Is Dolphin-Watching Sustainable in Bocas del Toro, Panama

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DEDICATION

This is dedicated to my incredibly caring and supportive parents David Marsh (Dad), Barbara Young (Mom), my grandmother Patricia Sitar and amazing life mentor Chris Parsons.

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ABSTRACT

IS DOLPHIN-WATCHING SUSTAINABLE IN BOCAS DEL TORO, PANAMA

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Due to concerns of unsustainable dolphinwatching tourism in Bocas del Toro, and the increase in dolphin mortality in Bocas due to dolphinwatching boat collisions research was conducted in the summer of 2013, to evaluate the severity of the situation, and to assess the tourists and boat operators' level of concern for dolphin and environmental conservation. This project examined whether dolphinwatching was negatively disrupting dolphin behaviors, and whether dolphinwatching operators were following Panama's dolphinwatching regulations. This project provides informative data to assist with the establishment of more stringent dolphinwatching management and enforcement, and it is hoped it will assist with the establishment of Marine Protected Areas that include important habitat for the bottlenose dolphin population in Bocas del Toro.

STATEMENT OF THE PROBLEM

There once was a time when bottlenose dolphins swam freely off the east coast of Panama. In recent years these creatures' lives have been threatened by intense and unmanaged dolphinwatching. However, ecotourism, if properly managed, could be an innovative way to protect the dolphins and their habitat, while at the same time generating income for the community. The future of Bocas del Toro, Panama as a dolphinwatching destination was a critical subject discussed at the 2012 International Whaling Commission (IWC) Scientific Committee meeting, spurred by experts' fear that Bocas' dolphin population is nearing extirpation. Based on previous studies conducted by May-Collado and colleagues (2007), the dolphin population is declining rapidly. Within two years (2012-13) 10 bottlenose dolphins were killed by boat strikes, likely due to high traffic volume of dolphinwatching boats (IWC 2013a, 2013b). There are currently 200-250 bottlenose dolphins in Bocas del Toro's waters (IWC 2013a, 2013b). Even though that number is low, the number of bottlenose dolphins that are habitually observed by dolphinwatching boats is even lower (May-Collado et al. 2007; IWC 2013a, 2013b). The predominant cause of the decrease in bottlenose dolphins in Bocas may arguably be the increase in unregulated dolphinwatching, and the lack of knowledge and training about best practices among the local tourism operators.

Off the northeast coast of Panama in the Atlantic Ocean resides the beautiful and biodiverse archipelago of Bocas del Toro (May-Collado et al. 2007). The province of Bocas del Toro (hereafter simply referred to as "Bocas") is situated near the Chiriqui Lagoon and Almirante Bay, and located 35km from Costa Rica (May-Collado et al. 2007). This easily accessible province entices many immigrants and tourists because of its features, scenic landscape, and marine diversity, which include sea turtle beaches, mangrove forests, coral reefs, sea grasses, and the local dolphin population (May-Collado et al. 2007; Windevoxhel & Heegde 2008). Although, technically Panama has regulations to protect cetacean populations (such as their whalewatching regulations) its enforcement is limited. Previous studies in the area have shown that dolphins respond negatively to intense dolphinwatching boats by spending more time in avoidance behaviors such as traveling (Taubitz 2007, Barragan-Barrera 2010). Their communication also seems to be affected by increasing engine noise associated with dolphinwatching boats, causing dolphins to increase signal emissions (Quinones-Lebron & May-Collado 2011) and changing their sounds to minimize signal masking (May-Collado & Wartzok 2008).

Dolphinwatching is increasing exponentially every year. Furthermore, during high tourism season more than 100 boats are in the bay simultaneously searching for dolphins. In 2013, dolphins were commonly observed being followed by up to 37 boats (May-Collado pers. comm. 2013). This number of interactions per dolphin encounter is hardly sustainable. Concerns were recently expressed in the International Whaling Commission

(IWC 2012; 2013a, 2013b) where it was declared a situation that needed to be urgently addressed.

Because the community of Bocas del Toro is economically dependent on marine tourism it is important to supply the right tools and information to help the community transform into a marine conservation conscious society. The goal of this project is to evaluate the status of the dolphinwatching industry in Bocas del Toro and propose sustainable alternatives to reduce the negative impact that dolphinwatching operators are having on this dolphin population.

In addition this project will try to acquire information to aid tourism strategies by evaluating the tourists who visit Bocas, evaluate the current behaviors of whalewatching tourism operations, and evaluate the effects of unregulated and unsustainable dolphin tourism. The information collected will provide supporting evidence for locals and relevant authorities as to what visiting tourists desire from whalewatching and information about what is needed to ensure that their tourism operations are more successful, less harmful to the marine species, and thus more sustainable for the future.

RESEARCH OBJECTIVE

The purpose of this study was to evaluate the status of the dolphinwatching industry in Bocas del Toro, and to determine its impact on local bottlenose dolphins. In addition, this study emphasizes the importance of sustainable tourism in establishing equilibrium between humans and the nonhuman environment. There are many areas around the world, in less-developed countries, where entire human populations and communities depend on whalewatching tourism for their livelihood. Bocas del Toro is one of those communities that now rely on tourism income, much of it related to dolphinwatching. Once the bottlenose dolphins are gone due to the lack of conservation regulations and the income they bring in disappears, what will happen to the human community of Bocas del Toro? There is concern that the dolphin population of Bocas del Toro is shrinking drastically because of harmful whalewatching activities (May-Collado et al. 2007). So, as much as it is important to protect cetaceans from irresponsible whalewatching, it is as important to realize that local human communities depend on the cetaceans' existence.

Previous studies have shown that dolphins react to dolphinwatching boats' presence by swimming away, increasing whistle emission, and shifting of whistle frequency to reduce signal masking (Taubitz 2007; May-Collado & Wartzok 2008; Barragan-Barrera 2010; Quinones-Lebron & May-Collado 2011, May-Collado et al. 2013). However, other

behavioral indicators of dolphin responses to dolphinwatching boats include breathing synchronization, a decrease in foraging, resting and socializing, an increase in diving and travel frequency (Dans et al. 2008, Montero-Cordero 2010; Papale et al. 2011, Steckenreuter et al. 2012; May-Collado et al. 2014).

To address this part of the project the objectives was met via two innovative boat-based surveys (semi-scan and focal follows) evaluated the levels of dolphin disturbance (measured by behavioral change) from whalewatching tourism in Boca del Toro, Panama. The first boat-based survey evaluates the level of harmful behaviors by dolphinwatching boat operators when around dolphins, and the second boat-based survey evaluates the behavioral effects of dolphins in response to dolphin tourism

Secondly, two written questionnaire surveys meet this study's objective. To determine the status of the dolphinwatching industry, questionnaire surveys will be conducted to determine tourist demographics, their awareness of dolphinwatching and the attitudes towards this activity and their opinions on dolphin conservation. The purpose of the second questionnaire was to examine boat operators' awareness of dolphinwatching, their attitudes towards this activity, and their opinions on dolphin conservation. These surveys provide the necessary information to establish alternatives that will bolster responsible whalewatching regulations.

The research from this study: 1) provides information that will promote sustainable and responsible whalewatching behaviors; 2) helps communicate to the Panamanian government and the community of Bocas del Toro the serious urgency for cetacean conservation and enforcement of whalewatching codes of conduct; and 3) supplies beneficial information to the community about tourists, whalewatching behavior and the effect it has on dolphins.

BACKGROUND

Bocas del Toro has a rich and diverse marine ecosystem that has unfortunately fallen victim to the rapid development of unsustainable tourism (Kayes 2005; Reid et al. 2007; Shepherd 2008). Bocas has approximately 87 sq km of coral reef (Guzmán 2003; Kayes 2005) and is an important part of the green sea turtle's migratory route. Loggerhead sea turtles lay their eggs on nesting beaches from March to May (Meylan et al. 1991; Meylan and Meylan 1999; Shepherd 2008; LGL 2007). Bocas' ecosystems support 121 algae species, 82 mollusks, 36 sea sponges, and 89% of the stony coral reef species found in the Caribbean. At least 123 fish, 75 mammal, 29 reptile, and 4 marine turtle species have been recorded (Windevoxhel & Heegde 2008). Many of these species are listed as threatened and endangered, including seventeen reptile and amphibian species and several species of birds (Windevoxhel & Heegde 2008).

In the past twenty years, Bocas del Toro evolved from indigenous communities and commercial plantations to a high volume tourism destination for Panamanians and foreigners. Visitors and locals alike have noticed the rapid increase in unsustainable tourism and its repercussions for marine species and habitat (Guzmán 2003; Rodríguez 2005; Kayes 2005; Windevoxhel & Heegde 2008; Bedi 2009). Reid et al. (2007) suggested there was an urgency to visiting Bocas in the *Lonely Planet* guide to Panama:

"Unfortunately, the secret is out, and although locals have thus far welcomed the increase in tourism, bulldozers have already started clearing land for condos and resorts…It's difficult to predict the future of the islands, but this is certain – see Bocas now, as the unspoiled beauty of the islands won't last forever" (p. 681).

Subsequently, the concern about protecting Bocas del Toro's ecosystems has intensified (Bedi 2009; Claiborne 2010). The rapid decline of bottlenose dolphins in Bocas is one of the most obvious repercussions of the impact of rapid development. The IWC Scientific Committee:

> *strongly recommends that Panamanian authorities enforce the relevant whalewatching regulation (ADM/ARAP No. 01) and in particular promote adherence to requirements regarding boat number and approach speed and distances…The Committee recommends continued research to monitor this dolphin population and the impacts of tourism on it* (IWC 2013b, p.80).

The rapid social transition in Bocas del Toro from indigenous community to tourism destination has been paralleled by rapid depletion of its marine environment (Reid et al. 2007; Claiborne 2010). The decline in Bocas' dolphin population has raised alarms among experts, making the initiation of baseline research projects an urgent matter. I started this project in July 2013 with partners that included the Smithsonian Tropical Research Institute in Bocas and Dr. May-Collado.

In the past five years, a few sustainable tourism and management initiatives haven been funded or supported in Bocas del Toro by the Nature Conservancy, USAID, Solimar

International, Sustainable Travel International, Asociacion Panamena del Turismo Sostenible, and the Smithsonian Tropical Research Institute (Claiborne 2010). Some of these projects addressed habitat protection, such as helping to protect Red Frog Beach from resort development and helping to create the Bocas Sustainable Tourism Alliance (BSTA) (Claiborne 2010). However these projects were short-term and lacked the necessary capacity building, leaving locals unable to continue the work on their own without future funding (Claiborne 2010). As of today, many of the environmental projects in Bocas are stagnant.

In an interview by Claiborne (2010), local Bocas resident and activist Lui Mou expressed concern for Bocas del Toro's environment and the support needed to protect it:

> *Now however, there are numerous boats all over Bocas but a common regulation and control is missing…no limit or control of how many of the 100 boats or people can go on these tours at the same time, which puts a lot of pressure on the animals and nature, and their environmental carrying capacity becomes too small under this stressful atmosphere…For me it is a very sensitive/delicate topic and situation, since having more than 10-15 boats following and circling a couple of dolphins all day long, every single day, or having 100, sometimes 200, tourists snorkeling within the same area frequently, is evidently mistreating the nature and its animals…This place needs someone…who really cares about this area and its communities, and invests in them* (p.viii).

Due to these high concerns, research was conducted in Bocas del Toro in the summer of 2013 to evaluate the severity of the dolphinwatching situation, and to assess the tourists' and operators' level of concern for dolphin and environmental conservation. This project was created to examine whether dolphinwatching was negatively disrupting dolphin behaviors and to assess whether dolphinwatching operators were following Panama's dolphinwatching regulations. This project provided informative data to assist with the

establishment of more stringent dolphinwatching management and enforcement, and it is hoped it can assist with the establishment of Marine Protected Areas that include important habitat for the bottlenose dolphin population in Bocas del Toro.

HYPOTHESIS AND RESEARCH QUESTIONS

Hypothesis 1:

Dolphins in Bocas del Toro are changing their behavior as a result of dolphin-watching

Hypothesis 2:

Dolphinwatching boat operators in Bocas del Toro are not following best whalewatching practices

Hypothesis 3:

Tourists support greater dolphin conservation by preferring educational and/or sustainable dolphinwatching

Hypothesis 4:

Tourists notice environmental issues in Bocas del Toro and believe that stronger government regulations are needed

Hypothesis 5:

Whalewatching boat operators in Bocas del Toro are not familiar with and are not practicing sustainable dolphinwatching tourism practices

Hypothesis 6:

Boat operators are not interested in practicing sustainable dolphinwatching tourism

Hypothesis 7:

Boat operators in Bocas del Toro are not knowledgeable about their resident bottlenose dolphin population

AREA SITE

Bocas del Toro is a small group of islands located at 9° 20' 0" N and 82° 15' 0" W and situated off Panama's northeast Caribbean coast close to the border of Costa Rica (Shepherd 2008). The archipelago has a population of approximately 10,000 people. Most of the population lives on Colón Island in the town of Bocas del Toro (Shepherd 2008). There are several indigenous groups in Bocas del Toro including Panama's largest indigenous group the Ngöbe-Buglé (Guaymi) (Shepherd 2008).

Bocas del Toro is a paradise full of terrestrial and marine diverse ecosystems (Shepherd 2008). "When asked about the concerns of the residents while tourism was being developed in the area, Participant 3 expressed her thoughts by stating that tourist destinations are "land[s] of mavericks" (2010). This statement can be referred back to the previous statement by Participant 2, that outsiders have been infiltrating the region, buying land to be developed for tourism, and then sold. Participant 3 was expressing concern and strong emotions towards outside investors that do not plan to stay in the region they develop because, as she had witnessed, it usually leads to environmental degradation. Participant 3 then went on to state that the impact on the environment is always a big concern, but there are no regulations or ways to monitor abuse of the environment in Bocas del Toro (Bedi 2009, p.52).

CHAPTER 1
LITERATURE REVIEW: THE NATURE OF WHALEWATCHING

INTRODUCTION: TOURISM AND WHALEWATCHING

Whalewatching is another kind of tourism. According to World Tourism Organization (2015) "Tourism is a social, cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes." (p.1). Tourism is one of the fastest growing industries worldwide. It brings foreign exchange and it helps creates jobs for developing countries (UNEP 2015). There are many different classes of tourism such as: sustainable tourism, ecotourism, nature tourism, indigenous tourism, community-based tourism, and culture tourism). There is much confusion about this because many people use these terms interchangeably (Wight 2002). Despite this confusion each term has distinctive qualities (Wight 2002).

SUSTAINABLE TOURISM AND ECOTOURISM

Defined by United Nations World Tourism Organization (UNWTO) (2015b) sustainable tourism is when "tourism takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities." (*sic*) (p.1). More generally, its goal is to "not threaten the

economic, social, cultural or environmental integrity of the tourist destination over the long term" (p.80, Weaver 2001).

The United Nations World Tourism Organization (2015b) explains that "sustainable tourism development requires the informed participation of all relevant stakeholders, as well as, strong political leadership to ensure wide participation and consensus building", and "achieving sustainable tourism is a continuous process and requires constant monitoring of impacts, introducing the necessary preventive and/or corrective measures whenever necessary" (p.1).

Table 1. A comparison of Sustainable Tourism and Ecotourism's principles

Sustainable Tourism Principles	Ecotourism Principles
• Make optimal use of environmental resources that constitute a key element in tourism development • Maintain essential ecological processes and help to conserve natural heritage and biodiversity. • Respect the socio-cultural authenticity of host communities • Conserve their built and living cultural heritage and traditional values • Contribute to inter-cultural understanding and tolerance. • Ensure viable, long-term economic operations • Provide socio-economic benefits to all stakeholders that are fairly distributed, including stable employment and income-earning opportunities, and social services to host communities • Contribute to poverty alleviation. (UNWTO 2015b)	• Minimize physical, social, behavioral, and psychological impacts.Build environmental and cultural awareness and respect.Provide positive experiences for both visitors and hosts.Provide direct financial benefits for conservation.Generate financial benefits for both local people and private industry. • Deliver memorable interpretative experiences to visitors that help raise sensitivity to host countries' political, environmental, and social climates. • Design, construct and operate low-impact facilities • Recognize the rights and spiritual beliefs of the Indigenous People in your community and work in partnership with them to create empowerment. (TIES 2015)

The new buzzword 'Ecotourism' is a subset of sustainable tourism and is now the fastest growing sector of the tourism industry (Honey 2008; Gale & Hill 2009). Ecotourism originated from nature tourism, outdoors tourism, and adventure tourism (Lindberg & Hawkins 1993).

The International Ecotourism Society (2015) defines ecotourism as "responsible travel to natural areas that conserves the environment and sustains the well-being of local

people." Ecotourism should contribute to the protection of biodiversity, should benefit local communities (both economically and socially), and should build educational and awareness components (Dowling & Fennell 2003). Principles of ecotourism can be seen in Table 1 above. However, these principles are very basic definitions.

Martha Honey (2008), expert in responsible tourism, describes seven specific characteristics of ecotourism. The *first* is that ecotourism is traveling to a natural destination. The *second* is ecotourism should minimize the impact of tourism by using renewable energy sources, recycling, safe disposal of sewage and garbage, and other actions that minimize adverse effects of tourism (Honey 2008). *Thirdly*, ecotourism builds environmental awareness by educating tourists and the nearby community. This means providing tourists with interpretation or reading or other materials about the culture, environment and codes of conduct (Honey 2008). It also means having well trained tour guides that are educated about the environment, species, culture, effective communication and ethics principles (Honey 2008). Educating the local community and their school children is essential. Honey (2008) suggests free educational trips for the locals.

The *fourth* characteristic of ecotourism is producing financial benefit for conservation. Ecotourism should accrue funds for environmental protection, education and research. It also can provide research facilities, research monitoring, or a research platform (Honey 2008). *Fifthly*, ecotourism must bring financial benefit and empowerment to the local

community. Ecotourism cannot succeed unless the locals are happy (Honey 2008). The local people have to be involved with receiving some financial benefit from the ecotourism project (Honey 2008). This could be income or tangible benefits like potable water, or health clinics (Honey 2008). The *sixth* characteristic of ecotourism is respecting the local culture. This includes being educated in the local customs, their dress code, their social norms, and how not to intrude on the community (Honey 2008). The *seventh*, and final characteristic of ecotourism is supporting human rights and democratic movements. This implies being educated in the level of rights and the locals' political status with their government (Honey 2008). Many ecotourism projects are in remote areas where the people struggle for political rights and tourists are clueless about the political conflicts (Honey 2008).

WHALEWATCHING TOURISM

Here is where things can get confusing. Ecotourism is a subset of sustainable tourism but it is also a subset of nature-based tourism (Orams 2001). Nature-based tourism is tourism in a natural setting that includes tourism such as (adventure tourism, wildlife tourism, and marine tourism) (Hall & Boyd 2005).

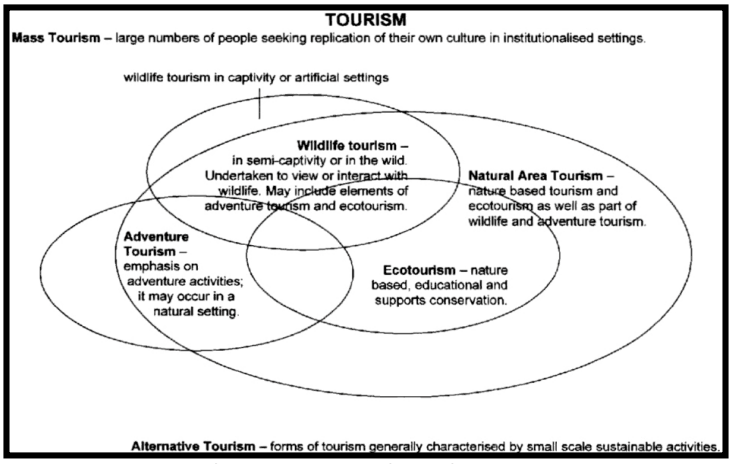

Figure 1. Relationship of ecotourism to other forms of tourism (Gale & Hill 2009, p.5)

Whalewatching is a type of natural-based tourism (also known as "nature tourism") - which also comes under the category of wildlife tourism that gives tourists the opportunity to observe animals in their natural environment (Zeppel & Muloin 2007; Ballantyne et al. 2011; Tisdell & Wilson 2005). Wildlife tourism contains seven categories: hunting/fishing tours, habitat specific tours, thrill-offering tours, artificial attractions based on wildlife, locations with good wild opportunities, and nature-based tourism with a wildlife component (Reynolds & Braithwaite, 2001; Ballantyne et al. 2011). That being said, whalewatching is strictly observing wildlife in their natural environment (Parsons et al. 2006). This means that any enclosed facilities with wildlife, like tanks or artificial wildlife attractions do not fall under the definition of whalewatching (Parsons et al. 2006).

WHALEWATCHING AND ECOTOURISM

Incorporating ecotourism into whalewatching, i.e. “whale ecotourism” would be more sustainable and create conservation benefits. It is taking steps to ensure less harmful impacts are occurring. According to Parsons et al. (2006) here are 4 major steps in “whale ecotourism”:

- Minimize Impact- reduce emissions or dispose of refuse appropriately and adhere to whalewatching regulations or an appropriate set of guidelines, if no specific regulations are available for the area
- Build Environmental Awareness- provide appropriate, accurate and detailed interpretative/educational materials or activities for the clientele about the cetaceans viewed and their associated habitat
- Provide Direct Financial Benefits for Conservation- actively assist with the conservation of their resource (cetaceans), *such as cooperating with research groups and other scientists and with research projects or allowing vessels to be used by scientists/research groups as platforms of opportunity*
- Financial Benefits and Empowerment to the Local Community- provide some benefits to the local host community within which the company operates. Such benefits could include a policy of preferential employment of local people, selling local handicrafts, or supporting (either financially or in kind) local community-based conservation, education, culture or social projects or activities, (for example financially or in kind support for a voluntary marine rescue service or providing non-profit trips for local schools)

(Parsons et al. 2006)

However, Parsons et al. (2006) did not mention two of ecotourism’s principles: “respect local culture”, and “support human rights and democratic movement". These both will need to be incorporated into “whale ecotourism” for it to be a true ecotourism.

It is suggested that the whalewatching industry, including “whale ecotourism”, adopt the “sustainability report card” as outline by Hoyt (2005). The "sustainability report card"

provides a simple blueprint for assessing the level of sustainability of the industry in an area (Hoyt 2005). The report card questions, among other issues:

- Is the whale population growing?
- Are the whales moving out of an area?
- Are the whales exhibiting changes in behaviour?
- What are the levels of biological and chemical pollutants in coastal waters?
- Are whalewatching operators knowledgeable about cetaceans and local culture?
- Are they good education providers?
- Are whalewatching operators concerned about the safety and welfare of their customers?
- Does the whalewatching activity aid or benefit the local community?

(Hoyt 2005)

Incorporating both ecotourism and the sustainability report card in whalewatching will reduce adverse effects, will help sustain the whalewatching industry, and will facilitate conservation initiatives.

THE HISTORY OF WHALEWATCHING

Humans' interest in whales began long before whalewatching tourism existed. Since the mid 1800s the public was able to see whales up close in captivity (Reeves & Mead 1999). The concept of whalewatching started in the mid-1900s with the first official whalewatching boat trip occurring in California in 1955 (Hoyt & Parsons 2014). The term "whalewatching" should have been called "cetacean watching", so as not to confuse the public because whalewatchers are not only looking for mysticetes cetaceans (baleen whales) on their trip, but also observing other cetaceans such as dolphins and porpoises (Garrod & Fennell 2004; IWC 2014a). However, the term "cetacean watching" never

caught on with the public, and the term "whalewatching" became the permanent term (Garrod & Fennel 2004; Corbelli 2006). Nonetheless, in this paper the term whalewatching will be used to describe the overall activity (whales and dolphins included), but the term dolphinwatching will be used when describing activities that specifically involve only dolphins.

Whalewatching can be conducted in many different ways (Corbelli 2006; Day 2006; Higham & Luck 2007). To date, whalewatching can be done on land (off of coastal beaches or cliffs), by air (in helicopters, or in fixed planes), or on vessels (including cruises, recreational boats, commercial tour boats, kayaks, sail boats or canoes) (Parsons et al. 2006; Corbelli 2006; Day 2006; Higham & Luck 2007). In addition to these three main methods of whalewatching there are two new whalewatching activities that have recently been included in whalewatching tourism because of their popularity and close interaction with cetaceans (Corbelli 2006). Even though feeding cetaceans and swimming with dolphins are fairly new tourism activities and are controversial, their popularity has increased rapidly worldwide (Orams 1997; Curtin 2006). Swimming with dolphins is already a well-favored activity in Japan, New Zealand and Australia (Hoyt 2001; Corbelli 2006).

However, feeding dolphins and swimming with dolphins are intrusive activities (Parsons et al. 2006). The sub category of whalewatching, swimming with dolphins, (that can only include free-range cetaceans, not captive cetaceans) can be considered physically

intrusive: “operations involving the tourists or tour operators/crew physically touching the cetaceans in any except for accidental or incidental contact” and/or ecologically intrusive “operations including activities that alter the natural history and behavioural ecology of cetaceans, such as introducing food to cetaceans” (Parsons et al. 2006, p.4). Feeding dolphins would be considered ecologically intrusive, and therefore it can produce negative repercussions (Parsons et al. 2006).

Even though there are many different types of whalewatching, vessel-based is the most desirable method of them all (estimated at an overall 72% of whalewatching) (Corbelli 2006; Day 2006). Land-based whalewatching is the second most popular, estimated at an overall 27.9% of whalewatching (Corbelli 2006). More than 2.55 million tourists in ten major countries participated in land-based whalewatching (Corbelli 2006). Whalewatching by air is the least utilized of the three main methods, approximating less than 0.1% of whalewatching (Hoyt 2001; Corbelli 2006). Less than 10,000 people a year participated in aerial whalewatching (Hoyt 2001).

Whalewatching began in the 1950s, when Californians became more interested in gray whales migrating along their coastal waters (Day 2006; Hoyt & Parsons 2014). It first started as land-based whalewatching off San Diego, on the California coast. But in 1955, vessels were used to take tourists out to sea to see gray whales up close (Corbelli 2006; Hoyt & Parsons 2014). Back then, the starting rate for whalewatching was 1 US dollar (Hoyt 2002). Within five years this tourism experience began to spread like wildfire up

the US west coast. By the 1960s commercial whalewatching extended from California to Washington State (Corbelli 2006). Whalewatching caught on on the east coast, and in 1971, Montreal Zoological Society began the first North American east coast whalewatching trip touring off the St. Lawrence River, Canada (Corbelli 2006).

By 1975 whalewatching tours in Hawaii and New England were established to take tourists out to see the magnificent humpback whales (Corbelli 2006). New England then became the most favored region for whalewatching in the U.S. One of the reasons for this is that they began a type of commercial whalewatching that integrated rich scientific and educational elements (Hoyt 2001).

Humpback whales are a major contributing factor to New England's whaling industry (Corbelli 2006). Humpback whales are already spectacular animals to look at because of their remarkable size, but humpback whales are also very entertaining (Corbelli 2006): they are noticeably more active than many other cetaceans and are often seen displaying impressive surfacing behaviors (Corbelli 2006). Humpback whale calves are also known for approaching boats as if they are curious about them (Corbelli 2006). So, for whale-watchers a humpback whale experience can be of great worth, thus making the industry in that area very alluring to tourists (Corbelli 2006).

