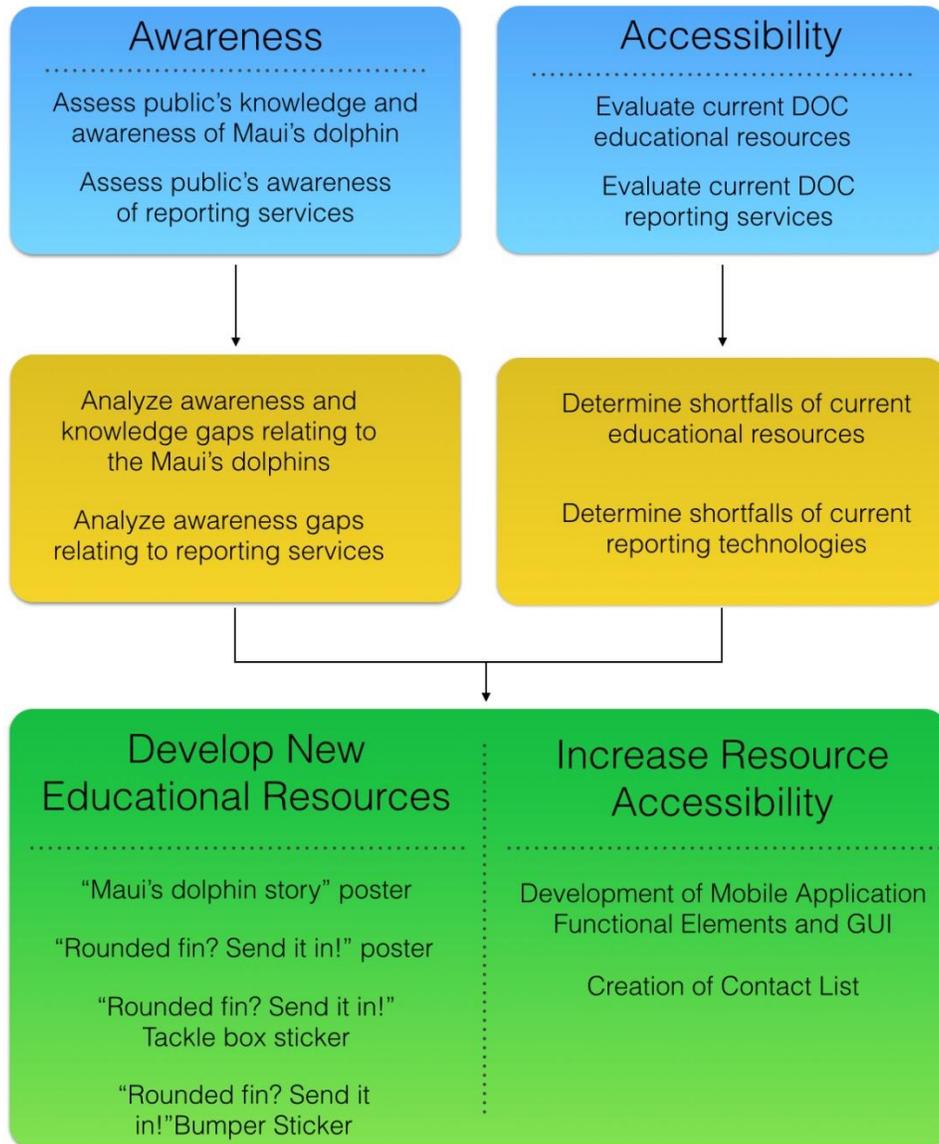


Figure i: Methodology employed to fulfill our project recommendations and deliverables

The blue boxes at the top of the figure represent the information we needed to assess and

evaluate before moving forward with our project. We determined this information by following the methodology shown in the yellow boxes. Once we analyzed the resulting data, we were able to make recommendations to DOC regarding new educational resources and resource accessibility, as shown in the green boxes. Our recommendations were formed based on data analysis. These recommendations included the development of two posters, a bumper sticker, and a tackle box sticker, as well as the design of a smartphone application and creation of a contact list.

The three project objectives that helped us arrive at our final recommendations are as follows:

Objective 1: Assess and evaluate public awareness and knowledge of the Maui's dolphin and available sighting report services

Our first objective was to establish what the public already knows about the Maui's dolphin. To assess this, our survey included a question asking respondents if they had ever heard of the Maui's dolphin. If the respondent was aware of the dolphin, they were asked several questions probing for specific knowledge about the species' population status, home range, and identifying characteristic. This information would ultimately be used to form our recommendations concerning the content of educational resources.

The second part of this objective was to determine if the public knows that DOC has services to report Maui's dolphin sightings. To assess this, our survey asked respondents who were aware of the dolphin whether they knew that DOC had services to report Maui's dolphin sightings. This information would also be used to form recommendations about the content of educational resources.

Objective 2: Recommend approaches to raise awareness about the Maui's dolphin and sighting report services

Survey data was analyzed for insight into topics such as public awareness and knowledge of the Maui's dolphin, public knowledge of available sighting report services, and the most prominent sources used by the public to obtain information on the Maui's dolphin. In recommending approaches for raising awareness about conservation efforts to protect the Maui's dolphin we also consulted with DOC employees and had several correspondences with primary

and secondary educators from the west coast of the North Island regarding the extent to which Maui's dolphins are covered in school curriculums. We also observed public reactions to proposed educational materials at Seaweed in Auckland.

Objective 3: Improve accessibility of resources available to the public

Our third objective was to utilize available technologies to facilitate the sighting report process. We began by assessing DOC's current services for reporting Maui's dolphin sightings including the online report form and the DOC HOTline. We also discussed the possibility of a smartphone application at length with DOC employees. Drawing on background research and global examples including Australia's Coastal Walkabout application, we designed a smartphone application that incorporated all of the available reporting services in one user-friendly mobile interface. A graphical user interface (GUI) mock-up of the application was brought to Seaweed in Auckland so we could receive feedback from the public.

In order to improve the accessibility of educational resources we also identified local organizations for the compilation of a contact list that DOC could use to distribute Maui's dolphin information and broadcast conservation alerts. Our survey had a question asking respondents if they were a member of any water-based organizations or clubs. A preliminary list was created by compiling responses to this survey question, conducting additional online research, and emailing DOC rangers about existing contacts. We then contacted these organizations via email and phone, asking if they were interested in receiving informational materials on the Maui's dolphin for distribution to their members or visitors.

In another attempt to improve accessibility of Maui's dolphin information, we spoke with DOC employees about possible methods for reporting back to the public about conservation efforts and the significance of publicly reported sightings. Background research confirmed the importance of reporting back to participants on the significance of their efforts in furthering conservation campaigns. Discussions with DOC employees led us to make recommendations for the content of feedback material and potential vehicles for distributing the report.

Findings and Conclusions

The information gathered from conducting surveys led our team to several findings and conclusions. First, **although most respondents claimed to have heard of the Maui's dolphin,**

not many knew specific details about the species. Respondents often answered confidently that they had heard of the Maui's dolphin, but admitted that they would be guessing if they tried to answer any of the specific knowledge questions including the species' population status, home range, and identifying characteristic.

Second, of the survey respondents who knew of DOC's services for reporting Maui's dolphin sightings, very few could accurately report a sighting. Overall, only 5% of the survey sample could report a sighting because most respondents have not heard of the Maui's dolphin, are unaware of DOC's reporting services, or do not know how to identify the dolphin.

Third, older age groups (35+) were on average 27% more aware of the existence of the Maui's dolphin than younger age groups. Compared to respondents between the ages of 18 and 34, a greater number of respondents over the age of 35 reported having heard of the Maui's dolphin. Although younger generations have a reputation for being involved in conservation efforts, our survey data and background research showed that this is a common misconception. This age group could benefit from education on conservation efforts to protect the Maui's dolphin.

Fourth, respondents who have lived within 10 km of the west coast of the North Island were more aware of the Maui's dolphin and in general more knowledgeable about specific characteristics of the species than those who have never lived within 10 km of the west coast of the North Island. Most respondents who have lived within 10 km of the west coast of the North Island have heard of the Maui's dolphin. In addition, more respondents who have lived within 10 km of the west coast of the North Island were able to identify the species' population status and home range than respondents who had never lived within 10 km of the west coast of the North Island.

Fifth, few respondents aged 18 to 24 reported learning about the Maui's dolphin in a school setting. Because the Maui's dolphin was not discovered as a distinct subspecies of the Hector's dolphin until 2002, only a portion of the population surveyed could have actually learned about the dolphin in primary or secondary school. Of the respondents who could have learned about the dolphin in school, most respondents did not report having learned about the dolphin in a school setting. Although it could be a good outlet for informing a large population about the Maui's dolphin, it appears that education is not being used to its full potential.

Sixth, of the representative sample, most respondents obtained any knowledge they have of the Maui's dolphin through media, followed by education/school and word of mouth. When asked to rank the top three sources from which they obtained any knowledge of the Maui's dolphin, respondents most often ranked media either first, second, or third. Media is an outlet that reaches a large number of people with information regarding the Maui's dolphin. Contrary to our expectations, DOC publications were infrequently ranked first, second, or third by respondents. Perhaps DOC publications are not highly accessible to the general public.

Seventh, respondents who ranked media as their primary source of information regarding the Maui's dolphin were more knowledgeable about the dolphin's status, home range, and identifying characteristic than respondents who did not rank media as their primary source of information. Our findings show that media is an effective method for informing respondents about the Maui's dolphin. Because our survey did not ask respondents which form of media they obtained information about the Maui's dolphin from, a future study could determine which sources are most widely used and which sources are more effective at informing the audience.

Eighth, the representative sample believes that conservation of endemic species is significant both on a personal level and on a national level. On a scale of 1 to 5 (5 being 'most important') most respondents rated either a 4 or a 5 when asked how important saving New Zealand's native species is to them. The majority of respondents also rated either a 4 or a 5 for the importance of saving New Zealand's native species on a national level. This finding validates the significance of our project and shows that perhaps lack of public involvement in conservation efforts is not due to lack of interest, but rather another cause.

Ninth, respondents who identified as Maori ranked the personal importance of saving New Zealand's native species higher than non-Maori respondents did. This finding reveals a reason to target Maori audiences, by playing into the fact that New Zealand's native species are culturally significant to the Maori people.

Recommendations

Our findings, background research, and experiences throughout the completion of our project informed our recommendations to DOC. We strongly recommend that:

1. To increase the likelihood of sighting reports, DOC produce and distribute educational resources aimed at educating the public about the Maui's dolphin in general in conjunction with outreach material regarding available sighting report services.
2. DOC tailor the content, distribution location, and vehicle of educational resources to effectively target various audiences with information about services to report Maui's dolphin sightings and about the Maui's dolphin in general.
3. DOC distribute a "Maui's dolphin story" poster that can be used to inform the reader of the Maui's dolphin in a relatable way and gain the reader's empathy for the dolphin.
4. DOC consider targeting younger generations by providing primary and secondary school educators with Maui's dolphin information and sample lesson plans that can be included in a school curriculum.
5. DOC further inform the public about the value of reported Maui's dolphin sightings submitted through DOC's services.
6. DOC uses the slogan "Rounded fin? Send it in!" in new educational resources.
7. DOC distribute a poster featuring simple, step-by-step instructions on how to report a sighting.
8. DOC distribute a bumper sticker with the "Rounded fin? Send it in!" slogan.
9. DOC distribute to anglers a tackle box sticker with the "Rounded fin? Send it in!" slogan and more detailed instructions for reporting a sighting.
10. DOC regularly publish a newsletter to report back to the public on the importance of Maui's dolphin sightings and distribute it using an automated email, the community contact list, and a regular online publication.
11. As well as distributing educational resources at DOC Visitor Centres, DOC distribute educational materials in other locations not associated with DOC to more broadly reach the public.
12. DOC continue with the development of a smartphone application that allows users to report Maui's dolphin sightings.
13. DOC use a community contact list to spread awareness about conservation efforts to protect the Maui's dolphin and to broadcast important conservation alerts.

Conclusions

The final recommendations and deliverables produced provide an approach to educating the public about the Maui's dolphin and sighting report services using educational resources tailored to target various audiences. By effectively educating the public about both available reporting services and the species in general, DOC could increase the population that is capable of reporting a Maui's dolphin sighting. Coupled with more accessible reporting services, increasing the public reporter base through education could lead to a higher frequency of sighting report submission, thus allowing DOC to gain a better understanding of the extent of the Maui's dolphin's range. With more concrete information on the species' range, DOC will be able to more effectively propose extensions to current fishing bans. This project has implications beyond protecting the Maui's dolphin. Our methodology can be applied to develop future programs to inform the public about other threatened species in New Zealand, allowing people to participate in various conservation efforts.

Acknowledgements

Our group would like to sincerely thank the following organizations, individuals, and teams for assisting and supporting us throughout the completion of this project:

- DOC Marine Species and Threats Team for sponsoring this project.
- Ian Angus and Laura Boren for advocating for the WPI-DOC partnership and for providing the project team with important insight and guidance.
- Will Arlidge and Hannah Hendricks by providing valuable information and assisting the project team with various aspects of this project.
- Tom Lind-Jackson and the design team and Yang Gan and the publishing team, for helping the project team design and produce the posters, bumper stickers, and tackle box stickers used at Seaweed in Auckland.
- Melanie Borich for helping us understand DOC's process of designing and producing outreach material.
- Ian Westbrooke for advising us on the power of inference for our survey data and the correct statistical analyses to perform.
- Dan Hurley for guiding us around Whanganui and advising us on the best survey locations.
- Callum Lilley for assisting us in various aspects of our project, specifically in speaking with Te Reo O Taranaki Tari to approve the Māori quote.
- Stephanie Watts and Trish Irvine for providing us the opportunity to attend Seaweed in Auckland and for assisting us at the event.
- Professor Paul Davis and Professor Vincent "V.J." Manzo for providing on-site advice and for numerous edits and revisions.
- Professor Stephen McCauley and Professor Michael Elmes for helping to prepare us for our IQP.
- All other individuals or groups that contributed to our project in some way throughout the duration of our on-site work.

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Chapter 1: Introduction

With each passing year more species are added to the IUCN Red List of Threatened Species. The list ranks species on a scale ranging from “least concern” to “extinct.” According to the World Wide Fund for Nature (WWF), the background extinction rate – the rate at which extinctions would occur without human interference – is about one to five species annually. Currently, the world is losing species at a rate 1,000 to 10,000 times greater than the historic background rate (How many species are we losing?, 2013). If extinction continues at this rate, thirty to fifty percent of all species could be at risk of extinction within the next fifty years (Thomas *et al.*, 2004). Human interactions with the environment resulting in pollution, habitat destruction, over-harvesting, and introduction of foreign species are the primary causes of extinction (Welch, 2011). In particular, marine species are threatened by pollution, unsustainable fishing practices, the use of high-impact fishing gear, and ocean acidification (The Caribbean environment programme, n.d.; Shaikh, 2013). It is clear that action must be taken to preserve the world’s biodiversity, but because conservation efforts have many social and socioeconomic implications, it is a difficult and complex challenge.

New Zealand is currently home to 671 species of animals (Red list category summary country totals, 2013). According to the Total Endemic and Threatened Endemic Species in Each Country table on the IUCN’s website, all five of New Zealand’s endemic mammals, all four endemic amphibians, and 44 out of 79 endemic bird species are listed as threatened on the IUCN’s Red List. Compared to most other countries listed on the IUCN’s table, New Zealand has a high rate of threatened endemic species relative to endemic species (Total endemic and threatened endemic species in each country, 2013). Many preventable extinctions are taking place throughout New Zealand and without future intervention many more will take place. The Maui’s dolphin, a critically endangered subspecies of the endangered Hector’s dolphin, is one example of a species in decline. In 2004, it was estimated that there were approximately 111 dolphins; over nine years the population has decreased to a total of 55 dolphins (Currey, Boren, Sharp, & Peterson, 2012). The Maui’s dolphin population can only sustain one human-induced death every 10-23 years, and is currently at a rate of 5.27 human-induced deaths per year (Currey *et al.*, 2012). If the number of human-induced deaths of Maui’s dolphins does not decrease, it is likely that they will not be able to reproduce enough calves to sustain their lineage in the near

future. The New Zealand Department of Conservation (DOC) has been working to protect the Maui's dolphin, but public awareness and knowledge of the conservation issue remains low.

Since the Maui's dolphin was discovered as a subspecies of the Hector's dolphin in 2002, DOC has been studying the Maui's dolphin in order to gain a better understanding of how to protect them. In 2003, a ban on set net fishing was placed on the west coast of the North Island. It has been argued that the ban is insufficient in protecting the Maui's dolphin (Science news, 2013). In hopes of extending the ban further south, several proposals have been drafted and brought before the government. In November of 2013, the New Zealand Government approved an extension to the existing marine protected area, which now extends from Pariokariwa Point to the Waiwhakaiho River (Maui's dolphin conservation, 2013). Although this ban helps protect the dolphins from bycatch, it is not supported by all due to its potential to affect commercial fishermen and place their livelihoods in peril.

Considering the critical plight of the Maui's dolphin, the issue has not captured as wide public attention as one would expect. Lack of public awareness undermines DOC's currently utilized monitoring strategy, which depends on accurate, publicly reported dolphin sightings. Available reporting services could be better utilized if the public were well educated on the issue. In order to report a Maui's dolphin sighting, the public must be aware of the species' existence, its identifying characteristic, **and** sighting reporting services. This is an issue, as public knowledge is lacking in all three areas.

The ultimate goal of this project is to help the New Zealand Department of Conservation raise awareness about conservation efforts to protect the Maui's dolphin (*Cephalorhynchus hectori maui*) through providing recommendations for creating effective educational resources and by utilizing available technology to increase the frequency of sighting reports. Through surveying we hope to gain information on the public's knowledge of the Maui's dolphin and the existence of available Maui's dolphin sighting report technologies. Using this information, we will (1) recommend to the New Zealand DOC an effective approach for educating people about the Maui's dolphin and services for reporting sightings and (2) improve current technologies through proposing a smartphone application design.

Chapter 2: Background

The New Zealand Department of Conservation (DOC) depends primarily on publicly reported sightings to determine the range of the Maui's dolphins' habitat. It is necessary to know the range of the dolphins' habitat in order to create new bans and regulations. To increase sighting reports from the public, it is important to have accessible technology and to educate the community on the existence and use of these services. This section explores the conservation efforts already established in New Zealand with regards to the Maui's dolphin. We will then examine monitoring strategies essential to establishing a comprehensive range for the species and address the tensions and challenges associated with these techniques. Finally, we will analyze relevant examples of outreach programs aimed at educating the public about available reporting systems, such as the strategies employed by the National Oceanic and Atmospheric Administration (NOAA) to raise awareness about their hotline for reporting sightings and marine mammal strandings.

2.1 Marine Biodiversity

The ocean makes up a huge portion of our planet and provides a home to 50%-80% of all life on earth (UNESCO, n.d.). A 2012 analysis showed that between 700,000 and 1 million species inhabit the world's oceans (Discovery news, 2012). These species are incredibly diverse, ranging from microscopically small plankton to the largest blue whale. Maintaining the marine ecosystem is essential to life on earth. Marine species account for over half of the primary productivity on earth, serving as a major food source for ocean species and humans alike (World ocean review, n.d.).

According to the World Wide Fund for Nature (WWF), the current extinction rate is up to 10,000 times greater than the average natural rate of extinction (How many species are we losing?, 2013). Although most marine species' individual risks of extinction have not been investigated, scientists have reason to believe that a broad range of marine species and entire marine ecosystems may be facing the threat of extinction (Polidoro, Livingstone, Carpenter, Hutchinson, Mast, Pilcher, Sadovy de Mitcheson, & Valenti, 2008). A report produced by the International Programme on the State of the Ocean (IPSO) in conjunction with the International Union for Conservation of Nature (IUCN) concedes that marine ecosystems are declining at an

alarming rate and due to human causes, the current global oceanic condition is comparable to the condition of the oceans prior to each of the five historic mass extinctions (Shaikh, 2011). A result of pollution, habitat destruction, species over-harvesting, and introduction of foreign species, human-induced extinction is becoming more prevalent (Welch, 2011). Bycatch due to harmful fishing gear is a major threat to marine species, placing more cetaceans on the endangered species list each year. Global organizations sustain efforts to protect marine ecosystems in general and species such as whales, sea lions, dolphins, turtles, and fish. Despite these efforts, China's Baiji, or Yangtze River dolphin (*Lipotes vexillifer*) was the first dolphin species to go extinct due to human causes in 2006. The freshwater dolphin's disappearance was greatly influenced by harmful fishing practices such as the use of rolling hooks and fyke nets (Turvey, Pitman, & Wang, 2007). Although five reserves were established along the Yangtze River beginning in 1986, this did little to prevent human-induced mortalities of the Baiji and the issue received little public attention (Wang, Zhang, Wang, Wei, Würsig, Braulik, & Ellis, 2006). Unless immediate action is taken, many of New Zealand's endemic species could face a similar fate.

2.1.1 Species Richness in New Zealand

Scientists have described New Zealand as the closest they will come to "studying life on another planet" (Biodiversity in New Zealand, n.d.). The land masses that we now know as New Zealand split from other continents 80 million years ago, forming an isolated continent, where species evolved over a long period of time until they were distinct and unique (Biodiversity in New Zealand, n.d.). Although only 30,000 species have been classified, it is estimated that New Zealand is home to at least 80,000 native species (What is biodiversity?, n.d.). The volume of unusual species endemic to New Zealand makes it a global hotspot for diversity (The New Zealand threat classification system, n.d.). In addition, the WWF estimates that there are at least 65,000 marine species in New Zealand, with at least 44% thought to be endemic, also making the region a global hotspot for marine biodiversity (Marine Biodiversity, n.d.).

Unfortunately many of the species endemic to New Zealand are threatened, also making it a hotspot for extinctions (The New Zealand threat classification system, n.d.). All five endemic mammals, all four amphibians, and 42 out of 76 (55%) endemic bird species are listed on the IUCN's Red List of threatened species (Total endemic and threatened endemic species in each country, 2013). Compared to most other countries listed on the table, New Zealand has a high

rate of threatened endemic species relative to total endemic species. One such species is New Zealand's Maui's dolphin.

2.1.2 The Maui's Dolphin

The Maui's dolphin, a subspecies of the Hector's dolphin, is a critically endangered species endemic to New Zealand. Based on 2012 population estimates, as few as 55 Maui's dolphins inhabit the waters of the west coast of the North Island. The Maui's are the smallest dolphins in the world, growing up to 1.7 m long and weighing only 50 kg (Maui's dolphin, n.d.). The dolphins live to approximately 20 years of age, but since females are not sexually mature until age 7-9 the species reproduces very slowly (Maui's dolphin, n.d.). The species is easy to differentiate from any other dolphin because of its unique, rounded dorsal fin (Maui's dolphin, n.d.). The only infallible way to tell the difference between a Maui's and a Hector's is through DNA testing. Since this is impractical for the common observer, recording the geographical location of sighting reports is a common way to differentiate between subspecies. The Hector's dolphin typically inhabits the waters of the South Island, while the Maui's dolphin lives off the west coast of the North Island, with the northernmost extent of the range at Kaipara Harbour. There is significant overlap between the dolphins' habitat and New Zealand's major commercial and recreational fishing regions (Anderson, Bagley, Hurst, Francis, Clark, & McMillan, 1998).

As with many other marine mammals, Maui's dolphins are easily entangled in commonly used set nets, and subsequently drown. According to the 2012 Risk Assessment of Threats to the Maui's dolphins, it is estimated that there are 5.27 human-induced Maui's dolphins deaths per year, with 95.5% of these deaths due to fishing related threats. Other, less prominent human-induced deaths result from tourism, petroleum and mineral exploration, mining, and coastal development. Taking into consideration the rate of human-induced deaths and the species' low natality rate (1.8% per year), the population declines by 2.8% a year (Currey et al., 2012). If this trend were to continue, with all variables remaining constant, the Maui's dolphin will be extinct within 12.88 years (by 2025). It is clear that changes must be made in order for this unique species' population to be sustainable.

2.2 Conservation Efforts in New Zealand

There are many groups actively involved with different efforts to protect the Maui's dolphin. DOC works with the government to protect the species while the WWF, along with

many other smaller groups, works to campaign and raise awareness for the dolphins. By using offshore, aerial, and boat-based surveys, DOC can gain a better understanding of the habitat of the Maui's dolphin. As long as there is explicit reasoning for this range, the government can implement new protective measures for the dolphins without upsetting stakeholders such as local fishermen. Another way to gain information about the dolphin's range is through public sightings. The public can report their sightings to DOC in order to help protect the dolphins. When sightings are reported efficiently, DOC is able to construct a more accurate model of the dolphins' distribution.