By the mid 1980s whalewatching became so popular that word spread to other countries, and in the late 1900s, New Zealand and Australia grew to become the best destination for

whalewatching (Higham & Luck 2007). Since then, the phenomenon of whalewatching spread to Hong Kong, Indonesia, Tonga, Fiji, the Solomon Islands, Taiwan, and even Japan despite their involvement with dolphin- and whale-hunting (Higham & Luck 2007). Whalewatching tourism grew at a rapid rate (Hoyt 2001). In 1991, 31 countries participated in whalewatching, and whalewatching tourists increased to 4 million people (Hoyt 2001).

In 1994, the total number of whalewatching tourists increased by 1.4 million; making the new whalewatching count 5.4 million tourists (Hoyt 2001). That same year, expenditures calculated to 504 million U.S. dollars (Hoyt 2001). Additionally, the United States became the first country to announce having more than one million whalewatching tourists per year in 1994 (Corbelli 2006). In 1998, the count of whalewatching tourists reached a new high increasing to 9 million tourists, accounting for 1,049 million U.S. dollars in expenditure (Hoyt 2001). By 2001 the Canary Islands, Spain and Canada were able to make the same claim as the United States (Corbelli 2006). By 2001, South Africa and Australia were able to claim having half-a-million whalewatching tourists per year (Corbelli 2006). Hoyt (2001) expected the number of tourists to continue to increase in these two countries.

Based on an 18-month survey commissioned by the International Fund for Animal Welfare, approximately 13 million tourists participated in whalewatching tourism within 119 countries and this generated $2.1 billion U.S. dollars (O'Connor et al. 2009).

BENEFITS OF WHALEWATCHING

Whalewatching can bring many benefits including cetacean conservation. Based on its economic value and the interest in whalewatching, whalewatching can be a useful method for cetacean conservation initiatives. Whalewatching brings economic benefits to the host country (Corbelli 2006). Whalewatching alone can generate millions of dollars (Hoyt 2001; Higham & Luck 2007). It can also bring benefits by raising awareness of cetaceans and conservation, and it can be a great way to gather cetacean research for scientists (Muloin 1998; Wilson & Tisdell 2003; Moscardo et al. 2004; Corbelli 2006; Zeppel & Muloin 2007; 2008a, 2008b). The public increases their knowledge about cetaceans and the marine environment, which also increases their appreciation for cetaceans (Tilt 1987; Corbelli 2006). Whalewatching is by no means seen as a negative activity (Day 2006). Researchers have verified that whalewatching tours increase the appreciation of whales among watchers, and when knowledge is imparted on tours, then attitudes and behavioral change occurs (Orams 1997; Malcom and Duffus 2008; Corbelli 2006). If education generates that much influence, then all whalewatching tours should ideally be required to have educational content (IFAW et al. 1997).

Another positive benefit from wildlife tourism (including whalewatching) is how it brings opportunities to raise money for wildlife conservation projects and to raise money to help sustain wildlife management and wildlife habitats (Ballantyne et al. 2011a; 2011b). Wildlife tourism can encourage volunteer contributions (Ballantyne et al. 2011a;

200b). It also can provide "socio-economic incentives for the conservation of natural resources" (Ballantyne et al. 2011a, p. 771). Numerous studies are showing that after nature-based tourism, people feel more strongly about the environment and the wildlife that they saw. In a whalewatching study in Queensland, Australia, 80% of the tourists felt a greater need for more action to be taken to protect the whales in Australia (Wilson & Tisdell 2003). Seventy-three percent of the tourists were more likely to report whale injuries, stranding or mistreatment (Wilson & Tisdell 2003), and only 3% of tourists surveyed said they were not influenced by the experience, which means that many more people were influenced by seeing the whales (Wilson & Tisdell 2003).

In conclusion whalewatching is potentially a good way to promote cetacean conservation, and it helps make a deeper connection between the person and cetaceans and other mammals (Day 2006; Ambler 2011).

WHALEWATCHING IMPACTS

Wildlife-tourism is believed to have a positive impact on tourists, as well as bringing positive benefits to wildlife and the environment (Ballantyne et al., 2011a). Tourists have been reported to develop appreciation and respect for the environment and/or wildlife (Mayes & Richins 2008; Ballantyne et al. 2011b). Evidence shows that wildlife tourism increases awareness of environmental issues. Ballantyne et al. (2011a) expressed that many wildlife tourists become involved in promoting conservation issues in their hometowns, as well as in "promoting environmentally sustainable attitudes and actions"

(p. 771) after wildlife tourism. In addition, wildlife tourism encourages the "long term adoption of sustainable living practices" (Ballantyne et al., 2011a, p. 771). In Mayes & Richins' (2008) study conducted in Nelson Bay, New South Wales, Australia participants' strength of feeling and level of support for conservation increased after the educational whalewatching tours. In addition, whalewatching is a sustainable activity (Orams 2000).

At the same time, researchers have indicated that human disturbance does indeed cause negative behavioral change in many mammalian species such as the humpback whale (*Megaptera novaeangliae*), African elephants, (*Loxodonta africana*), and chimpanzees (*Pan troglodytes*) (Lott & McCoy 1995; Corkeron 1995; Johns 1996; Andersen & Eltringham, 1997).

Although whalewatching can be detrimental, such as vessel strikes that cause immediate injury or death to the animal (Laist et al. 2001; van Waerebeek et al. 2007), most impacts are more subtle. Considering, that many of the behavioral reactions of cetaceans to whalewatching are not immediately detrimental and are short-term negative impacts at the population level, they may not be noticeable until many years after the long-term exposure (Constantine et al. 2004; Bejder, 2005; Bejder et al. 2006a; Bejder et al. 2006b; Foote et al. 2004; Lusseau 2005; Lusseau & Bejder 2007; Williams et al. 2006a, 2006b; Parsons 2012). Because of this, it can be difficult for conservationists to convey the sense of urgency required for cetacean protection from whalewatching, and it can be difficult to

gain affirmative conservation action from policy makers, managers and the whalewatching industry.

Studies have demonstrated that human disturbance from unmanaged whalewatching activities is causing short-term negative impacts such as a change in activity (e.g. Constantine et al. 2004), dive intervals (e.g. Ng & Leung 2003; Miller et al. 2008), swim speed (e.g. Nowacek et al. 2001), group cohesion (e.g. Miller et al. 2008), swim direction (Au & Perryman 1982; Nowacek et al. 2001), calling rates (Lesage et al. 1999; Scarpaci et al. 2000; Van Parijs & Corkeron 2001; Buckstaff 2004), and habitat use (e.g. Bejder et. al. 2006b) (Bejder et. al., 2006b; Martinez & Orams 2011; IWC, 2013b).

Kruse (1991) recorded orcas increasing their traveling speed (1.48 times faster) when boats were present (Trites & Bain 2000). Kruse (1991) recorded "a correlation between swimming speed and number of boats within 400 m of the whales" (Trites & Bain 2000, p.4). In Williams's (1999) study, female orcas swam faster when followed by a boat. The orca males in Williams' (1999) study carried out the same swimming speed when followed by a boat, but in a less direct path (Trites & Bain 2000)

Adimey's (1995) study found that orcas' surface behavior changed when boats were present. Orcas surfacing activity increased 3 to 4 times when a single boat would closely approach (Adimey 1995). Lemon and colleagues' (2006) data revealed coastal bottlenose

dolphins changing their surfacing behavior from travelling to milling (a transition behavior), changing their direction, and traveling away from the approaching powerboat.

There is a great deal of concern by the scientific community (e.g. IWC, 2013b) about whalewatching impacts since many of the popular whalewatching species are classified as endangered (Orams 2000). Many species are being provoked to abandon their habitats (such as important breeding and feeding grounds) to avoid human harassment, thus increasing the risks of offspring mortality and population declines (Chapman et al. 2000; Heckel et al. 2000; Stevens & Boness 2003; Constantine et al. 2004; Timmel et al. 2008).

Many of these negative effects are caused by persistent and continuous human disturbance. Scientists have been investigating the negative effects on repetitive anthropogenic exposure and cetacean's long-term health (IWC 2013b). What they have found is that short-term behavioral changes due to whalewatching have resulted in an increase in energy expenditure, a decrease in resting activity, and a change in the animals' location, (Constantine 1999; Constantine et al. 2004; Bejder et. al., 2006a, 2006b; IWC 2013a), thus possibly impacting specific cetaceans' long-term fitness.

Briggs (1991) discovered orcas avoiding or spending less time at their rubbing beach when vessels were present (Trites & Bain 2000). A study conducted from 1991 to 1994 by Trites and colleagues (1995) found that the vessels within the Ecological Reserve affected the animals' movement (Trites & Bain 2000). Trites and colleagues (1995)

found that the orcas would move to another area of the Reserve or leave the Reserve completely when vessels were near (Trites & Bain 2000). "Furthermore, the probability of whales leaving the Ecological Reserve increased with the number of vessels that were present" (Trites & Bain 2000, p.4).

BOAT STRIKES

Vessel strikes have always been a threat to cetaceans, but because of the increase in boat traffic, collisions have become a bigger threat to large cetacean populations (Filla et al. 2008; Reeves et al. 2003). It does not matter how big or high powered the boat is, harm can be inflicted to cetaceans (Laist et al. 2001). A single boat collision can cause serious injury that can eventually lead to death or cause mortality upon impact (Reeves et al. 2003; van Waerebeek et al. 2007). However, faster boats have less time to react and decrease their speed to avoid a collision (Parsons 2013). Also, faster boats are more likely to cause more serious injuries as opposed to non-threatening life injuries (Laist et al. 2001; van Waerebeek et al. 2007). Cetaceans are more likely to be killed in a collision with a vessel traveling over 13 knots (Laist et al. 2001). Many stranded cetacean carcasses show signs of vessel strikes (van Waerebeek et al. 2007), with fin whales being the most common cetacean species to be hit by boats (van Waerebeek et al. 2007; Ambler 2011). There are also numerous reports of common bottlenose dolphins (*Tursiops truncatus*) presenting injuries from small boat propellers (Lusseau 2002; Van Waerebeek et al. 2007; Currey 2008; Baker et al. 2010; Dwyer et al. 2014).

METHODS

This study will be conducted in the Archipelago of Bocas del Toro, Panama. This small group of islands is located at 9° 20' 0" N and 82° 15' 0" W, off Panama's northeast Caribbean coast close to the border with Costa Rica (Windevoxhel & Heegde 2008).

Figure 2. Map: Bocas del Toro Archipelago from Wikipedia (2015)

As noted previously, this site was chosen because of the high level of concern for the community of dolphins in the area. Because of the high level of whalewatching operations, the dolphin community in Bocas is threatened (May-Collado et al. 2007).

Dolphin deaths have occurred in this small isolated population due to the lack of compliance with whalewatching guidelines and a lack of effective management of this activity (May-Collado et al. 2007). The dolphin population in Bocas del Toro consists of 200-250 animals (May-Collado et al. 2012), however those resident dolphins with home ranges within Bocas Torito (also known as Dolphin Bay) and adjacent waters are the most threatened. Because of their high site fidelity this sub-population attracts high intensity dolphinwatching activity (May-Collado et al. 2007).

Methods used in this survey had not been used before. To carry out this study, two boat-based surveys, two written questionnaires were conducted in July, August and September 2013. One of the boat-based surveys was to observe the local bottlenose dolphins' behavior (with boat interaction and without boats present) and the other assessed local dolphinwatching vessels.

In order to gather control behavioral data, boat-based surveys were conducted throughout the Archipelago (Isla Popa Uno, Shark Hole, Dolphin Bay, Pastores, Almirante, Solarte, Loma Partida, Bocas del Drago, T. Oscura, Bahia Honda, Osa Perezoso, San Cristobal, Basimentos, Punta Caracol, Isla Peresosos) observing dolphins without whalewatching interactions. A second set of boat-based surveys quantifying the level of compliance with whalewatching codes of conduct were conducted with the majority of the time spent in Dolphin Bay. This site was specifically chosen because of the concern for the community of dolphins due to the high level of dolphinwatching traffic (May-Collado et al. 2007), as

noted above. Some boat interaction surveys were conducted throughout the Archipelago (Isla Popa Uno, Shark Hole, Dolphin Bay, Pastores, Almirante, Solarte, Loma Partida, Bocas del Drago, T. Oscura, Bahia Honda, Osa Perezoso, San Cristobal, Basimentos, Punta Caracol, Isla Peresosos). However, data was collected mostly at Dolphin Bay because of the intense dolphinwatching activity that occurs there and the importance of the area for the local dolphins.

The two questionnaires (for Bocas del Toro whalewatching tourists and for dolphinwatching boat operators) were collected in key points on Isla Colon, Bocas Town, where tourism businesses are located. Both questionnaires were voluntary and anonymous, and participants had this explained to them before beginning the questionnaire. The questionnaires were not timed, and any participant could decline the offer to take the survey at any time. Tourists and boat operators were randomly sampled (a random non probability sampling) in Bocas Town (the most populated area with the highest tourist numbers) to avoid biased sampling (Czaja & Blair 2005). The questionnaires began with simple questions that pertained to the individual. This allowed an easy progression into the survey (Czaja & Blair 2005). Demographic questions, and questions on environmental issues in Bocas were asked. Questions were also asked about dolphinwatching tourism in Bocas del Toro and the tourists' perspective and opinions about whalewatching tourism. Boat operators were questioned about their experience in dolphinwatching tourism and their income first, then the questionnaire progressed to

more detailed questions about their dolphin and dolphinwatching knowledge and their perspective on dolphin conservation.

BOAT-BASED SURVEYS

This study consists of two boat surveys. The first boat-based survey evaluated the short-term effects of whalewatching on bottlenose dolphins in Bocas del Toro. The second survey observed the boat operators' level of compliance with Panama's whalewatching codes of conduct. Both surveys were conducted during July and August 2013, from powerboats ranging from 19 feet to 30 feet long, with either a 75 hp or 90 hp four-stroke outboard motors. This type of boat is common in Bocas del Toro especially for recreational use. When dolphins were encountered the research boat approached slowly and moved to a parallel position (Wursig and Jefferson 1990, Resolution ADM/ARAP NO. 01, 2007). To minimize noise disturbance the motors were turned off when dolphins were in a 100 meters radius from the research boat. Data was collected from the hours of 0700 hrs to 1600 hrs (weather and accessibility permitted).

The dolphin behavior survey began when dolphins were sighted in the study area. Behaviors were recorded (categorized as traveling, milling, resting, and foraging) using standard scan sampling methods (Altmann 1974).

During the sightings, dolphin behaviors were recorded every minute until the dolphins were out of sight. If dolphinwatching boats were present, then boat behaviors were

recorded simultaneously every minute. Surveys terminated when dolphins were no longer present in the study area or when boats had left the area. Typically an observation was conducted for 20 minutes to 2 hours. If it was necessary, boat surveys continued consecutively until 4 p.m. The only interruption was when dolphin observations became all day events. In that case, there was a 15-minute lunch/bathroom break.

The behaviors were recorded on survey forms (see Appendix), and if an assistant was available, they helped the lead researcher collect field data during studies. To limit disturbing dolphin behaviors the researcher's boat cut off its engine or was put in neutral when dolphins were in sight. The research boat maintained a 50 to 100 meter distance from dolphins if possible. The further away the research boat was, the less likely it was a disturbance factor. When needing to approach the dolphin(s), the research boat approached at a slow speed and in a parallel direction to the dolphins' travel. These measures are standard for cetacean research in order to minimize influencing the dolphins' behavior.

Photographs of dolphins' behaviors and their dorsal fins were continuously taken with a Canon Digital EOS 400D to document the sightings during each entire dolphin encounter.

DOLPHIN BEHAVIOR SURVEYS

For the dolphin behavioral surveys, the date and time (start and finish), weather and sea state (conditions), the latitude and longitude were collected at the beginning of each sighting. The number of dolphins, and the number of boats present were recorded every minute as well as the dolphin behaviors (in categories of forage, shallow dive, deep dive, disappear, rest, surface, socialize, play, sexual, mill, slow travel, fast travel, aerial, aggressive) (see Table 2). There was also a comment section available for every minute on the form where any out-of-the-ordinary or significant notes could be written down (such as any physical interaction or serious harassment by whalewatching tour operators; see Appendix).

This study's dolphin behavior categories were modified from definitions used in previous studies (Parsons 1998; Lusseau 2003a; May-Collado & Ramírez, 2005; Montero-Cordero & Lobo, 2010).

Table 2. Behaviors recorded in this study and behavior definition

Recorded Behavior	Behavior description
Social	Socializing behaviors include dolphins interacting with each other by playful chasing, leaping, physically touching each other in play, or sexually interacting. For this study Inquisitive behaviors were included in the social category because they involved interaction with whalewatching boats, or other animals. Inquisitive behaviors include "peeping", or "spy-hopping", and voluntarily approaching a boat as if curious.
Forage:	Foraging behaviors are actions that indicate putting effort into capturing prey, fish-whacking, having prey in their mouths, consuming prey, chasing prey, circling deep dives with loud exhalations, swimming rapidly in circles (carousels), and a sequence of dives ending with a fluke dive.

Resting	Resting behaviors involve very slow movement in tight groups, traveling at about one knot. Or when dolphins are floating on top of the water still with their blowhole visible.
Slow Travel	Travel consists of slow traveling at a pace of three knots or less, and high speeds of travel with a pace faster than three knots.
Fast travel with a purpose	Purposeful travel- is considered fast travel in one direction without any action of foraging, milling or socializing.
Milling	Milling consists of different directional headings. It can be connected with socializing, play and foraging.
Deep Dive	A deep dive is when the fluke is visibly sticking out of the water
Shallow Dive	A shallow dive is when the dorsal fin and back are visible. The fluke is not visible in a shallow dive.
Disappear	This behavior describes when all dolphins in a group dive underwater and are no longer visible.
Surface	This behavior is when dolphins come up for air.
Play	Throwing objects out of the water (such as a fish), leaping in the wake of a boat, riding with a boat.
Sexual	This behavior is rolling (twisting, rolling around together in one place), displaying abdomen and/or penis.
Aerial	The behavior is leaping (leaping clear out of the water and re-entering head first) and porpoising (arching leaps with partial or entire body out of water)
Aggressive	This includes biting another dolphin, body slamming (a forward or side slam against the water), headbanging (head slapping the water), headbutting, head toss (abrupt head jerk), flipper/fluke strike, tail slap, and shaking body (a low scale of body thrashing, or convulsion).

BOAT OPERATOR COMPLIANCE SURVEYS

When dolphinwatching or other vessels were present during dolphin sightings, compliance surveys commenced. As in the behavioral survey, boat compliance surveys were conducted every minute. This survey was collected simultaneously with the dolphin behavior survey. Boat compliance surveying began when boats were sighted. For every minute, the number of boats, the type of boat (see Table 3), and the distance of boats to

dolphins was collected. The boats' actions were recorded every minute (e.g. approach speed, direction of approach, engine status, circling, chasing, following, etc) (see Table 4; 5). A comment section for every minute allowed any unusual or significant events to be documented.

Table 3. Types of vessel recorded in this study

Type of Boat Recorded	Definition
Whalewatching boats	Any boat that was participating in dolphinwatching for a company or private boat operator including sailboats
Canoe	Wooden canoe with paddles
Canoe with motor	Wooden canoe with attached motor
Transport boat	Any motorized boat (except for canoe with motor) that is traveling by
N/A	No boats present except for research boat

This study had 11 boat behaviors that were categorized as noncompliant maneuvers.

Table 4. List of whalewatching boat operators' noncompliant maneuvers in this study

Noncompliant maneuvers	
CIR	Circling dolphins
FD	Fast speed direct to dolphins
FL	Fast speed leaving
FOL	Following dolphins
HAR	Harassing dolphins
MD	Medium speed direct to dolphins
ML	Medium speed leaving
SCH	Searching for dolphins
SD	Slow speed direct to dolphins
THR	Moving through dolphin group
WTH	Within the dolphin group

Maneuvers that are categorized as compliant are ones that are required by the Panamanian whalewatching guidelines (see table 5).

Table 5. List of whalewatching boat operators' compliant maneuvers in this study

Compliant maneuvers	
IDLE	Idle engine
OFF	Off engine
SL	Slow speed leaving
PAR	Parallel with dolphins

Photographs of boats and their actions were taken with a Canon Digital EOS 400D to document the sightings.

PHOTOGRAPHIC DATA

Photos were taken with a Canon Digital EOS 400D throughout all sightings for three purposes. The first was for photo-identification of individual dolphins. The second purpose was documenting dolphin behavior. The third was to document whalewatching operator behavior and to collect evidence of any serious harassment.

Photo-identification data for dolphins was not analyzed in this study, but it will be used to further information about the dolphins in Bocas del Toro for other studies by a local organization, Panacetacea. Photographing began at dolphin sighting and continued until

the sighting was over. When photos were taken they were linked to the data recorded at that time.

CHAPTER 2

OBSERVATIONS OF DOLPHINWATCHING BOAT OPERATORS IN BOCAS DEL TORO

INTRODUCTION

There are concerns that unsustainable tourism development in Bocas del Toro, Panama, is starting to degrade the natural environment. Indications of this have become very apparent among locals, scientists, and even outside observers (Kayes 2005; Claiborne 2010). Even the leading guidebook Lonely Planet published in 2007 expressed these concerns stating:

> "*Unfortunately, the secret is out, and although locals have thus far welcomes the increase in tourism, bulldozers have already started clearing land for condos and resorts… It's difficult to predict the future of the islands, but one this is certain – see Bocas now, as the unspoiled beauty of the islands won't last forever*" (p. 681).

This note of alarm was expressed by Lonely Planet six years ago, and since then the sense of urgency has increased. At present, dolphinwatching trips are a major tourist activity in Bocas del Toro, with these trips being advertised in most hotels and restaurants. The sustainability of this dolphinwatching tourism is a cause for concern.

There are approximately 200-250 resident bottlenose dolphins (*Tursiops* spp.) in Bocas del Toro. These dolphins are genetically isolated from other populations in the Caribbean

(May-Collado et al. 2012; IWC 2013a; Panacetacea 2013). Over a period of three years (2012-2014), at least 10 resident dolphins have died due to boat collisions (Panacetacea 2013). Panama does, however, have official whalewatching guidelines. Concern has been expressed that these whalewatching guidelines are unclear, not obeyed, and not enforced (May-Collado et al. 2014). Effectively, anyone who has a boat can take tourists out to watch the dolphins whenever and however they want. In Bocas del Toro at present, dolphinwatching is becoming an example of Hardin's "tragedy of the commons" (Hardin 1968). Concern about the impact of dolphinwatching in Bocas Del Toro on the dolphins, has attracted international attention. When the status of the dolphin population was raised at the 2012 meeting of the International Whaling Commission (IWC) (which incidentally was held in Panama), the IWC Scientific Committee stated that:

> "*The Committee strongly recommends that Panamanian authorities enforce the relevant whalewatching regulation (ADM/ARAP No. 01) and in particular promote adherence to requirements regarding boat number and approach speed and distances… The Committee recommends continued research to monitor this dolphin population and the impacts of tourism on it*" (p.80; IWC 2013b).

LEGISLATION OF WHALEWATCHING TOURISM

Meanwhile, in 1975, The International Whaling Commission (IWC) became concerned about the negative effects of whalewatching activities (Carlson et al. 2014). From then on the IWC arguably became the global body for advocating and advising whalewatching impact research, education, and voluntary regulation development (Carlson et al. 2014). In 1996, the IWC Scientific Committee developed a set of whalewatching guidelines. They compiled whalewatching regulations from around the globe, to develop a set of

"best practice" guidelines that could be available to any region (Carlson et al. 2014). These guidelines are now used internationally as benchmark voluntary whalewatching guidelines (International Whaling Commission 2014b):

- Operators should have a sound understanding of the behavior of the cetaceans and be aware of behavioral changes which may indicate disturbance.
- In approaching or accompanying cetaceans, maximum platform speed should be determined relative to that of the cetacean, and should not exceed it once on station.
- Use appropriate angles and distances of approach; species may react differently, and most existing guidelines preclude head-on approaches.
- Friendly whale behavior should be welcomed, but not cultivated; do not instigate direct contact with a platform.
- Avoid sudden changes in speed, direction or noise.
- Do not alter platform speed or direction to counteract avoidance behavior by cetaceans.
- Do not pursue (chase as opposed to follow), causing the whale to change its course or speed), head off, or encircle cetaceans or cause groups to separate.
- Approaches to mother/calf pairs and solitary calves and juveniles should be undertaken with special care; there may be an increased risk of disturbance to these animals, or risk of injury if vessels are approached by calves.
- Cetaceans should be able to detect a platform at all times; while quiet operations are desirable, attempts to eliminate all noise may result in cetaceans being startled by a platform which has approached undetected; rough seas may elevate background noise to levels at which vessels are less detectable.

As noted above, Panama does have official whalewatching[1] guidelines which require that vessels:

- Do not get closer than 100m from the dolphins, unless approached by them. If approached, turn off your engine and enjoy the company! Don't turn the engine back on unless you make sure they are 100m far from you (Fig 1).
- Inside the Dolphin Bay, or when a group of dolphins is detected, travel no faster than 4 knots or 7km per hour. If you are following a group, your speed should be lower than the group's speed.
- Observation time should not exceed 30 mins.
- Do not travel perpendicular to the direction of the group. Always travel in a parallel position.
- A maximum of 2 boats should be observing dolphins at the same time and boats should be at least 200m apart from each other.
- Leave a 30 mins rest after each observation event.
    - Do not feed the dolphins.
    - Do not make loud noises. Music and loud sounds might disorient dolphins.
    - Do not follow the dolphins when they are diving to ambush them when they re-emerge to breath.

Special considerations for groups with calves:

- Do not get closer than 250m from the dolphins, unless approached by them. If approached, turn off your engine and enjoy the company! Don't turn the engine back on unless you make sure they are 250m far from you.
- Observation time should not exceed 15 mins.

[1] The term whalewatching is used throughout the rest of this paper, as the term refers to commercial activities that involve watching any wild cetacean, even though bottlenose dolphins are the primary target of the industry in Bocas Del Toro.

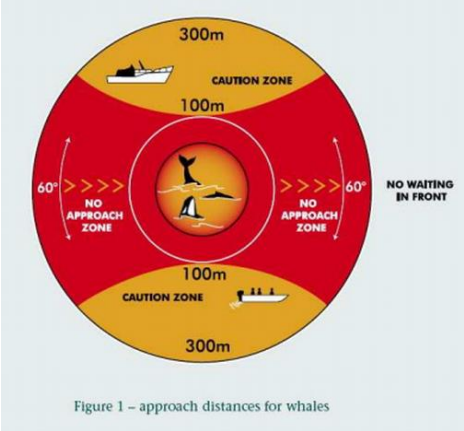

Figure 3. Approach distances for whalewatching vessels as outlined in Panamanian guidelines (República de Panamá Asamblea Nacional Legispan Legislación de la República de Panamá, 2007).

Bocas' situation is unfortunately not unique. Many countries have legally binding whalewatching regulations that are violated by whalewatching operators (Scarpaci et al. 2003; Corbelli 2006). In Victoria, Australia, where boat operators are licensed to whale-watch by the Department of Natural Resources and the Environment, one-third of all dolphinwatching boat approaches were determined to be illegal: operators were seen approaching very young calves (displaying the fetal-folds indicating a newly born animal), spending more than recommended time with animals, and approaching closer than proscribed distances (Scarpaci et al. 2003).

Elsewhere, whalewatching trip operators have frequently been reported disregarding whalewatching guidelines and, more generally, the well-being of the target species by closely following, or chasing, animals so that their passengers are able to get a closer

look and take better pictures (e.g., Timmel et al. 2008). Because of inappropriate vessel activity in close proximity to cetaceans many animals have been struck by whalewatching vessels, leading to serious, or even deadly, injuries (Laist et al. 2001; Waerebeek et al. 2007; Panacetacea 2013). Much of this behavior is seen in Bocas Del Toro where whalewatching guidelines are not currently enforced by the Panamanian government or the local community (Clairborne 2010; May-Collado et al. 2012).

In Bocas Del Toro, boat operators tend to leave port at the same time, *en masse*, and as such, many boats frequently surround any given dolphin group. The majority of the boats head to "Dolphin Bay" which is regularly utilized by approximately 150 dolphins from the resident population (May-Collado et al. 2014). Panama's whalewatching guidelines require boat operators to stay at a distance of 100m from dolphins, with no more than two boats at a time. Community members have noted seeing dolphinwatching operators not complying with codes of conduct (Clairborne 2010). For example, it is reportedly common to see dolphins being circled and chased by more than 10 to 15 boats all day long (Clairborne 2010). Scientists have confirmed that, as activities are not officially monitored, these prohibitions seem to be violated on an almost daily basis (Barragán-Barrera et al. 2013; May-Collado et al. 2014).

During the "low" tourist season, as many as 37 boats have been observed surrounding a group of dolphins (May-Collado pers. comm. 2013). However, scientists have reported seeing more than 100 boats interacting with a group of dolphins during "high" tourism

season (May-Collado et al. 2014). According to one senior boat captain, there are over 200 boat operators in Bocas del Toro, although this needs to be assessed. This number doesn't even consider the private residents who own boats. This implies that the potential maximum number of boats that could be engaged in whalewatching is substantial, and a cause for concern.

Previous research has made it evident that vessel activity can disturb bottlenose dolphins' natural behavioral patterns (e.g. Au and Perryman 1982; Kruse 1991; Janik and Thompson 1996; Williams 1999; Orams 2000; Nowacek et al. 2001; Buckstaff 2004; Scheidat et al. 2004; Stamation et al 2010; Papale et al. 2012; Parsons 2012). Yet, it is the continuous, chronic exposure to disturbance that is most likely to cause negative impacts at a population level. Such behavioral changes can increase energetic costs or prevent biologically important behaviors. Also chronic stress responses could be detrimental to the health of dolphin populations (Orams 2000; Orams 2004; Lusseau & Bejder 2007; Wright & Kuczaj 2007; Stockin & Lusseau 2008).

A common behavioral response to boat traffic is avoidance behavior (Buckstaff 2004; Parsons 2912). Other behavioral responses to boat traffic include: changing their swimming speed (Au and Perryman 1982; Kruse 1991; Nowacek et al. 200l); altering their swim direction (Au and Perryman 1982; Nowacek et al. 2001); increasing breathing synchrony (Hastie et al. 2003); decreasing inter-animal distance (Bejder *et al.* 1999; Nowacek el al. 2001); and exhibiting longer dive durations (Janik and Thompson 1996; Nowacek et al. 200l).

It is not only vessel exposure that can cause behavioral changes. Engine noise is another contributing factor to the response of the animals (Ebre 2002). The majority of acoustic energy from boats is produced at frequencies between 0.1 and 10 kHz (Buckstaff 2004). This boat noise range can "mask", or acoustically obscure, dolphin whistles at frequencies between 4 and 20 kHz (Buckstaff 2004). This noise masking could prevent cetaceans from hearing calls from group members that are important for communication and social cohesion, (Erbe 2002; Buckstaff 2004). At higher speeds many boats can also produce noise at higher frequencies that could potentially cause masking problems for echolocation that is biosonar used for foraging and navigation (May-Collado 2007).

Orams (2004) explains the physiological response to short term threats: "a mammalian body rapidly mobilizes energy from storage sites (and inhabits further storage); heart rate, blood pressure, and breathing all increase in order to transport nutrients and oxygen to muscles; reproduction is curtailed, sex drive decreases, pain is blunted, and perception sharpened" (p.23). All this increases energy cost and reduces the behaviors for reproduction. The fact is, if this type of reaction is continuous because of continuous exposure to threats over time like unregulated whalewatching, more serious health problems will occur (Orams 2004).

Previous research done on the bottlenose population in Bocas del Toro has shown that approximately every 1.5 minutes a boat passes the local researchers' boat, with the vast majority of these being whalewatching boats (May-Collado 2007; Taubitz 2007). The average number of whalewatching boats in Bocas del Toro (interacting with a group of

dolphins at the same time) has been documented as typically ranging from 3 to 12 boats (May-Collado 2007), although as noted above, higher numbers have been reported. According to May-Collado (2007) and Taubitz (2007), boats drove "aggressively" and provoked a "negative response" 78% of the time. Dolphins showed more "travelling" behavior in the presence of dolphin-watching boats (Taubitz 2007). Taubitz (2007) found that dolphins in Bocas whistle repetition rates increased as dolphinwatching boats approached, and whistle rates decreased following boat encounters. Interestingly, dolphins in Bocas Del Toro also produced more frequency modulated whistles when dolphinwatching boats were present (May-Collado 2007), although the reason for this is unknown.

METHODS

This study was conducted in the Bocas del Toro Archipelago from July to August 2013. Bocas del Toro is located at 9° 20' 0" N and 82° 15' 0" W, off the Caribbean coast of Panama, close to the border of Costa Rica (Windevoxhel & Heegde 2008) (see map figure 2).

A boat-based survey was conducted to measure levels of compliance with whalewatching guidelines. Research was conducted from small boats ranging from lengths of 19 to 30 ft with a 75 hp or a 90 hp four-stroke outboard motor. If weather and accessibility permitted data was collected from 0700-1600 hrs. To minimize impact of the research vessel on the study animals, the motor was turned off when dolphins were within a radius of 100m.

Surveys were conducted throughout the Archipelago (off of Isla Popa Uno, Shark Hole, Dolphin Bay (Bocatorito), Pastores, Almirante, Solarte, Loma Partida, Bocas del Drago, T. Oscura, Bahia Honda, Osa Perezoso, San Cristobal, Basimentos, Punta Caracol, Isla Peresozos). However, the majority of surveys were conducted in Dolphin Bay (which is Laguna Bocatorito, see map above) due to its popularity for dolpinwatching trips (May-Collado et al. 2012).

Behavioral observations began when dolphins were sighted in the study area. At the beginning of each sighting, GPS coordinates, location name, weather and sea state were all recorded. The number of boats present and number of dolphins was recorded at the beginning of every minute throughout the entire sighting. Sightings ended when dolphins left the area or ended because of logistic reasons (which could include weather). The boats' distance to dolphins was also recorded. Every minute from the start of the encounter to the end, dolphin behaviors and boat behaviors related to compliance with the whalewatching guidelines were recorded. The vessel behaviors recorded were: the boats' approach speed; direction of approach; engine status; and type of maneuvering with respect to dolphins observed e.g., circling, following, moving through the dolphin pod, and searching for dolphins (see Table 3b; 3c)). Additionally, if any notable events or activities were observed they were also recorded at the time of the observation. These would include any physical interaction or serious harassment conducted by whalewatching operators.

CATAGORIZING BOATS

Observed boats were categorized as whalewatching boats, canoes, sailboats, transport boats and canoes with motors (see Table 3a). If more than one type of boat was recorded in that minute, the boat type that was assessed to have the greatest impact on dolphins (e.g., largest, loudest or closest) was the listed boat type for that minute. For instance, if a whalewatching boat (50m away from dolphins) and transport boat (100m away from dolphins) were documented together, the whalewatching boat would be the category recorded for that occurrence because it was presumed to have the greatest impact on dolphins because of its close proximity and directed activity. Any private boats were categorized by their activity, e.g. if a private boat was interacting with a dolphin group, it was categorized as whalewatching. For one incident, a sailing boat 100m or more in length was categorized as "transport" because this large vessel was transiting through the area.

METHOD ANALYSIS

Level of whalewatching compliancy was analyzed by evaluating 1) the distance of the boat to dolphins, 2) the number of boats with dolphins, and 3) the maneuvering behaviors of the boats. All canoes or transport boats in proximity to dolphins were removed from the compliance analysis because they were not interacting with the dolphins, and were not whalewatching.

1) Noncompliant and complaint whalewatching boats with regard to distance

Boats that were at noncompliant distances of 50m or less were categorized A=noncompliant distance and boats at compliant distances of 100m or more were categorized as B=compliant distance. Because of the difficulty of boat operators judging distances at sea, boats at distances between 50-100m were excluded - effectively boat operators were given the benefit of the doubt - and vessels categorized as definitively compliant, or noncompliant.

2) Noncompliant and compliant whalewatching boats with regard to quantity

The number of boats seen for each observation was assessed as A=noncompliant quantity for 3 or more boats seen at a given time, and B=compliant quantity for 1 or 2 boats seen at a given time.

3) Noncompliant and compliant whalewatching boats with regard to maneuvers

Boat maneuvers were evaluated according to whether they were following the Panamanian whalewatching guidelines (see Table 3b; 3c). Maneuvers for boats at both compliant and noncompliant distances were assessed for the level of compliancy within each category. Only further analysis of the behaviors of the boats was conducted on A=noncompliant (distance of 50m or less) boats. This was done because noncompliant maneuvers are assumed to have more impact at close distances.

A final maneuvering type, “travel” was recorded but omitted from analysis because boats that were transiting were neither directly interacting with the dolphins nor were they a purely control situation.

From July to August 2013, over 13 and half hours (817 minutes) of whalewatching "occurrences" were recorded (each "occurrence" was a 1-minute recording). Noncompliant boats with respect to distance (50m or less distance from dolphins) accounted for 583-recorded minutes and 234-recorded minutes involved distance compliant boats (100m or more from dolphins).

A total of 62 dolphin survey sightings were recorded. Fifteen sightings were control sightings (no boat traffic) (#6, #10, #11, #13, #14, #18, #19, #28, #29, #32, #34, #43, #45, #55, #56). Twenty-six of the sightings had transiting boats or canoes in proximity to dolphins (#5, #7, #8, #9, #12, #16, #17, #22, #23, #24, #27, #30, #33, #35, #40 #44, #46, #47, #48, #49, #50, #51, 53, #54, #57, #58). Twenty-one sightings occurred where there were whalewatching boat interactions (Sightings #3, #4, #15, #20, #21, #25, #26, #31, #36, #37, #38, #39, #41, #42, #52, #59, #60, #61, #62, #63, #64).

The Chi-square tests of independence were conducted with a subsample of 5 minutes via the statistics program, R (64-bit version 3.1.2.: R Core Team, 2014) to examine this study’s hypothesis “dolphinwatching boat operators in Bocas del Toro are not following best whalewatching practices?” Where possible, subsampling of 5 minutes was used to

offset autocorrelation and psuedoreplication).

RESULTS

The Chi-square results showed a significant difference in observations of noncompliant and compliant boat distance from dolphin groups ($X^2 = 149.0832$, df = 1, p-value < 2.2e-16, N=817). Figure 4 illustrates that 71% of the time boats were noncompliant (50m or less from the dolphin groups and only 29% of the time boats were complying with whalewatching regulations.

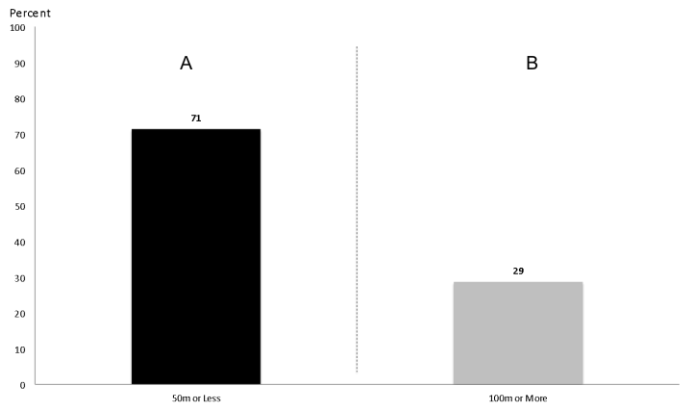

Figure 4. Proportion of boat operators not following whalewatching regulation and following whalewatching regulations. A majority of 71% of boats were A="noncompliant distance" vs. 29% of boats B="Compliant distance".

Evaluated more closely, both distance noncompliant (50m or less from dolphins) and Distance compliant (100m or more from dolphins) boats were not following proper whalewatching maneuver techniques. Figure 5 demonstrates that improper maneuvers

were seen more frequent than proper whalewatching maneuvers. Noncompliant boats (in terms of distance) were observed maneuvering in violation of regulations 66% of the time (Fig. 5). Similarly, even the boats at whalewatching compliant distances were observed maneuvering in violation of the regulations 58% of the time (Fig. 5). Only 34% of the time boats 50m or less were using proper maneuvers that might reduce harm to cetaceans (e.g. switching off engines).

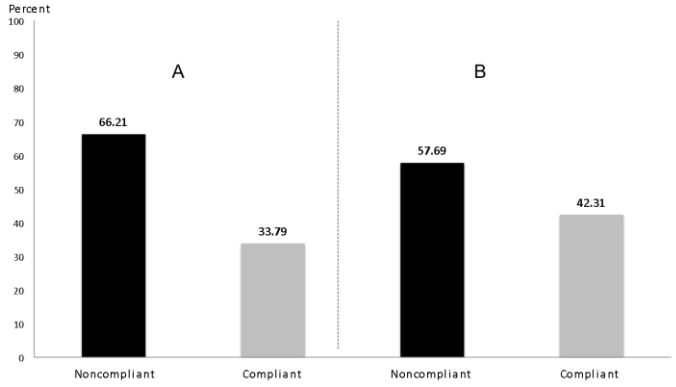

Figure 5. Proportion of noncompliant and compliant boat maneuvering for both boats at A=noncompliant boat distance and B=compliant distance. Within 817 occurrences 66% percent of A=noncompliant boat distance were improperly maneuvering, and only 34% the boats were properly maneuvering. Boats within the B=compliant distance were in violation 58% of the time, while 42% of the time the boats were proper maneuvering.

Further analysis on the maneuvers of noncompliant boats with respect to approach distance (50m or less from dolphins) showed that of 583 observed maneuvers, 197 events (34%) involved compliant maneuvering, versus 386 events (66%) that included noncompliant (aka improper) maneuvering, regardless of the approach distance itself

being noncompliant (Fig. 6). Most of the violating maneuvers were “slow speed, direct approaches towards dolphins” (SD; 106 occurrences, 18% of all maneuvers, 27% of noncompliant maneuvers only), “following dolphins” (FD; 81 occurrences, 14% of all maneuvers, 21% of noncompliant maneuvers only), “searching for dolphins” (SCH; 64 occurrences, 11% of all maneuvers, 17% of noncompliant maneuvering only), and “harassing dolphins” (HAR; 49 occurrences, 8% of all maneuvers, 13% of noncompliant maneuvers only). "Idle" was the most frequent compliant maneuver observed (139 occurrences, 24% of all maneuvers, 71% of compliant maneuvering only), with other compliant maneuvers being switching off engines when encountering dolphins (OFF; 41 occurrences, 7% of all maneuvers, 21% of proper maneuvers only), approaching parallel to dolphins (PAR; 11 occurrences, 2% of all maneuvers, 6% of compliant maneuvers only), and slowly leaving dolphin (SL; 6 occurrences, 1% of all maneuvers, 3% of compliant maneuvers only).

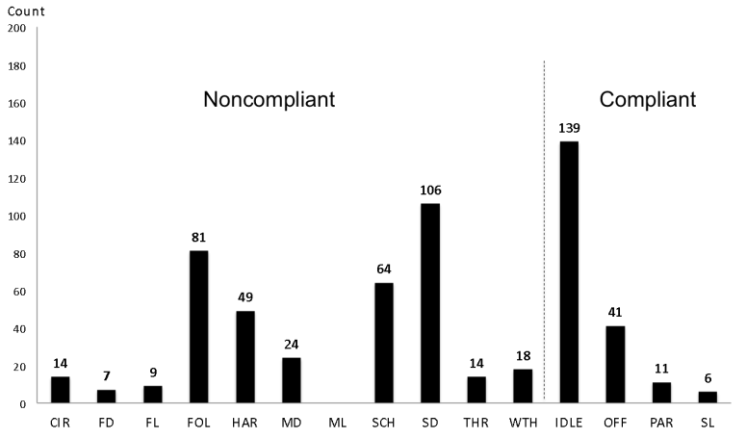

Figure 6. Total count of whalewatching boat maneuvers in 583 observations 50 meters or less from dolphins. *Maneuvers are listed from left to right: CIR=Circling, FD=Fast speed direct, FL=Fast speed leaving, FOL=Following dolphins, HAR=Harassing dolphins, MD=Medium speed direct, ML=Medium speed leaving, SCH=Searching for dolphins, THR=Driving through pod, WTH=With dolphins, IDLE=Idle engine, OFF=Engine Off, PAR=Driving parallel, SL=Slowly leaving

Over 817 sightings, 45% of the time (446 sightings) boats were in compliance with whalewatching regulations that only 1 or 2 boats should be around dolphins at one time. However, there were 371 occurrences (45% of the time) that whalewatching regulations were being violated with 3 or more boats present around dolphins simultaneously (Fig. 7a). The modes number of boats was 5 (64 total occurrences) to 6 (63 total occurrences) boats (Fig. 7b). There were 3 occurrences when 15 boats were present around dolphins (Fig. 7b).

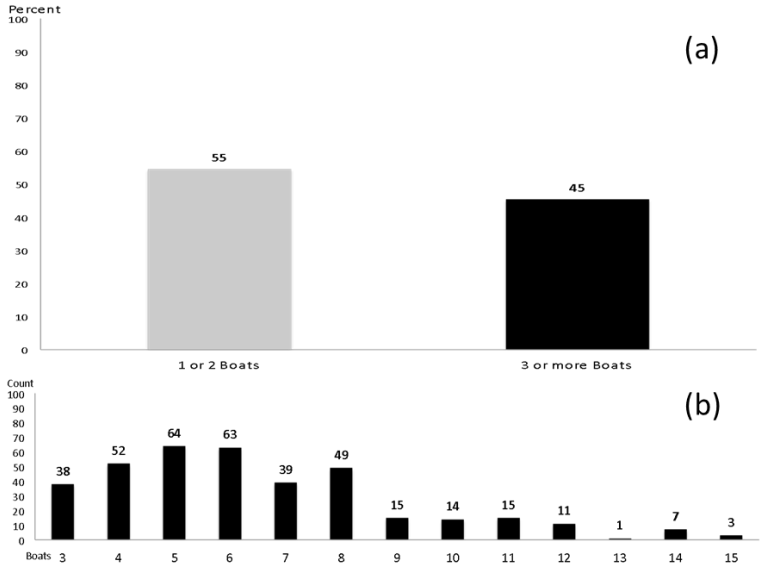

Figure 7. B=Compliant (gray) and A=noncompliant (black) whalewatching boat numbers within 50m of dolphins: (a) A comparison of the proportion of occurrences in the two categories (n=817); (b) Total number of occurrences of noncompliant whalewatching boat numbers (n=583).

DISCUSSION

This study was conducted a year after the International Whaling Commission gave recommendation to the Panamanian Government to ensure whalewatching guideline enforcement in Bocas Del Toro in 2012. These results demonstrate that noncompliance levels were still high and that the IWC recommendations had not been heeded.

According to Kessler and Harcourt (2013), in Sydney, Australia, breaching whalewatching regulations may be a combination of misjudging distance between the cetacean and boat, and complete disregard for the implemented whalewatching regulations. Panama's whalewatching guidelines require boat operators to maintain a distance of 100m from cetaceans and a distance of 200m from other whalewatching vessels. This study illustrates that boat operators is Bocas del Toro are not following these whalewatching guidelines. Seventy-one percent of the time boat operators were 50m or less. However, in the case of Bocas del Toro, boat operators may not be breaching these guidelines because of misjudgment or disregard for the guidelines. Instead boat operators in Bocas may simply have little to no knowledge of Panama's whalewatching guidelines (Sitar et al. in prep).

Results also indicate that boat operators in Bocas were not complying with whalewatching guidelines with respect to the number of boats with dolphins at any given time (Fig 7a). Forty-five percent of the time there were 3 or more boats with dolphins, with up to 15, but most frequently 5 or 6, vessels seen with dolphins (Fig. 7b). Kessler and Harcourt (2013) and Christiansen et al. (2010) both recorded similar findings. Kessler and Harcourt (2013) recorded 2 to 12 boats with cetaceans at a given time, while Christian et al. (2010) noted 1 to 13 boats with a single dolphin group. The high number of whalewatching boats with a single groups of dolphins makes it quite likely that whalewatching in Bocas del Toro is having an impact on the local dolphins. It should be noted that this study was conducted during low tourism season in Bocas del Toro, and

past studies in Bocas conducted by May-Collado et al. (2013, 2014) recorded up to 37 boats with any given group of dolphins.

Williams et al. (2002a) explain that an invasive boat approach, such as “leapfrogging” (driving parallel with cetaceans at a faster speed than the cetacean, then turning 90° in the cetacean’s predicted path) induces disturbance (Williams et al. 2002a). However, invasive approaches were not the only approach that affected behavioral response. Williams et al. (2002b) demonstrated that even vessels following whalewatching guidelines (including boat maneuvers such as slow and parallel approach) could affect cetacean movement patterns.

Like leapfrogging, many invasive behaviors were observed in this study. When boat behavior was considered for compliance, the proportion of inappropriate maneuvering was higher for close (<50m) than for more distant (>100m) approaches, although rates of noncompliant maneuvering were relatively high for both distances. The high rate of noncompliant maneuvering very close to animals (i.e. operators are being 'doubly noncompliant') could exacerbate disturbance and pose greater risk, making this a particular concern (Fig 5.). When noncompliant boat maneuvers for illegally close boats (50m or less) were examined more closely (Fig 6) 91 of the occurrences (14% of maneuvers 50m or less, n=583) were boats following dolphins, 106 of the occurrences were boats moving slowly and directly towards dolphins, 49 of the occurrences were harassing incidents (8% of maneuvers 50m or less, n=583), and 64 of the occurrences

were boats searching (11% of maneuvers 50m or less, n=583) around for dolphins. It is important to note that 14 events (2% of maneuvers 50m or less, n=583) of circling around dolphins were documented, 14 events (2% of maneuvers 50m or less, n=583) had boats driving through the dolphin pod, and 18 events (3% of maneuvers 50m or less, n=583) had boats within the dolphin group.

Williams et al (2002a, 2002b) notes that leapfrogging can cause noise disturbance. Similarly, many of the noncompliant maneuvers in Fig. 6 required sharp changes in speed and direction. Boat speed and movement affect the intensity of noise frequency (Richardson et al. 1995). "Propeller cavitation produces much of the broadband noise from ships and boats, and propeller singing can produce strong tones at the propeller blade rate and some of its harmonics" (Richardson et al. 1995, p. 430), Therefore the invasive maneuvering recorded in this study can potentially interfere with the dolphins' communication and impair the dolphins' hearing (temporary or permanent deafness or "threshold shifts") (Richardson et al. 1995; Erbe 2002). Thus, these maneuvers could potentially influence Bocas dolphin's behavior, and could potentially worsen their chances of collision with whalewatching boats.

It is possible that Bocas boat operators think a close encounter with dolphins creates a better experience for their tourists, which might be why operators are constantly ready to be in close proximity with dolphin, and often chase and/or follow the cetaceans. However, the need to get close to the cetaceans in order to generate customer satisfaction

is a misconception (Orams 2000). A survey conducted in Queensland, Australia by Orams (2000) revealed that the distance between boat and cetacean had no actual effect on consumer satisfaction. In fact, tourists were generally still satisfied with their whalewatching experience even when cetaceans were not seen (Orams 2000). Constantine (2001) found that intrusive boat maneuvers resulted in more avoidance behavior and less dolphin-human interaction. Conversely more interaction was seen when boat maneuvering was less intrusive. Constantine (2001) also found that human-dolphin interactions were more likely when dolphins had a "choice". Therefore the intrusive boat behavior in Bocas Del Toro could actually be reducing the ability of tourists to view cetaceans and thus impeding customer satisfaction.

A bottlenose dolphin-focused study conducted in Sarasota, Florida, found that boat collisions with dolphins were associated with higher than normal boating activity (Wells & Scott 1997). More collisions were recorded on holiday weekends when more boats were on the water (Wells & Scott 1997). In Sarasota, bottlenose dolphins in sheltered areas (shallow waters) are actually at greater risk of collision due to higher recreational boat density (Wells & Scott 1997). Much like Sarasota, Dolphin Bay in Bocas del Toro (the area where most of the dolphinwatching is being conducted) is a shallow area (approximately 20 m deep), with narrow mangrove channels (May-Collado 2007; May-Collado & Wartzok 2008). Shallow waters are commonly used as shelter for calf rearing and feeding (Norwacek 2001). Norwacek (2001) suggested that dolphins may have once used these shallow areas as a safe haven from boat traffic. However, now that watercraft

vehicles are more able to access such shallow water areas, they are no longer safe areas for dolphin nurseries, or sheltered areas for feeding (Norwacek 2001). The calves and mothers are particularly at risk as calves are slow moving and mothers will typically remain very close (Wells & Scott 1997). Our results indicated that this might be happening in Bocas del Toro i.e., that the resident dolphins' "safe haven" is no longer a sheltered place for nursing or feeding.

This brings us to another major concern regarding the health of the dolphin population in Bocas del Toro, i.e., that they may be experiencing repeated and/or chronic stress responses from continuous exposure to unmanaged dolphinwatching with the associated potential for increased energetic costs due to physiological responses (Beale 2007; Wright et al. 2007). If dolphins are displaced from the region because of these disturbances, there could be lost opportunities for foraging or mating, or they may relocate to a less desirable habitat (Wright et al. 2007). Monitoring the long-term distribution, reproductive success and health of individual dolphins would be important future research in the area to detect if such impacts do, in fact, occur.

The findings from this study provide suggestive evidence to support previous comments by scientists on unsustainable whalewatching activity in Bocas del Toro (e.g. May-Collado et. al 2014). Boats are not following whalewatching regulations with regards to number of boats. Operators are also driving too aggressively and too closely to dolphins,

which increase the chances of dolphin injury and fatalities, in addition to increasing disturbance.

CHAPTER 3
TOURISTS' PERSPECTIVE ON WHALEWHALE IN BOCAS DEL TORO

INTRODUCTION

Bocas Del Toro is a province of Panama that borders the Caribbean to the south of the Costa Rican border. It consists of a strip of mainland and its islands. The capital of the region is also called Bocas Del Toro (or Bocas Town) which is on the main island of Isla Colón.