2.2.1 New Zealand Department of Conservation and Collaborators

DOC was created in 1987 by Prime Minister David Lange to help protect the natural and historic heritage of New Zealand as well as to provide the opportunity for safe recreational activity on preserved land (Vision, role overview and statutory mandate, n.d.). Over 26 years, DOC has expanded to include more offices and employees throughout the country, an indication that conservation in New Zealand is becoming a more prominent issue. Today, DOC is responsible for many conservation efforts including the management, preservation, advocacy, and promotion of conservation (Vision, role overview and statutory mandate, n.d.). DOC's purpose is "conservation leadership for a prosperous New Zealand" with an outcome to have "New Zealanders gain environmental, social and economic benefits from healthy functioning ecosystems, recreation opportunities and living our history" (Vision, role overview and statutory mandate, n.d.). Under the Marine Mammals Protection Act of 1978, DOC provides conservation, protection, and management of all marine mammals (DOC's role, n.d.).

The WWF works in partnership with many groups including DOC to "halt and reverse the threats to New Zealand's biodiversity and special places" and make conservation efforts more effective (Supporting community conservation in New Zealand, n.d.). DOC is also a part of the International Whaling Commission (IWC), which helps raise awareness of conservation issues on a global level (International Whaling Commission, n.d.).

DOC also works with the Ministry for Primary Industries (MPI) to learn more about the Maui's dolphins and how to protect them. In 2012, the two joined forces to manage human-induced threats to Hector's and Maui's dolphins by assessing their Threat Management Plans (Currey et al., 2012). The risk assessment workshop also included scientists from the Royal Society of New Zealand. Stakeholders from a range of sectors, including central and local

government, environmental NGOs, the fishing industry, the mining industry, and iwi gathered in order to inform the risk assessment scoring by the panel and to ensure transparency in the workshop process (Currey et al., 2012). Together, the representatives agreed upon a distribution of the Maui's dolphins, as shown in Figure 1 below.

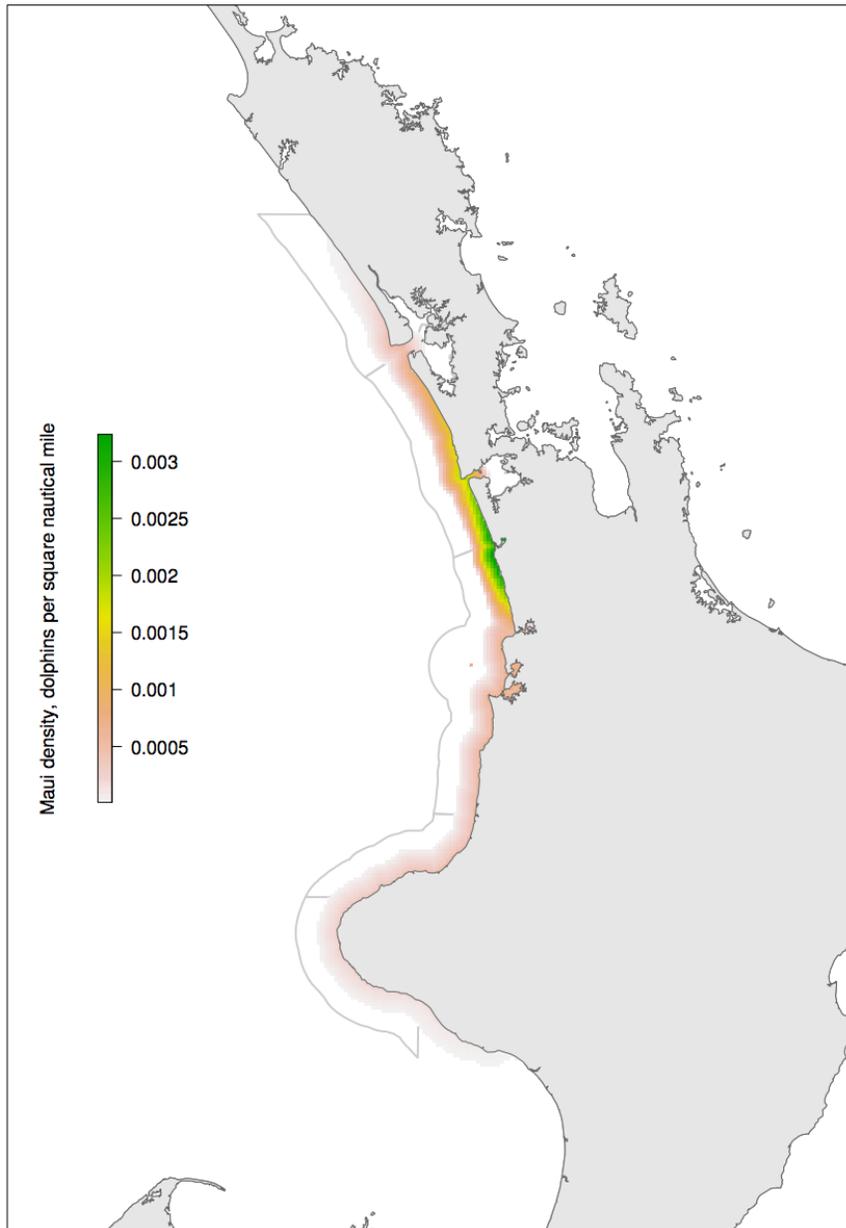


Figure 1: Maui's dolphin density per square nautical mile, as agreed upon by an expert panel. Color scale from red to green represents dolphin density, with green being most dense (Currey et al., 2012)

Through collaboration with organizations such as MPI, DOC is able to determine critical information about the Maui's dolphin such as their home range, which is necessary for the government to pass new bans to protect the species.

2.2.2 Determining the Range of the Maui's Dolphin

DOC is continually gaining information about the Maui's dolphin through research and scientific studies. Topics that require further attention are the dolphin's range, additional threats to the species, ecological impact, conservation status, and life history (Maui's dolphin, n.d.). The most effective way to determine the range of the Maui's habitat is through surveying and sighting reports. DOC has completed many surveys of the dolphins in order to obtain a better understanding of their range. Since 2006, DOC has used offshore, aerial, and boat-based surveys to determine the extent of the Maui's habitat (Maui's dolphin, n.d.).

Many resources have been utilized in order to mitigate the current void of knowledge surrounding the exact habitats and migration patterns of the Maui's dolphin. For years, aerial surveys have been performed over areas, which were believed to have active existing populations of Maui's dolphins. According to a Ferreira and Roberts aerial survey performed in 2003, a total of eighty-four Maui's dolphins were sighted when both alongshore and offshore methods of surveying were performed. The observed extent of the Maui's range was noted to be primarily between Raglan Harbour and Kaipara Harbour, with a noticeable increase in population density near the mouth of the Waikato River (Figure 2 a,b). A similar survey done by the University of Otago obtained complementary results one year later, indicating that the dolphins primary observed range was between Raglan and the northern extremes of Auckland. The University of Otago has also analyzed the sightings throughout different seasons in order to examine possible effects on migration. The results from this survey showed little change in the Maui's dolphin overall range and distance offshore between the seasons (Fresne, 2010). Both aerial surveys, however, indicated that several dolphins appeared to be outliers, referring to the fact that they were located significantly farther away from the areas of high population density. While these outliers may appear to be statistically insignificant, they are actually crucial considering the severity of the Maui's dolphins' situation. If effective and inclusive protections are to ever be placed on the species, every sighting needs to be considered.

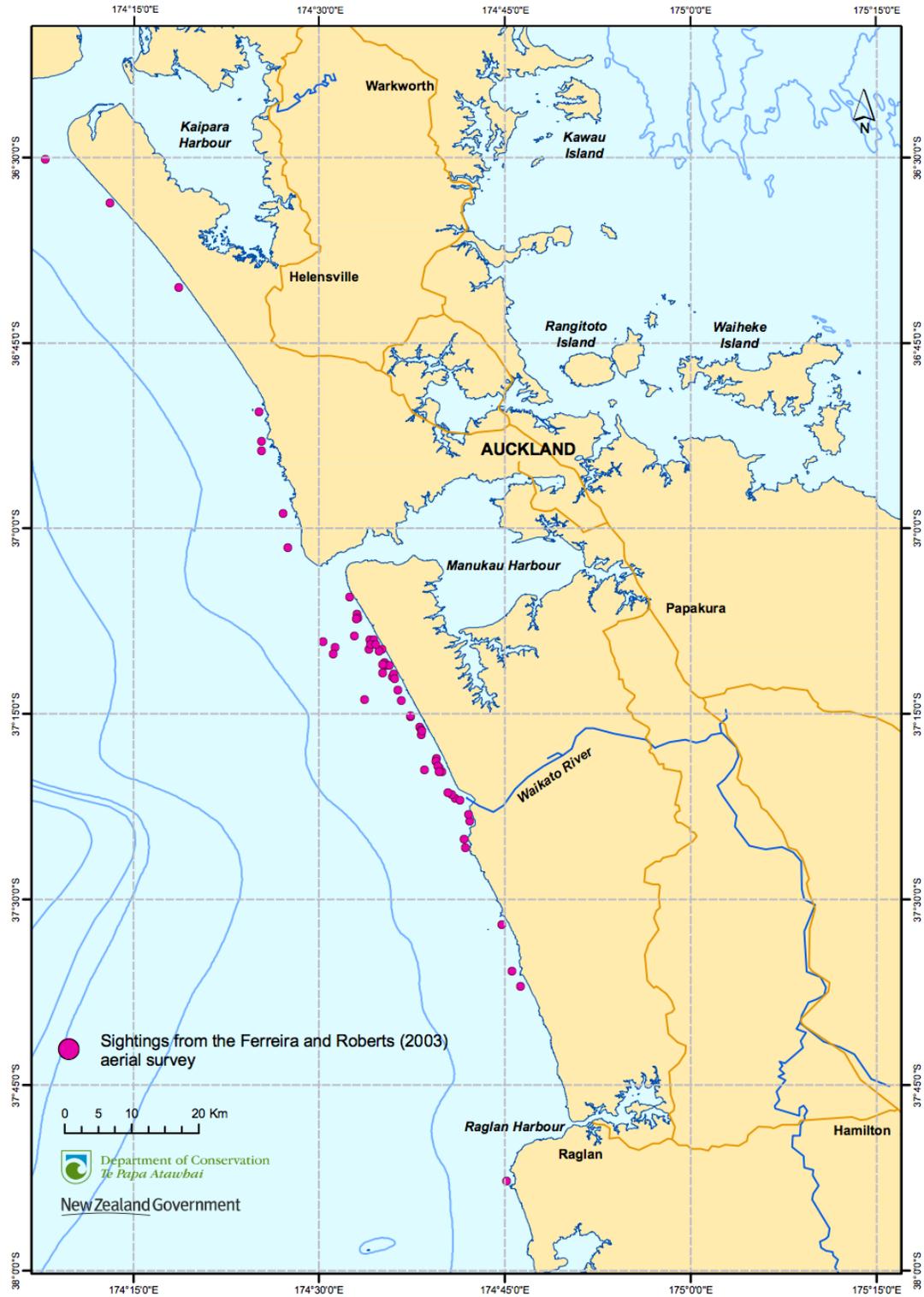


Figure 2a:
Sightings of Maui's dolphins from the University of Otago summer and winter aerial surveys, 2004

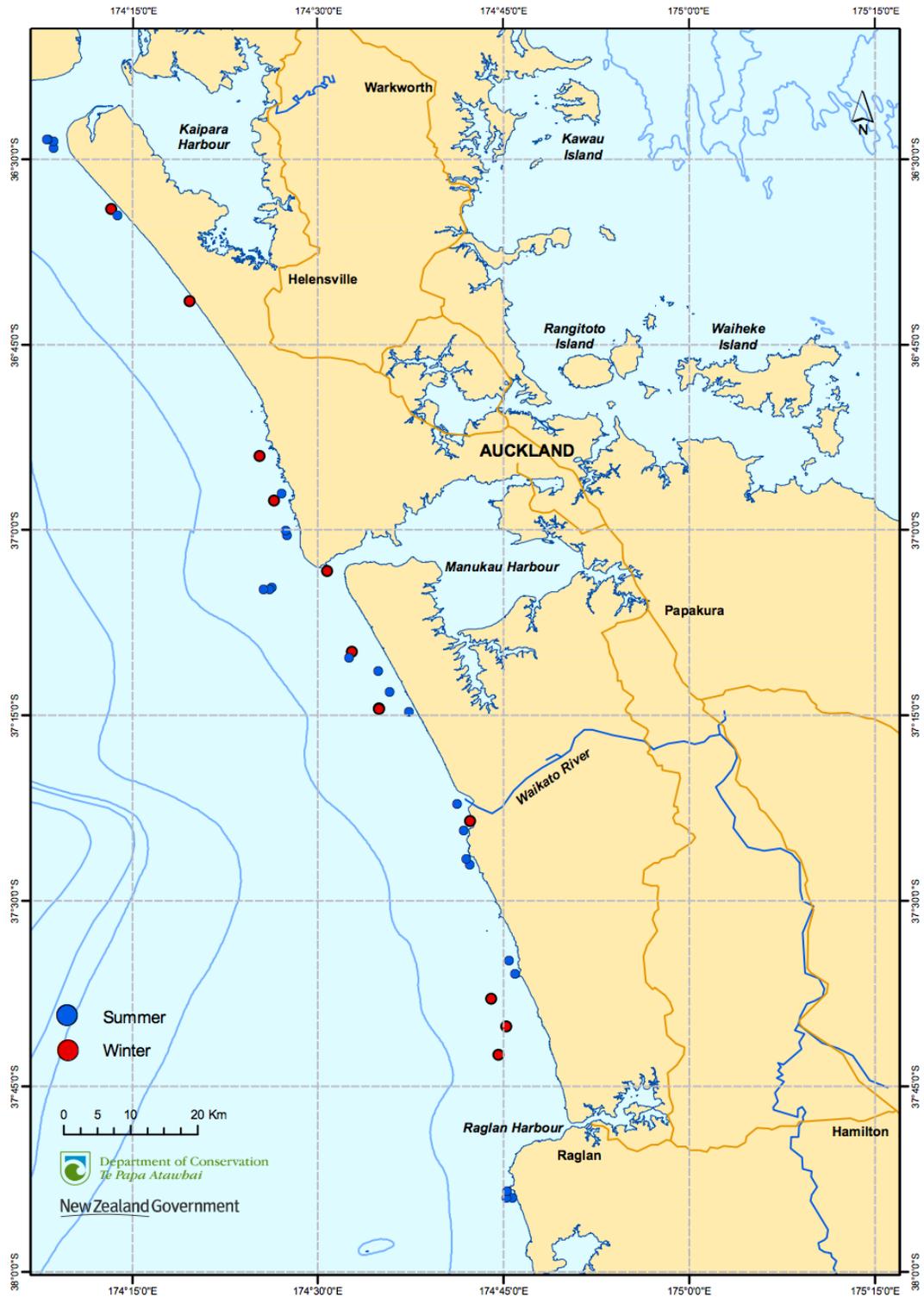


Figure 2b:
Sightings of Maui's dolphins made during systematic, offshore aerial surveys, 2006-2009
(Fresne, 2010)

Public sightings are heavily relied upon in order to accurately plot the dolphin's range. The sparsity of the Maui's population and DOC's limited resources limit the feasibility of other options. However, one major statistical disadvantage exists upon examining publicly reported sightings. More heavily populated areas vastly increase the odds of individuals coming in contact with a Maui's dolphin, which in turn can dramatically alter the observed range of the species. Also, in order to effectively utilize the public in the Maui's conservation effort, easily accessible methods of reporting a sighting must be available to everyone.

Currently the New Zealand DOC utilizes three resources in order to allow the public to report sightings of and threats to Maui's dolphins. These are:

- Marine mammal sighting form (print and mail)
- Department of Conservation hotline
- Marine mammal sighting form (online)

Through these reports, the general public is able to play a crucial role in determining important details relating to the species such as their range, migration patterns, population density, and preferred habitat characteristics. The first method involves printing and filling out a "Marine Mammal Sighting Form," located on DOC's conservation page and sending the document by mail to a threat management center located in Wellington (You can help: Maui's dolphin, n.d.). The form displays photographs of many commonly sighted marine species, and asks the witness to answer several questions in order to substantiate a sighting. Data such as personal information, location of the sighting, environmental observations, and any identifiable characteristics of the animal are all imperative questions that must be answered in order for DOC to verify the report.

The second method of reporting a sighting entails calling the DOC HOTline directly at +64 0800 DOC HOT and providing them with all the necessary information needed for DOC to respond to the sighting appropriately (You can help: Maui's dolphin, n.d.). This reporting service is much quicker and more efficient than manually filling out the sighting report form; however, it typically relies on the availability of a mobile device and cellular reception. Vodafone and Telecom, New Zealand's major mobile device providers, both provide service along most of the western coast of the North Island. Vodafone discloses that they employ an extended network specifically intended to provide fishermen with connectivity while out at sea (Mobile network coverage on 2G, 3G and 4G, n.d.). All of this data suggests that the majority of the currently

protected region on the western shore of the North Island is within range to effectively utilize DOC's conservation hotline.

The last reporting tool available is the online marine mammal sighting form (You can help: Maui's dolphin, n.d.). This form can be filled out and submitted online, allowing DOC to immediately begin processing the information in order to verify the report. One concern with this method is the availability of the online form to those out on the water. Currently, unless one is using a laptop, it is exceedingly difficult to navigate and fill out the online sighting report form quickly, as the report page is not completely mobile-friendly. It has been proven that mobile-friendly websites are able to present more useful information and engage users much more effectively than websites lacking mobile compatibility (Boyer, 2012). Figure 3 is a graphical representation of the tracking techniques previously discussed.

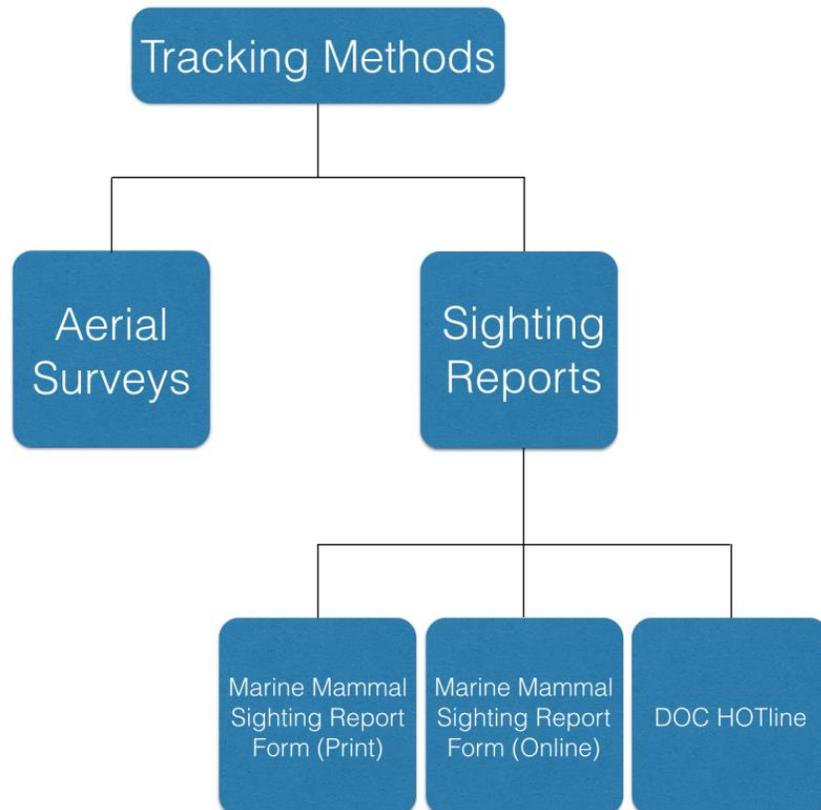


Figure 3: Techniques used to determine the range of the Maui's dolphin's habitat

Due to the critical nature of the Maui's dolphin situation, it is imperative that all sightings are accurately recorded as soon after the initial encounter as possible. The time lag in between

the sighting and the process of filing a report could allow inaccuracies to develop, further complicating any DOC response. All sighting report data is carefully processed in order to determine a sighting's validity, enabling DOC to effectively utilize its resources only where they are most needed. Sightings are typically ranked on a scale from 1 to 5, where 1 is most reliable and 5 is least. Factors that influence a report validation process include: the reporter's preexisting knowledge pertaining to the Maui's dolphin, whether a photo of the creature is included within the report, and whether an accurate geographic position was stated (Department of Conservation and World Wide Fund for Nature Maui's (and Hector's) dolphin databases and validation system, n.d.). If a report is considered reliable, a phone interview will directly follow the processing of the report in order to gather further knowledge about the encounter. An emergency response team will respond to the area only if enough data is present indicating a legitimate sighting. Currently, all sighting reports are recorded by DOC within a database that has been in existence since 1970. The WWF has recently (2003) begun to develop their own database focused around sighting report data, and currently collaborates directly with DOC. Any reports received by the WWF are immediately forwarded to DOC in order to maintain consistency between the two. This collaboration ensures the full range of the dolphin is accurately predicted, allowing for more comprehensive protection. Comprehensive protection comes from involving a variety of stakeholders, who inevitably will have differing opinions.

2.3 Tensions and Challenges

Various audiences will respond differently to the attempts at raising awareness. Attempts to further protect the dolphins will upset some groups of stakeholders, namely fishermen, whose livelihoods may be damaged by extensions to bans and regulations (L. Boren, personal communication, November 18, 2013). There are extremists on both sides of the issue, however. This has led to the contention surrounding the set net bans proposed along the west coast of the North Island. Local fishermen say the proposed bans are too extensive and may hurt their livelihoods, while conservationists insist they are insufficient for sustaining the Maui's dolphin population. This tension makes it extremely difficult for the government to protect the dolphin and satisfy all groups involved.

2.3.1 Potentially Contentious Regulations

The set net bans passed in 2003 did not have a significant impact on the fishing industry in regards to the amount of fish caught and the profits gained by fishermen (Stewart & Callagher, 2013). Although these bans did not prove detrimental to New Zealand’s fishing industry, Dr. Nick Smith, New Zealand’s Minister of Conservation, admitted that the November 2013 extension to the set net ban does have the potential to negatively impact Taranaki’s fishing industry (Wong, 2013). Figure 4 shows the 2013 set net bans that were passed in November. The 2013 protection plan also resulted in the creation of the Maui’s dolphin Research Advisory Group to work with stakeholders, including those whose livelihoods the new bans will undoubtedly affect, to maintain cooperation for sustainable efforts to protect the Maui’s dolphin (New Zealand’s endangered dolphins slide toward extinction, 2013).