The resident population of bottlenose dolphins (*Tursiops truncatus*) in Bocas del Toro sustains the largest dolphin watching industry in Panama (May-Collado et al. 2012, 2014). The rapid and disorganized growth of dolphin watching activity has resulted in an exponential increase in boat-dolphin watching interactions (May-Collado et al. 2014). This repetitive exposure to boat traffic is reducing foraging time and increasing avoidance behaviors (May-Collado in prep). Furthermore, because boats do not have mufflers to reduce engine noise, dolphins are often exposed to high noise levels. In Bocas dolphins respond to noise levels by lowering the frequency and increasing the duration of their communication signals, two well-known mechanisms used by cetaceans to avoid signal masking (May-Collado and Wartzok 2008, May-Collado & Quinones-Lebron 2014). Another outcome of high boat presence is *in situ* competition among tour

operators, which in 2012 and 2013 resulted in 10 dolphin fatalities due to collisions with boats (May-Collado et al. 2012). Furthermore, a number of dolphins have been observed with mutilated fins, tails, and marks of propellers on their bodies (May-Collado pers. comm.) Non-fatal collisions during dolphinwatching activities can have sub-lethal effects by impacting the dolphins' ability to perform important biological activities such as feeding and resting (Parsons 2012).

Most dolphinwatching vessels leave from Bocas Town in Isla Colon, a location that has become a busy tourist destination since the start of a rapid tourism boom about ten years ago (Kayes 2005). Bocas Del Toro has had to accommodate a high level of tourism with very little infrastructure in place (Kayes 2005). This has put a lot of pressure on the environment and the local species.

What once was an archipelago of islands populated by indigenous communities with stilt houses is now subjected to the pressures of extensive human activity. Bocas is now a landscape with luxurious hotels, and the high demands of tourists have resulted in an increase in pollution from plastic waste, raw sewage, and oil (pers. obs). In the tourist guide book *Lonely Planet* for Panama, this statement was found in the description of Bocas, "Unfortunately, the secret is out, and although locals have thus far welcomed the increase in tourism, bulldozers have already started clearing land for condos and resorts… It's difficult to predict the future of the islands, but this is certain – see Bocas now, as the unspoiled beauty of the islands won't last forever" (Reid et al. 2007, p. 681).

To date, there has not been an in-depth study that evaluates tourists' perspectives on conservation issues and tourism in Bocas del Toro, including the sustainability of dolphin watching. Since Bocas del Toro has become a major tourist destination in Panama, and because tourism developed so fast, the opinions of the tourists themselves are critical in shaping the development of the tourism industry in the region. Most tourists stay in "downtown" Bocas, on Isla Colon, the main island (Kayes 2005). This town is approximately 1.5 km long and consists of only two main roads (Kayes 2005). It is a condensed area where all the tourist shops, restaurants and hotels are located. The majority of the tourism trips depart from this location; however there are also private hotels in the various islands that have their private boat fleets for trips (May-Collado et al. 2014). Most of the trips consist of multiple short activities (swimming, dolphin watching, and snorkeling) that usually cover most of the Archipelago in a few hours (May-Collado et al. 2014; 2015). All of the companies offer daily trips to Dolphin Bay and all have similar itineraries, thus boats generally arrive in Dolphin Bay about the same time or within a few minutes of each other. Boats arrive in Dolphin Bay - located in between Isla Cristobal, and the mainland Bocas Del Toro, Almirante - at 9:30 a.m., 12:30 p.m., 1:30 pm., and 2:30 p.m (May-Collado et al. 2014). Dolphinwatching trips in Bocas del Toro are available every day, all year long, because their dolphin population shows high site fidelity to the area (Barragan-Barrera et al 2012). Thus, their predictable presence makes dolphinwatching a year round activity.

The resolution ADM/ARAP NO. 01 (2007) describes norms of conduct for dolphin and whalewatching operators. The regulations require boat operators to remain at a distance of 100 meters from cetaceans, that there not be more than 2 boats at a time, and that viewing is limited to 30 min (May-Collado 2013). However, these norms are not followed resulting in unsustainable dolphin watching activity. Recently, May-Collado et al. (2014) reported that a group of dolphins can be followed by 19 boats simultaneously and interact with 39 boats within a period of one hour. Contributing factors in the lack of compliance to the regulations are the lack of training opportunities and the fact that there are no requirements for licensing.

May-Collado and colleagues are currently evaluating the archipelago with the approval of the Autoridad Maritima de Panama (AMP) to obtain information on the number of licensed boats and boat captains. According to a senior boat captain in Bocas del Toro, there are over 200 boat captains in Bocas Del Toro. Private residents and private hotels who have their own boats and conduct private dolphinwatching trips (i.e. "recreational whale-watching" as defined in Parsons et al. 2006) are not included in this number. This suggests that the potential maximum number of boats that can be watching dolphins at any one time could be extremely high. During high tourism seasons (late September thru October, and January through February) scientists have estimated that over a 100 boats or more may be simultaneously viewing the dolphins in Dolphin Bay (May-Collado et al. 2014). This is a major cause of concern for the viability of these local dolphins, which are estimated to number approximately 200-250 individuals (May-Collado et al. 2014). It has

been suggested that 10 of these dolphins have died from boat strikes between the years of 2012 and 2014 (May-Collado et al. 2012).

Numerous studies have shown that without well-enforced tourism regulations and management, whalewatching tourism can cause disturbance and negative impacts on cetaceans (e.g. Au and Perryman 1982; Kruse 1991; Janik and Thompson 1996; DeNardo 1998, Nowacek et al. 2001; Scheidat et al. 2004; Stamation et al 2010; Parsons 2012). For smaller coastal cetacean populations like the population in Bocas del Toro, high levels of dolphinwatching activity are a serious threat. Boat collisions during dolphinwatching activities can have sub-lethal effects, by affecting the dolphins' ability to perform important biological activities such as feeding and resting (Parsons 2012). The situation is particularly worrisome because a recent study has found that the Bocas bottlenose dolphins are genetically isolated from other populations in the Caribbean (Barragan-Barrera et al. 2012). A combination of small population size, genetic isolation, and frequent boat-dolphin interactions make this population vulnerable. Special consideration for listing by the IUCN may be warranted for this population.

Appropriate tourism management must be established to minimize any harm (Kessler et al. 2014). Kessler et al. (2014) notes that managing tourism is important for the greater objective of spreading conservation awareness and increasing interest in and willingness to help protect the well being of animals and their habitat. It is however clear that appropriate management is lacking in Bocas del Toro, Panama and much harm is being

done at this time. In the past year, thanks to the recommendations of scientists and the International Whaling Commission, Bocas del Toro has begun a process of change.

TOURISM IN BOCAS DEL TORO

According to Kayes' (2005) findings, 50% of Bocas residents (local people) live on Isla Colon, and the rest of the Bocas residents are spread throughout the archipelago. Kayes (2005) concludes that a high proportion of locals are exposed to tourists and their lifestyle. In Bocas there are two different types of tourists that visit: Panamanians (domestic tourists) and international tourists. These two kinds of tourists are looking for two different experiences in Bocas del Toro (Kayes 2005). According to Kayes (2005) the majority of tourists said it was "important" to "very important" for "having fun"; "visiting a place" or "having an experience you could not have on your own; learning something new"; and "direct and active involvement with the environment". In addition tourists said that "learning something new", having direct and active "involvement with the environment" and participating in environmentally responsible and/or minimal impact tourism was important (Kayes 2005). Kayes (2005) also discovered that tourists rated being "physically challenged", being "intellectually challenged", and "having a guide" onboard from "neutral" to "important". When Kayes (2005) evaluated the motivations of SCUBA divers against those of other tourists, answers were not significantly different, except for one motivational factor. SCUBA divers seem to be more interested in participating in environmentally responsible and/or minimal impact trips than other tourists (Kayes 2005).

Based on Kayes' (2005) study, tourists used Bocas del Toro as an en-route destination in between travels to and from Costa Rica and Panama City. Most of the younger (<30 years of age) tourists were found to be from the Netherlands, Israel and Canada, while most of the older (>30 years of age) tourists were found to be from the United States (Kayes 2005). Although Kayes' (2005) findings are of interest, the study's sample size was limited, "the study was limited by time constraints (only two weeks) and my ability to attend only one tour each day", "I accompanied 7 tours in all" (p.13). The total sample size in the study was not reported. These findings provide rudimentary information about tourists in Bocas del Toro. However, a more thorough survey is essential to gain a better perspective of tourism in Bocas.

WHALE AND DOLPHINWATCHERS

Many studies have revealed that whale- and dolphinwatchers (hereafter referred to as whalewatchers) usually have certain attributes. Females are more likely to engage in whalewatching then males (Tilt 1987; Duffus 1988; Muloin 1996; Hoyt 2001; Finkler 2001; Lück 2003; Parsons et al. 2003; Lück 2015). In Lück's (2015) study 58.4% of the respondents were female, and in Fibly et al. (2015) 69.3% respondents were female.

Studies have also shown that whalewatchers tend to have higher levels of education, with many having college-level degrees (e.g. Tilt 1987; Duffus 1988; Forestell & Kaufman 1990; Neil et al. 1996; Fundacion Cethus 1999; Finkler 2001; Parsons et al. 2003; Mayes & Richins 2008; Lück 2015; Filby et al. 2015). For example, in California, 79% of

whalewatchers had at least 4 years of college (Tilt 1987). In the 1980s, when whalewatching was still fairly new in British Columbia, 51% of whalewatchers had a university degree (Duffus 1988). In the 1990s the percentage of tourists with a university degree went up to 70% in British Columbia (Finkler & Higham 2004). Comparably, Forestell and Kaufmann (1990) and Neil et al. (1996) noted the majority of their whalewatching respondents had higher education as well. In San Julian, Argentina, 72% of the whalewatchers had university degrees (Fundacion Cethus 1999). Parsons et al. (2003) found that 63% of the whalewatching participants in West Scotland had received higher education. Likewise three-fourths of participants in "swim with dolphin" trips in New Zealand, had college-level degrees: 43.4% had a university degree, 22.4% had a postgraduate degree, and 9.4% held a polytechnic certificate or diploma (Lück 2015). In contrast, Lück (2015) reports that 17% had a high school degree, 5% a vocational/trade qualification, and 2% had no formal education. Lastly, Finkler (2001) reported that between 64.7% and 81.2% of orca watchers had a higher degree.

Additionally, in many studies whalewatchers were found to be relatively affluent, with many being middle-class (Tilt 1987; Duffus 1988; Forestell & Kaufman 1990; Iniguez et al. 1998; Parsons et al. 2003). A study in west Scotland conducted by Parsons et al. (2003) found that 89% of the whalewatching participants were middle class, and 63% of the participants take more than one vacation each year. In Forestell and Kaufman's (1990) study in Hawaii, 62% of the participants had salaries of $40,000 or more, and 68% of the participants were ages 20-60 years old. The ages of participants vary from country

to country: the average age of whalewatchers in New Zealand was 20 to 34 years old (Pearce & Wilson 1995), while the average age of whalewatchers in other regions tends more towards middle–age (Muloin 1996; Duffus 1988; Parsons et al. 2003). Similarly Lück (2015) found 66.3% of the respondents were under 40 years old, and 23.4% were between the ages of 40 and 60 years, and 10% were 60 years and older. New Zealand may however be a special case, as it is known to attract younger adventure-seeking travelers from around the world.

The typical demographic make-up of whalewatching tourists allows whalewatching to be fairly expensive; whalewatching tourists have been found to be bigger spenders than average tourists (Hoyt 2001). For example, in order to take a whalewatching trip in Península Valdés, Argentina, tourists usually spend from US $660 to $1000 in total vacation costs (Iniguez et al. 1998). Draheim et al. (2010) reports most tourists would pay $30 to $60 US dollars for a dolphin trip. Additionally, Draheim et al. (2010) noted that 13% of the respondents were willing to pay $61 to $90 US dollars per person for a dolphin trip. These examples show that marine trip tourists are bigger spenders.

Somewhat related to wealth and education, Rawles and Parsons (2005) discovered in Scotland that most of the whalewatching participants displayed a high level of environmental activity and responsibility. Among the respondents, 83% said they recycle regularly, 58% said they were members of environmental organizations, and 91% said they participated regularly in wildlife-related activities (Rawles & Parsons 2005).

The majority of whalewatchers in many locations tend to be domestic tourists (Hoyt 2001; Finkler & Higham 2004). For example, in Finkler & Higham (2004) a study conducted in Washington State, USA, 93% of the land based whalewatchers and 94% of the boat-based whale-watchers were residents of the USA. Similarly, whale-watchers in New England were 75.4% American (Hoyt 2001). Likewise, in Queensland, Australia, 70% of the whale-watchers were domestic tourists (Hoyt 2001). In contrast however, in New Zealand only 40% of whale watchers were domestic (Hoyt 2001).

DOLPHINWATCHING TOURIST SATISFATION

There are many elements when creating a satisfactory whalewatching tour for tourists. For instance, seeing cetaceans, being up close, capacity of the boat and weather (e.g. Orams 2000; Higham & Hendry 2008; Kessler et al. 2014) are all potential elements for a satisfactory tour. However, a large part of tourists' satisfaction was following a code of conduct, preventing animal harm, and being educated about their tour experience and about the animals (e.g. Roggenbuck et al. 1990; Forestell 1992; Reid 1993; Neil et al. 1996; Reid 1996; Reid 1999; Orams 2000; Bierman 2001; Lück 2003; Shapiro 2006; Kessler et al. 2014).

Thus, seeing cetaceans in their environment and being able to get close to them are two large components in tourist satisfaction (Shapiro 2006). In addition, Kessler et al. (2014) found satisfaction was garnered as a result of the overall experience, which included good weather and how the tour was conducted (e.g. number of passengers on a trip, trip

duration, size or type of vessel, and personal health (Orams 2000).

In Kessler et al. (2014) participants expressed that they would prefer to be closer (i.e., to 50 m), to the whales than Australia's regulations permitted (100 m). However, "the high levels of satisfaction of boat-based whale watchers suggest closer approach distances are not necessary to ensure a positive whale-watching experience" (Kessler et. al. 2014, p.21). In Orams' (2000) study evaluating customers' whalewatching satisfaction, the level of satisfaction was high even when customers did not see any cetaceans. This being said, the closeness of the cetacean to the boat was irrelevant in customer overall satisfaction (Orams 2000). The results from the study of Kessler et al. (2014) indicated that both land- and boat-based whale watchers preferred a smaller capacity sized boat to a 200-passenger vessel. Interestingly, the boat based participants' strongest vessel preference was the motorized 70-passenger boat in comparison to the participants who chose the shore-based or the sailboat as their strongest preference (Kessler et al. 2014). Higham & Hendry (2008) found that shore-based whale watchers are more concerned with the impact of boat noise on the animals as opposed to the boat-based whale-watchers.

Dickson and Benham (2001) add that the more important factors for participants were whether the operator was behaving responsibly around wildlife and whether there was a naturalist guide on the trip. A demonstration of respect for the local environment and species, as well as seeing the operators support of conservation issues were a contributing factor to tourist satisfaction.

In the Kessler et al. (2014) study in Australia, all the participants had a strong preference for minimizing harm to the animals. Despite the fact that tourists would prefer to be closer to the animal than the code of conduct allows, no changes in boat distance are necessary to ensure a positive experience because tourists prefer to minimize their negative impact (Kessler et al. 2014). As Kessler et al. (2014) suggest, if the minimum distance to reduce harm to the animals is communicated to the tourists, then a positive whalewatching experience can be established.

Shapiro (2006) discovered that whalewatching passengers believe it is important to minimize negative impact on marine life. Approximately, 88% of the passengers said it was "somewhat important" or "very important" to minimize tour boats' impact on marine life (Shapiro 2006). In addition, 78% of Shapiro's (2006) whalewatching participants said that it was "very important" for them to know "that the tour operator supports conservation efforts financially".

Additionally, several studies have shown that the education component on a whalewatching trip has prompted a high level of satisfaction (e.g. Forestell 1992; Roggenbuck et al. 1990; Neil et al. 1996; Reid 1999; Orams 2000; Bierman 2001; Lück 2003; Shapiro 2006; Kessler et al. 2014). To date, educational (e.g. interpretation or educational material) dolphinwatching trips in Bocas del Toro do not exist (pers. obs.). Boat operators are not educated about dolphin biology or their dolphin population (pers. obs.). All of the whalewatching participants in the Kessler et al. (2014) study had a strong preference for having on-board education. Similarly, in three other studies, whale-

watchers evaluated educational interpretation on their trip as an important part of the tour (Neil et al. 1996; Reid 1999; Bierman 2001). Several studies have determined that the main reason for tourists to attend nature-based trips is to learn about the local environment and species (Forestell 1992; Roggenbuck et al. 1990; Orams 2000).

In Lück's (2003) study, 95% of participants agreed "mildly" to "strongly" with the importance of learning as much as they can about wildlife during their vacation. Participants that did not have a guide on board during their trip made comments such as "I would've liked more info [sic] about the dolphins and the ecosystem of this place," and "I think the tours should have more info [sic] about the dolphins and their lifestyles" (Lück 2003, p.8). On a second whalewatching trip that had on board interpretation, approximately 76% of participants agreed "mildly" to "strongly" that the trip was an educational experience and 63% "mildly" to "strongly" agreed they felt they learned a lot about dolphins (Lück 2003). Shapiro (2006) found that 93% of the whale-watchers said it was "somewhat important" or "very important" for them to listen to and interact with a naturalist guide on the whalewatching vessel. Additionally, in a later study, Lück (2014) reported that respondents who received an educational experience and had a knowledgeable interpreter still indicated that they would have liked to receive more information about the dolphins, their lifestyle, the marine environment, and conservation restrictions and regulations.

It is important to analyze whether current whalewatching tours in Bocas are operating in a satisfactory way for tourists. In Bocas del Toro, boat operators are seen driving circles around the dolphins to entice the dolphins to leap in the wake (Kayes 2005). The boat operators do this because they believe it increases the tourists' enjoyment and satisfaction. However, this type of action might not be what visitors expect or desire, and this type of "harassing" behavior deters tourists from satisfactory dolphinwatching experiences.

STUDY INVESTIGATION

This study investigated the demographic composition of tourists visiting Bocas, and their perceptions, particularly with respect to dolphinwatching and marine conservation. Most tourism trips in Bocas include a stop at dolphin bay to see the dolphins. Therefore this study could include all tourists. Understanding tourist's opinions on dolphin watching tourism should help support ongoing awareness campaigns. Additionally, information gathered from this study could possibly help with the management of dolphinwatching operations and enhance local marine conservation. Three research questions were evaluated in this study: 1) To what extent do tourists in Bocas de Toro feel that boat operators should be regulated? 2) Is there a relationship between higher education and views on the importance of having educational dolphin watching trips? 3) What are the perceptions of tourists concerning the Panamanian Government's involvement in protecting the environment?

The hypothesis to be tested for research questions 1 and 2 is: "Tourists support greater dolphin conservation by preferring educational and/or sustainable dolphinwatching."

The hypothesis to be tested for research question 3 is: "Tourists notice environmental issues in Bocas del Toro and believe that stronger government regulations are needed."

In this study dolphinwatching tourists, specifically in Bocas as well as overall tourists in Bocas, will be described and studied. When specifically speaking of just the dolphin-watchers in this study, the term "dolphinwatchers" will be noted. When all the tourists (which include all participants, both dolphinwatchers and non-dolphinwatchers) are mentioned, they will be referred to as "tourists."

METHODS

This study was performed in the Bocas del Toro Archipelago in Panama between July and September 2013 (See Map fig. 2). In the archipelago, Bocas town on Isla Colón is the main area of tourist activity and is where the majority of tourism trips depart. Thus, this study was conducted on the streets of Bocas town.

INTERVIEWS

This study explored Bocas tourists' perspective of tourism and the environment of Bocas by randomly selecting 129 participants. Tourists 18 years or older were approached and asked to participate in an anonymous voluntary questionnaire, which was constructed in

compliance with the guidelines of the Human Subject Review Board of George Mason University. The study utilized a pre-written questionnaire as the survey instrument, which was untimed. Tourists of any race, origin, and gender could participate. Tourists were not required to answer any questions they did not want to answer. The questionnaire consisted of 17 questions. The first 5 questions were to provide a demographic background (gender, age, origin, level of education, and eco-conscience level). The second part of the questionnaire (consisting of 12 questions) was related to tourism, whalewatching tourism and Bocas del Toro's environment.

Data were analyzed using non-parametric statistics. Chi-square tests were used to look at differences in opinions on the above questions at a level of significance of $p<0.05$. The analysis was conducted in R (64-bit version 3.1.1. R Core Team, 2014) and results are given in percentages or counts.

HYPOTHESIS TESTING

To test the hypothesis for research questions 1 and 2, "Tourists support greater dolphin conservation by preferring educational and/or sustainable dolphinwatching," statistical tests were applied to the responses to questionnaire questions #14- How important is it to you that your whalewatching boat operators have a whalewatching government license, #15- How important is it to you to have dolphin watching boat operators educated about dolphins, #16- How important is it for a dolphinwatching tour to be educational, and #17- How important is it to you to have dolphinwatching boat operators following Codes of Conduct (whalewatching rules) to prevent harm or disturbance to the dolphins? Likewise,

the relationship between answers to questionnaire questions #4 and #6 was analyzed with a Pearson's Chi-squared test, both with and without a Yates' continuity correction.

To test the hypothesis for research question 3 “Tourists notice environmental issues in Bocas del Toro and believe that stronger government regulations are needed,” a Pearson's Chi-squared test with Yates' continuity correction was also used to test research question #3 “What are the perceptions of tourists concerning the Panamanian Government’s involvement in protecting the environment?” via survey question #9 “In your opinion, do you think there are environmental issues not currently being addressed in Bocas?” and survey question #8 “In your opinion, from what you have observed, how effective is the Panamanian Government in protecting its environment?” Answers were in the format of “yes” “no” or “not sure” which were coded into two categories, and the “not sure” answers were removed from the analyses. Question 10 “In your opinion, from observation, should the Panamanian government have more, less or the same environmental regulations in Bocas” was also analyzed with a Chi-square test. Respondents answered with either “more”, “less”, “same” and “don’t know”. The “don’t know” answers were ruled out in the resulting analysis.

The statistical program, R (64-bit version 3.1.1.: R Core Team, 2014) was used for Chi-square tests for given probability ($p < 0.05$). Survey questions #8- In your opinion, from what you have observed, how effective is the Panamanian Government in protecting its environment, #14- How important is it to you that your whalewatching boat operators

have a whalewatching government license, #15- How important is it to you to have dolphin watching boat operators educated about dolphins, #16- How important is it for a dolphin watching tour to be educational, and #17- How important is it to you to have dolphin watching boat operators following Codes of Conduct (whalewatching rules) to prevent harm or disturbance to dolphins were answered on a five point Likert-scale (1= "Not at all" or "Not Important" or "Not Effective" to 5= "Very" or "Very Important" or " Very Effective"). The answers for these questions were coded for R into 2 categories (A & B). Likert-scale answers 1= "Not at all" or "Not Important" or "Not Effective", 2= "Little", and 3= "Somewhat", were collaborated as category A="Not Important" ((or for question #8, A= "Not Effective"). Likert-scale answers 4="Well" or "Important" or "Effective", and 5= "Very Well" or Very Important" or "Very Effective" were combined as category B= "Important" (or for question #8, B= "Effective"), because answers 4 and 5 are the definitive statements of importance. This was done as responses of "Somewhat Important" incorporate a certain amount of doubt and thus fall short of a definitive positive opinion.

RESULTS

A total of 129 tourists in Bocas del Toro were randomly sampled from July 2013 to September 2013 during the low tourist season. For this study 72 of the 129 participants were considered dolphin-watchers (this included tourists that have been on a

dolphinwatching trip in Bocas and tourists that are planning to go on a dolphinwatching trip in Bocas).

Of 128 survey participants who responded, 45% (n = 58) of them had already taken a dolphinwatching trip in Bocas del Toro. Moreover, 11% (n = 14) were planning to take a dolphinwatching trip, leaving 45% (n = 57) of tourists who were not planning to take a dolphinwatching trip (Table 6). The 56% (n = 72) of participating tourists who had either been on, or were planning to go on a dolphinwatching trip were compared to the remainder of the total data set to determine if they were notably different from the general tourist population.

Table 6. Total number of Dolphinwatching tourists in Bocas del Toro (N=128).

Survey Question	No. Of Tourists
Already been on a trip	58
Planning a dolphinwatching trip (with none previous)	14
No previous or planned dolphinwatching trips	57

*Blanks were assumed to be "no" responses

Of those who provided a gender (n = 109) 37% of individuals (n = 40) were male and 63% (n = 69) were female. Of the 72 dolphin-watchers that responded 62% individuals (n = 38) were female and 38% (n = 23) were male. About 50% of the interviewed tourists were between 22 to 30 years of age (Table 7). Results were similar for dolphin-watchers 52% were from 22 to 30 years old. In general, tourists were found not to be domestic

travelers, only 6 % of the tourists were from Panama, and 10% of the dolphin-watchers specifically were Panamanian (Table 8). About 30% were from United States (27% for dolphin-watchers) and 43% answered "other" (40% of dolphin-watchers) because their country was not one of the listed as an option on the questionnaire (Table 8).

The majority (89% of tourists) of the participants (n=123) had high education qualifications (college qualifications 33%, a bachelors degree 30%, a master degree 23%. and a PhD/JD/MD degree 2%) (Table 9). Only 11% of the respondents had secondary school qualifications (1% had elementary school qualification, and 11% had high school qualification). Numbers were again similar for dolphin watchers that responded (n=70), with 84% of individuals having a higher education (college qualifications 30%, a bachelors degree 30%, Master degree approximately 23%, and 1% PhD/JD/MD), and approximately 16% having only a basic education (1% had elementary schooling, and 14% had high schooling).

When looking at all tourists, most respondents (n=126) were first time visitors, approximately 78%, to Bocas del Toro (Table 10). Ten percent of tourists were second time visitors, 7% were third or fourth time visitors, approximately 2% were fifth or six time visitors and 3% of tourists visited Bocas seven times or more.

When asked to list all the various reasons for their visit to Bocas, 53% of all tourists questioned (n =129, with a total of 304 reasons given) indicated the beach was one of the

main attractions (Table 11). Nature was the next most popular selection at approximately 42%, with snorkeling in third place at 31%. Nineteen percent of the tourists indicated diving as a purpose for their visit, 17% for surfing, 16% for dolphin tourism, 10% for indigenous tourism, and 6% for sea turtle tourism (Table 11).

When tourists were asked how they heard about dolphin watching tourism (n = 96, with 116 total responses), hotel/hostel was the primary source advertisement or communication to tourists about dolphinwatching trips in Bocas, accounting for 22% (Table 12). The following source friend/family was 20%, and 19% for travel agent. Locals were another popular source for dolphinwatching advertisement or communication, accounting for 16%. Local flyers were the next category selected as tourists' means of hearing about dolphinwatching trips at 13%, internet was 12% of the participants, and other sources was 12%; as well the least marked source of information was travel books at 8% (Table 12).