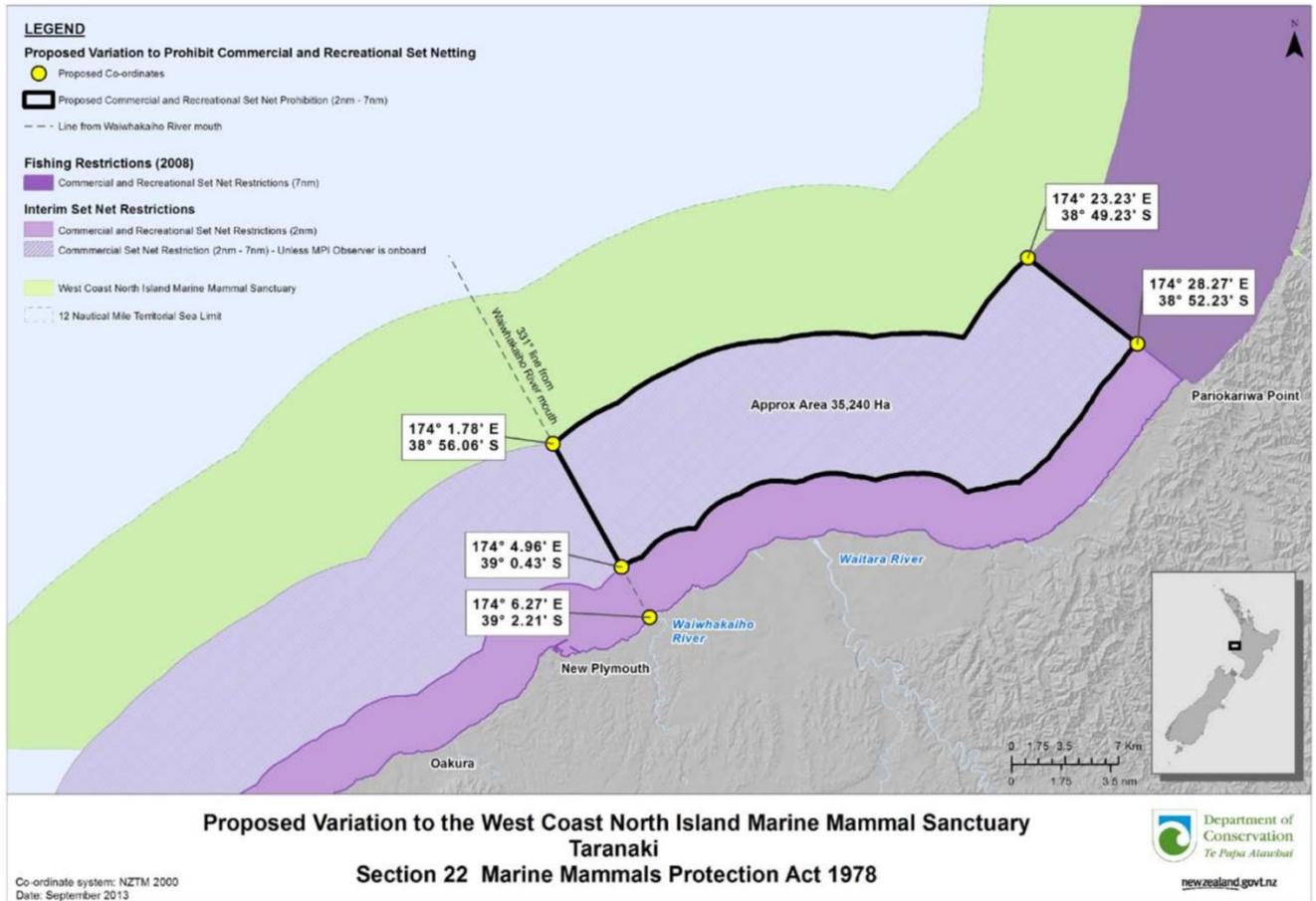


Figure 4: Outlined in black is the 2013 extension to the set net bans for protecting the Maui’s dolphin (Proposed Variation to the West Coast North Island Marine Mammal Sanctuary, Taranaki, Section 22 Marine Mammals Protection Act 1978, 2013)

Even though these new bans will affect livelihoods due to their impact on the fishing industry, conservation advocates still argue that the efforts to protect the Maui's dolphins are not enough to sustain the dolphin population, given its current state (Dyson, 2013). Some campaigners refer to the extension to the set net ban passed in November 2013 as a "death sentence" for the Maui's dolphin (McGrath, 2013). It is believed, however, that much of the New Zealand population does not know about the Maui's dolphin and the importance of conservation efforts to protect the critically endangered species (L. Boren, personal communication, November 18, 2013). In order for the current reporting services to be effective, the public must know how to accurately identify the species, and also what to do when one is sighted. This, along with other factors, result in infrequent sighting reports.

2.3.2 Challenges of Reporting Systems

Sightings of the Maui's dolphins are already rare due to their incredibly small population size (~55). This makes it imperative that any sightings are promptly reported. This problem is compounded by the fact that it is unknown what percentage of the general public knows how to correctly report sightings to DOC for processing. If the sighting is never processed, then DOC has lost out on that piece of data.

This sighting data is extremely important for establishing a comprehensive database of the species. After receiving a sighting report, DOC officials gather relevant data and information from the reporter, and then attempt to move to the witness's location. Upon identification and apprehension, a health assessment of the dolphin is conducted and a genetic sample is taken (Conservation, n.d.; Stone, Hutt, Duignan, Teilmann, Cooper, Geshke, & Yoshinaga, 2005). The purpose of this genetic sampling is three-fold: to ensure the individual is indeed a Maui's dolphin and not the morphologically similar Hector's dolphin, to add to the capture history for each individual dolphin, and to compile a comprehensive library of the Maui's dolphin genome (Baker, Smith, & Pichler, 2002).

An additional use for the genetic sampling is to attempt to establish a confident population estimate for the species. As of 2011, DOC has identified 41 unique individuals (Maui's dolphin sightings, n.d.). By comparing the numbers of individuals sampled multiple times to the number of new individuals observed, DOC has been able to provide a "revised abundance estimate" of 55 (95% CI of 48-69) individuals over the age of one (Maui's dolphin,

n.d.). With more widespread use of the public sighting report services, DOC can create a more accurate population estimate.

Several other problems exist with this report-based monitoring system. One major issue is that, between the time a sighting is made and a report is filed, the witness's report becomes gradually less reliable. The longer the gap between the two events, the more likely inaccuracies develop in the witness's report. In addition, the reporting services are not necessarily available everywhere they are needed. The online or phone-based reporting services require cellular coverage. While cellular service providers claim to provide coverage for offshore fishermen, gaps in coverage could exist that could delay a report being filed. Despite this flaw, this system is far faster than DOC's third reporting method, which involves manually filling out a sighting report form and submitting it via mail. These delays reduce the reliability and usability of any reports.

It appears that although DOC has available reporting services, the public has little knowledge of the conservation issue. As long as the public at large remains uneducated on the status of the dolphin, the value of DOC's reporting services is undermined. If no one is aware of the status of the Maui's dolphin, they do not know to report a sighting, let alone how to do it. Unfortunately, very little has currently been done to mitigate the lack of public knowledge surrounding the Maui's dolphin (L. Boren, personal communication, November 18, 2013). Public education is a key step in garnering support for conservation efforts (Australian government, 2000).

2.4 Raising Awareness

Public support is an essential component of the success of any conservation effort to protect an endangered species. Conservation groups need to raise public awareness about conservation issues, in turn garnering community support through education. We have analyzed relevant global case studies to draw from them the characteristics of successful community education and outreach programs. An Australian government publication on creating a sustainable national action plan through environmental education outlines five principles of successful environmental education. In order to be sustainable, environmental education must:

1. Involve everyone (government, industry, media, community)
2. Be lifelong (refresh knowledge and skills based on technological advances)

3. Be holistic and about connections (social, scientific, cultural, economic and ethical aspects must be taken into consideration; collaboration between different groups)
4. Be practical (actions lead to outcomes)
5. Be in harmony with social and economic goals (give people knowledge to influence society) (Australian government, 2000).

When stakeholders, specifically members of the public, are educated on a topic, they gain the knowledge and skills necessary to voice their own opinion on conservation and collaborate with other stakeholders to form sustainable community-based outreach programs (Howe, 2009). Education can also boost public involvement and ongoing protection of species and change stakeholders' opinions on a topic (Aipanjiguly, Jacobson, & Flamm, 2002; English & Baker, 2003). A manatee conservation study assessing the knowledge, attitudes, and intentions of boat operators in Florida found that there was a positive correlation between educating boaters about the manatees and boaters' support for manatee conservation (Aipanjiguly et al., 2002). In addition, when community members feel that they are directly involved in furthering a conservation effort, they are more willing to participate in the cause. A program in Myanmar showed that reporting back to the public on the importance of conservation efforts boosts community involvement (Tun Min, 2009).

In the scope of our project working with the New Zealand Department of Conservation to protect the Maui's dolphins, it is important that people are educated on the existence and usage of sighting report services. Educating the public will result in not only a greater awareness of the Maui's dolphin, but also meaningful engagement in a conservation effort. This inference was formed based on the conclusions of the 2002 Aipanjiguly study. Population estimates for the Maui's dolphin depend on reliable publicly reported sightings (You can help: Maui's dolphin, n.d.). Raising awareness about the Maui's dolphin and the usage of available sighting report services will enable the public to report Maui's dolphin sightings to DOC. This will provide the organization with valuable information about the dolphins' habitat needed to justify the extension of fishing bans (Office of the minister of conservation, 2013). Because little educational outreach for raising awareness about the Maui's dolphin has been carried out in New Zealand, in recommending an approach, it is necessary for us to examine global examples of organizations raising awareness about available sighting report services.

2.4.1 NOAA's Reporting Hotline

The National Oceanic and Atmospheric Administration (NOAA) Northeast Regional Office has several reporting services currently accessible to the public including an 800 number, a NOAA Fisheries Northeast Regional 24-hour hotline, and an online contact list with other organizations' numbers for reporting marine mammal sightings, strandings, or entanglements based on the reporter's location.

It is not only important that the systems for reporting are widely effective but equally necessary that the public has clear guidance for using the available reporting systems. NOAA tailors the content and appearance of their educational materials to effectively target specific audiences. To educate the general public, the organization distributes simple, visually appealing bumper stickers containing contact information at outreach events such as festivals and tourist sites. The organization has also designed brochures that are available on the Northeast Regional Office's Protected Resources Division website. The brochures offer information on safe dolphin watching, responsible whale watching, safe seal watching, and instructions for helping stranded animals. Each brochure contains phone numbers people can call to report law violations, strandings, and sightings. The brochures on helping stranded marine life and seal watching guidelines list the phone numbers of organizations that collaborate with NOAA to form stranding networks.

To educate recreational fishermen, NOAA distributes a sticker for tackle boxes with contact information. Figure 5 shows a tackle box sticker providing instructions for what fishermen should do if they catch a turtle on their line.



Figure 5: NOAA's tackle box sticker designed to educate recreational fishermen (C. Coogan, personal communication, December 5, 2013)

In addition to including a graphic and detailed instructions for reducing turtle injuries, the tackle box sticker provides fishermen with the NOAA Fisheries Service website.

NOAA also puts stranding and entanglement posters up at fishing docks and large beach parking lots to educate recreational fishermen. Pamphlets and fact sheets designed specifically for recreational fishermen are distributed at boating and fishing trade shows. One NOAA brochure titled “Are You an Ethical Angler?” details how to adopt a code of angling ethics, urging fishermen to make little impact on the environment, use the correct fishing hooks, and obey angling and boating laws.

To educate commercial fishermen, NOAA creates factsheets and guides explaining compliance guidelines in simple language. These guides are often laminated and compiled for use in a wheelhouse. One example includes a guide to educate commercial fishermen on complying with the Atlantic Large Whale Take Reduction Plan (ALWTRP). The fact sheet uses pictures for clarification and provides phone numbers and a website link for additional information.

The approach used by NOAA to design and educate the public on available systems for reporting marine mammal sightings, strandings, and entanglements fulfills the five principles of environmental education. The organization involves a wide range of support and avoids alienating or offending various groups of people by distributing outreach materials designed specifically for different stakeholders. These include, but are not limited to: members of the general public, commercial fishermen, and recreational fishermen. In addition, the approaches used by NOAA focus on collaboration with different groups. Contact lists available online and printed in various outreach materials prove that the organization collaborates with other conservation groups. Providing information to individuals of many different community groups fosters collaboration between stakeholders. By creating outreach materials for different target audiences, NOAA takes into consideration the various social, scientific, cultural, economic and ethical aspects of a conservation issue. NOAA’s strategy of tailoring educational material to different stakeholders is practical because the education methods employed aim to convey clear, concise instructions that will result in positive outcomes. For example, if a fisherman has a sticker on his or her tackle box providing information about what to do if a turtle is caught, this will translate into actions favored by NOAA such as those outlined on this sticker. Ultimately, NOAA can influence positive conservation outcomes by increasing the frequency of favorable

actions. In the future, the NOAA Northeast Regional Office hopes to create and educate the community about a regulatory smartphone application (C. Coogan, personal communication, December 5, 2013). This goal reflects the organization's attempts to follow technological trends and through education, refresh public knowledge and skills as technology advances.

2.5 Background Summary

The Maui's dolphin is a critically endangered species endemic to New Zealand. As of 2012, only about 55 Maui's dolphins remain in their known range along the west coast of the North Island. Without further intervention, the dolphin may be brought to extinction by 2025 (Maui's dolphin, n.d.). The species is threatened by set nets and trawls, which are employed in the suspected range of the dolphin. A more definitive range of the dolphin must be established in order for comprehensive protected areas and bans to be implemented. With this ticking clock, it is crucial that the number of publicly reported sightings and their accuracy increases.

The dolphin's range can be mapped accurately using these sighting reports. These services are lacking in two areas: They are not easily accessible, and few are aware of their existence. These complications are overshadowed by the fact that a large percentage of the New Zealand population is not aware of the Maui's dolphin's existence, let alone how to identify them correctly. The public can accurately report a sighting if they possess proper information regarding the species' likely location and identifying characteristics. In addition, it has been found that an educated population is more likely to be engaged in conservation programs and activities (Aipanjiguly et al., 2002). When people are educated on a topic, they gain the knowledge necessary to voice their own opinion and collaborate with other stakeholders to form sustainable community-based outreach programs (Howe, 2009).

Chapter 3: Methodology

The ultimate goal of this project is to help the New Zealand Department of Conservation raise awareness about conservation efforts to protect the Maui's dolphin (*Cephalorhynchus hectori maui*) through providing recommendations for creating effective educational resources and by utilizing available technology to increase the frequency of sighting reports. DOC will use these sighting reports to determine the range of the species. With a range established, comprehensive protective measures can be instituted to sustain the Maui's dolphin population.

To accomplish our goal, we identified the following objectives:

- Assess and evaluate the public's awareness and knowledge of the Maui's dolphins and sighting report services
- Recommend approaches for raising awareness about the Maui's dolphin and sighting report services
- Recommend approaches to improve the accessibility of resources available to the public

The process by which we fulfilled our three objectives to arrive at the project's final recommendations and deliverables is shown in Figure 6.

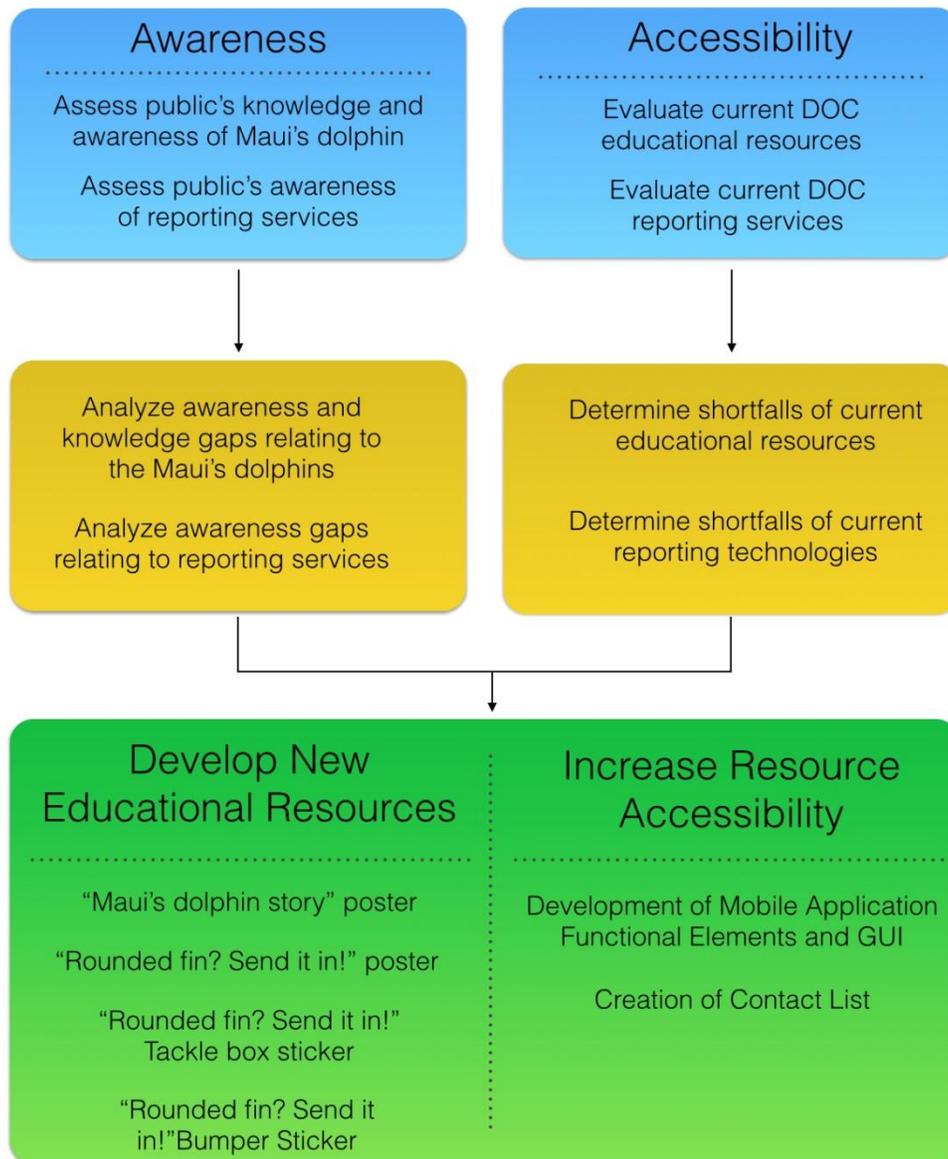


Figure 6: Methodology employed to fulfill our project recommendations and deliverables

Figure 7 shows how we spent our time in New Zealand for the duration of our project. Contained within are our major objectives and deliverables.

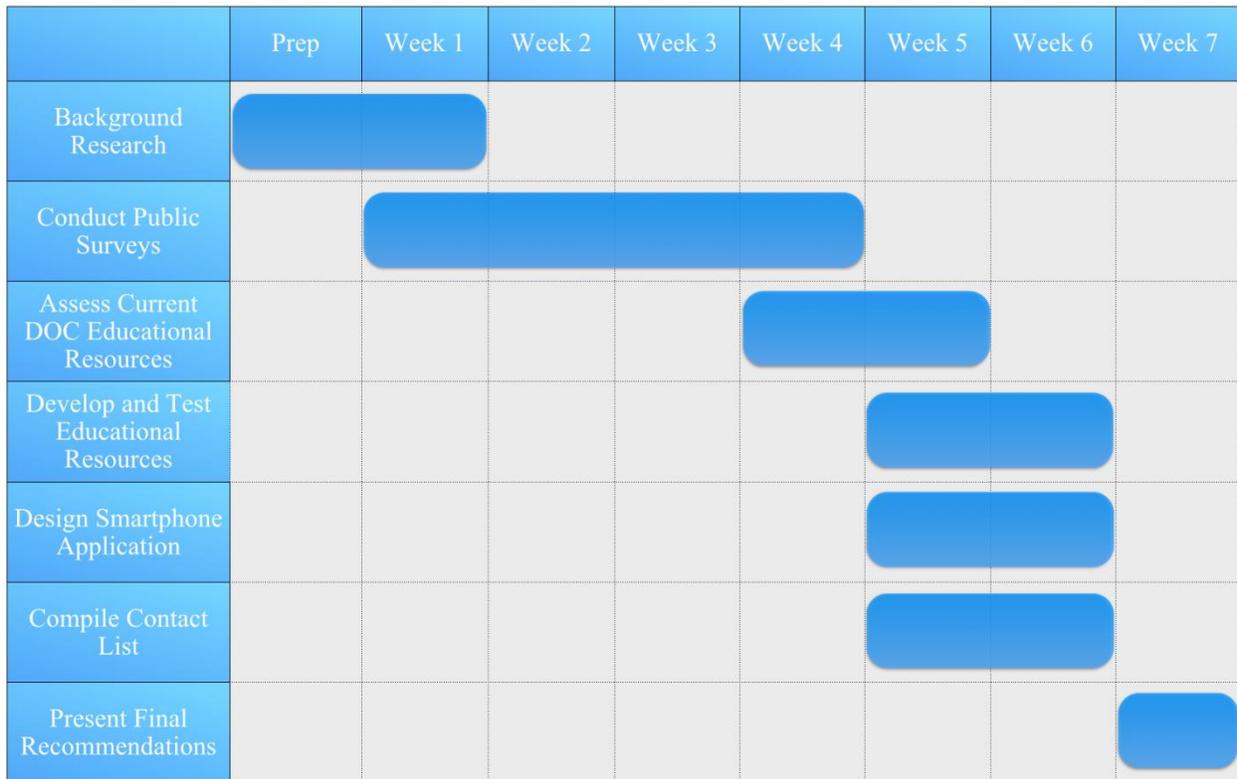


Figure 7: Timeline representing what we accomplished on a weekly basis

3.1 Assessment and Evaluation of the Public’s Awareness

We created a survey designed to measure public awareness and knowledge pertaining to conservation initiatives, specifically revolving around the Maui’s dolphin. The initial survey questions were revised and rephrased due to fears that the data gathered would not allow us to accurately draw powerful conclusions. The redrafted version was tested by administering it to several members of DOC who were not directly involved with conservation efforts. Edits were made based on respondents’ critique in order to minimize any future confusion with survey structure and questions. The final survey can be found in Appendix A.

3.1.1 Survey Design

We began the survey with a brief statement that introduced who we were and established that we were surveying on behalf of DOC. We purposefully did not specify the objective or topic of the survey in the introduction so that we did not accidentally educate potential participants. For example, if we mentioned the Maui’s dolphin, the fact that it is critically endangered, or even

that it was native to New Zealand, it may have provided information to the respondent for questions we wanted to ask.

The survey was divided into several sections, each inquiring about different relevant topics. The survey questions were ordered so that the most important questions were asked first, in order to immediately engage the participant, and also to prevent the respondent from losing interest as the survey progressed. Demographic-based questions (*e.g.* gender, age, ethnicity) were asked last so that the survey tapered as it was concluded. In an additional attempt to maintain engagement throughout the survey, the length was limited to one page, front and back. When initially timing the survey, it took approximately seven minutes to complete. After conducting the survey on members of the public, it was found that most respondents took approximately five minutes to answer all of the questions. There was quite a range in response time, however, with some respondents taking as little as three minutes and others taking as long as 15 minutes to complete the survey. This difference in response time was mainly attributed to respondents' level of engagement and the amount of additional information they could provide on the survey topics.

The first section (Questions 1-4) was geared towards determining the amount of time the respondent spent by the water and what they tended to do when on or by the water. Table 1 shows the survey questions in the first section of the survey.

Table 1: Survey questions regarding respondents' water-based tendencies

Respondents' Tendencies for Time Spent By the Water		
Question	Possible Answers	Significance of Response
1. How often are you by the water?	Very often Often Sometimes Not often Never	If yes, proceed to next questions. If no, skip questions 2-4
2. Are you by the water primarily for (select all that apply)	Work Recreation	Determine popular public activities near the water, leading to potential outlets for distribution of educational resources.
3. In New Zealand, what activities do you participate in on the water? (Select all that apply)	Kayaking Surfing Paddle boarding Snorkeling/Diving Going to the beach Swimming Going on a boat Recreational Fishing Commercial fishing Other: _____	
4. Are you a member of any water-related organizations (i.e. yacht clubs or other sports clubs)? If so, which ones?	Yes No	Responses used to compile a list of water-based organizations that could be contacted about participation in a community contact list.

The first question, “How often are you by the water?”, offered responses based on a 5-point Likert scale from “Very often” to “Never.” Many respondents required clarification as to the meaning of the question, which was clarified by asking the follow-up question: “How often are you within sight of salt-water?”. If the respondent replied “Never” to Question 1, the surveyor progressed directly to Question 5, as Questions 2, 3, and 4 all applied to the nature of time spent by the water. Questions 2 and 3 were asked with the goal of determining if there were any trends in respondents’ participation in water-based activities. Question 4 allowed us to identify any publicly known water-based organizations that could be contacted for participation in the community contact list.

The second section (Questions 5-12) was asked to assess the respondent’s knowledge of the Maui’s dolphin and his or her information sources about the species. Table 2 shows a breakdown of the questions regarding a respondent’s knowledge of the Maui’s dolphin, knowledge of services to report Maui’s dolphin sightings, and sources of information on the Maui’s dolphin.

Table 2: Survey questions regarding knowledge of the Maui’s dolphin and respondents’ information sources

Assessing Public Knowledge of the Maui’s dolphin		
Question	Possible Answers	Significance of Response
5. Have you ever heard of the Maui’s dolphin?	Yes No	Determines whether the respondent is aware of the Maui’s dolphin. If yes, proceed to next questions. If no, skip questions 6-12.
6. Have you learned about the Maui’s dolphin in a school setting? If so, where?	Yes No	Determines respondents’ source of information about the Maui’s dolphin. Data can be used to determine if education is a currently used source of information about the Maui’s dolphin. If so, is it effective?
7. Which best describes the status of the Maui’s dolphin population?	Increasing Stable Decreasing	If the respondent does not answer correctly to these questions (correct answers highlighted in bold) we can determine that the respondent do not have specific knowledge of the dolphin. Determine knowledge gaps. Is low public involvement in Maui’s dolphin conservation efforts due to lack of knowledge?
8. Which best defines the home range of the Maui’s dolphin?	West Coast North Island East Coast North Island West Coast North Island East Coast North Island	
9. Which of the following is an identifying characteristic of the Maui’s dolphin?	Long, narrow nose Rounded dorsal fin Large, white eyespots 3 meters in length	
Assessing Public Knowledge of Reporting Services		
10. Are you aware that DOC has reporting services for reporting Maui’s dolphin sightings?	Yes No	Determine public whether public is aware of DOC’s reporting services. Expose a possible knowledge gap attributing to infrequent sighting reports

Determining public Information Sources		
11. Have you ever seen signage about the Maui's dolphin?	Yes No	Determine whether DOC signs are accessible to the public and widely used as a source of information about the Maui's dolphin.
12. Where have you obtained any knowledge you have of the <i>Maui's dolphin</i> ? (Rank your top 3 sources of information)	Online search engines DOC publications Media Education/School Word of mouth Awareness events Other: _____	Determine possible vehicles for future dissemination of Maui's dolphin information and conservation alerts. Data can be used to determine trends in respondents' knowledge in relation to information source used.