Table 7. The age of tourists that responded to survey in Bocas del Toro (n = 125)

Age	18-21	22-30	31-40	41-50	51-60	61>
Total of all Tourist	24	63	24	7	3	4
Percent % of all tourists	19.2	50.4	19.2	5.6	2.4	3.2
Total of Dolphin-Watchers	12	36	15	2	2	2
Percent % of Dolphin-Watchers	17.4	52.2	21.7	2.9	2.9	2.9

*4 did not answer with a single response: Participants that had multiple answers were removed

Table 8. The origin of tourists that responded surveyed in Bocas del Toro

Origin	Costa Rica	Panama	Colombia	U.S.A	Mexico	Canada	Spain	England	Italy	Other
Total of all Tourists (N=124)	4	8	1	37	2	4	9	5	1	53
Percent % of all Tourists (N=124)	3.2	6.5	0.8	29.8	1.6	3.2	7.3	4.0	0.8	42.7
Total of Dolphin-Watchers (N=70)	3	7	1	19	1	1	8	1	1	28
Percent % of Dolphin-Watchers (N=70)	4.3	10	1.4	27.1	1.4	1.4	11.4	1.4	1.4	40

*5 did not answer for all tourists with a single response and 2 did not answer for dolphin watchers with a single response: Participants that had multiple answers were removed

Table 9. The level of education tourists in Bocas del Toro have acquired (n=123)

Education	Elementary	High School	College	Bachelors	Masters	PhD/JD/MD
Total of all Tourists (N=123)	1	13	41	37	28	3
Percent % of all Tourists (N=123)	0.8	10.6	33.3	30.1	22.8	2.4
Total of Dolphin Watchers (N=70)	1	10	21	21	16	1

Percent % of Dolphin Watchers (N=70)	1.4	14.3	30	30	22.9	1.4

*6 did not answer for all tourists with a single response and 2 did not answer for dolphin watchers with a single response: Participants that had multiple answers were removed

Table 10. Number of times tourists have visited Bocas del Toro (n=126)

# of Visits	1st Time	2nd Time	3rd or 4th Time	5th or 6th Time	7th or More
Total of Tourists	98	13	9	2	4
Percent % of Tourists	77.8	10.3	7.1	1.6	3.2

*2 did not answer with a single response: Participants that had multiple answers were removed

Table 11. Tourists' activity/attraction purpose of visit in Bocas del Toro (n=129). There were 304 responses given in total.

Purpose	Snorkel	Diving	Sea Turtles	Dolphins	Nature	Indigenous	Beach	Surf	Other
Total	40	25	8	20	54	13	69	22	53
Percent of answers	13.2	8.2	2.6	6.6	17.8	4.3	22.7	7.2	17.4
Percent % of Tourists	31.0	19.4	6.2	15.5	41.9	10.1	53.5	17.1	41.1

*Tourists were allowed to circle more than one purpose for their visit

Table 12. How did tourists hear of dolphin watching trips (n=96) total number of responses is 115.

Individual	Travel agent	Hotel/ hostel	Travel Book	Local Flier	Internet	Friend/ Family	Locals	Others
Total	18	21	8	12	11	19	15	11

Percent % of Responses	15.7	18.3	7	10.4	9.6	16.5	13.0	9.6
Percent % of Tourists	19	22.1	8.4	12.6	11.6	20	15.8	11.6

*33 tourists did not respond thus inferring that their lack of response could have been not hearing of Dolphin watching trips (it could be a "no" I did not hear of dolphinwatching trips or "not responding"

The hypothesis "Do tourists support greater dolphin conservation by preferring educational and/or sustainable dolphinwatching?" was accepted.

The responses for question #14 "how important is it to you that your whalewatching boat operators have a whalewatching government license?" were significantly different, with the proportion of tourists answering "not important" being less than those saying that it is important (X^2= 70.127, df = 1, p-value < 0.0001, n=126). This suggests that a whalewatching trips licensed by the government is an important criterion for all overall responding tourists (n=126) (see Fig. 8 below). The proportion of the tourists that answered that a whalewatching government license was B="important" was 87%, vs. 13% of tourists answering A="not important". When comparing the responding tourists that have been on a dolphinwatching trip in Bocas del Toro, or planned on going on a dolphinwatching trip (n=70), the result was very similar and also significant (X^2= 38.629, df = 1, p-value < 0.0001, n=70, 87% vs. 13%).

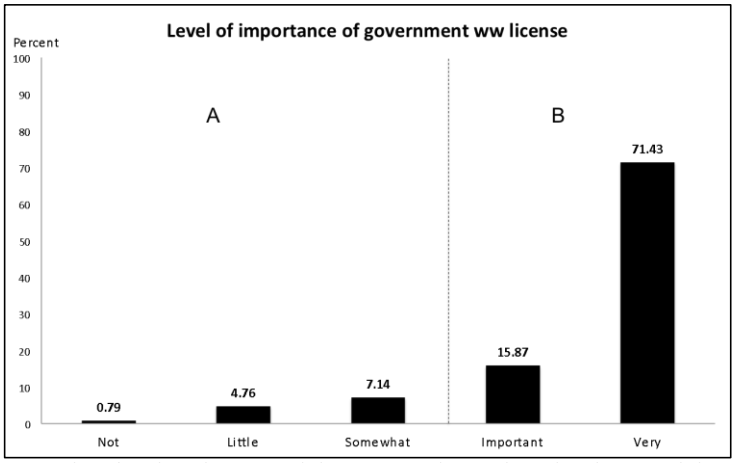

Figure 8. Proportion of tourists who answered "important" to the question: "how important is it to you that your whalewatching boat operators have whalewatching government license?" A majority of 87% responded B="important" vs. 13% of tourists who responded A= "not important".

In addition, responses to the question #15 "how important is it to you to have dolphinwatching boat operators educated about dolphins?" were found to be significantly different (X^2= 91.125, df = 1, p-value < 0.0001, n=128). This indicates that it is important to all overall responding tourists that dolphin watching boat operators be educated about dolphins (Fig. 9). Of the tourists that responded (n=128) 92% answered that it is important for dolphin watching boat operators to be educated about dolphins, while 8% of the tourists answered not important. When comparing the responding tourists that have been on a dolphin watching trip in Bocas or planned on going on a dolphin watching trip (n=72), the results were very similar and significant (X^2= 60.500, df = 1, p-value < 0.0001, n=72, 96% vs. 4%).

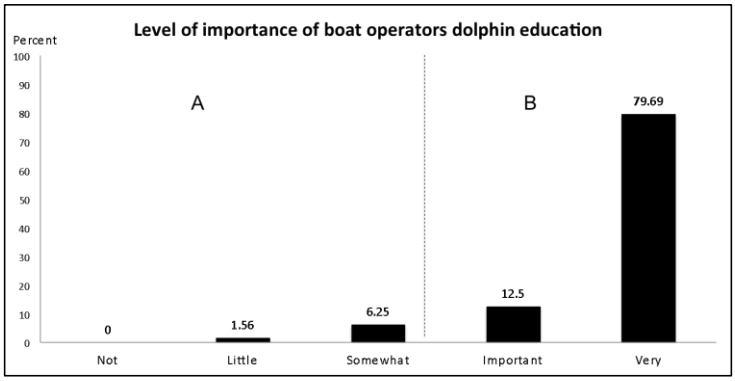

Figure 9. The proportion of tourists who answered B="important" to question 15 "How important is it to you to have dolphin watching boat operators educated about dolphins?" 92% vs. 8% of tourists who responded A="not important".

Finally, for the question #17 "how important is it to you to have dolphinwatching boat operators following Codes of Conduct (whalewatching rules) to prevent harm or disturbance to dolphins?" responses were found to be significantly different as well (X^2= 116.281 df = 1, p-value < 0.0001, n=128). Of the overall responding tourists (n=128), 98% of them answered that following Codes of Conduct was "important",, whilst 2% of the tourists answered "not important" (Fig. 10). Analysis of only the dolphin-watchers (n=72) again provided a very similar and significant result (X^2= 64.222, df = 1, p-value < 0.0001, n=72, 97% vs. 3%). Thus, it is important to tourists that whalewatching codes of conduct are followed by dolphinwatching boat operators.

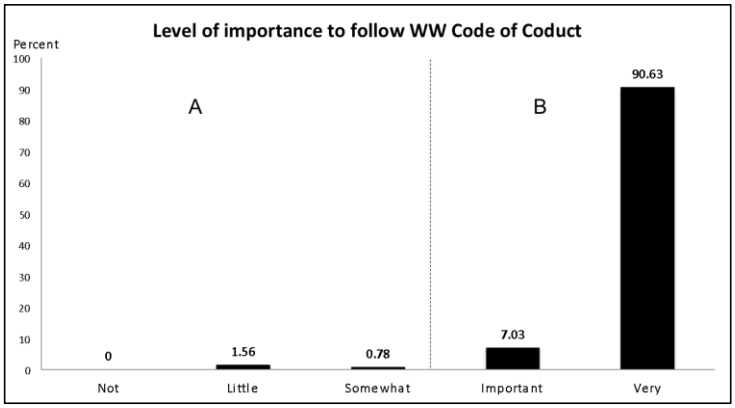

Figure 10. The proportion of tourists who answered "important" to the question "how important is it to you to have dolphinwatching boat operators following Codes of Conduct (whalewatching rules) to prevent harm or disturbing the dolphins?" A large majority of 98% stated that this was B= "important" vs. 2% of the tourists who answered A="not important"

To assess the desire of tourists to receive education/interpretation, a chi-square test was conducted for the question #16 "importance for a tour to be educational" The difference in desire for the trips to be educational was found to be highly significant (X^2= 72.938, df = 1, p-value < 0.0001, n=128) (Fig. 11). The proportion of tourists that answered B="important" to dolphinwatching trips to be educational was 88%, vs. 13% of tourists that answered A="not important". Once again, the result for dolphin-watchers (n=72) was very similar and significant (X^2= 43.556, df = 1, p-value < 0.0001, n=72, 89% vs. 11%).

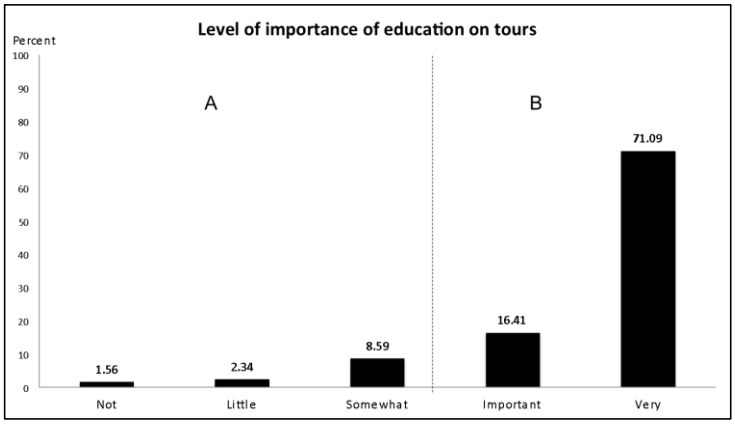

Figure 11. The proportion of tourists who responded B="important" to question 16 "How important is it for a dolphinwatching trips to be educational?" 87.5% vs. 12.5% of the tourists who answered A= "not important"

A visual inspection of how tourists with different academic level (question #4) responded to the question #16 "importance for a tour to be educational" suggests that the more educated tourists had a greater preference for on-board education efforts (Fig. 12). However, a Pearson's Chi-squared test with Yates' continuity correction found that there was no significant difference between the groups (X^2= 0.453, df = 1, p-value = 0.5006 with Yates, n=122). The result was still non-significant when the Yates correction was not used (p= 0.2687). However, the potential for the small number of lower educated respondents to have influenced this result must be noted. When comparing the responding tourists that had either been on a dolphinwatching trip in Bocas del Toro, or had planned on going on a dolphin watching trip (n=70), the result was similar and non-significant with the Yates correction (X^2= 2.349, df = 1, p-value = 0.1254, n=70).

Removing the Yates correction initially produced a significant difference (X^2= 4.326, df = 1, p-value < 0.0375, n=70), although application of the Bonferroni correction required for the number of tests we have here would ultimately lead to a non-significant result.

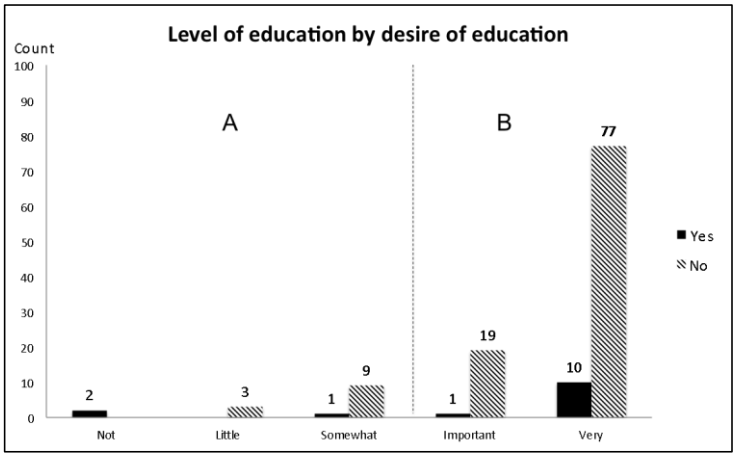

Figure 12. Comparison of the responses to the question of "how important is it for tourists to have an educational dolphinwatching tour" varied with "tourists' academic level" (N=122). The majority of tourists (107 of the participants) say it is B= "important" to have an educational tour and of those 96 had higher education.

Tourists notice environmental issues in Bocas del Toro and believe that stronger government regulations are needed?

Tourists noticed environmental issues and believe stronger government regulations are needed. Results from the Chi-square test demonstrated that responses, which were grouped into the same A & B, two-way split of the five-point Likert scale as used

previously, to the question #8 “In your opinion, from what you have observed, how effective is the Panamanian Government in protecting its environment?” were significantly different (X^2= 87.2258, df = 1, p-value < 0.0001, n=124). The proportion of tourists who answered that the level of the environmental protection of the government was “not effective” was 91.94% vs. 8.06% of the tourists who answered “effective”. When comparing the responding tourists that have either been on a dolphinwatching trip in Bocas Del Toro, or planned on going on a dolphin watching trip (n=72), the result was again very similar and significant (X^2= 42.6056, df = 1, p-value < 0.0001, n=71, 88.73% vs. 11.27%) (Fig. 13).

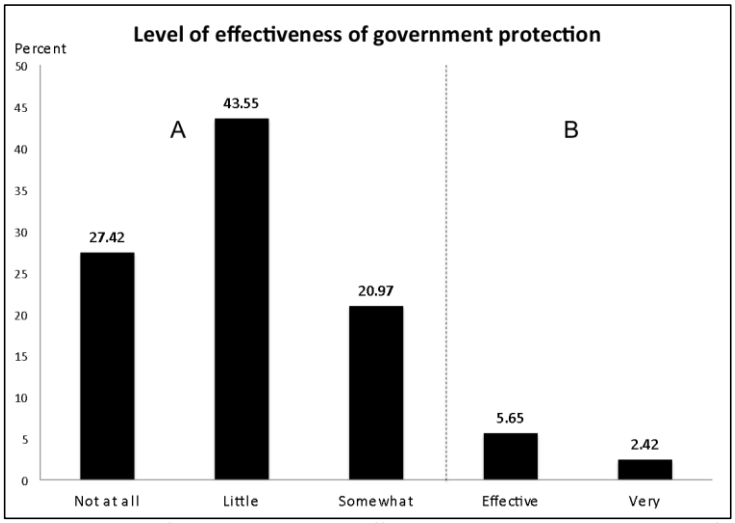

Figure 13. The proportion of tourists who answered effective to the question “In your opinion, from what you have observed, how effective is the Panamanian Government in protecting its environment?” Only 8.06% responded B=“Effective” vs. 91.94% of the tourists who answered A=“Not Effective” (n=124).

A non-significant result a Pearson's Chi-square test was obtained when assessing the relationship between perceived level of environmental protection and assertion that current environmental issues are not being addressed in both the wider population of tourists, and those linked to dolphinwatching, regardless of the use of Yates correction or not (all tourists n=89, X^2= 1.3606, df = 1, p-value = 0.2434, N=89 with Yates, X^2= 2.7984, df = 1, p-value = 0.09436, without Yates; dolphin-watchers n=67, X^2= 0.7349, df = 1, p-value = 0.3913 with Yates, X^2= 2.2507, df = 1, p-value = 0.1336 without Yates) (see Fig. 14). In figure 14 (below) 66% of the tourists that said "yes" there are current environmental issues not being addressed also said that the environmental protection in Bocas was "not effective".

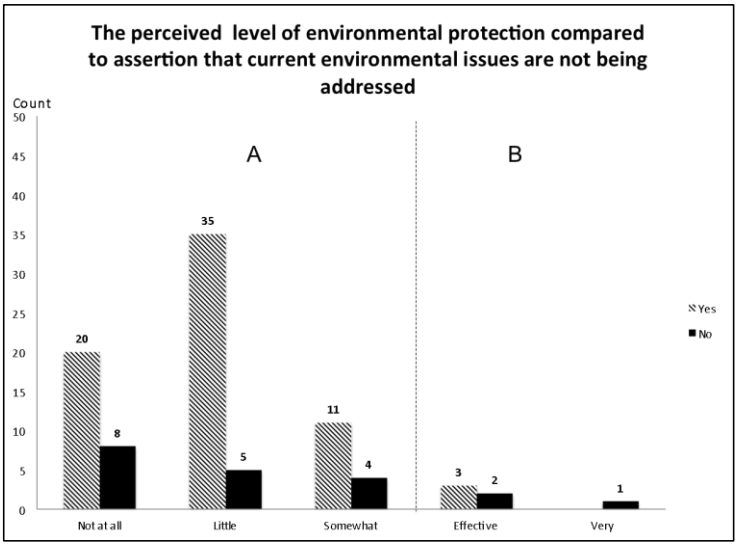

Figure 14. Comparison of the responses to survey question #9"are there environmental issues not currently being addressed in Bocas" with responses to survey question #8 "effectiveness of environment protection" (n=89). The majority of tourists believe the level of protection is A="Not Effective" vs. B="Effective."

Furthermore, chi-square results for Question 10 "In your opinion, from observation should the Panamanian government have more, less or the same environmental regulations in Bocas" was found to be significant (X^2= 141.8679, df = 2, p-value < 0.0001, n=106; dolphin-watchers n=67, X^2= 67.6842, df = 2, p-value = 0.0001). The majority of respondents said that the Panamanian government should be providing more environmental protection in Bocas del Toro (see Fig. 15).

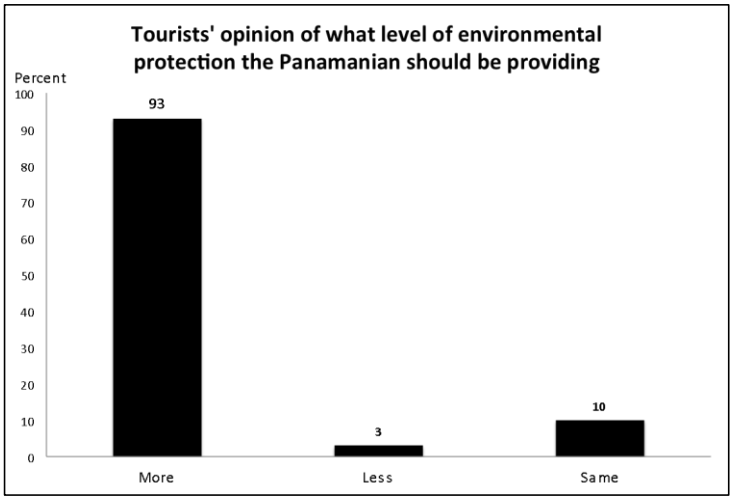

Figure 15. Demonstrates 93% percent of tourists believe the Panamanian government should have more environmental protection in Bocas del Toro.

DISCUSSION

This study, conducted in summer of 2013, evaluated the perspective of tourists in Bocas del Toro. Overall, tourists indicated strong conservation opinions and concerns for Bocas del Toro's marine environment and dolphin tourism. This included all tourists, not just tourists taking dolphinwatching trips. However, responses for just dolphinwatchers (that includes tourists that have gone on a dolphinwatching trip in Bocas and tourists that are planning to go on a dolphinwatching trip in Bocas) (n=72) showed little difference from all tourists (n=129) responses. Taking a dolphin tourism trip in Bocas was thus apparently not a factor in influencing local conservation thinking.

In support of findings from other regions (e.g. Tilt 1987; Duffus 1988; Forestell & Kaufman 1990; Fundacion Cethus 1999; Parsons et al. 2003; Mayes & Richins 2008) 84% of dolphinwatching tourists in Bocas had received higher education. Similar to Pearce & Wilson (1995), 52% percent of Bocas del Toro dolphinwatching tourists were ages 22-30 years old, thus differing from the majority of other studies (e.g. Muloin 1996; Duffus 1988; Parsons et al. 2003) that have reported more middle-aged whalewatchers. Only 3% of dolphinwatchers in Bocas were ages 41 to 50 years old and 6 percent were 51 years or old. However, as in New Zealand, this finding could be due to a targeted audience factor. Bocas del Toro has a reputation for being a "party spot" for backpackers (pers. obs.). It also does not have much accommodation or many attractions for young families (pers. obs.). Thus, middle-aged tourists may choose not to travel to Bocas because of its reputation. Interestingly, contrary to other studies (Hoyt 2001; Parsons et al. 2003; Finkler & Higham 2004) only 10% of dolphinwatchers were domestic tourists from Panama – a more extreme proportion than even New Zealand (Hoyt 2001). In contrast, 27% of dolphinwatchers were from the USA and a large majority (40%) came from countries not specifically listed on the questionnaire (i.e., not Panama, USA, Costa Rica, Columbia, Mexico, Canada, Spain, UK or Italy). However, it is possible that domestic tourists may represent a higher proportion of Bocas visitors during high tourism seasons that coincide with Panamanian government holidays. In April and November a large number of Panamanian tourists come to Bocas during 'Semana Santa' and the 'Festival del Mar'. Therefore, during this time there can be a higher percent of domestic tourists than when this study was performed.

The results of this study show that tourists do not think highly of the current dolphinwatching practices in Bocas del Toro, Panama. Dolphinwatching trips in Bocas Del Toro lack an educational component, lack compliance to any whalewatching code of conduct, do not have operators with whalewatching licenses, and the boat operators are not formally trained or have not received education about dolphins. Tourists in Bocas del Toro prefer these factors.

This study shows that tourists in Bocas would prefer whalewatching trips with educational elements. As described in Kessler et al. (2014) and many other studies (e.g. Forestell 1992; Roggenbuck et al. 1990; Neil et al. 1996; Reid 1999; Bierman 2001; Orams 2000; Shapiro 2006; Lück 2003), tourists who go on nature-based tours are interested in learning about the nature they are viewing. If educational components were supplied, tourists' satisfaction levels with the trip would increase. Unfortunately in Bocas del Toro dolphinwatching trips do not have an educational component. Therefore, it could be hypothesized that adding an educational component would increase satisfaction levels among tourists.

Tourists in Bocas Del Toro also would prefer to be on a whalewatching trip that has a boat operator with a government whalewatching license. Moreover, if boat operators had a government whalewatching license, they would know the Codes of Conduct that minimize harm to the animals. Similar to the findings of Shapiro (2006) and Kessler et al.

(2014), tourists highly prioritize minimizing the negative effects that their trips have on the animals they are viewing. In Bocas del Toro, trip operators do not follow the Code of Conduct and approach the dolphins too closely (Sitar et al. 2014). According to Kessler et al. (2014), even though tourists might say they prefer to be closer to the animals, satisfaction would remain high if they were informed of the reasons behind any required separation distance because preventing harm is more important to them than proximity.

For the reasons outlined above, tour operators in Bocas need to be informed of this study's findings. Responding to the concerns raised here could help improve tourist satisfaction with their dolphin trips. Boat operators need to be educating their tourists about the dolphins, the marine environment and whalewatching regulations in Panama.

Furthermore, as evidenced by current studies from Kessler et al. (2014) and Lück (2003), tourists are more concerned with reducing harm and would like to learn about conservation regulations. It is thus recommended that operators keep tourists informed about whalewatching guidelines. Ideally the regulations should be displayed on every boat in Bocas del Toro, visible for all tourists to see. In addition, educating the tourists about whalewatching guidelines (along with adherence to the guidelines) would likely increase satisfaction with the tour experience as a whole.

Tourists and their behaviors can have many harmful effects on host cultures and the local environment (Blangy & Wood 1993). During this study there were many occasions when

tourists on dolphinwatching trips behaved inappropriately and harmfully towards the dolphins (pers. obs). Tourists would splash their hands in the water in hopes of calling the dolphins over and on two occasions tourists jumped off their boat into the water to swim after the dolphins (pers obs.) (See Photo 1). In addition, in Claiborne's (2010) study the local host community in Bocas was concerned that local youths were picking up tourist's bad behaviors.

Photo 1. Tourist from a dolphinwatching boat jumping off the boat to swim after dolphins.

Moreover, if tourists in Bocas del Toro know about the guidelines they could help avoid these harmful behaviors. As suggested by Parsons and Woods-Ballard (2003), tourists might even help to 'police' whalewatching operators' behavior.

One option is to have the trip operators educate their customers about the 'do's' and 'don'ts' for the area with the culture and history of Bocas del Toro (i.e. associating respect for the locals and the environment). This could help minimize problematic

behaviors like poor manners, and help minimize harmful actions to the local environment and animals.

In addition, the results demonstrate that tourists notice the problematic environmental issues in Bocas del Toro, and the lack of government action. Figure 14 suggests that the majority of tourists interviewed believe environmental issues were not being addressed (i.e. "yes" to question #9); they also believed that the level of environmental protection was not effective (i.e. B = "not effective" to question #8). However, because of the low sample size, especially for "no" answers to question #9, the analysis is not significant. Tourists also indicated that the Panamanian government should provide more environmental protection. In conclusion, stronger government environmental protection would not only benefit the environment, but also potentially help tourism. If the environmental situation in Bocas del Toro is not dealt with, tourist numbers may decline as the environment degrades further.

CHAPTER 4
PERSPECTIVES OF THE DOLPHINWATCHING BOAT OPERATORS IN BOCAS

INTRODUCTION

Commercial whalewatching started in the 1950's in California. These early whalewatching operations likely had little impact on wild populations of cetaceans as most of these activities were conducted from land-based vantage points (Hoyt & Parsons 2014). By the 1970's, boat-based whalewatching became more popular, raising concerns among the scientific community about the direct and indirect impact of the activity (Hoyt 2001). The rapid worldwide increase in whalewatching and the initial scientific studies addressing the negative impact on coastal populations of cetaceans (IWC 2001) prompted the establishment of voluntary guidelines and legislation to manage this activity (Carlson 2004; Constantine et al. 2008). Over the years, numerous studies have documented how cetaceans respond to whalewatching boats (see review in Parsons 2012). Studies of vessels' effect on cetaceans describe a decrease in time invested in biologically important activities such as feeding and resting (e.g., Lusseau & Bejder 1997; Constantine et al. 2004; Chistiansen et al. 2010), and a change in communication signals (e.g., Buckstaff 2004; Foote et al. 2004; Parks et al. 2007; May-Collado & Wartzok 2008; May-Collado & Quinones-Lebron 2014). Although, voluntary codes of conduct and statutory

regulations have been developed in many countries (Carlson 2004), the mitigation of any impact on cetacean populations ultimately depends on compliance with these by local whalewatching operators. Thus, boat operators access to training and understanding of local guidelines is fundamental to ensure a sustainable whalewatching industry.