If the respondent replied “No” to Question 5, “Have you ever heard of the Maui’s dolphin?”, the surveyor skipped to Question 13. Question 6 was asked to determine how frequently the survey sample had learned about the Maui’s dolphin in a school setting. Questions 7-9 gauged the respondent’s knowledge of specific characteristics of the species - population status, range, and identifying characteristic. These were asked to differentiate between whether the respondent had a simple awareness of the species’ existence or more in-depth knowledge of the Maui’s dolphin and its features. Multiple-choice answers were provided for Questions 7-9 so that the respondent had to select the correct answer from among the possible responses. The questions were designed so that a respondent would need existing specific knowledge of the dolphin in order to discern the correct answer. For example, for Question 9, we developed the incorrect answers by choosing characteristics that were opposite of the Maui’s dolphin. The incorrect answers were as follows: (a) “Long, narrow nose” because of the Maui’s dolphin’s short, stubby nose, (b) “3 meters in length” because the Maui’s dolphins are the smallest in the world, only growing to 1.7 meters, and (c) “Large, white eyespots” because the dolphin has dark eye spots. Question 10 ascertained if the respondent knew about the reporting services for the dolphin, with “Yes” and “No” as possible responses. Questions 11 and 12 were asked to determine where the respondent may have learned about the Maui’s dolphin, with Question 11 specifically asking about signage (*e.g.* posters, bulletins). Question 12 asked the participant to rank his or her top three sources of information about the Maui’s dolphin. Seven categories were provided, including “Other.”

The final section (Questions 13-19) was subdivided into smaller sections consisting of one to three related questions. Questions 13-15 were aimed at determining where survey respondents gain information about the Maui’s dolphin and New Zealand’s native species. Table 3 shows a breakdown of questions 13-15.

Table 3: Survey questions regarding conservation efforts in New Zealand

Where People Obtain Information		
Question	Possible Answers	Significance of Responses
13. Where have you obtained any knowledge you have of <i>New Zealand’s native species</i>? (Rank top 3)	Online search engines DOC publications Media Education/school Word of mouth Awareness events Other: _____	By finding out the public’s primary sources of information, we can determine the most effective ways to disseminate information about the Maui’s dolphin to the public.
To what extent do you agree with the following statements:	5-Point Likert Scale (1 being “Not Important” and 5 being “Very Important”)	Determines whether lack of public involvement in conservation efforts is due to lack of interest in conservation in general.
14. Saving New Zealand’s native species is important to <i>me</i> ?		
15. Saving New Zealand’s native species is important to <i>New Zealand</i> ?		

Question 13 was similar to Question 12 in that it asked the respondent to rank his or her top three sources of information out of the same seven categories - this time about New Zealand’s native species. Question 13 was included so that if a participant had never heard of the Maui’s dolphin, his or her preferred sources of knowledge about native species in general could be determined. Questions 14 and 15 asked respondents to rate the importance of conserving New Zealand’s native species on a personal and national level, respectively. These questions offered responses based on a 5-point Likert scale, with 1 being “Not Important,” and 5 being “Very Important.” The goal of these questions was to gauge public interest in conservation efforts for personal and national reasons.

Questions 16-18 inquired about the respondent’s demographics (*e.g.* gender, age, and ethnicity), with possible responses provided so data could be grouped easily. Table 4 shows a breakdown of demographics questions.

Table 4: Survey questions regarding demographics

Demographics		
Question	Possible Answers	Significance of Responses
16. With what gender do you identify?	Male Female	Data on demographics allows us to explore trends in respondents’ knowledge of the Maui’s dolphin in relation to various demographics. This helps identify knowledge gaps and allows us to determine which audiences should be targeted with educational resources.
17. What is your age?	18-24 years old 25-34 years old 35-44 years old 45-54 years old 55-64 years old 65-74 years old 75+ years	
18. What ethnicity do you identify with? (Select all that apply)	New Zealand European Maori Asian Pacific Islander Other: _____	
19. Have you ever lived within 10 km of the west coast of the North Island?	Yes No	

Question 19 was the final survey question, and determined whether the participant had ever lived within 10 km of the west coast of the North Island, the home range of the Maui’s dolphin. We originally chose to ask whether the respondent had ever lived within 50 km; however, we narrowed the range upon finding that 97% of the New Zealand population lives within 50 km of any coast, in 2006 (Statistics New Zealand, 2006). We decided upon 10 km because only 75% of the New Zealand population lives within that range. 10 km is a reasonable drive for someone to go to the ocean or beach often enough to be aware of any educational materials on the Maui’s dolphin located along the waterfront.

3.1.2 Survey Strategy

We conducted the survey over the course of several work weeks (Monday-Friday), between the hours of 10:00 AM and 4:00 PM. Respondents were selected at random from those members of the public available in our proximity. The survey was conducted face-to-face in

teams of two. One surveyor asked the participant questions, while the second surveyor recorded responses and notes. The respondent was able to follow the survey using a laminated copy given to them once they agreed to participate. We initially considered distributing the survey to be completed manually by each respondent, which would have eliminated the time constraints and would have potentially allowed us to reach a greater portion of the population. This method was eventually discounted, as face-to-face afforded us the opportunity to clarify any confusion and take notes on any unique responses or relevant qualitative data. We also decided against distributing the surveys via email, as employing this vehicle may have skewed our data. If DOC had used its existing mailing list, the respondent pool would not have been representative of the general New Zealand population or respondents could have looked up the correct answers to survey questions online.

The surveys were administered at various locations in the national capital of Wellington and the coastal town of Whanganui. Wellington was selected as a survey location because of its high population and ease of access from our base of operations at the DOC National Office on Manners Street. Whanganui, located at the southernmost extent of the Maui's dolphin's proposed range, was selected because of its popular beaches and its proximity to the species' range.

We had initially hoped to survey farther north along the west coast of the North Island, in regions within the known range of the Maui's dolphin such as Taranaki, New Plymouth, Raglan, or Auckland. This would have given our survey more power of inference, and potentially given us more relevant data. After discussing the feasibility of surveying within the dolphin's known range with DOC, it was determined that this would not be possible. This decision was made because of the increased tension surrounding the Maui's dolphin conservation issue after the introduction of new protected areas around Taranaki in November 2013. In order to shield us from any hostility from fishermen or other parties impacted by these bans, our range was limited to south of Taranaki.

3.1.3 Correspondence with Educators

In order to determine the extent to which material on New Zealand's native species - specifically the Hector's/Maui's dolphin - is incorporated into the New Zealand school curriculum, several primary and secondary school educators were contacted via email. A copy of this correspondence can be found in Appendix E.

3.1.4 Data Analysis

All surveys were numbered and entered into SurveyMonkey.com to obtain frequency data and to keep a digital database of responses. Survey Monkey allowed us to filter responses based on question and answer. We were able to easily examine data with regards to a specific response or demographic. In addition to this, the Survey Monkey “analyze” tool depicts the survey data in various graphs and charts, which allowed us to easily extract frequencies and percentages from the database.

Data sets that included only one variable (*e.g.* “Yes” or “No” responses to Question 5) were analyzed for significance using 95% Confidence Intervals. Data sets that compared two or more variables (*e.g.* “Yes” responses to Question 5 based on age reported in Question 17) were tested for significance using a Chi-squared test. Sample calculations for both 95% Confidence Intervals and Chi-squared tests can be found in Appendix C.

3.2 Educating the Public

Using information gathered from the survey, background research, and correspondences with DOC employees, we designed several educational materials. Findings from our analysis of survey data were primarily used to guide the content of these resources, background research was useful for determining vehicle of distribution, and input from DOC employees helped determine the design of the materials, but also substantially contributed to recommendations for content, vehicle, and distribution. Tables 1-4 detail the significance of each survey question and how each question led us to final recommendations. Background research on global examples of successful conservation efforts, findings from analysis of survey responses, and correspondences with DOC staff contributed to our recommendations for educational material. We determined the best combination of educational material would be a bumper sticker, a tackle box sticker, and two posters - one providing information about the Maui’s dolphin, the other outlining how to report a sighting. In addition, informational resources were included in the smartphone application graphical user interface (GUI), discussed at greater length in section 3.3.1. Designs of these materials can be found in Appendix F. The bumper sticker, tackle box sticker, and reporting process poster featured the phrase “Rounded fin? Send it in!”. We developed this slogan with the goal of creating an informational, yet catchy title for these and future educational materials. The “Maui’s Dolphin Story” poster featured the Maori saying “Ahakoa he iti he

pounamu,” meaning “although it is small, it is a treasure.” By using this phrase, which was approved for use by the Te Reo o Taranaki Trust, we were able to tie the dolphin to the Maori culture and to New Zealand as a nation.

In addition to designing these educational resources, the bumper sticker was approved by DOC and produced *en masse*, and prototypes of the tackle box sticker and two posters were produced in small amounts for evaluation at Seaweek in Auckland on March 2nd, 2014. In order to produce tangible materials, we spoke with DOC’s marketing department to identify any features that would be beneficial to our material, or anything key to avoid. Based on these suggestions, we then designed mock-ups of what we envisioned the final product to be. Included with each initial design was a description of that resource’s objective and content. We consulted with the Marine Species and Threats team to discuss and revise the material before sending the mock-ups to the design team. The design team was able to generate design drafts for the material, which were then reviewed and revised one final time before being printed.

3.3 Increase Accessibility of Resources

A key component contributing to the effectiveness of educational material and reporting services is whether these resources are readily accessible to a wide audience. Currently, DOC’s primary method of disseminating information on the Maui’s dolphin entails the utilization of posters and brochures, which are generally distributed at DOC visitor centers. While these resources may effectively target individuals who frequent those locations, integrating this information within a mobile environment greatly increases the amount of people who have direct access to it.

Currently DOC’s marine reporting services are only available via the DOC website and by calling the DOC HOTline. These methods are inherently inconvenient in today’s society, thus limiting usage. By effectively bringing current services and educational resources to a mobile environment, DOC could compile all available reporting services into one, user-friendly mobile interface as well as expand the reporting service user base by making resources more readily available to the public.

3.3.1 Development of Mobile Application Functional Elements and GUI

In order to increase the accessibility of both reporting services and educational resources, we investigated the idea of creating a smartphone application that includes both elements. DOC

was very interested in this concept since the success of the Australian application “Coastal Walkabout,” aimed at targeting Australia's western coast. We initially contacted the developer of “Coastal Walkabout” and submitted a developer request, but we did not receive a response back within a reasonable period of time. As a result, we changed our focus to developing functional elements and the general graphical user interface (GUI) design for the application, providing the framework for future development of an application with similar elements.

In designing the application, there were three main goals: (1) To integrate the marine mammal reporting services within a mobile platform, (2) to integrate educational resources within a mobile platform, and (3) to integrate a DOC contact list including all offices throughout the country within a mobile platform.

In order to address the first goal, we analyzed DOC’s current online reporting system in order to determine elements that were necessary to include within the mobile application. Upon investigation, we discovered that the online service was scheduled for optimization in the upcoming months. We obtained the official documentation outlining the details of the future overhaul and used it as the foundation for the mobile reporting service. The mobile reporting service contains all of the fields required for an accurate sighting report. The fields include the observer’s contact information and specific details of the sighting such as the dolphins group size, distance from shore, and approximate depth. Additional entry fields can be seen in Appendix F. In order to further expedite the reporting process, the application was designed to use location services and system services integration to automatically determine the observer's location and the date and time of the sighting report.

The second goal was accomplished by creating an educational portal designed to inform users about the Maui’s dolphin. Using the most up-to-date information from Maui’s dolphin brochures, the portal aimed to provide users with a comprehensive educational resource. As with the mobile reporting service, the inclusion of educational resources within the app will allow for a wider distribution of the most important information regarding the Maui’s dolphin and conservation efforts to protect the species.

Lastly, we created a DOC contact page within the application containing information about all of the offices throughout the country. Including this within a mobile environment puts an incredible resource in each user’s hand - the entire network of DOC rangers and conservation experts working to protect Maui’s dolphins. As the Maui’s dolphin population is at a critical

level, an individual may have additional concerns that need to be quickly passed along to a regional ranger. In this situation, the mobile app's simple sighting report option may not suffice. The contact list was designed so that each ranger office is listed below a category based on location. For example, "Auckland" would have offices in the entire Auckland region such as the Auckland City office and the North Head office.

3.3.2 Creation of Contact List

An additional tool to increase the accessibility of various materials was provided to DOC in the form of a community contact list. Such a contact list could allow for wider distribution of educational resources to individuals who frequent locations where conservation efforts recently have been directed. The contact list was compiled using publicly known water-based organizations collected from survey responses (Question 4), water-based organizations found in online research, and contacts recommended via email correspondence with DOC rangers, which can be found in Appendix E. Each group was contacted by phone or email to explain the objective of the contact list and to enquire if that organization would be interested in being included in the contact list. If a group refused, they were thanked for their time and not contacted again. A formal document was drafted to fully explain the list's objectives and potential uses for those organizations who requested further information. This document can be found in Appendix G. The contact list was compiled using our WPI "dolphins-c14" email alias, with plans to transfer control to DOC personnel after our departure.

3.4 Participation at Seaweek Activity Hub

As part of the culmination of our project, we traveled to Auckland to participate in the first annual Seaweek, an event that focused on educating people about marine life and conservation. While there, we helped set-up and run two DOC info booths, one of which was completely devoted to the Maui's dolphin. In addition to educating passersby, we also brought our two posters, bumper stickers and tackle-box stickers. We displayed the two posters and observed the public's overall reaction to their appearance and content. We also periodically asked individuals to critique the posters so we could report to DOC which messages the public found appealing and which messages may have been unclear. We distributed approximately 300 bumper stickers throughout the event, providing people with a small and concise distributable that passes along the very important message of reporting Maui's dolphin sightings. Lastly, we

brought with us ten draft-quality tackle-box stickers in order to gauge interest. The tackle-box sticker was a niche product targeted specifically at the fishing and boating communities, so we thought the idea should be presented to Seaweed attendees in order to determine if the product was worthy of being a final recommendation to DOC.

3.5 Internal Memo

To fully inform DOC about our project and the possibilities for future collaboration with WPI, an internal memo was drafted for distribution throughout DOC. This document included a summary of our project and the impact our project has had on DOC's conservation efforts to protect the Maui's dolphin. The internal memo also outlined the potential benefits of a continued partnership between WPI and DOC, and discussed potential future projects with DOC that could be explored by WPI students for their Interactive Qualifying Projects. Once completed, this internal memo was left with Ian Angus for distribution.

Chapter 4: Summary of Findings

The findings in this section are a result of the analysis of responses from our survey described in section 3.2. In reference to this survey, “awareness” means a respondent answered “yes” to Question 5, “Have you ever heard of the Maui’s dolphin.” The term “specific knowledge” is used to describe correct answers to Questions 7, 8, and 9, which ask about features of the Maui’s dolphin. The full survey can be found in Appendix A and the survey results can be found in Appendix B.

Surveys of 99 respondents in Whanganui and 285 respondents in Wellington revealed that most of the survey sample is aware that the Maui’s dolphin species exists and that the species’ population is decreasing. The 384 total surveys also revealed that most of the survey sample is not able to accurately identify the home range or the identifying characteristic of the Maui’s dolphin. Some demographics, however, showed greater awareness and knowledge of the dolphin than others. Older generations are more aware of the Maui’s dolphin than younger generations (18-24; 25-34). Respondents who have ever lived within 10 km of the west coast North Island are more aware of and have greater specific knowledge of the Maui’s dolphin.

All *p*-values were generated using a Chi-squared test with a significant *p*-value being less than 0.05; in graphs, 95% confidence intervals are used to show significance for single-variable analyses. These are denoted by % ± 95%CI.

4.1 Public Awareness and Knowledge

Although most respondents claimed to have heard of the Maui’s dolphin, not many knew specific details about the species. Figure 8 shows the percentage of the survey sample that is aware of the Maui’s dolphin, and then shows what percentage of that population knows specific details about the species.

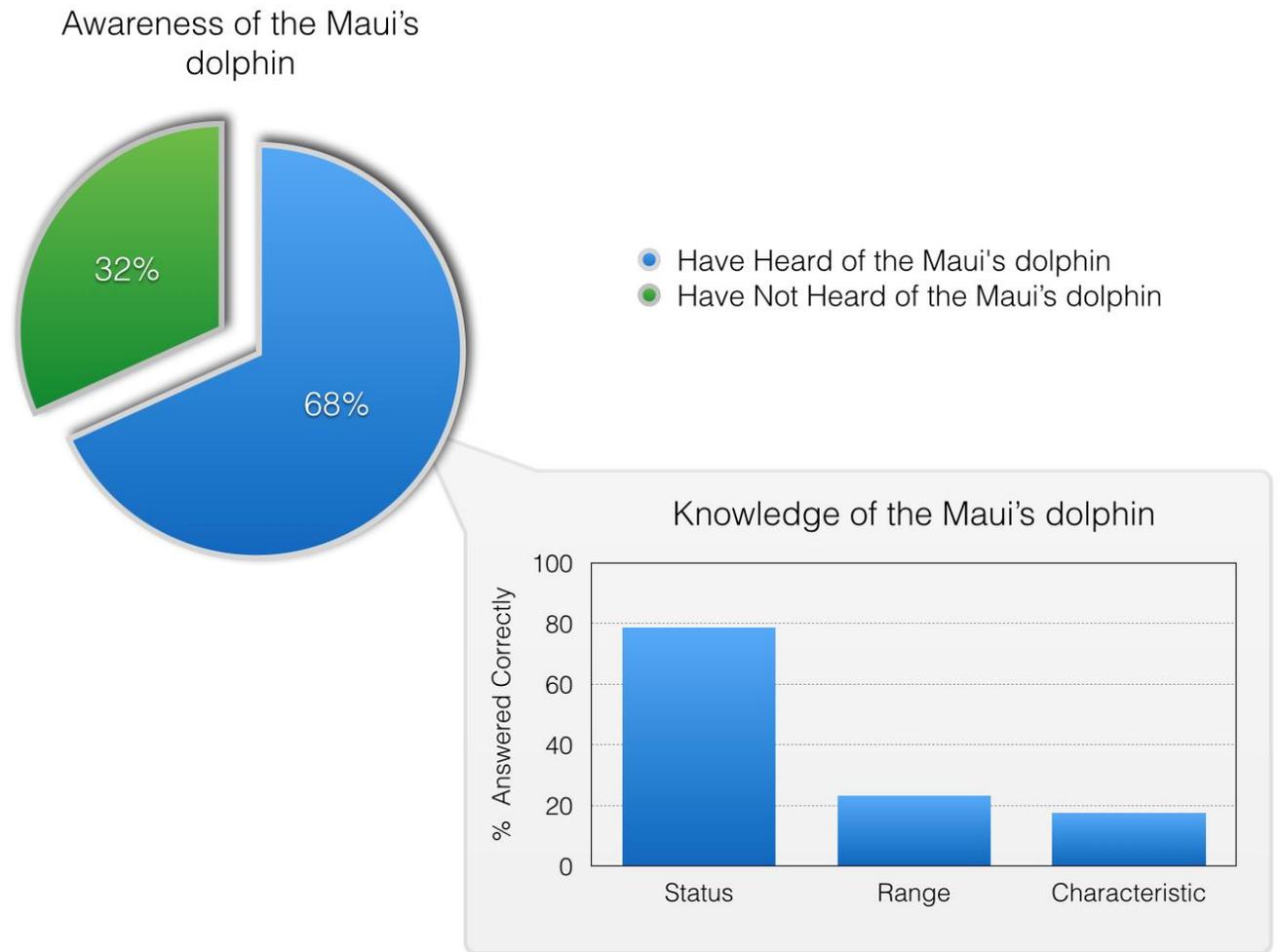


Figure 8: Public knowledge of the Maui's dolphin

This figure shows that 68% ($\pm 0.238\%$) of the population surveyed is aware that the Maui's dolphin exists. Of those, 79% ($\pm 0.238\%$) know that the Maui's dolphin population is decreasing, 23% ($\pm 0.316\%$) know that the Maui's dolphin lives off the west coast of the North Island, and only 18% ($\pm 0.285\%$) know that the Maui's dolphin is identified by a unique, rounded dorsal fin.

It is surprising that such a great percentage of the survey sample is aware of the Maui's dolphin but unaware of three important specific details: the species' declining population, range, and rounded dorsal fin. Respondents often answered confidently that they had heard of the Maui's dolphin but admitted that they would be guessing if they tried to answer any of the specific knowledge questions.

It is also surprising that while a very small percentage of respondents can identify the Maui's dolphin's home range or identifying characteristic, most of the survey sample knows that the population is decreasing. From the survey results, it is not possible to determine whether respondents who otherwise do not know much about the Maui's dolphin actually know that the population is decreasing or if they were able to guess that the population is decreasing because a survey was conducted on behalf of DOC. It is also common knowledge that most of New Zealand's native species are in decline, so it is possible this may have influenced responses.

The survey respondents' lack of specific knowledge about the Maui's dolphin raises many questions. Do respondents currently know enough about the Maui's dolphin to respond to a conservation campaign? Will people become involved in conservation efforts to protect the Maui's dolphin if the apparent gaps in public knowledge are filled? These results also raise the question: Is lack of public knowledge about the Maui's dolphin the primary reason why DOC does not receive more Maui's dolphin sighting reports? The discovery that respondents knew so little about Maui's dolphins changed the focus of this project from improving available sighting report services to improving education about available reporting services **and** about the species itself: Citizens cannot report seeing what they cannot identify.

Of the survey respondents who know of DOC's services for reporting Maui's dolphin sightings, very few could accurately report a sighting. If a respondent is aware that DOC has services to report a Maui's dolphin sighting and knows that the Maui's dolphin is identified by a rounded dorsal fin, we presume that they would be able to accurately report a sighting. As shown in Figure 9, of the 262 (68% \pm 0.238% of the 384 total respondents) people who have heard of the Maui's dolphin, 93 (35% \pm 0.358%) people know of DOC's service for reporting Maui's dolphin sightings. Of those 93, only 18 (19% \pm 0.833%) people were able to correctly answer the question, "Which is an identifying characteristic of the Maui's dolphin?". Therefore, only 19% of the people who know of DOC's Maui's dolphin sighting reporting service would be able to identify accurately a Maui's dolphin in the wild and report a sighting.