THREATS FROM WHALEWATCHING

As noted above, unregulated boat-based whalewatching can become a threat to cetaceans. This threat can be associated to the size and number of boats and to how the boat operators behave in the presence of the animals. The boat type and size used for whalewatching varies considerably by region. In some locations, whalewatching boats maximize tourists per tour and in other locations the use of smaller boats is more common. Independently of the size, one of the major concerns of boat-based whalewatching is the noise associated with the boat engines. Noise caused by boat propellers and engines can potentially mask signals used by cetaceans to maintain group cohesion (Richardson et al. 1995; Erbe 2002). Signal masking may increase the likelihood of collisions, the separation of mothers and their calves, and may lower the cetaceans' ability to coordinate behaviors such as foraging and may disrupt social activities that rely on sound (e.g. Erbe 2002; Tyack 2008; Jensen et al. 2009).

Another factor threatening the target cetacean population is the number of whalewatching boats interacting simultaneously with a group of animals. In many countries whalewatching boat traffic is concentrated in areas where cetaceans are predictable. This

profusion of boats can increase the risk of collisions and exacerbate the impact on cetacean behaviors (e.g. Wells & Scott 1997; Ng & Leung 2003; Constantine et al. 2004; May-Collado 2007; Waerebeek et al. 2007). For example, in the Canary Islands (Spain) and Bocas del Toro (Panama), scientists have reported up to 100 boats simultaneously using the same area for whalewatching (Hoyt & Parsons 2014; May-Collado *et al.* 2014, respectively). Previous studies have shown a correlation between dolphin collision injuries and high boat traffic (Wells & Scott 1997).

The proximity between whalewatching boats and cetaceans is another concern. Boat operators often assume that tourist satisfaction is higher when they can get closer to the animals (Orams 2000). However, close range observations of cetaceans are invasive and can increase the risk of disturbance and collision. Several studies have shown that cetaceans typically respond to close range interactions with boats by exhibiting anti-predator like behaviors such as fleeing or diving (Janik & Thompson 1996; Williams et al. 2002a; 2002b; Lusseau 2003; Garrod & Fennel 2004; Williams & Ashe 2007; May-Collado et al. 2014; Sitar et al. 2014).

Moreover, a high number of whalewatching boats inevitably prompts competition among boat operators to have visual access to the animals, resulting in a high occurrence of aggressive and inappropriate maneuvers around the animals such as, circling the animal to entice them to jump in the wake of boats, cutting across their paths, and driving through the center of groups (Clairborne 2010; Barragán-Barrera et al. 2013; May-Collado et al. 2014; Sitar et al. 2014).

Most studies on whalewatching boat and cetacean interactions are about the short-term influence of the boats' presence on the surface behavior of dolphins (Blane & Jaakson, 1995; Bejder & Harraway 1999; Au & Green 2000; Nowacek et al. 2001; Williams et al. 2002b; Hastie et al. 2003; Lusseau 2006a; and see review in Parsons 2012). As noted above, these short-term responses (such as avoidance tactics or temporary suspension of current behaviors) when vessels are present can lead to long-term, and population-level negative effects when animals are repeatedly exposed (Nowacek et al. 2001; Frid & Dill, 2002; Foote et al. 2004; Bejder 2005; Lusseau, 2005; Bejder et al. 2006a, 2006b; Lusseau et al. 2006; Williams et al. 2006a, 2006b; Lusseau & Bejder 2007). These repeated responses can lead to energetic costs to cetaceans and can influence their vitality and the viability of their population (Lusseau & Bejder 2007) especially when their forage patterns are impacted (Duffus 1996). Biologically important events such as breeding, birthing and nursing can be affected (Garrod & Fennell 2004). There should be significant concern for cetacean population viability when research results show foraging and resting disruption as the result of boat interactions (Stockin et al. 2008), especially as the disruption of biologically important behaviors caused by whalewatching vessels, can linger even after boats have left the area (Stockin et al. 2008).

The bottlenose dolphins of Dolphin Bay, in the Archipelago of Bocas del Toro, experience the highest level of whalewatching activity in Panama. The local industry has grown rapidly and in an unplanned manner with little thought by authorities towards ensuring sustainability and minimizing negative impacts. Concerned with an exponential

increase in the number of boats dedicated to whalewatching in Bocas del Toro, May-Collado et al. (2012, 2014), Barragan-Barrera et al. (2013), and Sitar et al. (2014) presented preliminary evidence of the impact and the vulnerability of this population to a continuously growing industry. These studies summarize 10 years of monitoring that found that Bocas dolphins' population was small (less than 250 animals) and showed high site fidelity. Furthermore, genetic data confirmed this high site fidelity with both males and females showing high philopatry to the site. Finally, although dolphins are found everywhere in the Archipelago, a subset is found in Dolphin Bay (approximately 100-150 individuals), and it is these animals that are exposed to daily boat interactions. This area is shallow, sheltered and is where a higher incidence of mother-calf pairs have been found (May-Collado et al. 2012). Shallow waters are commonly used for foraging and calf rearing (Nowacek et al. 2001). Because this is an important nursery ground, dolphins are particularly vulnerable to anthropogenic activities such as boat traffic (Wells 1993, Nowacek et al. 2001). Because there are so few individuals in this population, behavioral disturbance and especially boat strikes, could pose a serious threat to the population's viability (Laist et al. 2001). Due to these concerns, the International Whaling Scientific Committee recommended (International Whaling Commission 2013, 2014) that the government of Panama promote adherence to, and enforce, Panamanian whalewatching guidelines (Resolution ADM/ARAP NO. 01, 2007).

WHALEWATCHING REGULATIONS

A comprehensive version of these guidelines was drafted by the IWC in 2013 (International Whaling Commission 2014c) and these are a good benchmark for whalewatching management and regulation internationally.

Whalewatching guidelines generally insist whalewatching vessels remain more than 100m from cetaceans, a distance which is considered the “watch zone” (Carlson 2012). Vessels in the “watch zone” should observe cetaceans for no more than 20 to 30 minutes at a time (Carlson 2012). Any vessels within 300m of cetaceans are in the “approach zone”, i.e. a "no wake" area, where vessels should maintain speeds of no more than 6 knots (Carlson 2012).

These guidelines are the closest to an international whalewatching code of conduct because there are not any recognized international regulations (Garrod & Fennell 2004). However, whalewatching guidelines vary around the world (Garrod & Fennell 2004). Some countries have legal (non-voluntary) regulations whereas other countries have voluntary codes of conduct or best practice guidelines (Garrod & Fennell 2004). Even though a country might have legal regulations to control and prohibit certain whalewatching activities, they might not monitor or enforce these.

Panamanian whalewatching guidelines (Resolution ADM/ARAP NO. 01, 2007) require boat operators to be 100 meters or more from cetaceans. They also instruct that only 2

boats can be with dolphins at a time, and can only remain for 30 minutes (May-Collado 2013). However concerns have been expressed, as noted above, that Panamanian whalewatching guidelines are not enforced (International Whaling Commission 2013, 2014). As evidenced in Chapter 4, there is a high level of boat operator noncompliance with guidelines.

WHALEWATCHING MANAGEMENT EFFECTIVENESS

Bocas del Toro, is one of many places in the world where whalewatching operators do not comply with their country's codes of conduct (e.g. Wells & Scott 1997; Parsons & Woods-Ballard 2003; Scarpaci et al. 2003; Corbelli 2006; Clairborne 2010). In these other locations, the majority of boat operators know about the codes of conduct but for their own reasons they decide not to comply with them (Scarpaci et al. 2003; Parsons & Woods-Ballard 2003). Guidelines produced by a "bottom up" process involving local stakeholders and nongovernment regional organizations are often preferred by whale-watching operators (Parsons & Wood-Ballard 2003) as there is a sense of ownership of the guidelines that protect their resources. Gjerdalen and Williams (2000) further stated that operators were less likely to follow codes if they did not make sense to the operators or seemed irrelevant to them. Blangy and Epler Wood (1993) additionally point out that effective voluntary guidelines need to be self-explanatory, avoid prohibitive language and need to be positive. Likewise, Scarpaci et al. (2004) suggested operators might adhere better to regulations with simple conditions that are easy to apply in the field and that are easily enforceable.

To illustrate, in western Scotland, Parsons & Woods-Ballard (2003) found that the preferred whalewatching codes of conduct were ones produced by local operators. Also, three other commonly utilized codes of conduct were created by environmental nongovernment organizations (Parsons & Wood-Ballard 2003). When asked about the whale-watching guidelines only 27% of the operators were aware that the UK had even developed whalewatching guidelines, but even those that were aware specifically did not use or refer to them (Parsons & Woods-Ballard 2003). Interestingly, Parsons & Woods-Ballard (2003) reported that the most followed (43% of operators) guideline was indeed developed by a tour operators' association. This suggests having stakeholder-facilitated management (i.e "bottom-up") is more effective than "top-down" regulation in some locations (Parsons & Woods-Ballard 2003), especially when whale-watching locales are remote with little official oversight.

If there is stakeholder ownership, self-policing might be an effective way to enforce regulations. In Gairloch, northwest Scotland, a whalewatching operator actually reported cetacean harassment (an incident involving a Rigid Inflatable Boat) to authorities (Pooley 2000). If the host community, whalewatching operators, and local nongovernment organizations create their own guidelines then it is possible that like in Scotland, self-policing could occur (Parsons & Wood-Ballard 2003).

However, with any whalewatching location, scientific monitoring should be instituted as an ongoing, long-term oversight mechanism to ensure the sustainability of the whalewatching industry and to protect the target cetacean species. As with guidelines, such monitoring programs would be more effective with the support and, especially, respect of boat operators and the host community, rather than researchers and the local community having an adversarial relationship.

This study evaluates dolphinwatching operators' level of awareness of the local whalewatching guidelines and their state of knowledge about the local dolphins, in Bocas del Toro, Panama. It is important to determine if lack of compliance to the guidelines is due to willful disregard or simple unawareness of the guidelines' existence. Identifying the reason for lack of compliance is fundamental in determining future strategies for training and licensing.

Throughout this paper the term whalewatching is used to describe cetacean-viewing tourism, even though in Bocas del Toro this activity is largely restricted to watching dolphins.

METHODS

This study was carried out in 2013 from July to September in Bocas del Toro, an Archipelago located on the northeast Caribbean coast of Panama. More specifically, surveys were conducted in the main island, Isla Colón, where most tourists vacation and depart for dolphinwatching trips.

This study investigated Bocas del Toro boat operators' perspectives on dolphin tourism in the area, on marine/dolphin conservation and on their knowledge about dolphins. Fifteen dolphinwatching trip operators were randomly selected from tour companies in Bocas. In many cases, questionnaires were read to the boat operators by request of the boat operators. The questionnaire was constructed in compliance with the guidelines of George Mason University's Human Subject Review Board, who also approved the questionnaire on an ethical basis. At any time the boat operators could excuse themselves from participation, and they were not required to answer any question they did not want to answer. The questionnaire consisted of 15 questions. The first four questions provided background information: amount of dolphinwatching experience; estimated income; whether they had received dolphinwatching training; and what they charged tourists for a trip. Boat operators were asked if they would like training if it were available. Three questions were related to knowledge of Bocas del Toro dolphins. A further three questions inquired about dolphinwatching tourism guidelines. Finally, the survey finished with questions on marine and/or dolphin conservation in Bocas del Toro.

HYPOTHESIS TESTING

Unless otherwise noted, answers to survey questions were grouped into 2 categories in accordance with the Likert-scale: category A= answers 1 through 3 (up to uncertain); and category B = answers 4 and 5 (Ref for Likert-scale). To test each hypothesis (see below) a Chi-square test of independence was used via the statistics program, R (64-bit version 3.1.1.: R Core Team, 2014). Throughout the rest of the paper the term whalewatching is used to describe cetacean-viewing tourism, even though in Bocas del Toro this activity is

largely restricted to watching dolphins.

To test the first hypothesis, that "whalewatching boat operators in Bocas del Toro are not familiar with and are not practicing sustainable dolphinwatching tourism practices", the survey questions "when whalewatching how close do you get to the dolphins?" (Q#10) and "did you receive whalewatching tourism training?" (Q#3) were evaluated with a Chi-square test. For the question "how many boats do you think should be around a group of dolphins?" (Q#11) average mean, mode and range were evaluated. Additionally, "does Panama have a whalewatching conduct regulation?" (Q#9) was evaluated with descriptive statistics.

To measure level of compliance the question on "closeness of approach" (Q#10) a chi-square test was conducted to measure the proportion of operators that did, or did not, comply with whalewatching guidelines. For the question on "closeness of approach" (Q#10), operators had a choice of six answers of which only one complied with the whalewatching guidelines' distance. These answers were grouped into 2 categories: category A= noncompliant with Panama's current whalewatching guidelines which included answers 5 m or less, 5-10m, 10-30m, 30-50m, and 50-100m; and category B= compliant with the whalewatching guideline distance (100m or more).

To test the second hypothesis "boat operators are not interested in practicing sustainable dolphinwatching tourism" a chi-square test was conducted for survey question "how important is it to you that Bocas' marine environment be protected" (Q#12) and "how

important is it to you that you would be more likely to vote for a politician that supports dolphin conservation" (Q#15). Both of these survey questions were answered on a Likert-scale (1= "not at all" or "not important" to 5 = "very" or "very important"). The answers were grouped in 2 categories (A & B). Likert-scale responses 1= "not at all" or "not important", 2= "little", and 3= "somewhat", were collaborated as category A=not important. Likert-scale answers 4= "well" or "important", and 5= "very well" or very important" were combined as category B= important, because answers 4 and 5 are the definitive statements of importance. Any answer that has "some" importance incorporates a certain amount of uncertainty and thus cannot be considered a definitive opinion.

To test the third hypothesis "boat operators in Bocas del Toro are not knowledgeable about their resident bottlenose dolphin population" three survey questions were analyzed to evaluate boat operator knowledge about the status of resident dolphins: "do you think the dolphin population is increasing, decreasing or staying the same?" (Q#5); "how many dolphins do you think are in Bocas del Toro?" (Q#6); and "do you think the size of the dolphin population will stay the same over the next 20 years?" (Q#7). These questions were evaluated with descriptive statistics.

RESULTS

Of the 15 interviewed operators, 47% had seven years or more of dolphinwatching experience, and 33% had five to six years of experience (Table 13). Of the 15 boat operators 33% of operators depended upon tour activities that include dolphinwatching as

their primary source of income (Fig. 16). The average amount boat operators said they charged a tourist for a whalewatching trip was US$20 (mode= US$20, range =US$12.5 - $25; n =15).

Table 13. Number of years experienced in whale watching (N=15)

Years of experience	>1yr	1-2yrs	3-4yrs	5-6yrs	7yrs or more
Total of Operators	1	0	2	5	7
Percent of Operators (%)	6.67	0.00	13.33	33.33	46.67

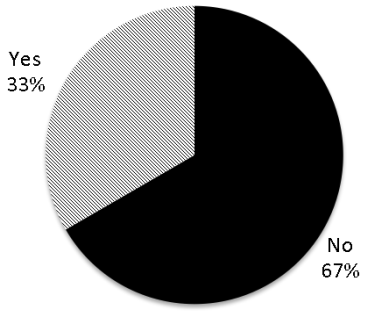

Figure 16. Answers to the question "is whalewatching your primary source of income?"

Hypothesis 1 analysis

The various analyses supported the null hypothesis, i.e., boat operators are not familiar with, and are not practicing, sustainable whalewatching tourism practices.

Results from the chi-square test demonstrated that responses about receiving training (Q#3) were non-significant (X^2= 0.0667, df = 1, p-value = 0.7963, N=15). Slightly less than half (47% of participants) answered that they had received no whalewatching training, whilst 53% stated that they had (Figure 17).

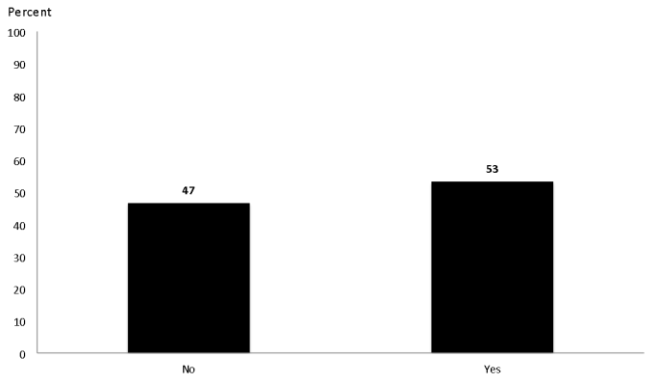

Figure 17. Proportion of boat operators that have received whalewatching training (N=15). Figures above the bars are percentages.

With respect to closeness of approaches to dolphins (Q#10), a chi-square test determined a significant difference between the proportions of incorrect versus correct responses (X^2 = 15, df = 1, p-value < 0.001, N=15). In fact, none of the boat operators in Bocas responded that they actually operated at the distance required by Panamanian whalewatching guidelines (100 meters or more) (Figure 18). Four-fifths of boat operators responded they approach closer than 50 meters from dolphins. This implies that boat

operators in Bocas del Toro are arguably not practicing sustainable whalewatching tourism practices.

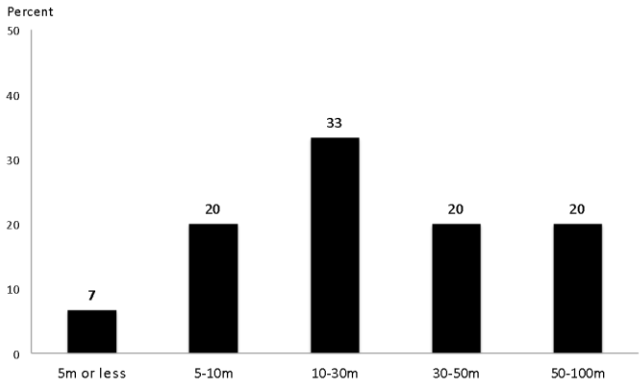

Figure 18. Summary of how close boat operators (N=15) in Bocas del Toro stated that they approach dolphins while on a whalewatching trip. All 15 of the boat operators stated that they approach closer (< 100m) than Panamanian guidelines permit, i.e. all operators effectively admitted to being non-compliant.

A Pearson's Chi-squared test with Yates' continuity correction was used to test a relationship between having "received training" (Q#3) and level of regulation compliance via the question on approach distance (Q#10). Approach distance results were grouped into the same two categories A and B (mentioned above), i.e. a two-way split of a five-point Likert scale. A non-significant result was obtained (X^2= 0.4537, df = 1, p-value = 0.5006 with Yates, N=122). Thus, there was no significant difference in undergoing whalewatching training and whether the code of conduct was complied with. Figure 19 clearly illustrates that all boat operators were noncompliant with the Panamanian

whalewatching codes of conduct and having received whalewatching training made no difference in their level of regulation compliance.

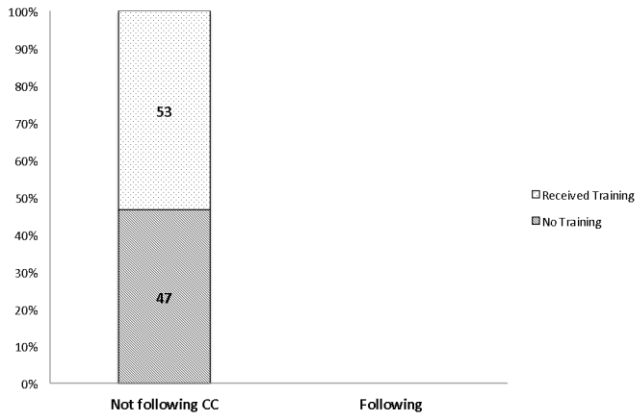

Figure 19. Comparison of the responses to the question of "did you receive whalewatching tourism training?" to compliance with whalewatching guidelines with respect to approach distances (N=15). Figures within the bars are percentages of participants.

To evaluate their familiarity with the whalewatching guidelines boat operators were asked whether or not Panama had official whalewatching guidelines (Q#9). Of the 15 boat operators 40% said they did not know that Panama had whalewatching guidelines, and 33% confidently stated that there were no official guidelines. Only 27% said that Panama did indeed have whalewatching guidelines (Figure 20).

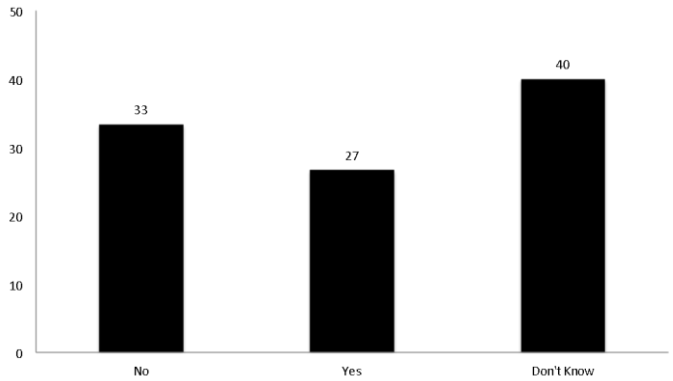

Figure 20. A comparison of boat operator responses to whether there are official Panamanian whalewatching guidelines (n=15).

In response to the "how many boats do you think should be around a group of dolphins?" (Q#11) the mean value of responses was 5.43 (SD 3.3) and the modal value was 5. Responses ranged from 3 boats to 15 boats. The guidelines currently prohibit more than 2 boats around dolphin groups.

Hypothesis 2 analysis

The results showed for that boat operators do, in fact, have an interest in engaging in sustainable dolphinwatching tourism practices. Therefore hypothesis 2 was rejected.

A chi-square test of independence was conducted for the question "how important is marine environment protection" (Q#12). The chi-square results showed a significant

difference in responses on level of importance for dolphin conservation (X^2= 11.2667, df = 1, p-value = 0.0007891, N=15). More specifically 93% of the boat operators stated that dolphin protection was “very important” (Figure 21). Thus, protecting Bocas del Toro’s marine environment is clearly a priority to the large majority of local boat operators.

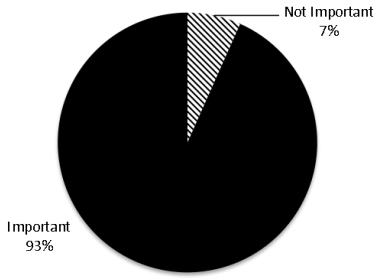

Figure 21. How important is marine environment protection to boat operators (N=15) in Bocas del Toro. A majority of 93% said it was “very important” while only 7% answered, it was not.

For question which asked how likely boat operators would be to vote for a politician that supported dolphin conservation (Q#15) responses from the boat operators were found to be significantly different (X^2=5.4, df = 1, p-value = 0.02014, N=15). Eighty percent of boat operators said they were more likely to vote for a politician that supported dolphin conservation (noting that this was "important" or "very important" on a Likert scale; Figure 22). This infers that that dolphin conservation is potentially a political “hot topic” that could increase votes from boat operators for a specific politician who visibly supported dolphin protection.

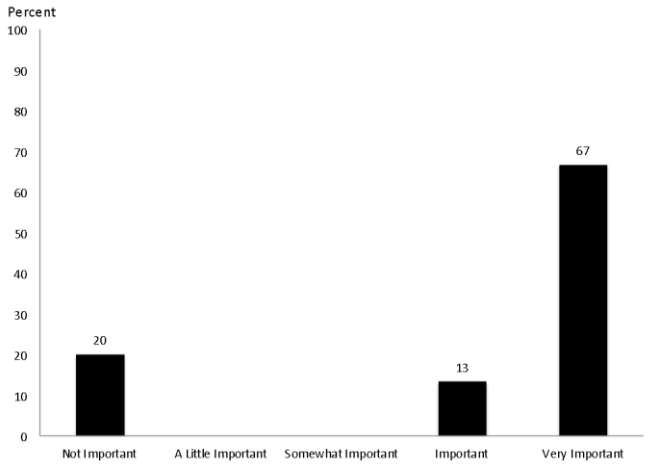

Figure 22. Comparison of the responses to the question "How important is it to you that you that a politician that supports dolphin conservation" (N=15). Numbers above bars are percentages of responses.

Additionally, when boat operators were asked "would you like whalewatching training (including dolphin information) if it were available" 100% of the operators said yes. Similarly, 93% of operators answered "very important" to the question "how important is dolphin conservation to you."

Hypothesis 3 analysis

The results demonstrate that "boat operators in Bocas del Toro are not knowledgeable about their resident bottlenose dolphin population" and thus the third hypothesis was accepted.

When boat operators were asked if the Bocas del Toro dolphin population is increasing, decreasing or staying the same (Q#5), approximately 67% answered staying the same (Figure 23). Thirteen percent answered that the population is increasing and only 20% of the boat operators answered correctly that it was "decreasing".

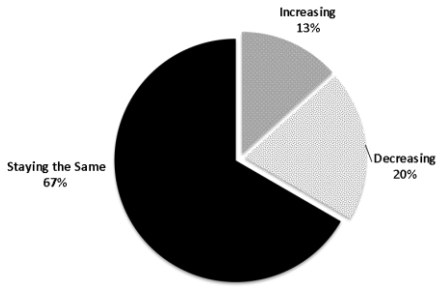

Figure 23. Boat operators' (N=15) opinion on the of the current population status of the resident Bocas del Toro dolphin population.

Moreover, 47% of the boat operators believe there to be 50 to 100 bottlenose dolphins in the resident Bocas del Toro population (Q#6) (Figure 24). Only, 13% percent of boat operators chose the correct population estimate category (200 to 300 individuals). Approximately 7% of participants answered "less than 5" individuals, and the same proportion responded "400 or more" individuals in the population. Twenty percent of participants believed there to be 100 to 200 individuals (7% answered, "don't know" to

the question), which is approximately the number of animals that utilize Dolphin Bay (May-Collado et al. 2012), the main whalewatching location.

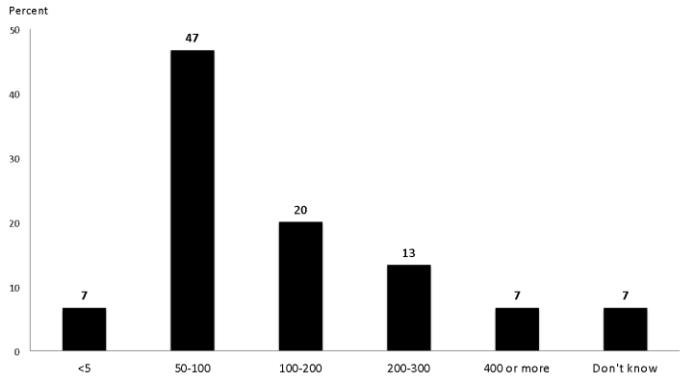

Figure 24. Boat operatorsercent of boat operators chose the correct population estimate category (200 to 300 individuals). Approximately 7% of participants answered "less than 5" individuals, and the same proportion responded "400 or more" inde of respondents answering different categories.

Final question asked to boat operators to measure their level of knowledge about their bottlenose dolphins (Q#7), showed that operators were unaware of their dolphin population status. When boat operators were asked about the resident dolphin populations' 20 year projected future 50% said the dolphin population will "stay the same" and 50% said it would "not stay the same", i.e. that the population is sustainable in the long term.

DISSCUSION

In Bocas del Toro, it appears that most of the boat operators claimed to have years of experience (5 or more years for approximately 80% of operators) in whalewatching activity and that for two-thirds of the operators whalewatching is not their primary source of income. In Bocas whalewatching tours are not as expensive as in other places around the world. This study found that the average cost for a dolphinwatching trip in Bocas is just $20 per person. Interestingly, in other whalewatching studies in similar locations (Iniguez et al. 1998; Hoyt 2001; Draheim et al. 2010) whalewatchers would spend more for a trip: US$30 - 60. This demonstrates that the price of trips in Bocas del Toro could potentially be increased, especially if this increased cost went towards funding dolphin conservation. As found in previous studies (e.g. Wilson & Tisdell 2002; Warren 2012), tourists are willing to pay more for conservation efforts and Stamation et al. (2007) found that boat-based whalewatchers were willing to pay money to help an environmental organization. Warren (2012) noted that whalewatchers were also willing to pay an additional fee (up to $15) for habitat protection. Therefore, elevating prices slightly (i.e. a conservation tithe) could be an opportunity for raising funds for dolphin conservation in Bocas del Toro. A partnership between a local NGO and the boat operators could be developed to set up a community trust fund where the extra charge would go to support conservation projects, community educational programs, habitat restoration and training for local boat operators. Such training might help boat operators to increase tourists' satisfaction level as boat operators will be more informed about the dolphins, better able

to answer questions, and be more professional in their operations (e.g. Shapiro 2006; Kessler et al. 2014). The result would be mutually beneficial.

In this study, boat operators were found to be unfamiliar with Panama's whalewatching guidelines even though 53% claimed they had whalewatching training. Boat operators generally believed the appropriate number of boats that could be around a group of dolphins was 5 boats, but opinions ranged up to 15 boats. Clearly, the number of boats they consider to be appropriate around a group of dolphins was higher than the permitted number (2 boats) under the Panamanian whalewatching guidelines. These results support May-Collado and colleagues previous work (2014) that mentioned high numbers of boats around Bocas dolphins.

Likewise, lack of compliance with guidelines is illustrated by the fact that 100% of the boat operators stated that they approached dolphins closer than 100m on a trip. Troublingly, 80% of these operators stated that they approached closer than 50m when viewing the dolphins. This suggests that the findings from Sitar et al. (2014) are accurate and that the majority of boat operators get far too close to dolphin groups increasing the risk of collisions between dolphins and boats. Panacetacea (2013) and May-Collado et al. (2014) reported that 10 dolphins were killed by boat strikes in the period 2012-14, which considering the self-confessed close approach distances by boat operators is not surprising.

This study suggests that whalewatching boat operators in Bocas del Toro are not familiar with sustainable whalewatching tourism practices, are not following the Panamanian whalewatching guidelines, and indeed are largely unaware of these guidelines. Among the boat operators 53% said they had received whalewatching training, but there were no differences in operations when looking at non-trained boat operators and trained boat operators (see Figure 17). Neither trained nor untrained operators followed the official whalewatching guidelines (see Figure 17). Boat operators who claimed to be trained may have been trained by an NGO or local body or were "self-trained". Only 27% of boat operators even knew that Panama has whalewatching guidelines which conflicts somewhat with the statement by half of the operators that they were trained. It is, however, critical to note that before this study was conducted, the Panamanian Government in Bocas apparently provided formal whalewatching training. So it is interesting that even though many boat operators might have had formal training before this study, they were still not following the guidelines. Clearly any such training was unsatisfactory. The reason why this training was unsuccessful should be further investigated. It is, however, important to consider the nature of whalewatching training methods in locations such as Bocas del Toro. In a recent study (Betzi Perez, Lissette Trejos, and Laura May-Collado pers. com. 2015) and in this study, it was clear that many of the boat operators in Bocas do not know how to read or write. Training based on written materials and presentations is unlikely to be effective.

In October, 2014, new formal whalewatching training was provided by the Panamanian government and facilitated by the local NGO Panacetacea (Betzi Perez, Lissette Trejos, and Laura May-Collado pers. com. 2015). It will be interesting to see if this training has any impact on whalewatching guideline compliance.

Despite a lack of compliance with guidelines, boat operators were nonetheless interested in participating in sustainable whalewatching tourism. Results showed that boat operators have a strong regard for dolphin conservation with 93% of boat operators stating that marine protection is “important”. Additionally, 80% said that they would be more likely to vote for a politician who supported dolphin conservation. Likewise, 93% of boat operators said that dolphin conservation was "very important", and 100% of them would like whalewatching training if it were available.

However, boat operators in Bocas del Toro were not that knowledgeable about the status of the resident bottlenose dolphin population. Only 13% stated the correct size category of the dolphin population with several responses being very off the mark. However, as noted, May-Collado et al. (2012) estimated that probably fewer than 150 animals regularly utilize Dolphin Bay and are continuously exposed to whalewatching vessels. This matches more closely with the answers of a larger proportion of the boat operators. If operators actually thought the dolphin population was just 50 to 100 individuals, one would think that this would provoke some sort of concern. However, it is possible that because Bocas is such unique area where dolphins are sighted on an everyday basis, there

is a disregard for the population. Two-thirds of the boat operators indicated that they thought that the dolphin population is stable. As noted above, within just two years (2012 to 2014), 10 resident dolphins were killed by boat strikes (Panacetacea 2013). However, this figure only includes incidences that were reported to scientists, thus it is entirely possible that more dolphins have been killed by dolphinwatching in Bocas. The fact that half of the operators thought that the dolphin population would remain stable for the next twenty years suggests that they do not see unregulated dolphinwatching as a threat to the population.

In conclusion, this study shows that boat operators in Bocas del Toro are not following Panama's whalewatching guidelines and/or are unfamiliar with them. More importantly, boat operators are putting the dolphin population in Bocas at risk from higher chances of collision and behavioral disturbance (May-Collado et al. 2012, 2014) because they approach dolphins too closely. These results are in line with several other studies of dolphinwatching activities around the world (e.g. Herman 1989; Wells 1993; Wells & Scott 1997; Constantine 1999; Nowacek et al. 2001; Ng & Leung 2003; Ng & Leung 2003; Constantine et al. 2004; Buckstaff 2004; Bejder 2005; Lusseau, 2005; Bejder et al. 2006a; Bejder et al. 2006b; Dolman et al. 2006; Lusseau et al. 2006).

On the positive side, the results showed that boat operators do care about the resident bottlenose dolphins and support conservation. They also would like formal whalewatching training if it were made available to them. Therefore, the situation in

Bocas with unregulated and unmanaged dolphinwatching trips is not hopeless. Because the boat operators care about the dolphins and want to learn more about them, swift change may be possible if appropriate training were provided.

CHAPTER 5
THE EFFECTS OF WHALEWATCHING TOURISM ON THE BEAHVIORAL CHANGE OF BOTTLENOSE DOLPHINS IN BOCAS DEL TORO

INTRODUCTION

Previous studies have documented cetaceans altering their behavior as a result of vessel interactions (i.e. boats and whalewatching) (e.g. Au and Perryman 1982; Kruse 1991; Janik and Thompson 1996; DeNardo 1998, Nowacek et al. 2001; Hastie et al 2003; Parsons 2012). Thus, unmanaged and unregulated boat-based whalewatching is an anthropogenic impact to cetacean populations and as such, it has been argued that it is a type of exploitation (Orams 1999; Martinez & Orams 2011). The harm that unmanaged and unregulated whalewatching tourism causes can be both direct and indirect (Mattson et. al. 2005). The most obvious direct impacts are injuries and death caused by propeller strikes or other boat collisions, but whalewatching boats can also cause behavioral changes (Donaldson et al. 2012). Several studies have documented cetaceans performing short-term, but immediate, behavioral changes when boats are present (Lusseau & Bejder 1997: Constantine et al. 2004; Carrera 2004; Chistiansen et al. 2010; Parsons 2012; May-Collado et al. 2014; Sitar et al. 2014). One of the most serious behavioral changes recorded is a decline in foraging when boats are present (Carrera 2004; Williams et al. 2006a; Stockin et al. 2008; May-Collado et al. 2014; Sitar et al. 2014). Another immediate behavioral change is that some individuals move closer to each other when boats approach (spatial distribution) (Bejder et al. 1999; 2006a; Barr & Slooten 1999).

Engine noise can mask cetacean calls, obstructing them (Erbe 2002; Nowacek et al. 2007; Tyack 2008; Jensen et al. 2009) and high levels of noise can cause temporary or permanent hearing damage (more correctly referred to as temporary or permanent threshold shifts, or TTS or PTS, respectively), especially if the distance from the boat and the cetacean in question is minor and the source level is high (Ketten 1998; Ng & Leung 2003; Mattson et al. 2005). Noise can thus disrupt echolocation, feeding, socializing, communication between group individuals and other behaviors (Bain & Dahlheim 1994; Richardson et al. 1995; Mattson et. al. 2005). Van Parijs and Corkeron's (2001) documented Pacific humpback dolphin (*Sousa chinenis*) mother and calf pairs increasing whistle rates after boats have passed. They assume this is the result of mothers and calves trying to re-establish communication (Van Parijs & Corkeron 2001). Several studies have similarly reported bottlenose dolphin mothers and calves whistling repeatedly when separated or during unexpected events (e.g. Tyack 1986; Caldwell et al. 1990; Smolker et al. 1993; Janik & Slater, 1998; Van Parijs & Corkeron 2001). It isn't surprising that mothers and calves are most disturbed by boat traffic and call out for each other repeatedly because predation and other risks for calves increase when separated from their mothers (Mann & Barnett, 1999; Van Parijs & Corkeron 2001). A few tens of meters of separation can increase the risk of a shark attack (Mann & Barnett 1999).

Sound is an important sensory system for cetaceans. They utilize it for communication, detecting the environment around them and locating prey (Au 2000; Tyack & Clark 2000; Trites & Bain 2000; Lemon et al. 2006). Ng & Leung (2003) discuss that faster

moving boats cause more noise than slow moving boats. The speed and unpredictable movement of boat traffic can also cause similar effects as engine noise (Mattson et al. 2005). When anthropogenic noise from whalewatching boats is elevated or exacerbated by enclosed areas, the ability of cetaceans to communicate or navigate is reduced (Richardson et al. 1995; Lemon et al. 2006). Scarpaci et al. (2001) documented bottlenose dolphins increased whistle rates when tourist boats were around, moreover Van Parijs & Corkeron (2001) note an increase in whistle rate when vessels were less than 1.5km from dolphins. Another potentially harmful impact of high boat traffic includes diesel fumes and oil; exposure to these over time can cause toxic harm to cetaceans (Trites & Bain 2000).

Cetaceans may be particularly vulnerable to the impact of whalewatching boats, but the impact might not be immediately apparent. Cetaceans are typically long-lived (Constantine 2014). They are also a slow-breeding species, and short-term effects like resting and foraging disturbances could have cumulative energetic costs that might have long-term, population-level effects (Constantine 2014; New et al. 2015). Realistically, it could take up to 30 years to be fully recognized as a negative impact on reproduction rate and population size (Wilson et al. 1999, Thompson et al. 2000; Constantine et al. 2004). Bottlenose dolphins (*Tursiops* spp.) are especially vulnerable to these long-term negative effects since they are one of the most exposed cetacean species to consistent and high-intensity whalewatching tourism (Constantine 2001).

It is often assumed by lay people that if cetaceans are disturbed by activities such as whalewatching they can simply swim away (Parsons pers. obs). However, this may not always be the case. Cetaceans may be less likely to abandon their habitat even if they are being severely harassed by human disturbance. If the habitat is essential because of vital food supply and safety, and if a suitable alternative habitat is not nearby, cetaceans will remain in disturbed areas even though this exposes them to stress (Gill et al. 2001; Frid & Dill 2002; Constantine et al. 2004; Beale & Monaghan 2004a, 2004b; Beale 2007; Bejder et al. 2009).

Residential or semi-residential cetaceans (like Bocas del Toro's dolphins) are more vulnerable to and may experience higher impacts from boat traffic (Williams et al. 1993; Schneider 1995). In reaction to whalewatching vessels, residential dolphins might avoid the vessels or possibly become habituated to them (Constantine 1999). However, serious concerns have been expressed about the use of terms such as "habituation," "sensitisation" and "tolerance" (Bejder et al. 2009; Donaldson et al. 2012). These terms are often misused in scientific work, and there is much confusion about the term "habituation," and as a result, these terms mislead wildlife tourism managers (Wright et al. 2007; Bejder et al. 2009). There are three terms used for changes in behavioral stress responses (Wright & Kuczaj 2007; Wright et al. 2007; see Table 14 below). These three terms have very different definitions, and they are not interchangeable (Bejder et al. 2009; Table 14).

Table 14. Working definitions for categories of behavioral response and requirements for their demonstration (Bejder et al. 2009, p.181). N.B. The definition of sensitization in this table is not common in the field of physiology but is rather a definition used by Wright et al. (2007) and is more common. Sensitization: when acclimation to one stressor increases subsequent stress responses to the original stressors (as per Romero 2004).

Term	Definition	Time course of response	Requisites to demonstrate response
Habituation	Relative persistent waning of a response as a result of repeated stimulation which is not followed by any kind of reinforcement (Thorpe 1963, p. 61)	Longitudinal process	Sequential measures taken from the same individuals over time
Sensitisation	Increased behavioural responsiveness over time when animals learn that a repeated or ongoing stimulus has significant consequences for the animal (Richardson et al. 1995, p. 543)	Longitudinal process	Sequential measures taken from the same individuals over time
Tolerance	Intensity of disturbance that an individual. …tolerates without responding in a defined way (Nisbet 2000, p. 315)	State	Instantaneous measurement of many individuals at one time

As an ethnological concept, habituation is a response from repeatedly being exposed to human activity and "claims of habituation are usually based on quantitative or anecdotal observations that the behaviour of animals appears to become progressively less influenced by the presence of particular anthropogenic stimuli" (Bejder et al. 2009, p179). However, the term habituation with regards to marine mammal response is not the same concept when referring to human behaviors. So habituation and sensitisation do not allude to specific behavioral responses that the word habituate refers to.

Behavioral habituation is the "relative persistent waning of a response as a result of repeated stimulation which is not followed by any kind of reinforcement" (Thorpe 1963, p. 61). Habituation is, therefore, "a process involving a reduction in response over time as individuals learn that there are neither adverse nor beneficial consequences of the occurrence of the stimulus" (Bejder et al. 2009, p. 180). In conclusion, to be habituated to something is to become less influenced (less affected) to the repeated stimuli, such as

whalewatching, but still continue to be physiologically stressed internally (Wright et al. 2007a, 2007b). Therefore, anthropogenic activities can still be impacting wildlife, even though the animal's overt reaction to the activities is reduced, or has become less obvious (see Wright et al., 2007a, 2007b). Through habituation, cetaceans are even more vulnerable to boat collision because animals exhibit less avoidance behavior around vessels (Spradlin et al. 1998; Stone & Yoshinaga 2000; Woodford et al. 2002). According to Erbe's (2002) study, the killer whale (*Orcinus orca*) study population did not exhibit the typical swim-away-response to whalewatching boats as expected from other studies (i.e. Kruse 1999; Williams et al. 2002). In Erbe's (2002) study, killer whales did not show avoidance behaviors until whalewatching boats were 50 meters or less to cetaceans indicating that habituation could be a factor for this population (Erbe 2002).

In opposition to habituation, sensitisation is "increased behavioural responsiveness over time when animals learn that a repeated or ongoing stimulus has significant consequences for the animal" (Richardson et al. 1995, p. 543). According to Finley et al. (1990) marine mammals are less likely to be tolerant of human interaction unless there are incentives (e.g. the disturbed area is an important feeding ground) (Constantine 2001). Without such an incentive, marine mammals will likely be more sensitive to an adverse stimulus and will perform avoidance behaviors (Constantine 2001). Constantine's (2001) study conducted on dolphins in the Bay of Islands, New Zealand, showed that their avoidance behaviors with swim-with-dolphin tourists increased over time (i.e. sensitisation occurred).

Boat traffic density is also another concern for cetaceans (Ng & Leung 2003; Constantine et al. 2004). Density of vessels has been correlated with behavioral changes in a variety of cetaceans (Adimey 1995; Williams 1999; Trites & Bain 2000; Ng & Leung 2003; Buckstaff 2004; Corbelli 2006 Parsons 2012). Bejder (2005) notes a decline in female reproductive rate in the indo-pacific bottlenose dolphin (Tursiops sp.) population in Shark Bay, Australia that has high boat traffic. In Constantine and colleagues' (2004) New Zealand study, bottlenose dolphins showed a decrease in resting behavior when the number of boats increased. Similarly, Würsig (1996) indicates that resting behavior decreased when dolphins were exposed to repeated swimming interactions with tourists and in the presence of vessels. As resting is clearly a biologically important activity, any decrease in this behavior is significant.

In addition to biologically important behaviors that may be disrupted by boat traffic, animals may have locations that are important. Briggs (1991) found, for example, that killer whales are more likely to be disturbed by the presence of vessels near rubbing beaches. Cetaceans can have specific feeding grounds or important areas where socializing and feeding occurs. These locations are of great importance, and once tolerance levels have been exhausted by chronic boat traffic, cetaceans may abandon these areas (Baker & Herman 1989) and that could have an impact on the health of the population.

Dolphin Bay in Bocas del Toro, where most of the unmanaged dolphinwatching tourism occurs, is an important area for socializing (e.g. mating feeding, and rearing calves) for the resident dolphins (May-Collado 2007). If the resident Bocas del Toro bottlenose dolphins abandon Dolphin Bay because of the intolerable level of boats, what will happen to the population? Bejder et al. (2006a, 2006b) noted disturbed dolphins relocating from a site impacted by whalewatching disturbance. The resident dolphins in Bocas del Toro could decide to stay in the area and tolerate exposure to dolphinwatching activities because, although being stressful, these might be less costly in energy than fleeing to in optimal habitat (Beale 2007). This can have an even greater consequence because of chronic stress and the cumulative impact of increased energetic costs over time (Beale 2007).

The issue of whalewatching disturbance is becoming a very serious concern for the well being of many targeted cetacean populations since this industry is rapidly growing without accompanying protections and regulations (Garrod & Fennel 2004). Because authoritative regulations require extensive amounts of research and an understanding of the full implication of threats to populations, it is important to continue ongoing assessment of changes in the size of populations, in their habitat ranges, and more specifically habitat and behavioral changes due to continuous human disturbance (Constantine 1999; Constantine 2001).

This study evaluated the effects of whalewatching tourism on common bottlenose dolphins (*Tursiops truncatus*) in Bocas Del Toro Panama. The data gathered could be helpful in advocating for sustainable dolphinwatching and protective dolphin management in Bocas del Toro.

METHODS

This study was conducted in Bocas del Toro, Panama from July to August 2013. Bocas is an Archipelago 9° 20' 0" N and 82° 15' 0" W, off the northeast Caribbean side of Panama, near the border of Costa Rica (Windevoxhel & Heegde 2008) (see Map fig. 2).

In this study, a hybrid/composite boat-based survey technique was developed to evaluate the effects on dolphin behavior from dolphinwatching tourism. This new method has been dubbed "Focal Group Scanning" (FGS), and it was developed to fit the specific circumstances in Bocas del Toro i.e. a high level of unmanaged whalewatching tourism and numerous vessels with a small population of dolphins being observed. FGS is semi-continuous and discontinuous sampling of dolphin behaviors. It essentially involves a focal follow but of an entire group of dolphins with a one-minute snapshot of the entire group's activities (see Table 15) conducted over that period. Dolphin behaviors were recorded utilizing a one-zero discontinuous sampling method, i.e. the behavior did occur (scored as "1") or the behavior did not occur (scored as "0").

The survey was conducted from a four-stroke outboard motor research boats of 19 to 30 feet and with engines of 75 hp or 90 hp, respectively. Data collecting ranged from 7am to 2pm if weather and accessibility permitted. The research boat's motor was turned off when dolphins were spotted within a radius of 100m to minimize disturbance. Surveys were conducted throughout the Bocas del Toro Archipelago (off of Isla Popa Uno, Shark Hole, Dolphin Bay, Pastores, Almirante, Solarte, Loma Partida, Bocas del Drago, T. Oscura, Bahia Honda, Osa Perezoso, San Cristobal, Basimentos, Punta Caracol, Isla Peresozos) (see Map fig.2), however, most surveys were conducted in Dolphin Bay because that is where the majority of dolphinwatching activity takes place (May-Collado et al. 2012).

Behavioral observations began when dolphins were sighted. At the beginning of each sighting, GPS coordinates, location name, weather and sea state were all recorded. The number of boats and number of dolphins present was recorded for every minute throughout the entire sighting. Sightings ended when dolphins left the area or ceased because of logistic reasons (which could include adverse weather). The boats' distance to the dolphins was also recorded. Every minute from the start of the encounter to the end, dolphin behaviors were recorded under assigned behavioral categories (e.g., forage, shallow dive, deep dive, disappear, rest, surface, socialize, play, sexual activity, mill, slow travel, fast travel, aerial and aggressive) (see Table 15). If there were any, out of the ordinary or significant activities were recorded as well.

Table 15. Behaviors recorded in this study and behavior definition

Recorded Behavior	Behavior description
Social	Socializing behaviors include dolphins interacting with each other by playful chasing, leaping, physically touching each other in play, or sexually interacting. For this study Inquisitive behaviors were included in the social category because they involved interaction with whalewatching boats, or other animals. Inquisitive behaviors include "peeping", or "spy-hopping", and voluntarily approaching a boat as if curious.
Forage:	Foraging behaviors are actions that indicate putting effort into capturing prey, fish-whacking, having prey in their mouths, consuming prey, chasing prey, circling deep dives with loud exhalations, swimming rapidly in circles (carousels), and a sequence of dives ending with a fluke dive.
Resting	Resting behaviors involve very slow movement in tight groups, traveling at about one knot. Or when dolphins are floating on top of the water still with their blowhole visible.
Slow Travel	Travel consists of slow traveling at a pace of three knots or less, and high speeds of travel with a pace faster than three knots.
Fast travel with a purpose	Purposeful travel- is considered fast travel in one direction without any action of foraging, milling or socializing.
Milling	Milling consists of different directional headings. It can be connected with socializing, play and foraging.
Deep Dive	A deep dive is when the fluke is visibly sticking out of the water
Shallow Dive	A shallow dive is when the dorsal fin and back are visible. The fluke is not visible in a shallow dive.
Disappear	This behavior describes when all dolphins in a group dive underwater and are no longer visible.
Surface	This behavior is when dolphins come up for air.
Play	Throwing objects out of the water (such as a fish) a fashion taht was not related to feeding, leaping in the wake of a boat, riding with a boat.
Sexual	This behavior is rolling (twisting, rolling around together in one place), displaying abdomen and/or penis.
Aerial	The behavior is leaping (leaping clear out of the water and re-entering head first) and porpoising (arching leaps with partial or entire body out of water)
Aggressive	This includes biting another dolphin, body slamming (a forward or side slam against the water), headbanging (head slapping the water), headbutting, head toss (abrupt head jerk), flipper/fluke strike, tail slap, and shaking body (a

	low scale of body thrashing, or convulsion).

To assess the potential impact of whalewatching on dolphin behaviors, the dependence of each behavior on several explanatory variables was considered using an AIC reduction process. These variables were the number of dolphins in a group (log transformed), the presence or absence of vessels (with the exception of the research vessel), any recent changes in vessel numbers and the location of the sighting. Boat maneuvers could not be included in this analysis against control conditions, as none could be independent of vessel presence. The original model was a binomial regression containing all the above-mentioned explanatory variables and a stepwise removal process was undertaken automatically in the program R, until a final model was selected (Akaike 1973).

For the purposes of the analyses, explanatory variables over one minute were compared to dolphin behaviors in that minute and the following minute, the latter to capture any time-based activities (e.g., disappearance). The data included in the analysis was sub-sampled from the full follow data set (to every 5 minutes) to reduce autocorrelation to the greatest extent possible.

RESULTS

Over 13½ hours (817 minutes) of whalewatching 'occurrences' were recorded (each occurrence was a 1-minute recording) from July to August 2013. Approximately 5½ hours (320 minutes) of 'true control' (sightings that did not have any boat activity) occurrences were recorded. Moreover, there were 732 occurrences of 'zero boat' activity

from encounters where boat activity was recorded before and/or after, but not during the occurrence.

Table 16. Categories of survey sighting, description and number of occurrences.

Events of sightings	Description	Total occurrences
1) Whalewatching	Dolphins exposed to whalewatching activity	817
2) Control	Dolphin sighting with no boat activity	320
3) Zero boat occurrences	1 minute events with zero boats during that specific 1 minute interval	732
4) All no boat events	Total of 2) Control and 3) Zero boat occurrences	1052

AIC analysis for behavior 'disappear'

The AIC selection process for the behavior "disappear" selected the log-transformed number of dolphins present and the presence/absence of boats (see Tables 17; 18).

Table 17. AIC selection process for the first part of the analyses for TwoMinDisappear. AIC values for stepwise elimination presented.

Model	AIC
Start	566.74
Location	560.44
CngBoats	557.05
End	557.05

Table 18. Metrics for final model for the behavior 'Disappear.' TwoMinDisappear ~ a * log(No. Dolphins +1) + b*BoatPres + c. Def Freedom = 434

Variable	Coefficient	p
log10(NoDolphins + 1)	-2.6373	<0.001
BoatPres - N	0	<0.001
BoatPres - Y	0.2066	

AIC analysis for behavior 'aerial'

For the model for 'aerial' behavior, the AIC model process selected only the log-transformed number of dolphins (Tables 19; 20).

Table 19. AIC selection process for the first part of the analyses for TwoMinAerial. AIC values for stepwise elimination presented.

Model	AIC
Start	274.08
Location	258.19
CngBoats	254.31
BoatPres	253.09
End	253.09

Table 20. Metrics for final model for the behavior 'Aerial.' TwoMinAerial ~ a * log(No. Dolphins +1) + b. Def Freedom = 434

Variable	Coefficient	p
log10(NoDolphins + 1)	1.4069	0.045

AIC analysis for behavior 'tail slap'

The AIC reduction selected only changes in boat numbers as an influencing factor for TwoMinTailSlaps (see Tables 21; 22).

Table 21. AIC selection process for the first part of the analyses for TwoMinTailslaps. AIC values for stepwise elimination presented.

Model	AIC
Start	187.58
Location	178.19
log10(NoDolphins + 1)	176.34
BoatPres	174.89
End	174.89

Table 22. Metrics for final model for the behavior 'Tail slapping.' TwoMinTailSlaps ~ a * CngBoats + b. Def Freedom = 434

Variable	Coefficient	p

CngBoats - D	0	0.071
CngBoats - I	-16.6689	
CngBoats - N	-1.0528	

AIC analysis for behavior 'deep dive'

The AIC selection process found the number of dolphins (log-transformed), boat presence/absence and location to influence the behavior 'deep dives' (see Tables 23; 24).