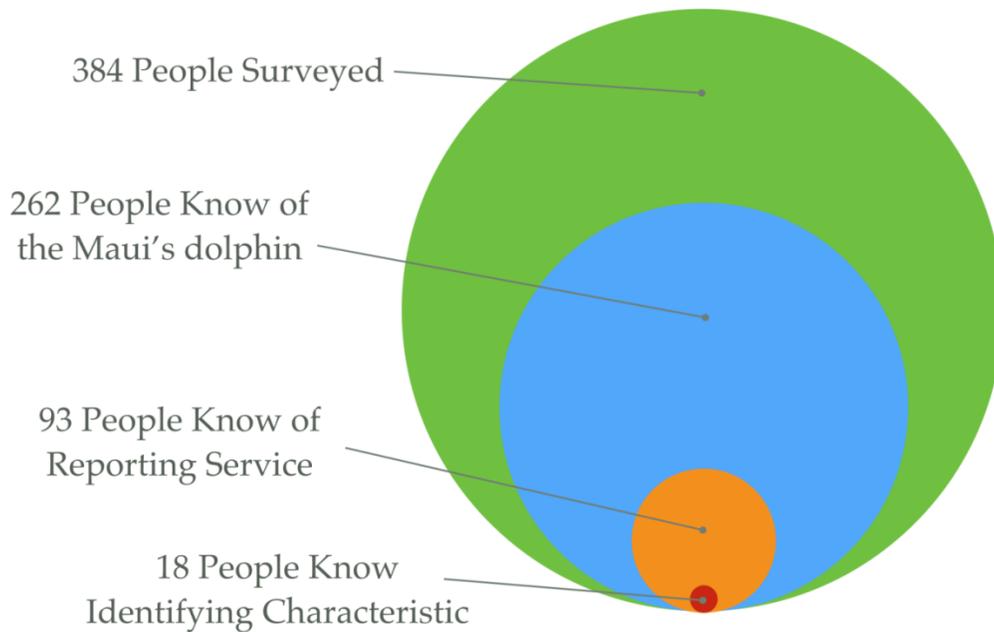


Figure 9: Lack of knowledge of both the Maui's dolphin and DOC's sighting report services results in a very small percentage of respondents being able to accurately report a sighting

Respondents who could *not* accurately report a Maui's dolphin sighting include those who have not heard of the Maui's dolphin, those who have not heard of DOC services for reporting Maui's sightings, and those who cannot correctly identify the Maui's dolphin by its rounded dorsal fin. **Overall, only 5% ($\pm 0.108\%$) of the representative sample could accurately report a Maui's dolphin sighting.**

This is surprising as DOC currently has several available services for reporting sightings including the DOC HOTline and an online sighting report form. Since sighting reports are relied upon so heavily to track the range of the Maui's dolphin, DOC's ability to effectively map the range of the dolphin could be undermined by the small percentage of the population surveyed who are able to accurately report a sighting. In addition, extensions to bans and protected areas are not passed without evidence that the species inhabits the region where the extension was proposed. Referring to extending existing set net bans and marine protected areas, Conservation Minister Dr. Nick Smith said, "The controversy around this issue essentially comes down to pinpointing where the Maui's dolphin are sufficiently present to justify set net bans." The small

percentage of the survey sample deemed potential reporters greatly limits DOC's chance of receiving sighting reports of the Maui's dolphin, a species whose small population size already limits the number of sightings received. This finding emphasizes the importance of public knowledge of both services available to report sightings and of the Maui's dolphin in general.

4.2 Awareness and Knowledge Based on Demographics

We hypothesized that awareness and specific knowledge of the Maui's dolphin would vary based on different demographics, specifically age and proximity to the dolphin's proposed range. To determine any such correlations, we analyzed levels of awareness and specific knowledge in relation to these key demographics. We found that respondents' age and location of residence significantly impacted awareness and knowledge of the dolphin, while location of survey did not.

4.2.1 Age

Older age groups (35+) are on average 27% more aware of the existence of the Maui's dolphin than younger age groups ($p = 0.0006$). Initially, we hypothesized that members of the younger generation (18-24; 25-34) would be more knowledgeable about conservation efforts. Figure 10 shows this discrepancy.

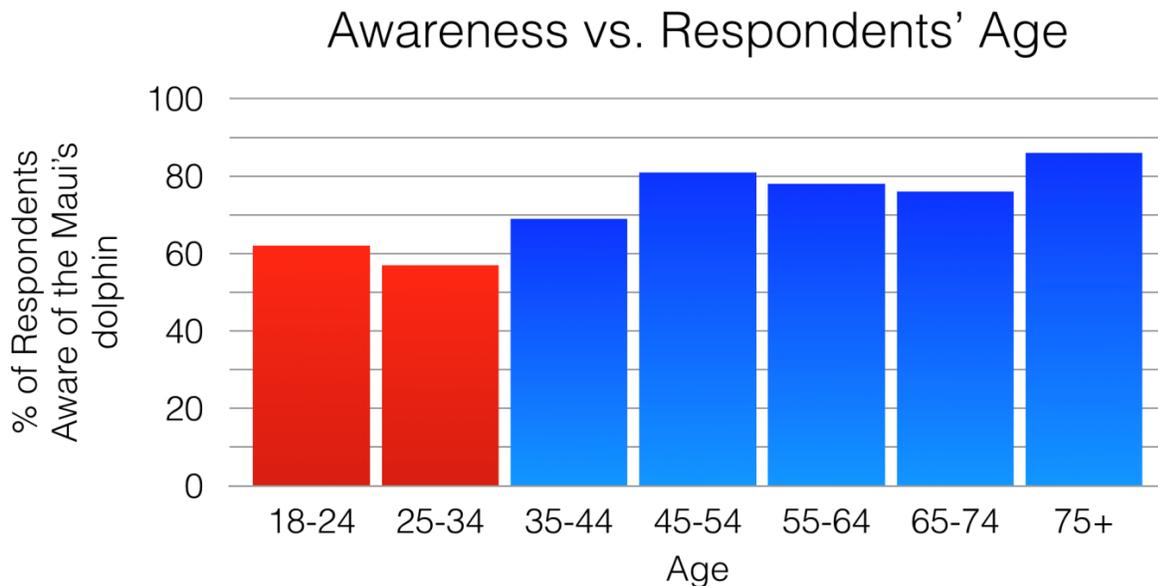


Figure 10: Awareness of Maui's dolphin based on age

Overall, $60\% \pm 0.5524\%$ of the younger respondents (18-24; 25-34) are aware of the Maui's dolphin and $75\% \pm 0.4029\%$ of the older respondents (35-44; 45-54; 55-64; 65-74; 75+) are aware of the Maui's dolphin. (Note that relatively few respondents fell into the two oldest age ranges, only seven over 75 years old and 22 in 65-74).

Further research showed that although younger generations have a reputation for being involved in conservation efforts, this is a commonly made misconception. An American survey on water use and attitudes toward water conservation found that younger residents did not participate in more conservation behavior than older residents. In fact, the survey concluded that "...older, more affluent residents are most likely to take steps to conserve water" (Wolters, 2013). In addition, a Saudi Arabian case study showed that the younger generation has very little knowledge about the importance of wildlife. The study attributed this low level of knowledge to the lack of available educational programs focusing on topics such as wildlife conservation (Al-Shayaa, El Hag & Muneer, 2007). Younger generations' lack of interest in conservation efforts appears to be a chronic problem.

Would younger generations respond to education about the Maui's dolphin? Could members of the younger generations have learned about the Maui's dolphin in a school setting? Since the Maui's dolphin was discovered as a subspecies of the Hector's dolphin in 2002, besides educators, respondents under the age of 24 are the only people in the survey sample that could have learned about the Maui's in a school setting. Survey data revealed that only $38\% (\pm 1.117\%)$ of the respondents aged 18 to 24 reported learning about the Maui's dolphin in a school setting. Although it could be a good outlet for informing a large population about the Maui's dolphin, it appears that education is not being used to its full potential.

4.2.2 Location

It was hypothesized that people who were frequently by the water would have greater level of awareness and specific knowledge of the Maui's dolphin because of the potential for increased exposure to educational resources, such as DOC signage, and other sources of information regarding the species. This conjecture was based on DOC's previous efforts to target communities close to the proposed range of the Maui's dolphin. We examined two possible location-based trends. First, we analyzed whether there was a correlation between respondents who had ever lived within 10 km of the west coast of the North Island, a region that encompasses the Maui's dolphin's proposed range, had a greater level of awareness and knowledge of the

Maui’s dolphin. Second, we determined if respondents surveyed in Whanganui, a town near the southernmost extent of the current protected areas, had a greater level of awareness and specific knowledge of the dolphin than respondents who had been surveyed in Wellington. Either of these trends could be used to determine the effectiveness of current educational material.

Respondents who have lived within 10 km of the ocean anywhere along the west coast of the North Island were significantly more aware of the Maui’s dolphin. This was determined by dividing the survey sample into two groups: respondents who answered “Yes” to “Have you ever lived within 10 km of the west coast of the North Island?” (n=232), and respondents who replied “No” to the same question (n=152). The percentage of aware respondents from each group was then examined. Figure 11 shows that a greater percentage of the respondents who have ever lived within 10 km of the west coast of the North Island are aware of the Maui’s dolphin.

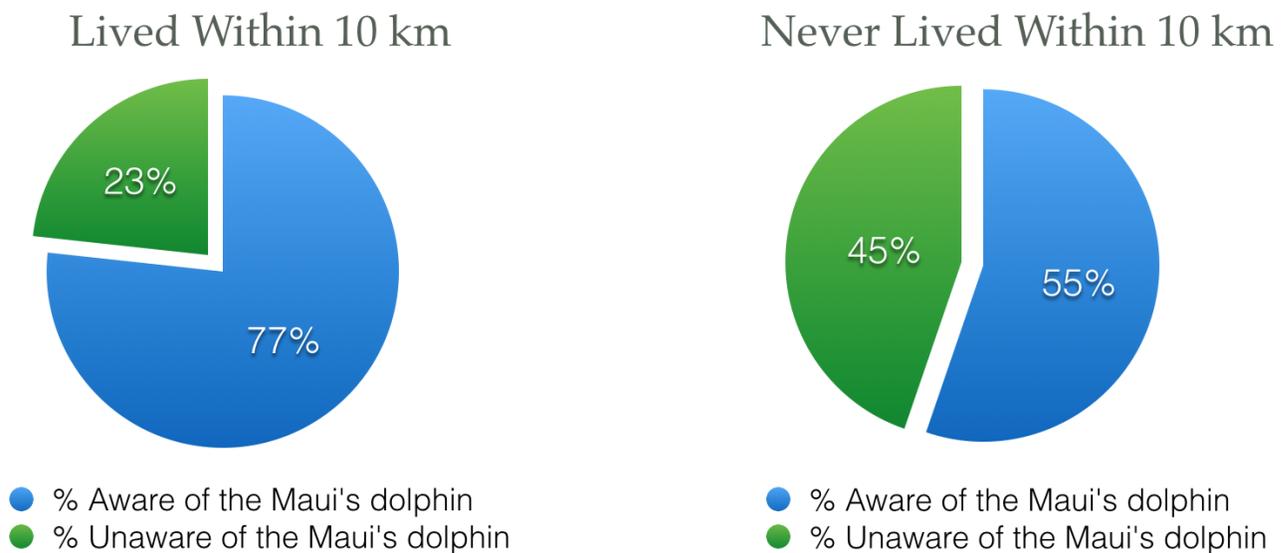


Figure 11: Percentages of respondents from each residence group who were aware of the Maui’s dolphin

In addition to assessing awareness based on location of residence, we examined specific knowledge of each group. We compared the percentages of correct answers to the specific knowledge questions (Questions 7-9) of the 232 respondents who had ever lived within 10 km of the West Coast to the 152 respondents who had not. In doing so, it was determined that

respondents who have ever lived within 10 km of the West Coast had more specific knowledge of specific characteristics of the species. This data can be seen in Figure 12.

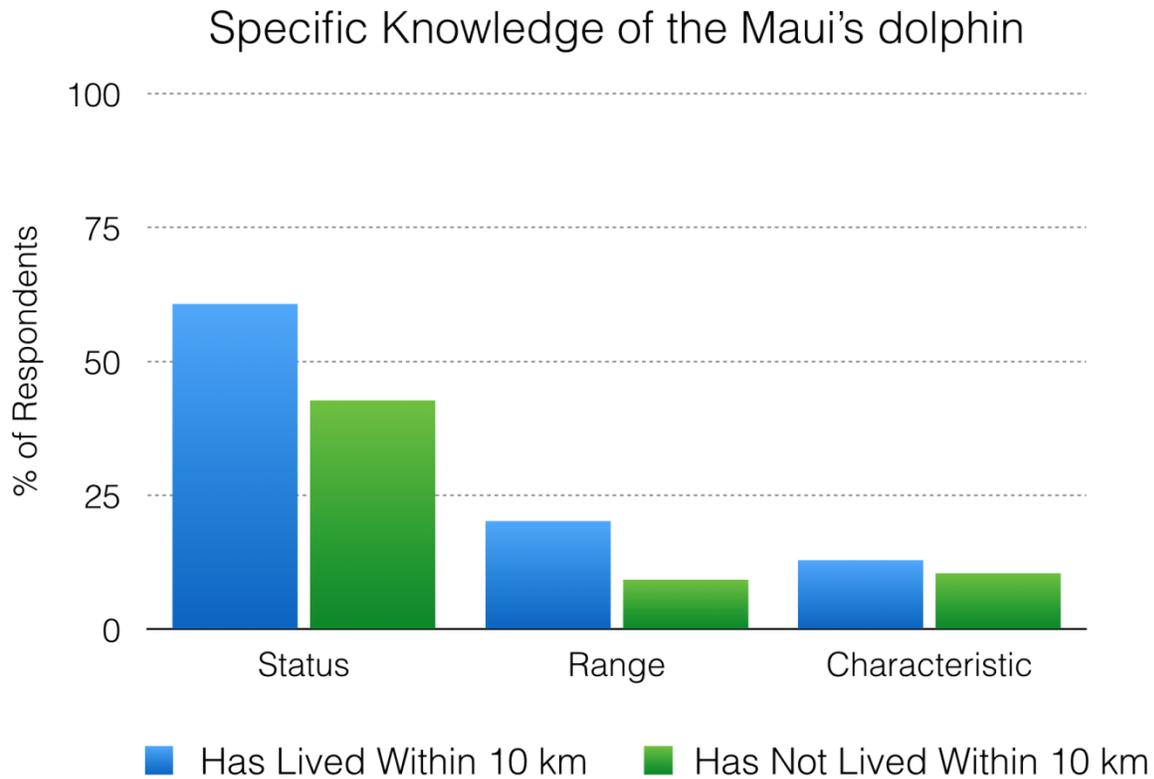


Figure 12: Percentages of each residence group that provided correct responses to specific knowledge questions (Questions 7-9)

As Figure 11 shows, respondents who have lived within 10 km of the West Coast were 39% more aware of the Maui's dolphin's existence ($p = 5.233 \times 10^{-6}$) than participants who have not. That same group is 42% more knowledgeable about the population's status ($p = 0.0003$), and 120% more aware of the species' range ($p = 0.002$). These differences are statistically significant, showing that respondents who have lived within 10 km of the West Coast are more aware of the Maui's dolphin, and are more knowledgeable about the population's status and species' range. In contrast, respondents who have lived within 10 km of the West Coast were only 23% more knowledgeable of the species' identifying characteristic. This difference is statistically insignificant ($p = 0.437$). The lack of significance in this data is most likely due to the universally low level of knowledge about the dolphin's unique rounded dorsal fin.

If respondents reported they had lived within 10 km of the west coast of the North Island, it is more likely that at some point during the duration of their residence they were exposed to information about the Maui's dolphin. This is evidenced by the higher percentage of respondents who have lived within 10 km of the West Coast with awareness and specific knowledge of the dolphin. This data raises several additional questions about respondents' sources of information, as the overwhelming majority of respondents reported that they had never seen any signage about the Maui's dolphin ($7\% \pm 0.220\%$). Lack of accessible signage implies that the higher level of awareness and specific knowledge was a result of other sources of information. Is it possible specific sources are more accessible to respondents who live within 10 km of the West Coast?

An additional concern raised by this data is that respondents did not have the specific knowledge required to participate in the conservation efforts. In other words, knowledge of the range and identifying characteristic of the species is directly necessary to report a sighting, while knowing the population status is not directly connected to the ability to submit a sighting report. As the data in Figure 12 shows, the percent of correct answers to the range and identifying characteristic questions were remarkably lower than the percent of correct status responses. This data might imply that the survey sample is obtaining information from ineffective materials. Perhaps the focus of these materials should be assessed.

Next, we examined the survey data based on where the respondent was surveyed (Whanganui versus Wellington). After analyzing the awareness and specific knowledge of respondents in Whanganui versus respondents in Wellington, it was found that the resulting data did not support our initial hypothesis - there was no significant correlation between location of survey and respondents' specific knowledge of the Maui's dolphin. *p*-values for this data can be found in Appendix C. While this was a potentially interesting trend we wanted to examine, we found that we did not design/execute our survey in a way that would have shown a significant correlation. To improve this, we should have asked the respondent about their hometown and current place of residency.

Several possible explanations may account for insignificant differences in knowledge between respondents surveyed in Whanganui and those surveyed in Wellington. The first and foremost is that even though we may have surveyed a respondent in Whanganui, that does not necessarily imply that the respondent **resides** in Whanganui. In our survey, the current place of

residence of the respondent was not ascertained. Whanganui is a popular summer vacation town, so if respondents were only in the region for a short period, there is no guarantee that they had been exposed to educational material tailored to the local community.

A second possible explanation is that we did not survey in the correct regions to be able to compare survey location to awareness and specific knowledge. We wanted to compare data from surveys conducted in two areas: One area **outside** the Maui's dolphin's known range, and one area **inside** the known range. Wellington was a suitable region, as it is outside the known range. Whanganui, however, is also outside the dolphin's range. Had we surveyed in a region well within the known range such as New Plymouth, Raglan, or Auckland, it is possible that we would have been able to see a significant correlation between survey location and awareness/specific knowledge of the Maui's dolphin.

4.3 Source of Information Versus Knowledge

Of the representative sample, most respondents obtain any knowledge they have of the Maui's dolphin through media, followed by education/school, and word of mouth. Figure 13 shows a breakdown of how the percentage of the representative sample that has heard of the Maui's dolphin obtains knowledge of the Maui's dolphin. The breakdown is based on the respondent's answers when asked to rank their top three sources used to obtain knowledge of the Maui's dolphin. Since respondents were asked to answer this question by using a ranking system, we devised the following point system in order to evaluate this data:

- A rank of 1 was given 3 points
- A rank of 2 was given 2 points
- A rank of 3 was given 1 point

Primary Sources of Information The Representative Sample Learn From

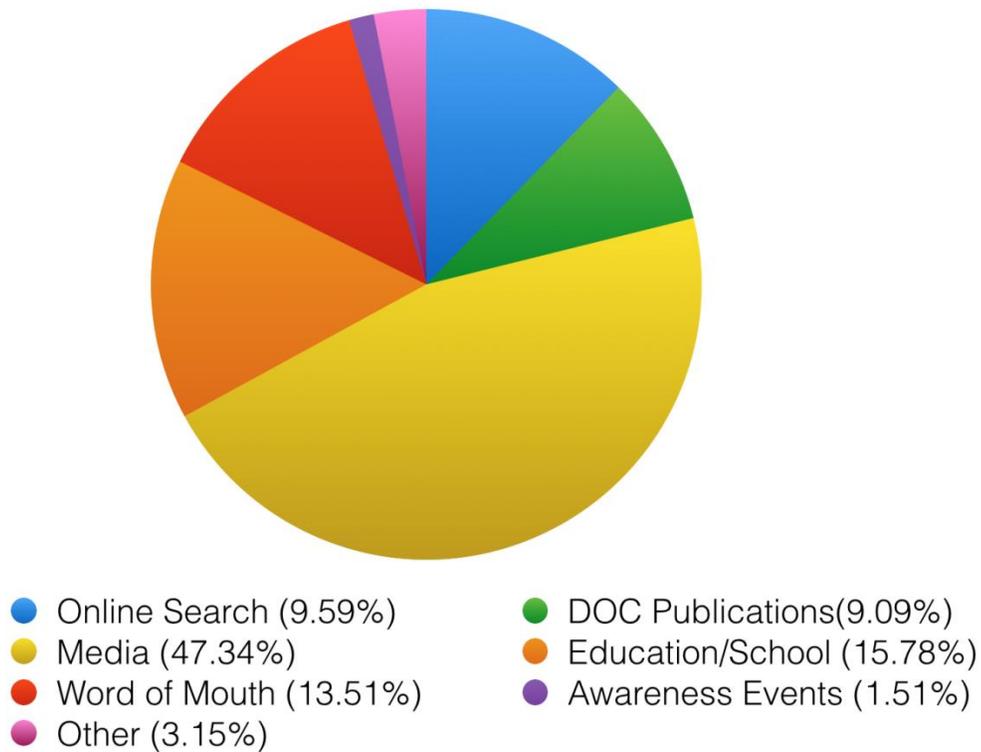


Figure 13: Breakdown of sources, using our points system, used by the survey sample to obtain knowledge of the Maui's dolphin

After assigning points to each source of information based on our points system, we determined that the most reported source of information is the media, including but not limited to television, radio, movies, and press releases (45%), followed by education/school (16%) and word of mouth (13%).

Furthermore, respondents who ranked media as their primary source of information regarding the Maui's dolphin were significantly more knowledgeable about the dolphin's status, home range, and identifying characteristic than respondents who did not rank media as their primary source of information ($p = 1.535E-12$, $p = 3.977E-11$; $p = 0.0001$). Respondents who ranked education/school as their primary source of information regarding the Maui's dolphin did not have significantly more knowledge about the dolphin's home range or identifying characteristic than respondents who ranked other sources as their primary source of information ($p = 0.707$; $p = 0.139$). Respondents who ranked DOC publications as their primary source of

information regarding the Maui's dolphin did not have significantly more knowledgeable about the dolphin's home range or identifying characteristic than respondents who ranked other sources as their primary source of information ($p = 1.92$; $p = 0.368$). As calculated according to our points system, respondents' relative levels of specific knowledge of the Maui's dolphin's population status, home range, and identifying characteristic in relation to primary information source are shown in a table included in Appendix D.

What specific sources of media do respondents use to obtain information about the Maui's dolphin? In addition, could DOC publications and school curriculums be better used to educate respondents on the Maui's dolphin and conservation efforts to protect the species? Why are DOC publications not a primary source of information about Maui's dolphins?

4.4 Public Opinion on Conservation

The representative sample believes that conservation of endemic species is significant both on a personal level and on a national level. Figure 14 shows respondents level of importance when asked if saving New Zealand's native species was personally important to them, as well as important to New Zealand as a nation. Of the 384 people surveyed, 353 (92% \pm 0.139%) selected either a 4 or a 5 (on a scale of 1 to 5, with 5 being most important) on a personal level. In addition to this, of the 384 people surveyed, 372 (97% \pm 0.089%) respondents felt as if saving native species was important to New Zealand as a nation. Figure 14 shows that most respondents reported that conservation is important to them for personal reasons and Figure 15 shows that most respondents reported that conservation is important to New Zealand as a nation.

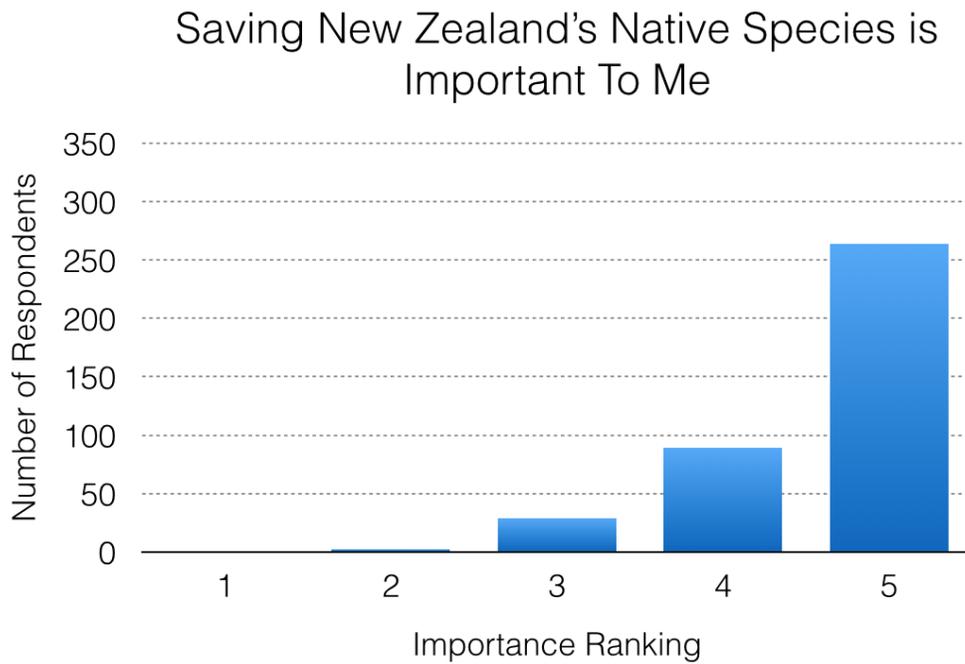


Figure 14: Respondents' interest in saving New Zealand's native species on a personal level

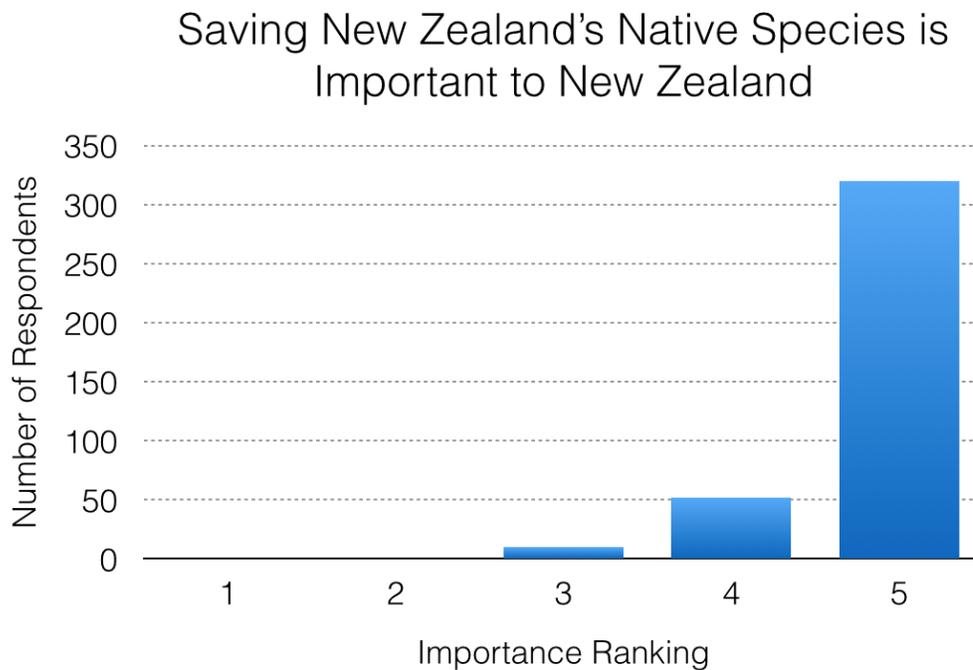


Figure 15: Respondents' interest in saving New Zealand's native species on a national level

Since respondents reported high levels of interest in saving New Zealand's native species, what can the current low level of public participation in conservation efforts be attributed to? Is inaccessibility of information regarding the Maui's dolphin and instructions on how to aid in conservation efforts a likely cause of little public involvement? It could be beneficial for DOC to assess the content and accessibility of any educational material being distributed to ensure that it is effectively educating the representative sample on Maui's dolphin.

In order to amplify the effectiveness of future material, the specific personal or national reasons for the representative sample's interest could be identified. Once identified, these reasons could be exploited to generate a potentially more effective outreach campaign. For example, one such reason could be the sense of nationalism that many New Zealanders share. If this were the source of the representative sample's interest, it could be taken advantage of to better engage the target audience and help improve the lack of knowledge regarding the Maui's dolphin.

A respondent's ethnicity could also be related to how much value they assign to saving New Zealand's native species for personal or national reasons. Survey data showed that respondents who identified as Maori were 9% more interested in saving New Zealand's native species on a personal level than non-Maori respondents were ($p = 0.0325$). This result could suggest that New Zealand's native species are important to Maori culture, revealing an audience who would most likely be interested in and respond well to educational resources focused on conservation efforts to save the Maui's dolphin. Are there specific ways to target the Maori population by drawing from the fact that New Zealand's native species are culturally significant to Maori people?

Chapter 5: Conclusions and Recommendations

This chapter summarizes our conclusions and subsequently presents in detail our recommendations for educating the public about available sighting report services and the Maui's dolphin. These recommendations are aimed at increasing the number of publicly reported sightings DOC receives. When forming the conclusions and recommendations of our project, we drew on background research, personal experiences throughout the project, correspondences with DOC employees, and survey data. Our recommendations were sourced from the findings outlined in the previous chapter. Based on our survey design, our findings were only applicable to respondents in Wellington and Whanganui, but our sample's interest in conservation revealed that there was a niche for an effective and engaging educational program about the Maui's dolphin. This conclusion validated our project, and enabled us to make the following recommendations to DOC so that they can effectively fill that niche. We will also discuss the future implications of our recommended educational program.

5.1 Educating the Public about the Maui's Dolphin

One of the primary deliverables outlined at the outset of the project was a set of recommendations geared towards streamlining sighting report services and improving their accessibility. After careful analysis of survey data, consideration of background research, and correspondence with DOC employees, we determined that the our sample is as equally unaware of characteristics of the Maui's dolphin species as it is of available reporting services and the usage of available reporting services. **We recommend that to increase the likelihood of sighting reports, DOC produce and distribute educational resources aimed at educating the public about the Maui's dolphin in general in conjunction with outreach material regarding available sighting report services.** While it is important that DOC receives Maui's dolphin sighting reports in order to assist with habitat mapping and legislative measures, our respondents remain generally uneducated on the conservation issue. Without basic knowledge of the species, people cannot identify a Maui's dolphin, let alone report a sighting.

Figures 16 and 17 illustrate the key difference between the optimal situation and the current situation: The public's awareness is insufficient to generate sighting reports. In an ideal situation, awareness increases the likelihood of sighting reports and eventually leads to improved

protection. However, the current situation fails to generate sighting reports because of this stunted knowledge base, which results in less enhanced protection. Figure 18 suggests a cure, improved education and enhanced reporting services.



Figure 16: Optimal flow of conservation process



Figure 17: Current failed conservation process

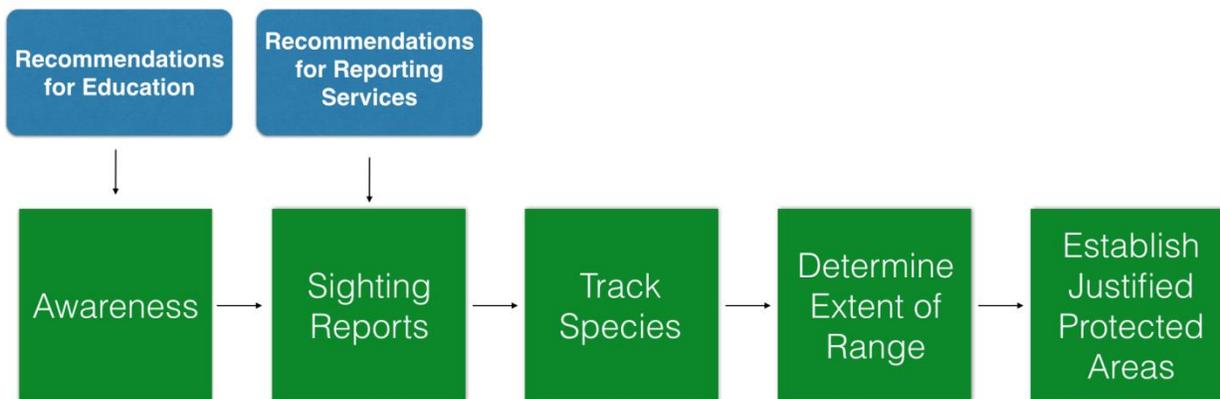


Figure 18: Flow of conservation process improved by better education and enhanced reporting services

Note that in Figure 18, better education and enhanced sighting report services are used to remedy respondents' lack of awareness of the Maui's dolphin and its characteristics, allowing for sighting reports to be submitted. These reports allow DOC to track the species and determine its comprehensive range. With knowledge of the extent of the dolphin's range, effective protected areas can be established. As previously mentioned, the Minister of Conservation is hesitant to enact any new bans or protected areas without extensive knowledge of the range of the Maui's dolphin, emphasizing the importance of frequent and accurate sighting reports. Still, it is unclear whether increasing respondents' awareness of the dolphin would result in more conservation behavior. A future study could investigate which behavioral strategies most effectively lead people from simply being aware of a species to actively conserving it.

We recommend that DOC tailor the content, distribution location, and vehicle of educational resources to effectively target various audiences with information about services to report Maui's dolphin sightings and about the Maui's dolphin in general. By keeping a consistent message throughout all educational resources, but changing details about how and where the message is presented, it is possible to reach a large portion of the general population as well as improve message uptake by establishing a "Maui's dolphin brand." Our findings show that, overall, the public's specific knowledge of the Maui's dolphin is very low. Hence, DOC might profitably aim to educate as much of New Zealand's public as possible about conservation efforts to protect the Maui's dolphin. Although findings show that certain demographics have significantly greater knowledge of the Maui's dolphin, it is also apparent that other demographics lack awareness and specific knowledge of the species and could benefit greatly from targeted, engaging educational resources. This recommendation is also built upon the National Oceanic and Atmospheric Administration (NOAA) Northeast Regional Offices' example of designing educational resources to best inform different audiences such as the general public, boaters, recreational fishermen, and commercial fishermen about endangered species. Section 2.4.1 further examines NOAA's example to raise awareness about the organization's reporting hotline. The following sections will outline specific ways to target different audiences in New Zealand.

5.1.1 “Maui’s Dolphin Story” Poster

We recommend that DOC distribute a “Maui’s Dolphin Story” poster that can be used to inform the reader of the Maui’s dolphin in a relatable way and gain the reader’s empathy for the dolphin. In 2012, Air New Zealand partnered with DOC to launch a translocation campaign which resulted in the production of multiple posters. These posters presented a story about a specific species, including a paragraph informing the reader about the species in an informal way. Our group liked how these posters made us feel for the animals and made us want to become involved in conservation efforts to protect them. In addition, the poster inspired us to view Air New Zealand in a very benevolent light as a company who is devoted to protecting New Zealand’s native species. The poster we modeled after the Air New Zealand translocation campaign posters is shown in Figure 19. The “Maui’s Dolphin Story” poster is meant to humanize the Maui’s dolphin so readers feel a sense of empathy for the species. It may also serve to portray DOC not only as a government agency, but also as a compassionate organization.

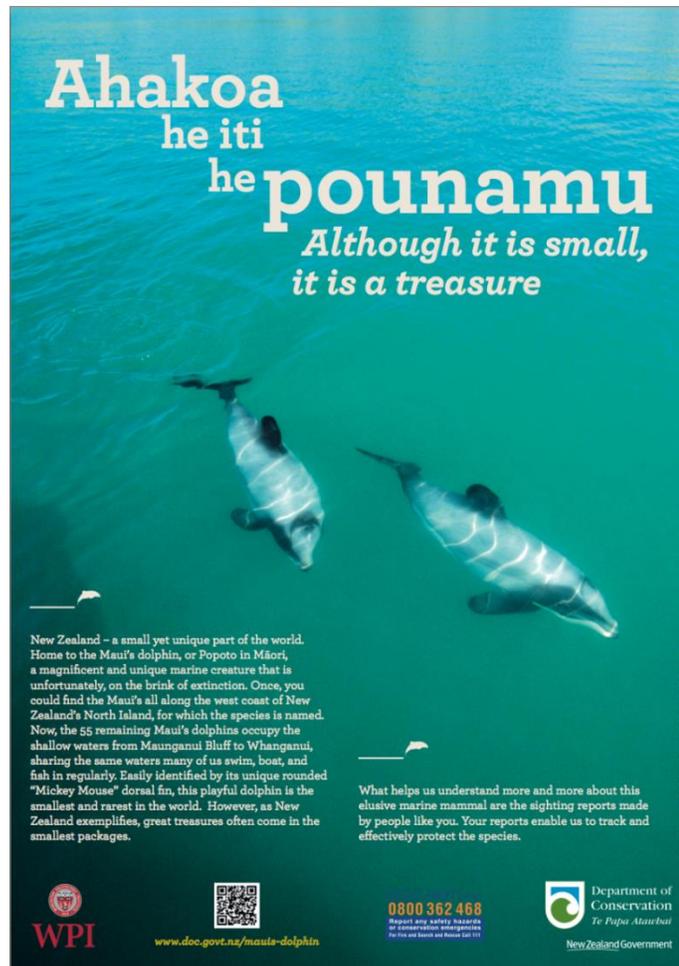


Figure 19: “Maui’s Dolphin Story” poster

The poster relates information in a colloquial, easy-to-read narrative that outlines the importance of Maui’s dolphins to New Zealand and the conservation issue at hand. Still, the text contains key facts about the species. The title of the poster is a Maori whakatauki relating the dolphin to New Zealand, “Ahakoa he iti he pounamu (*Although it is small, it is a treasure*).” The background of the poster is a photograph of Maui’s dolphins in the water, clearly showing the dolphins’ rounded dorsal fins. A QR code on the poster links the reader to DOC’s Maui’s dolphin information page. From the information page, a reader could navigate to the online sighting report form if necessary.

Because of its general, non-controversial content, this poster could be placed anywhere so it is easily accessible to various audiences. Putting this poster in visitor centers, on cruise ships, or on tour ships could inform tourists about New Zealand’s native species, while placing this

poster at bus stops, in grocery stores, or on buildings could inform residents about an urgent conservation issue facing their nation. The text of this poster reads:

New Zealand - a small yet unique part of the world. Home to the Maui's dolphin, or Popoto in Māori, a magnificent and unique marine creature that is unfortunately, on the brink of extinction. Once, you could find the Maui's all along the west coast of New Zealand's North Island, for which the species is named. Now, the 55 remaining Maui's dolphins occupy the shallow waters from Maunganui Bluff to Whanganui, sharing the same waters many of us swim, boat, and fish in regularly. Easily identified by its unique rounded "Mickey Mouse" dorsal fin, this playful dolphin is the smallest and rarest in the world. However, as New Zealand exemplifies, great treasures often come in the smallest packages.

What helps us understand more and more about this elusive marine mammal are the sighting reports made by people like you. Your reports enable us to track and effectively protect the species.

5.1.2 Classroom Education

Our findings show that, of our sample, younger generations are generally less aware of the Maui's dolphin. In addition, few younger generation respondents reported learning about the Maui's dolphin in a school setting. Survey results also revealed that many respondents reported learning about New Zealand's native species in school. After emailing several primary and secondary educators from schools along the west coast of the North Island, a biology educator from a Wellington secondary school wrote us: "Year 12 & 13 biology uses NZ native species examples extensively...[we] use NZ examples almost every lesson and study the species of plants and animals in detail in experiments weekly." However, when asked if the Maui's dolphin is a topic currently covered in the classroom, he replied, "[O]nly in passing as an example of a species on the brink of extinction with reluctance by the Government and its agencies ... to care for and protect these species."

We recommend that DOC consider targeting younger generations by providing primary and secondary school educators with Maui's dolphin information and sample

lesson plans that can be included in a school curriculum. As younger age groups represent long term and impressionable investments, DOC should focus on effectively engaging these groups. While these educational programs could be widely distributed throughout the country, it is most valuable for Maui's dolphin education to be included in the curriculum of schools that are attended by students living on the west coast of the North Island, within the range of the Maui's dolphin. Proper education in these areas will most directly influence accurate sighting reports and other actions that will help to progress conservation efforts.

5.2 Educating about Reporting Services

We recommend that DOC further inform the public about the value of reported Maui's dolphin sightings submitted through DOC's services. In addition to being knowledgeable about the Maui's dolphin in general, the public must also be informed of the services used to report Maui's dolphin sightings. Our survey data shows conclusively that very few respondents would be able to accurately report a sighting. This roadblock is partly due to respondents' lack of knowledge of the Maui's dolphin but also due to respondents' lack of knowledge regarding available reporting services. By raising awareness about reporting services, we hope to increase the frequency of Maui's dolphin sightings that are reported, which will in turn allow DOC to track the species, determine the extent of its range, and establish Marine Protected Areas.

We recommend that DOC use the slogan "Rounded fin? Send it in!" in educational resources. This catchy slogan can be used to grab the target audience's attention, and will hopefully become ingrained in the reader's mind. The slogan reminds the reader of the Maui's dolphin's distinctive rounded dorsal fin, while at the same time conveying a very important message: Send all Maui's dolphin sightings to DOC. We initially considered using "Call it in!" as the second half of the slogan, but changed it to "Send it in!" with consideration of the online and smartphone reporting services. If the slogan were left as "Call it in!" it may have been unclear to the public that these services were available in addition to the DOC HOTline. We aimed to create a universal slogan that would encompass all current and future reporting services in order to "brand" the Maui's dolphin conservation efforts and to address half of the challenge associated with accurately reporting a sighting -- correctly identifying the animal.

5.2.1 “Rounded fin? Send it in!” Poster

To address the other half of the challenge of accurately reporting sightings – getting the report to DOC – we recommend that DOC distribute a poster featuring simple, step-by-step instructions on how to report a sighting. The poster shown in Figure 20 walks the reader through DOC’s current report system and includes the “Rounded fin? Send it in!” slogan.



Figure 20: “Rounded fin? Send it in!” poster

Using three simple key words, the poster outlines the most important details to follow when spotting a Maui’s dolphin:

1. **Spot:** informs the reader of facts that can lead to the proper identification of a Maui’s dolphin

2. Report: tells the reader to report the sighting by calling the DOC HOTline or by going to DOC's website and filling out the online form
3. Confirm: notifies the reader that he or she will be contacted in the future in order to verify the Maui's dolphin sighting

Also included in the poster is a QR code that links the user to the Maui's dolphin report page. If a smartphone application is developed in the future, this QR code can link the user to the application instead.

This poster should be distributed in locations close to the Maui's dolphin's range (from Maunganui Bluff down to Whanganui). Outside of the dolphin's range, the reporting details in this poster are unlikely to be useful. The audiences in regions outside of the dolphin's range would more likely benefit from the "Maui's Dolphin Story" poster, which would inform them about the species in general.

5.2.2 Bumper Sticker

To widely promote both the dolphin's identifying feature and the importance of reporting sightings, **we recommend that DOC distribute a bumper sticker with the "Rounded fin? Send it in!" slogan.** The bumper sticker shown in Figure 21 contains a picture of Maui's dolphin, the DOC HOTline logo, and the request, "Please report all Maui's dolphin sightings." This combination is a quick and easy way to educate many people about the Maui's dolphin and DOC's services for reporting their sightings. Since bumper stickers are mainly seen on moving vehicles, readers only have a few seconds to absorb the stickers' brief content. The "Rounded fin? Send it in!" bumper sticker shows a memorable slogan and an image of a Maui's dolphin with its rounded dorsal fin easily visible.



Figure 21: “Rounded fin? Send it in!” bumper sticker

5.2.3 Tackle Box Sticker

We recommend that DOC distribute to anglers a tackle box sticker with the “Rounded fin? Send it in!” slogan and more extensive instructions for reporting a sighting. The content of the tackle box sticker was based on current DOC instructions in case of a Maui’s dolphin sighting; see Figure 22. We decided to target fishermen because they are often near or on the water and therefore have a higher probability of spotting a Maui’s dolphin. The sticker describes the range of Maui’s dolphins and the species’ rounded dorsal fin, increasing the likelihood of accurate sighting reports. After walking the reader through the identification process, the sticker outlines the procedure for reporting a Maui’s dolphin sighting.

The sticker directs the reader to report a sighting either by calling the DOC HOTline or by completing an online form. The online form can be accessed by scanning a QR code on the sticker that links the user to the report website. Safety precautions are also included on the sticker for both the reader’s and the dolphin’s safety. If the reader is in a protected area and sees set nets, the reader is encouraged to call a number to report poaching.



Figure 22: "Rounded fin? Send it in!" tackle box sticker

5.2.4 Reporting Back

We recommend that DOC regularly publish a newsletter to report back to the public on the importance of Maui's dolphin sightings and distribute it using an automated email, the community contact list, and a regular online publication. Survey data revealed that most respondents feel that conserving New Zealand's native species and the Maui's dolphin is important on a personal level, on a national level, or both. Although our respondents' specific knowledge of the Maui's dolphin is low, this interest suggests that perhaps respondents would become involved in conservation efforts to protect the Maui's dolphin if they were properly educated and engaged. When members of the public feel that they are appreciated and important to a cause, they are more willing to participate, as further examined in section 2.4 (Tun Min, 2009).

The newsletter should convey to the reader that verified publicly reported sightings help DOC accurately map the range of the Maui's dolphin. To enhance a reader's understanding of the genuine utility of publicly reported sightings, the publication could include facts such as the number of recent reports that led to positive conservation outcomes. DOC also logs every sighting reported in an online, up-to-date database. This resource could be continually updated

and attached to the newsletter in order to provide the public with a wealth of knowledge surrounding recent and past sightings.

DOC could reach a broader audience by using various vehicles to distribute the newsletter. By including a copy of the publication in the automatic email sent to people who report a Maui's dolphin sighting, the population who already participates in the conservation effort is targeted. Providing feedback to reporters on the significance of their sighting report could make them want to remain involved in the cause and participate in the future.

By using the community contact list discussed in section 5.3.2, DOC could regularly distribute a newsletter targeted towards audiences who may not have reported a Maui's dolphin sighting. The newsletter would not only inform readers about available reporting services, but also fulfill DOC's goal of imparting to the reader that the Maui's dolphin conservation issue is not one that DOC can tackle without public support.

5.3 Increase Accessibility of Resources

We recommend that as well as distributing educational resources at DOC Visitor Centres, DOC distribute educational materials in other locations not associated with DOC to more broadly reach the public. Many materials with excellent content are not readily accessible to people who would most benefit from them, leaving many individuals generally unaware of and uninformed about the critically endangered Maui's dolphin. This gap could explain the general trends we observed when analyzing survey data, which indicated that to a measurable extent, the majority of our sample was primarily unaware of and not knowledgeable about the Maui's dolphin. All of the specific knowledge questions asked on the survey are stated within all currently printed Maui's dolphin outreach material, which indicates flaws not necessarily with content, but more with overall accessibility. The following sections contain recommendations for making DOC's information about the Maui's dolphin more accessible to the public.

5.3.1 Smartphone Application

We recommend that DOC continue with the development of a smartphone application that allows users to report Maui's dolphin sightings. DOC has recently been interested in creating a mobile smartphone application in order to increase the number of

reported sightings of Maui's dolphins. Upon examination of knowledge gaps that existed within the public, it became clear that there *was* in fact a need to increase the accessibility of currently implemented sighting report services.

Similar applications already exist and have been proven successful elsewhere in the world. Specifically, DOC was inspired by Australia's "Coastal Walkabout" application, which was developed to track native wildlife encounters on Australia's west coast. Elements of DOC's application will be tailored to expedite and simplify the reporting process, enabling users to more easily report Maui's dolphin sightings regardless of their location. The design of the mobile reporting form is based upon a newly drafted version of the currently implemented online sighting report form, which has recently been redesigned by DOC staff in order to provide complete optimization. In addition, the application will include an educational section, which will be aimed at providing an accessible medium by which to educate the public. This section will use information obtained from newly updated DOC resources such as brochures and informational signage, ensuring that factual claims remain consistent between resources. As distribution of relevant material is a challenge for any conservation campaign, integrating important educational resources within a mobile application could prove to be an effective way to reach large audiences. Based on the five major principles of successful environmental education, effective usage of available technology is a major necessity of any sustainable and impactful campaign (Australian government, 2000).

5.3.2 Contact List

We recommend that DOC use a community contact list to spread awareness about conservation efforts to protect the Maui's dolphin and to broadcast important conservation alerts. Findings showed that respondents' specific knowledge of the Maui's dolphin is generally low. If insufficient knowledge of the species is due to a lack of exposure to educational resources, the creation of a community contact list comprised of various organizations and groups associated with the issue could improve the accessibility of educational resources. Groups that would be beneficial to target include but are not limited to conservation groups within the Maui's dolphin's habitat, marine studies departments at New Zealand universities, yacht and fishing clubs, and other clubs for water-based recreational activities. Many survey respondents were involved in water-based organizations or clubs. Water-based organizations and contacts

that have previously worked with DOC are good outlets for disseminating information about DOC's conservation campaigns.

The contact list, shown in Appendix G, could be used to distribute various important information to as large a portion of the New Zealand population as possible. This list could be used regularly to disseminate new educational materials, important alerts or updates on conservation efforts, or even distribute the newsletter generated as a recommendation in this project. Educational materials could include informational fact sheets, educational posters, and newsletters. Informational resources such as bumper stickers, brochures, and tackle box stickers could also be supplied to the organizations and contacts for distribution to their members or visitors.

5.4 Future Implications

We recommend that DOC apply our methodology to other conservation issues. Our project's overall design and implementation can be utilized to test the New Zealand public's general awareness and knowledge of other threatened species, including New Zealand birds, seals, sharks, and whales.

Several aspects of our survey design can be improved for future use. One major limitation of our survey was that we were not able to use our results to make inferences about the New Zealand public as a whole. Due to the controversial nature of the issue DOC suggested that we only conduct surveys in Whanganui and Wellington. As a result, we could only apply our findings to the respondents we surveyed in those locations. Our location may have also influenced some participants' responses. Since we were surveying in Whanganui, which is on the west coast of the North Island within the Maui's dolphin's home range, respondents in this location may have been able to infer the correct answer to the question about the dolphin's home range.

It was not clear whether respondents could have guessed that the Maui's dolphin population status was decreasing, simply because they were participating in a survey regarding the species on behalf of DOC. Also, the multiple-choice questions (Questions 7, 8, and 9), regarding testing specific knowledge of the dolphin could be improved. Our full survey can be found in Appendix A. Although we verbally offered the option, we should have included "I don't know" as a written multiple-choice option, as it was a frequent response.