Table 23. AIC selection process for the first part of the analyses for TwoMinDive. AIC values for stepwise elimination presented.

Model	AIC
Start	554.17
CngBoats	550.41
End	550.41

Table 24. Metrics for final model for the behavior 'Diving deep.' TwoMinDive ~ a* Location + b*log(No. Dolphins +1) + c*BoatPres + d. Def Freedom = 434

Variable	Coefficient	p
Location - Almirante	0	0.108
Location - Bahia Honda	0.7738	
Location - Basimentos	3.1779	
Location - Bocas Del Drago	0.311	
Location - Dolphin Bay	0.2809	
Location - Isla Peresosos	-14.5854	
Location - Isla Popa Uno	-0.3601	
Location - Loma Partida	1.079	
Location - Osa Perezoso	1.5359	
Location - Pastores	0.2803	
Location - Punta Caracol	-14.2005	
Location - San Cristobal	1.4138	
Location - Shark Hole	-0.1169	
Location - Solate	2.0545	
Location - T. Oscura	-0.2188	
log10(NoDolphins + 1)	1.2786	0.005
BoatPres - N	0	0.009
BoatPres - Y	-0.3712	

AIC analysis for behavior 'shallow dive'

The AIC reduction process determined location to be an influencing variable for 'shallow dives' (see Table 25, 26).

Table 25. AIC selection process for the first part of the analyses for TwoMinShallowsDives. AIC values for stepwise elimination presented.

Model	AIC
Start	563.92
CngBoats	561.42
log10(NoDolphins + 1)	559.42
BoatPres	557.66
End	557.66

Table 26. Metrics for final model for the behavior 'Shallow dives.' TwoMinShallowsDives ~ a Location + b*Def Freedom = 434

Variable	Coefficient	p
Location - Almirante	0	
Location - Bahia Honda	-1.5404	
Location - Basimentos	0.6931	
Location - Bocas Del Drago	-1.4534	
Location - Dolphin Bay	-0.9931	
Location - Isla Peresosos	-15.7202	
Location - Isla Popa Uno	-2.4567	
Location - Loma Partida	-0.8473	0.011
Location - Osa Perezoso	0.1335	
Location - Pastores	-0.2595	
Location - Punta Caracol	-15.7202	
Location - San Cristobal	0.2513	
Location - Shark Hole	-0.4418	
Location - Solate	-1.2528	
Location - T. Oscura	-0.665	

AIC analysis for behavior 'slow travel'

The behavior 'slow travel' was selected as having a relationship to change in boats and boat presence or absence (see Tables 27; 28).

Table 27. AIC selection process for the first part of the analyses for TwoMinTravSlow. AIC values for stepwise elimination presented.

Model	AIC
Start	481.78
Location	478.13
log10(NoDolphins + 1)	476.13
End	476.13

Table 28. Metrics for final model for the behavior 'Slow Travel.' TwoMinTravSlow ~ a * CngBoats + b*BoatPres + c. Def Freedom = 434

Variable	Coefficient	p
CngBoats - D	0	0.041
CngBoats - I	-0.827	
CngBoats - N	0.488	
BoatPres - N	0	0.067
BoatPres - Y	0.4234	

AIC analysis for behavior 'forage'

The AIC reduction process determined that foraging was dependent upon boat presence or absence and location (see Tables 29; 30).

Table 29. AIC selection process for the first part of the analyses for TwoMinForage. AIC values for stepwise elimination presented.

Model	AIC
Start	543.92
CngBoats	541.19
log10(NoDolphins + 1)	539.41
End	539.41

Table 30. Metrics for final model for the behavior 'Forage.' TwoMinForage ~ a * Location + b*BoatPres + c. Def Freedom = 434

Variable	Coefficient	p
Location - Almirante	0	0.003
Location - Bahia Honda	-16.62573	
Location - Basimentos	0.53085	
Location - Bocas Del Drago	0.06133	
Location - Dolphin Bay	-0.06212	

Location - Isla Peresosos	0.78217	
Location - Isla Popa Uno	-0.13412	
Location - Loma Partida	1.00405	
Location - Osa Perezoso	-15.97644	
Location - Pastores	-0.22701	
Location - Punta Caracol	-16.88251	
Location - San Cristobal	0.68273	
Location - Shark Hole	1.76385	
Location - Solate	16.68369	
Location - T. Oscura	0.56517	
BoatPres - N	0	<0.001
BoatPres - Y	-1.38943	

AIC analysis for behavior 'social'

The AIC process selected the number of dolphins (log transformed) and changes in boat numbers as influencing the occurrence of social behavior (see Tables 31; 32).

Table 31. AIC selection process for the first part of the analyses for TwoMinSocial. AIC values for stepwise elimination presented.

Model	AIC
Start	457.57
Location	454.03
BoatPres	452.36
End	452.36

Table 32. Metrics for final model for the behavior 'Social.' TwoMinSocial ~ a * log(No. Dolphins +1) + b*CngBoats + c. Def Freedom = 434

Variable	Coefficient	p
log10(NoDolphins + 1)	1.1833	0.014
CngBoats - D	0	0.029
CngBoats - I	-1.9101	
CngBoats - N	-0.3924	

AIC analysis for behavior 'play'

The AIC reduction selected variables (log-transformed) number of dolphins and boat presence or absence as influencing the occurrence of 'play' behavior (see Tables 33; 34).

Table 33. AIC selection process for the first part of the analyses for TwoMinPlay. AIC values for stepwise elimination presented.

Model	AIC
Start	161.73
Location	153.28
CngBoats	150.89
End	150.89

Table 34. Metrics for final model for the behavior 'Play.' TwoMinPlay ~ a * log(No. Dolphins +1) + b*BoatPres + c. Def Freedom = 434

Variable	Coefficient	p
log10(NoDolphins + 1)	-1.6305	0.1309
BoatPres - N	0	0.135
BoatPres - Y	-0.7443	

AIC analysis for behavior 'wake riding'

The AIC reduction process determined that none of the variables influenced whether dolphins engaged in 'wake riding' behavior (see Table 35).

Table 35. AIC selection process for the first part of the analyses for TwoMinWakeRiding. AIC values for stepwise elimination presented. Final mode

Model	AIC
Start	193.01
Location	185.57
BoatPres	183.75
log10(NoDolphins + 1)	182.25
CngBoats	182.00

End	182.00

AIC analysis for behavior 'fast travel'

For the behavior 'fast travel', the number of dolphins (log-transformed) was determined to be influential (see Tables 36; 37), albeit non-significant.

Table 36. AIC selection process for the first part of the analyses for TwoMinTravFast. AIC values for stepwise elimination presented.

Model	AIC
Start	187.43
Location	177.28
BoatPres	175.31
CngBoats	174.25
End	174.25

Table 37 Metrics for final model for the behavior 'Travel Fast.' TwoMinTravFast ~ a * log(No. Dolphins +1) + b. Def Freedom = 434

Variable	Coefficient	p
log10(NoDolphins + 1)	-1.8946	0.057

AIC analysis for 'sexual behavior'

The AIC reduction process for 'sexual behavior' selected boat presence or absence as the only influential variable (see Tables 38; 39).

Table 38. AIC selection process for the first part of the analyses for TwoMinSexual. AIC values for stepwise elimination presented.

Model	AIC
Start	189.17
Location	183.27
CngBoats	181.56
log10(NoDolphins + 1)	181.17
End	181.17

Table 39. Metrics for final model for the behavior 'Sexual.' TwoMinSexual ~ a *BoatPres + b. Def Freedom = 434

Variable	Coefficient	p
BoatPres - N	0	0.093
BoatPres - Y	-0.7443	

AIC analysis for the 'rest' behavior

AIC results selected changes in the numbers of dolphins and the presence or absence of boats as influencing variables for the occurrence of the behavior 'rest' (see Tables 40; 41). Therefore, resting behavior happened less often in the presence of boats and more often when there were many dolphins.

Table 40. AIC selection process for the first part of the analyses for TwoMinRest. AIC values for stepwise elimination presented.

Model	AIC
Start	354.32
Location	346.34
CngBoats	342.98
End	342.98

Table 41. Metrics for final model for the behavior 'Rest.' TwoMinRest ~ a * log(No. Dolphins +1) + b*BoatPres + c. Def Freedom = 434

Variable	Coefficient	p
log10(NoDolphins + 1)	1.6443	0.005
BoatPres - N	0	0.030
BoatPres - Y	-0.617	

AIC analysis for 'milling' behavior

The AIC reduction process determined that none of the variables influenced 'milling' behavior (see Table 42).

Table 42. AIC selection process for the first part of the analyses for TwoMinMilling. AIC values for stepwise elimination presented.

Model	AIC
Start	226.18
Location	220.32
CngBoats	218.13
BoatPres	216.33
log10(NoDolphins + 1)	215.09
End	215.09

AIC analysis for the behavior 'surfacing'

For the behavior 'surfacing,' location was determined to be influential (see Tables 43; 44). 'Surfacing' behavior was seen more in Almirante, Bahia Honda, Dolphin Bay, Isla Popa Uno, Loma Partida, Osa Perezoso, Pastores, and Shark Hole. It was less likely to occur in Basimentos, Bocas del Drago, Isla Peresosos, Punta Caracol, and Solarte.

Table 43. AIC selection process for the first part of the analyses for TwoMinSurfacing. AIC values for stepwise elimination presented.

Model	AIC
Start	562.9
BoatPres	561.03
CngBoats	559.42
log10(NoDolphins + 1)	558.25
End	558.25

Table 44. Metrics for final model for the behavior 'Surface.' TwoMinSurfacing ~ a * Location + b. Def Freedom = 434

Variable	Coefficient	p
Location - Almirante	0	
Location - Bahia Honda	1.4702	
Location - Basimentos	-1.1325	
Location - Bocas Del Drago	-15.5014	0.002
Location - Dolphin Bay	0.6446	
Location - Isla Peresosos	-15.5014	
Location - Isla Popa Uno	0.5051	

Location - Loma Partida	0.6592	
Location - Osa Perezoso	0.1484	
Location - Pastores	0.2915	
Location - Punta Caracol	-15.5014	
Location - San Cristobal	1.4702	
Location - Shark Hole	0.1484	
Location - Solarte	-15.5014	
Location - T. Oscura	-0.8812	

AIC analysis for 'aggression'

The variable 'change in the number of boats was selected to be related to the presence of 'aggression' (See Tables 45; 46). Therefore 'aggression' was less with

Table 45. AIC selection process for the first part of the analyses for TwoMinAggression. AIC values for stepwise elimination presented.

Model	AIC
Start	214.08
Location	204.48
log10(NoDolphins + 1)	202.52
BoatPres	201.10
End	201.10

Table 46. Metrics for final model for the behavior 'Aggression.' TwoMinAggression ~ a *CngBoats + b. Def Freedom = 434

Variable	Coefficient	p
CngBoats - D	0	
CngBoats - I	-17.0079	0.026
CngBoats - N	-1.1897	

DISCUSSION

This study demonstrates that dolphinwatching in Bocas del Toro does cause short-term behavioral disruption to the resident dolphins. Scientists are most concerned about

anthropogenic disruption to the vital behaviors of socializing (that may include important reproductive behavior), foraging, and resting because the disturbance of these behaviors has significant health and energetic implications or the population vitality depends on these behaviors. In this study, foraging was found, perhaps unsurprisingly, to be highly dependent on location (see Table 30). It was also found to occur less frequently when boats were present. Given this combination, it would be difficult to assess from these results alone which areas may be important foraging areas, as vessel presence may be altering the natural behavior of the animals. Nevertheless, as foraging is disrupted by boat presence, this is a concern for the sustainability and conservation of the population.

It was determined through the AIC process that social behavior is related to the number of dolphins and changes in boat numbers (see Table 32). Unsurprisingly, greater numbers of dolphins seem to make social behavior more probable. However, it was also more probable when the number of vessels around the dolphins decreased. This may represent some sort of effort to re-establish bonds or social order following a disturbance event, but more detailed study would be needed to assess this.

Sexual behavior was found only to be related to boat presence or absence and to occur less when there were boats, albeit non-significantly (see Table 39). This may suggest that more important factors were missing from the analysis. Vessel presence also seemed to be related to a lower resting rate (see Table 41). For resting behavior, the number of dolphins was also important suggesting that the dolphins in this area may gather in larger

groups to rest. Again, this is an important consideration for the conservation and viability of the population. Boat activity in Bocas Del Toro is linked to a decrease in reproductive, resting and foraging behavior, and thus, the trifecta of biologically important behaviors were all affected by dolphinwatching for this population.

Many cetacean studies have had similar findings (Lusseau 2003a, Williams et al. 2006, Dans et al. 2008, Stockin et al. 2008,Christiansen et al. (2010; Steckenreuter et al. 2012). Christiansen et al. (2010) found that when tourist boats were present in Zanzibar, Tanzania, Indo-Pacific bottlenose dolphins' (Tursiops aduncus) behaviors such as socializing, resting and foraging were less likely to continue when boats were present. Lusseau (2003a) noted in his study that socializing reduced by half when boats were present, and resting reduced by 10%. Additionally, these finding reinforce past studies in Bocas Del Toro. May-Collado et al. (2014) who found a negative correlation between foraging and socializing with increasing boat presence.

Travelling and changes in dive frequency have also been associated with the presence of boats. May-Collado et al. (2014) found that dolphins in Bocas del Toro were seen travelling and diving more when calves were present. To give just two examples, Christiansen et al. (2010) found travelling was more likely to start when boats were present, and Lusseau (2003a) found that travel and diving were both more frequent with boat presence as well.

In this study, location was found to have a significant effect on shallow dives (see Table 26). Shallow dives were more likely to occur in Almirante, Basimentos, Osa Perezoso, and San Cristibal, and less likely to occur in the other locations (see Table 25; 26). Nonsignificant influences were also seen by location for deep diving (a deep dive with flukes out of the water) (see Table 24). However, deep diving was also selected to be related to (and increased by) the numbers of dolphins present and a lack of whalewatching vessels (see Table 24).

Similarly to May-Collado (2013), Christiansen et al. (2010) and Lusseau (2003a). this study found that 'slow travel' behavior was related to the presence of boats and changes in boat numbers. Boat presence was found to increase the likelihood of slow travel, although this was marginally nonsignificant (see table 28). Smaller groups were also associated with 'fast travel' (see Table 37), although this was again marginally non-significant. It has been suggested by others, that such behavior could represent a stress response related to predation (Howland 1974; Weihs & Webb 1984; Kruse 1991). It been noted in other studies that cetaceans increased their swimming speeds as a response to boat disturbance and also when boats approached closely (e.g., Baker et al. 1983; Richardson et al. 1985; Kruse 1991; Williams & Bain 2002b)

Additionally, the number of dolphins (log-transformed) and boat presence were found to influence dolphin 'disappearance' (staying underwater for at least a minute) (see Table 18). Disappearance was recorded less when more dolphins were present which may

simply be an artifact of the visibility of larger numbers of animals. In contrast, the presence of whalewatching boats was associated with a greater occurrence of 'disappearance' behavior. This study suggests that this behavior is another indication of avoidance and is likely a stress response.

Some aerial behavior is considered to be a form of non-vocal communication (Norris & Dohl 1980; Slooten 1994; Herzing 2000; Lusseau 2006b; Lusseau 2006c). Norris and Dohl (1980) suggested aerial behaviors could be used socially for foraging. According to Wursig and Wursig (1980) Argentinean dusky dolphins (Lagenorhynchus obscurus) jump to catch prey at the surface, so jumping in this situation is not a form of communication. Either of these reasons is relevant to this study's findings; aerial behavior was more likely to occur with greater numbers of dolphins (see Table 20) Therefore, because there are more dolphins, more aerial behavior could be a form of communication. Conversely, more aerial behavior could be because when more bottlenose dolphins are around, cooperative foraging could be occurring. In both instances aerial behavior is seen more frequently with larger numbers of dolphins.

'Tail slaps' were found to be more likely when vessel numbers decreased (see Table 22), however, this relationship was non-significant. This type of behavior was often observed when dolphinwatching vessels were departing rapidly. Perhaps the behavior might represent (at least on occasion) an aggression response to these vessels that can suddenly alter the soundscape via an increase in underwater noise (pers. obs.). This is supported by

the fact that the behavior ‘aggression’ shows a similar pattern of occurrence (see Table 46).

These findings support Noren and colleagues’ (2009) results on surfacing activity with southern resident killer whales. Noren et al. (2009) reported that surfacing behavior (such as spy hops, breaches, tail slaps and pectoral fin slaps) were more frequent when boats approached closer than the recommended distance for whalewatching. Noren and colleagues (2009) suggest that these behaviors may be more frequent with moving vessels than with stationary boats. Therefore, as this study suggested, the response to rapid movement of the boats could be the related to aggression, tail slap and change in boats (see Table 46; 22). Herzing (2000) suggests that tail slapping could be performed for communication purposes as a means to get the attention of dolphins in the pod. This compliments this study’s finding and the Noren et al. (2009) hypothesis. The tail slaps seen in Bocas del Toro could well be caused by the sudden change in noise from boat activity. Since dolphins’ calls could be masked by the noise of boat engines, a tail slap may be a way of communicating or locating each other.

Other findings from this study were that ‘play’ behavior decreased with greater number of dolphins and in the presence of vessels, although both relationships were non-significant (see Table 34). Surfacing behavior was found to be related to location (see Table 44) and was seen more in locations, Almirante, Bahia Honda, Dolphin Bay, Isla

Popa Uno, Loma Partida, Osa Perezoso, Pastores and Shark Hole. It was less likely to occur in Basimentos, Bocas del Drago, Isla Peresosos, Punta Caracol and Solarte.

Finally, no explanatory variables (location, number of dolphins, change in dolphins, change in boats and boat presence) were found to influence the behaviors wake riding and milling. However, given that wake riding requires the presence of a vessel, there may be some issues with independence affecting this result. Similarly, lack of full independence among the explanatory variables may have influenced their significance (or lack thereof) in various ways. For example, certain locations might be related to different activities that are also associated with different group sizes. Similarly, whalewatching vessels may more easily spot larger groups of dolphins, leading to a relationship between the two. Despite these interactions, it was not possible to further reduce the variables included in the analyses as each contained distinct and important information for consideration. Similarly in Costa Rica, Montero Cordero (2010) found little evidence that milling behavior in spotted dolphins (Stenella attenuata) was influenced by boat presence. It is evident from this study's results that dolphinwatching in Bocas del Toro is influencing dolphin behavior. This evidence supports May-Collado et al.'s (2014) findings. Because dolphinwatching is unmanaged in Bocas del Toro it is necessary to promote teach and enforce Panama's whalewatching guidelines.

CONCLUSION

In conclusion, this study shows that boat operators in Bocas del Toro are not following Panama's whalewatching guidelines and/or was unfamiliar with the guidelines and because of this dolphin behaviors are being influenced. Addition, this study concludes that boat operators care about their marine environment and dolphins and would like to participate in sustainable dolphinwatching tourism.

Other studies have ascertained that tourists in the Caribbean often prefer whalewatching trips that have sustainable practices (Draheim et al. 2010; Luksenburg & Parsons 2014), and thus it would be in the operators' benefit to adhere to whalewatching guidelines and best practices. As noted above, the Panamanian Government clearly has ignored the IWC recommendation to monitor and enforce their whalewatching guidelines. Encouraging the local community to play a greater role in monitoring and enforcing (i.e. peer-to-peer) whalewatching guidelines may therefore be a better approach. This is to say, "bottom up" management of whalewatching guidelines, instead of relying on a "top down" approach. This would require a greater level of outreach and engagement with the local community and it would require local scientists to work with community leaders to provide feedback on the effectiveness of this approach. The local community in Bocas Del Toro appears to be highly interested in marine conservation, especially dolphin protection (Sitar et al. in prep), and thus such a bottom up approach is probably feasible.

In this study sailboats had to be analyzed as a whalewatching boat or traveling transport because there were less than ten occurrences of sailboats. However, comparing whalewatching sailboats to high-powered motorized vessels is suggested as a future study as it would be interesting to see if different types of whalewatching boats have different effects on dolphin behavior. For example, sailboats may have less impact as a type of whalewatching vessel.

The unmanaged dolphin tourism in Bocas del Toro is causing behavioral change and decreasing important behaviors such as foraging, socializing and resting. Another serious concern is potential avoidance by the dolphins of their assumed feeding and breeding area, Dolphin Bay. Management is urgently required, and it can be recommended that at least some areas important to foraging and resting be designated as off-limits to whalewatching vessels as their presence seems to disrupt these activities, i.e. refuge areas.

This study finds that tourists visiting Bocas del Toro are first time visitors with little interest in seeing wild dolphins. However, because of the way trips are organized they all end up visiting Dolphin Bay where they become aware of the poor dolphin practices of the industry in the region. The interviews reveal poor satisfaction in the dolphinwatching experience and provide strong opinions about the need for regulation and sustainability. The fact that few tourists return may indicate the need for a marketing strategy that goes

along with conservation strategies to develop sustainable trips that increase tourism satisfaction while enhancing the protection of the natural resources in the archipelago.

It is important to note that some questions in this study pertaining to participant preferences were direct questions that carried the risk that participants would respond with answers that they believed were socially acceptable. For example, the question, "In your opinion, do you think there are environmental issues not currently being addressed in Bocas?" (Question 10 in Appendix) could have placed the respondent in the position of making the assumption that there are already environmental issues occurring in Bocas, whereas the respondent may or may not felt this to be the case. It is suggested that the next questionnaire written for Bocas del Toro tourists be written in a "stated choice" form as used in Kessler et al. (2014) to prevent tourists from selecting "socially acceptable" answers. The stated choice experiments conducted by Kessler et al. (2014) address the problems of direct questions by having participants select scenarios that allow their preferences to be indirectly ascertained from their answers. Because this survey was to evaluate the perception of tourists in Bocas del Toro, it is suggested a similar survey be done on just dolphin-watchers.

APPENDIX

Chapter 5 Questionnaire for Whale Watching Boat Operators

1. How long have you been a whale watching Boat operator?

Less than 1yr 1-2years 3-4years 5-6yrs 7 or more

2. Is dolphin watching your primary income?

Yes No

3. Did you receive whale watching tourism training?

Yes No

4. Would you like whale watching training (including dolphin info) if it were available?

Yes No

5. Do you think the dolphin population is increasing, decreasing or staying the same?

Increasing Decreasing Staying the Same

6. How many dolphins do you think are in Bocas?

10-50 50-100 100-200 200-300 300-400 400 or more Don't Know

7. Do you think the dolphin size of the population will stay the same in 20 years?

Yes No

8. How much do you charge an individual for a dolphin tours?

9. Does Panama have a whale watching guidelines?

Yes No Don't Know

10. When whale watching how close do you get to the dolphins?

5meters or less 5-10meters 10-30meters 30-50meters 50-100meters 100meters or more

11. How many boats do you think should be around a group of dolphins?

12. How important is it to you that Bocas' marine environment be protected? 5- Very Important and 1- Not important

1 2 3 4 5

13. Who do you think it would be best at protecting the marine environment? Rank 1-3 (1 most effective 3 least effective)

Panamanian Government Local Government Local community

14. How important is dolphin conservation to you? 5- Very Important and 1- Not important

1 2 3 4 5

15. How important is it to you that you would be more likely to vote for a politician that supports dolphin conservation? 5- Very Important and 1- Not important

Figure 25. Boat operators questionnaire

Chapter 4 Questionnaire for Tourists

1. Gender

Male Female

2. Age

18-21 22-30 31-40 41-50 51-60 61<

3. Which country/state are you from?

Costa Rica Panama Colombia U.S.A. Mexico Canada Spain England Italy

Other _____

4. Level of Education

Elementary High School University: College Bachelor Masters PhD/JD/MD

5. Are you a member of an environmental group?

Yes No Which?_____

6. How many times have you traveled to Bocas del Toro?

1st time 2 3-4 5- 6 7 or More

7. What is the purpose of your visit to Bocas del Toro?

Diving Sea Turtles Dolphin Watching Indigenous community Nature

Beach Leisure Other_____

8. In your opinion, from what you have observed, how effective is the Panamanian Government in protecting its environment? 5- Very Effective and 1- Not At All Effective

1 2 3 4 5

9. In your opinion, do you think there are environmental issues not currently being addressed in Bocas?

Yes, and if so what _____ No Not sure

10. In your opinion, from observation should the Panamanian government have more, less or the same environmental regulations in Bocas.

More Less Same Don't Know

11. Have you been on a dolphinwatching trip in Bocas del Toro?

Yes No

12. If not, are you planning to go on a dolphinwatching trip?

Yes No

13. How did you hear about dolphinwatching in Bocas del Toro?

Travel agent Hotel/Hostel Travel book Local fliers Internet Friends/Family Locals Other _____

14. How important is it to you that your whalewatching boat operators have whalewatching government license? 5- Very Important and 1- Not important

1 2 3 4 5

15. How important is it to you to have dolphinwatching boat operators educated about dolphins? 5- Very Important and 1- Not important

1 2 3 4 5

16. How important is it for a dolphinwatching trip to be educational? 5- Very Important and 1- Not important

1 2 3 4 5

17. How important is it to you to have dolphinwatching boat operators following Codes of Conduct (whalewatching rules) to prevent harm or disturbance to dolphins? 5- Very Important and 1- Not important

1 2 3 4 5

Figure 26 . Tourist questionnaire

Date _____ Site #_____ Start Time _____ End Time _____ Weather _____ Sea State ___ Long_____ Lat_____

Time	#Dolphins	Dolphin Behavior	# Boats	Type	>50	50	100	<100	Boat Behavior
		Forage Shallow Dive Dive Disappear Rest Surface Socialize Play Sexual Mill S. Travel F.Travel AcriaL Aggression _____ Comments _____		WW Canoe _____					Idle Engine off Travel _____
		Forage Shallow Dive Dive Disappear Rest Surface Socialize Play Sexual Mill S. Travel F.Travel AcriaL Aggression _____ Comments _____		WW Canoe _____					Idle Engine off Travel _____
		Forage Shallow Dive Dive Disappear Rest Surface Socialize Play Sexual Mill S. Travel F.Travel AcriaL Aggression _____ Comments _____		WW Canoe _____					Idle Engine off Travel _____
		Forage Shallow Dive Dive Disappear Rest Surface Socialize Play Sexual Mill S. Travel F.Travel AcriaL Aggression _____ Comments _____		WW Canoe _____					Idle Engine off Travel _____
		Forage Shallow Dive Dive Disappear Rest Surface Socialize Play Sexual Mill S. Travel F.Travel AcriaL Aggression _____ Comments _____		WW Canoe _____					Idle Engine off Travel _____
		Forage Shallow Dive Dive Disappear Rest Surface Socialize Play Sexual Mill S. Travel F.Travel AcriaL Aggression _____ Comments _____		WW Canoe _____					Idle Engine off Travel _____
		Forage Shallow Dive Dive Disappear Rest Surface Socialize Play Sexual Mill S. Travel F.Travel AcriaL Aggression _____ Comments _____		WW Canoe _____					Idle Engine off Travel _____

Figure 27. Field record sheet for behavioral and boat compliance surveys

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