Another improvement would be to ensure that none of the incorrect choices were misleading. For example, we felt that for the identifying characteristic question (Question 9) the multiple-choice answer “large, white eyespots” was too similar to the characteristic white markings on the dolphin’s underside. Some of our questions (Questions 14 and 15) may have induced response bias because the reader may have answered what they thought we wanted to hear even though we encouraged honesty.

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Appendices

Appendix A - Survey Questions

Date:

Location:

We are American university students conducting a **7-minute** survey on behalf of the Department of Conservation (DOC). Would you like to participate? Please answer all questions based on your experiences in New Zealand only.

How often are you by the water?

Very often Often Sometimes Not often Never

Are you by the water primarily for (select all that apply):

Work Recreation

In New Zealand, what activities do you participate in on the water? (Select all that apply)

Kayaking Going to the beach Recreational Fishing
Surfing Swimming Commercial Fishing
Paddle boarding
Snorkeling/ Diving Going on a boat Other: _____

Are you a member of any water-related organizations (i.e. yacht or other sports clubs)? If so, which ones?

Yes No

Have you ever heard of the Maui's dolphin?

Yes No

Have you learned about the Maui's dolphin in a school setting? If so, where?

Yes No

Which best describes the status of the Maui's dolphin population?

Increasing Stable Decreasing

Which best defines the home range of the Maui's dolphin?

West Coast North Island West Coast South Island
East Coast North Island East Coast South Island

Which of the following is an identifying characteristic of the Maui's dolphin?

Long, narrow nose Large, white eyespots
Rounded dorsal fin 3 meters in length

Are you aware that DOC has reporting services for reporting Maui's dolphin sightings?

Yes No

CONTINUED ON NEXT PAGE

Appendix B – Survey Results

1. Location of Survey		
Answer Options	Response Percent	Response Count
Kai Iwi	6.3%	24
Whanganui Marketplace	9.9%	38
Castlecliff Beach	4.4%	17
Whanganui Park/Gypsy Fair	5.2%	20
Wellington	74.2%	285
<i>answered question</i>		384
<i>skipped question</i>		0

2. How often are you by the water?		
Answer Options	Response Percent	Response Count
Very Often	43.2%	166
Often	27.3%	105
Sometimes	20.6%	79
Not Often	8.3%	32
Never	0.5%	2
<i>answered question</i>		384
<i>skipped question</i>		0

3. Are you primarily by the water for work or recreation?		
Answer Options	Response Percent	Response Count
Work	12.6%	48
Recreation	96.1%	367
<i>answered question</i>		382
<i>skipped question</i>		2

4. In New Zealand what activities do you participate on in the water?		
Answer Options	Response Percent	Response Count
Kayaking	24.3%	93
Surfing	7.6%	29
Paddle boarding	3.9%	15
Snorkeling/Diving	16.5%	63
Going to the beach	80.9%	309
Swimming	70.4%	269

Going on a boat	25.7%	98
Recreational Fishing	27.2%	104
Commercial Fishing	0.3%	1
Other (please specify)	13.9%	53
<i>answered question</i>		382
<i>skipped question</i>		2

5. Are you a member of any water-related organizations?

Answer Options	Response Percent	Response Count
Yes	8.9%	34
No	91.1%	348
<i>answered question</i>		382
<i>skipped question</i>		2

6. Have you ever heard of the Maui's Dolphin?

Answer Options	Response Percent	Response Count
Yes	68.2%	262
No	31.8%	122
<i>answered question</i>		384
<i>skipped question</i>		0

7. Have you heard of the Maui's Dolphin in a school setting?

Answer Options	Response Percent	Response Count
Yes	29.8%	78
No	70.2%	184
<i>answered question</i>		262
<i>skipped question</i>		122

8. Which best describes the status of the Maui's dolphins population?

Answer Options	Response Percent	Response Count
Increasing	0.8%	2
Stable	4.6%	12
Decreasing	78.6%	206
I don't know	16.0%	42
<i>answered question</i>		262
<i>skipped question</i>		122

9. Which best describes the home range of the Maui's Dolphin?

Answer Options	Response Percent	Response Count
West Coast North Island	23.3%	61
East Coast North Island	6.9%	18
West Coast South Island	6.9%	18
East Coast South Island	6.5%	17
I don't know	56.5%	148
<i>answered question</i>		262
<i>skipped question</i>		122

10. Which of the following is an identifying characteristic of the Maui's Dolphin?

Answer Options	Response Percent	Response Count
Long, narrow nose	10.3%	27
Rounded dorsal fin	17.6%	46
Large, white eyespots	7.3%	19
3 meters in length	1.1%	3
I don't know	63.7%	167
<i>answered question</i>		262
<i>skipped question</i>		122

11. Are you aware that DOC has reporting services for reporting Maui's dolphin sightings?

Answer Options	Response Percent	Response Count
Yes	35.5%	93
No	64.5%	169
<i>answered question</i>		262
<i>skipped question</i>		122

12. Have you seen signage about the Maui's dolphin?

Answer Options	Response Percent	Response Count
Yes	11.8%	31
No	88.2%	231
<i>answered question</i>		262
<i>skipped question</i>		122

13. Where have you obtained any knowledge you have of the Maui's dolphin? Please rank the top 3

Answer Options	1	2	3	Response Count
Online Search	23	23	11	57
DOC publications	17	23	12	52
Media	147	40	16	203
Education/school	45	20	14	79
Word of mouth	17	43	14	74
Awareness events	1	6	4	11
Other	12	5	4	21
(please specify)				21
<i>answered question</i>				262
<i>skipped question</i>				122

14. Where have you obtained any knowledge you have of New Zealand's native Species? Please rank the top 3.

Answer Options	1	2	3	Response Count
Online searches	52	27	40	119
DOC publications	49	41	34	124
Media	93	102	34	229
Education/school	103	44	35	182
Word of mouth	37	54	39	130
Awareness events	3	11	14	28
Other	42	19	12	73
(please specify)				74
<i>answered question</i>				380
<i>skipped question</i>				4

15. Savings New Zealand's native species is important to me?

Answer Options	Response Percent	Response Count
1	0.0%	0
2	0.5%	2
3	7.6%	29
4	23.2%	89
5	68.8%	264
<i>answered question</i>		384
<i>skipped question</i>		0

16. Saving New Zealand's native species is important to New Zealand?

Answer Options	Response Percent	Response Count
1	0.3%	1
2	0.3%	1

3	2.6%	10
4	13.5%	52
5	83.3%	320
<i>answered question</i>		384
<i>skipped question</i>		0

17. With what gender do you identify?

Answer Options	Response Percent	Response Count
Male	46.4%	178
Female	53.6%	206
<i>answered question</i>		384
<i>skipped question</i>		0

18. What is your age?

Answer Options	Response Percent	Response Count
18-24	22.1%	85
25-34	23.2%	89
35-44	20.8%	80
45-54	13.8%	53
55-64	10.7%	41
65-74	7.6%	29
75+	1.8%	7
<i>answered question</i>		384
<i>skipped question</i>		0

19. With what ethnicity do you identify

Answer Options	Response Percent	Response Count
New Zealand European	73.2%	281
Maori	9.9%	38
Asian	2.3%	9
Pacific Islander	2.3%	9
Other (please specify)	20.1%	77
<i>answered question</i>		384
<i>skipped question</i>		0

20. Have you ever lived within 10km of the West Coast of the North Island?

Answer Options	Response Percent	Response Count
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Yes	60.4%	232
No	39.6%	152
<i>answered question</i>		384
<i>skipped question</i>		0

Appendix C – Statistical Analyses

Chi-squared tests

A Chi-squared test was used to determine if two variables were dependent of each other. We tested the null hypothesis, that the two were independent of each other, and came to the following conclusions:

Key: If $p < .05$ → reject H_0 (they are dependent)
 If $p > .05$ → fail to reject H_0 (they are independent)

H_0	p-value
Living within 10 km of the west coast of the North Island	
Awareness of the Maui's dolphin is independent of living within 10 km of the west coast of the North Island	5.2335E-06
Knowledge of the Maui's dolphin's status is independent of living within 10 km of the west coast of the North Island	0.000288244
Knowledge of the Maui's dolphin's home range is independent of living within 10 km of the west coast of the North Island	0.00207697
Knowledge of the Maui's dolphin's unique rounded dorsal fin is independent to living within 10 km of the west coast of the North Island	0.437007078
Survey Location (Wellington vs. Whanganui)	
Awareness of the Maui's dolphin is independent of survey location	1.025398692
Knowledge of the Maui's dolphin's status is independent of survey location	0.1812077
Knowledge of the Maui's dolphin's home range is independent of survey location	1.1945E-05
Knowledge of the Maui's dolphin's rounded dorsal fin is independent of survey location	0.229118989
Age (Younger (18-34) vs. Older (35+))	
Awareness of the Maui's dolphin is independent of age	0.000645058

Knowledge of the Maui's dolphin's status is independent of age	0.13070457
Knowledge of the Maui's dolphin's home range is independent of age	1.59481E-06
Knowledge of the Maui's dolphin's rounded dorsal fin is independent of age	1.4454846
Ethnicity (Maori vs. Non-Maori)	
Awareness of the Maui's dolphin is independent of ethnicity	0.439160767
Knowledge of the Maui's dolphin's status is independent of ethnicity	0.3493829
Knowledge of the Maui's dolphin's home range is independent of ethnicity	0.102595557
Knowledge of the Maui's dolphin's rounded dorsal fin is independent of ethnicity	0.39159839
Ethnicity vs. interest in saving native species (Maori vs. non-Maori)	
Personal interest in saving New Zealand's native species is independent of ethnicity	0.03253626
National interest in saving New Zealand's native species is independent of ethnicity	2.129800876
Knowledge vs. number 1 source (Media)	
Knowledge of the Maui's dolphin's status is independent of number 1 source (Media)	1.535E-12
Knowledge of the Maui's dolphin's range is independent of number 1 source (Media)	3.977E-11
Knowledge of the Maui's dolphin's rounded dorsal fin is independent of number 1 source (Media)	0.0001229
Knowledge vs. number 1 source (DOC publications)	
Knowledge of the Maui's dolphin's status is independent of number one source (DOC)	0.032067

Knowledge of the Maui's dolphin's home range is independent of number one source (DOC)	1.922646
Knowledge of the Maui's dolphin's rounded fin is independent of number 1 source (DOC)	0.368207
Knowledge vs. number 1 source (Education/school)	
Knowledge of the Maui's dolphin's status is independent of number 1 source (Education/school)	2.26036E-05
Knowledge of the Maui's dolphin's home range is independent of number 1 source (Education/school)	0.706846044
Knowledge of the Maui's dolphin's rounded fin is independent of number 1 source (Education/school)	0.138820305
Age vs. Interest	
Personal interest in saving New Zealand's native species is independent of age	0.08869336
National interest in saving New Zealand's native species is independent of age	0.084531974

95% CI tests

We then used a 95% confidence interval to determine the range for single variables:

H ₀	CI
91.9271% of the representative sample believes that saving New Zealand's native species is important to them on a personal level	91.9271% ± 0.1390% (91.7880-92.0661)
96.8750% of the representative sample believes that saving New Zealand's native species is important on a national level	96.8750% ± 0.08881% (96.7862-96.9638)
68.2292% of the representative sample have heard of the Maui's dolphin	68.2292% ± 0.2380% (67.9916-68.4668)
53.6458% of the representative sample know the Maui's dolphins are in decline	53.6458% ± 0.2545% (53.7456-54.2544)
15.8854% of the representative sample know the Maui's dolphin live off the west coast of the North Island	15.8854% ± 0.1866% (15.8129-16.1871)

11.9792% of the representative sample know the Maui's dolphin have a rounded dorsal fin	11.9792% ± 0.1657% (11.8341-12.1659)
59.7701% ± 0.5524% of the younger respondents (18-24; 25-34) are aware of the Maui's dolphin	59.7701% ± 0.5524% (59.2178-60.3225)
75.2381% ± 0.4029% of the older respondents (35-44; 45-54; 55-64; 65-74; 75+) are aware of the Maui's dolphin	75.2381% ± 0.4029% (74.8352-75.6409)

Do respondents perceive the value of New Zealand's native species to the country to be greater than the value they personally ascribe to said species?	On average, people ranked the value of NZ's native species to the country to be 0.1927% ± 0.0020% (0.1907-0.1947) greater than to them personally
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Sample Calculations:

Chi-squared test

H₀: Awareness of the Maui's dolphin is independent of living within 10 km of the west coast of the North Island

The following observed values were obtained from the survey results:

	Lived within 10 km	Not lived within 10 km	
Aware	178	84	262
Unaware	54	68	122
	232	152	384

From the observed values, expected values were calculated by multiplying the row and column of the wanted number, and dividing by the total number of respondents:

	Lived within 10 km	Not lived within 10 km	
Correct	$232 \cdot 262 / 384 = 158.29$	$152 \cdot 262 / 384 = 103.71$	262
Incorrect	$232 \cdot 122 / 384 = 73.71$	$152 \cdot 122 / 384 = 48.29$	122
	232	152	384

The deviation was found using the following formula: $\frac{(\text{Observed} - \text{Expected})^2}{\text{Expected}}$

	Lived within 10 km	Not lived within 10 km
Correct	2.4638	3.7453
Incorrect	5.2697	8.0432

The Chi-square value is equal to the sum of the deviations: 19.5120

The degrees of freedom is equal to (Number of rows – 1)*(Number of columns -1) = (1)*(1) = 1

The p-value was found using Microsoft Excel’s “CHISQ.DIST” formula: 5.2335E-06

Since the p-value is less than 0.05, we rejected the null hypothesis, proving that awareness of the Maui’s dolphin is dependent of living within 10 km of the west coast of the North Island.

95% Confidence Interval

H₀: 91.9271% of the representative sample believes that saving New Zealand’s native species is important to them on a personal level.

A 95% confidence interval is determined by using the following formula: $p \pm \frac{1.96*\theta}{\sqrt{n}}$, where p = probability, θ = standard deviation, and n = sample size

$$p = 0.919271$$

$$\theta = \sqrt{\frac{p*(1-p)}{n}} = \sqrt{\frac{(0.919271)*(1-0.919271)}{384}} = 0.0139$$

$$\text{Standard error} = \frac{1.96*\theta}{\sqrt{n}} = \frac{1.96*0.0139}{\sqrt{384}} = 0.0014$$

$$95\% \text{ Confidence Interval} = 91.7880 - 92.0661$$

Appendix D - Respondent's Knowledge in Relation to Primary Information Source

Since respondents were asked to answer this question by using a ranking system, we devised the following point system in order to evaluate this data:

- A rank of 1 was given 3 points
- A rank of 2 was given 2 points
- A rank of 3 was given 1 point

The data included in the table is weighted according to our ranking system.

	Ranked 1st (weighted)	Ranked 2nd (weighted)	Ranked 3rd (weighted)	Points	Percentage of total points
Media	441	80	16	537	45.46994073
Education/ School	135	40	14	189	16.00338696
Word of mouth	51	86	14	151	12.78577477
Online search	69	46	11	126	10.66892464
DOC publications	51	46	12	109	9.229466554
Other	36	10	4	50	4.233700254
Awareness events	3	12	4	19	1.608806097

Appendix E - Correspondences

Email to DOC rangers

Hello Callum, Garry, and Stephanie,

We are a group of university students from Worcester Polytechnic Institute that are working with Laura Boren's team on the Maui's dolphin project. Will, Hannah, and our team alias are Cc'd in this email. We are trying to figure out the best way to raise awareness about the Maui's dolphin and engage the public in conservation efforts. We will be designing a smartphone application and recommending to DOC an educational approach to increase the public's awareness of the Maui's dolphin in general, sighting report services, and the use of sighting report services.

As part of our project, we will be compiling a contact list that DOC can use to spread awareness material and get important information out to the public. We were wondering if you could provide us with a list of some organizations that you currently work with so we can add them to our contact list. Thanks for your help!

Mary-Lee Barboza

Kyle Foster

Jesse Lehman

Sam Lowe

Email to primary & secondary school educators

Hello,

We are a group of American university students from Worcester Polytechnic Institute working on a project with the New Zealand Department of Conservation. We are trying to figure out the best way to raise awareness about the Maui's dolphin and engage the public in conservation efforts. One aspect of our project involves determining knowledge gaps and recommending ways

DOC can better educate the public, and more specifically younger age groups, about native species.

We were wondering:

To what extent do your curriculums include education about New Zealand's native species?

Are New Zealand's Hector's and/or Maui's dolphin a topic currently covered in the classroom?

Any information regarding this subject matter would greatly benefit our study.

Thank you!

Mary-Lee Barboza

Kyle Foster

Jesse Lehman

Sam Lowe

Email to water-based organizations for the contact list

Hello,

We are a group of American university students from Worcester Polytechnic Institute working on a project with the New Zealand Department of Conservation. We are trying to figure out the best way to raise awareness about the Maui's dolphin and engage the public in conservation efforts. One aspect of our project involves the creation of a contact list of interested parties to allow for a wider distribution of important alerts and educational bulletins. This is not to be confused with a formal partnership with DOC, instead it is merely a way to inform a greater audience about conservation efforts, with hopes that organisations will pass any relevant information along to its members.

If you would like to be included in this contact list please email us at dolphins-c14@wpi.edu with an email address (optional: phone number) you would like to be included in the contact list.

Also if you know of other organisations that would be interested in being added to this contact list, please inform us within the email.

Please don't hesitate to send us any questions or concerns you may have.

Thank you!

Mary-Lee Barboza

Kyle Foster

Jesse Lehman

Sam Lowe

Appendix F - Educational Resources

“Maui’s Dolphin Story” Poster

Ahakoia he iti he pounamu

*Although it is small,
it is a treasure*

New Zealand – a small yet unique part of the world. Home to the Maui’s dolphin, or Popoto in Māori, a magnificent and unique marine creature that is unfortunately, on the brink of extinction. Once, you could find the Maui’s all along the west coast of New Zealand’s North Island, for which the species is named. Now, the 55 remaining Maui’s dolphins occupy the shallow waters from Maunganui Bluff to Whanganui, sharing the same waters many of us swim, boat, and fish in regularly. Easily identified by its unique rounded “Mickey Mouse” dorsal fin, this playful dolphin is the smallest and rarest in the world. However, as New Zealand exemplifies, great treasures often come in the smallest packages.

What helps us understand more and more about this elusive marine mammal are the sighting reports made by people like you. Your reports enable us to track and effectively protect the species.

  **0800 362 468**
Report any safety hazards
or conservation emergencies
For Fire and Search and Rescue Call 111

 Department of
Conservation
Te Papa Atawhai
New Zealand Government

www.doc.govt.nz/mauis-dolphin

Maui's Dolphins (Cephalophony) - Photo: Bob Scahill/Alamy Photo



Rounded fin? Send it in!

Please report all Maui's dolphin sightings



Spot

Maui's dolphins live in the shallow waters off the **West Coast of the North Island**. They are most easily identified by their **small size** (1.7m) and by their **unique rounded dorsal fin**.



Report

If you spot a Maui's dolphin:
Report It!
By Phone: **0800 DOC HOT** or via the web:
www.doc.govt.nz/marine-mammal-sighting-form
Include location, group size, time, date, and photos showing nearby landmarks if possible.



Confirm

All reported sightings go through a validation process by DOC staff. Following validation, sightings are entered into the DOC sighting database. This database is accessible through the DOC website.



“Rounded Fin? Send it in!” Bumper Sticker



Tackle box sticker

Rounded fin? Send it in!

Common dolphin

Maui's dolphin

Do you think you've spotted a Maui's Dolphin?

1. Are you in their range? The Maui's dolphins live on the west coast of the North Island.
2. Does it have the Maui's unique rounded 'Mickey Mouse' dorsal fin?

If so, great! You've spotted a rare Maui's dolphin! So what now?

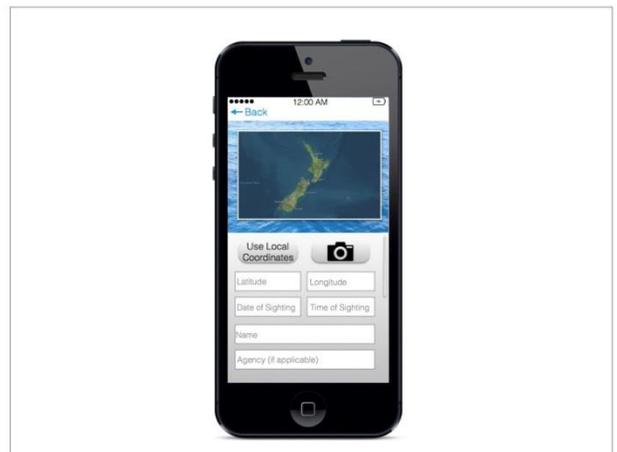
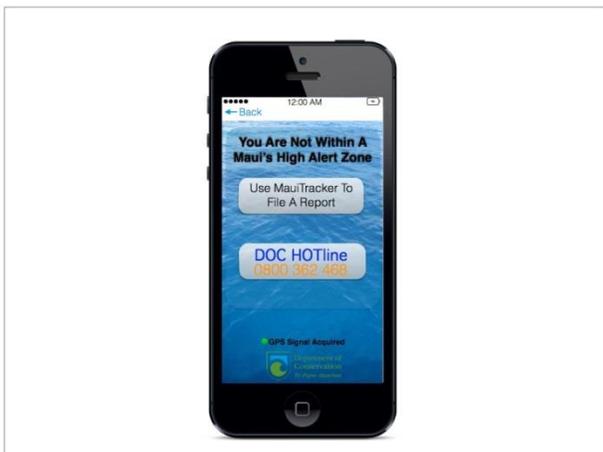
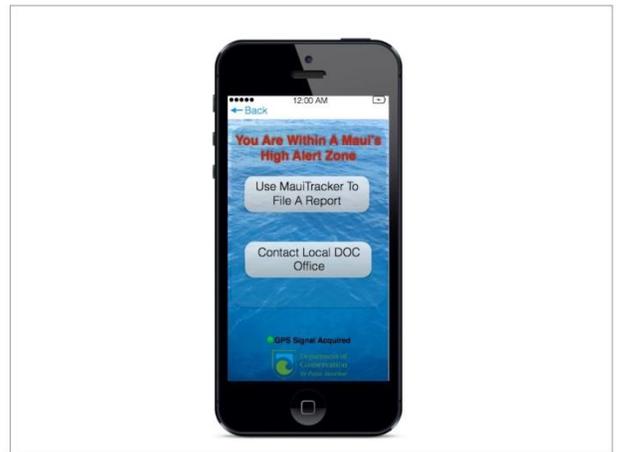
1. Report the sighting on the phone or online:
 - Call 0800DOCHOT
 - Scan the QR code below to report online
2. Include location, number seen, time, date and photos showing landmarks if possible.
3. Avoid contact with the dolphin – don't feed or swim with them.
4. Keep all nearby vessels to a safe distance – about 300m.
5. Keep your wake to a minimum.
6. If you are in a protected area and see set nets, call 0800 4 POACHER.

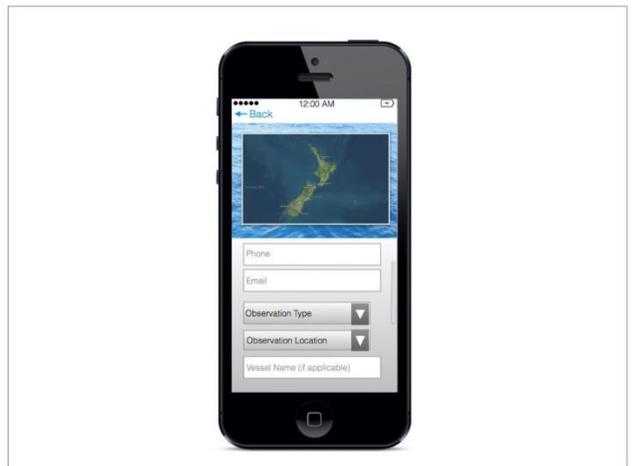
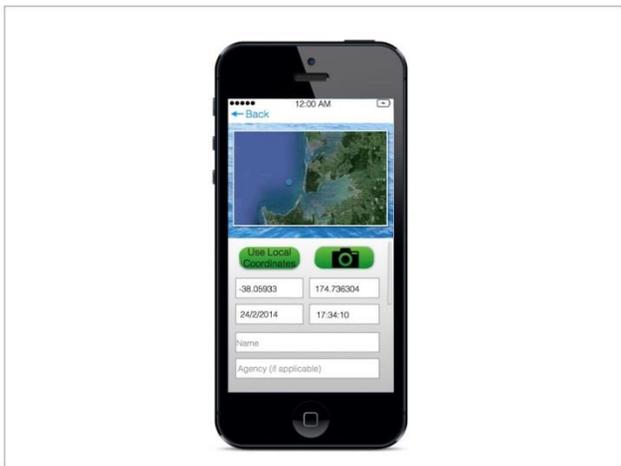
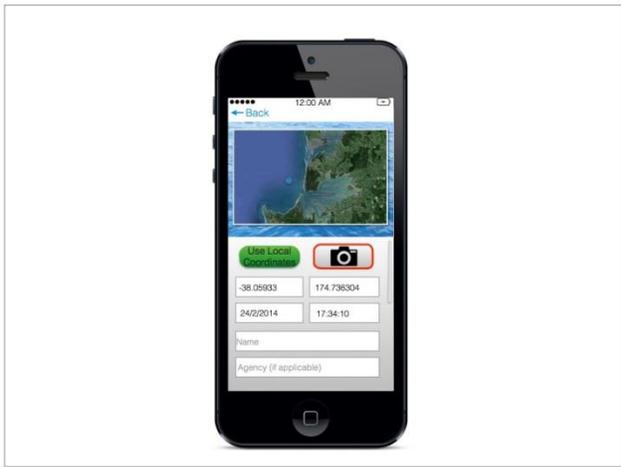
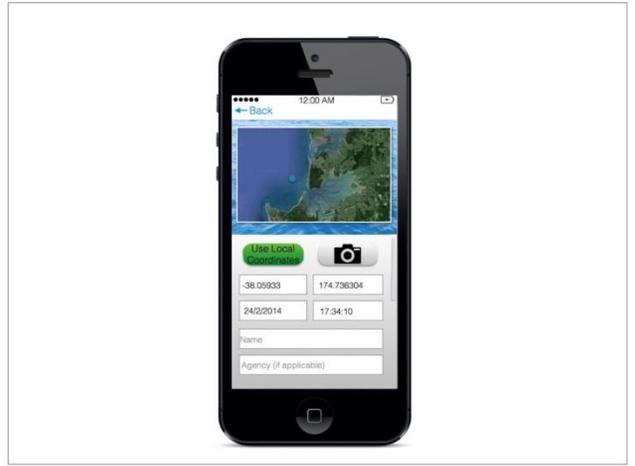
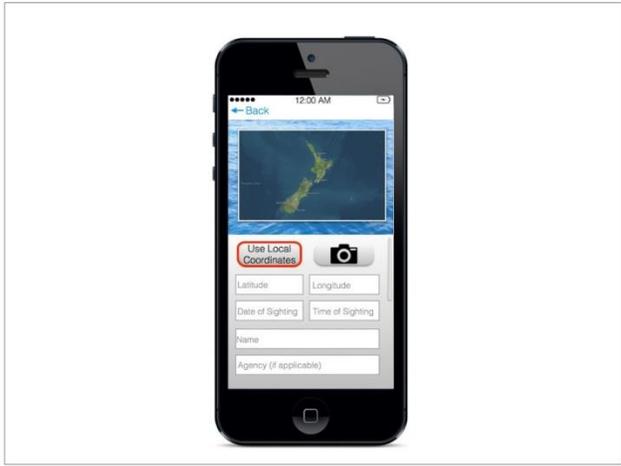
DOC HOTline
0800 362 468
Report any safety hazards
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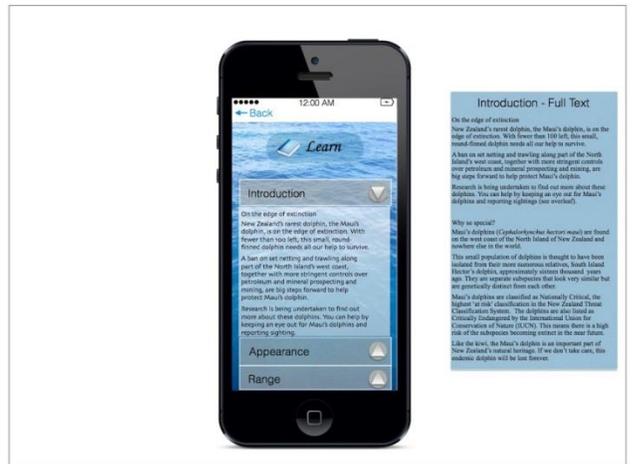
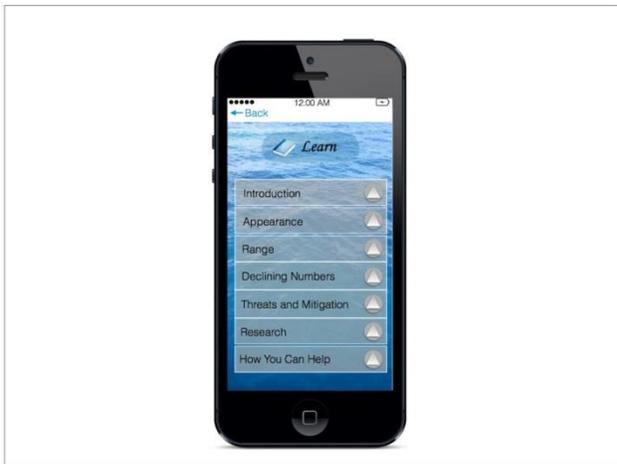
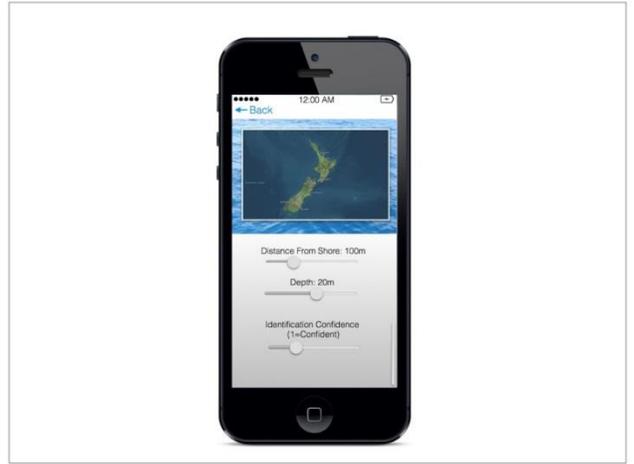
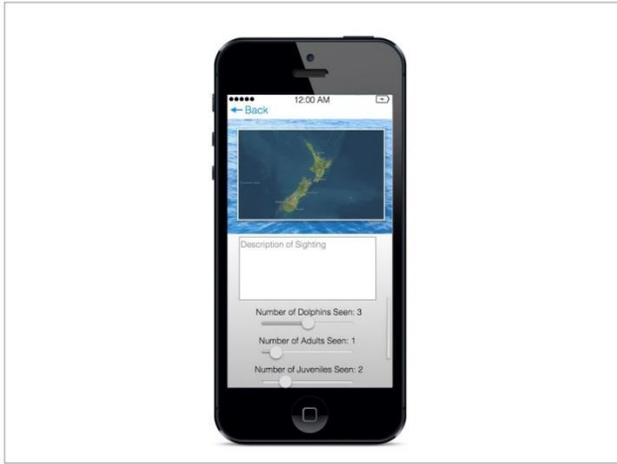
newzealand.govt.nz

Department of Conservation
Te Papa Atawhai

Smartphone Application





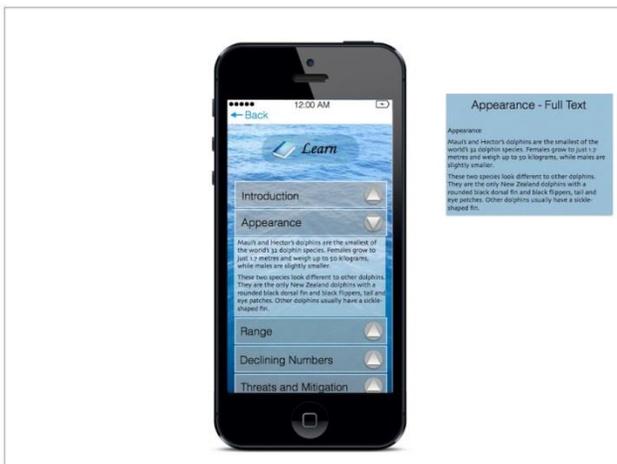


Introduction - Full Text

On the edge of extinction... New Zealand's rarest dolphin, the Maui's dolphin, is on the edge of extinction. With fewer than 100 left, this small, round, finned dolphin needs all our help to survive. A few are still nesting and traveling along parts of the North Island's west coast, together with more stringent controls over petroleum and mineral prospecting and mining, are being focused to help protect Maui's dolphins. Research is being undertaken to find out more about these dolphins. You can help by helping us get out for Maui's dolphins and reporting sightings (see overview).

Why so special?
Maui's dolphins (*Corynorhinus australis*) are found on the west coast of the North Island of New Zealand and nowhere else in the world. The small population of dolphins is thought to have been isolated from their more numerous relatives, South Island Hector's dolphins, approximately seven thousand years ago. They are separate subspecies that look very similar but are genetically distinct from each other.

Maui's dolphins are classified as Nationally Critical, the highest 'at risk' classification in the New Zealand Threat Classification System. The dolphins are also listed as Critically Endangered by the International Union for Conservation of Nature (IUCN). This means there is a high risk of the subspecies becoming extinct in the future. Like the kea, the Maui's dolphin is an important part of New Zealand's nature heritage. If we don't take care, the endemic dolphin will be lost forever.



Appearance - Full Text

Appearance
Maui and Hector's dolphins are the smallest of the world's 34 dolphin species. Females grow to just 1.7 metres and weigh up to 30 kilograms, while males are slightly smaller. These two species look different to other dolphins. They are the only New Zealand dolphins with a rounded black dorsal fin and black flippers, tail and eye patches. Other dolphins usually have a sickle-shaped fin.



Range - Full Text

Range
Maui's dolphins are generally found close to shore in groups or pods of several dolphins. They are often seen in water less than 20 metres deep but may also range further offshore. We know that they use the mouth of the Manukau and Waikare harbours, and are often seen just outside many of the other harbours on the coast. Studies suggest that individual dolphins generally use about 50 km of shoreline, but some individuals have been recorded moving nearly 80 km in under three weeks!

Historical samples indicate Maui's dolphins inhabited the New Plymouth and Taranaki regions in recent years, but most sightings of the dolphins now occur between Auckland's West Coast and Kapiti in South Waikato. Sightings as far south as Taranaki occur infrequently. Increased sightings in the southern area provide evidence of range restriction.



Declining Numbers - Full Text

Declining numbers
 Maui's dolphins are known to live up to 20 years. Females are not sexually mature until seven to nine years old, and produce just one calf every two to four years. This means any population increase is slow. Recent studies show the number of Maui's dolphins has reduced since earlier surveys and may still be declining.

DCC surveys in 2006 and 2009 found that there were at least two South Island Hector's dolphins swimming among the Maui dolphins. It seems likely that they could interbreed, which may provide the Maui's dolphins with a much needed boost in genetic diversity. Interbreeding would provide Maui's dolphins with a much needed boost in genetic diversity, but there is no evidence that this has occurred yet.

Maui's dolphins are known to live up to 20 years. Females are not sexually mature until seven to nine years old, and produce just one calf every two to four years. This means any population increase is slow. Recent studies show the number of Maui's dolphins has reduced since earlier surveys and may still be declining.

DCC surveys in 2006 and 2009 found that there were at least two South Island Hector's dolphins swimming among the Maui's.



Threats - Full Text

It is recognized that there are natural and human-induced factors impacting on this subspecies and all of these need to be better understood. Human-induced threats

- The close inshore distribution of Maui's dolphins overlaps with many coastal activities that pose a threat to their survival.
- Maui's dolphins are threatened by human activities in the following ways:
 - Becoming entangled in fishing gear and drowning, including from set netting, trawling and drift netting.
 - Being hit by boats and their propellers.
 - Becoming entangled in or ingesting marine litter (especially plastic).
 - Pollution.
 - The effects of marine mining and construction, including seismic surveys.

Set netting gear (further near the info above or after the 'Other threats' section).
 Set netting poses a threat to Maui's dolphins. Regulations under both the Fisheries Act 1991 and the Marine Mammals Protection Act 1978 have been set netting along part of the west coast of the North Island. See www.dcc.govt.nz/whims and www.dcc.govt.nz/far for more on these threats.

Artisanal fishermen found fishing with set nets in the closed area can be fined up to 100,000 and fishing equipment can be seized. Fines for commercial fishermen are up to 500,000 under the Marine Mammals Protection Act 1978. If you see set nets within the closed area please phone either a POACHER (0800 47 63 43) or a DOC HOT (0800 354 4848).

Non human-induced threats
 Some other threats are beyond our control but have significant effects due to the small population size of Maui's dolphins. These include:

- Disease
- Predation from sharks and orcas (killer whales)
- Extreme weather, which can cause mothers and calves to be separated, resulting in the death of the calf.

The review of the Maui's Dolphins Threat Management Plan provides further details on threats facing Maui's dolphins, and how the Department of Conservation and Ministry of Primary Industries are seeking to mitigate threats against them. See www.dcc.govt.nz/whims



Research - Full Text

There is still a lot that we don't know about Maui's dolphins.

Can the population recover, and how quickly?
 What species are most important to them for food?
 How will they be affected by increasing human use of their home range (marine mining, seismic surveying, marine construction)?

Are there ways we can mitigate impacts of disease?

DCC, together with university researchers and conservation groups, is seeking answers to these questions using a range of research methods and techniques. You can help with this research by reporting sightings of Maui's dolphins (see below).

There is still a lot that we don't know about Maui's dolphins.

Can the population recover, and how quickly?
 What species are most important to them for food?



How You Can Help - Full Text

- If you see Maui's dolphins when out on the water:
- Avoid approaching Maui's dolphins and never swim with them.
 - Ensure there are no more than three vessels (including jet ski and kayak) within 300 m of a pod.
 - Keep your speed to a minimum – no wake allowed within 300 m.
 - Do not feed Maui's dolphins or dump rubbish, and keep food to a minimum.
 - Report any sightings of Maui's dolphins to the DCC HOT line above 354 4848. Include the location (GPS coordinates if possible), number seen, time, date and photos showing landmarks if possible.
 - If you see set nets within the closed area, phone either a POACHER (0800 47 63 43) or a DOC HOT (0800 354 4848).

See www.dcc.govt.nz/whims for more information or phone your local DOC Office.



**New Zealand Department of Conservation
 National Office**

Physical Address	Postal Address
Conservation House 14-16 Morningside Avenue Wellington 6142	PO Box 10420 Wellington 6142
Phone: 0800 47 1078	Facsimile: 0800 47 1080
Email: enquiries@dcc.govt.nz	

- Nearby DCC Offices**
- Northern North Island
 - Auckland
 - Central North Island
 - Lower North Island
 - North and Western South Island

Appendix G - Contact List

The following groups have agreed to participate in the contact list:

Group Name	Contact Email	Alternate Email
New Plymouth Surf Club	pidwell@orcon.net.nz	
Splash Gorden Dive Club - Dive Wellington	dive@divewellington.co.nz	
Lyll Bay Surf Life Saving Club	admin@lyallbayslsc.org.nz	
Project Jonah	info@projectionah.org.nz	
Christian Surfers	taylorcdonald@christiansurfers.org.nz	
Clarks Beach Yacht Club	neil.robinson@ps.gen.nz	reception@clarksbeachyachtclub.org.nz
Glendowie Boating Club	admin@gbcyachting.org.nz	
Hobsonville Yacht Club	www.hycnz.org.nz find PO box:	
Maraetai Sailing Club	admin@maraetaiboatclub.org.nz	
Royal Akarama Yacht Club	okahu@amsc.co.nz	
Short Handed Sailing Association	thorpecameron@xtra.co.nz	
Bucklands Beach Yacht Club	accounts@bbyc.org.nz	
Clearwater Cove Yacht Club	johntwodogs@woosh.co.nz	
Gulf Harbour Yacht Club Inc.	admin@ghyc.co.nz	
Milford Cruising Club	milfordcruising@xtra.co.nz	
Dargaville Yacht Club Inc.	herald@xtra.co.nz	
Kerikeri Cruising Club	info@kerikericruisingclub.org.nz	
Bays Fishing Club	bobtowersey@clear.net.nz	
Big Fishing Club	bigfishfishingclub@vodafone.co.nz	
Manukau Sport Fishing Club Inc.	msfc@ihug.co.nz	
NZ Land Based Gamefishing Club Inc.	statesmanhomes@xtra.co.nz	
Raglan Sportfishing Club	theharts.raglan@actrix.gen.nz	
Vic U Ecology and Biodiversity (Program Admin)	biosci@vuw.ac.nz	
Port Waikato Beachcare group & Sunset Beach Surf Club	k.opie@xtra.co.nz	
PEW environment trust charitable	bgolder@pewtrusts.org	
Kupe Canoe Club	sandy.wint@clear.net.nz	
NZ Sport Fishing Club	secretary@nzsportfishing.org.nz	

The following groups are organizations that have the potential to be included in the contact list, after approval from their council:

Group Name	Contact Email	Alternate Email
Royal Port Nicholson Yacht Club	sailing.academy@rpnyc.org.nz	ocean@rpnyc.org.nz
Akitio Fishing Club	judy_brian@xtra.co.nz	
Coast Guard	phil.pollero@nzcoast.org.nz	
Green Party	adminassist@greens.org.nz	
Yakity Yak Kayak Club	pete@canoeandkayak.co.nz	
Navy	mark.sleeman@nzdf.mil.nz	
Royal New Zealand Yacht Squadron Inc.	aroberts@rnzys.org.nz	
Ponsonby Cruising Club	info@pcc.org.nz	
Richmond Yacht Club	info@richmondyc.org.nz	
Takapuna Boating Club	info@takapunaboating.org.nz	
Weiti Boating Club	weiti@xtra.co.nz	
Opuia Cruising Club	secretary@opuacruisingclub.co.nz	
Clevedon Game Fishing Club	clevedon.gfc@hotmail.com	
Environment and Conservation Organizations	eco@eco.org.nz	
Wanganui Swimming Club	admin@wanganuiswimclub.org.nz	
Waterfront Watch	waterfrontwatch@xtra.co.nz	
Forest and Bird	Office@forestandbird.org.nz	
New Plymouth Sportfishing and Underwater Club	npsuc@xtra.co.nz	
Albany Sportfishing Club Inc.	albanyfishing@xtra.co.nz	
Hauraki Gulf Sportfishing Club Inc.	glenedenrsa@xtra.co.nz	
Muriwai Sports Fishing Club Inc.	berniejward@gmail.com	
Whakatakataka Bay Sport Fishing Club Inc.	simonb@ddsit.co.nz	
Wellington Marine Conservation Trust	info@octopus.org.nz	
Marine NZ	info@marinenz.org.nz	

The following document is the form we sent to the above organizations to present to their council:



Department of
Conservation
Te Papa Atawhai

Date:

To:

From:

Subject: Maui's Dolphin Contact List Inquiry

Introduction to the Maui's Dolphin Issue

The Maui's dolphin was classified as a subspecies of the Hector's dolphin in 2002. With only 55 remaining, the species has been labelled as critically endangered by the IUCN. DOC and MPI have partnered up in an effort to comprehensively protect the Maui's dolphin's range along the west coast of the North Island. Due to overlap of proposed protected regions and current set net fishing grounds, there has been much controversy surrounding conservation efforts. In order to mitigate this controversy, DOC needs accurate sighting reports to determine the extent of the dolphin's range. With this range, a justified protected region can be established.

Creation of a Community Contact List

In an attempt to raise awareness about the Maui's dolphin and engage the public in conservation efforts, a community contact list is being created. Organizations included on this contact list will be forwarded important alerts, newsletters and educational materials relevant to marine mammal conservation. Such a contact list will allow for a wider distribution of these resources to individuals who frequent locations where conservation efforts have recently been directed. This is not to be confused with a formal partnership with DOC, instead it is merely envisioned to be a way to inform a larger audience about conservation information. The end goal is that organisations such as yours will pass any relevant information along to its members.

Correspondences may include but are not limited to:

- Informational Fact Sheets
- Educational Posters
- Newsletters
- Relevant Conservation Alerts

Newsletters and such will be sent out once a month at most, while updated educational resources will be distributed as they become available.

If you are interested in being added to this contact list please contact:

Marine Species and Threats Team

lboren@doc.govt.nz



Appendix H – Internal Memo

As of March 6, 2014, the following represents the internal memo we submitted to DOC:

For the past four months, four American university students who attend Worcester Polytechnic Institute (WPI) have been working with DOC's Marine Species and Threats team. They have been working to raise awareness for the Maui's dolphin.

While attending WPI, all undergraduate students must complete three research projects: a Capstone in Humanities which builds well-rounded, globally aware graduates with superior analytical thinking skills; a Society and Technology project – an Interactive Qualifying Project – which the students are fulfilling now; and a Senior project that focuses around the student's major. WPI sends more engineering & science students abroad than any other US college or university.

The students spent two months preparing for their project before coming to Wellington. In this time, they researched the Maui's dolphin and wrote a proposal including background information and a methodology as to how they would be completing their project while on site. Students and faculty advisors were on site for two months, where they worked full time to complete the deliverables DOC had proposed.

DOC provided the students with a problem: The Maui's dolphin is critically endangered but there is little public awareness of the issue. After gathering and interpreting data, the team of 4 students produced a written report and an oral presentation detailing their recommendations to DOC.

The team's objectives included:

- Assess and evaluate the public's awareness and knowledge of the Maui's dolphins and sighting report services
- Recommend approaches for raising awareness about the Maui's dolphin and sighting report services

- Recommend approaches to improve the accessibility of educational resources available to the public

The students surveyed 384 people in Whanganui and Wellington. They found that many people have heard of the Maui's dolphin, but don't know much about them. Their survey data also showed that there is a lack of public knowledge regarding the Maui's dolphin & available reporting services. The students asked respondents if they were aware that DOC had services to report a Maui's dolphin sighting. Most did not know this. Even fewer people were able to correctly answer the specific questions about the dolphin.

The project team concluded that it would be beneficial to educate the public about the dolphin and about available sighting reporting services. People need to be knowledgeable about both in order to participate in any Maui's dolphin conservation campaign.

Based on their findings, they produced:

- The design of a smartphone application
- Contact list of key community organizations
- Bumper sticker with a "Rounded fin? Send it in!" slogan and DOC's hotline
- Tackle box sticker with slogan and instructions of what to do if a fisher has spotted a Maui's
- Educational poster on Maui's dolphin species
- Educational poster on sighting report process

The students traveled to Seaweed in Auckland to test posters and gauge public opinion on the two different designs at a Maui's dolphin booth. One poster tells the "Maui's dolphin story." This poster attempts to humanize the dolphin & make the reader want to help. The second poster is more informational, using three key words to tell the reader what to do if they see a Maui's in the water. This type of poster would be most beneficial if placed in locations near the dolphin's range. These posters can be seen below.

Ahakoā
he iti
he **pounamu**
*Although it is small,
it is a treasure*



New Zealand – a small yet unique part of the world. Home to the Maui's dolphin, or Popoto in Māori, a magnificent and unique marine creature that is unfortunately, on the brink of extinction. Once, you could find the Maui's all along the west coast of New Zealand's North Island, for which the species is named. Now, the 55 remaining Maui's dolphins occupy the shallow waters from Maunganui Bluff to Whanganui, sharing the same waters many of us swim, boat, and fish in regularly. Easily identified by its unique rounded "Mickey Mouse" dorsal fin, this playful dolphin is the smallest and rarest in the world. However, as New Zealand exemplifies, great treasures often come in the smallest packages.

What helps us understand more and more about this elusive marine mammal are the sighting reports made by people like you. Your reports enable us to track and effectively protect the species.

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for fire and search and rescue call 111

 Department of
Conservation
Te Papa Atahauti
New Zealand Government

www.doc.govt.nz/maui-dolphin

“Maui’s dolphin story” poster



“Rounded fin? Send it in!” poster

The students hope that their recommendations will help DOC increase accurate Maui’s dolphin sighting reports by engaging the public in Maui’s dolphin conservation efforts through education. Research shows that when someone is more knowledgeable about a topic, they are more apt to become engaged in a cause. In addition, the team made recommendations to increase the accessibility of educational material and reporting services.

Increasing the number of accurate sighting reports received will allow DOC to have a more comprehensive understanding of the dolphin’s entire range. This information can be brought before policy makers to push for increased protection of the dolphin’s home range.

IQP projects offer incredible opportunities for project sponsors. A team of students from various fields of study has the potential to offer unique perspectives on real-world problems faced by project sponsors. Many IQP projects focus on conservation or sustainability. The 2013-2014 DOC-WPI project focuses on conservation of a single marine species, but has wider implications, getting the ball rolling for protecting New Zealand's endemic species. DOC, as a conservation-focused organization, could benefit greatly from a continued partnership with WPI.